Revista Brasileira de Psiquiatria. 2014;36:285–292

doi:10.1590/1516-4446-2013-1329

ORIGINAL ARTICLE

The joint structure of major depression, anxiety disorders, and trait negative affect

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Objective: Dimensional models of psychopathology demonstrate that two correlated factors of fear and distress account for the covariation among depressive and anxiety disorders. Nevertheless, these models tend to exclude variables relevant to psychopathology, such as temperament traits. This study examined the joint structure of DSM-IV-based major depression and anxiety disorders along with trait negative affect in a representative sample of adult individuals residing in the cities of São Paulo and Rio de Janeiro, Brazil.

Methods: The sample consisted of 3,728 individuals who were administered sections D (phobic, anxiety and panic disorders) and E (depressive disorders) of the Composite International Diagnostic Interview (CIDI) 2.1 and a validated version of the Positive and Negative Affect Schedule. Data were analyzed using correlational and structural equation modeling.

Results: Lifetime prevalence ranged from 2.4% for panic disorder to 23.2% for major depression. Most target variables were moderately correlated. A two-factor model specifying correlated fear and distress factors was retained and confirmed for models including only diagnostic variables and diagnostic variables along with trait negative affect.

Conclusions: This study provides support for characterization of internalizing psychopathology and trait negative affect in terms of correlated dimensions of distress and fear. These results have potential implications for psychiatric taxonomy and for understanding the relationship between temperament and psychopathology.

Keywords: Diagnosis and classification; emotion; epidemiology; unipolar mood disorders; generalized anxiety disorder

Introduction

There has been intensive effort to develop a quantitative, empirically based model for psychopathology.[1-4] These efforts have been directed at addressing inherent limitations associated with pervasive clinical heterogeneity and diagnostic comorbidity,[5-8] along with the fact that covariance patterns among differing psychopathologies and temperament/personality traits are not addressed by dominant classification systems of mental disorders.[9,10]

In response to these limitations, different researchers have modeled the underlying structure of common psychiatric conditions to characterize diagnostic overlap using structural equation modeling techniques.[11-15] These studies have consistently shown that a higher-order factor of internalizing proneness accounts for the covariation among unipolar mood and anxiety disorders, whereas a factor of externalizing proneness underlies the covariation among antisocial behavior and substance-use disorders.[16,17] The internalizing factor is composed – at a next-order structural level – by two subfactors of distress or anxious-misery (comprising unipolar mood disorders, generalized anxiety disorder, and posttraumatic stress disorder) and fear (comprising phobic, panic, and obsessive-compulsive disorders). However, this two-subfactor higher-order internalizing structure is somewhat controversial, with recent evidence examining: 1) the role of latent internalizing and externalizing variables in the development of lifetime comorbidity[18]; 2) the structure of common mental disorders in incarcerated offenders[15]; and 3) the structure of common and uncommon mental disorders,[19] suggesting a less-differentiated, single-factor solution to the domain of mood and anxiety disorders.

Additionally, the conceptual boundaries of dispositional distress/anxious-misery and fear remain controversial, sometimes being characterized as distinct and sometimes as psychologically indistinguishable phenomena.[20] Tellegen & Waller[21] describe anxiety and depression as specific manifestations of a higher-order dimension of negative emotionality, and fear as pertaining to a higher-order dimension of constraint vs. disinhibition. These personality variables have also been characterized as independent at empirical and conceptual levels. The

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Submitted Nov 27 2013, accepted Jan 02 2014.

affective and emotional composite temperament model (AFECT)[22,23] conceives of distress and fear as independent emotional factors, with distress composed of separable facets that account for the degree of sensitivity to adversity and anxiety, and fear comprising a lower-order trait concept akin to inhibition.[22]

By contrast, the Five Factor Model of Personality delineates negative emotions (fear, anxiety, distress, anger) as lower-order facets of a common trait dimension of neuroticism.[24,25] Along similar lines, Clark & Watson's temperament model[26] posits that fear, anxiety, and distress are manifestations of a common negative affect/activation factor. Furthermore, both models posit that neuroticism/negative affect is common to all unipolar mood and anxiety disorders.[24,25] Clark & Watson also showed that symptomatic elements specific to anxiety and depression allowed them to be differentiated: anxiety is characterized by physiological hyperarousal, whereas depression is characterized by anhedonia or low positive affect (PA).[26] Watson[27] advanced this conception by formulating a hierarchical model in which each unipolar mood and anxiety condition was classified into four groups based on the level of specificity vs. variability attributable to the general negative affect factor: 1) high negative affect conditions with limited specificity; 2) high negative affect conditions with greater specificity; 3) low negative affect conditions with greater specificity; and 4) low negative affect conditions with limited specificity. Within this framework, depressive and anxiety conditions can be differentiated according to the size of this general negative affect factor, and depression is further characterized by low levels of PA (a construct similar to anhedonia).

Few studies have examined the latent structure of internalizing psychopathology in conjunction with temperament/personality traits. One study by Hettema et al.[28] examined how genetic and environmental factors shared by trait neuroticism and internalizing disorders accounted for covariation patterns in a large sample of twins. Results indicated substantial overlap between the single-genetic factors that account for individual differences in trait neuroticism and increased liability across the internalizing disorders. Another relevant study that employed the Personality Assessment Inventory (PAI) – a widely used measure of adult personality and psychopathology – delineated internalizing and externalizing factors as distinct factors that saturated directly the covariation patterns among indicators of anxiety, depression, and aggression.[29]

Taken together, the published evidence indicates that subdivision of the internalizing factor into distress/anxious-misery and fear subfactors requires further examination, particularly if model estimation includes temperament/personality traits. Thus, the current study had three main objectives: 1) to evaluate – via correlational analysis – the hypothesis that trait negative affect (NA) is associated, to differing degrees, with all internalizing psychopathology, whereas PA is a specific feature of depression[26,27]; 2) to examine the structure of eight DSM-IV-defined unipolar mood and anxiety disorders; 3) to examine the joint structure of DSM-defined internalizing disorders along with a validated measure of trait negative affect.[30]

Methods

Participants and data collection procedures

The data for the current study were derived from a single-session, population-based cross-sectional survey carried out in the cities of São Paulo and Rio de Janeiro, Brazil. The study was conducted to assess the impact of urban violence on the prevalence of alcohol dependence, unipolar mood and anxiety disorders, and other mental health-related problems. A detailed description of the protocol of this study is provided elsewhere by Andreoli et al.[31]

All participants were assessed in their households by trained non-clinicians using structured questionnaire and interview measures used widely in international research in psychology and psychiatry, including the 20-item Positive and Negative Affect Schedule (PANAS)[30] and the Composite International Diagnostic Interview (CIDI) 2.1.[32,33] All instruments were previously adapted and validated for use in Brazil or, in the case of some inventories including the PANAS, carefully translated to Brazilian Portuguese via standard procedures of translation/back-translation. Participation in the study was voluntary, written informed consent was obtained prior to data collection, and the study protocol was approved by the ethics committee of the Universidade Federal de São Paulo, Brazil.

The resulting sample consisted of 3,728 individuals (1,614 males and 2,114 females), with a mean age of 39.38 years (SD = 15.52, range = 15 to 75 years) and mean educational attainment of 8.79 years of formal schooling (SD = 4.29, range = 0 to 30 years). The racial composition was 43.7% white, 15.6% black, and 36.9% mixed-race. Most participants reported being single (41.5%) or married (41%).

Instruments

The PANAS[34] consists of two 10-item mood scales designed to provide independent measures of PA and NA. The PANAS was originally designed as a self-report questionnaire[34]; however, its administration in a face-to-face interview setting was preferred in the current study to allow the standardization of data gathering procedures regardless of the literacy level of the participant. This interview version of PANAS has been previously validated.[30] Respondents were asked to rate, on a 5-point Likert scale ("very slightly or not at all" to "very much"), the extent to which they experienced each particular emotion within a general time-frame (i.e., "in general, in your life as a whole"), yielding trait-oriented scores.

The CIDI 2.1[32,33] is a structured questionnaire that assesses psychiatric diagnoses via computerized algorithms according to the criteria of the ICD-10 and the DSM-IV. The Brazilian version of the CIDI 2.1 exhibits good levels of internal consistency and acceptable

sensitivity and specificity in relation to clinical assessments performed by psychiatrists for most disorders. In the current study, CIDI-2.1 diagnoses were obtained on the basis of the DSM-IV criteria for major depressive disorder (MDD), general anxiety disorder (GAD), post-traumatic stress disorder (PTSD), obsessive-compulsive disorder (OCD), social phobia (SP), specific phobia (SpP), agoraphobia (AP), and panic disorder (PD). All diagnostic variables were coded in binary format as present or absent.

Statistical analysis

Diagnostic structure was first examined using weighted least squares exploratory structural equation modeling (EFA) with geomin oblique rotation. Models with one to three factors were evaluated using root mean square residual (RMR) ($\leqslant$ 0.05), root mean square error of approximation (RMSEA) ($\leqslant$ 0.06) values as goodness of fit indexes.[35,36] Next, based on published evidence[11-15] and EFA results, the fit of two alternative structural models (single-factor and a two-factor model) were evaluated using weighted least square confirmatory factor analysis (CFA). The fit of these models was compared based on multiple goodness fit indexes: RMSEA; the comparative fit index (CFI); and the Tucker-Lewis index (TLI). Values greater than 0.90 are considered to indicate adequate fit to the data, and those greater than 0.95, close fit for CFI and TLI.[35,36]

Subsequently, the same procedure described above was implemented using diagnostic and trait NA variables. First, EFA with geomin oblique rotation was used to estimate models with one to three factors, with factors retained based on RMR and RMSEA value considerations. Second, four models were compared: a single-factor model, a two-factor model with NA loading on the distress factor, a two-factor model with NA loading on the fear factor, and a two-factor model with NA loading on both distress and fear factors.

Table 1 Lifetime prevalence of hierarchy-free disorders

Disorder	Prevalence (%)
Specific phobia	18.7
Social phobia	7.3
Agoraphobia	12.9
Panic disorder	2.4
Major depressive disorder	23.2
Generalized anxiety disorder	8.4
Obsessive-compulsive disorder	4.0
Posttraumatic stress disorder	9.7

Results

Descriptive statistics, prevalence, and interrelations among variables

The mean PA score for the sample was 30.57 (SD = 8.44) and the mean NA score was 20.92 (SD = 8.85). The least prevalent disorder was PD (2.4%) and the most prevalent was MDD (23.2%). Table 1 displays the prevalence of hierarchy-free MDD and anxiety disorders.

Tetrachoric correlations among mental disorders were mostly moderate: AP and PD exhibited the highest association (0.66) and GAD and AP the weakest one (0.29). NA displayed mild positive associations with all diagnostic variables (ranging from 0.27 to 0.30), while PA showed a modest negative association with MDD (0.18) and negligible associations with other diagnostic variables. NA and PA themselves were moderately correlated (0.29). Because correlations of PA with diagnostic variables were low and inconsistent, this variable was excluded from structural analysis. Table 2 displays the correlation matrix of the diagnostic and mood variables.

Factor structure of diagnostic variables

The statistical criteria adopted for the EFA phase identified two correlated factors (r = 0.66) underlying the covariation among internalizing disorders. The first (fear) factor subsumed phobic and panic disorders and the second (distress) factor subsumed SpP, MDD, GAD, OCD and PTSD. Contrary to prediction, SpP displayed appreciable loadings on both factors ($\geqslant$ 0.32), with a stronger loading for the distress factor. Table 3 shows the retained two-factor solution and reference model-fit statistics.

As shown in Table 4, both models displayed excellent fit to the data. The two-factor model showed slight statistical superiority in relation to the one-factor model and was favored on the basis of previous evidence.[12] Figure 1 depicts the retained model.

Table 2 Matrix of tetrachoric correlation among evaluated variables

Variable	SpP	SP	AP	PD	MDD	GAD	OCD	PTSD	NA	PA
SpP	1									
SP	0.48	1								
AP	0.43	0.53	1							
PD	0.43	0.48	0.66	1						
MDD	0.37	0.26	0.35	0.46	1					
GAD	0.39	0.38	0.29	0.39	0.54	1				
OCD	0.42	0.45	0.48	0.48	0.45	0.43	1			
PTSD	0.50	0.41	0.40	0.50	0.50	0.49	0.44	1		
NA	0.27	0.29	0.28	0.28	0.27	0.27	0.28	0.30	1	
PA	-0.03	-0.08	-0.08	-0.10	-0.18	-0.07	-0.12	-0.08	0.29	1

AP = agoraphobia; GAD = general anxiety disorder; MDD = major depression; NA = negative affect; OCD = obsessive-compulsive disorder; PA = positive affect; PD = panic disorder; PTSD = posttraumatic stress disorder; SP = social phobia; SpP = specific phobia.

Table 3 Approximate simple factor structure for diagnostic variables

Diagnosis	Distress factor	Fear factor	Residual variance
MDD	**0.75**	-0.06	0.50
GAD	**0.78**	-0.10	0.49
PTSD	**0.63**	0.15	0.47
OCD	**0.47**	0.22	0.58
SpP	**0.39**	**0.32**	0.57
SP	0.17	**0.55**	0.54
AP	-0.12	**0.89**	0.33
Panic	0.15	**0.69**	0.37
RMR	0.04		
RMSEA	0.02		

AP = agoraphobia; GAD = general anxiety disorder; MDD = major depression; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder; RMR = root mean square residual; RMSEA = root mean square error of approximation; SP = social phobia; SpP = specific phobia.
Bold type denotes significant correlations (> 0.32).

Factor structure of diagnostic and NA variables

RMR (0.037) and RMSEA (0.02) indicated the presence of two correlated factors (r = 0.72) underlying the covariation of diagnostic and NA variables. The first factor subsumed AP, SP, and PD, while the second factor subsumed SpP, MDD, GAD, OCD, PTSD, and NA. Unexpectedly, SpP did not show a significant loading on the fear factor (< 0.32). Table 5 shows the factor structure of joint diagnostic and NA variables based on EFA.

Table 6 shows fit statistics for the single- and alternative two-factor models that were specified. As evident, all models show excellent fit to the data, with the two-factor models displaying slight statistical superiority in relation to the single-factor model. Correlations between the factors in all two-factor models were uniformly high (> 0.85), and associations of NA with the distress factor were more substantial than with the fear factor. Based on EFA results and theoretical accounts, the two-factor model with NA loading on the distress factor was preferred in relation to other models. Figure 2 depicts the retained model.

Discussion

Evaluations of the structure of mental disorders in adult samples have consistently shown that a dimension of internalizing proneness underlies the systematic comorbidity between unipolar mood and anxiety disorders.[11-15] This dimension has often been partitioned into subfactors of distress (also called anxious-misery) and fear.[12] However, some recent evidence has favored a single-factor model.[15,18] It has also been suggested that a general internalizing factor may account for the covariation among traits related to NA and internalizing disorders.[28,29] Nonetheless, very few attempts have been made to address this particular issue empirically. The present study sought to address these gaps by examining the underlying structure of internalizing disorders alone and in conjunction with an NA trait measure.

Correlations among variables of interest indicated moderate overlap in general, with the exception of PA, which showed slight to nonsignificant associations with diagnostic variables. In general, these results are in accordance with previously reported findings and provide additional support for the classification of unipolar mood and anxiety disorders into a single diagnostic spectrum of internalizing/emotional disorders.[37] Additionally, this observed pattern of correlations appears relevant to the viability of tenets of Watson's quadripartite model[27] regarding the role of NA and PA (or activation) in differentiating depressive and anxiety disorders. Watson[27] proposed that depressive mood and anxiety syndromes could be classified and differentiated, based on the level of specificity vs. the degree of variance attributable to the general distress factor (NA), into four groups: 1) high distress symptoms/conditions with limited specificity; 2) high distress symptoms/conditions with greater specificity; 3) low distress symptoms/conditions with greater specificity; and 4) low distress symptoms/conditions with limited specificity. Based on these assumptions, it was expected that NA would show consistent but varying degrees of association with assessed diagnostic conditions, and that PA would show significant associations with MDD alone. As shown in Table 2, these predictions were only partially supported by our data: PA showed negative associations with MDD and null or almost null associations with the other diagnoses, whereas NA showed indistinguishable coefficient values across variables. Based on our findings, PA may be efficient in differentiating MDD from anxiety

Table 4 Fit statistics for single- and two-factor confirmatory models using diagnostic variables

Model	Chi-square	DF	SRMR	RMSEA	CFI	TLI
One factor	97.079	18	0.06	0.03	0.96	0.96
Two factors	45.313	17	0.04	0.02	0.99	0.99

CFI = comparative fit index; DF = degrees of freedom; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; TLI = Tucker-Lewis index.

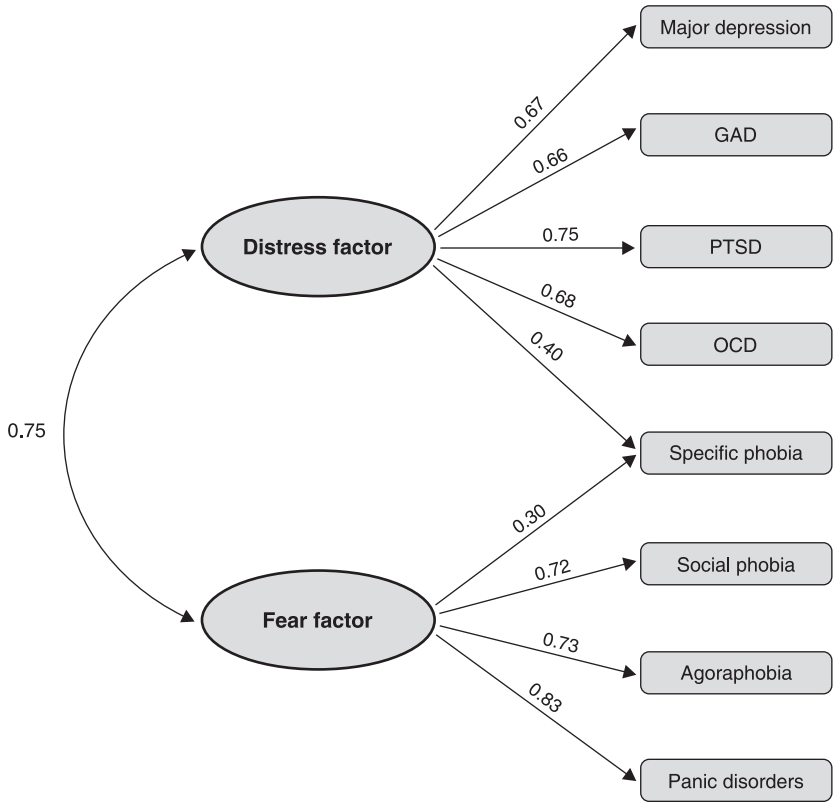

Figure 1 Optimal two-factor model for diagnostic variables. GAD = general anxiety disorder; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder

disorders, but the degree of NA cannot be used to account for differential diagnoses.

Similar to previously reported findings,[12,13] our optimal structural solution indicates that internalizing structure is better conceptualized using a two-factor model of distress and fear tendencies. Still, the way diagnostic conditions were situated within the two-factor model was slightly different here than in other studies,[12,13] OCD was positioned with the distress disorders and SpP loaded on both distress and fear factors (Figure 1). When NA was included in the structural model, SpP was positioned with the distress disorders, not the fear disorders (Figure 2).

These dissimilarities may be attributed to methodological differences. Unlike previous studies,[12,13] we used an exploratory/confirmatory approach – first allowing the data to show the best way to fit the model, and then testing the fit of alternative models via CFA using more stringent criteria. Despite this, it remains conceptually unclear whether OCD is best understood as a fear- or distress-laden disorder. For example, trait fear may be described as a disposition to show flight/fight/freeze

Table 5 Approximate factor structure for diagnostic and trait variables

Variable	Distress factor	Fear factor	Residual variance
NA	**0.35**	0.11	0.81
MDD	**0.74**	-0.08	0.53
GAD	**0.73**	-0.10	0.55
PTSD	**0.75**	0.04	0.40
OCD	**0.54**	0.16	0.56
SpP	**0.44**	0.26	0.58
SP	0.25	**0.49**	0.53
AP	-0.11	**0.92**	0.28
Panic	0.16	**0.65**	0.41
RMR	0.03		
RMSEA	0.02		

AP = agoraphobia; GAD = general anxiety disorder; MDD = major depression; NA = negative affect; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder; RMR = root mean square residual; RMSEA = root mean square error of approximation; SP = social phobia; SpP = specific phobia.
Bold type denotes significant correlations (> 0.32).

Table 6 Fit statistics for four competing confirmatory models using diagnostic and trait variables

Model	Description	Chi-square	DF	RMSEA	CFI	TLI
One factor	Single-factor	120.612	25	0.032	0.979	0.982
Two factors	NA-distress	70.362	24	0.020	0.990	0.990
Two factors	NA-fear	112.514	24	0.031	0.980	0.983
Two factors	NA-distress/fear	74.109	23	0.024	0.989	0.990

CFI = comparative fit index; DF = degrees of freedom; RMSEA = root mean square error of approximation; TLI = Tucker-Lewis index.

responses in the face of an actual threat, whereas trait anxiety (distress/misery-anxiety factor) may be understood as a tendency to experience hypervigilance and discomfort in the perception of potential threats[20]; OCD symptomatology is clearly characterized by heightened distress and vigilance motivated by the anticipation of threats and negative outcomes,[9,10] which seems closer descriptively to trait distress/anxious-misery than fear.

The placement of OCD and SpP as indicators of a distress factor in the current study may have a clinical explanation, i.e., it may be related to the effect of restricting people to places where the feeling that one is able to control the situation predominates. SP, AP, and PD share acute anxiety related to the possibility of being in a place or situation where escape would be difficult if something went wrong (like a panic attack),[9,10] which may lead to avoidance of external environments and increased time in familiar surroundings such as one's home. MDD, GAD, and TEPT do not necessarily show a similar pattern: in these disorders, symptomatology tends to be more pervasive and, thus, not have an effect that causes increasing avoidance of outdoor environments. Similarly, OCD and SpP may not prevent people from going outdoors: OCD has the potential to benefit society and work environments,[38] which shows its potential viability in outdoor activities; on the other hand, the stimulus associated with a specific phobia may not even be available in the external environment, as is typically the case for those who live in major cities and have specific animal phobias (e.g., of snakes). Thus, the structure reported herein indicates that the organization of internalizing disorders in terms of distress and fear may also be related to the effect these factors have on restricting a person into familiar and controllable environments.

The observed loading of NA on the distress factor was somewhat less robust than the loading of the other disorders on the same factor. This finding, which suggests that NA variability only partially accounts for a common liability factor of distress, is in accordance with

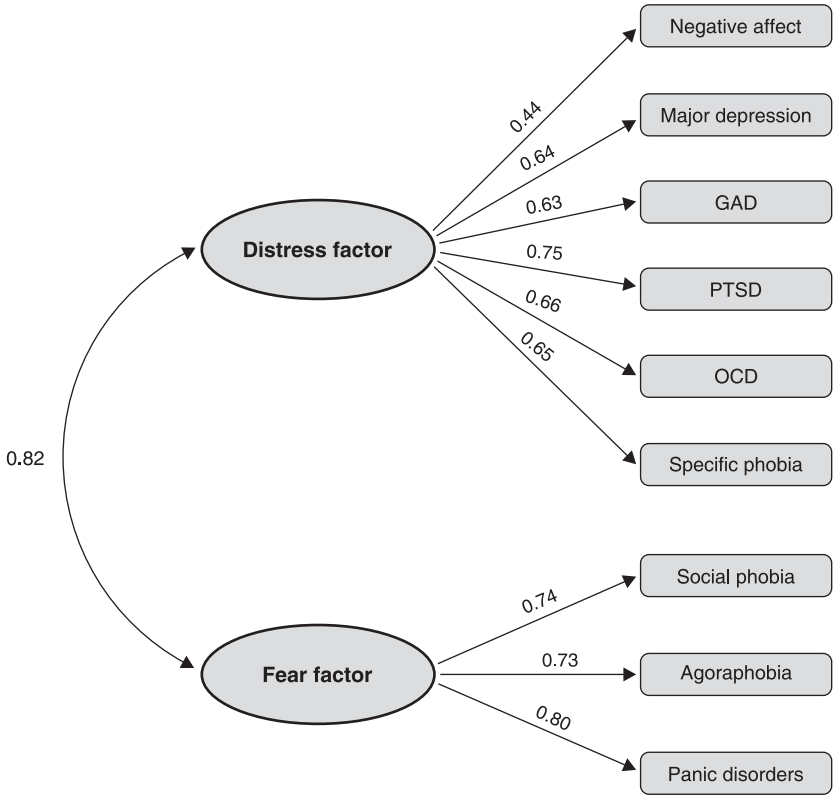

Figure 2 Optimal two-factor model for joint diagnostic and trait negative affect variables. GAD = general anxiety disorder; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder

Hettema et al.,[28] who reported similar results using neuroticism as an indicator of the internalizing factor. Further investigations are required to address the complex relations between temperament, personality, and psychopathology.[39]

This study has notable strengths and limitations. Among its virtues, we highlight the breadth and representativeness of the sample, which allows the results to be generalized with some confidence to the population of Brazilian adults. Moreover, the instruments used in the evaluations show good evidence of validity and reliability. A limitation that is worth mentioning was the non-availability of the diagnosis of dysthymic disorder in the study sample, which prevented the structural analysis from containing the entire spectrum of unipolar internalizing psychopathology.

In conclusion, our findings showed that two correlated factors of distress and fear may account for the covariation among NA, major depression, and anxiety disorders, and that OCD and SpP are better conceptualized as distress disorders in the current sample. Furthermore, we hypothesize that distress and fear factors impact the life of people in different ways: the fear factor may be associated with avoidance of external environments, while the distress factor may not.

Acknowledgements

Funding for this study was provided by grants from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (process no. MCT/CNPq 01/2005) and from Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) (process no. 420122/2005-2). HWC, DRL, RAB, MFM, and JJM are CNPq research fellows.

Disclosure

The authors report no conflicts of interest.

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