J Abnorm Child Psychol (2008) 36:1279–1288
DOI 10.1007/s10802-008-9250-8

Common and Unique Factors Associated with DSM-IV-TR Internalizing Disorders in Children

Charmaine K. Higa-McMillan · Rita L. Smith · Bruce F. Chorpita · Kentaro Hayashi

Published online: 8 July 2008

Abstract With the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association. *Diagnostic and statistical manual of mental disorders DSM-IV Fourth Edition-Text Revision*. Author, Washington, DC. 2000) ahead, decisions will be made about the future of taxonomic conceptualizations. This study examined the factor structure of items from three internalizing disorders (Social Phobia, Generalized Anxiety Disorder, and Depression) on the Anxiety Disorders Interview Schedule for DSM-IV-Child Version (Silverman, W. K., & Albano, A. M. *Anxiety disorders interview schedule for children for DSM-IV, child and parent versions*. Psychological Corporation, San Antonio, 1996). Two-, three-, and four-factor models emerged in an exploratory factor analysis. Confirmatory factor analysis provided additional empirical support for the four-factor model over the two- or three-factor models. Implications for the structure of the DSM-V taxonomy in children and adolescents are discussed.

C. K. Higa-McMillan (✉) · R. L. Smith · K. Hayashi
Department of Psychology, University of Hawaii at Manoa,
2430 Campus Road, Gartley Hall 110,
Honolulu, HI 96822-2294, USA
e-mail: higac@hawaii.edu

R. L. Smith
e-mail: ritas@hawaii.edu

K. Hayashi
e-mail: hayashik@hawaii.edu

B. F. Chorpita
Department of Psychology,
University of California at Los Angeles,
1285 Franz Hall,
Los Angeles, CA 90095, USA
e-mail: chorpita@ucla.edu

Keywords Children · Adolescents · Internalizing disorders · Comorbidity · Tripartite model · DSM taxonomy

As the next Diagnostic and Statistical Manual of Mental Disorders (4th Edition-Text Revision; DSM-IV-TR; American Psychiatric Association 2000) is being drafted, the current system of taxonomy is being reevaluated. Issues of taxonomy and the current gold standard for classifying disorders into discrete categories have been long-debated in the field (e.g., Widiger and Samuel 2005). At least two related problems exist with our current nosologies for anxiety and mood disorders—generally poor discriminant validity between classifications and a significantly high rate of comorbidity. In child and adolescent clinic-referred samples anxiety and depression are often co-occurring, with rates ranging widely from 32% (Kovacs et al. 1989) to 62% (Masi et al. 1999). This high overlap of symptoms suggests that depression and anxiety disorders may not be separate entities and heterogeneous disorders, but rather underlying symptoms common to many disorders (e.g., Brown et al. 1998).

This high rate of co-occurring internalizing symptoms is supported by a recent investigation by van Lang et al. (2006). These authors investigated children with symptoms of anxiety and/or depression using latent class analysis and determined whether children with such symptoms could be categorized into homogeneous groups. Results on self-report measures from their sample showed that only very few individuals had only anxiety or depression, and almost all (99%) had comorbid symptoms.

DSM-IV-TR Taxonomy and the Tripartite Model

Much of the recent discussion on *DSM-IV-TR* categories has focused on adult populations with an increased interest

in a dimensional over a categorical model (Brown and Barlow 2005). The *DSM-IV-TR* organizes the mood and anxiety disorders into separate, discrete diagnostic categories which may not reflect the true relationship between depression and anxiety. The high comorbidity rates described above in children and adolescents together with the growing literature base in adult populations on the problems with our current taxonomy suggest rethinking this organization (e.g., Krueger 1999; Mineka et al. 1998; Watson 2005).

The tripartite model is a theory that explains the high rate of co-occurrence of anxiety and depression (e.g., Clark and Watson 1991). It proposes to account for the shared variance in anxiety and depression through the construct of negative affect (NA), an underlying temperament variable associated with generalized affective distress. It also proposes to discriminate anxiety from depression through the unique variance produced by low positive affect (PA) and physiological hyperarousal (PH; Clark and Watson 1991). In other words, high NA leads to vulnerability to both mood and anxiety disorders whereas low PA is related to depression and high PH is related to anxiety.

In an attempt to account for some inconsistencies evidenced in the tripartite model since it was first described, Watson (2005) recently argued that disorders may be more closely related across diagnostic categories (e.g., anxiety and mood disorders) than within them (e.g., social phobia [SOC] and generalized anxiety disorder [GAD] in the anxiety disorders category). Watson proposed a hierarchical model such that mood and anxiety disorders are grouped together with three sub-categories: bipolar disorders, distress disorders, and fear disorders. Within this classification, GAD would cluster with the distress disorders, along with Major Depressive Disorder (MDD), Dysthymia, and Post-traumatic Stress Disorder (PTSD), rather than with the fear disorders (Panic Disorder [PD], SOC, and Specific Phobia [SP]). Such a model would be consistent with the tripartite model, as both link GAD more closely with MDD than the other anxiety disorders (Brown et al. 2001b; Watson 2005). For example, Brown et al. (2001b) evaluated the classification of anxiety and mood disorders using the Anxiety Disorders Interview Schedule for DSM-IV-Lifetime Version (ADIS-IV-LV; Di Nardo et al. 1994) in an adult outpatient sample. They found that "mood disorders pose a more significant boundary issue for GAD than do other anxiety disorders" (p. 55). Brown et al. (2001a) also evaluated the comorbidity of current and lifetime internalizing disorders in adult outpatients. In accord with Watson's (2005) proposed distress sub-category, Brown et al. (2001a) found that diagnostic categories with the highest rates of comorbidity were mood disorders, PTSD, and GAD.

Models of Internalizing Symptoms in Child Populations

Literature to date evaluating child populations to address these theories of categorization of symptoms has proven mixed, with support for one, two, and three factor structures underlying mood and anxiety disorders.

Three-factor models Joiner et al. (1996) assessed the three-factor structure of the tripartite model in a child and adolescent clinical population. Their study provided support for the tripartite model, demonstrating that in children and adolescents, anxiety and depression overlap on the construct of NA, with low PA being uniquely associated with depression and PH being uniquely associated with anxiety. Chorpita et al. (1998) found similar results in clinically anxious children and adolescents.

Chorpita et al. (2000) also found support for a three-factor model in a child clinical sample. In their sample, NA was significantly related to GAD, PD, and Obsessions/Compulsions and PA was significantly related to MDD and SOC. However, they found that the PH factor did not correlate significantly with GAD. This finding is congruent with the notion that the somatic element of GAD in children may be less related to the severity of the disorder than once thought, and that worry may account for the majority of the disturbance (Tracey et al. 1997). Similarly, Chorpita (2002) also found support for the tripartite model factors, and that different tripartite factors were differentially related to anxiety and depressive disorders. As with prior work, NA was positively related to both anxious and depressive scales, and PA was negatively related to the depressive scale in a large non-clinical school sample. The construct of PH, however, was only related to PD, and not to other anxiety disorders. Thus, there is strong support for NA and PA in child samples; however, the evidence for PH is not as strong in child samples as it is in adult samples.

Two-factor models Lonigan et al. (2003) evaluated PA and NA in 270 fourth to eleventh grade children. They evaluated items from the Positive and Negative Affect Schedule-Extended Version (PANAS-X; Watson and Clark 1991), the Children's Depression Inventory (CDI; Kovacs 1981), and the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds and Richmond 1985) and found that a two-factor orthogonal model of affectivity was the best fit for their data.

Ollendick et al. (2003) also evaluated the factor structure of child self-report measures of depression and anxiety in order to better understand the relationship between anxiety and depression in the context of NA, PA, and elevated PH. These authors conducted a confirmatory factor analysis using the CDI and the RCMAS evaluating a one-factor solution (NA), a two-factor solution (anxiety and depres-

sion), and a three-factor solution (NA, PA, PH). Congruent with Lonigan et al. (2003) findings, Ollendick et al. (2003) found that a two-factor solution of NA and PA represented the best fitting model.

One-factor models Krueger and Finger (2001) evaluated models of the relationships between internalizing disorders (SOC, SP, Agoraphobia, GAD, PD, MDD and Dysthymia) in a treatment-seeking sample of adolescents and adults (ages 15–54). They examined the comorbid relationships between internalizing disorders using Item Response Theory on a structured diagnostic interview to assess how these disorders relate to each other. They found that these disorders can be conceptualized as different aspects of a single internalizing factor.

Furthermore, in a recent examination of the factor structure of DSM symptoms in youth, Lahey et al. (2008) evaluated a modified form of the Child and Adolescent Psychopathology Scale (CAPS; Lahey et al. 2004), a structured interview with a large sample of non-referred twin dyads and their caregivers. Although findings were complex, Lahey et al. (2008) concluded that a hierarchical dimensional taxonomy for *DSM-IV-TR* mood and anxiety symptoms was a more interpretable model for children and adolescents, reporting that the higher-order internalizing factor accounted for much of the variance in the model. They further reported that there was relatively little improvement in fit when MDD and GAD were distinguished from each other thus replicating findings in the adult literature (Brown et al. 2001b; Krueger 1999).

In sum, while there is evidence to support a three-factor tripartite model (NA, PA, & PH), a two-factor partial tripartite model (NA & PA only), and a one-factor hierarchical internalizing model, a bulk of the evidence suggests that a two-factor partial tripartite model may provide the best fit for children and adolescents.

The Current Investigation

The current investigation evaluated the overlap of symptoms associated with SOC, GAD, and MDD in clinic-referred children. These issues have been addressed in several of the above works. Most research in this area, however, has relied on self-report measures and in many instances the measures used were developed in order to evaluate tripartite traits and not *DSM* symptoms. As such, it is not surprising that trait-based tripartite measures would find trait-like tripartite factors. Brown and Barlow (2005) suggest that the problem of *DSM* criteria overlap might be less evident in interview data, as self-report measures are more likely to be influenced by general distress rather than the functional relationships among *DSM* disorder features. Moreover, given the movement towards a multi-method approach to examining child psychopathology (e.g., Hoagwood et al. 1996), it may be fruitful to examine the structural relationships in the mood and anxiety disorders using alternative methods such as structured diagnostic interviews.

Given the mixed findings in the literature and the fact that much of the work in this area in the past has used self-report measures on non-clinic referred children, this study extended previous work by examining the taxonomic classification of internalizing disorders in clinic-referred children via symptom endorsement on a structured diagnostic interview. An exploratory factor analysis (EFA) was employed to allow the data to guide initial model and indicator building. It was determined that a confirmatory factor analysis (CFA) would be helpful to empirically test the relative fit of models that have been supported in previous studies and that were obtained in the EFA. Based on previous research, it was hypothesized that an EFA of three sections of a structured diagnostic interview would support a one-, two-, or three-factor model.

Method

Participants

This study examined a sample of 289 children and adolescents (Girls n=92, 31.8%) who were consecutively referred for a mental health assessment at the Center for Cognitive Behavior Therapy at the University of Hawaii. Grade level ranged from 1 to 12 and the mean age was 12.3 years (SD=3.3; range=6.0 to 18.2). Ethnic groups represented in this sample were Multiethnic (n=126; 43.6%), Other (n=53; 18.3%), Asian (n=41; 14.2%), Caucasian (n=40; 13.8%), Native Hawaiian or Pacific Islander (n=29; 10.0%), Black or African American (n=6; 2.1%), and Hispanic or Latino (n=4; 1.4%). Parental marital status was: married, 47.1%; divorced 23.9%; single parent 11.8%; separated 9.0%; and widowed 2.4%. Median reported household income was $40,000. Youth diagnoses were determined through use of a semi-structured clinical interview (see Table 1).

Measurement

Anxiety Disorders Interview Schedule for DSM-IV-Child Version (ADIS-IV-C; Silverman and Albano 1996). The ADIS-IV-C is a semi-structured clinical interview designed for *DSM-IV* diagnosis of childhood anxiety, mood, behavior, and attentional disorders. The ADIS-IV-C has demonstrated good to excellent interrater reliability and one to 2-week test–retest reliability across diagnoses (Silverman et al. 2001). The ADIS-IV-C includes both symptom present/

Table 1 Principal and Comorbid Diagnoses

Disorder	Principal Diagnosis	Anywhere in the Diagnostic Profile
Attention Deficit/Hyperactivity Disorder	19.4%	
No Diagnosis	18.4%	
Conduct Disorder	11.6%	
Oppositional Defiant Disorder	11.3%	
Social Phobia	**7.4%**	**13.2%**
Major Depressive Disorder	**3.9%**	**7.1%**
Disruptive Behavior Disorder, NOS	2.3%	
Generalized Anxiety Disorder	**1.9%**	**8.4%**
Posttraumatic Stress Disorder	1.9%	
Anxiety Disorder, NOS	1.6%	
Asperger's Disorder	1.6%	
Obsessive Compulsive Disorder	1.6%	
Separation Anxiety Disorder	1.6%	

Diagnoses examined on the ADIS-IV-C in this study are in bold

absent binary questions as well as severity and interference questions that allow for a continuous range of responses. For the purposes of this study, only the binary questions or symptom present/absent questions were examined. On the ADIS-IV-C, for each disorder, youth are asked between one and three initial screening questions followed by a series of symptom and severity questions if the initial screening questions are positive. For this study, all 55 symptom items in the Social Phobia, Generalized Anxiety, and Depression sections (23, 16, and 16 items, respectively) were asked regardless of whether the child answered positively to the screening item or not. In other words, interviewers did not use the "skip out" option for these three disorders if youth did not endorse the initial screening items, thus all 55 items are included in this investigation.

All interviewers were senior doctoral students that underwent thorough ADIS-IV-C training procedures before administering the measure on their own. Training included observation of three pairs of parent-child interviews conducted by expert interviewers. Subsequently, the trainee conducted child and parent interviews using the ADIS-IV-C under the observation of an expert interviewer. The trainee was considered "trained" after matching (i.e., assigning correct diagnoses in the correct order with the severity ratings within one point of the criterion interviewer) on at least three out of five separate parent-child interviews. Although the parent was also interviewed using the ADIS-IV-C, this investigation only utilized child-report data.

Procedure

This study was reviewed and approved by the University of Hawaii Institutional Review Board. Parents completed consent forms and children completed assent forms prior to participation in the ADIS-IV-C interviews and completion of a standardized battery of self- and parent-report questionnaires (not examined in this study).

Factor Analytic Strategy

Both an exploratory and a confirmatory factor analysis were conducted for this study. An EFA was performed to let the data determine the most appropriate structure. In order to provide additional support for the findings from the EFA and to provide clear recommendations for model structure, a CFA was conducted.

Mplus, Version 3.0 (Muthen and Muthen 2004) was used for the EFA because it has the capability to accurately compute a solution with both continuous and ordered categorical (including binary) variables. The scree-plot of eigenvalues (Cattell 1966) was employed to identify the number of factors. After obtaining the initial solution, the Promax rotation (Hendrickson and White 1964) was applied to find the simple structure, the factorial structure that is easiest to interpret. The Promax rotation is one of the most frequently used oblique rotations for EFA which allows factors to be correlated with each other.

The CFA was performed to examine the factor structure of the items and covariance among the observed items was evaluated with a maximum likelihood solution using LISREL 8.7 (Jöreskog and Sörbom 1993). Because different fit indices are sensitive to unique artifactual influences (e.g., chi square fit index increases with sample size), multiple fit indices were used to provide a more conservative and reliable evaluation of the models. These indices included the traditional Goodness of Fit Index (GFI; Jöreskog and Sörbom 1993) and the Standardized Root Mean Square Residual (RMR; Jöreskog and Sörbom 1993), which test the absolute fit of the model, the Incremental Fit Index (IFI; Bentler 1990), which tests the fit of the model relative to a fully orthogonal "independence" model, and the Root Mean Square Error of Approximation (RMSEA; Steiger 1990), which evaluates the model relative to degrees of freedom.

Conventionally, scores of 0.90 and above on the GFI and the IFI and scores below 0.05 on the RMR represent good model fit. Browne and Cudeck (1993) suggest that RMSEA values at or below 0.08 represent acceptable fit, and that values at or below 0.05 represent good fit. An inferential test for close fit (defined as RMSEA <0.05) can also be examined, for which a nonsignificant result ($p>0.05$) would indicate good model fit (Cfit; Browne and Cudeck 1993).

Results

All participants were asked all questions from each of the three sections of the ADIS-IV-C. However, missing data

remained as some participants failed to answer all questions (e.g., refusal to answer a question, ambiguous responses that were not coded by the clinical interviewer, etc.). Thus, missing data were deleted list-wise. Raw data for these analyses were binary. The proportions of *yes* and *no* responses were initially examined to determine if there was sufficient variability to continue with the EFA. Item positive endorsement ranged from 8 to 15 percent of the sample (mean endorsement=13.2%), indicating sufficient variability in item responses. Based on rational judgment of the items, it was concluded that the range of endorsement would produce sufficiently stable estimates. Therefore, all the binary items were used for the categorical EFA (Muthen and Muthen 2004).

Exploratory Factor Analysis

Judging by the change in slope observed on the scree-plot it was concluded that a two-, three-, or four-factor solution would fit the data (Hoyle and Duvall 2004). As each of these three models provides unique information, all three were examined further.

Two-factor model Factor correlations between the first and second factor in the two-factor model were moderate (r= 0.50). In this model all SOC items loaded highly on the first factor, and all MDD items loaded highly on the second factor. The GAD items were split between the two factors with somewhat higher loadings on the MDD factor.

Three-factor model In the three-factor solution, correlations between all three factors were moderate (r=0.40 to 0.60). In this model all 23 of the SOC items loaded highly on the first factor, with all values greater than 0.25. Twenty-one of the MDD items had high factor loadings on the second factor with three items also loading on the third factor (i.e., "ate more than usual," "gained weight," and "had trouble sitting still"). The GAD items were not as clear in their loadings. The items concerning performance and social or interpersonal concerns loaded highly on factor two, whereas the items concerning school, little things, perfectionism, health concerns, family issues, and things going on in the world loaded highly on the third factor.

Four-factor model The correlations between the factors in the four-factor solution were also moderate (r=0.38 to 0.49). Although most of the SOC items loaded on the first factor, several items also loaded on the third factor. The MDD items loaded primarily on the second factor while GAD worry items loaded highly on factor three and GAD somatic items loaded highly on the fourth factor. Table 2 provides the exploratory factor analysis factor loading matrix.

Table 2 Exploratory Factor Analysis Factor Loading Matrix

(Disorder Group) Item	Factors			
	1	2	3	4
(SOC) work/playing with kids	0.90		0.36	
(SOC) boy/girl scouts, team meetings	0.80			
(SOC) starting/joining conversation	0.77			
(SOC) inviting a friend to get together	0.74			
(SOC) attending parties, dances, etc.	0.73			
(SOC) talk to persons don't know well	0.68			
(SOC) dating	0.63			
(SOC) having your picture taken	0.62			
(SOC) musical/athletic performances	0.61			
(SOC) walk in the hall/hanging by locker	0.60		0.34	0.50
(SOC) giving a report or reading aloud	0.59			
(SOC) ask teacher a question/for help	0.58			
(SOC) writing on the chalkboard	0.58			
(SOC) speaking to adults	0.57			
(SOC) answering questions in class	0.55			
(SOC) eating in front of others	0.55			
(SOC) answering or talking on the phone	0.53			
(SOC) gym class	0.51			0.32
(SOC) ask do something, can't say no	0.46		0.32	
(SOC) using public bathrooms	0.46			
(SOC) can't tell someone to stop	0.46			
(GAD) social/interpersonal	0.33	0.31		
(SOC) other	0.31			0.37
(SOC) social/interpersonal	0.30	0.31		
(MDD) thought about killing self		0.87		
(MDD) thought of a way to kill self		0.81		
(MDD) moved slow		0.78		
(MDD) tried to kill self		0.78		
(MDD) thought about death		0.75		
(MDD) blamed self		0.74		
(MDD) things not fun		0.71		
(MDD) trouble sleeping		0.67		
(MDD) tired, no energy		0.66		
(MDD) trouble thinking/distracted		0.62		
(MDD) slept more		0.55		
(MDD) ate less		0.53		
(MDD) lost weight		0.41		
(MDD) trouble sitting still		0.36	0.30	
(GAD) health (self)			0.80	
(GAD) health (family)			0.71	
(GAD) things going on in the world			0.67	
(GAD) perfectionism			0.63	
(GAD) family (divorce, finance)			0.49	
(GAD) grouchy			0.35	0.45
(GAD) little things			0.33	
(GAD) trouble relaxing			0.32	0.49
(MDD) ate more			0.32	
(GAD) trouble concentrating			0.31	0.41
(GAD) school			0.31	0.37
(SOC) talking tests			0.31	
(MDD) gained weight			0.31	
(GAD) muscles ache				0.89
(GAD) trouble sleeping				0.54
(GAD) tired easily				0.52

SOC Social phobia, *GAD* generalized anxiety disorder, *MDD* depression

Taken together, in the two-factor solution the first factor was comprised of SOC items and the second factor was comprised of MDD items with GAD items split between the two factors. In the three-factor solution the first factor was comprised of SOC items, the second factor was primarily comprised of MDD items, and most of the GAD items comprised the third factor (performance, social, and interpersonal concerns loaded on factor two). Similar to the two- and three-factor models, the SOC items loaded primarily on factor one and the MDD items loaded primarily on factor two in the four-factor solution. GAD worry items loaded on factor three, and factor four was comprised of somatic items from the GAD section.

Confirmatory Factor Analysis

Given that the exploratory analysis supported a two-, three-, and four-factor solution, a CFA was conducted to empirically test the best fitting solution. As the items from the ADIS-IV-C are binary, in order to conduct a CFA using LISREL, it was necessary to compute dimensional factor indicators using a combination of two or three binary items per indicator (Brown 2006). Because models were completely nested, items were combined by taking every third item for the first two factors and every other item for the third and fourth factors from the four-factor model of the EFA. Thus each factor had a total of two or three indicators.

One-factor model Although a one-factor model did not emerge in the EFA, given a priori hypotheses, a one-factor model was examined in the CFA with all model indicators loading on one factor. Completely standardized factor loadings ranged from 0.44 to 0.73 (M=0.61; SD=0.09). See Table 3 for model fit statistics for each of the various models tested as well as significance tests evaluating fit between nested models. Fit statistics for the one-factor solution suggested poor model fit.

Two-factor models Two separate two-factor models were examined. The first two-factor model (Two-Factor *DSM-IV-TR*; see Fig. 1) examined the combination of factor indicators based on the *DSM-IV-TR* categories of anxiety (GAD and SOC) and depression (MDD). The latent factor intercorrelation for this model was statistically significant. Completely standardized factor loadings ranged from 0.42 to 0.81 (M=0.69; SD=0.11). Although model statistics suggested improved fit over the one-factor model (see Table 3) and led to a significant decrease in χ^2 ($\chi^2_{diff}[1] = 197.90$, $p<0.01$), Cfit remained in the statistically significant range and RMSEA, GFI, IFI, and standardized RMR failed to meet the recommended criterion for good model fit.

The second two-factor model examined a different grouping of the indicators using Watson's (2005) Fear-Distress model (see Fig. 2). Indicators on the "fear" factor were from the SOC section whereas indicators on the "distress" factor were from the GAD and MDD sections. The latent factor intercorrelation was statistically significant. Completely standardized factor loadings of indicators ranged from 0.45 to 0.87 (M=0.69; SD=0.12). This model (Two-Factor Fear-Distress) demonstrated improvement over the one-factor model, evidencing a significant decrease in χ^2 ($\chi^2_{diff}[1] = 230.44$, $p<0.01$). Cfit remained in the statistically significant range and RMSEA, GFI, IFI, and standardized RMR failed to meet the recommended criterion for good model fit. Both two-factor models provided better fit for the data than the one-factor model; however the model that grouped the GAD and MDD indicators together (Fear-Distress) provided slightly better fit for the data (see Table 3).

Three-factor model Given that the two-factor models did not meet recommended criteria for good model fit, a nested three-factor was examined (see Fig. 3). Latent factor intercorrelations were statistically significant and completely standardized factor loadings of indicators on their latent variables ranged from 0.45 to 0.87 (M=0.75; SD=0.12). This model was an improvement over the two-factor Fear-Distress model and led to a significant decrease in χ^2 ($\chi^2_{diff}[2] = 172.90$, $p<0.01$). GFI, IFI, and standardized RMR met the recommended criterion for good model fit; however, Cfit remained in the statistically significant range

Table 3 Fit Statistics for Confirmatory Factor Analysis Structural Models

Model	χ^2	*df*	*P*	RMSEA	Cfit	GFI	IFI	RMR	Nested Comparison	$\chi^{2\ diff}$	df^{diff}	*P*
1-Factor	498.06	35	0.00	0.23	0.00	0.72	0.79	0.12				
2-Factor *DSM-IV-TR*	300.16	34	0.00	0.18	0.00	0.80	0.88	0.09	1-Factor	197.90	1	0.00
2-Factor Fear-Distress	267.62	34	0.00	0.17	0.00	0.83	0.89	0.08	1-Factor	230.44	1	0.00
3-Factor	94.72	32	0.00	0.08	0.00	0.94	0.97	0.05	2-Factor Fear-Distress	172.90	2	0.00
4-Factor	50.28	29	0.01	0.05	0.54	0.97	0.99	0.03	3-Factor	44.44	3	0.00

RMSEA Root mean square error of approximation, *Cfit* test for close fit (RMSEA<0.05), *GFI* goodness of fit index, *IFI* incremental fit index, *RMR* standardized root mean square residual

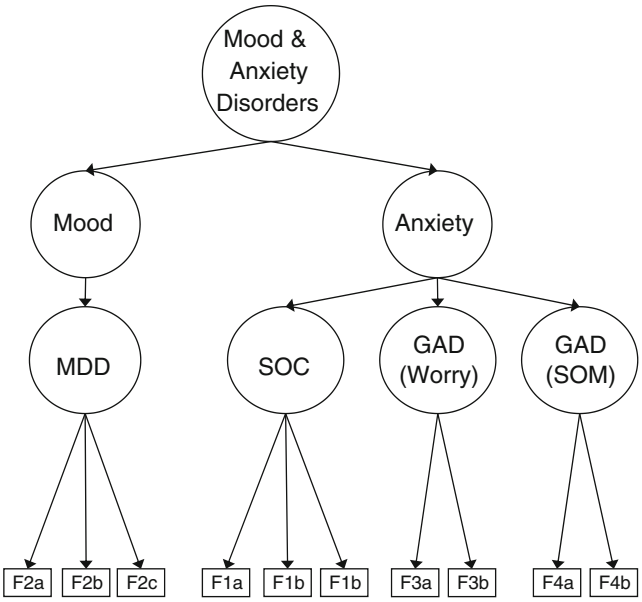

Fig. 1 Two-factor *DSM-IV-TR* structural model and factor indicators. *MDD* depression, *SOC* social phobia, *GAD* generalized anxiety disorder, *SOM* somatic symptoms. Factor indicators *1a* thru *4b* = *F1a...F4b*

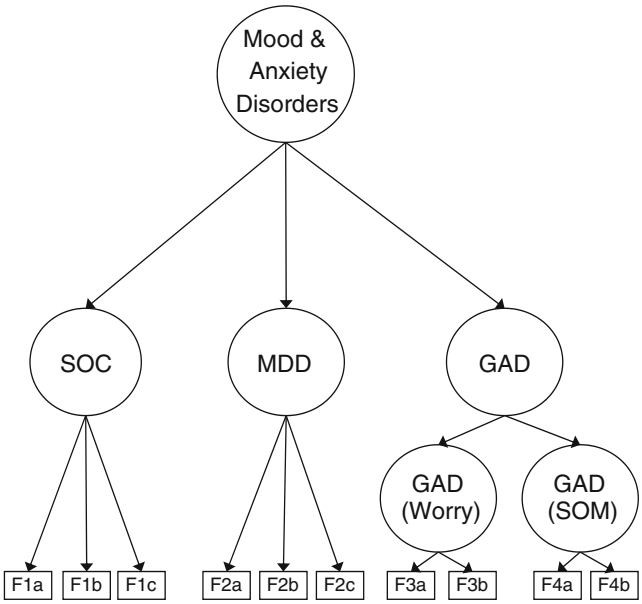

Fig. 3 Three-factor structural model and factor indicators. *SOC* social phobia, *GAD* generalized anxiety disorder, *MDD* depression, *SOM* somatic symptoms. Factor indicators *1a* thru *4b* = *F1a...F4b*

and the RMSEA value was in the marginal range (see Table 3).

Four-factor model Finally, a four-factor model with separate factors for SOC, MDD, GAD-Worry, and GAD-SOM was examined (see Fig. 4). Latent factor intercorrelations were statistically significant (see Table 4) and completely standardized factor loadings of indicators on their latent variables are presented in Table 5 (M=0.79; SD=0.09). This model evidenced improved fit over the three-factor model as demonstrated by a significant decrease in χ^2 ($\chi^2_{diff}[3] = 44.44$, $p<0.01$). In this model, Cfit was not statistically significant and RMSEA, GFI, IFI, and stan-

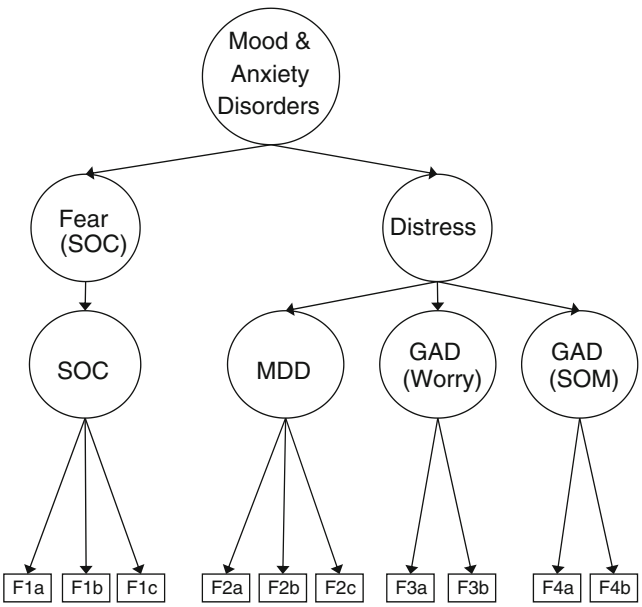

Fig. 2 Two-factor Fear-Distress (Watson 2005) structural model and factor indicators. *SOC* social phobia, *GAD* generalized anxiety disorder, *MDD* depression, *SOM* somatic symptoms. Factor indicators *1a* thru *4b* = *F1a...F4b*

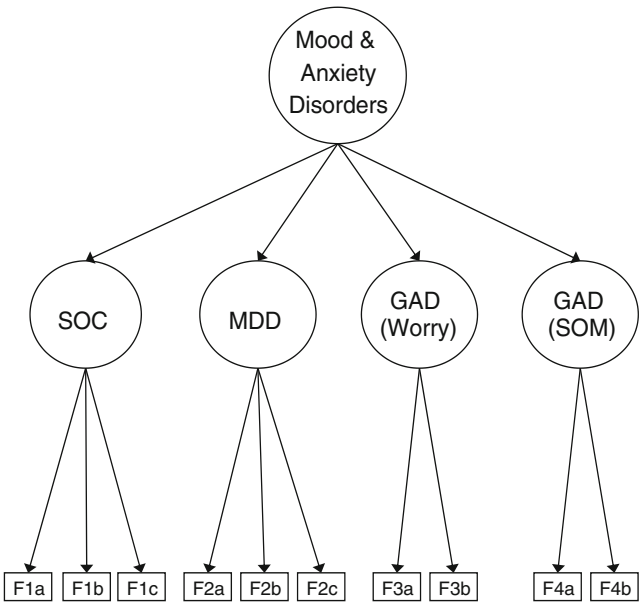

Fig. 4 Four-factor structural model and factor indicators. *SOC* social phobia, *GAD* generalized anxiety disorder, *MDD* depression, *SOM* somatic symptoms. Factor indicators *1a* thru *4b* = *F1a...F4b*

Table 4 Confirmatory Factor Analysis Factor Intercorrelations for the Four-factor Model

Factor	SOC	MDD	GAD-Worry	GAD-SOM
SOC	1.00			
MDD	0.39*	1.00		
GAD-Worry	0.48*	0.49*	1.00	
GAD-SOM	0.59*	0.57*	0.67*	1.00

SOC Social phobia, *MDD* depression, *GAD* generalized anxiety disorder, *SOM* somatic symptoms
*$p<0.05$

dardized RMR all met the recommended criterion for good model fit.

In summary, (1) both two-factor models demonstrated improved fit over the nested one-factor model, (2) the two-factor Fear-Distress model evidenced slightly better fit than the two-factor *DSM-IV-TR* model, (3) the three-factor model demonstrated improved fit over the two-factor Fear-Distress model, and (4) the four-factor model provided the best fit among all models tested in the CFA.

Discussion

The present study is the first to date to test the structural model of *DSM-IV* symptoms of three common internalizing disorders in clinic-referred children and adolescents using a structured diagnostic interview. An exploratory factor analysis (EFA) was first conducted to identify the factorial structure without prior hypotheses. In order to empirically test the structures evidenced from the EFA and to provide clear recommendations for model structure, a confirmatory factor analysis (CFA) was conducted. There were two central findings of this investigation.

Table 5 Confirmatory Factor Analysis Completely Standardized Solution for the Four-factor Model

Factor indicators	SOC	MDD	GAD-Worry	GAD-SOM
1a	0.87			
1b	0.80			
1c	0.76			
2a		0.77		
2b		0.81		
2c		0.77		
3a			0.90	
3b			0.57	
4a				0.83
4b				0.84

Items in each indicator are not listed for brevity but are available on request
SOC Social phobia, *MDD* depression, *GAD* generalized anxiety disorder, *SOM* somatic symptoms

First, contrary to a priori predictions, the best fit for the data was the four-factor model. In this model there were two stable diagnostic categories for Social Phobia (SOC) and Major Depressive Disorder (MDD). On the other hand, Generalized Anxiety Disorder (GAD) split into two factors—a worry factor and a somatic distress factor. Thus, these findings provide further support for SOC and MDD *DSM-IV-TR* syndrome categories but call into question the GAD syndrome category. In particular, though significantly moderately correlated, the GAD worry symptoms clustered together whereas the GAD somatic symptoms clustered on one factor, and this structure was a statistically significant improvement over the three-factor model which "forced" all GAD symptoms together. This is a particularly interesting finding in children given that Criteria C (i.e., the "physical/somatic" symptom criteria) for GAD in the *DSM-IV-TR* has a different criterion for children and adolescents than it does for adults. That is, in order to meet criteria for GAD, adults must experience three or more of a list of six somatic or physical symptoms (i.e., restlessness, fatigue, difficulty concentrating, irritability, muscle tension, and/or sleep disturbance) but children only need to experience one of these symptoms to meet this criteria (APA 2000).

Only two studies to date have specifically examined Criteria C for GAD in children. Both studies evidenced poor parent-child agreement on the presence of somatic symptoms associated with GAD on the ADIS-C-IV (Kendall and Pimentel 2003; Tracey et al. 1997). Tracey and colleagues (1997) reported that cross-informant agreement on GAD diagnosis improved when Criteria C was ignored. Additionally, Kendall and Pimentel (2003) found that parents consistently reported more somatic symptoms than children. Both studies also found that older youth reported more somatic symptoms than younger youth. Thus it appears that at least for younger children, somatic symptoms may not play a large role in the phenomenology of GAD. This might be due to developmental differences such that younger children are still learning to identify and become aware of somatic experiences and may not consistently link such experiences to feelings of anxiety and worry. Taken together, this may in part explain the findings in the present study where GAD worry symptoms and GAD somatic symptoms though moderately correlated, separated into two separate factors. These combined findings on the potentially problematic somatic symptom criteria for GAD in children should be considered in the revised *DSM-V*. Future studies should consider examining the factor structure of GAD symptoms by age as well as by parent report.

Additionally, a related finding was that the GAD somatic factor evidenced almost as strong a relationship between the SOC and the MDD factors as with the GAD worry factor whereas the correlation between the GAD worry

factor and the SOC and MDD factors were fair. In line with these findings, Tracey et al. (1997) reported that the negative predictive power of Criteria C for a diagnosis of GAD was low because children with other anxiety disorders also endorsed somatic symptoms. These collective findings suggest that the presence of somatic symptoms may not be useful when making differential diagnoses between GAD and other anxiety or depressive disorders.

The second finding worth discussing is that although both a three- and four-factor model fit the data better than either of the two factor models, the two-factor Fear-Distress (Watson 2005) model evidenced improved fit over the two-factor *DSM-IV-TR* model (see Figs. 1 and 2). This suggests that GAD in children may have a stronger relationship to depression than it does to social phobia. This finding is consistent with the substantial literature in adults (e.g., Brown et al. 1998; Krueger 1999) as well as the recent study conducted by Lahey and colleagues (2008) which have demonstrated that GAD is structurally more closely linked to the depressive disorders than it is to other anxiety disorders. Taken together, results from the current study provide partial support for Watson's (2005) proposed revision for the mood and anxiety disorder categories in the DSM which places GAD together with the depressive disorders under a hierarchical "Distress Disorders" category. According to Watson (2005), this proposed revision takes into account the shared higher-order general negative affectivity factor between GAD and depression as well as problems with the autonomic or physiological arousal factor in the tripartite model by consolidating the remaining anxiety disorders (Social Phobia, Panic Disorder, Specific Phobia) and renaming them "Fear Disorders." Additional work is needed to fully investigate whether structural relationships between other internalizing disorders proposed in the model fit with children and adolescents such as Post-Traumatic Stress Disorder with the Distress Disorders and Panic Disorder and Specific Phobia with the Fear Disorders.

Findings from this study extend the research base on the structural relationships between three common internalizing disorders by using a structured diagnostic interview where much of the research in the past has focused primarily on self-report questionnaires. Although underlying latent dimensions of psychopathology are continuous, use of dichotomous measures when using a taxonomy that is based on discrete binary diagnoses is an important contribution. In the present study symptom present/symptom absent data were used in the EFA and dimensional indicators representing a sum of binary symptom data were used in the CFA. Future research may consider using multi-method approaches in the same study to examine structural models of symptoms of psychopathology. In addition, future research using diagnostic interviews should consider the overlapping symptoms across disorders as well as the proximity of item presentation. Lahey and colleagues (2004) developed a structured interview that randomizes items across the instrument and has two counter-balanced orders to account for potential order effects. The use of such sophisticated measurement tools promises to enhance the internal validity of research designs and will advance our understanding of child and adolescent psychopathology.

References

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders DSM-IV Fourth Edition-Text Revision*. Washington, DC: Author.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238–246.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York: Guilford.

Brown, T. A., & Barlow, D. H. (2005). Dimensional versus categorical classification of mental disorders in the fifth edition of the diagnostic and statistical manual of mental disorders and beyond: comment on the special section. *Journal of Abnormal Psychology*, *114*, 551–556.

Brown, T. A., Campbell, L. A., Lehman, C. L., Grisham, J. R., & Mancill, R. B. (2001a). Current and lifetime comorbidity of the DSM-IV anxiety and mood disorders in a large clinical sample. *Journal of Abnormal Psychology*, *110*, 585–599.

Brown, T. A., Chorpita, B. F., & Barlow, D. H. (1998). Structural relationships among dimensions of the DSM-IV anxiety and mood disorders and dimensions of negative affect, positive affect, and autonomic arousal. *Journal of Abnormal Psychology*, *107*, 179–192.

Brown, T. A., Di Nardo, P. A., Lehman, C. L., & Campbell, L. A. (2001b). Reliability of DSM-IV anxiety and mood disorders: implications for the classification of emotional disorders. *Journal of Abnormal Psychology*, *110*, 49–58.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen, & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park: Sage.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, *1*, 245–276.

Chorpita, B. F. (2002). The tripartite model and dimensions of anxiety and depression: an examination of structure in a large school sample. *Journal of Abnormal Child Psychology*, *30*, 177–190.

Chorpita, B. F., Albano, A. M., & Barlow, D. H. (1998). The structure of negative emotions in a clinical sample of children and adolescents. *Journal of Abnormal Psychology*, *107*, 74–85.

Chorpita, B. F., Plummer, C. M., & Moffitt, C. E. (2000). Relations of tripartite dimensions of emotion to childhood anxiety and mood disorders. *Journal of Abnormal Child Psychology*, *28*, 299–310.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology*, *100*, 316–336.

Di Nardo, P. A., Brown, T. A., & Barlow, D. H. (1994). *Anxiety disorders interview schedule for DSM-IV: lifetime version: client interview schedule*. San Antonio: Psychological Corporation.

Hendrickson, A. E., & White, P. O. (1964). Promax: a quick method for rotation to oblique simple structure. *British Journal of Statistical Psychology*, *17*, 65–70.

Hoagwood, K., Jensen, P., Petti, T., & Burns, B. (1996). Outcomes of mental health care for children and adolescents: I. a comprehen-

sive conceptual model. *Journal of the American Academy of Child and Adolescent Psychiatry*, *35*, 1055–1063.

Hoyle, R. H., & Duvall, J. L. (2004). Determining the number of factors in exploratory and confirmatory factor analysis. In D. Kaplan (Ed.), *The sage handbook of quantitative methodology for the social sciences* (pp. 301–315). Thousand Oaks: Sage.

Joiner, T. E., Catanzaro, S. J., & Laurent, J. (1996). Tripartite structure of positive and negative affect, depression, and anxiety in child and adolescent psychiatric inpatients. *Journal of Abnormal Psychology*, *105*, 401–409.

Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: structural equation modeling with the SIMPLIS command language*. Chicago: Scientific Software International, Inc.; Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.

Kendall, P. C., & Pimentel, S. S. (2003). On the physiological symptom constellation in youth with Generalized Anxiety Disorder (GAD). *Journal of Anxiety Disorders*, *17*, 211–221.

Kovacs, M. (1981). Rating scales to assess depression in school-aged children. *Acta Paedopsychiatrica*, *46*, 305–315.

Kovacs, M., Gatsonis, C., Paulauskas, S. L., & Richards, C. (1989). Depressive disorders in childhood. *Archives of General Psychiatry*, *46*, 776–782.

Krueger, R. F. (1999). The structure of common mental disorders. *Archives of General Psychiatry*, *56*, 921–926.

Krueger, R. F., & Finger, M. S. (2001). Using item response theory to understand comorbidity among anxiety and unipolar mood disorders. *Psychological Assessment*, *13*, 140–151.

Lahey, B. B., Applegate, B., Waldman, I. D., Loft, J. D., Hankin, B. L., & Rick, J. (2004). The structure of child and adolescent psychopathology: generating new hypotheses. *Journal of Abnormal Psychology*, *113*, 358–385.

Lahey, B. B., Rathouz, P. J., Van Hulle, C., Urbano, R. C., Krueger, R. F., Applegate, B., et al. (2008). Testing structural models of DSM-IV symptoms of common forms of child and adolescent psychopathology. *Journal of Abnormal Child Psychology*, *36*, 187–206.

Lonigan, C. J., Phillips, B. M., & Hooe, E. S. (2003). Relations of positive and negative affectivity to anxiety and depression in children: evidence from a latent variable longitudinal study. *Journal of Consulting and Clinical Psychology*, *71*, 465–481.

Masi, G., Mucci, M., Favilla, L., Romano, R., & Poli, P. (1999). Symptomatology and comorbidity of generalized anxiety disorder in children and adolescents. *Comprehensive Psychiatry*, *40*, 210–215.

Mineka, S., Watson, D. W., & Clark, L. A. (1998). Psychopathology: comorbidity of anxiety and unipolar mood disorders. *Annual Review of Psychology*, *49*, 377–412.

Muthen, L. K., & Muthen, B. O. (2004). *Mplus user's guide* (3rd ed.). Los Angeles: Muthen & Muthen.

Ollendick, T. H., Seligman, L. D., Goza, A. B., Byrd, D. A., & Singh, K. (2003). Anxiety and depression in children and adolescents: a factor-analytic examination of the tripartite model. *Journal of Child and Family Studies*, *12*, 157–170.

Reynolds, C. R., & Richmond, B. O. (1985). *Revised children's manifest anxiety scale*. Los Angeles: Western Psychological Services.

Silverman, W. K., & Albano, A. M. (1996). *Anxiety disorders interview schedule for children for DSM-IV, child and parent versions*. San Antonio: Psychological Corporation.

Silverman, W. K., Saavedra, L. M., & Pina, A. A. (2001). Test-retest reliability of anxiety symptoms and diagnoses with the anxiety disorders interview schedule for DSM-IV: child and parent versions. *Journal of the American Academy of Child and Adolescent Psychiatry*, *40*, 937–944.

Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research*, *25*, 173–180.

Tracey, S. A., Chorpita, B. F., Douban, J., & Barlow, D. H. (1997). Empirical evaluation of DSM-IV generalized anxiety disorder criteria in children and adolescents. *Journal of Clinical Child Psychology*, *26*, 404–414.

van Lang, N. D. J., Ferdinand, R. F., Ormel, J., & Verhulst, F. C. (2006). Latent class analysis of anxiety and depressive symptoms of the youth self-report in a general population sample of young adolescents. *Behaviour Research and Therapy*, *44*, 849–860.

Watson, D. (2005). Rethinking the mood and anxiety disorders: a quantitative hierarchical model for DSM–V. *Journal of Abnormal Psychology*, *114*, 522–536.

Watson, D., & Clark, L. A. (1991). *The PANAS-X: Preliminary manual for the positive and negative affect schedule—expanded form*. Dallas: Author.

Widiger, T. A., & Samuel, D. B. (2005). Diagnostic categories or dimensions? A question for the diagnostic and statistical manual of mental disorders-fifth edition. *Journal of Abnormal Psychology*, *114*, 494–504.