Applied Neuropsychology
2005, Vol. 12, No. 1, 30–39

Symptom Checklist–90 Revised Scores in Persons With Traumatic Brain Injury: Affective Reactions or Neurobehavioral Outcomes of the Injury?

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The goal of this study was to examine the concurrent validity of the Symptom Checklist-90 Revised (SCL–90–R) as a measure of emotional distress among persons with traumatic brain injuries (TBI). Following previous studies, the scale was divided into a "Brain Injury Subscale" (BIS), composed of items that are confounded with the neurobehavioral outcomes of TBI, and a "Non Brain Injury Subscale" (NBIS), composed of items unrelated to the neurobehavioral outcomes. The scores of 94 persons with TBI were analyzed on the two subscales. Although more frequently endorsed, the BIS items were equally related to the cognitive and behavioral outcomes of the injury and to the respondents' affective dispositions. The same pattern of correlations was evident with the NBIS items. In addition, both scales were predicted by measures of emotional reactions to the injury. These results were interpreted as supporting the validity of the SCL–90–R as a measure of emotional distress among persons with brain injuries.

Key words: affective-disorders, psychological-assessment, symptom-checklists, traumatic-brain-injury

Traumatic brain injury (TBI) is considered a risk factor for psychiatric disorders (Newburn, 1998). Self-report measures as well as Diagnostic and Statistical Manual of Mental Disorders-based clinical evaluations reveal that persons with TBI frequently develop mood and anxiety disorders and that these disorders are evident among persons with varying levels of TBI severity and with varying length of time elapsed since the injury. In one of the earliest studies of self-reported depression among persons with TBI, Brooks and Aughton (1979) found that 74% of the relatives of 35 persons with severe TBI noted anxiety in the injured family member and 73% of the relatives reported that their injured family member suffered from depression. Morton and Wehman (1995) reviewed numerous findings of increased depressive and anxiety symptoms as reported by family members as well as by persons with TBI. The authors concluded that " … anxiety and depression are found at high levels, for prolonged periods of time following severe brain injury … "(p. 89). In a study of 66 persons with closed head injury at several intervals during the first

This study was supported by a research grant from the National Institute for the Rehabilitation of Persons with Brain Injury, Israel.

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year postinjury, Jorge, Robinson, Starkstein, and Arndt (1993) found major depression in 25.8% of their sample and general anxiety disorder (GAD) in 10.6%, using the Diagnostic and Statistical Manual of Mental Disorders (3rd ed., rev.; DSM–III–R) and the Present-State-Examination. Significantly elevated proportions of depression among persons with TBI were reported by Silver, Kramer, Greenwald, and Weissman (2001). In their study, an National Institute of Mental Health (NIMH) Diagnostic Interview Schedule, which generated DSM–III definitions of psychiatric disorders, was used to reveal significant differences in prevalence of psychiatric symptoms between persons with TBI (n = 361) and those who did not suffer TBI (n = 4,673), within the same New Haven, CT, communities. Life-time prevalence of major depression was diagnosed in 11.1% of the TBI sample as compared to 5.2% of the non-TBI sample, and dysthymic disorder in 5.5% of the TBI group as compared to 2.9% in the non-TBI group. The odds ratio of major depression and dysthymic disorder was more then twice as high in the TBI group even when controlled for sociodemographic variables and alcohol abuse. Van Reekum, Bolago, Finlayson, Garner, and Links (1996) also utilized DSM–III–R-based psychiatric interviews. They reported that 9 out of their 18 participants were diagnosed as suffering from major depression.

Not only are mood and anxiety disorders frequent following TBI, but they are also a chronic phenomenon, lasting years postinjury. Hoofien, Gilboa, Vakil, and Donovick (2001) demonstrated that at an average of 14 years postinjury, the hostility, depression, and anxiety subscales of the Symptom Checklist-90 Revised (SCL–90–R) were endorsed above the 95th normative percentile by more than 40% of the 76 participants with TBI. In a study of 100 persons with TBI living in the community, at an average of 8 years postinjury, the occurrence of psychopathology was assessed by using the Structured Clinical Interview of the DSM–IV (Hibbard, Uysal, Kepler, Bogdany, & Silver, 1998). Prevalence rates of psychopathologies in this group were compared to community base rates from the National Institute of Health Epidemiologic Catchment Area Survey and the National Comorbidity Survey. The overall frequency of postinjury major depression was 61%, as compared to 17% of preinjury episodes in the same sample and 6% in the general community. Major depression was the most common psychiatric sequel among the Axis I disorders investigated. Post-TBI anxiety disorders were also common, with 19% of participants diagnosed with posttraumatic stress disorder, 15% with obsessive-compulsive disorder, 14% with panic disorder, and 9% with GAD, as compared to prevalence rates in the community of 8%, 3%, 2%, and 4%, respectively.

In view of their high frequency and long duration, the assessment of mood and anxiety disorders is of great significance in the clinical evaluation, forensic assessment, and treatment of persons with TBI. However, there is a considerable overlap between the DSM–IV (1994) criteria of these psychopathologies and descriptions of common outcomes of TBI (Newburn, 1998; Ownsworth & Oei, 1988; Prigatano, 1996). This overlap is exemplified in the DSM–IV criteria of a Major Depressive Episode and GAD, which include three subgroups: (a) affective symptoms, (b) cognitive manifestations, and (c) somatic changes. Of these three symptom groups, the cognitive and somatic ones most obviously resemble outcomes of TBI. However, some of the affective symptoms of depression and GAD, which are part of the first symptom group, also overlap several natural consequences of TBI (Busch & Alpern, 1998; Corey, 1987; Lezak, 1995; Rosenthal, Christensen, & Ross, 1998).

Because the DSM–IV criteria of depression and anxiety overlap so many aspects of the outcomes of head injury, it is difficult to correctly assess the affective state following TBI. This difficulty is further intensified by the extensive reliance on self-report scales in clinical and research settings. Indeed, Woessner and Caplan (1995) noted that the reliance on such tools results in an exaggerated rate of psychiatric symptomatology. They explained that there are items in these self-report scales that can refer to symptoms characteristic of both affective disorders and the natural consequences of head injury. Thus, in the TBI population, these items may not hold the same diagnostic meaning regarding affective disturbances as they do in neurologically intact individuals. In addition, argued Woessner and Caplan (1995), diminished awareness (Prigatano, 1996), poor association between self-reports on cognitive impairments and actual performance (Allen & Ruff, 1990; Anderson & Tranel, 1989; Sherer et al., 1998), or other cognitive deficits, may cause inaccurate estimates of symptoms. However, it should be noted that these cognitive deficits may lead to overestimates as well as to underestimates of symptoms (Langer, 1999). Woessner and Caplan (1995) added that involvement in litigation procedures may further contribute to an exaggeration in symptomatology, whose purpose is to obtain secondary gains from the injury.

Several studies have questioned the validity of applying symptom checklists that were normed on nonpatient populations to persons with neurological disorders (Kaplan & Miner, 1998). Artificial inflations of psychiatric profiles or inadequate indications of depression were reported with regard to the Minnesota Multiphasic Personality Inventory (MMPI; Alfano, Paniak, & Finlayson, 1993; Gass, 1991; Gass & Russell, 1991; Novack, Daniel, & Long, 1984,), and with regard to the Beck Depression Inventory (BDI; Sliwinski, Gordon, & Bogdany, 1998).

The SCL–90–R (Derogatis, 1994) also tends to result in spurious elevations of the depression and anxiety scales, among others, due to its sensitivity to cognitive impairment and somatic symptoms related to TBI (Woessner & Caplan, 1995) or malignant brain tumors (Kaplan, 1998). Extraction of 10 "somatic treatment" items resulted in lower profiles on the somatization, obsessive-compulsive, depression, and anxiety subscales, although clinical "caseness" (i.e. whether a person is categorized as a clinical case) for individuals remained greater than indicated by clinical interviews (Kaplan, 1998).

To examine the validity of the SCL–90–R, as well as to render it useful for work in the TBI population, attempts have been made to identify the items that refer specifically to the common consequences of brain injury. Woessner and Caplan (1995) isolated 14 such items, which were rated by experts to be "usual consequences of traumatic head injury," and labeled them the "Brain Injury Scale" (BIS; e.g., "feeling low in energy," "feeling everything is an effort," "loss of sexual interest or pleasure," and "difficulty making decisions"). They found that individuals with TBI endorsed a much higher percentage of the BIS items (71%) than the non-BIS items (Woessner & Caplan, 1995). In addition, the symptoms most endorsed by persons with TBI loaded primarily on the obsessive-compulsive and depression subscales. Woessner and Caplan concluded that although marked elevations are also found on non-neurologically contaminated scales, a substantial proportion of self-reported psychopathology is derived from endorsement of BIS items. However, their data does not indicate whether these elevated scores are related more to the participants' neurobehavioral deficits than to their affective disposition, or vice versa—whether the nonconfounded items in the SCL–90–R are less associated with participants' neurobehavioral deficits than with their affective disposition. Thus, the mere fact that participants with TBI endorse more frequently the psychogenic and endogenic confounded items does not necessarily indicate the endogenic etiology of the reported symptoms.

Two studies have suggested alternative subdivisions to address the question of the relation between specific SCL–90–R items and neurobehavioral symptoms of brain injury. O'Donnell, DeSoto, and Reynolds (1984) defined an eight-item Cognitive Deficit (CD) subscale of the SCL–90–R, using both empirical and a priori criteria. They found significant correlations between the CD subscale and two measures of the Halstead–Reitan battery, namely the Impairment Index (r =.37, p < .01, n = 48) and the Category Test (r = .37, p < .01, n = 41) On the other hand, Kaplan and Miner (1998) found that among 19 adults with malignant brain tumors, the SCL–90–R obsessive-compulsive subscale was related to self-reported symptoms of depression (r = .809, p < .005), anxiety (r =. 659, p < .005), and to subjective complaints of cognitive problems (r = .753, p <. 005), but not to objective cognitive measures of attention and verbal memory. However, the small number of patients, as well as the sole emphasis on the obsessive-compulsive subscale, limits the generalization power of these findings.

Following Woessner and Caplan (1995) and Kaplan and Miner (1998), the aim of this study was to examine the relation between responses on the SCL–90–R provided by persons with TBI, and measures of cognitive and behavioral functioning, as well as with their affective disposition. The aforementioned studies have questioned the validity of the SCL–90–R, as BIS items were conceived to represent the neurobehavioral consequences of TBI. If that is the case, then BIS items should correlate more with the participants' cognitive status and neuro-behavioral aberrations than with their affective disposition. On the other hand, if BIS and NBIS items are equally valid for assessing psychiatric symptomatology after TBI, then although more frequently endorsed, BIS items would show correlations with the participants' cognitive performance, behavioral aberrations, and affective disposition similar to those shown by NBIS items.

To examine this hypothesis, SCL–90–R responses of persons with TBI were divided, following Woessner and Caplan (1995), into two subscales: the BIS and the NBIS. Scores on the BIS and NBIS were correlated with objective evaluations of cognitive functioning, with participants' behavioral aberrations as evaluated by a significant other, with respondents' subjective evaluations of their own cognitive and behavioral malfunctioning, and with reports of their affective disposition toward their injury.

Materials and Methods

Participants

This study is based on the responses of 94 persons with TBI (75 of them men, 73 right-handed), and on the responses of 44 of their family members (parents or spouses). These participants were retroactively selected for the study from a list of 197 consecutive referrals to the National Institute for the Rehabilitation of Persons with Brain Injury in Israel during a period of 16 years prior to the study. The institute is a public, community-based, postacute neuropsychological rehabilitation center. Persons with TBI or other disorders of the central nervous system, with various etiologies and levels of functional and mental disabilities, are referred to the institute for assessment and rehabilitation soon after discharge from physical rehabilitation departments. Inclusion criteria for this study were a medically documented TBI from ages 12 to 65, ages 18 to 65 years at the time of referral to the institute, no preinjury history of neurological or psychiatric diseases, or severe learning disabilities as documented in the participant's medical files. Exclusion criteria were a Full Scale Intelligence Quotient (FSIQ) of less than 70, very severe verbal communication disorders that prevented clear written or oral response to questionnaires, and significant postinjury psychiatric illness or substance abuse. Of the list of 197 referrals, 79 (40%) were excluded from the study according to these criteria and 24 (12%) were not located.

The mean ages of the 94 participants were 40.0 years (*SD* = 10.2) at the time of the study and 28.1 years (*SD* = 11.1) at the time of the brain injury. The participants had an average of 13.2 (*SD* = 2.9) years of education (mostly preinjury). A majority of 49 (52%) of the participants were injured in vehicular accidents, 16 (17%) in combat injuries, and the rest in work accidents, by falls or by other causes. The mean length of coma, as documented in the participant's medical files and defined as the time to follow commands, was 15.7 days (*SD* = 11.84), 57% of the participants having been comatose for more than a week and 27% for more than a month.

Participation of family members depended on availability and on the consent obtained from both the participant and his or her family member to participate in the study. No refusals were encountered. The 44 participants whose family members participated in the study did not differ in terms of age, education, severity of injury, mental status, or outcome measures from those who had no available family member.

Tests and Procedure

The participants in this study were evaluated as part of a larger outcome study performed by the National Institute for the Rehabilitation of Persons with Brain Injury in Israel (Hoofien et al., 2001). Demographic and medical data were collected from the participants' medical files. In addition, each participant was assessed by a psychology graduate student, either at the National Institute for the Rehabilitation of Persons with Brain Injury or at the participant's home. For this analysis, the following questionnaires were used:

1. The Symptom Checklist–90–Revised (SCL–90–R; (Derogatis, 1994; Derogatis, Lipman, & Covi, 1973, Hebrew version[1]) is a 90-item psychiatric symptoms checklist that assesses psychiatric symptomatology and psychological reactions. Nine psychopathology scores and a Global Severity Index (GSI), which reflects the overall severity of all symptoms, can be derived from this questionnaire. Internal consistency and test–retest reliability coefficients of .70 to .90 have been reported for this questionnaire (Derogatis, 1994; Derogatis et al., 1973). The scale allows for the comparison of participants' scores to a U.S. normative sample. The Hebrew version has been extensively studied on various psychiatric populations. Normative scores of a large sample of Israeli veterans with and without Combat Stress Reaction, as well as of their spouses, are also available (Solomon, Weisman, Levy, & Fried, 1992; Solomon, Mikulincer, & Flum, 1989).

Following Woessner and Caplan (1995), the SCL–90–R was divided into two subscales, yielding two scores: The BIS, consisting of 14 items that reflect the usual consequences of TBI, as determined by psychiatric experts (see Table 1); and the NBIS, consisting of the remaining 76 SCL–90–R items, which the same experts deemed to be unrelated to the usual consequences of head injury.

The cognitive abilities of the participants were measured by the following:

2. The Wechsler Adult Intelligence Scale–Revised (WAIS–R; Wechsler, 1981; the test was administered in

[1]The Symptom Checklist–90 was translated to Hebrew by Roskin (1984) and has been used in numerous studies of various psychopathologies since then. The Hebrew version's concurrent and predictive correlations that are reported in these studies, as well as the normative data to which we refer in the text, closely resemble those reported with the original form. Nevertheless, to the best of our knowledge, a formal validation review or study has not been published.

Table 1. *The 14 Items of the Brain Injury Scale (BIS; Woessner & Caplan, 1995)*

#	Item Number	Description
1	OCD09	Trouble remembering things
2	OCD38	Having to do things very slowly to ensure correctness
3	OCD46	Difficulty making decisions
4	OCD51	Your mind going blank
5	OCD55	Trouble concentrating
6	DEP05	Loss of sexual interest or pleasure
7	DEP14	Feeling low in energy/slowed down
8	DEP71	Feeling everything is an effort
9	HOS11	Feeling easily annoyed/irritated
10	HOS24	Temper outbursts that you could not control
11	HOS74	Getting into frequent arguments
12	SOM01	Headaches
13	SOM04	Faintness or dizziness
14	PSY90	The idea that something is wrong with your mind

Note: OCD = Obsessive-Compulsive; DEP = Depression; HOS = Hostility; SOM = Somatization; PSY = Psychoticism. Items appear according to their System Chcklist-90–Revised sub-scales.
From "Affective disorders following mild to moderate brain injury: Interpretive hazard of the SCL–90–R," by R. Woessner and B. Capain, 1995, *Journal of Head Trauma Rehabilitation, 10*, pp. 78–89. Copyright © 1995 Lippincott, Williams, & Wilkins. Reprinted with permission.

Hebrew[2]) FSIQ and the Attention-Concentration (AC) factor (also known as the freedom from distractibility factor), which is the mean of scores on the Digit-Span and Arithmetic subtests (Spreen & Strauss, 1998).

3. Purdue Peg-Board (PPB; Tiffin, 1968)—The raw score of performance for the dominant hand was used as an index of manual speed and dexterity, to reflect the psychomotor retardation that is typical following depression and TBI.

The behavioral aberrations of the participants were measured by the following:

4. Behavior Evaluation Questionnaire (BEQ; Hoofien et al., 2001)—This questionnaire assesses behavioral aberrations typical to persons with TBI; it is composed of 15 items, and is answered by a significant other who is asked to grade the frequency of each type of behavior on a scale of 0 (*not at all*) to 5 (*very frequently*). Five behaviors are addressed: impulsiveness, rigidity, dullness, low frustration level, and aggressiveness (e.g., "To what extent is the participant self-centered and irresponsive to novel experiences?" or "To what extent is the participant's emotional world limited or apathetic?"). Scores range from 0 to 75. The scale was found to have good interitem consistency (Alpha Cronbach = .92)

The affective disposition was measured by the following:

5. Cognitive Self-Rating Questionnaire (CSRQ)—This is a 24-item questionnaire that was constructed for the purposes of this study to measure the respondent's self-evaluation of his or her cognitive and behavioral malfunctioning and effectiveness of coping. Eight domains are addressed: attention-concentration, memory, comprehension, dexterity, speech, writing, reading, and arithmetic. Respondents are asked to grade the frequency of each behavior on a scale of 0 (*not at all*) to 5 (*very frequently*). Example questions are "To what extent do your memory difficulties hamper with your daily functioning?" or "To what extent do you feel you can cope with your speech difficulties?" Scores range from 0 to 120. The questionnaire was found to have good internal consistency and reliability (Alpha Cronbach = 0.87; Gutman split half = 0.81).

6. Acceptance of Disability Questionnaire (ADQ; Linkowski, 1971, Hebrew version)—This questionnaire measures the respondent's attitude toward his or her disability. Linkowski's (1971) original 50-item

[2]The Wechsler Adult Intelligence Scale and the Wechsler Adult Intelligence Scale–Revised, Hebrew versions, have been extensively used clinically and in numerous studies since their publication. In the Hebrew version, the verbal subtests have been modified as follows: The Dictionary subtest has been omitted (one verbal subtest may be omitted as a standard procedure), and in the Information and Comprehension subtests, a few items were adapted to Israeli history, mentality, and culture. In the Arithmetics subtest, the currency and names were also adapted. Similarities and Digit-Span were translated as is. The accumulated experience with the Hebrew version, as exemplified in the studies, shows that at least from the normative point of view, there is no difference between the Hebrew and the original version when the standard normative sample is used. Here again, no formal validation study has been conducted. The Hebrew version of the Wechsler Adult Intelligence Scale–Third Edition is presently in the process of validation.

scale has been translated into Hebrew by Almagor, Jaffe, and Lomerantz (1978) and has yielded good reliability and validity (Nadler, Sheinberg, & Jaffe, 1982). To ease the translated scale's administration to persons with TBI, the scale was later shortened from 50 to 40 items by Silberg (1983), who applied an item analysis procedure to select the items that correlate highest with the total score. The scale includes statements describing positive and negative reactions toward the disability (e.g., "Due to my injury I feel miserable most of the time" or "Due to my injury I will never be able to perform most of the activities carried out by normal people"). Respondents are asked to grade how well they agree with each statement on a scale of 1 (*disagree completely*) to 6 (*largely agree*). Scores range from 40 to 240. Good reliability (Alpha Cronbach coefficient = 0.96) and validity data were also reported for the shortened version (Melamed, Groswasser, & Stern, 1992).

Data Analysis

A related samples *t* test and a correlational analysis (Pearson correlations) were used to compare the participants' average scores on the BIS and NBIS and to examine the association between the two scales. A second correlational analysis was used to reveal the relations between the participants' BIS or NBIS scores and FSIQ, AC, PPB, BEQ, CSRQ, and ADQ scores. To examine the relative contribution of cognitive performance and affective disposition variables in predicting BIS and NBIS scores, two stepwise multiple regression analyses were performed: one using BIS and the other using NBIS scores as the dependent variables, and FSIQ, AC, PPB, CSRQ, and ADQ as the independent variables. The BEQ was deleted from the regression analyses due to the relatively small number of family relatives that participated in the study (44). Adding the BEQ scores to the analyses would have limited the number of participants and variables in the regression analyses to this smaller *N*.

Results

The mean scores of the SCL–90–R GSI, depression and anxiety subscales of the participants were 1.06 (*SD* = 0.66), 1.22 (*SD* = 0.82), and 0.93 (*SD* = 0.76), respectively. These findings reflect an overall high level of psychiatric distress relative to Israeli normal controls: mean scores of 0.47 (*SD* = 0.40) in the GSI, 0.49 (*SD* = 0.48) in the depression subscale, and 0.54 (*SD* = 0.54) in the anxiety subscale (Solomon et al., 1992; Solomon et al., 1989).

As expected, the participants' mean score on the SCL–90–R BIS was 1.42 (*SD* = .83) and significantly higher than their scores on the NBIS (*M* = 0.98, *SD* = .65), $t(94) = 10.31$, $p < .0001$. The correlation between the two subscales was high and significant ($r = .873$, $p < .0001$, $n = 94$).

To test the study hypothesis, BIS and NBIS scores were correlated with participants' cognitive performance, behavioral aberrations, and affective disposition. The means and standard deviations of these variables are presented in Table 2; the correlation matrix is presented in Table 3. As noted earlier, the participants in this study were evaluated as part of a larger outcome study in which an extended battery of neuropsychological tests, questionnaires, and structured interviews has been administered. Due to technical and time constraints, some of the participants failed to complete all six tests and questionnaires required for this study. As a rule, only those who completed the SCL–90–R and at least four out of five of the other measures needed for this study were included in the analyses. The numbers of participants that completed each measure appear in Table 2. A pairwise solution for missing values has been used in the correlational analysis (Table 3). Note also that the 'Behavior Evaluation Questionnaire' was completed by the 44 family members who participated in this study.

The BIS and NBIS scores showed negative correlations of the same magnitude and level of significance with performance on the WAIS–R FSIQ and with the attention-concentration factor. Hence, the higher the BIS or NBIS score, the lower the participant's performance on these tests. No significant correlations were found between either the BIS or the NBIS and the PPB dominant hand performance. The variance accounted for the BIS and for the NBIS by the statisti-

Table 2. *Descriptive Statistics of Cognitive Abilities, Behavioral Aberrations and Affective Disposition*

	Cognitive, Behavioral, and Affective Variables					
	FSIQ	**AC**	**PPB**	**BEQ**	**ADQ**	**CSRQ**
M	90.09	78.90	13.02	2.37	135.80	48.37
SD	12.30	27.07	2.87	1.18	41.54	26.25
n	82	86	76	44	87	94

Note: FSIQ = Full Scale IQ from the Wechsler Adult Intelligence Scale–Revised (WAIS–R); AC = Attention-Concentration factor from the WAIS-R; PPB = Purdue Peg Board; BEQ = Behavior Evaluation Questionnaire; ADQ = Acceptance of Disability Questionnaire; CSRQ = Cognitive Self-Rating Questionnaire.

Table 3. *Pearson Correlations Between BIS and NBIS Scores and Cognitive Abilities, Behavioral Aberrations, and Affective Disposition (N)*

	SCL-90-R Sub-Scales			
	BIS		NBIS	
Cognitive, behavioral, and affective variables	***r***	***n***	***r***	***n***
Full Scale IQ	–.359***	80	–.371***	80
Attention Concentration Index	–.393***	84	–.358***	84
Purdue Peg Board	–.054	75	–.115	75
Behavior Evaluation Questionnaire	.335**	44	.402**	44
Acceptance of Disability	.599***	87	.594***	87
Cognitive Self Report	.577***	94	.503***	94

*$p < .05$. **$p < .01$. ***$p < .001$.
Note. BIS = Brain Injury Scale; NBIS = Non Brain Injury Scale; SCL–90–R = System Checklist–90–Revised.

Table 4. *Regression Analyses of Cognitive Performance and Affective Disposition Variables on the BIS and NBIS Scores*

Dependent Variable	Step	Variable entered	*R*	R^2	SEE	*F*	*Df*	Sig. F
BIS	1	CSRQ	.618	0.382	.676	42.01	1, 68	.000
	2	ADQ	.692	0.479	.626	30.72	2, 67	.000
NBIS	1	ADQ	.601	0.361	.511	38.39	1, 68	.000
	2	CSRQ	.637	0.406	.496	22.87	2, 67	.000

Note: BIS = Brain Injury Scale; NBIS = Non Brain Injury Scale; SEE = Standard Error of the Estimates; Sig. = Significance; CSRQ = Cognitive Self-Rating Questionnaire; ADQ = Acceptance of Disability Questionnaire.

cally significant correlations with cognitive variables is 14% on the average (range 13% to 15%). The two SCL–90–R subscales showed positive correlations of similar magnitude and significance level with the participants' behavioral aberrations and affective disposition, as measured by the Behavior Evaluation Checklist, the Acceptance of Disability questionnaire, and the Cognitive Self-Rating Questionnaire. Hence, the higher the BIS or the NBIS score, the more behavioral aberrations and the worse the affective disposition reported. The variance accounted for by the statistically significant correlations with the behavioral and affective variables is 27% on the average (range 11% to 36%) for the BIS and 25% (range 16% to 35%) for the NBIS.

To examine the relative contribution of the variables of cognitive performance and affective disposition in predicting BIS and NBIS scores, a stepwise regression analysis was performed, with BIS and NBIS scores as the dependent variables (Table 4). The Behavior Evaluation Questionnaire was excluded from the regression analysis due to the limited number of significant others who completed the questionnaire ($n = 44$).

The SCL–90–R BIS subscale is predicted first by the Cognitive Self-Rating Questionnaire ($R = .618$, $p < .0001$), and in the second stage by the Acceptance of Disability Questionnaire, which raises the regression quotient to $R = .692$, accounting together for 50% of the variance. The SCL–90–R NBIS subscale is predicted first by the Acceptance of Disability Questionnaire ($R = .601$, $p < .0001$), and in the second stage by the Cognitive Self-Rating Questionnaire, which raises the regression quotient to $R = .637$, accounting together for 41% of the variance.

Discussion

Two main findings were revealed in this study. First, in accordance with previous studies, it was shown that relative to normal population norms, the participants reported more psychiatric symptomatology on the SCL–90–R. This increase was evident mainly in symptoms that were judged a priori to be associated with consequences of TBI (BIS items). Second, the psychiatric symptoms that are associated with consequences of TBI (BIS), as well as psychiatric symptoms judged to be unrelated to these consequences (NBIS), were similarly correlated with the participants' cognitive functioning, behavioral aberrations, and affective dispositions. Even more so, the BIS and NBIS were highly intercorrelated and equally predicted by subjective self-rating of cognitive performance and acceptance of disability, variables characterizing the participants' af-

fective disposition toward their injury. Our results clearly indicate that the BIS and NBIS do not represent distinct etiological factors, and affirm the significant impact of affective distress in determining psychiatric symptomatology rates in this group of brain-injured persons.

Participants in this study scored higher on the SCL–90–R relative to normal Israeli controls (Solomon et al., 1989). These results replicate and confirm previous findings that demonstrated a high level of self-reported psychiatric symptomatology in the TBI population using the SCL–90–R (Kaplan et al., 1998; Woessner & Caplan, 1995), as well as the MMPI (Alfano et al., 1993; Gass & Russell, 1991), and the BDI (Green, Felmingham, Baguley, Slewa–Younan, & Simpson, 2001). However, it has been argued that persons with TBI tend to endorse more SCL–90–R BIS items (Woessner & Caplan, 1995) due to their neurobehavioral difficulties rather than their affective dispositions. In psychometric terminology, the BIS items were conceived as valid measures of the severity of the neurobehavioral consequences of brain injury rather than of the affective distress of the respondents. This approach to validity was based on a differential criterion, namely, a between-items frequency-of-endorsement analysis. BIS items were taken to validly measure the neurobehavioral consequences of TBI because persons with TBI endorsed them more frequently than NBIS items. Hence, the potential validity of BIS items as indicators of the affective status of the brain-injured person has been suggested (O'Donnell et al., 1984; Woessner & Caplan, 1995).

However, the rise in BIS scores does not necessarily provide sufficient evidence to question the validity of the SCL–90–R as a measure of the affective status of persons with TBI. BIS items represent symptoms that, according to the DSM–IV (1994) criteria, may be attributed both to neurobehavioral manifestations of TBI as well as to the affective reaction to its existence (i.e. depression and anxiety). Hence, exaggerated scores in BIS do not indicate the source of symptom amplification.

An alternative procedure to the differential criterion validity reported in the aforementioned studies is to use a concurrent-criterion validity test. In this study, cognitive, behavioral, and affective variables were used as concurrent validity criteria in the examination of BIS and NBIS scores. Accordingly, if BIS items are considered valid as estimators of the neurological consequences of head injury, then a high and positive correlation is expected between BIS scores and variables that measure cognitive and behavioral consequences of TBI, whereas the correlation with the affective variables should be low. The NBIS score, on the other hand, should show a reverse pattern of correlations: a high correlation with the affective status and a low correlation with the cognitive and behavioral consequences of the injury.

The results supported the hypothesis that in this group of persons with head injuries, the SCL–90–R BIS and NBIS scores were similarly correlated with cognitive performance (negative correlation), behavioral disturbances (positive correlation), and affective disposition (positive correlation). The significant role of the affective component in participants' responses to both the BIS and the NBIS is evident in the results of the regression analysis. Of the five affective and cognitive independent variables that were included in the regression analysis, the Cognitive Self-Rating Questionnaire (Hoofien et al., 2001) as well as the Acceptance of Disability Questionnaire (Linkowski, 1971) contributed to the prediction of the BIS scores. The same variables in the reverse order also contributed to the prediction of the NBIS scores. Similarly, Kaplan and Miner (1998) found that the SCL–90–R obsessive-compulsive subscale was predicted by the "mood assessment scale" and the "Beck anxiety inventory," but not by cognitive or demographic variables. Hence, objective measures of cognitive performance were found to be less significant in predicting SCL–90–R scores than participants' subjective rating of their affective reactions or cognitive performance. These findings are also consistent with clinical conceptions of the frequency of morbid and depressive content of thoughts, in the form of "mobile mourning" and "partial death," among persons with TBI (Muir & Haffey, 1984). Recent empirical support for this line of interpretation was revealed by a principal component analysis of the responses of 117 persons with TBI on the BDI (Green et al., 2001), in which three factors were extracted: affective or performance complaints, negative attitudes toward the self, and somatic complaints. These factors were similar to a three-factor structure of the BDI found in a depressed, neurologically intact population. Even more so, in the sample of persons with TBI, somatic or performance complaints accounted for the smallest part of the variance in BDI scores.

This study suffers from several methodological weaknesses that have to be taken into account when generalizing its conclusions. The group of 94 participants was selected for this study from a database of a previous long-term outcome study (Hoofien et al., 2001). The selection was based on data availability and

the aforementioned inclusion criteria but not on a systematic sampling method. Notice also that this group consists of persons who were injured 11.9 years (*SD* = 7.0) prior to the time of this study. Thus, our findings should be interpreted cautiously as representing the cognitive and emotional status of persons with TBI long after the injury. The existence of a similar pattern of results in the acute or short-term phases of recovery of TBI needs to be examined further. The correlations between the BIS and the NBIS with the Behavior Evaluation Checklist are based on responses of 44 family members (46% of the participants). Although we encountered no family members who refused to participate, and no differences were found between the individuals whose family members participated in the study and those who did not, these results should still be considered with caution due to a possible selection bias. In addition, the relatively limited number of family respondents prevented measurement of the contribution of their evaluations of the participants' behavioral aberrations to the variability of the BIS and NBIS scores in the regression analysis. Of the three measures of the participants' affective disposition and behavioral aberrations, this particular measure was based on more objective evaluations (by family members). In light of the inherent weakness of a comparison between self-report of psychiatric symptomatology and self-evaluations of affective reactions, the application of additional objective measures such as clinical interviews of postinjury affective dispositions is also recommended.

In summary, the findings of this study do not support the distinction between SCL–90–R BIS and NBIS items. The participants' self-ratings on both scales were equally related to the affective status as well as to the cognitive-behavioral consequences of brain injury. Although more frequently endorsed, the supposedly "organically" confounded (BIS) items were similarly related to cognitive-behavioral measures than nonconfounded psychiatric symptoms. Affective status was found to be a better predictor of overall distress levels, thus confirming the hypothesis that the exaggerated psychiatric symptomatology scores in this sample are not necessarily a result of a cognitive-behavioral or affective confound, as was previously suspected.

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