

A Review of the Factorial Structure of the Brief Symptom Inventory (BSI): Greek Evidence

Anthi Loutsiou-Ladd

*Department of Psychology, University of Cyprus
Nicosia, Cyprus*

Georgia Panayiotou

*Department of Psychology, University of Cyprus
Nicosia, Cyprus*

Costantinos M. Kokkinos

*Department of Primary Education, Democritus University of Thrace
Alexandroupolis, Greece*

This study extends the psychometric evidence on the Brief Symptom Inventory (BSI) in a sample of Greek-speaking adults ($N = 818$). Alpha coefficients for the nine dimensions indicated high consistency among the comprising items of each scale. The convergent and discriminant validity of the Greek-BSI were checked against the personality constructs on the NEO-Five Factor Inventory (NEO-FFI) and were both adequate. An exploratory factor analysis with principal components extraction and an oblique rotation yielded a single factor that appeared to measure a mild form of depression. Findings pose questions about the validity of the dimensional scores in nonclinical samples. The expression of psychopathology on the BSI may be constrained by sample characteristics. The search for a uniform factorial solution for the BSI across cultures and diagnostic groups might be a misguided one.

Keywords: Brief Symptom Inventory, BSI, construct validity, factor analysis, psychometrics

One of the most widely accepted psychometric screening tools of general psychopathology in both research and clinical practice is the Brief Symptom Inventory (BSI; Derogatis, 1975; Derogatis & Melisaratos, 1983; Derogatis & Spencer, 1982). The BSI was developed as a multidimensional test to measure current levels of psychological symptoms and it is essentially the brief form of the Symptom Checklist-90-R (SCL-90-R; Derogatis, 1977). Scoring gives information on nine primary symptom dimensions that evolved through a combination of clinical and empirical procedures that confirmed the construct definitions (Derogatis, 1993). These nine dimensions are somatization (SOM), obsessive-compulsive (OC), interpersonal sensitivity (INT), depression (DEP), anxiety (ANX), hostility (HOS), phobic anxiety (PHOB), paranoid ideation (PAR), and psychoticism (PSY). There are also three global indices, that is, global severity index (GSI), positive symptom total (PST), and positive symptom distress index (PSDI), which were developed to provide an overall assessment of psychological functioning. The original development of the BSI established norms on four groups from U.S. samples, namely, psychiatric outpatients, non-patient, psychiatric inpatients, and non-patient adolescents (Derogatis & Spencer, 1982).

There are several advantages of the BSI that relate to its wide acceptance in the scientific community. A main advantage is that it is practical and concise, making it a useful screening tool when assessment time is limited for nonexpert administration, although interpretation requires expert knowledge. Another key property of the BSI is that it provides information on both the range (GSI scores) and the intensity (PSDI) of mental health symptoms (Derogatis, Lipman, & Covi, 1973). Further, the BSI is widely accepted for its strong reliability. It is a reliable measure over time with a stability coefficient of .90 for the GSI, .87 for the PSDI, and .80 for the PST (Derogatis & Spencer, 1982). Regarding internal consistency in the same original study, the alpha coefficients of the nine dimensional scales ranged from a low of .71 for PSY to a high of .85 for DEP. The DEP dimension consistently presents with the highest internal consistency coefficient among all scales in subsequent studies, with alpha coefficients ranging from .87 to .91 (Boulet & Boss, 1991; Hayes, 1997; Ruy Pérez, Ibáñez, Lorente, Moro, & Ortet, 2001).

Another strong psychometric property of the BSI is its convergent validity, which has been consistently replicated in the literature. In its original development, Derogatis and Spencer (1982) compared the BSI against another general measure of psychopathology, the Minnesota Multiphasic Personality Inventory (MMPI). The analysis revealed excellent convergence between the nine dimensions of the BSI and the analogous clinical scales of the MMPI. Correlational studies with personality measures have further established the convergent validity of the BSI. Although not a personality measure itself, one would expect that the BSI would hold a positive correlation with personality dimensions. Panayiotou, Kokkinos, and Spanoudis, (2004) found such a correlation with the Neurotism scale of the NEO Five Factor Inventory (NEO-FFI), a scale that measures negative and

probably pathological aspects of personality. This hypothesis was also verified in studies showing high correlations between the BSI and the Eysenck Personality Questionnaire (EPQ-R), with multiple regression analysis showing significant contributions of the personality dimensions to each of the BSI scales (Ruipérez et al., 2001). On the basis of the same findings, “positive” aspects of personality that correlate negatively with neuroticism, such as agreeableness and extroversion on the NEO-FFI, hold a negative correlation with all BSI dimensions (Panayiotou et al., 2004). The later finding might be suggestive of the BSI’s discriminant validity. To the contrary, Boulet and Boss (1991) found that the BSI correlated highly with MMPI scales measuring dissimilar constructs, suggestive of poor discriminant validity. Thus, the above studies support the strong convergent validity of the BSI but raise questions regarding the discriminant validity of the dimensional scales. The methodological approach of comparing the BSI against various personality inventories that measure more stable aspects of personality has become a tradition over the years by researchers who explore the discriminant and convergent validity of the instrument. Similarly, in this study we use the NEO-FFI personality scale to investigate these validity issues with the cultural adaptation of the Greek BSI.

Another desirable property of the BSI is its multidimensional structure that allows for nine dimensional scores, making it a useful tool in distinguishing between clusters of symptoms. Although the original nine dimensional scales of the BSI emerged from clinical rationale; that is, they reflect distinct aspects of psychological disorders (Derogatis, 1993), researchers have increasingly used factor analysis to explore the BSI’s multidimensional structure. The nine factor internal structure of the BSI has been brought into question by subsequent research efforts that have yielded different factor solutions. These results not only depart from the original psychometric properties published by Derogatis (1993), but they also pose ongoing questions regarding the construct validity of the instrument. Psychometricians have increasingly emphasized construct validity as the principal validity criterion for psychological tests (Messick, 1989). Given that the BSI was developed as a multidimensional test, the issue of internal structure is critical in establishing its construct validity. We thus turn our attention to a synopsis of the factor analytic findings regarding the internal structure of the BSI.

Two main trends emerge regarding the factor structure of the BSI. On one hand, even studies that support an underlying multidimensional structure in clinical and community samples report deviations from the originally proposed nine dimensions, as shown in Table 1. For example, Kellet, Beail, Newman, and Hawes (2004) found a structure of eight factors. Six-factor models emerged from studies by Ruipérez et al. (2001), Heinrich and Tate (1996), and Hayes (1997). A structure of five factors was evident in studies by Johnson, Murphy, and Dimond (1996) and by Sahin and Durak (1994). Despite the differences in the number of factors found in studies yielding a multidimensional structure, there is repeatedly a large amount of variance accounted for by the first factor in comparison to the subsequent

TABLE 1
 Comparison of Factor Analytic Procedures and Adult Sample Characteristics Used in Various Studies on the BSI in Chronological Order

Source	Factor Analysis/Rotation	Sample	Factors
Derogatis & Melisaratos (1983)	Principal components/Varimax	N = 1,002, outpatients	Nine
Boulet & Boss (1991)	Principal components/None	N = 501, male, forensic patients	One
Piersma, Boes, & Reaume (1994)	Principal components/None	N = 217 & N = 188, psych. inpatients	One
Sahin & Durak (1994)	Not available	N = ?, Turkish university students	Five (ANX, DEP, negative self-concept, SOM, HOS)
Heinrich & Tate (1996)	1. Exploratory principal components/Oblimin	N = 215, patients with spinal cord injury	Six (ANX, DEP, Mental Blocks, IS, Spinal Cord Injury, Hostile Susceptiousness)
Johnson, Murphy, & Dimond (1996)	2. Maximum likelihood	N = 260, bereaved parents	Five
Hayes (1997)	1. Little variation across various combinations/Oblimin	N = 3128, counseling center clients	Six (DEP, SOM, HOS, Social Comfort, OC, PHO)
Benishek, Hayes, Bieschke, & Stoffelmayer (1998)	2. Exploratory principal-axis	1. N = 440	One (general distress)
	1. Exploratory principal axis/Oblimin	2. N = 456, adult substance abusers undergraduate students	
	2. Confirmatory	N = 199 in India	
Watson & Sinha (1999)	Multidimensional Scaling (MDS)	N = 347 in Canada	Two (Indian sample SOM/PAR, HOS/PA) (Canadian sample HOS/PA, SOM/PA/PD)
Ramírez, Álvarez, & Galán (2000)	Principal components/Varimax	N = 743, community sample	One (general distress)
Pang (2000)	Exploratory principal components/Varimax	N = 70, elderly Korean immigrants	One (SOM)
Ruipérez et al. (2001)	Exploratory principal components/Oblimin	N = 254, Spanish Community sample	Six (DEP, PHO, PAR, OC, SOM, HOS)
Sahin, Batigün, & Ugurtas (2002)	?	N = 559, Turkish adolescents	Five
Kellet, Beail, Newman, & Hawes (2004)	Exploratory principal components/Varimax	N = 335, Intellectually disabled	Eight

factors (Benishek et al., 1998). Specifically, DEP tends to independently explain most of the sample variance in studies yielding multidimensional structures, for example 30.56% (Kellet et al., 2004) and 30% (Hayes, 1997). To the contrary, PSY tends to be the most problematic, failing to emerge as an interpretable factor in various studies with most of its items converging with other scales (Hayes, 1997; Kellet et al., 2004; Ruipérez et al., 2001).

On the other hand, there are studies with clinical samples suggesting that the BSI is primarily a unidimensional scale measuring a single construct; that is, general psychological distress. The BSI emerged as a unidimensional instrument in studies by Piersma et al. (1994); Boulet and Boss (1991); Ramírez, Álvarez, and Galán (2000); and Benishek et al. (1998), as shown in Table 1. Pang (2000) also found one factor with an elderly community sample of Korean immigrants, although this factor represented Somatization and not general distress. The argument for the unidimensionality of the instrument also emerges from studies arguing that a single personality construct, that is neuroticism, correlates highly with all nine BSI dimensions suggestive of significant overlapping homogeneity among the different scales (Panayiotou et al., 2004).

Explanations for the variations in factor structure of the BSI include both methodological and substantive reasons. There are two methodological issues that stem from the literature review. First, there is considerable variation in the sample size used in the various studies as presented in Table 1. Given that smaller samples tend to yield less reliable factor solutions, the differences in the factor solutions might be attributable to sample size (Hayes, 1997). At least two studies (Heinrich & Tate, 1996; Pang, 2000) did not meet the required sample of 265 participants that would be necessary for factor analytic procedures of the 53 BSI items according to the *1 item: 5 cases* ratio recommended by Floyd and Widaman (1995). The study by Ruipérez et al. (2001) only marginally met the same requirement. A second methodological issue relates to differences in factor analytic procedures used to examine the data, as shown in Table 1. This issue is reflective of a more general and ongoing debate in the field about the appropriate and effective methods of extracting the number of factors (Wood, Tataryn, & Gorsuch, 1996). Specifically in the case of the BSI, some researchers (Derogatis & Melisaratos, 1983; Kellet et al., 2004) used a varimax rotation in their factor analysis while an oblimin rotation is usually preferred in the social sciences as most variables are considered related. Yet others (Boulet & Boss, 1991; Piersma et al., 1994) did not report any rotation in their factor analytic procedures, which might explain the extraction of one general factor. Along the same lines, some researchers (Benishek et al., 1998; Hayes, 1997) preferred a principal axis over the more commonly used principal components factor analysis, arguing that the principal axis is more appropriate when factors are related. Authors who used secondary confirmatory factor analysis tended to verify the results of the original exploratory analysis (Benishek et al., 1998; Hayes, 1997). In summary, the literature review suggests

that the variation in the proposed factorial solutions of the BSI might be partially attributable to methodological approaches in the factor analytic procedures rather than inherent differences in the internal structure of the BSI. Further, the different logic underlying the various factor analytic approaches may render the results of the various studies incomparable.

Substantive explanations about the variations reported in the BSI's factor structure include population differences. Different samples appear to yield variable factor solutions despite the fact that the original author of the BSI (Derogatis, 1993) argued that the instrument holds its proposed multidimensional structure in various clinical and nonclinical populations (Schwarzwald, Weisenberg, & Solomon, 1991). Such conclusions relate to the idea that clusters of mental health symptoms might be expressed differently in individuals from various populations. It is ironic that one of the few studies that closely supported the original nine-factor model came from a sample of adults with "mild intellectual disability" (Kellet et al., 2004). As Kellet et al. explained, this was a sample that superseded Derogatis's (1993) assumption that "retarded" individuals breach the "inventory premise" for valid administration. Given the inconsistent factorial solutions that result from different samples, there is a broader question regarding the validity of the nine-dimensional structure of the BSI in populations other than the one used in the initial study by Derogatis and Melisaratos (1983). It is thus meaningful to keep exploring the construct validity of the BSI in various populations before there is conclusive support for any factor solution.

One way populations meaningfully differ from the normative U.S. sample pertains to ethnic differences. This points to the importance of psychometric exploration of the BSI in non-American populations. In the broader European region, adaptations of the BSI have been published for Italian community elderly (De Leo, Frisoni, Rozzini, & Trabucchi, 1993), nonclinical Spanish adults (Ruipérez et al., 2001), Russian immigrants (Ritsner, Rabinowitz, & Slyuzberg, 1995), German outpatients (Geisheim et al., 2002), Israeli adolescents (Canetti, Shalev, & De-Nour, 1994), and Turkish youth (Sahin & Durak, 1994). However, reliability and validity information did not always accompany these adaptations of the BSI, posing unresolved questions as to whether the instrument retains its psychometric properties in various cultural contexts.

Given the significant ethnic diversity that exists within Europe, it is important to continue investigating the psychometric properties and usefulness of the BSI in other European ethnic groups. One such European ethnic group that can be used to extend the available psychometric data for the BSI is the Greek population. There is also a pragmatic need for the psychometric adaptation of the BSI within the Greek context. In contrast to the plethora of valid and reliable screening tools for psychological symptoms that are available for use with the U.S. population and for native English speakers more broadly, there is a notable scarcity of such tools that are standardized for the assessment of Greek persons. A review of the literature

suggests that there is an apparent general need for brief, self-report screening tools of general psychopathology with Greek persons. Although the goals of the studies vary widely, different researchers have used adaptations of other self-report instruments of general psychopathology as a means of screening for overall mental health symptoms among Greek persons. For example, Kontaxakis, Mavreas, and Stafanis (1994); Kontaxakis et al. (1990); and Oulis, Mamounas, Hatzimanolis, and Christodoulou (1998) used the Brief Psychiatric Rating Scale, while Fichter, Xepapadakos, Quadflieg, Georgopoulou, and Fthenakis (2004) used the General Health Questionnaire with Greek samples. The BSI, specifically, is starting to be used in research with the Greek population (e.g., Panayiotou et al., 2004). Although these screening tools are used in research and practice with Greeks, this is done in a vacuum of psychometric evidence. This significant gap poses a challenge in the accurate detection, evaluation, and formulation of mental health problems among Greek persons. Thus, further research is needed for the psychometric adaptation of screening tools of psychopathology in Greek. Despite the pending questions relating to the construct validity of the instrument, the BSI remains an important tool in screening for psychopathology and is a primary candidate for adaptation and use among the Greek population.

In summary, the primary purpose of the present study is to further establish the psychometric properties of the BSI, and in particular its factorial structure, in a nonclinical sample. On one level, we preferred a nonclinical sample based on the scarcity of published BSI data in English from community samples. On another level, it was pragmatically easier to access a nonclinical rather than a clinical sample. One goal is to conduct a focused review of prior factor analytic studies conducted with the BSI to explore possible methodological differences that might explain the noted variance in factor solutions. Another goal is to contribute to the ongoing discussion as to whether the BSI is a multidimensional instrument, as proposed by the original authors, or a unidimensional scale, as has been suggested by subsequent research. There were no a priori assumptions about the anticipated factor structure of the Greek-BSI given the variation in factor solutions in the literature, the scarcity of prior evidence from nonclinical samples, and possible population differences from prior studies. Consistent with prior research, we anticipated that the DEP dimension would explain most of the sample variance. Prior findings from Mediterranean community samples (e.g., Ruipérez et al., 2001) led us to hypothesize that the PSY dimension would not clearly emerge in the factor analysis. A third goal of this study was to establish normative data for a nonclinical Greek population and provide psychometric information regarding the adapted form of the Greek-BSI. We anticipated the same gender differences reported by the original authors (Derogatis, 1993); that is, females scoring higher than men on all BSI dimensions. The Greek version of the NEO-FFI (Panayiotou et al., 2004) was used as the criterion instrument to establish the convergent and discriminant validity of the Greek-BSI. Although the two scales do not measure

the same psychological dimensions, one expects based on prior findings that there would be a high correlation between similar constructs on the two instruments. Specifically, in terms of convergent validity we predicted that to the degree that the BSI is a measure of psychological distress its dimensional scales and global indices would show positive correlations with the neuroticism factor on the NEO-FFI. Further, in regards to discriminant validity, we expected that high scores on the agreeableness factor of the NEO-FFI would be associated with low dimensional scores on the BSI. A similar prior comparison (Panayiotou et al., 2004) was done with a different sample and focus of standardizing the Greek NEO-FFI. This comparison also provides further evidence regarding the concurrent validity of the original instrument by attempting to replicate findings. We aspire to provide the necessary information for the use of the BSI as a reliable and valid indicator of psychological symptoms in research and clinical work with Greek persons.

METHOD

Participants

A total of 818 ($N = 556$ female, $N = 262$ male) adult native Greek speakers participated voluntarily in the study. The overall sample was achieved by aggregating four independent data sets of community samples from recent studies. One study ($N = 186$) explored stress and coping in family members of severely injured accident victims (Loutsiou-Ladd, Kyprianou, Sofroniou, & Panayiotou, 2005). The second study ($N = 204$) explored the relationship between obsessive thinking and styles of personality in the general population (Psaropoulou, Panayiotou, & Loutsiou-Ladd, 2005). The third study ($N = 122$) purported to delineate the relationship between the teachers' emotional state and their assessments of students' problematic behavior (Kokkinos & Davazoglou, 2004). The fourth data set ($N = 306$) was from a study examining familial correlates of social anxiety in the general population (Panayiotou & Konstantinou, 2005). The mean age of the participants was 32.61 ($SD = 12.65$), the mode was 19, and the range of ages was 15–75 years. Seventy-nine participants had less than high-school education, 181 were high-school graduates, 332 had some university education, and 202 participants were at least university graduates ($N = 24$ missing data). The sample was a convenience one and represented some deviations from the general population that might affect the generalizability of the results. That is, the sample was overwhelmingly female, representing an unbalanced gender ratio. Further, the sample represented a younger and better educated group than the Cyprus Census. Given that BSI scores tend to vary with age (Derogatis & Spencer, 1982) one should also consider that the fact that this sample was predominantly young might pose some limitations on the generalizability of the results.

Instruments

The BSI was a common assessment tool embedded in a battery of other self-report instruments in all four of the studies. The participants from the third and fourth data sets ($N = 428$) also completed the adapted Greek NEO-FFI and these results were used to obtain convergent and discriminant validity information about the Greek-BSI.

Greek-BSI. The BSI (Derogatis & Melisaratos, 1983) is a self-report inventory with 53 items describing a variety of psychological problems that can be completed in as little as 8 to 10 minutes. The translation and adaptation of the BSI from English to Greek was done by two of the authors who are bilingual (Greek and English). The method of front and back translation was used for its development. That is, the BSI was first translated from its original English version into Greek. Then, the translated items were transformed back into English. The investigators then checked for the conveyance of the translated with the retranslated items. Differences were resolved through consensus. Initial pilot administrations of the Greek version of the BSI did not indicate any problems with the instructions, the items, or the scale. The response scales were maintained in their original form. Each item was anchored on a five-point Likert-type scale of distress, ranging from “not at all” (0) at one pole to “extremely” (4) at the other. The BSI was scored according to the guidelines specified by Derogatis (1993).

Greek NEO-FFI. The Greek NEO-FFI is an adaptation of the NEO-FFI (Costa & McCrae, 1992) into the Greek language by Panayiotou et al. (2004). It maintains the same number of items and scoring procedures as the original. The instrument contains 60 items measuring the Big Five personality dimensions that is, neuroticism, extroversion, openness to experience, agreeableness, and conscientiousness. Respondents indicate their degree of agreement with each item on a five point Likert-type scale (0 = strongly disagree, 4 = strongly agree).

Procedure

In order to better understand the reasons behind the variations in factor analytic studies of the BSI, it was deemed necessary to first conduct a more focused review of these specific studies with the aim of categorizing them in terms of methodological differences. The review of the literature was conducted using PsycINFO (American Psychological Association, 2005) electronic database using the terms BSI, Brief Symptom Inventory, factor analysis, factor structure, psychometric properties, and construct validity, from 1985 onward in journal articles. Only articles that included exploratory or confirmatory factor analysis were used in this review.

The assessment was largely achieved through the completion of self-report questionnaires in individual/group meetings with the investigators. Some data from study one was collected via mailed questionnaires. Targeted samples of relatives of adult patients hospitalized in the intensive care unit and elementary school teachers were used in studies one and three, respectively. A sample of undergraduates completed the questionnaires for studies two and four, who then used the “snowball” technique to recruit friends and family who participated voluntarily in the study. The order of administration of the instruments varied among the various sample sets because the Greek-BSI and the Greek NEO-FFI were embedded in a more extensive assessment package.

Data Analysis Rationale

We used exploratory factor analysis with principal components extraction. An exploratory analysis was deemed appropriate given the variation in BSI factorial solutions in the literature, as well as the lack of any theoretical or empirical a priori predictions about a Greek version of the BSI. An oblique rotation was preferred based on the assumption that the dimensions are intercorrelated. The following criteria were used to select the factors: (1) inspection of the scree plot (Cattell, 1966); (2) Eigenvalue greater than 1.0 (Kaiser, 1960) and accounting for 3% or more of the variance; (3) magnitude of the item loadings (Comrey, 1973); but not less than .30; and (4) the conceptual meaningfulness of the factor (Gorsuch, 1983). The four “additional” BSI items (11, 25, 39, 52) were excluded from the analysis.

RESULTS

Normative Data and Group Differences

The sample size ($N = 818$) allowed for the calculation of normative BSI data for Greek persons. These norms are limited to the use of the BSI in community Greek samples. The means and standard deviations of the raw scores for each of the nine dimensional scales and global scale were calculated according to the guidelines provided by Derogatis and Spencer (1992) and are presented in Table 2. Gender differences were examined with one-way analyses of variance (ANOVAs). Women scored higher ($p < .001$) than men on all dimensional and global scales as presented in Table 2.

Reliability

The internal consistency of the entire Greek-BSI scale was excellent based on a reliability analysis calculated with Cronbach’s alpha coefficient ($\alpha = 0.96$).

TABLE 2
Mean Raw Scores and Standard Deviations for the Greek-BSI, and ANOVA Comparisons
for Gender Differences in a Greek Community Sample

<i>BSI Scales</i>	<i>Women (N = 555)</i>		<i>Men (N = 262)</i>		<i>Total (N = 817)</i>		<i>F (1, 815)</i> <i>p < .001</i>	<i>Cronbach's</i> <i>Alpha</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
SOM	.89	.84	.51	.64	.77	.79	41.20	.85
OC	1.45	.83	1.12	.77	1.34	.83	29.74	.78
IS	1.27	.92	.81	.78	1.12	.90	47.63	.79
DEP	1.05	.85	.66	.65	.92	.81	44.40	.83
ANX	1.20	.90	.76	.67	1.06	.85	49.98	.82
HOS	1.00	.78	.76	.74	.93	.78	19.46	.78
PHOB	.62	.68	.35	.52	.53	.64	32.61	.72
PAR	1.22	.86	.98	.76	1.14	.83	14.12	.74
PSY	.81	.74	.55	.59	.72	.70	25.45	.67
GSI	1.05	.67	.71	.54	.94	.65	51.15	
PST	28.15	12.57	21.25	12.59	25.94	12.97	53.55	
PSDI	1.83	.56	1.66	.53	1.77	.55	16.87	

The reliability coefficients for most of the primary symptom dimensions were satisfactory overall and ranged from .72 to .85, with the exception of the PSY scale, which had a low coefficient alpha of .67.

Concurrent Validity

Concurrent validity of the Greek-BSI was checked against comparative scales of the Greek NEO-FFI and the results are presented in Table 3. As expected, the neuroticism scale of the NEO-FFI displayed large correlations with five of the BSI dimensions and medium correlations with the other four. As predicted, Agreeableness had five medium and four small correlations (negative) with the BSI dimensions. Extraversion displayed four to five negative correlations (small) with the BSI dimensions. Openness and Conscientiousness scales of the NEO-FFI demonstrated three to four positive (small) correlations with the BSI dimensions. These two factors did not correlate with six BSI dimensions. The Depression dimension of the BSI correlated with all NEO-FFI scales. Specifically, there were positive correlations with Neuroticism (large) and Openness (small), and negative correlations with Agreeableness (medium), Extraversion (small), and Conscientiousness (small). Very similar findings were also found with Interpersonal Sensitivity that correlated with all NEO-FFI scales. Obsessive-Compulsive had three negative small correlations and one large correlation with the NEO-FFI scales.

TABLE 3
Correlations between the BSI Dimensional Scores and the Greek-NEO-FFI Scales

<i>BSI Dimension</i>	<i>NEO FFI Scale</i>				
	<i>Neuroticism</i>	<i>Extraversion</i>	<i>Openness</i>	<i>Agreeableness</i>	<i>Conscientiousness</i>
Somatization	.42**	-.04	.07	-.20**	.03
Obsessive Compulsive	.57**	-.14**	.08	-.29**	-.14*
Interpersonal Sensitivity	.60**	-.17**	.14*	-.22**	-.14*
Depression	.58**	-.17**	.15*	-.36**	-.15*
Anxiety	.51**	-.01	.15*	-.28**	.01
Hostility	.46**	.01	-.03	-.46**	-.07
Phobic Anxiety	.44**	-.17**	.08	-.19**	.00
Paranoid Ideation	.49**	-.05	.07	-.42**	-.07
Psychoticism	.52**	-.09*	.09	-.37**	-.11

* $p < .05$, two-tailed, ** $p < .01$, two-tailed.
 $r = .10 \rightarrow$ small, $r = .30 \rightarrow$ medium, $r = .50 \rightarrow$ large.

Dimensional Independence

We calculated Pearson coefficients for all BSI dimensional pairs to examine the orthogonality of the dimensions. The intercorrelations among the nine dimensions and the global score were large and positive ($p < .001$) as expected and are presented in Table 4.

TABLE 4
Pearson Correlations among the Dimensional and the GSI Scores of the BSI

	<i>BSI Dimension</i>								
	<i>OC</i>	<i>IS</i>	<i>DEP</i>	<i>ANX</i>	<i>HOS</i>	<i>PHOB</i>	<i>PAR</i>	<i>PSY</i>	<i>GSI</i>
SOM	.64	.52	.59	.72	.56	.57	.54	.61	.81
OC		.63	.70	.71	.58	.54	.61	.65	.83
IS			.72	.64	.57	.60	.68	.72	.81
DEP				.70	.63	.57	.60	.78	.86
ANX					.66	.64	.62	.67	.88
HOS						.45	.59	.59	.76
PHOB							.52	.64	.74
PAR								.65	.78
PSY									.85

$p < .001$ for all correlations.

Construct Validity: Factor Structure

A principal components analysis with oblique rotation was conducted and yielded a satisfactory Kaiser–Meyer–Olkin (KMO) statistic of .98. First, there was an inspection of the scree plot, which showed a single factor. On a second level, the principal component analysis indicated eight dimensions with Eigenvalues greater than one. Only five of these eight dimensions explained at least 3% or more of the variance each. Thus, we automatically dropped from further consideration the last three dimensions that explained less than 3% of the variance.

In support of the single-factor structure evident from the scree plot was the fact that the first dimension had a large Eigenvalue of 16.87 and accounted for an overwhelming 34% of the total variance. The next dimension explained only 4.5% of the variance and had, compared to the first factor, a small Eigenvalue of 2.2. The third dimension explained 4.2% of the variance and had an Eigenvalue of 2. The fourth and fifth dimensions explained 3% of the variance each and had Eigenvalues of 1.6 and 1.5 respectively.

Another consideration regarding the factorial structure of the instrument was the number of items loading on each dimension. An examination of the structure matrix, as shown in Table 5, revealed that an overwhelming 39 of the 49 Greek-BSI items loaded on the first factor, further supporting the argument for a unidimensional instrument. The loadings associated with this factor ranged from a low of .30 to a high of .87. Additionally, the five dimensions shared many co-loadings amongst them suggestive of a high degree of overlap or of a fuzzy differentiation between them.

Further support for the unidimensional nature of the Greek-BSI came from the conceptual exploration of the structure matrix, as shown in Table 5, which indicated that only 19 of the 49 Greek-BSI items correlated primarily as expected with their hypothesized original dimensions. Further, none of the hypothetical constructs as proposed by Derogatis and Spencer (1982) emerged intact from the analysis based on an inspection of the primary loadings, although there was partial replication. Specifically, the first factor included four of the six DEP items along with two PSY items that seemed to describe emotional distance (“feeling lonely even when you are with people” and “never feeling close to another person”). The second component replicated the original SOM dimension and also included an item from DEP (“thoughts of ending your life”). The third component seemed to measure general anxiety and included four of the five items from PHOB and three of the six items from ANX. Further, the HOS dimension was largely replicated with four of the five anticipated items emerging together on the fourth component. The PAR dimension was also largely replicated on the fifth component. However, it was embedded within a bigger component that included two items each from INT (“feeling that people are unfriendly or dislike you,” and “your feelings being easily hurt”) and OC dimensions (“having to check and double check what you do,”

TABLE 5
Structure Matrix with the Primary Loadings and the Coloadings of the Greek-BSI Derived from the Exploratory Factor Analysis

<i>BSI Item</i>	<i>Original BSI Dimension</i>	<i>Components</i>							
		<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
16. Feeling lonely	DEP	.872	.312	.341	.320	.353	.377		
14. Feeling lonely even when you are with people	PSY	.839	.386	.324	.331	.381	.371		
18. Feeling no interest in things	DEP	.754	.320	.385	.347		.457		
17. Feeling blue	DEP	.729	.361		.355		.352		.541
35. Feeling hopeless about the future	DEP	.586	.395	.335	.321	.370	.584		
44. Never feeling close to another person	PSY	.510		.301		.365	.464		
37. Feeling weak in parts of your body	SOM	.382	.809	.339	.301		.349		.361
33. Numbness or tingling in parts of your body	SOM		.733			.349			
29. Trouble getting your breath	SOM		.697	.406	.397				
02. Faintness or dizziness	SOM	.402	.674	.350	.324			.475	
07. Pains in heart or chest	SOM	.394	.671	.346		.312		.396	
23. Nausea or upset stomach	SOM	.305	.647	.483	.374				
30. Hot or cold spells	SOM		.596					.354	
09. Thoughts of ending your life	DEP	.326	.454		.415		.444		
19. Feeling fearful	ANX	.517	.405	.761	.351	.313	.321	.300	
45. Spells of terror or panic	ANX	.343	.380	.719	.448		.397		
12. Suddenly scared for no reason	ANX	.568	.354	.713			.315	.315	
31. Having to avoid certain things, places, or activities because they frighten you	PHOB	.349	.408	.679		.341	.402		
08. Feeling afraid in open spaces or on the streets	PHOB	.364		.664		.309		.345	
28. Feeling afraid to travel on buses, subways, or trains	PHOB			.643					
47. Feeling nervous when you are left alone	PHOB	.313		.482	.348		.394		.331
40. Having urges to beat, injure, or harm someone	HOS	.304			.769		.313		

TABLE 5
Continued

<i>BSI Item</i>	<i>Original BSI Dimension</i>	<i>Components</i>							
		<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
46. Getting into frequent arguments	HOS				.758				
41. Having urges to break or smash things	HOS	.410	.322	.301	.749		.381		
13. Temper outbursts that you could not control	HOS	.454	.302		.580	.345		.391	.481
51. Feeling that people will take advantage of you if you let them	PAR		.362		.349	.705	.321		
48. Others not giving you proper credit for your achievements	PAR	.313	.319		.348	.684	.314		
21. Feeling that people are unfriendly or dislike you	IS	.548	.302	.338	.374	.673	.525		
10. Feeling that most people cannot be trusted	PAR	.470	.323	.348		.667		.332	
24. Feeling that you are watched or talked about others	PAR	.364		.385	.360	.609	.394	.379	
20. Your feelings being easily hurt	IS	.572	.334	.309		.588	.377	.367	.338
26. Having to check and double-check what you do	OC		.354	.338		.510	.303		.443
27. Difficulty making decisions	OC	.369		.374		.466	.398	.336	.410
50. Feelings of worthlessness	DEP	.417			.380	.347	.817		
22. Feeling inferior to others	IS	.441		.398		.394	.726		
53. The idea that something is wrong with your mind	PSY	.313			.376		.725	.331	
42. Feeling very self-conscious with others	IS	.438		.461		.487	.641		
32. Your mind going blank	OC	.468	.501	.316	.402		.599	.325	
36. Trouble concentrating	OC	.480	.435		.321		.593	.353	.517
43. Feeling uneasy in crowds, such as shopping or at a movie	PHOB	.396		.488		.423	.511		
34. The idea that you should be banished for your sins	PSY		.380	.457		.450	.497		

TABLE 5
Continued

<i>BSI Item</i>	<i>Original BSI Dimension</i>	<i>Components</i>							
		<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
03. The idea that someone else can control your thoughts	PSY			.352			.310	.651	
01. Nervousness or shakiness inside	ANX	.465	.449	.326	.311			.579	.438
05. Trouble remembering things	OC		.354				.321	.575	
04. Feeling others are to blame for most of your troubles	PAR	.312			.352	.332		.564	
06. Feeling easily annoyed or irritated	HOS	.479			.416	.376		.538	.534
38. Feeling tense or keyed up	ANX	.405	.516		.373	.330	.307	.311	.702
49. Feeling so restless you couldn't sit still	ANX	.330	.442		.455	.403			.619
15. Feeling blocked in getting things done	OC	.488	.389				.378	.414	.545

and “difficulty making decisions”). Finally, the items of the original PSY and OC dimensions were dispersed across many components and were not meaningfully replicated.

DISCUSSION

The main goal of this article was to extend the psychometric evidence of the BSI and to critically examine its construct validity. It is the first study to report normative, reliability, validity, and factor structure data of the instrument from the Greek population. Such psychometric evidence significantly contributes to the ongoing, yet unresolved discussion regarding the structure and application of the BSI.

In terms of normative data, the gender differences that emerged in this study are consistent with those of prior research. Specifically, women reported higher levels of psychopathology than men. We thus suggest that future users of the Greek-BSI implement separate norms in assessing the scores of males and females. Further, this study indicated the presence of normative differences as compared to normative sample in terms of the intensity of psychological distress. Specifically, the raw mean scores of the nine symptom dimensions and the Global Severity Index (GSI) were higher than those published by Derogatis (1993) for the normative sample. Other authors who studied cultural adaptations of the

BSI found higher mean scores than those proposed in the manual. Specifically, Ruipérez et al. (2001) found higher than normative means with a non-clinical sample from another Mediterranean country and Acosta, Nguyen, and Yamamoto (1994) found higher means with a clinical sample of Spanish speaking psychiatric outpatients. Watson and Sinha (1999) also found higher scores in nonclinical samples of university students from India and Canada and in fact these findings were comparable to the ones from this study. The fact that the means vary to such an extent from those of the normative sample reiterates the importance of developing culture-specific norms for instruments such as the BSI. One possible methodological explanation for the high level of psychological distress in the total sample is the unbalanced gender ratio of the sample. Given the noted normative differences, additional research with a clinical sample is needed to clarify the level at which the intensity of the Greek-BSI scores indicate actual psychopathology.

The findings provide psychometric support for the adapted Greek-BSI. The results indicate strong reliability of the Greek-BSI with a high degree of consistency between the various items that comprise each of the originally proposed nine dimensions. It was not possible to have multiple administrations of the Greek-BSI and thus the test-retest reliability of the Greek-BSI can be a goal in future research efforts. The convergent and discriminant validity of the Greek-BSI were supported through correlational investigation of its dimensions with the personality factors of the Greek-NEO-FFI that reflect similar and dissimilar psychological constructs respectively.

In regards to construct validity in the Greek context, there are several findings that lead one to critically question the multidimensionality of the scale as originally proposed by Derogatis (1993). First, although the high intercorrelations of the BSI dimensions with each other and the global score evidence high uniformity, they also point to the non-independent nature of the emerging dimensions. One wonders whether such high intercorrelations reflect the inadequacy of the dimensional scores to effectively distinguish among different classes of symptoms as the original instrument proposes. The high intercorrelations further suggest that all dimensional scores are affected by a common meaningful factor, possibly general distress, as others have previously suggested (e.g., Boulet & Boss, 1991).

The scree plot of the exploratory analysis clearly suggested a single factor and provided the strongest evidence for the unidimensionality of the BSI in the Greek context. Further, this single factor explained more than half of the total variance. Each of the additional dimensions that emerged explained a very small proportion of the variance compared to the first factor. Although the Eigenvalues-greater-than-1 rule used to determine the number of factors remains popular, several studies have indicated that it is unsatisfactory (see Wood, Tataryn, & Gorsuch, 1996, for a review) and should be used with caution in combination with other findings. Even considering this rule, none of the factors with Eigenvalues greater than 1 replicated the original dimensions of the BSI intact (Derogatis & Spencer,

1982). Further, the broad picture emerging from the analysis suggested that less than half of all BSI items loaded primarily on their corresponding hypothesized dimension. We therefore concluded that the Greek-BSI appears to be a unidimensional instrument. Given the high number of items from all of the original BSI dimensions that loaded on this single factor, we agree with other researchers who argue that this single factor appears to measure general psychological distress. It is noteworthy, however, that four of the six items loading primarily on this single factor were DEP items. This finding provides partial support to the original hypothesis that the DEP dimension would explain most of the sample variance.

Little additional information is gained by separating the scores into dimensions of psychopathological categories as proposed by Derogatis and Spencer (1982). Thus, we suggest that in using the BSI within a Greek community context, it might be most meaningful to use the Global Scales rather than the dimensional scores. Apparently, in the Greek population, the dimensional scores present with a lot of subscale overlap and do not clearly distinguish between classes of symptoms. In particular, the items of the PSY dimension were dispersed across various dimensions, a finding that adds to the existing evidence that PSY is particularly problematic. The OC dimension also appeared to be particularly problematic with this population.

The findings suggest that a community sample of Greek adults responded to the items on the BSI in a different manner than the sample used in its original development. One methodological explanation for these results, and more broadly for the variability of factorial solutions in the literature, does indeed appear to relate to the rationale and criteria used to extract the factors as described in the introduction. Another methodological explanation for these results might be the non-clinical nature of the sample. Others (e.g., Schwarzwald et al., 1991) have also questioned the multidimensionality of the BSI and its predecessor the SCL-90 in non-clinical samples. One might expect that discrete clinical populations with specific diagnoses would have more clearly defined constellations of symptoms that would better fit a multidimensional structure. To a nonclinical population any mild psychological symptom might be experienced as generalized distress and may be better captured by the items in the primary factor that clearly emerged. Further, a community sample might not present with adequate levels of psychopathology to allow for distinct dimensions to emerge. This hypothesis poses questions about the validity of the dimensional scores in non-clinical samples in general. Further research can explore the psychometric properties, and especially the dimensional structure, of the Greek-BSI in a clinical sample of Greek persons.

A substantive hypothesis for the variation in factorial solutions about the internal structure of the BSI might relate to cultural differences among the samples. There might be fundamental differences in the construction and expression of internal experience and psychopathology among the different cultural groups from

which the various samples are drawn. In this study, the construction of psychological distress within the Greek context might be of a more unidimensional nature. From this perspective, one either has or does not have psychopathology and there are no fine distinctions or classes of symptoms that lie in-between. Pang (2000) also proposed cultural differences in the construction of internal experience based on the response patterns on the BSI of elderly Koreans. Pang also found one factor (SOM), and suggested that elderly Koreans experience body and mind as a unitary system and tend to communicate distress through somatic symptoms. Thus, the search for and debate over which BSI factorial solution is correct may be misguided since the expression of psychopathology may be constrained by the particular cultural context. From this perspective, the need for culture specific norms for instruments assessing psychological symptoms is critical.

In conclusion, the Greek-BSI is a reliable measure of psychopathology and can be used to identify overall psychological distress in the general population. It could be particularly helpful within a Greek context in both research and clinical work for the accurate assessment and detection of overall psychopathology. The utility, however, of the dimensional scores of the Greek-BSI to discriminate between categories of psychological symptoms is less clear and one should take a cautious approach in using and interpreting the subscale profile scores. Finally, findings from this and other studies regarding the construct validity of cultural adaptations of the BSI raise questions about fundamental cultural differences in the construction and expression of psychological distress that might render a universal factorial solution of the BSI meaningless.

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