Running head: Factor Structure of Anxiety and Depressive Disorders

The Factor Structure of Anxiety and Depressive Disorders in a Sample of Clinic-Referred
Adolescents

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Abstract

The current study used confirmatory factor analysis (CFA) to examine the factor structure of anxiety and depressive disorders in a sample of clinic-referred adolescents, aged between 12 and 18 years, for diagnoses based on parent ($N = 655$; male = 441) and adolescent ($N = 626$; male = 417) interviews. Three models were examined: a 1-factor model, with all anxiety and depressive disorders in a single factor; a DSM-based 2-factor model, with anxiety disorders in one factor, and depressive disorders in another factor; and an alternate 2-factor model, with fear related anxiety disorders in one factor, and other anxiety and depressive disorders in another factor. The findings indicated support for all three models. Also, ADHD and ODD/CD were associated with only the shared variances between the latent factors in the 2-factor models, and not their unique variance. The implications of the findings for taxonomy, comorbidity, and clinical practice are discussed.

Key Words: Depressive and Anxiety Disorders, Children and Adolescents, Confirmatory Factor Analysis, Taxonomy, Comorbidity.

The Factor Structure of Anxiety and Depressive Disorders in a Sample of Clinic-Referred Adolescents

Disorders of anxiety and depression (generally referred to as internalizing disorders) are common in children and adolescents, with prevalence rates of around 10 to 25% for anxiety disorders (Kashani & Orvaschel, 1990), and 5 to 15% for depressive disorders (Kovacs & Devlin, 1998). The common internalizing disorders are separation anxiety disorder (SAD), social phobia (SOP), specific phobia (SPP), panic disorder (PD), agoraphobia (AG), generalized anxiety disorder (GAD), obsessive compulsive disorder (OCD), post traumatic stress disorder (PTSD), dysthymia (DYTH), and major depressive disorder (MDD). Based primarily on shared phenomenological features, the 4th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association [APA] 1994) and its text revision edition (DSM-IV TR [APA], 2000) have anxiety and depressive disorders organized into two separate diagnostic groups, thereby implying a 2-factor model. Despite this, research with adults has generally shown little support for this model (Slade & Watson, 2006; Vollebergh et al., 2001). Instead, there has been support for a 1-factor model, with anxiety and depressive disorders, loading on a single (internalizing disorders) latent factor; and a 2-factor model, with fear related anxiety disorders (fear disorders) in one latent factor, and the other anxiety disorders and depressive disorders (distress disorders) in another latent factor. These models for internalizing disorders have not been comprehensively evaluated in children and adolescents.

DSM-IV has just been replaced by DSM-5 (APA, 2013). In it SAD, SOP, SPP, PD, AG, and GAD are all considered as anxiety disorders. In DSM-5, OCD and PTSD are not grouped as anxiety disorders. DSM-5 has a new group of disorders called obsessive-compulsive and related disorders that includes OCD, and other disorders (body dysmorphic disorder, trichotillomania, and two new disorders called hoarding disorder and excoriation

(skin-picking) disorder. PTSD is grouped with other trauma- and stressor-related disorders (i.e., acute stress disorder, adjustment disorders, and reactive attachment disorder). In relation to the depressive disorders, DSM-5 has MDD and DYTH combined together under the category of persistent depressive disorder. Thus DSM-5 suggests four groups for the DSM-IV anxiety and depressive disorders. Although this paper will examine existing studies in terms of the organization of these disorders in DSM-IV, the review of findings will be related to DSM-5, where appropriate.

To date, many studies involving adults (e.g., Clark & Watson, 2006; Krueger, 1999; Mineka, Watson, & Clark, 1998; for a meta-analysis, see Krueger & Markon, 2006), including a study based on the cumulative prevalence of disorders assessed over four occasions from adolescence through age 30 (Seeley, Kosty, Farmer, & Lewinsohn, 2011), and children and adolescents (e.g., Higa-McMillan, Smith, Chorpita, & Hayashi, 2008; Lahey et al., 2008; Lewinsohn, Zinbarg, Seeley, Lewinsohn, & Sack, 1997; for a meta-analysis, see Angold, Costello, & Erkanli, 1999) have shown high comorbidity between anxiety and depressive disorders. Clark and Watson (1991) have proposed the tripartite model to explain the comorbidity between depressive and anxiety disorders. This model proposes three major dimensions of affective experience: negative affectivity (reflecting subjective distress and dissatisfaction), positive affectivity (reflecting positive mood states), and hyperarousability. While both depressive and anxiety disorders have been linked to negative affectivity, depressive disorders have been linked specifically to positive affectivity, and anxiety disorders have been linked specifically to hyperarousability. Different types of anxiety disorders are hypothesized to have different levels of hyperarousability, thereby accounting for their differences.

Many studies that have examined the tripartite model have however reported findings that are inconsistent with predictions from this model. For instance, not all types of anxiety

disorders have shown associations with hyperarousability, and some types of anxiety disorders have shown associations with positive affectivity (Brown, Chorpita, & Barlow, 1998; Watson, Clark, & Carey, 1988). To account for such inconsistent findings, Mineka and colleagues (1998) have proposed a hierarchical model that has a single higher-order general negative affectivity/distress factor that is common to both anxiety and depressive disorders (similar to the negative affectivity factor in the tripartite model) and lower-order specific factors for the different depressive and anxiety disorders. This model also proposes that the different anxiety and depressive disorders have different amounts of the general and specific factors, thereby raising the possibility that these disorders may cohere into separate subgroups of more closely related disorders.

For a group of clinic-referred adults, Krueger, Caspi, Moffitt, and Silva (1998) examined the factor structure of a range of common clinical disorders, including the internalizing disorders of MDD, DYTH, GAD, AG, SOP, SIP, and OCD. Results indicated support for a single internalizing disorders factor for these disorders that captured a general negative affectivity and distress dimension. Other studies of clinic-referred adults, involving various sets of the depressive and anxiety disorders, have replicated this finding (Krueger & Finger, 2001; McGlinchey & Zimmerman, 2007). Studies also suggest that the single internalizing latent factor comprises two lower-order factors (Beesdo-Baum et al., 2009; Krueger, 1999; Slade & Watson, 2006; Vollebergh et al., 2001; Watson, 2005; see Krueger & Markon, 2006 for a meta-analysis), labelled anxious-misery (made up of MDD, DYTH, and GAD) and fear (made up of SOC, SIP, AG, and PD). This conceptualization is referred to herein as the Krueger model. Watson (2005) has extended the Krueger model by including in the general higher-order internalizing factor (renamed emotion disorders), a third lower-order factor for the bipolar disorders (i.e., Bipolar I and II, and cyclothymia). Also, PTSD was proposed to be part of the anxious-misery factor (renamed distress disorders). In light of

contradictory findings, the placement of OCD was not specified by Watson. The extended Krueger model is referred to herein as the Watson model. It is worthy of note that neither the Krueger model nor Watson model are consistent with predictions from DSM-IV TR or DSM-5.

Recently, Seeley, Kosty, Farmer, and Lewinsohn (2011) compared three different factor models of the internalizing disorders for a group of adults, with and without a history of psychiatric history. The models compared were the 1-factor model (all disorders loading on a single internalizing disorder factor), a 2-factor DSM-based model (the anxiety disorders loading on an anxiety disorders factor and the two depressive disorders loading on a depressive disorders factor), and an extension of the 2-factor Watson model. The disorders included were SAD, SOP, SPP, PD, OCD, PTSD, GAD, DYTH, and MDD. Although it did not include AG, it included OCD and also SAD that are not featured in models proposed by Krueger or Watson. In the extension of the 2-factor Watson model, SAD, SOP, SPP, PD, and OCD loaded on a fear disorders factor, and DYTH, MDD, GAD, and PTSD loaded on a distress disorders factor. As previously stated, in the Watson model, the fear factor comprises SOC, SIP (comparable to SPP), AG, and PD, and the distress factor comprises PTSD, MDD, DYTH, and GAD. This extension of the Watson model is herein referred to as the Seeley et al. model. The Seeley et al. model is not consistent with how these disorders are grouped in DSM-5.

Findings in the Seeley et al. (2011) study indicated good support for all three models, and these models showed comparable fit. However, the correlations in this study for the latent factors of the Seeley et al. model (fear disorders factor and distress disorders factor), and the latent factors of the DSM 2-factor model (anxiety disorders factor and depressive disorders factor) were .84 and .81, respectively. As these findings suggest low discrimination between the latent factors in these models, it can be argued that the 1-factor model is adequate to

represent the anxiety and depressive disorders. Similar high correlations have been reported by others (e.g., a correlation of .84 between the anxious–misery and fear factors was reported by Beesdo-Baum et al., 2009).

While many studies have examined the factor structure of the symptoms of anxiety and depression for children and adolescents, only a few studies have examined the factor structure of the internalizing disorders in children and adolescents (Higa-McMillan et al., 2008; Lahey et al., 2004; Lahey et al., 2008; Trosper, Whitton, Brown, & Pincus, 2012). In the studies by Lahey and colleagues, the anxiety and depression symptoms covered were those associated with SAD, SOP, SPP, AG, GAD, OCD, and MDD. Symptoms covering PTSD and PD were not included, and MDD and DYTH were not distinguished from each other. In their first study (Lahey et al., 2004), involving children and adolescents, between 9 and 17 years of age from the general community, exploratory factor analysis (EFA) was used to ascertain the factor structure of these symptoms as well as symptoms related to inattention and disruptive behavior. For caretaker reports, one factor comprised MDD and GAD symptoms (i.e., “anxious–misery” disorders as described by Krueger, 1999). The other factor comprised the fear-related symptoms of SPP, AG, and SAD, and also symptoms of OCD. SOP symptoms was a third factor for caretaker reports, but was substantially correlated with the MDD/GAD or “anxious–misery” factor. The analyses of youth reports supported two factors: one factor with symptoms of MDD, GAD, and also SOP, and a fear factor, comparable to that found for caretaker reports. There was high correlation between these factors ($r = .69$), thereby raising questions about their discriminant validity. In their second study (Lahey et al., 2008), involving a different general community sample, aged 6- through 17-years, the findings showed most support for a model with separate factors for the symptoms for SAD, SOP, SPP, AG, GAD, OCD, and MDD. However, a substantial amount of variance in these factors could be explained by a single internalizing latent factor. The

studies by Higa-McMillan et al. (2008) and Trosper et al. (2012) included only the symptoms of the internalizing disorders. Higa-McMillan et al. examined clinic-referred 6 to 18 year olds, and included symptoms of depression, GAD and SOP. The study by Trosper et al. examined 6 to 18 year olds, referred for emotional disorders , and included the symptoms of MDD, GAD, SOP, OCD, PD, and SP. They found support for a higher-order 1-factor model for both parent and child reports. In contrast, Higa-McMillan et al. (2008) found support for a 4-factor model, with separate factors for depression, SOP, GAD worrying symptoms, and GAD somatic distress symptoms.

Overall, with the exception that SOP may be part of the anxious–misery factor rather than the fear factor, there are findings, albeit limited, for children and adolescents that are in accord with the Seeley et al. model. However, the existing findings in this area are limited. First, the Lahey et al. (2004) study did not include PTSD (a disorder conceptualized as a part of the anxious–misery factor of the Krueger model, or the renamed distress disorders factor of the Watson model) or PD symptoms. Second, the Lahey et al. study and also the studies by Higa-McMillan et al. (2008) and Trosper et al. (2012) that examined children and adolescents included only the symptoms of the internalizing disorders, and not their diagnoses. Researchers have noted that the associations among symptoms might show different patterns of associations than those obtained on the basis of diagnostic categories (Seeley et al., 2011). Third, as the Lahey et al. study examined community samples, we have no information about the structural organization of the anxiety and depressive disorders (as distinct from symptoms for clinical samples of children and adolescents). Such data would be more useful for clinical purposes (diagnosis and treatment). Fourth, currently there is no data on the shared and unique contributions of the latent factors in the Watson model to the prediction of other child and adolescent psychological disorders. Such data would indicate how the shared and unique variances of the internalizing disorders are related to other disorders.

Given the existing limitations and omissions, the major aim of the current study was to use CFA to examine support for three different measurement models proposed for the internalizing disorders in a large group of clinic-referred adolescents. The internalizing disorders were SAD, SOP, SPP, PD, AG, GAD, OCD, PTSD, DYTH, and MDD; and the three measurement models evaluated were the 1-factor model, 2-factor DSM-based model, and the 2-factor Seeley et al. model. These models are shown in Figure 1. In the Seeley et al. model, SAD, SOP, SPP, PD, AG, and OCD loaded on a fear disorders factor, and DYTH, MDD, GAD, and PTSD loaded on a distress disorders factor. In the 1-factor model, all ten internalizing disorders loaded on a single internalizing disorders factor. In the 2-factor DSM-based model, in line with DSM-IV, the eight anxiety disorders (SAD, SOP, SPP, PD, AG, GAD, OCD, and PTSD) loaded on one factor (anxiety disorders factor) and the two depressive disorders (DYTH and MDD) loaded on another factor (depressive disorders). As previous measurement model studies of the internalizing disorders in children and adolescents have not included PTSD, PD, and AG, their inclusion in the current study means that the current study provides a more extended coverage of the anxiety and depressive disorders than previous studies in this area. It is worth noting that the primary differences between MDD and DYTH are the time duration and severity of symptoms. Although these differences cannot be adequately captured in CFA models, they were analyzed in the current study as separate disorders so as to correspond with DSM-IV. They have also been treated as separate disorders in past CFA studies. However it is worth noting that this separation is not embraced in the new DSM-5. Since there is evidence of different measurement models for the internalizing disorders for parent and adolescent reports (Lahey et al., 2004), and also low agreement between parent and adolescent self-reports of anxiety and depression, with higher levels being reported by adolescents (Cantwell, Lewinsohn, Rohde, & Seeley, 1997), it is possible that findings could differ across diagnoses based on parent and adolescent

interviews. Given this, we examined all these models for clinical diagnoses based on parent interviews, and also clinical diagnoses based on adolescent interviews. Based on past studies we expected support for all three models, with most support for the Seeley et al. model. However we also expected to find significant correlations between the latent factors in both the 2-factor models at levels that would question their discriminant validity. For all models that showed good fit, we examined the shared and unique contributions of their latent factors to the prediction of Attention Deficit/Hyperactivity Disorder (ADHD) and Oppositional Defiant Disorder/Conduct Disorder (ODD/CD) for the parent-interview data set, and to the prediction of ADHD (ODD and CD not available in this data set) for the adolescent interview data set. These relations were examined because previous studies have shown that the factors in models comparable to the 1- and 2-factors internalizing disorders models tested in the current study have high correlations with these externalizing disorders (Lahey et al., 2004; Lahey et al., 2008). Thus the examination of these associations would provide not only an extended understanding of how the measurement models for the internalizing disorders are related to the other major group of psychopathology (i.e., externalizing), but it will also indicate the shared core component or components across the internalizing and externalizing disorders.

Method

Participants

The parent-interview data and the adolescent-interview data for all participants were collected archivally from the Academic Child Psychiatry Unit (ACPU) of the Royal Children's Hospital, Melbourne, Australia. The ACPU is an out-patient psychiatric unit that provides services for children and adolescents with behavioral, emotional, and learning problems. Referrals are generally from other medical services, schools, and social and welfare organizations. For the current study we used the records of adolescents, aged between

12 and 18 years, referred between 2004 and 2010, who had been interviewed for clinical diagnoses. In all, for parent interviews, there were 655 adolescents, comprising 441 males (67.3%) and 212 females (32.7%). The overall mean age of participants was 14.00 ($SD = 1.64$). For adolescent interviews, there were 626 adolescents, comprising 417 males (66.6%) and 209 females (33.4%). The overall mean age of participants was 13.90 ($SD = 1.52$). All participants with adolescent-interview data were part of the parent-interview data.

Although details are not provided, most fathers of participants (for both parent-interview data and the adolescent-interview data) were employed, and most mothers were mainly employed or involved in home duties. More than two-third of participants had mothers and fathers who had attended at least secondary school, and were from families with income less than \$50,000 per year. These figures correspond close to the Australian population. In terms of parental relationship, approximately 49.1% were living together and 43.0% were separated or divorced.

Table 1 shows the point prevalence rates for different disorders for the participants with parent interviews and with adolescent interviews. As shown, for both data sets, ADHD and ODD/CD were more prevalent than the other disorders. Around three-quarter of participants had at least one depressive or anxiety disorder, and about 4 in 5 of these participants had either ADHD or ODD/CD or both. GAD and DYTH were more prevalent than the other depressive and anxiety disorders. For those with an anxiety disorder, around 50% had a depressive disorder, and for those with a depressive disorder, 90% had an anxiety disorder. SOP, SPP, and MDD were also relatively high. AG and PD were relatively rare. There was about twice more DYTH than MDD diagnoses. For parent interviews, 75.7% of individuals with MDD were diagnosed for DYTH, whereas 39.6% of individuals with DYTH were diagnosed for MDD. For adolescent interviews, 72% of individuals with DMM were diagnosed for DYTH, whereas 47.4% of individuals with DTYH were diagnosed for MDD.

The agreements (kappa values) for the same diagnoses derived from parent and adolescent interviews ranged from .20 (for PD) to .39 (for MDD). These values are generally considered low (Fleiss, 1981), thereby justifying separate analyses for parent and adolescent interviews, as done in the current study.

Place Table 1 about here

Measures

Anxiety Disorders Interview Schedule for Children (ADISC-IV; Silverman & Albano, 1996).

The ADISC-IV is a semi-structured interview, based on the DSM-IV diagnostic system. Although ADISC-IV has been designed primarily to facilitate the diagnosis of the major anxiety and depressive disorders, it can also be used for diagnosing other major childhood disorders and a range of other behavior problems, such as school refusal and interpersonal relationship problems. Clinical diagnosis can be based either on parent (ADISC-IV-P) or child (ADISC-IV-C) interview or on both interviews together. There is considerable overlap across the parent and child versions. The ADISC-IV guideline for diagnosis is that the child be given a diagnosis of all disorders meeting the diagnostic criteria. The scores of ADISC-IV have sound psychometric properties (Silverman, Saavedra, & Pina, 2001). Test-retest reliability for the ADISC-IV scores over a 7 to 14-day interval has shown good to excellent reliability. Kappa values for interviews with parents ranged from 0.65 to 1.00 ([Silverman et al., 2001](#)). Clinical diagnosis was made using the parent version of the ADISC-IV. Kappa values for interview with children between 7 and 16 years ranged from 0.61–0.80. For parent, it ranged from 0.65 to 1.00, and for combined informants, it ranged from 0.62–1.00 ([Silverman, et al., 2001](#)).

Because the parent version includes additional disorders (e.g., CD and ODD) and more detailed evaluation of the history and consequences of specific problems, the clinical

diagnoses reported earlier for both data sets are from mother interviews. The clinical diagnoses from the mother interviews and child interviews were used separately for evaluating support for the Seeley et al. 2-factor model, the DSM 2-factor model, and also the 1-factor model. All diagnoses in this study did not take into account the hierarchical exclusionary rules in DSM-IV. For the parent-interview data, ADHD and ODD/CD that were used to examine the shared and unique contributions of the latent factors in the models that showed good fit were derived from the ADISC-IV-P. For the adolescent-interview data, ADHD was derived from the ADISC-IV-C.

Procedure

Initially all parents and children give written consent for any data provided by or about them to be used for future research. The study was approved by the RCH ethics committee as part of our group's comprehensive examination of psychopathology in children and adolescents. All adolescents and their parents participated in separate interviews and testing sessions with breaks as needed over two consecutive days. Information was also obtained from teachers using various checklists and questionnaires. In all cases, parental consent forms were completed prior to the assessment. The data collected covered a comprehensive demographic, medical (primarily neurological and endocrinological), educational, psychological, familial, and social assessment of the child and their family. All psychological data were collected by research assistants, who were advanced doctoral students in clinical psychology or in child psychiatry, and under the supervision of registered clinical psychologists/child and adolescent psychiatrists. The research assistants were provided with extensive supervised training and practice by the psychologists/child and adolescent psychiatrists prior to them collecting data. This training for the ADISC-IV included observations of it being administered by supervisors. The research assistants commenced administering the ADISC-IV only after they attained competence in its

administration, as assessed by their supervisors. There was adequate inter-rater reliability during training for the diagnoses made between the research assistants and their supervisors, and between research assistants (kappa values generally more than .88). Standard procedures were used for the administration of all measures. Where necessary, researchers read the items to participants who then completed their responses. Approximately 95% of the parent ADISC-IV interviews involved mothers only, and the rest involved fathers only or both fathers and mothers together. Clinical diagnosis was determined by two consultant child and adolescent psychiatrists who independently reviewed these data. The inter-rater reliability for diagnoses (for 10% of the parent and 10% of the child interviews) of the two psychiatrists was high for both the parent and child versions (kappa values of .90).

Statistical Analysis

All CFA was conducted with *Mplus* Version 6.2 (Muthen & Muthen, 2010), using the mean and variance-adjusted weighted least squares or WLSMV. This is a robust estimator, recommended for CFAs with ordered-categorical scores. Model fit was evaluated using the WLSMV χ^2 , the root mean squared error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis Index (TLI).

The guidelines suggested by Hu and Bentler (1998) for inferring good model fit are $p > .05$ for the χ^2 , that CFI and TLI values close to .95 or more and RMSEA values close to 0.06 or less. Model fit and selection was also guided by the Akaike information criterion (AIC) and the sample-size-adjusted Bayesian information criterion (ABIC). As these information criteria are not available for WLSMV estimation, robust maximum-likelihood estimation was used to obtain these values. Lower ABIC and AIC values indicate greater parsimony and fit. For the AIC, difference of 10 or more points between two models are inferred as indication of substantial differences between them, and the model with the lower AIC being taken as the better fit model (Burnham & Anderson, 2004).

The procedure recommended by Fornell and Larcker (1981) was used to assess discriminant validity between factors. This procedure involves comparing the averages of variances (consistency coefficients) of all the items comprising the respective factors with the shared variance (square of the correlation) between the same two factors. Discriminant validity between the factors is supported when the average consistency coefficient for both factors are greater than the shared variance between them.

For the models with two latent factors, we used the same procedure used by Seeley et al. (2011) to examine the extent to which observed associations for the latent factors with other disorders (ADHD and ODD/CD) could be explained by the unique and/or shared variances in the latent factors. This involved a series of three separate regression analyses for each of the other disorders. In the first analysis (adjusted approach), the other disorder was regressed on the factor scores of the two latent factors. As shared variances among latent factors will be removed in this analysis, the regression coefficients in this analysis are the unique variance of the each latent factor to the prediction of the other disorder. In the second regression analysis, the other disorder is predicted by the scores for one of the latent factors predicted (unadjusted approach), and in the third analysis, the other disorder is predicted by the scores for the other latent factor (unadjusted approach). For analyses 2 and 3, the regression coefficient is explained by both the unique variance of the latent factor in the model and the shared variance of this factor with the other factor not in the model. Taken together, these three analyses will indicate the unique and shared contributions of the latent factors in the prediction of the behavior problem.

Results

Parent-Interviews: Fit for the Internalizing Disorders Factor Models

Table 2 shows the tetrachoric correlations between all the internalizing disorders, and Table 3 shows the model fit indices for the models tested in this study. The CFI, TLI, and

RMSEA values suggest good fit for the Seeley et al. 2-factor model and the DSM 2-factor model. For the 1-factor model, the RMSEA values showed good fit, As CFI values close to .95 are considered good fit, the CFI value for this model (.944) can also be considered as indicating good fit. The TLI value showed adequate fit. These findings can be interpreted as indicating that there was good support for the Seeley et al. 2-factor model, the DSM 2-factor model, and to a lesser degree the 1-factor model. The ABIC and AIC values for the Seeley et al. 2-factor model were lower than the DSM 2-factor model. Also, the Δ AIC between the DSM 2-factor model and the Seeley et al. 2-factor model was 12.58. This value is above that recommended (10.00) for inferred substantial differences between models compared. Thus although there was good support for both the Seeley et al. 2-factor model and the DSM 2-factor model, the ABIC, AIC, and Δ AIC findings indicate that the Seeley et al. 2-factor model had better parsimony and fit than the DSM 2-factor model. For the 1-factor model, there was an extremely high modification index (MI) between the error variances for DYTH and MDD (MI = 21.58). All fit values of a revised model with these error variances correlated were identical to that for the DSM 2-factor model, thereby adding further support for the view that the DSM 2-factor model is a better model than the original 1-factor model.

Place Table 2, followed by Table 3 about here

Parent-Interviews: Convergent and Discriminant Validity of the Factor Models

The factor loadings for the disorders in the Seeley et al. 2-factor, the DSM 2-factor, and the 1-factor models are shown in Table 4. As shown, all loadings were salient ($> .40$), thereby supporting their convergent validity. Table 4 also shows the averages of the variances of all the disorders comprising the respective factors. They were .42 and .40, respectively for the fear and distress factors of the Seeley et al. model. Since the correlation between the fear and distress factors was .73 ($p < .001$), the amount of shared variance between these factors was .53. The averages of the variances of the anxiety and depression factors in the DSM-IV

model were .38 and .52, respectively. As the correlation between the anxiety and depression factors was .67 ($p < .001$), the amount of shared variance between these factors was .45. Thus, the averages of variances of all the disorders comprising the respective factors were less than the shared variances between them, thereby indicating no support for the discrimination of the latent factors in both the 2-factor models.

Place Table 4 about here

Parent-Interviews: Associations of Measurement Model Latent Factor Scores with ADHD and ODD/CD

Given good fit for the Seeley et al., 2-factor DSM, and 1-factor models, the shared and unique contributions of the latent factors in all three models to the prediction of ADHD and ODD/CD were examined. The findings are presented in Table 5. As shown, the overall internalizing factor (1-factor model) was significantly associated with ADHD ($r = .15, p < .001$) and ODD/CD ($r = .10, p < .05$). In relation to both the 2-factor models, the regression coefficients for all latent factors involving the predictions of ADHD and ODD/CD were significant for the adjusted analyses. They were all not significant for the unadjusted analyses. These findings suggest that ADHD and ODD/CD are associated with only the shared variances between fear and distress latent factors in the Seeley et al. model, and between anxiety and depression latent factors in the 2-factor DSM model.

Place Table 5 about here

Adolescent-Interviews: Fit for the Internalizing Disorders Factor Models

Table 2 includes the tetrachoric correlations between all the internalizing disorders, and Table 3 shows the model fit indices for the models tested in this study. The CFI, TLI, and RMSEA values suggest good fit for the Seeley et al. 2-factor model, the DSM 2-factor model, and the 1-factor model. The ABIC and AIC values (Table 3) for the Seeley et al. 2-factor

model were lower than the DSM 2-factor and 1-factor models. Also, the ΔAIC between the DSM 2-factor and 1-factor models with the Seeley et al. 2-factor model was 12.58 and 32.05, respectively. These values are above that recommended (10.00) for inferred substantial differences between models compared. The ABIC and AIC values for the DSM 2-factor model were lower than the 1-factor model. Also, the ΔAIC between the DSM 2-factor and 1-factor models was 18.18. Again, this value is above that recommended (10.00) for inferred substantial differences between models compared. Thus although there was good support for all three factor models, the Seeley et al. 2-factor model had better parsimony and fit than the DSM 2-factor and 1-factor models, and the DSM 2-factor model had better parsimony and fit than the 1-factor model.

Adolescent-Interviews: Convergent and Discriminant Validity of the Factor Models

The factor loadings for the disorders in the Seeley et al. 2-factor, the DSM 2-factor, and the 1-factor models are shown in Table 6. As shown, all loadings were salient ($> .40$), thereby supporting their convergent validity. Table 8 also shows the averages of the variances of all the disorders comprising the respective factors. They were .43 and .52, respectively for the fear and distress factors of the Seeley et al. model. Since the correlation between the fear and distress factors was .83 ($p < .001$), the amount of shared variance between these factors was .69. The averages of the variances of the anxiety and depression factors in the DSM-IV model were .42 and .64, respectively. As the correlation between the anxiety and depression factors was .83 ($p < .001$), the amount of shared variance between these factors was also .69. Thus, the averages of variances of all the disorders comprising the respective factors were less than the shared variances between them, thereby indicating no support for the discrimination of the latent factors in both the 2-factor models.

Place Table 6 about here

Adolescent-Interviews: Associations of Measurement Model Latent Factor Scores With ADHD

Given support found for the fit of the Seeley et al. model, the DSM 2-factor model, and 1-factor model, the shared and unique contributions of the latent factors in all three models to the prediction of ADHD were examined. The findings are presented in Table 5. As shown, the overall internalizing factor (1-factor model) was significantly associated with ADHD ($r = .23, p < .001$). In relation to both the 2-factor models, the regression coefficients for all latent factors involving the predictions of ADHD were significant for the adjusted analyses. They were all not significant for the unadjusted analyses. These findings suggest that ADHD is associated with only the shared variances between fear and distress latent factors in the Seeley et al. model, and between anxiety and depression latent factors in the 2-factor DSM model.

Discussion

The findings in the current study for both parent and adolescent interviews showed good support for all three internalizing disorders measurement models: 1-factor, Seeley et al. 2-factor, and DSM 2-factor. These findings are consistent with existing data for children and adolescents (Leahy et al., 2004; Trosper et al., 2012). The findings for both parent and adolescent interviews showed that the Seeley et al. 2-factor model had better fit than the DSM 2-factor and 1-factor models, and the DSM 2-factor model had better fit than the 1-factor model. Despite showing better fit, the correlations between the factors in both the 2-factor models were substantial, and they lacked discriminant validity. Similar findings have been reported by others (Beesdo-Baum et al., 2009; Seeley et al., 2011). Collectively, these findings suggest that anxiety and depressive disorder are strongly related, and that they are likely to share common etiological determinants. Additionally, these findings provide strong support for a single factor for the anxiety and depressive disorders. As mentioned previously

this factor has been called internalizing and captures a general negative affectivity and distress dimension (Clark & Watson; 1991; Mineka et al., 1998).

The study also examined the extent to which the shared and unique variances of the latent factors in the 2-factor models predicted ADHD and ODD (for parent interview data), and ADHD (for adolescent interview data). The findings showed that ADHD and ODD were associated with only the shared variances between the relevant latent factors. Since negative affectivity has been implicated as constituting this shared variance, this means that ADHD and ODD/CD will also be associated with negative affectivity. Indeed there are empirical data for such an association (e.g., Gomez & Corr, 2010; Nigg et al., 2002). This also raises the possibility that negative affectivity is likely to be a common vulnerability factor for internalizing and externalizing psychopathology in general.

The findings in this study have implications for taxonomy in relation to depressive and anxiety disorders in adolescents. Support for the 1-factor model and the Seeley et al. model is not consistent with the DSM-IV approach that separates anxiety and depressive disorders into different diagnostic groups. It is also not consistent with how the relevant disorders are organized in DSM-5, which suggests four different groups for the internalizing disorders. One group comprises SAD, SOP, SPP, PD, AG, and GAD. OCD, PTSD, and MDD combined with DTYH are each in three different groups.

The support for the 1-factor model, the Seeley et al. model, and the DSM 2-factor model implies that current taxonomy that considers the different types of these disorders as discrete diagnostic categories may need reconsideration to recognize the high degree of comorbidity among them. The support for a 1-factor model in this study suggests that at least for adolescents, the depressive and anxiety disorders, including OCD and PTSD, could be grouped under an overall group called emotional disorders (Watson, 2005). The list of symptoms in this group could be that currently used for mixed anxiety depression (MAD),

which was a provisional diagnosis in DSM-IV. They include dysphoric mood, trouble concentrating or with memory, disturbed sleep, tiredness or lack of energy, feeling irritable, worrying, crying easily, enhanced sensory state, expecting the worst, feeling hopeless or pessimistic, or having low self esteem/feeling worthless. In order to recognize the specific symptoms of the other internalizing disorders, appropriate descriptors could be added to the diagnosis of emotional disorder. For example, when an individual has panic and social phobia, the diagnosis could be emotional disorder with panic and social phobia. Despite our proposal, we wish to stress that more research and replication of the findings in this study is needed before such changes are adopted.

The findings also have implications for understanding the comorbidity of the internalizing disorders and for clinical practice. The support found in the current study for the 1-factor model, with salient loadings of all the indicators on the internalizing factors can be inferred as indications of the strength of the associations of the disorders with the underlying latent factor, and by extension the comorbidity of the disorders. Consistent with past studies (for a meta-analysis studies, see Angold et al., 1999; Krueger & Markon, 2006), these findings suggest high comorbidity among the internalizing disorders. In relation to clinical practice, the close associations between anxiety and depressive disorders found in this study highlights the need for a comprehensive evaluation of all the internalizing disorders for a better understanding of an adolescent's psychopathology. The findings would also imply that treatment may have to focus on general distress with special focus on the range of associated abnormal anxiety and fear responses rather than the individual disorders. In this respect, recently developed transdiagnostic treatment approaches for anxiety and depression disorders in children and adolescents would be valuable (Ehrenreich-May & Bilek, 2012). In brief, transdiagnostic approaches focus on common factors that produce symptoms in related

classes of disorders, such as anxiety and depression, thereby addressing multiple concerns or disorders within an individual (McEvoy, Nathan, & Norton, 2009).

There are several strengths to the current study. First, unlike previous studies that omitted one or more of the anxiety disorders, this study included all the anxiety disorders, and thus provides more comprehensive findings. Second, this study examined the factor models, based on diagnostic categories, for a clinic-referred sample of adolescents (not examined previously, as they have involved a range of anxiety and depression symptoms), and therefore these findings can be seen as being more useful from a clinical viewpoint. Third, to increase the creditability of our findings we examined our models for clinical diagnosis based on parent interviews and also adolescent interviews. The comparability of the findings across these sources of information attest to the robustness of the findings reported in this study.

There are also limitations in this study that need to be considered when interpreting the findings reported. First, about two-thirds of the participants in the current study had externalizing disorders. This high rate may be due to biases in ADHD referrals to this clinic. As comorbidity with externalizing disorders was not controlled, it is uncertain if this exerted any influence on the findings. Second, all the participants in this study were from the same clinic. Thus it is possible that this may constitute an additional bias for the sample examined, limiting the findings and conclusions made in this study. Third, unlike previous studies (e.g., Lewinshon, Rohde, Seeley, & Hops, 1991), which have shown more MDD than DYTH diagnosis among adolescents, in the current study there was about twice more DYTH than MDD diagnoses. This raises the possibility of further biases in the sample examined in the current study. It is possible that the diagnostic practise at the source (ACPU of the RCH) from where participants came could have been biased in favour of a diagnosis of DYTH over MDD when a depressive disorder was deemed appropriate. This view is support by the

findings here that about 7 to 8 in every 10 adolescents who received a diagnosis of MDD also received a diagnosis of DYTH, whereas only around 4 in every 10 adolescents who received a diagnosis of DTYH received a diagnosis of MDD (based on parent interviews). Fourth, this study examined the factor structure of the DSM-IV anxiety and depressive disorders at the diagnostic level. Thus the findings may not reflect the factor structure of the anxiety and depressive disorders at the level of symptoms. As noted by Seeley et al. (2011), when analyses are focused at the disorder level, the underlying dimensionality associated with diagnostic criteria for specific disorders is ignored, and consequently, associations among symptoms might show different patterns of associations than those obtained on the basis of diagnostic categories. Fifth, while SAD, SOP, SPP, PD, AG, and GAD are still considered anxiety disorders in DSM-5 (APA, 2013), OCD and PTSD are not grouped under anxiety disorders, and are in their own separate groups. Although we have argued that our findings are inconsistent with the factor model implied by DSM-5, this model was not directly tested. This test was seen as inappropriate as there would have been only one indicator for the OCD and PTSD latent factors, which can be problematic for estimating reliable CFA model estimates (Brown, 2006). Thus we do not have clear data on the applicability of the factor model implied in DSM-5 for the DSM-IV anxiety and depressive disorder. Sixth, as this study examined a clinic-referred sample, the current findings here may not be applicable to comorbidity of the depressive and anxiety disorders in the general community. Indeed there is evidence that in clinical samples, comorbidity rates are usually higher than in general population samples (Angold, et al., 1999) due to a methodological problem called Berkson's bias (i.e., people with multiple disorders are more likely to be referred to clinics than are people with single disorders). Seventh, since the meaning, incidence, age of onset, course, stability, and comorbidity of the depressive and anxiety disorders are different across children, adolescents, and adults (Kessler, Chiu, Demler, & Walters, 2005; Wittchen, Leib,

Schuster, & Oldehinkel, 1999), the current findings are not applicable to either children or adults. There is a need for future studies taking into consideration these limitations.

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Table 1

Frequency and Percentage of Different Disorders of Participants

	Parent Interview		Adolescent Interview	
	Frequency	Percentage	Frequency	Percentage
Separation Anxiety Disorder	139	21.2	129	20.6
Social Phobia	186	28.4	180	28.8
Specific Phobia	191	29.2	182	29.1
Panic Disorder	72	11.0	68	10.9
Agoraphobia	31	4.7	31	5.0
Generalized Anxiety Disorder	310	47.3	300	47.9
Obsessive Compulsive Disorder	137	20.9	130	20.8
Post Traumatic Stress Disorder	106	16.2	105	16.8
Dysthymia	324	48.5	314	50.2
Major Depressive Disorder	169	25.8	165	26.4
Attention Deficit/Hyperactivity Disorder	446	69.1	424	67.7
Oppositional Defiant/Conduct Disorder	438	66.9	-	-
No diagnosis	27	4.1	21	3.4

Table 2

Tetrachoric Correlations between the Internalizing Disorders

Disorder	1	2	3	4	5	6	7	8	9	
SAD (1)	-	.364	.312	.283	.459	.434	.336	.233	.233	.230
SOP (2)	.462	-	.287	.414	.530	.448	.449	.209	.466	.391
SPP (3)	.306	.295	-	.420	.387	.314	.315	.279	.269	.237
PD (4)	.371	.275	.341	-	.650	.551	.401	.421	.409	.570
AG (5)	.471	.614	.498	.503	-	.620	.611	.470	.441	.399
GAD (6)	.429	.438	.367	.365	.415	-	.476	.350	.596	.612
OCD (7)	.385	.372	.369	.378	.476	.369	-	.300	.355	.322
PTST (8)	.226	.287	.158	.104	.302	.322	.197	-	.383	.381
DYTH (9)	.330	.430	.194	.295	.305	.416	.162	.274	-	.643
MDD (10)	.158	.239	.117	.322	.293	.449	.075	.355	.511	-

Note. SAD = separation anxiety disorder, SOP = social phobia, SPP = specific phobia, PD = panic disorder, AG = agoraphobia, GAD = generalized anxiety disorder, OCD = obsessive compulsive disorder, PTSD = post traumatic stress disorder, DYTH = dysthymia, MDD = major depressive disorder.

Values below the diagonal are for parent interviews, and values above the diagonal are for adolescent interviews.

Table 3

Model Fit Indices and Selection Criteria

Model	χ^2	df	CFI	TLI	RMSEA	ABIC	AIC	Δ AIC
Parent Interviews								
2-factor Seeley	55.00*	34	.977	.969	.031	5919.15	5878.55	0.00
2-factor DSM	61.63*	34	.969	.960	.035	5931.73	5891.14	12.58
1-factor	85.41***	35	.944	.928	.047	5954.31	5915.02	36.47
Adolescent Interviews								
2-factor Seeley	40.82	34	.995	.993	.018	4939.58	4900.38	0.00
2-factor DSM	45.60	34	.991	.989	.023	4953.40	4914.26	13.88
1-factor	58.97	35	.981	.976	.033	4970.37	4932.44	32.06

Note. The “best” of the competing model as implied by the AIC statistic is indicated by a value of 0.00 in the Δ AIC column. The Δ AIC was obtained by subtracting the AIC value for the best model from the target model. CFI = comparative fit index; TLI = Tucker–Lewis fit index; RMSEA = root-mean-square error of approximation; ABIC = Adjusted Bayesian information criterion; AIC = Akaike information criterion.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4

Parent Interviews: Factor Loadings for the Disorders in the Seeley et al. 2-Factor, 2-Factor DSM, and 1-Factor Models

	Seeley et al. 2-factor		DSM 2-factor		1-factor
	Fear	Distress	Anxiety	Depression	Internalizing
SAD	.642		.620		.609
SOP	.704		.676		.666
SPP	.521		.502		.480
PD	.585		.567		.561
AG	.815		.791		.780
OCD	.561		.540		.526
PTSD		.467	.427		.427
GAD		.782	.712		.702
DYTH		.648		.785	.588
MDD		.582		.652	.516
Mean Variance	.42	.40	.38	.52	.37

Note. SAD = separation anxiety disorder, SOP = social phobia, SPP = specific phobia, PD = panic disorder, AG = agoraphobia, GAD = generalized anxiety disorder, OCD = obsessive compulsive disorder, PTSD = post traumatic stress disorder, DYTH = dysthymia, MDD = major depressive disorder. All factor loadings were significant ($p < .001$).

Table 5

Latent Factor Scores as Predictors of Other Behavior Problems

	Seeley et al. 2-factor		DSM 2-factor		1-factor
Analysis	Fear	Distress	Anxiety	Depression	Internalizing
Parent Interviews/Criterion: ADHD					
Adjusted	.15***	.12**	.14***	.11**	.15***
Unadjusted	.14	.00	.14	-.04	-
Parent Interviews/Criterion: Conduct Disorder					
Adjusted	.10*	.10*	.10*	.09*	.10*
Unadjusted	.04	.06	.07	.03	-
Adolescent Interviews/Criterion: ADHD					
Adjusted	.22***	.22**	.22***	.21***	.23***
Unadjusted	.22	.00	.17	.05	-

Table 6

Adolescent Interviews: Factor Loadings for the Disorders in the Seeley et al. 2-Factor, 2-Factor DSM, and 1-Factor Models

	Seeley et al. 2-factor		DSM 2-factor		1-factor
	Fear	Distress	Anxiety	Depression	Internalizing
SAD	.517		.500		.492
SOP	.644		.619		.611
SPP	.480		.462		.454
PD	.756		.729		.719
AG	.847		.821		.810
OCD	.635		.613		.509
PTSD		.527	.515		.604
GAD		.829	.812		.793
DYTH		.748		.798	.720
MDD		.758		.806	.729
Mean Variance	.43	.52	.42	.64	.43

Note. SAD = separation anxiety disorder, SOP = social phobia, SPP = specific phobia, PD = panic disorder, AG = agoraphobia, GAD = generalized anxiety disorder, OCD = obsessive compulsive disorder, PTSD = post traumatic stress disorder, DYTH = dysthymia, MDD = major depressive disorder. All factor loadings were significant ($p < .001$).

Note. SAD = separation anxiety disorder, SOP = social phobia, SPP = specific phobia, PD = panic disorder, AG = agoraphobia, GAD = generalized anxiety disorder, OC = obsessive compulsive disorder, PTSD = post traumatic stress disorder, DYTH = dysthymia, MD = major depressive disorder.

Figure 1. Path diagrams for the structural models examined in the study.