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An Inventory for Measuring Clinical Anxiety: Psychometric Properties

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The development of a 21-item self-report inventory for measuring the severity of anxiety in psychiatric populations is described. The initial item pool of 86 items was drawn from three preexisting scales: the Anxiety Checklist, the Physician's Desk Reference Checklist, and the Situational Anxiety Checklist. A series of analyses was used to reduce the item pool. The resulting Beck Anxiety Inventory (BAI) is a 21-item scale that showed high internal consistency ($\alpha = .92$) and test–retest reliability over 1 week, $r(81) = .75$. The BAI discriminated anxious diagnostic groups (panic disorder, generalized anxiety disorder, etc.) from nonanxious diagnostic groups (major depression, dysthymic disorder, etc). In addition, the BAI was moderately correlated with the revised Hamilton Anxiety Rating Scale, $r(150) = .51$, and was only mildly correlated with the revised Hamilton Depression Rating Scale, $r(153) = .25$.

Studies addressing the distinctiveness of anxiety and depression depend on the availability of reliable and valid assessment instruments. However, a number of studies have reported high correlations ($r > .50$) between the widely used rating scales of anxiety and depression (e.g., Dobson, 1985; Mendels, Weinstein, & Cochrane, 1972; Mountjoy & Roth, 1982; Prusoff & Klerman, 1974; Riskind, Beck, Brown, & Steer, 1987; Tanaka-Matsumi & Kameoka, 1986). These findings raise the question, Are the high correlations due to a genuine shared symptomatology, or do they simply reflect a lack of discriminant validity? Consequently, to the extent that a given study fails to differentiate anxiety from depression, it is not possible to know whether anxiety and depression are truly indistinguishable or whether the results simply reflect the shortcomings of the instruments used to measure the two syndromes.

A possible contributing factor to the lack of discriminant validity is the inclusion of anxiety and depression symptoms on measures of both syndromes (Lipman, 1982; Riskind, Beck, Brown, & Steer, 1987). When emphasis is placed on theoretical (e.g., Spielberger, Gorsuch, & Lushene, 1970) and clinical (e.g., Hamilton, 1959, 1960; Zung, 1971) considerations in the early stages of clinical test construction, the discriminant validity of each test item is often overlooked. Discriminant validity is frequently addressed in the later stages of test construction when attention has shifted to total scores and away from individual test items (e.g., Zung, 1971).

A post hoc approach to reducing overlapping symptomatology across measures of anxiety and depression has involved shifting items to the more relevant scale by using applicable external criteria. For example, Riskind, Beck, Brown, and Steer (1987) found that the Hamilton Rating Scales for Anxiety and Depression (Hamilton, 1959, 1960) contained overlapping items and produced significantly correlated scores. When the authors revised the scales by deleting nondiscriminating items and transferring other items to more appropriate scales, the new scales were less correlated and discriminated better between patients with primary anxiety and depression diagnoses.

On the assumption that validity should be built into the test from the outset, other test constructors have used a sequential or multistage approach to test construction (Anastasi, 1986; Jackson, 1970; Millon, 1983). This strategy was followed in the present study to develop a new instrument for the measurement of clinical anxiety, the Beck Anxiety Inventory (BAI). The BAI was developed to address the need for an instrument that would reliably discriminate anxiety from depression while displaying convergent validity. Such an instrument would offer advantages for clinical and research purposes over existing self-report measures of anxiety, such as the State–Trait Anxiety Inventory (STAI; Spielberger et al., 1970) and the Self-Rating Anxiety Scale (SRAS; Zung, 1971), which have not been shown to differentiate anxiety from depression adequately (e.g., Dobson, 1985; Tanaka-Matsumi & Kameoka, 1986).

Method

Subjects

Three samples of psychiatric outpatients were drawn from consecutive routine evaluations at the Center for Cognitive Therapy in Philadelphia, Pennsylvania, from successive time periods beginning in early 1980 and lasting until late 1986. The total sample size was 1,086. The patients were either self-referred or referred by other professionals. There were 456 men (42%; mean age = 36.35, $SD = 12.41$) and 630

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women (58%; mean age = 35.69, *SD* = 12.12). The patients had predominantly affective and anxiety disorders, although a variety of other diagnoses were represented. Less than 1% of the sample was diagnosed as psychotic.

The final subsample (n = 160), on which extensive validation of the final BAI was carried out, was made up of groups with primary diagnoses of major depressive disorder (n = 40); dysthymic disorder and atypical depression (n = 11); panic disorder (n = 45); generalized anxiety disorder (n = 18); agoraphobia with panic attacks (n = 18); social and simple phobia (n = 12); and miscellaneous nonanxiety, nondepression disorders such as academic problems and adjustment disorders (n = 16).

Item Pool

The initial pool of 86 items comprised the contents of three self-report questionnaires administered routinely during intake evaluations at the center. These instruments were designed to cover the wide range of symptoms reported by patients diagnosed as having an anxiety disorder. Each instrument was developed for a specific purpose but contained items judged to be relevant to the assessment of anxiety.

Anxiety Checklist. The Anxiety Checklist (ACL; Beck, Steer, & Brown, 1985) was developed to assess the severity of anxiety symptoms in depressed patients. The 21 items were selected to reflect somatic, affective, and cognitive symptoms that are characteristic of anxiety but not of depression. The ACL exhibited good internal consistency (α = .92) and test–retest reliability, $r(58)$ = .75, over 1 week (Beck et al., 1985).

PDR Checklist. This checklist (PDR; Beck, 1978) provides 26 symptoms of the common side effects of anti-anxiety and antidepressant medications described in the *Physician's Desk Reference* (Medical Economics, 1977). The PDR items were included in the present study because a number of them (e.g., heart pounding, dizziness) also occur in anxiety states. In addition, the PDR items that occur only as medication side effects (e.g., strange taste, skin rash) served as a control on item selection: Content validity was supported when these nonanxiety items were eliminated statistically.

Situational Anxiety Checklist. The Situational Anxiety Checklist (SAC; Beck, 1982) is an experimental measure of the severity of somatic and cognitive symptoms of anxiety, both in general and in the context of two specific situations (public speaking and a problem situation provided by the respondent). The SAC was developed to assess the range of cognitive and somatic symptoms of anxiety that are not represented in existing anxiety measures and to assess the possible situation specificity of these symptoms.

Clinical Evaluation

Beginning with the last two subsamples (n = 116 and n = 160), we used the Structured Clinical Interview for *DSM–III* (SCID; Spitzer & Williams, 1983) to aid in arriving at a diagnosis. The SCID provides a standardized format for questioning patients about their symptoms, and the sequence of questions approximates the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM–III;* American Psychiatric Association, 1980) decision rules. The *DSM–III* criteria are embedded directly in the interview, thus ensuring adequate coverage of the relevant criteria.

The SCID was administered by postdoctoral clinical psychologists. Evidence for the reliability of SCID-based diagnoses on a portion of the present sample (n = 75) was provided by Riskind, Beck, Berchick, Brown, and Steer (1987), who reported kappa coefficients of .72 for major depression and .79 for generalized anxiety disorder.

Criterion Measures

Hamilton rating scales. Each patient was rated by a clinician on the Hamilton Rating Scales for Anxiety (Hamilton, 1959) and Depression (Hamilton, 1960). Because the standard scales overlap substantially, they were rescored as suggested by Riskind et al. (1987) to enhance the discrimination of anxiety and depression disorders. The alpha coefficients were .73 and .83 for the revised depression (HRSD–R) and anxiety (HARS–R) scales, respectively.

Beck Depression Inventory. The Beck Depression Inventory (BDI; Beck, Rush, Shaw, & Emery, 1979) is a widely used measure of the severity of depression. The psychometric properties of the BDI have been reviewed by Beck, Steer, and Garbin (1988).

Hopelessness Scale. The Hopelessness Scale (HS; Beck, Weissman, Lester, & Trexler, 1974) is a self-report instrument assessing the expectation that one will not be able to overcome an unpleasant life situation or attain the things that one values. In a sample of hospitalized patients who had made suicide attempts, the Kuder-Richardson reliability coefficient was .93. The HS was included as a measure theoretically related to depression but not to anxiety.

Cognition Checklist. The Cognition Checklist (CCL; Beck, Brown, Steer, Eidelson, & Riskind, 1987) is a measure of the frequency of automatic thoughts that occur during the course of depression and anxiety disorders. Both the Anxiety (CCL–A) and the Depression (CCL–D) subscales have high internal consistency (α = .92 and .90, respectively), and both subscales exhibited good, $r(64)$ = .76, test–retest reliability coefficients over 1 week.

Procedure

During the patient's initial telephone contact, a 20-min screening interview was conducted by a staff member to provide the caller with information about the treatment program provided at the center and to screen inappropriate subjects. Reasons for exclusion included clear evidence of an organic disorder, of the manic phase of a bipolar disorder with no medication, or of a condition requiring immediate hospitalization (e.g., acute suicidality or psychosis).

Individuals who were appropriate for treatment were scheduled for an intake interview with a clinician. On the date of the interview, the patient first met with an intake coordinator, who administered the ACL, the PDR, and the SAC as part of a comprehensive psychometric evaluation. On completion of the self-report battery, the patient was interviewed by a clinician, who administered the Hamilton scales and made a diagnosis. The diagnostician did not have access to the results of the self-report tests. The diagnosis was reviewed by a staff psychologist who confirmed that all diagnostic criteria were met or suggested modifications.

Results

Overview

Archival data from the ACL, the PDR, and the SAC were used to generate an initial pool of 86 items, and various item analysis strategies were used on the first subsample (n = 810) to eliminate inappropriate and redundant items. An intermediate 37-item scale based on the items that had not been eliminated to this point was administered to a second subsample (n = 116), and further item analyses were used to produce the final 21-item BAI. The final scale was administered to the last subsample (n = 160), and reliability and validity analyses were conducted.

Phase One: Reduction of the Item Pool

Of the initial 86 items, 20 were eliminated because they were either identical or very similar to another item. Successive iter-

Table 1
Means, Standard Deviations, and Corrected Item-Total Correlations for BAI Items

Item	*M*	*SD*	*r*	Factor loading 1	Factor loading 2
Numbness or tingling	.68	.80	.30	24	
Feeling hot	.86	.87	.63	65	
Wobbliness in legs	.61	.83	.54	44	
Unable to relax	1.89	.78	.61		60
Fear of the worst happening	1.74	1.03	.59		87
Dizzy or lightheaded	1.00	.95	.63	62	
Heart pounding or racing	1.18	.98	.55	42	
Unsteady	.96	.99	.71	65	
Terrified	1.15	1.14	.63		68
Nervous	1.89	.84	.60		61
Feelings of choking	.39	.80	.46		32
Hands trembling	.77	.85	.55	71	
Shaky	1.01	.94	.67	82	
Fear of losing control	1.54	1.07	.64		75
Difficulty breathing	.87	1.05	.53		41
Fear of dying	.90	1.11	.50		41
Scared	1.66	.97	.68	76	
Indigestion or discomfort in abdomen	1.10	.98	.42		29
Faint	.68	.91	.67	67	
Face flushed	.69	.85	.59	67	
Sweating (not due to heat)	.80	.97	.60	68	

Note. BAI = Beck Anxiety Inventory. $N = 160$. Cronbach's alpha = .92. Eigenvalues are 7.87 for Factor 1 and 1.38 for Factor 2. Decimal points are omitted from standardized regression coefficients. Secondary coefficients less than .30 are not shown. Interfactor correlation = .56.

ated principal factor analyses on the first subsample ($n = 810$) led to the elimination of an additional 19 items. The 47 items that remained at this point were each subjected to a series of validity analyses (including correlations with criterion measures and comparisons of means scores between diagnostic and other criterion groups) on the basis of which an interim 37-item scale was constructed. The 37-item interim scale was administered to a new sample of 116 patients. Further item validity and reliability analyses yielded the final scale.[1]

The final scale consists of 21 items, each describing a common symptom of anxiety. The respondent is asked to rate how much he or she has been bothered by each symptom over the past week on a 4-point scale ranging from 0 (*Not at all*) to 3 (*Severely—I could barely stand it*). The items are summed to obtain a total score that can range from 0 to 63.

Phase Two: Final Psychometric Properties

Reliability. The final 21-item BAI was administered to the last subsample ($n = 160$). The scale had high internal consistency ($\alpha = .92$) and item-total correlations ranging from .30 to .71 (median = .60; see Table 1). A subsample of patients ($n = 83$) completed the BAI after 1 week, and the correlation between intake and 1-week BAI scores was .75 ($df = 81$).

Factorial validity. An iterated principal factor analysis was performed on the intercorrelations of the 21 BAI items. A scree plot indicated that two underlying dimensions described the correlation matrix. The factor pattern after promax rotation is shown in Table 1. The first factor comprised somatic symptoms and the second factor comprised subjective anxiety and panic symptoms. To confirm that these dimensions were distinct from depression, the 21 BAI and 21 BDI items were intercorrelated and subjected to an iterated principal factor analysis followed by varimax rotation. Four factors were retained on the basis of a scree plot. Three factors were made up of BAI items and one of BDI items. Only one BAI item ("terrified") loaded on the Depression factor, and it had a secondary loading.

Convergent and discriminant validity of the final scale. We tested the ability of the BAI to discriminate homogeneous and heterogeneous diagnostic groups by forming three successive groupings of the sample (Table 2).

The first comparison was between patients with a primary *DSM-III* anxiety disorder and no secondary depression disorder ($n = 82$) and patients with a primary *DSM-III* depression disorder and no anxiety disorder ($n = 30$). The second comparison was between patients with a primary diagnosis of an anxiety disorder (whether or not there was a secondary depression disorder, $n = 95$) and patients with a primary depression disorder (whether or not there was a secondary anxiety disorder, $n = 49$). The third and final comparison was between patients diagnosed with an anxiety disorder, whether primary or secondary ($n = 114$) and depressed patients without an anxiety disorder ($n = 30$). Each comparison also included a group of control patients with neither an anxiety nor a depression disorder ($n = 16$). One-way analyses of variance (ANOVAs) followed by Tukey's tests indicated that the mean BAI score was significantly higher in the anxious group than in either the depressed or the control groups, which did not differ from each other. Table 2 also shows the results for the BDI. The mean BDI scores were significantly higher in the pure and primary depressed groups.

There was only moderate overlap between the BAI scores of the pure anxious and depressed groups. The scores of the anxious group ($n = 82$) ranged from 2 to 58 (median = 24), whereas the scores of the depressed group ($n = 30$) ranged from 1 to 31 (median = 13). Approximately 25% of the anxious group had scores that were higher than the highest score in the depressed group.

The correlations of the BAI with a set of self-report and clinician-rated scales are shown in Table 3. The correlations with the HARS–R and HRSD–R were .51 ($df = 150$) and .25 ($df = 153$), respectively. The correlation of the BAI with the BDI was .48 ($df = 158$).

Correlations were also computed between the BAI and nonsymptom constructs theoretically related to anxiety or depression. The correlation of the BAI with the CCL–A (Beck et al., 1987) was .51 ($df = 151$), whereas the correlation with the CCL–D was .22 ($df = 150$). The BAI also had a correlation of .15 ($df = 158$) with the HS (Beck et al., 1974), which is theoretically related to depression but not to anxiety (Beck, 1976), as contrasted with the BDI correlation of .59 ($df = 158$) with the HS.

[1] Copies of unpublished tests, manuscripts, and descriptions of analyses not described in this article due to space limitations can be obtained by writing to Aaron T. Beck.

Table 2
Analyses of Variance for DSM-III Diagnostic Groupings

Group	Anxiety			Depression			
	n	*M*	*SD*	*n*	*M*	*SD*	*F*
Pure[a]							
BAI[b]	82	24.59	11.41	30	13.27	8.36	13.77**
BDI[c]		15.18	8.46		21.30	9.31	5.02*
Primary[d]							
BAI[b]	95	25.39	11.48	49	18.84	11.81	8.34**
BDI[e]		17.09	9.56		24.76	9.51	11.01**
All Anxiety[d]							
BAI[b]	114	25.76	11.42	30	13.26	8.36	18.60**
BDI		19.28	10.40		21.30	9.31	1.44

Note. DSM-III = Diagnostic and Statistical Manual of Mental Disorders. $N = 159$. For control group, $n = 16$. BAI mean = 15.88, $SD = 11.81$; BDI mean = 15.88, $SD = 11.81$. Pure = no secondary diagnosis. Primary = anxiety or depression with possible secondary diagnosis. All anxiety = anxiety, whether primary or secondary.
[a] $df = 2, 125$. [b] With Tukey's honestly significant difference (HSD), anxiety > depression and control. [c] With Tukey's HSD, depression > anxiety. [d] $dF = 2, 157$. [e] With Tukey's HSD, depression > anxiety and control.
* $p < .01$. ** $p < .001$.

Discussion

The BAI was found to have high internal consistency and test–retest reliability and good concurrent and discriminant validity. The BAI was able to discriminate homogeneous and heterogeneous anxious diagnostic groups from other psychiatric groups. Correlations with measures of related constructs (HARS-R and CCL-A) were generally positive and high, and those with unrelated constructs (CCL-D, HS, and HRSD-R) were low.

Although the factor structure of the BAI was distinct from that of the BDI, the correlation of the BAI and BDI scores, $r(158) = .48$, was moderately high. However, this correlation was lower than the correlations of other anxiety scales with the BDI typically reported in the literature. For example, in a large undergraduate sample ($n = 391$), Tanaka-Matsumi and Kameoka (1986) reported correlations with the BDI of .60 for the State scale and .73 for the Trait scale of the State–Trait Anxiety Inventory (Spielberger et al., 1970), .71 for the Zung Self-Rating Anxiety Scale, and .67 for the Taylor Manifest Anxiety Scale (Taylor, 1953). Comparable correlations were also reported for these anxiety scales with the Self-Rating Depression Scale (Zung, 1965), and slightly lower correlations were reported with the Depression Adjective Checklist (Zuckerman & Lubin, 1965). Similarly, Dobson (1985), in a review of 34 studies reporting correlations between anxiety and depression self-report scales, found an average correlation of .61 (range = .27–.94).

Additionally, in interpreting the correlations of the BAI with the BDI and the Hamilton scales, the effects of method variance need to be kept in mind. Thus, the correlations of the BAI with the Hamilton scales, which do not share a common measurement method, are likely to be underestimates of the true correlation. Similarly, the correlation of the BAI with the BDI, another self-report measure, is likely to be an overestimate of the true correlation.

The BAI fills the need for a reliable and valid measure of anxiety specifically designed for use with psychiatric populations. Although the STAI has been used extensively in clinical settings, it was developed largely with nonclinical undergraduate and high school student samples (Spielberger et al., 1970). Trait scale items were selected on the basis of their correlations with other anxiety measures, and State items were selected on the basis of elevated mean scores in stressful situations relative to nonstressful situations. Because discriminant validity was not specifically addressed in the development of the STAI, it is not clear whether the STAI actually measures anxiety or a combination of anxiety and depression, as evidenced by the correlations cited previously. In fact, STAI scores are often found to be higher in depressed patients than in anxious patients (e.g., Barlow, DiNardo, Vermilyea, Vermilyea, & Blanchard, 1986). Thus, although the STAI may be a valid measure in nonclinical and experimental contexts in which discrimination of anxiety from other constructs is not vital, its suitability for use in clinical research and treatment is questionable.

The SRAS (Zung, 1971) is another commonly used measure of anxiety. Developed on an inpatient sample, the SRAS was reported by its author to discriminate significantly between patients diagnosed with anxiety disorders according to unspecified diagnostic criteria and patients diagnosed with other disorders. Brown and Beck (1987) were able to replicate these results on a more stringently diagnosed sample. However, they found

Table 3
Means, Standard Deviations, and Correlations of the BAI and Other Instruments

Measure	*M*	*SD*	BAI	BDI	HRSD-R	HARS-R	CCL-D	CCL-A	HS
BDI	19.32	11.38	.48	158	153	150	150	149	158
HRSD-R	8.93	6.12	.25	.61	153	150	150	146	153
HARS-R	13.97	8.73	.51	.24	.46	150	143	144	150
CCL-D	2.59	11.45	.22	.64	.53	−.01	150	149	150
CCL-A	19.41	9.47	.51	.38	.28	.45	.32	151	149
HS	9.11	5.47	.15	.59	.51	.10	.61	.22	158

Note. BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; HRSD-R = Hamilton Rating Scale for Depression–Revised; HARS-R = Hamilton Anxiety Rating Scale–Revised; CCL-D = Cognition Checklist–Depression subscale; CCL-A = Cognition Checklist–Anxiety subscale; HS = Hopelessness Scale. $N = 160$. $r > .21$, $p < .05$, two-tailed test, after correction for multiple dependent correlations. For each variable pair, *df*s appear in the upper part of the matrix; for the BAI, *df*s appear in the diagonal. BAI mean = 22.35, $SD = 12.36$.

that several SRAS items had higher correlations with the BDI than with the total SRAS score, contributing to a .59 ($df = 118$) correlation between the two measures.

In summary, the BAI is a new measure of anxiety that was carefully constructed to avoid confounding with depression. Preliminary validity data support its suitability for use in psychiatric populations as a criterion and outcome measure. Together with the revised Hamilton rating scales (Riskind, Beck, Brown, & Steer, 1987) with the BDI, and with improved diagnostic procedures (Riskind, Beck, Berchick, Brown, & Steer, 1987), the scale provides researchers and clinicians with a set of reliable and valid criteria that can be used to help further differentiate between anxiety and depression and to clarify outcome research and theoretical investigations of the two syndromes.

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