Establishing a trait anxiety threshold that signals likelihood of anxiety disorders

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Accepted author version posted online: 17 Oct 2011.Published online: 17 Nov 2011.

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Evidence suggests that the *State Trait Inventory for Cognitive and Somatic Anxiety* (STICSA) may be a more pure measure of anxiety than other commonly used scales. Further, the STICSA has excellent psychometric properties in both clinical and nonclinical samples. The present study aimed to extend the utility of the STICSA – Trait version by identifying a cut-off score that could differentiate a group of clinically diagnosed anxiety disorder patients ($n = 398$) from a group of student controls ($n = 439$). Two receiver operating characteristic curve analyses indicated cut-off scores of 43 (sensitivity $= .73$, specificity $= .74$, classification accuracy $= .74$) and 40 (sensitivity $= .80$, specificity $= .67$, classification accuracy $= .73$), respectively. In a large community sample ($n = 6685$), a score of 43 identified 11.5% of individuals as probable cases of clinical anxiety, while a score of 40 identified 17.0% of individuals as probable cases of clinical anxiety. As a result of differences in sensitivity and specificity, the present findings suggest a cut-off score of 43 is optimal to identify probable cases of clinical anxiety, while a cut-off score of 40 is optimal to screen for the possible presence of anxiety disorders.

Keywords: state trait inventory for cognitive and somatic anxiety; STICSA; anxiety; assessment; cut-off score

The notions that state and trait anxiety are separable entities and that the latter exists as a personality trait were proposed nearly half a century ago (Cattell, 1966; Spielberger, 1966). These ideas have since received considerable support via psychometric evaluation across scales (e.g., Endler, Parker, Bagby, & Cox, 1991; Spielberger, 1989), and the experimental study of anxiety-related phenomena (e.g., Matthews & MacLeod, 1985; Pacheco-Unguetti, Acosta, Callejas, & Lupiáñez, 2010). The most commonly used index of trait anxiety is the *State-Trait Anxiety Inventory* (STAI; Spielberger, 1983), referenced in at least 3500 published articles (Gros, Antony, Simms, & McCabe, 2007). Despite its predominance, the STAI has been critiqued for its inability to discriminate anxiety from depression

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(Bieling, Antony, & Swinson, 1998; Caci, Bayle, Dossios, Robert, & Boyer, 2003; Gros et al., 2007).

To address this limitation, the *State-Trait Inventory for Cognitive and Somatic Anxiety* (STICSA) was recently developed (Ree, French, MacLeod, & Locke, 2008) with the theoretical underpinning of Spielberger's (1966) formulation of state and trait anxiety and on cognitive and somatic symptom variation (e.g., Clark & Watson, 1991). Cognitive and somatic symptom clusters have been identified as comprising important differences in anxiety symptom profiles, subjective experience, and even response to treatment (e.g., Koskal, Power, & Sharp, 1991). To this end, separate item clusters focusing on these dimensions were developed with the aim of capturing symptoms specific to anxiety (Ree et al., 2008). The cognitive cluster aims to capture features of anxiety that are directly related to thoughts (e.g., worry, intrusive thoughts, difficulty concentrating). In contrast, the somatic cluster aims to capture features that are directly related to physical experiences (e.g., sweating, palpitations, muscle tension). Across several studies, Ree and colleagues (2008) have shown important state increases in cognitive (but less so somatic) anxiety related to exam stress as well as state increases in somatic (but not cognitive) anxiety following CO_2 challenge.

Not only has the STICSA been supported by factor analyses in student and clinical samples (Gros et al., 2007; Gros, Simms, & Antony, 2010; Ree et al., 2008), but subscale examinations have also revealed good to excellent convergent and discriminant validity (Gros et al., 2007, Gros et al., 2010; Ree et al., 2008). Of note, the STICSA, unlike the STAI, showed significantly stronger correlations with another measure of anxiety than with a measure of depression (Gros et al., 2007). Further, in a recent investigation of the relation between positive and negative affect, as well as between anxiety and depression (Van Dam & Earleywine, 2011), the STICSA followed patterns predicted by the tripartite model of anxiety and depression (Clark & Watson, 1991). When controlling for anxiety, there was a significant negative relation between positive affect and depression. However, when controlling for depression, the relation between positive affect and the STICSA was not significant. Both depression and the STICSA were correlated with negative affect (Van Dam & Earleywine, 2011). Since deficits of positive affect are specific to depression but negative affect is common to both anxiety and depression (Clark & Watson, 1991), these results support the construct validity of the STICSA. Since the STAI has exhibited both a depression factor (Caci et al, 2003) and a second order factor of negative affect (Bieling et al., 1998), the STICSA may represent a more pure measure of anxiety, consistent with the tripartite model (Clark & Watson, 1991).

Like direct indices of psychopathological symptoms (e.g., *Beck Anxiety Inventory*, BAI; Beck & Steer, 1993), trait anxiety commonly relates to physiological and neurobiological biomarkers of potential clinical utility (e.g., Bishop, 2007). There also is evidence that anxious temperament is stable across time (Kagan & Snidman, 1999) and that it strongly relates to the onset of emotional disorders (Leondaro & Hen, 2008). While anxiety is commonly measured on a dimensional basis, many clinical and research decisions are based on categorical classifications (e.g., whom to treat and with what intervention; whom to include in which group).

It has been pointed out that "clinical decisions are categorical" (Widiger & Samuel, 2005, p. 500). Due to the common necessity of categorical decisions, it is often beneficial to identify cut-off scores that differentiate probable "cases" from

probable "non-cases." However, contrasting opinions about dimensional and categorical assessment abound, many arguing that dimensional assessment more accurately reflects the "nature" of mental illness (e.g., Widiger & Samuel, 2005). Kraemer, Noda, and O'Hara (2004), however, point out that it is not really a question of either-or, but a question of when to primarily rely on categorical and when to primarily rely on dimensional assessment. While there is no definitive test or measure that can naturally define mental illness ("cut point dilemma"; Kessler, 2002), there is pragmatic clinical utility to cut-off scores (e.g., Kessler, 2002; Kessler et al., 2003; Kraemer et al., 2004). Clinicians must make decisions about who to treat and what interventions to provide and researchers are often required to decide who to include in "patient" and "control" groups of empirical studies (Kessler, 2002). The either-or debate often precludes the consideration of using both categorical and dimensional assessment; the primary decision being which to use first (Kessler, 2002; Kraemer et al., 2004).

The present study aimed to determine a cut-off score for the STICSA that could differentiate between a sample of controls ($n = 439$) and a sample of clinically diagnosed individuals with anxiety disorders ($n = 398$). This goal was, in part, aided by comparison of scores on the *Depression Anxiety Stress Scales, 21-item version* (DASS-21; Lovibond & Lovibond, 1995). We also aimed to examine the utility of the established cut-off scores in approximating the known prevalence of anxiety "cases" in a very large community sample ($n = 6685$). Given that the STICSA has been shown to better differentiate anxiety from depression than other commonly used anxiety measures and that it measures a range of anxiety symptoms (e.g., Gros et al., 2007), the identification of a cut-off score that is indicative of a probable case of clinical anxiety can inform important decisions in the treatment and study of anxiety.

Method

Participants

Participants were sampled from three different populations: (1) patients with Axis I anxiety disorders from St. Josesph's Healthcare, Hamilton, ON, (2) students from the University at Buffalo, and (3) community members who responded to an email request issued to the National Organization for the Reformation of Marijuana Laws (NORML) listserv.

Anxiety disorder patients

Responses and chart histories were collected from 567 psychiatric patients seen on an outpatient basis at the Anxiety Treatment and Research Centre (ATRC) at St. Joseph's Healthcare, Hamilton, ON. The ATRC specializes in the treatment of all anxiety disorders, with the exception of post-traumatic stress disorder (PTSD). The clinical presentation of the patient sample was assessed with the Structured Clinical Interview for DSM-IV (SCID-IV; First, Spitzer, Gibbon, & Williams, 1996) and several self-report measures. Cases were screened on the basis of clinician assessments of diagnostic certainty and self-report reliability. Diagnostic certainty was not provided in 212 cases and was rated "low" in 8 cases; all of which were excluded from subsequent analyses. Clinician-assessed patient self-report reliability

was absent in an additional 27 cases and rated as "low" in 3 cases; all of which were excluded. Those individuals who did not have a principal anxiety diagnosis or who had an additional principal diagnosis other than anxiety or depression were also excluded ($n = 30$). Next, missing values were imputed by mean substitution for cases where less than 10% of responses were missing for the STICSA and DASS-21; individuals with greater than 10% missing data were excluded ($n = 81$). The remaining 398 cases consisted of patients with principal Axis I diagnoses of panic disorder (PD; $n = 129$, 32.4%), social phobia (SocP; $n = 118$, 29.6%), obsessive-compulsive disorder (OCD; $n = 89$, 22.4%), generalized anxiety disorder (GAD; $n = 40$, 10.1%), specific phobia (SpP; $n = 15$, 3.8%), and anxiety disorder not otherwise specified (Anx NOS; $n = 7$, 1.8%). In addition to the primary anxiety diagnosis, 311 (78.1%) patients had an additional Axis I diagnosis (39.5% – 1 additional diagnosis, 26.4% – 2 additional diagnoses, 19.6% – 3 additional diagnoses, 8.0% – 4 additional diagnoses, 5.1% – 5 additional diagnoses, 1.0% – 6 additional diagnoses). Additional diagnoses were present in the following proportions of the entire patient sample: depression – 39.4%, SocP – 24.9%, SpP – 24.4%, GAD – 18.3%, PD – 12.8%, OCD – 12.8%, drug abuse/dependence – 8.5%, posttraumatic stress disorder – 7.5%. Although present as a group in approximately 15.1% of the patients, the following disorders were present in less than 5% of individual patients (adjustment disorder, agoraphobia, anorexia, Anx NOS, bipolar disorder, bulimia, hypochondriasis, impulse control disorders, somatoform disorders, and schizoaffective disorder).

The patient population was relatively well educated, 36.4% reporting a college education, 27.3% reporting completion of some college, and 17.9% reporting a high school diploma; 17.7% reported some high school and less than 1% of patients reported no high school education. Patients were an average of 35.1 years old (SD = 11.7) and were primarily female (61.7%). Patients predominantly self-identified as Caucasian (94.6%), with 1.8% identifying as Native Canadian, and less than 1% in all other ethnic groups.

Student controls

Across two studies (Gros et al., 2007, Gros et al., 2010), a large group of undergraduate psychology students from the University at Buffalo completed questionnaires for course credit. Responses from students who completed the STICSA and DASS-21 were pooled to form one sample ($n = 445$). Missing values were imputed by mean substitution for cases where less than 10% of responses were missing for the STICSA and DASS-21; this excluded six cases. Student controls were an average of 19.2 years old (SD = 11.7) and were approximately equivalent in gender (48.7% female). Students predominantly self-reported as Caucasian (54.1%), but also self-identified as Asian (25.1%), Black (10.0%), "Other" (5.7%), and Hispanic (5.0%).

Community participants

More than 10,000 participants responded to a request issued to the NORML listserv to complete questionnaires. NORML is a nonprofit organization that actively promotes the decriminalization and market regulation of marijuana among adult

users. Although previous work suggests that this sample does not differ from a national US sample demographically (see De Leo, Van Dam, Hobkirk, & Earleywine, 2011; Van Dam & Earleywine, 2011), with the exception of high gender disparities favoring males, the sample reported a considerably higher rate of lifetime marijuana use (>99%, compared to population estimates of 53.8%; see Substance Abuse and Mental Health Services Administration, 2003). Despite increased marijuana use, this sample was deemed appropriate for examination of anxiety because although a relation between anxiety and marijuana use has been established, there is no evidence for causality (e.g., Crippa et al., 2009). After screening, 7389 participants were retained for analyses (see Van Dam & Earleywine, 2011), though only 6685 participants completed all items on the STICSA. The majority of the sample was male (80.7%) with an average age of 30.6 years (SD = 13.1). Participants self-identified as Caucasian (89.4%), Hispanic/Latino (5.7%), Other (1.8%), African American (1.3%), Asian (1.2%), and Native American (0.6%). The sample was relatively well educated, 44.2% reporting completion of some college, 14.8% reporting a Bachelor's degree, 13.6% reporting a high school education, 10% reporting an Associate's degree, 8.1% reporting some high school, 5.4% reporting an Advanced Degree, and 3.8% reporting some graduate education.

Procedure

Each group of participants (anxiety patients [$n = 398$], student controls [$n = 439$], and community participants [$n = 6685$]) followed a specific procedure approved by the institutional review boards at St. Joseph's Healthcare Hamilton, the University at Buffalo, and the University at Albany. Anxiety patients were referred to the ATRC by a physician, after which they were individually scheduled for an intake interview. The intake interview included a modified version of the SCID-IV to establish Axis I diagnosis based on Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM-IV-TR, American Psychiatric Association, 2000), as well as several self-report measures. Student controls were recruited from the psychology research pool and attended a research session for course credit. Students completed questionnaire packets including several different measures (Gros et al., 2007, Gros et al., 2010). Community participants responded to an email request issued to the NORML listserv. Upon completion of the survey, community participants were entered into a drawing for a $250 Amazon.com giftcard or 1 of 5 4 GB iPods. Willing participants forwarded the email to others who might be interested (Van Dam & Earleywine, 2011).

Measures

Depression Anxiety Stress Scales 21-item version (DASS-21)

The DASS-21 (Lovibond & Lovibond, 1995) is a 21-item measure with three subscales designed to assess dysphoric mood (depression subscale: DASS-21-D), symptoms of fear and autonomic arousal (anxiety subscale: DASS-21-A), and symptoms of tension and agitation (stress subscale: DASS-21-S). Although not as widely used as other measures of anxiety and depression, the DASS-21 has resulted in a small but growing literature showing that it demonstrates greater discriminant

validity than the *Beck Depression Inventory* (BDI; Beck & Steer, 1987) and *Beck Anxiety Inventory* (Beck & Steer, 1993) (e.g., Lovibond & Lovibond, 1995). Moreover, several studies have found support for the factor structure, convergent and discriminant validity, and internal consistency of the DASS-21 in community (Crawford & Henry, 2003) and clinical samples (Antony, Bieling, Cox, Enns, & Swinson, 1998; Brown, Chorpita, Korotitsch, & Barlow, 1997; Lovibond & Lovibond, 1995). Together, these findings suggest that the DASS-21 can be used successfully to differentiate the symptoms of anxiety and depression. In the current study, the DASS-21 was only assessed in the anxiety disorder patients and student controls, not the community sample. Internal consistency was good in anxiety patients (total score, $\alpha = .92$; depression subscale, $\alpha = .81$, anxiety subscale, $\alpha = .91$; stress subscale, $\alpha = .86$) and student controls (total score, $\alpha = .94$; depression subscale, $\alpha = .85$, anxiety subscale, $\alpha = .87$; stress subscale, $\alpha = .85$).

State-trait inventory for cognitive and somatic anxiety – trait version

The STICSA-Trait (Gros et al., 2007; Ree et al., 2008) is a 21-item measure designed to assess cognitive and somatic trait anxiety. The cognitive (STICSA-C) and somatic (STICSA-S) subscales have been supported by confirmatory factor analyses, and both subscales have been found to have high internal consistency ($\alpha > .87$; Gros et al., 2007, Gros et al., 2010). In addition, the STICSA-Trait was found to remain stable over repeated administrations during several stress manipulations (r's $> .65$; Ree et al., 2008). As in previous psychometric analyses (Gros et al., 2007; Ree et al. 2008), the STICSA-C and STICSA-S subscales exhibited high correlations in the patients ($r = .533$), student controls ($r = .650$), and community sample ($r = .602$). Despite these high subscale correlations, it is worth noting that in each of these cases the overlap in variance between the subscales ranges from .28 to .42 (meaning there is a substantial amount of unique variance among the subscales). In the present study, internal consistency was good in anxiety patients (total score, $\alpha = .90$; STICSA-C, $\alpha = .86$, STICSA-S, $\alpha = .87$), student controls (total score, $\alpha = .92$; STICSA-C, $\alpha = .89$, STICSA-S, $\alpha = .88$), and the community sample (total score, $\alpha = .89$; STICSA-C, $\alpha = .86$, STICSA-S, $\alpha = .78$).

Structured clinical interview for DSM-IV

The SCID-IV (First et al., 1996) is a semi-structured diagnostic interview designed to assess the DSM-IV-TR diagnostic criteria for Axis I disorders (American Psychiatric Association, 2000). Interviewers were psychologists, supervised postdoctoral fellows, or senior graduate students, each of whom received extensive training and supervision in conducting this interview. The principal diagnosis of each patient was based on the disorder that was found to be most disabling at the time of the assessment. Earlier versions of the SCID have shown adequate interrater reliability for all disorders (r's: .69–1.0; Zanarini & Frankenburg, 2001) and adequate test–retest reliability over a 1–3-week interval in patient samples (r's: .40–1.0; Williams et al., 1992; Zanarini & Frankenburg, 2001). In each of the anxiety disorder sections on the SCID (except for PTSD), additional follow-up questions from the Anxiety Disorders Interview Schedule for DSM-IV (Di Nardo, Brown, & Barlow, 1994) were added to obtain more detail about the range of situations affected by the disorder. As a

semi-structured interview, the SCID administration guidelines permit the addition of such follow-up questions. The SCID-IV was only administered to the anxiety disorder patients.

Statistical methods

As the anxiety disorder patients and student controls appeared to have meaningful differences in demographics, between-group analyses were conducted to explore the extent of these differences. Within-group analyses were also conducted to ascertain whether any of the demographic variables exhibited meaningful relationships with the STICSA.

Receiver operating characteristic (ROC) curve analysis was conducted to evaluate the precision of the STICSA and its subscales in discriminating anxiety disorder patients from student controls (participants from the community sample were not included because no additional anxiety measure other than the STICSA was available). While using undiagnosed student controls is not an optimal approach for ROC analyses, a comparison group is required. Epidemiologic estimates suggest that anxiety disorders occur in approximately 12% of college students (Blanco et al., 2008). Because an additional anxiety measure was available in this sample, ROC analyses could be conducted both with and without exclusion of individuals from the student control sample who likely met criteria for an anxiety disorder.

ROC curve analysis displays the relation between the sensitivity (true positives) and the inverse of the specificity (true negatives) at each value along a dimensional screening scale as it pertains to differentiating two groups of interest (e.g., patients and controls). The main outcome variable is the area under the curve (AUC). The curve results from matching each point along the total scale score in terms of that score's sensitivity and the inverse of its specificity with regards to the two groups being examined. AUC is interpreted as the probability that a randomly sampled respondent will be correctly assigned to the appropriate "group" (Hanley & McNeil, 1982). In the present case, the groups were either patients or student controls.

There are important considerations associated with particular methods to identifying a cut-off score (Kraemer et al., 2004). True positives or sensitivity (correct identification as anxiety patient) and true negatives or specificity (correct identification as control) are the most obvious markers. However, one must also consider false positives (incorrect identification as anxiety patient) and false negatives (incorrect identification as control). In mental health, false positives can be associated with the inaccurate provision of a potentially stigmatizing label (mental illness), while false negatives can potentially result in a failure to obtain much needed therapeutic services. Identifying cut-off scores is tricky and often depends on the benefits of true positives and true negatives and the costs of false positives and false negatives (Kraemer et al., 2004). In traditional medical settings, missing an important diagnosis (false negative) may have a substantially greater cost than making a false diagnosis (false positive). In this case, the emphasis would be on sensitivity rather than specificity. However, the nature of mental health issues is such that false positives and false negatives are often considered equally problematic (Kessler et al., 2003). One method to minimize both false positives and false negatives is to give them equal weight in establishing a cut-off score (Kessler et al., 2003).

An additional consideration is the classification accuracy of established cut-off scores for the STICSA and its subscales across varying anxiety disorders. To examine the ability of the STICSA and its subscales to correctly classify individuals with varying anxiety disorders, we looked at the proportion of individuals within the anxiety patient population who were correctly identified as having a disorder within the available diagnostic categories.

Additional statistical comparisons and analyses were conducted as necessary. All computations were performed using IBM SPSS 18.0.

Results

Demographic factors

The ratio of females to males was significantly higher in the anxiety disorder patients (ratio = 1.6:1) than student controls (ratio = 1:1), $X^2_{(1)} = 14.1$, $p < .001$. In anxiety disorder patients, females ($M = 52.5$, SD = 12.0) exhibited significantly higher STICSA scores than males ($M = 48.9$, SD = 12.4), $t(395) = 2.89$, $p < .01$, $d = 0.30$. However, the same pattern was true in student controls, with females ($M = 37.0$, SD = 11.3) scoring significantly higher than males ($M = 34.7$, SD = 11.0), $t(435) = 2.19$, $p < .05$, $d = 0.21$. This pattern is consistent with previously reported gender differences in the prevalence rates for anxiety disorders (American Psychiatric Association, 2000). While there was a significant difference in racial/ethnic distribution between groups, $X^2_{(5)} = 185.4$, $p < .001$, there was no difference in STICSA scores by racial/ethnic group for either the anxiety disorder patients, $F(390) = 1.34$, $p > .05$, or the student controls, $F(437) = 1.98$, $p > .05$. Similarly, while there was a significant difference in mean group age ($\Delta = 15.9$ years), $t(833) = 27.67$, $p < .001$, there was no correlation between age and STICSA scores in either anxiety disorder patients ($r = .03$) or student controls ($r = -.08$). These results suggest no group differences in relations between demographic variables and the STICSA.

ROC analyses

The area under the curve (AUC) for the ROC of the STICSA was .82 (95% CI = .79 – .85), suggesting good discrimination between groups. The optimal cut point to equalize false positives and false negatives was a STICSA total score of 43. At this point, sensitivity was .73, specificity was .74, and classification accuracy was .74. The AUC for the ROC of the cognitive subscale was .82 (95% CI = .79 – .85); the optimal cut point was a STICSA-C score of 23. At this point, sensitivity was .70, specificity was .78, and classification accuracy was .74. The AUC for the ROC of the somatic subscale was .77 (95% CI = .73 – .80); the optimal cut point was a STICSA-S score of 18. At this point, sensitivity was .68, specificity was .76, and classification accuracy was .71 (see Table 1).

To optimize ROC analyses, a second round of computation was undertaken after further data screening. A small proportion of individuals from the student sample were within the "severe" (8.2%) and "extreme" (11.8%) range of anxiety for the DASS-21 anxiety subscale with scores ≥15. This combined proportion (20.0%) approximated the 1-year prevalence rate across all anxiety disorders (18.1%; Kessler

Table 1. Prediction parameters for total STICSA score, as well as cognitive and somatic subscales versus anxiety patient and student control group membership with no group exclusions.

Cut-off score	Sensitivity	Specificity	Positive predictive power	Negative predictive power	Classification accuracy
STICSA					
43	.73	.74	.72	.75	.74
40	.80	.67	.68	.79	.73
STICSA-C					
23	.70	.78	.70	.78	.74
22	.69	.79	.73	.69	.73
STICSA-S					
18	.68	.76	.68	.76	.71
17	.65	.76	.65	.76	.70

Note: Sensitivity = true positives/(true positives + false negatives); specificity = true negatives/(true negatives + false positives); positive predictive power = true positives/(true positives + false positives); negative predictive power = true negatives/(true negatives + false negatives); classification accuracy = (true positives + true negatives)/(true positives + true negatives + false positives + false negatives). STICSA, State Trait Inventory for Cognitive and Somatic Anxiety; STICSA-C, Cognitive Subscale; STICSA-S, Somatic Subscale.

et al., 2005), suggesting that these individuals may have had symptoms meeting criteria for an anxiety disorder diagnosis. The methods precluded confirmation of a diagnosis in the student sample. Any participant in the student group with a DASS-21 anxiety subscale score ≥ 15, indicating severe or extreme anxiety, was excluded ($n = 88$; 20.0% of the remaining sample). Additionally, a small proportion of the individuals in the clinical group were in the "normal," "mild," or "moderate" range of anxiety for the DASS-21 anxiety subscale, with scores ≤ 14. Patients who met the aforementioned criteria on the DASS-21 and who exhibited Global Assessment of Function (GAF) ≥ 71, indicating minimal functional impairment, were also excluded ($n = 9$; 2.3%).

The AUC for the second ROC of the STICSA was .88 (95% CI = .86–.91), suggesting very good discrimination between groups. The optimal cut point to equalize false positives and false negatives was a STICSA total score of 40. At this point, sensitivity was .78, specificity was .79, and classification accuracy was .79. When this same cut-off score was used with the unrestricted anxiety patient and student control samples, sensitivity was .80, specificity was .67, and classification accuracy was .73 (see Table 1). The AUC for the ROC of the cognitive subscale was .87 (95% CI = .84–.89); the optimal cut point was a STICSA-C score of 22. At this point, in the restricted sample, sensitivity was .81, specificity was .74, and classification accuracy was .78. The AUC for the ROC of the somatic subscale was .83 (95% CI = .80–.86); the optimal cut point was a STICSA-S score of 17. At this point, in the restricted sample, sensitivity was .79, specificity was .71, and classification accuracy was .75. Additional details for performance of the subscale cut-off scores in the unrestricted sample are presented in Table 1.

Table 2. Probable noncase and case identification in student controls by STICSA cut-off score according to DASS-21 Anxiety severity.

	DASS-21 Anxiety Severity Category				
	Normal (0–6)	Mild (7–9)	Moderate (10–14)	Severe (15–19)	Extreme (20 +)
STICSA Cut-off score = 43					
noncase	236 (53.8%)	19 (4.3%)	39 (8.9%)	17 (3.9%)	12 (2.7%)
Case	23 (5.2%)	8 (1.8%)	26 (5.9%)	19 (4.3%)	40 (9.1%)
STICSA Cut-off score = 40					
noncase	219 (49.9%)	16 (3.6%)	33 (7.5%)	12 (2.7%)	12 (2.7%)
Case	40 (9.1%)	11 (2.5%)	32 (7.3%)	24 (5.5%)	40 (9.1%)

Note: DASS-21, Depression, Anxiety and Stress Scales, 21-item version; STICSA, State Trait Inventory for Cognitive and Somatic Anxiety.

Comparing cut-off scores

Using both the clinical and student datasets without exclusions, cut-off scores were compared (see Tables 1 and 2). While the cut-off score of 40 had a greater sensitivity relative to 43 (.80 vs. .73), it also had a much lower specificity (.67 vs. .74). This result suggests that a cut-off score of 40 is better at identifying probable cases of clinical anxiety, but at a reasonably large cost of misidentifying probable cases (see Table 1). The cut-off score of 43 identified 26.4% of students as probable cases of clinical anxiety and misidentified a comparable proportion of patients (26.6%) as noncases. The cut-off score of 40 identified 33.5% of students as probable cases of clinical anxiety and misidentified a smaller proportion of patients (20.1%) as noncases. If we consider "severe" and "extreme" anxiety (based on DASS-21-A scores), to be likely indicators of clinical anxiety, then a cut-off score of 43 identified 33.0% of students who may have had clinical levels of anxiety as noncases. A cut-off score of 40 slightly improved on this, identifying 27.3% of students who may have had clinical levels of anxiety as noncases. On the opposite end of the range, assuming "normal" and "mild" anxiety are likely indicators of nonclinical anxiety, then a cut-off score of 43 misidentified 10.8% of student controls as cases. A cut-off score of 40 led to a 7% increase in misidentification of this type, indicating that 17.8% of student controls were cases.

Two separate cut-off scores were identified for each of the subscales (see Table 1). In both cases, the less conservative cut-off scores did not substantially improve upon any of the classification indices, warranting the retention of a STICSA-C cut-off score of 23 and a STICSA-S cut-off score of 18. Relative to the STICSA cut-off score, the subscale cut-off scores improved upon specificity and negative predictive power, but little else (see Table 1).

Classification accuracy within individual anxiety disorders

Six different primary anxiety disorder diagnoses were present within the anxiety patient sample. Both STICSA cut-off scores and the conservative subscale cut-off scores were examined within each of these diagnoses (see Table 3). For the STICSA

Table 3. Classification accuracy of cut-off score by primary Axis I anxiety disorder in Anxiety Patients.

Cut-off Score	Panic disorder ($n = 129$)	Social phobia ($n = 118$)	OCD ($n = 89$)	GAD ($n = 40$)	SP ($n = 15$)	Anx NOS ($n = 7$)
STICSA						
43	72.7	76.3	75.3	75.0	40.0	75.0
40	79.7	83.6	83.1	80.0	46.7	75.0
STICSA-C						
23	75.0	81.4	78.7	85.0	53.3	75.0
STICSA-S						
18	83.5	76.3	69.7	70.0	46.7	100.0

Note: OCD, obsessive-compulsive disorder; GAD, generalized anxiety disorder; SP, specific phobia; Anx NOS, anxiety disorder not otherwise specified.
STICSA, State Trait Inventory for Cognitive and Somatic Anxiety; STICSA-C, Cognitive subscale; STICSA-S, Somatic subscale.

cut-off scores, classification accuracy is comparable across disorders, with the exception of SpP, for which accuracy is substantially lower. This finding, however, has limited applicability since the sample of individuals with SpP diagnoses is very small. It is important to note that the subscales substantially improve upon classification accuracy for several disorders. In the case of panic disorder, accuracy is 72.7 and 79.7 for STICSA cut-off scores of 43 and 40, respectively, while accuracy is 83.5 for the STICSA-S. A similar finding is present for GAD, where accuracy is 75.0 and 80.0 for STICSA cut-off scores of 43 and 40, respectively, while accuracy is 85.0 for the STICSA-C. The STICSA-C also showed modest increases in classification accuracy for SocP and OCD (see Table 3).

Estimation of anxiety disorder prevalence

To examine the utility of the newly established cut-off scores to estimate prevalence of possible clinical anxiety in a community sample, examination was conducted with

Table 4. Mean, standard deviation, and frequency for STICSA scores by DASS21-A severity classification and sample.

	DASS-21 Anxiety Severity Category				
	Normal (0–6)	Mild(7–9)	Moderate(10–14)	Severe(15–19)	Extreme(20 +)
STICSA Student controls ($N = 439$)					
M (SD)	30.8 (7.6)	37.2 (8.3)	39.5 (9.1)	44.0 (11.5)	49.7 (12.6)
F	54.4%	6.2%	14.8%	8.2%	11.8%
STICSA Anxiety patients ($N = 398$)					
M (SD)	40.5 (10.1)	43.7 (8.6)	47.5 (9.6)	53.2 (8.1)	59.9 (10.3)
F	19.6%	8.5%	20.9%	14.8%	36.2%

Note: DASS-21, Depression, Anxiety and Stress Scales, 21-item version; STICSA, State Trait Inventory for Cognitive and Somatic Anxiety.

a preexisting dataset (Van Dam & Earleywine, 2011). In this sample of 7389 individuals, 6685 of whom completed all STICSA items, the cut-off score of 43 identified 771 (11.5%) cases of probable clinical anxiety. The cut-off score of 40 identified 1135 (17.0%) cases of probable clinical anxiety. Note that both cut-off scores are highly comparable to epidemiological estimates of anxiety disorders. A cut-off score of 43 approximates the 11.1% epidemiological estimate of Grant and colleagues (2004), while a cut-off score of 40 approximates the 18.1% epidemiological estimate of Kessler and colleagues (2005).

Trait anxiety by anxiety severity across groups

Examination of the DASS-21-A severity ranges across groups (see Table 4) revealed a strong difference in trait anxiety by anxiety severity by group. Patients classified as exhibiting normal levels of anxiety by the DASS-21-A showed comparable trait anxiety levels (STICSA $M = 40.5$, SD $= 10.1$) to student controls classified as exhibiting moderate levels of anxiety severity (STICSA $M = 39.5$, SD $= 9.1$). The same was true of mildly anxious patients (STICSA $M = 43.7$, SD $= 8.6$) and severely anxious student controls (STICSA $M = 44.0$, SD $= 11.5$). This result suggests important differences between anxiety symptom severity (as assessed by the DASS-21-A) over short periods of recall and general trait anxiety (as assessed by the STICSA).

Discussion

The present study aimed to identify a cut-off score on the STICSA that could differentiate a sample of nonanxious college controls from patients with a clinician-diagnosed Axis I anxiety disorder. We also aimed to compare the utility of these cut-off scores to approximate known prevalence rates of anxiety disorders in a large community sample. Two separate ROC curve analyses (the standard method for establishing a cut-off score; e.g., Kraemer et al., 2004) were conducted: one ROC including all members from both groups, and the other ROC excluding overlapping members from the two groups based on DASS-21-A scores for the student controls and GAF and DASS-21-A scores for the anxiety patients. The first ROC analysis identified a cut-off score of 43 with a sensitivity of .73, specificity of .74, and classification accuracy of .74. The second ROC analysis identified a cut-off score of 40 in the limited sample (based on additional exclusion criteria) with a sensitivity of .78, specificity of .79, and classification accuracy of .79. When the cut-off score of 40 was applied to the whole sample, it had a sensitivity of .80, specificity of .67, and classification accuracy of .73 (see Table 1). When both cut-off scores were applied to the large community sample, the cut-off score of 43 identified 11.5% of individuals as probable cases of clinical anxiety, while the cut-off score of 40 identified 17.0% of individuals.

Within the anxiety patients and student controls, the cut-off score of 43 is the more reliable of the two cut-off scores, with an overall classification accuracy of .74 (vs. .73). However, relative to the cut-off score of 43, what the cut-off score of 40 loses in specificity (−7.1%), it gains in sensitivity (+6.5%) (see Table 1). In other words, while the cut-off score of 40 classified more students as anxiety patients (false positives), it also identified more anxiety patients as anxiety patients (true positives).

Examining the relation of the two cut-off scores to DASS-21-A scores (see Table 2), the severity category with the largest differences is in "normal" anxiety (as classified by DASS-21-A). At this severity level, a cut-off score of 40 identifies 9.1% of student controls as probable cases of clinical anxiety, while the cut-off score of 43 only identifies 5.2% of student controls as probable cases of clinical anxiety (a difference of 3.9%). These differences might be explained by the fact that the DASS-21 measures past week symptoms while the STICSA measures general anxious tendencies. The DASS-21 assesses symptoms that occurred over the past week, while the STICSA (trait) assesses general anxious tendencies and/or feelings. Since many anxiety disorders have a chronic, recurrent course (see American Psychiatric Association, 2000), it actually may be more appropriate to consider general tendencies than past week symptoms. In the present analyses, comparison of recent (and/or state) anxiety symptoms (as measured by the DASS-21-A) to trait anxiety symptoms (as measured by the STICSA) provided support for the utility of trait measures of anxiety in predicting clinical anxiety (see Table 4). Across all categories of recent anxiety severity (DASS-21-A), anxiety patients exhibited mean STICSA scores about 10 points higher. This finding is consistent with evidence that suggests trait, rather than state anxiety, is a predisposing factor for mental illness (e.g., Clark & Watson, 1991; Leonardo & Hen, 2008). It may be the case that a small proportion of students who endorse a paucity of past week anxiety symptoms actually have higher levels of trait anxiety, thus placing them at greater risk for mental illness.

The two cut-off scores closely reflect two of the most widely cited estimates of 12-month prevalence rates of anxiety disorders in the USA (11.1%, Grant et al., 2004; 18.1% Kessler et al., 2005). A cut-off score of 43 identified 11.5% of individuals in the community sample as probable cases of clinical anxiety, while a cut-off score of 40 identified 17.0% as probable cases of clinical anxiety. While a higher prevalence rate is reflected in DSM-IV (American Psychiatric Association, 2000), a prevalence estimate of 11.1% is based on the largest epidemiological survey to date (Grant et al., 2004) and approximates a meta-analytic estimate across numerous European countries (12.0%; Wittchen & Jacobi, 2005). Regardless, both cut-off scores have utility in predicting empirically determined prevalence rates of anxiety disorders, though converging evidence does seem to suggest a prevalence rate around 11–12% rather than 18%. Thus, a cut-off score of 43 is more consistent with 12-month occurrence of anxiety disorders.

While a cut-off score of 43 seems to have more empirical support and predictive utility, one should not completely rule out the cut-off score of 40. As Kraemer and colleagues (2004) suggest, it is not so much a matter of which cut-off score, but more when to use which cut-off score. In the present case, the rates of sensitivity and specificity of the two cut-off scores (see Table 1) argue for their use in different circumstances. Researchers seeking to identify probable cases of clinical anxiety should use the cut-off score that is more accurate overall (STICSA total = 43). In contrast, clinicians seeking to identify the possibility of clinical anxiety should use the cut-off score that is more sensitive (STICSA total = 40). In either case a single score on one self-report measure cannot replace clinician judgment in terms of providing a diagnosis. Thus, in clinical settings, the use of a tool that has a sensitivity of about 80% in identifying probable cases of clinical anxiety is likely to be of considerable utility in identifying who requires follow-up assessment. In research settings, where clinician assessment is less often available (though equally important),

a cut-off score that more accurately estimates the prevalence and likelihood of clinical anxiety is warranted. One should use caution when applying these cut-off scores to the different anxiety disorders (see Table 3). Of note, the cut-off scores did not perform particularly well in cases of SpP, though the sample of individuals with this primary diagnosis was very small. Additionally, our findings cannot speak to all anxiety disorders – as not all were represented.

The cognitive and somatic subscales have additional utility. ROC analyses revealed an optimal cut-off score of 23 for the STICSA-C and of 18 for the STICSA-S. While the subscales did not substantially improve upon the identification across anxiety disorders, they did show important differences in relations to individual anxiety disorders. A STICSA-C score ≥ 23 likely confers additional classification accuracy for GAD and may confer additional accuracy for SocP and OCD. In contrast, a STICSA-S score ≥ 18 likely confers additional classification accuracy for PD (see Table 3). These findings are consistent with the general symptom presentations of these different anxiety disorders (American Psychiatric Association, 2000).

In both clinical and research settings, a cut-off score that identifies probable cases of clinical anxiety can be of great utility. While numerous measures of anxiety exist, emerging evidence suggests that the STICSA is a more pure measure of anxiety than other commonly used tools. Unlike the STAI, the STICSA shows stronger correlations to other measures of anxiety than to depression (Gros et al., 2007; Ree et al., 2008). The STICSA also shows theoretically consistent relations to positive and negative affect (Van Dam & Earleywine, 2011) in the tripartite model of emotional disorders (Clark & Watson, 1991); an outcome not necessarily the case for other measures of anxiety (e.g., STAI; Bieling et al., 1998). The STICSA also shows strong psychometric properties across a number of studies and within a number of different types of anxiety (Gros et al., 2007, Gros et al., 2010; Ree et al., 2008; Van Dam & Earleywine, 2011). The separation of cognitive and somatic symptoms also permits examination of prominent components of anxiety and inclusion of a range of anxious conditions, a feature lacking in another popular measure of anxiety, such as the BAI, which focuses predominantly on symptoms related to panic attacks (Cox, Cohen, Direnfield, & Swinson, 1996). Finally, the analyses in the present study show that recent anxiety (DASS-21-A) may be less accurate than trait anxiety (STICSA) in predicting clinical anxiety (see Table 4). In sum, these results suggest that the STICSA may be a more accurate measure of anxiety than other commonly used tools.

Several limitations of the current study need to be addressed. The use of two separate samples (anxiety disorder patients and student controls) to conduct ROC analyses is not optimal. Although the groups exhibited clear demographic differences, only gender was significantly related to scores on the STICSA. Even then, the gender pattern was consistent in size across groups and reflects common findings that females have higher rates of anxiety than males (American Psychiatric Association, 2000). The fact that patients were diagnosed with Axis I anxiety disorders was a strength of the paper but the inability to confirm lack of mental illness in the student control sample is potentially problematic. Future studies should include a large, diverse community sample with a range of nonanxious and anxious individuals who have been assessed via clinical interview (e.g., SCID-IV). An additional limitation of the present analyses is that only one additional anxiety

measure (DASS-21-A) was available for examination of convergent validity and it was only present in two of the three samples. Future studies should include multiple measures of anxiety (e.g., STAI, BAI, Hospital Anxiety and Depression Scales), as well as other discriminant measures, to further examine the construct validity of the STICSA.

Finally, the use of the NORML listserv to acquire a "population" sample is potentially problematic as there are potential self-selection biases, especially pertaining to use of illicit drugs. The most consistent difference of this sample from the national population is marijuana use. While there are links between marijuana and anxiety, no causal relation has been established (Crippa et al., 2009). If the elevated use of cannabis in the sample from NORML were to have an impact on anxiety, one might expect increased rates of anxiety (e.g., Bedi, Van Dam, & Redman, 2010), a finding not present for either cut-off scores in the present study.

Despite limitations, the present study identified two cut-off scores that were verified in a large community sample. The STICSA score of 43 is recommended for use in research settings and where individuals want to be more confident of a probable case of clinical anxiety. The STICSA score of 40 is recommended for use in clinical settings and where individuals want to maximize the identification of possible cases of clinical anxiety. The present study adds to the utility of an already promising measure, the STICSA, by providing researchers and clinicians with a cut-off score to identify probable cases of clinical anxiety. While trait anxiety is believed to be a predisposition to the development of anxiety disorders in general (e.g., Leonardo & Hen, 2008), levels of trait anxiety are variable across the anxiety disorders (Watson, Gamez, & Simms, 2005). For example, GAD has clear links to trait anxiety (and negative affect/neuroticism), while SpP, considerably less so. Thus, future studies should explore the utility of trait versus state forms of anxiety measures (including the STICSA) to delineate groups warranting prevention and intervention across the anxiety disorders.

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