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Dimensions of Oppositional Defiant Disorder in Young Children: Heterotypic Continuity with Anxiety and Depression

John V. Lavigne,

Department of Child and Adolescent Psychiatry, Ann & Robert H. Lurie Children's Hospital of Chicago and Feinberg School of Medicine, Northwestern University

Karen R. Gouze,

Department of Child and Adolescent Psychiatry, Ann & Robert H. Lurie Children's Hospital of Chicago and Feinberg School of Medicine, Northwestern University

Fred B. Bryant, and

Department of Psychology, Loyola University Chicago

Joyce Hopkins

College of Psychology, Illinois Institute of Technology

Abstract

There are distinct dimensions of Oppositional Defiant Disorder (ODD) that have been associated with symptoms of other disorders (heterotypic continuity). The present study compared the heterotypic continuity of a two-factor (Pitt-2) model and the three-factor model incorporated into DSM-5 with symptoms of anxiety and depression. Participants were a diverse community sample of 796 children (38.8% minority, 49.1% boys) assessed at ages 4, 5 and 6 years. Symptoms were assessed with the dimensional scales of the Diagnostic Interview Schedule for Children-Young Child version and the Child Symptom Inventory. Dimensions of both the two- and three-factor DSM-5 models were associated with later symptoms of anxiety and depression. The association, however, was weak when accounting for initial levels of internalizing symptoms: thus there was little evidence for the unique contributions of ODD dimensions to symptoms of subsequent internalizing disorders for either model.

Keywords

Oppositional Defiant Disorder; ODD dimensions; preschoolers; developmental psychopathology; heterotypic continuity; anxiety; depression

Oppositional Defiant Disorder (ODD), one of the most common disorders of childhood (Boylan, Vaillancourt, Boyle, & Szatmari, 2007; Lavigne, LeBailly, Hopkins, Gouze, & Binns, 2009; Nock, Kazdin, Hiripi, & Kessler, 2007) has been associated with a wide range of other disorders in children (Burke & Loeber, 2010; Drabick, Ollendick, & Bubier, 2010; Rowe, Costello, Angold, & Copeland, 2010). Burke and Loeber (2010) have suggested that

ODD may be a disorder of multiple dysfunctions that serves as a common antecedent to both internalizing and externalizing problems. Although the successive homotypic comorbidity of ODD (i.e., the relationship over time between ODD and later externalizing disorders), has been studied extensively (Angold, Costello, & Erkanli, 1999; Loeber, Green, Keenan, & Lahey, 1995; Moffitt, 1993; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996), less attention has been paid to the heterotypic continuity of ODD with concurrent and subsequent internalizing disorders.

Heterotypic Comorbidity of ODD with Internalizing Disorders

Currently, there is evidence that the concurrent heterotypic comorbidity (i.e., comorbidity at the same point in time; Angold et al., 1999) of ODD with an anxiety disorder, is high in both community (Boylan et al., 2007; Drabick et al., 2010; Maughan, Rowe, Messer, Goodman, & Meltzer, 2004; Simonoff et al., 1997) and clinical (Greene et al., 2002) samples. Similarly, there is evidence for the concurrent comorbidity of ODD and depression in both community (Boylan et al., 2007; Nock et al., 2007; Simonoff et al., 1997) and clinical samples (Greene et al., 2002). Studies of concurrent comorbidity, however, yield little information about how comorbidities develop. While interest in successive heterotypic continuity (Angold et al., 1999) of ODD with anxiety or depression has increased, further studies are needed to determine whether externalizing disorders like ODD increase risk for internalizing disorders, or vice versa (Bubier & Drabick, 2009). Bubier and Drabick (2009) note that studies of community (Lavigne et al., 2001; Rowe et al., 2010) and clinical (Speltz, McClellan, Deklyen, & Jones, 1999) samples of young children raise the possibility that ODD precedes anxiety. A study of older children (Burke, Loeber, Lahey, & Rathouz, 2005) also showed that anxiety may be preceded by ODD. Similar results have emerged regarding temporal relationships between the development of ODD and depression (Copeland, Shanahan, Costello, & Angold, 2009; Lavigne et al., 2001; Nock et al., 2007; Rowe et al., 2010; Rowe, Maughan, & Eley, 2006).

Internalizing Symptoms as Predictors of Subsequent ODD Symptoms

Other studies (Bubier & Drabick, 2009) raise the possibility that internalizing symptoms, specifically anxiety, may influence subsequent expression of symptoms of ODD. Some investigators have found that anxiety symptoms may be associated with higher levels of subsequent ODD or externalizing symptoms (Bittner et al., 2007; Foley, Pickles, Maes, Silberg, & Eaves, 2004; Last, Perrin, Hersen, & Kazdin, 1996; Nock et al., 2007). On the other hand, there is also evidence that anxiety is associated with fewer subsequent ODD symptoms (Drabick et al., 2010; Hofmann, Richey, Kashdan, & McKnight, 2009; Ollendick, Seligman, & Butcher, 1999). Drabick et al. (2010) proposed a dual process model of the comorbidity of ODD and anxiety, in which anxiety may either buffer (buffering hypothesis) or exacerbate (multiple problem or exacerbation hypothesis) subsequent ODD symptoms; leading to the suggestion that future studies address these competing hypotheses simultaneously. There is also some evidence that depression predicts subsequent ODD (Nock et al., 2007), but the possibility that depression may have a buffering effect has not been examined.

Dimensions of ODD: Heterotypic Continuity With Subsequent Internalizing Symptoms

The studies noted above treated ODD as a construct with a single latent dimension. Recent studies, however, indicate that ODD consists of multiple dimensions, and these different dimensions may be associated differentially with later occurring externalizing and internalizing disorders. Presently, several different models of the dimensions of ODD symptoms have been identified. These include (a) a single-factor model; (b) a two-factor model (oppositional behavior, negative affect) identified by Burke and colleagues (Burke & Loeber, 2010; Burke et al., 2005) at the University of Pittsburgh (Pitt-2 model); (c) a two-factor model (irritable, headstrong/spiteful; Rowe et al., 2010) identified in the Great Smoky Mountains dataset (GSMS model); (d) a three-factor model (oppositional behavior, negative affect, antagonistic behavior) also identified by Burke and colleagues (Pitt-3 model; Burke, Hipwell, & Loeber, 2010); (e) a three-factor model (irritable, hurtful, headstrong) identified by Stringaris and Goodman (2009a, 2009b) in the United Kingdom. and (e) a three-factor model (irritable, headstrong, hurtful) identified in a European/Middle Eastern clinical sample (EUR) by Aebi et al. (2010). While the names of the factors were the same for the Aebi and Stringaris and Goodman models, items loading on the factors differed. The UK model was adapted for use in DSM-5 with the dimensions renamed as angry/irritable mood, argumentative/defiant, and vindictive, respectively (UK/DSM-5 model).

The heterotypic continuity of ODD dimensions with other disorders has been reported for several of these models. The Pitt-2 model (Burke & Loeber, 2010; Burke et al., 2005) identified two dimensions of ODD symptoms: (a) symptoms of negative affect (ODDNA; touchy, angry, and spiteful or vindictive); and (b) symptoms of oppositional behavior (ODDB; arguing, defiant, and losing temper). Two DSM-IV symptoms (blames others, annoys others) did not load on either factor. In a sample of clinic-referred school-age boys, ODDNA predicted later depression, but ODDB did not. The Pitt-3 model (Burke et al., 2010), identified in a community sample of pre-adolescent girls, included: (a) an ODDB factor, with high factor loadings for items assessing defiance, arguing, and temper loss; (b) an ODDNA factor, with high loadings for items assessing being spiteful, touchy, and angry; and (c) an antagonistic behavior factor with high factor loadings for items assessing annoying others and blaming others. After controlling for race in the sample of girls, ODDB and antagonistic behavior symptoms were significant predictors of CD, but ODDNA symptoms were not.

In a community sample of children ages 5–18 years, the irritability dimension of the UK/DSM5 model was the best predictor of emotional problems; the hurtful dimension the best predictor of aggression; and the headstrong dimension the best predictor of hyperactivity (Stringaris & Goodman, 2009a, 2009b). Subsequently, other researchers applied the Stringaris et al. dimensional labels even though item loadings differed from those of Stringaris and colleagues. Rowe et al. (2010) identified two factors in a sample of 9–13 year-olds in which the irritability factor was associated with subsequent anxiety, and the headstrong factor with subsequent depression.

Exacerbating/buffering Associations of Internalizing Symptoms and Subsequent ODD Dimensions

While the other dimensional models were examined as predictors of other disorders, Aebi et al. (2010) used the approach of examining whether internalizing symptoms predicted the three dimensions of ODD symptoms. Consistent with the exacerbation hypothesis (Drabick et al., 2010), they found that a measure of emotional lability was a significant predictor of ODD irritability in a sample of psychiatrically-referred children with ADHD. Neither this study, nor other studies of ODD symptom dimensions, however, examined possible bidirectional relationships between symptoms of ODD and internalizing disorders. This underscores the need for such studies.

There are several limitations to the studies of the heterotypic continuity of ODD dimensions with subsequent internalizing disorders and also with studies of the relationship of internalizing symptoms with subsequent dimensions of ODD. First, with one exception (Burke et al., 2005), none of the reports of ODD as a predictor of subsequent internalizing symptoms, either anxiety or depression, controlled for the initial level of symptoms of that internalizing disorder. As a result, the temporal relationship of ODD dimensions with the subsequent internalizing symptoms may have been due to initial elevated levels of the internalizing symptoms. Second, while some attention has been paid to the role that the ODDNA component of ODD may play in subsequent depression (Burke et al., 2010; Burke & Loeber, 2010), and to emotional problems that included symptoms of anxiety and depression jointly (Stringaris & Goodman, 2009a), only one study (Rowe et al., 2010) has examined whether the irritability or the NA dimension of ODD is related to subsequent anxiety. While there is a high level of comorbidity between anxiety and depressive disorders when assessed as categorical constructs, and moderate-to-high correlations between anxiety and depression measured dimensionally (Brady & Kendall, 1992; King, Ollendick, & Gullone, 1991; Seligman & Ollendick, 1998), studies of the latent structure of anxiety and depression suggest that they should be considered to be separate, but correlated constructs (Chorpita, Albano, & Barlow, 1998; Cole, Peeke, Martin, Truglio, & Serczynski, 1998; Cole, Truglio, & Peeke, 1997; Snyder et al., 2009; Strickland et al., 2011). These studies also indicate that the association of different ODD components should be examined separately for both anxiety and depression.

Third, as awareness grows about the possible role that ODD components may play in relation to later heterotypic continuity of ODD with other disorders, it is important to determine if these ODD components each make an *independent* contribution to the subsequent development of other disorders, (i.e., do ODDNA and ODDDB each make a contribution to subsequent disorders that are distinct from one another?). To date, no studies have examined this issue.

Fourth, except for the Aebi et al. (2010) report, little attention has been paid to the possibility that internalizing symptoms are associated with subsequent ODD dimensions. Further attention is needed to determine if either (or both) of the dual buffering and exacerbating processes proposed by Drabick et al. (2010) occurs. Drabick et al. suggest that future studies address these competing hypotheses simultaneously.

The Present Study

The first aim of the present study was to examine the heterotypic continuity of two models of the structure of ODD with subsequent internalizing disorders. Because the three-factor UK/DSM-5 model was adopted for use in DSM-5, researchers will be particularly interested in the association of its dimensions with symptoms of subsequent disorders. A recent study (Lavigne, Bryant, Hopkins, & Gouze, submitted for publication), however, indicates that the UK/DSM-5 model is not invariant across gender and age, at least in a sample of young children. Data from this study also showed that, compared to all of the other dimensional models (including the UK-DSM-5 model), the Pitt-2 model showed better model fit for both boys and girls and both genders combined at ages 4, 5, and 6. The Pitt-2 model also showed configural, scalar, and metric invariance for age and gender. Because of the superiority of the two factor Pitt-2 model and the importance of the UK/DSM-5 model, we examined the heterotypic continuity of both models with subsequent anxiety and depression. The second aim was to examine whether internalizing symptoms were associated subsequently with dimensions of ODD symptoms in the manner suggested by Drabick et al. (2010). The research questions to be addressed were: (a) do the dimensions of ODD predict subsequent levels of anxiety and depression symptoms after controlling for initial levels of the respective internalizing symptom; (b) do the ODD dimensions make a contribution independent of one another to subsequent symptoms of anxiety and depression; (c) are there differences between the models on the predictive utility of the dimensions; and (d) is there evidence for the dual process model of anxiety or depression symptoms as predictors of subsequent ODD dimensions?

Important strengths of the present study include: (a) the use of a community sample to avoid the over-representation of comorbidity found in clinical samples (Caron & Rutter, 1991; Cole et al., 1998); (b) examining anxiety and depression dimensionally in order to assess the whole range of symptoms (i.e., the full range of symptoms from no symptoms through subclinical and clinical ranges of anxiety and depression (Cole et al., 1998); (c) assessing symptoms at multiple time points; and (d) assessing preschool children, the age when the prevalence of ODD is high, facilitating an exploration of developmental changes as the children transition into grammar school.

Method

Participants

Data were collected as part of a longitudinal study of risk factors for the development of psychopathology across an important developmental transitional period from ages 4 (preschool), 5 (kindergarten), and 6 (early school-age). Participants were 796 4-year-old children recruited from 13 Chicago Public School preschool programs and 23 primary care pediatric clinics throughout Cook County, Illinois. Eligible children: (a) were 4 years of age at initial data collection; (b) spoke Spanish or English; (c) lived with the parent participating in the study for 6 months or longer; (d) obtained a standard score on the Peabody Picture Vocabulary Test ≥ 70 (Dunn & Dunn, 1997), were not enrolled in class for the intellectually disabled or have a school IQ test score below 70; and (f) did not meet criteria for an Autism Spectrum Disorder.

The 796 4-year-olds (mean age = 4.44) included 405 (50.9%) girls and 391 (49.1%) boys. Based on parent-reported racial/ethnicity, there were: 433 (54.4%) White, non-Hispanic; 162 (20.4%) Hispanic; 133 (16.7%) African American; 19 (2.4%) Asian; 35 (4.4%) multi-racial or “Other;” and race/ethnicity not reported by 14 (1.8%) parents. All of the social classes (Hollingshead, 1975) were included, with 303 (38.1%) children in the highest class (Class I), 290 (36.4%) in Class II, 79 (9.9%) in Class III, 63 (7.9%) in Class IV, and 61 (7.7%) in Class V. Other details about the age-4 sample are available elsewhere (Lavigne et al., 2009).

There were 626 children and families (78.6%) who participated in all three waves of data collection. Families who completed all three waves of data collection differed from those who did not complete them with respect to: (a) SES, with a greater proportion of lower SES groups dropping out, $\chi^2(4, N = 796) = 69.61, p = .001$; (b) race, with a greater proportion of minority participants dropping out, $\chi^2(5, N = 796) = 77.7, p = .001$; and (c) child age, with drop-outs being, on average, 25 days older at study entry, $t(773) = 2.41, p = .02$.

Before conducting the analyses, missing data and item frequencies were examined within each age group. Less than 5% of the data were missing within each of the three age groups. Generally, imputation of missing data is less biased than listwise deletion (Graham, 2009), so missing data were imputed using SPSS V15.0 Expectation Maximization methodology using maximum likelihood procedures. The final sample N was 796.

Measures

Demographics—A demographic questionnaire was completed by the primary caretaker parent. That questionnaire provided information about the child’s age, race/ethnicity, parental education and occupation. Education and occupation information was coded for socioeconomic status using the Hollingshead Four-Factor Index of Social Status (Hollingshead, 1975).

Peabody Picture Vocabulary Test: 3rd Edition (PPVT-III)—The PPVT-III (Dunn & Dunn, 1997), a measure of receptive vocabulary, was administered to assess the child’s language skills. Sufficient receptive language skills were needed for certain tasks used in the larger study (but not included in the present report). The PPVT has good to excellent concurrent validity ($rs = .63 - .92$) with tests of verbal intelligence (Dunn & Dunn, 1997).

ODD dimensions—A measure of each of the eight DSM-IV symptoms of ODD were derived from two DSM-IV-coded measures: (a) The Diagnostic Interview Schedule for Children-Parent Scale-Young Child (DISC-YC) version (Fisher & Lucas, 2006) is a developmentally-appropriate structured parent interview that includes items measuring the DSM-IV symptoms of ODD. DISC-YC interviewers were clinical psychology graduate students trained to criterion on the interview by staff trained by the DISC-YC developers. Overall test-retest reliabilities of symptom scales are acceptable to high: for ODD, $r = .88$; anxiety and depression scales $r = .57-.81$ (C. Lucas, personal communication, September, 2006); (b) the early childhood form of the Child Symptom Inventory (CSI) (Gadow & Sprafkin, 1997, 2000) is a parent-completed checklist for which child symptoms are rated on a four-point rating scale (0 = *never*; 3 = *very often*). The CSI has been used previously in

studies of ODD dimensions (Burke et al., 2010; Keenan, Wroblewski, Hipwell, Loeber, & Stouthamer-Loeber, 2010). Internal consistency in this study was good ($\alpha = .70$).

In deciding on an approach to measuring each individual ODD symptom, several alternatives were considered. Both the CSI and DISC-YC included an item for each of the eight ODD symptoms. The first approach taken was to use a measurement model in which each CSI and DISC-YC item was used as an indicator for the relevant ODD item (e.g., the CSI and DISC-YC “temper tantrum” items were indicators for a latent DSM “temper tantrum” item). This approach resulted in an inadmissible solution not only when CSI- and DISC-items were freely estimated, but also when they were fixed to have equivalent factor loadings, and when correlated errors were allowed. Subsequently, to create the items measuring each ODD symptom, the one CSI and one DISC-YC item corresponding to each particular ODD DSM-5 symptom were converted to standard scores and the two comparable items (e.g., The CSI and DISC-YC items for temper tantrums) were summed together. This approach resulted in an admissible solution and was used in subsequent analyses. Items loading on the Pitt-2 ODD behavior factor were temper, argue, and defies; on the ODD negative affect factor, touchy, angry, and spiteful. Two items, annoys and blames, did not load on either Pitt-2 factor. Items loading on the UK/DSM-5 irritable factor were temper, touchy, and angry; on the headstrong factor, argues, defies, annoys, and blames; on the hurtful factor, spiteful/vindictive.

Anxiety and depression—Three parent-report measures of anxiety were used as indicators of the latent anxiety factor. These included the symptom count measure from the generalized anxiety scale of the Diagnostic Interview Schedule for Children-Parent Scale-Young child version (DISC-YC; Fisher & Lucas, 2006) and the generalized anxiety and separation anxiety scales of the Child Symptom Inventory (Gadow & Sprafkin, 1997, 2000). Similarly, three measures of depression were used to estimate the latent factor of child depression: the DISC-YC major depression scale, the CSI major depression scale, and the CSI dysthymia scale. Alpha in this study for the anxiety measure was .78, and for depression, .70.

Procedure

Parents were approached by research assistants at pediatric offices and preschools and given study information. Subsequently, a home visit was arranged at which study measures were completed. Parents were re-contacted 1 and 2 years after the initial visit for another visit during which the DISC-YC and study questionnaires were re-administered. Written consent to participate was obtained each year. This study was approved by the appropriate Institutional Review Boards.

Data analysis—Structural equation modeling (SEM) using LISREL 8.8 (Joreskog & Sorbom, 2006) was used to examine the heterotypic continuity of ODD dimensions with subsequent anxiety and depression. In these analyses, the errors of each measured indicator were allowed to correlate with the equivalent item (e.g., ODDNA at age 4 with ODDNA at age 5, CSI generalized anxiety scale at age 4 with that scale at age 5, etc.) across assessment periods. In addition, we followed Cole et al.’s (1998) procedure of allowing residuals of the

latent factors to covary within each time period. All paths were set to be free, allowing the magnitude of similar path coefficients to vary across time periods. Completely standardized beta weights are reported in figures and text.

In the Pitt-2 models, there were three indicators for ODDNA (one each for the ODD items of touchy, angry, and spiteful) and three indicators for ODDDB (one each for the ODD items of temper, argues and defies). For the UK/DSM-5 models there were three indicators for the irritable factor: one each for the ODD items of temper, touchy, angry; four for the headstrong factor (one each for the ODD items of argues, defies, annoys, blames); and one for the hurtful factor (one for the ODD item of spiteful/vindictive). There were three indicators for anxiety (one each for the CSI generalized anxiety, CSI separation anxiety, and DISC-YC generalized anxiety scales). There were three indicators for depression (one each for the CSI major depression, CSI dysthymia, and DICS-YC scales) at each age level. In each model, one factor loading per latent factor was fixed to 1 while the others were set free. For the two Pitt-2 models in Figures 1a and 1b, and the UK/DSM-5 model for irritability (Figure 3a), there were 43 parameters in each: 2 for the exogenous factors; 18 for error terms associated with the indicators; 4 for disturbances associated with the endogenous variables; 1 for the unanalyzed covariances between the exogenous factors; 12 for the non-fixed factor loadings; and 6 for direct effects on endogenous variables. In the model for bidirectional effects for the PITT-2 model (Figure 2), there were 71 parameters: 3 for the exogenous factors; 27 for error terms associated with the indicators; 6 for disturbances associated with the endogenous variables; 3 for the unanalyzed covariances between the exogenous factors; 18 for the non-fixed factor loadings; and 14 for direct effects on endogenous variables. For the UK/DSM-5 model for hurtful (Figure 3b), there were 31 parameters: 2 for the exogenous factors; 12 for error terms associated with the indicators; 4 for disturbances associated with the endogenous variables; 1 for the unanalyzed covariances between the exogenous factors; 6 for the non-fixed factor loadings; and 6 for direct effects on endogenous variables. For the headstrong model (Figure 3c), there were 49 parameters: 2 for the exogenous factors; 21 for error terms associated with the indicators; 4 for disturbances associated with the endogenous variables; 1 for the unanalyzed covariances between the exogenous factors; 15 for the non-fixed factor loadings; and 6 for direct effects on endogenous variables. For the UK/DSM-5 bidirectional model (Figure 4), there were 86 parameters: 4 for the exogenous factors; 30 for error terms associated with the indicators; 8 for disturbances associated with the endogenous variables; 6 for the unanalyzed covariances between the exogenous factors; 18 for the non-fixed factor loadings; and 20 for direct effects on endogenous variables.

In assessing goodness-of-fit, we employed an index of absolute fit that adjusts for model complexity (root mean square error of approximation, RMSEA) and two relative fit indices (non-normed fit index, NNFI; and comparative fit index, CFI). Models were judged as showing good fit if they met the following criteria: RMSEA $\leq .08$, NNFI $\geq .95$, and CFI $\geq .95$ (Browne & Cudeck, 1993; Hu & Bentler, 1999), and moderately good if RMSEA $\leq .09$, NNFI $\geq .95$, and CFI $\geq .95$. As recommended by Brown (2006), we reported the Satorra-Bentler scaled chi-square ($SB\chi^2$) (Satorra & Bentler, 1994) but did not use it to assess overall fit because that measure is inflated by large sample sizes (Bollen, 1989). To obtain a scaled ML chi-square values, we followed Bryant and Satorra's (2012) guidelines.

Results

Correlations Between Measured Indicators and Latent Factors

The tables of correlations between the measured indicators and the latent factors of ODD, anxiety and depression are presented on line to conserve space. As expected: (a) at each time period, the measured indicators of each factor are moderately, positively correlated; (b) across time periods, the autocorrelations are all positive and significant. The mean one-year autocorrelations for the measured indicators from age 4 to 5 and age 5 to 6 was .50 (range = .38 to .59). These significant correlations suggest that the range of symptom scores was not unduly restricted; and (c) the measured indicators for each cross-lag (i.e., ODDNA at time 1 with depression at time 2, etc.) are all positively correlated. With few exceptions, the correlations are statistically significant.

Heterotypic Continuity with Anxiety

Pitt-2 dimensions as predictors of anxiety without controlling for initial anxiety symptom level—Prior studies examined the dimensions of ODD as predictors of subsequent internalizing symptoms without controlling for the initial internalizing symptom level. To allow for comparisons with prior studies, we examined the relationship between ODD dimensions and subsequent anxiety symptoms without controlling for initial anxiety level. In this analysis, ODDNA was a strong, significant predictor of subsequent anxiety symptoms from both: (a) age 4 to 5 (path coefficient = .76, $p < .001$), and (b) age 5 to 6 (path coefficient = .58, $p < .001$). Like ODDNA, ODDDB was a strong, significant predictor of subsequent anxiety from both ages 4 to 5 (path coefficient = .72, $p < .001$), and ages 5 to 6 (path coefficient = .54, $p < .001$).

Pitt-2 dimensions as predictors of subsequent anxiety while controlling for initial anxiety level—To determine whether ODDNA predicts subsequent level of anxiety when controlling for initial level of anxiety, a model (Figure 1a) was examined that included the autoregressions of ODDNA and anxiety, plus the cross-lag of ODDNA with anxiety at the subsequent time period. That model showed a good fit, SB $\chi^2(113) = 445.59$, $p < .001$; RMSEA = .061; NNFI = .96; CFI = .97. At each age, anxiety was a strong predictor of subsequent anxiety. Similarly, ODDNA was a significant predictor for subsequent ODDNA. When controlling for the effects of initial level of anxiety in studying the relation of ODDNA with subsequent anxiety, ODDNA was not a significant predictor of subsequent anxiety for age 4 ODDNA with age 5 anxiety (path coefficient = .03), or age 5 ODDNA with age 6 anxiety.

The model (Figure 1b) including the autoregressions of ODDDB and anxiety, plus the cross-lag of ODDDB with subsequent anxiety also showed good model fit, SB $\chi^2(113) = 525.14$, $p < .001$; RMSEA = .068; NNFI = .96; CFI = .97. When controlling for the effects of initial level of anxiety, the relationship of ODDDB with subsequent anxiety was not significant for the path from ODDDB at age 4 to anxiety at age 5, but was significant, although small, for ODDDB at age 5 with anxiety at age 6.

Pitt-2 ODD dimensions as predictors of subsequent anxiety: independent contributions

—To examine whether the ODD dimensions made an independent contribution to subsequent anxiety and whether anxiety had a buffering or exacerbating effect on subsequent ODD dimensions, a bidirectional model (Figure 2) was examined. That model included the autoregressions of both Pitt-2 factors and anxiety along with cross-lags from each Pitt-2 factor to subsequent anxiety and anxiety to each subsequent ODD dimension. That model showed good model fit, $SB\chi^2(286) = 1086.30, p < .001$; RMSEA = .063; NNFI = .96; CFI = .97. ODDDB showed a negative, but nonsignificant, association with subsequent anxiety, while ODDNA showed a negative, but significant association with subsequent anxiety. Because both ODDDB and ODDNA were significant positive predictors of subsequent anxiety when examined as sole predictors without controlling for initial anxiety, these results were likely due to suppression effects (Gaylord-Harden, Cunningham, Grant, & Holmbeck, 2010). Suppression occurs when the association of one predictor variable with another (e.g., the beta coefficient of variable A with variable Y) either (a) increases in magnitude when a second variable is added (e.g., the beta coefficient of variable A with Y increases when variable B is included in the regression analysis as a predictor of Y); or (b) the coefficient changes sign. The former effect is called classical suppression; the latter, negative suppression. Suppression is more likely to occur when the shared variance between A and B is large. Consistent with negative suppression, the relation of age 4 anxiety with age 5 anxiety increased in magnitude. Thus, the two components of ODD seemed to be associated with subsequent anxiety by removing error variance associated with age 4 anxiety, thereby strengthening its association with subsequent anxiety. An alternative interpretation—that ODD actually suppresses subsequent anxiety—is not consistent with the fact that both ODD components show a positive relationship to subsequent anxiety as single predictors. At age 5, neither ODD component was a significant predictor of subsequent anxiety.

UK/DSM-5 dimensions as predictors of anxiety without controlling for initial anxiety symptom level

—When each of the UK/DSM-5 ODD components were examined as predictors of subsequent anxiety without controlling for initial anxiety level, each one was a strong, significant predictor of subsequent anxiety from: (a) ages 4 to 5 ODD (irritability, path coefficient = .85, $p < .001$; hurtful, path coefficient = .33, $p < .001$; headstrong, path coefficient = .78, $p < .001$); and (b) ages 5 to 6 (irritability, path coefficient = .64, $p < .001$; hurtful, path coefficient = .27, $p < .001$; headstrong, path coefficient = .61, $p < .001$).

UK/DSM-5 ODD dimensions as predictors of subsequent anxiety while controlling for initial levels of anxiety

Irritability: A model (Figure 3a) that included the autoregressions of ODD irritability and anxiety, plus the cross-lag of ODD irritability with anxiety at the subsequent time period was examined to assess the effects of irritability on subsequent anxiety while controlling for initial anxiety level. That model showed good model fit, $SB\chi^2(113) = 591.49, p < .001$; RMSEA = .073; NNFI = .95; CFI = .96. When controlling for the effects of initial level of anxiety, the relationship of age 4 ODD irritability with subsequent anxiety was significant, but negative. Since the correlations between the manifest indicators of age 4 ODD

irritability and age 5 anxiety were all positive, and the magnitude of the path between age 4 anxiety and age 5 anxiety increases (path coefficient = 1.24, $p < .001$), negative suppression appears to be occurring. Age 4 ODD irritability appears to predict subsequent anxiety because of its correlation with age 4 anxiety, rather than being an independent predictor per se. Also, age 4 ODD irritability contributes to predicting subsequent anxiety by reducing error variance in age 4 anxiety and strengthening its true relationship to age 5 anxiety.

At age 5, ODD irritability is a small but significant predictor of age 6 anxiety. To understand whether ODD irritability at age 5 improves prediction of subsequent anxiety, the model including the significant cross-lag of age 5 irritability with age 6 anxiety was compared to a model without that cross-lag. The cross path did not improve prediction of subsequent anxiety, $SB \chi^2(1) = 0.25$ over that expected from the autoregression of age 5 anxiety with age 6 anxiety.

Hurtful: The model (Figure 3b) that included the autoregressions of ODD hurtful and anxiety, plus the cross-lag of ODD hurtful with anxiety at the subsequent time period showed a good fit, $SB \chi^2(41) = 169.44$, $p < .001$; RMSEA = .067; NNFI = .97; CFI = .98. At each age, anxiety was a strong predictor of anxiety at the subsequent age, as was ODD hurtful for subsequent ODD hurtful. When controlling for the effects of initial level of anxiety in the relationship of ODD hurtful with subsequent anxiety, however, the relationships were not significant for the paths from ODD hurtful at age 4 to anxiety at age 5, or ODD hurtful at age 5 with anxiety at age 6.

Headstrong: The model (Figure 3c) that included the autoregressions of ODD headstrong and anxiety, plus the cross-lag of ODD headstrong with anxiety at the subsequent time period showed good model fit, $SB \chi^2(164) = 626.52$, $p < .001$; RMSEA = .060; NNFI = .96; CFI = .97. When controlling for the effects of initial level of anxiety, the relationship of ODD headstrong with subsequent anxiety was not significant for the path from ODD headstrong at age 4 to anxiety at age 5, it was significant but small for ODD headstrong at age 5 with anxiety at age 6. The chi-square difference test was significant, $SB \chi^2(1) = 5.05$, $p = .025$, indicating that ODD headstrong improved prediction of age 6 anxiety above that of age 5 anxiety.

UK/DSM-5 ODD dimensions as predictors of subsequent anxiety: independent contributions—A bidirectional model (Figure 4) that included the autoregressions of the three UK/DSM-5 factors and anxiety along with cross-lags from each UK/DSM-5 factor to subsequent anxiety, and anxiety to each subsequent ODD dimension showed poor fit, $SB \chi^2(448) = 2468.05$, $p < .001$; RMSEA = .075; NNFI = .93; CFI = .94 because both the NNFI and CFI were slightly lower than desirable. None of the UK/DSM-5 factors at age 4 or 5 were significant predictors of subsequent anxiety.

Heterotypic Continuity With Depression

Pitt-2 dimensions as predictors of depression without controlling for initial depression levels—When the effect of initial depression level on subsequent depression was not controlled, results were: ODDNA (age 4 to age 5 path coefficient = .54, $p < .001$

and age 5 to 6 path coefficient = .49, $p < .001$) and (b) ODDb were moderate to strong, significant predictors of subsequent depression (age 4 to age 5, path coefficient = .38, $p < .001$; age 5 to 6, path coefficient = .33, $p < .001$).

Pitt-2 dimensions as predictors of depression while controlling for initial depression levels—The model (Figure 1a) that included the autoregressions of ODDNA and depression, plus the cross-lag of ODDNA with depression at the subsequent time period showed good model fit, $SB \chi^2(113) = 487.28$, $p < .001$; RMSEA = .065; NNFI = .97; CFI = .98. While including the initial level of depression, the paths from ODDNA at age 4 to depression at age 5, and ODDNA at age 5 with depression at age 6, were significant. Chi-square difference tests showed that both the cross lag from age 4 ODDNA to age 5 depression, $SB \chi^2(1) = 53.92$, $p < .001$, and from age 5 to age 6, $SB \chi^2(1) = 45.62$, $p < .001$, improved prediction of subsequent depression.

The model (Figure 1b) including the autoregressions of ODDb and depression, plus the cross-lag of ODDb with depression at the subsequent time period showed a good fit, $SB \chi^2(113) = 520.10$, $p < .001$; RMSEA = .067; NNFI = .96; CFI = .97. When including the initial level of depression, the paths from ODDb at age 4 to depression at age 5, and ODDb at age 5 with depression at age 6 were significant. The chi-square difference tests showed both the cross lag from age 4 ODDb to age 5 depression, $SB \chi^2(1) = 18.5$, $p < .001$, and from age 5 to age 6, $SB \chi^2(1) = 19.86$, $p < .001$, improved prediction of subsequent depression.

Pitt-2 ODD dimensions as predictors of subsequent depression: independent contributions—A bidirectional model (Figure 2) that included the autoregressions of both Pitt-2 factors and depression along with cross-lags from each Pitt-2 factor to subsequent depression and depression to each subsequent ODD dimension showed good model fit, $SB \chi^2(286) = 1130.86$, $p < .001$; RMSEA = .061; NNFI = .97; CFI = .97. ODDb showed a, significant, negative association with subsequent depression, while ODDNA showed a strong positive, significant association with subsequent depression. As with anxiety, age 4 ODDb showed a possible suppression effect as a predictor of age 5 depression. That is, the inclusion of ODDb increases the strength of the relationship between age 4 ODDNA and subsequent depression. Thus, the age 4 ODDb component seemed to be associated with subsequent depression by removing error variance (Paulhus, Robins, Trzesniewski, & Tracy, 2012) and increasing the association of ODDNA with subsequent depression. The age 5 ODDNA component was a moderately strong, significant predictor of subsequent depression, while ODDb was not related to subsequent depression.

UK/DSM-5 dimensions as predictors of subsequent depression without controlling for initial levels of depression—ODD hurtful was a small but significant predictor of subsequent depression from both age 4 to 5 (path coefficient = .17, $p < .001$) and age 5 to 6 (path coefficient = .20, $p < .001$) when the effects of initial depression level on subsequent depression were not controlled. ODD irritable (age 4 to 5, path coefficient = .59, $p < .001$; age 5 to 6, path coefficient = .51, $p < .001$) and ODD headstrong age 4 to 5 (path coefficient = .43, $p < .001$) and age 5 to 6 (path coefficient = .40, $p < .001$) were

moderately strong, significant predictors of subsequent depression when the effects of initial depression level on subsequent depression were not controlled.

UK/DSM-5 dimensions as predictors of subsequent depression while controlling for initial levels of depression

Irritability: The model (Figure 3a) that included the autoregressions of ODD irritability and depression, plus the cross-lag of ODD irritability with depression at the subsequent time period showed good model fit, $SB \chi^2(113) = 668.58, p < .001$; RMSEA = .079; NNFI = .95; CFI = .97. While including the initial level of depression, the paths from ODD irritability at age 4 to depression at age 5, and ODD irritability at age 5 with depression at age 6 were significant and moderately strong. Chi-square difference tests shows both the cross lag from age 4 ODD irritability to age 5 depression, $SB \chi^2(1) = 358.45, p < .001$, and from age 5 to age 6, $SB \chi^2(1) = 346.29, p < .001$, improved prediction of subsequent depression.

Hurtful: The model (Figure 3b) that included the autoregressions of ODD hurtful and depression, plus the cross-lag of ODD hurtful with depression at the subsequent time period showed good model fit, $SB \chi^2(41) = 182.30, p < .001$; RMSEA = .066; NNFI = .97; CFI = .98. When including the initial level of depression, the paths from ODD hurtful at age 4 to depression at age 5, and ODD hurtful at age 5 with depression at age 6 were significant. Chi-square difference tests showed both the cross lag from age 4 ODD hurtful to age 5 depression, $SB \chi^2(1) = 15.09, p < .001$, and from age 5 to age 6, $SB \chi^2(1) = 15.93, p < .001$, improved prediction of subsequent depression.

Headstrong: The model (Figure 3c) including the autoregressions of ODD headstrong and depression, plus the cross-lag of ODD headstrong with depression at the subsequent time period showed a good fit, $SB \chi^2(113) = 668.75, p < .001$; RMSEA = .062; NNFI = .96; CFI = .97. When including the initial level of depression, the paths from ODD headstrong at age 4 to depression at age 5, and ODD headstrong at age 5 with depression at age 6 were significant. Chi-square difference tests showed both the cross lag from age 4 ODD headstrong to age 5 depression, $SB \chi^2(1) = 24.21, p < .001$, and from age 5 to age 6, $SB \chi^2(1) = 29.47, p < .001$, improved prediction of subsequent depression.

UK/DSM-5 dimensions as independent predictors of subsequent depression: independent contributions—A bidirectional model (Figure 4) that included the autoregressions of the three UK/DSM-5 factors and anxiety along with cross-lags from each UK/DSM-5 factor to subsequent anxiety and anxiety to each subsequent ODD dimension showed poor model fit, $SB \chi^2(448) = 2417.51, p < .001$; RMSEA = .074; NNFI = .94; CFI = .95 because one of the three indices (NNFI) was slightly lower than desirable. At both ages 4 and 5, ODD irritable was a moderately strong, significant predictor of subsequent depression, while neither ODD headstrong or ODD hurtful were significant predictors of subsequent depression.

Buffering/exacerbating Effects

Pitt-2 with anxiety: anxiety as a predictor of subsequent ODD dimensions—

With regard to anxiety symptoms as either a buffering or exacerbating factor, there were

indications of a developmental effect for Pitt-2 ODDNA and ODDDB (Figure 2). At age 4, anxiety was a significant predictor of both age 5 ODD dimensions, with the strongest effects being for ODDNA. At age 5, however, anxiety was not associated with either age 6 ODD dimension. This is consistent with the concept that anxiety contributes to ODD in preschool, but does not significantly increase ODD at age 5. Of note, the autoregression of age 4 ODDNA with age 5 ODDNA was small and nonsignificant.

UK/DSM-5 dimensions with anxiety: anxiety as a predictor of subsequent ODD dimensions—At both age 4 and age 5 (Figure 4), anxiety was associated with a significant increase in each of the UK/DSM-5 ODD factors at the subsequent age level. These relationships were strongest between age 5 anxiety and age 6 ODD irritability and ODD headstrong.

Depression as a predictor of subsequent ODD dimensions—There were no indications of either a buffering or exacerbating effect of depression with subsequent Pitt-2 or UK/DSM-5 dimensions.

Discussion

The questions we addressed in this study were: (a) do the dimensions of ODD predict subsequent levels of anxiety and depression symptoms after controlling for initial levels of the respective internalizing symptom?; (b) do ODD dimensions make a contribution independent of one another to subsequent symptoms of anxiety and depression?; (c) are there differences between the models for the predictive utility of the dimensions?; (d) is there evidence for the dual process model of anxiety or depression symptoms as predictors of subsequent ODD dimensions? The two models examined were a three-factor model adopted for use in DSM-5 (UK/DSM-5 model) and a two-factor model (Pitt-2 model) that had shown a better model fit than the UK/DSM-5 model, as well as age and gender invariance in young children in a previous study.

Do the Components of ODD Predict Subsequent Levels of Anxiety and Depression Symptoms After Controlling for Initial Levels of the Respective Internalizing Symptom?

When initial levels of anxiety were included in the model, the associations of the ODD dimensions with subsequent anxiety were much weaker. Indeed, the Pitt-2 ODDNA and ODDDB factors at age 4 were not significant predictors of anxiety at age 5. Moreover, age 5 ODDNA did not have a significant effect on age 6 anxiety, and age 5 ODDDB had only a small effect independent of age 5 anxiety as a predictor of anxiety at age 6. For the UK/DSM-5 dimensions, hurtful did not have a significant relation with subsequent anxiety at either age 5 or age 6 that was independent of the initial anxiety level. Similarly, the age 4 ODD headstrong dimension did not have an independent effect on subsequent anxiety at age 5. The age 5 headstrong measure did have a small, significant effect on subsequent age 6 anxiety that was independent of age 5 anxiety level. The association of irritability with subsequent anxiety symptoms was more complex because a suppression effect was evident at age 4. Irritability at age 4 was not directly associated with subsequent anxiety, but improved the measurement properties of age 4 anxiety as a predictor of subsequent anxiety.

In summary, previous findings demonstrating a relationship between early ODD dimensions and later anxiety need to be interpreted extremely cautiously; the bulk of these relationships disappear when controlling for initial levels of anxiety.

Unlike the results for anxiety, at age 4 and 5, both the Pitt-2 ODDNA and ODDDB factors were significant predictors of subsequent levels of depression even when initial levels of depression were controlled. At both age 4 and 5, when ODDDB, ODDNA, and depression were all modeled as predictors of subsequent depression, ODDNA made a significant, independent contribution to subsequent depression. Thus, high levels of ODDNA at both age 4 and 5 may lead to subsequent high levels of depression that cannot be accounted for by initial levels of depression. For the UK/DSM-5 factors, all three factors (irritability, hurtful, and headstrong) at age 4 and 5 were associated with subsequent depression when initial depression levels were controlled; thus, these three dimensions predict subsequent depression independently of initial levels of depression.

Do ODD Dimensions Make a Contribution Independent of One Another to Subsequent Symptoms of Anxiety and Depression?

If distinct dimensions of ODD are important for understanding the heterotypic continuity of ODD with internalizing disorders, then they should have associations with subsequent disorders that are distinct from one another as well as independent of the initial level of the internalizing disorder. At age 4, there is little evidence that either the Pitt-2 ODDNA or ODDDB factors make a significant, direct contribution to subsequent anxiety that is independent of one another and initial (age 4) anxiety level. At age 4, ODDDB is unrelated to subsequent anxiety when both age 4 ODDNA and age 4 anxiety are included as predictors. Rather than having a direct effect, age 4 ODDNA appears to have a suppressive effect in which it improves the prediction of age 4 anxiety with age 5 anxiety. Furthermore, at age 5, neither of the Pitt-2 dimensions of ODD is associated with subsequent anxiety. Thus, in this age group, the relationship of these factors to subsequent anxiety is limited to improving the effects of age 4 anxiety as a predictor of subsequent anxiety.

With regard to the UK/DSM-5 dimensions, the overall model of all UK/DSM-5 factors predicting anxiety showed a poor fit. Specifically, none of the factors were significant, independent predictors of subsequent anxiety.

For the Pitt-2 factors with depression, there was a significant negative association of ODDDB with subsequent depression when both ODDNA and initial depression levels were included as predictors at age 4. While this could be interpreted as indicating that age 4 ODDDB has a buffering or protective effect, it appears that age 4 ODDDB actually acts statistically as a suppressor, rather than having a direct effect on reducing subsequent depression. The inclusion of ODDDB reduces shared error variance with age 4 ODDNA, and strengthens the association of age 4 ODDNA with age 5 depression. Thus, while ODDDB may not be a factor contributing to subsequent depression, knowledge of ODDDB may improve the prediction of whether subsequent depression will occur. By age 5, however, that is no longer true, and ODDDB shows no relationship to depression at age 6.

For the UK/DSM-5 dimensions, the model used to assess the independent associations of ODD dimensions with subsequent depression showed poor model fit, which was partially due to nonsignificant independent associations of ODD hurtful and headstrong at ages 4 with subsequent depression. For the UK/DSM-5 dimensions, only irritability showed an independent association with subsequent depression.

Are There Differences Between the Models on the Predictive Utility of the Dimensions?

With regard to depression, the models examining whether the factors' independent contributions to predicting subsequent depression seem to favor the Pitt-2 model for two reasons: (a) the Pitt-2 model showed good overall fit, while the UK/DSM-5 model did not; (b) prior studies suggest the ODDNA factor of the Pitt-2 model should be a better predictor than ODDDB for depression. The results of this study are consistent with those prior studies at both age 4 and 5. Furthermore, the present study extends those results by showing that ODDNA is a better predictor than ODDDB and initial depression. For anxiety, neither Pitt-2 nor UK/DSM-5 factors seem to make an independent contribution to predicting subsequent anxiety, so neither model seems preferable.

Is there Evidence for the Dual Process Model of Anxiety or Depression Symptoms as Predictors of Subsequent ODD Dimensions?

With regard to anxiety, there were indications that age 4 anxiety was associated with higher levels of the Pitt-2 ODDNA and ODDDB factors at age 5, even when controlling for initial levels of anxiety, but not for age 5 anxiety with age 6. This supports the exacerbation hypothesis at one age level, but not the other. There were no indications of a buffering effect for the Pitt-2 factors for this age group. With regard to the UK/DSM-5 factors, higher levels of anxiety were associated with increases in all three UK/DSM-5 ODD components at both age groups, even when controlling for initial levels of anxiety. These results are more consistent with the exacerbation (multiple problem) hypothesis of Drabick et al. (2010) than with the buffering hypothesis. Drabick et al. also suggest that these processes may be specific to different developmental stages. The results for the Pitt-2 ODD dimensions suggest that exacerbation may be more common in preschoolers, and decline thereafter, while results for the UK/DSM-5 dimensions suggest a more consistent effect overall.

With regard to depression, the present data do not provide support for either an exacerbation or buffering effect for ages 4 or 5 depression on subsequent ODDDB dimensions.

Clinical Implications

Burke and Loeber (2010) suggest that evidence that ODDNA is a precursor to depression may indicate that ODD symptoms can be a "key marker" for early intervention for depression. The results of the present study suggest that early symptoms of depression, ODDNA, and ODDDB are all significant predictors of subsequent depression; thus a combination of all three factors may provide the greatest predictive validity for subsequent depression. Nevertheless, since symptoms of depression may be less noticeable in young children, high levels of ODDNA or ODDDB symptoms in these children could provide a window of opportunity for early identification and intervention. That is, the present data suggest that children who exhibit high levels of ODDNA and ODDDB symptoms should also

be screened for depression symptoms. Then, if these internalizing symptoms are also present, adding treatment strategies shown to be effective for treating child depression to standard treatment for preschool ODD may reduce the likelihood of later depression in these children. In contrast, neither ODDNA nor ODDDB improve the predictive ability of initial levels of anxiety for subsequent anxiety levels.

Limitations

Clearly, the findings of this study are limited to the developmental period between preschool and formal school entry, and may differ for older children and adolescents. In addition, it is possible that these relationships are different in a clinical sample. Furthermore, the results are limited to parent reports of symptoms. Reports of ODD symptoms are source specific (Drabick, Bubier, Chen, Price, & Lanza, 2011). Results may differ for teacher reports and self-reports of symptoms of ODD, anxiety and depression. Finally, a measure of social phobia was not included in the present analyses and social phobia warrants study in future research.

Directions for Future Research

Despite these limitations, this study contributes to the growing body of literature on the heterotypic continuity of ODD dimensions with internalizing problems. Future research is needed to examine the heterotypic continuity of ODD dimensions, particularly in clinical samples where rates of comorbidity are likely to be higher, and with different informants. Burke and Loeber (2010) have called for further studies of how behavioral and affective dysregulation differentially predict disorders such as ADHD, ODD, and depression, in order to clarify the relationships between early temperament, and oppositional and negative affective symptoms of ODD. The present study provides support for such a research agenda. Further studies are needed to examine the bi-directional influences of ODD symptom dimensions, and anxiety and depression symptoms. In addition, it would be useful to examine these relations in older children, particularly since they have a higher prevalence of depression, as well as increasing rates of comorbidity of anxiety and depression. Finally, while there are indications that the dimensions of ODD are gender invariant in young children, the possibility that patterns of heterotypic continuity vary by gender warrants further investigation.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1a

Figure 1b

Figure 1.

Figure 1a. Pitt-2 ODD NA with subsequent anxiety and depression.

Figure 1b. Pitt-2 ODD B with subsequent anxiety and depression. Path coefficients for anxiety occur before, and depression after, the slash. ODDNA = Oppositional Defiant Disorder negative affect factor; ODDB = Oppositional Defiant Disorder behavior factor.

* $p < .01$; ** $p < .01$; *** $p < .001$.

Figure 2.

Bidirectional relationships of ODDNA and ODDDB with subsequent anxiety and depression. Path coefficients for anxiety occur before, and depression after, the slash. ODDDB = Oppositional Defiant Disorder behavior factor; ODDNA = Oppositional Defiant Disorder negative affect factor. * $p < .01$; ** $p < .01$; *** $p < .001$.

Figure 3a. UK/DSM-5 ODD irritable with subsequent anxiety/depression

Figure 3b. UK/DSM-5 ODD hurtful with subsequent anxiety/depression

Figure 3c. UK/DSM-5 ODD headstrong with subsequent anxiety/depression.

Figure 3.

UK/DSM-5 irritable, hurtful, and headstrong dimensions with subsequent anxiety and depression. Path coefficients for anxiety occur before, and depression after, the slash. ODD = Oppositional Defiant Disorder. * $p < .01$; ** $p < .01$; *** $p < .001$.

Figure 4. Bidirectional relationships of UK/DSM-5 ODD factors with subsequent anxiety and depression. ODD = Oppositional Defiant Disorder. * $p < .01$; ** $p < .01$; *** $p < .001$.

Table 1

Correlations between manifest indicators

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Touchy: age 4	1														
2. Angry: age 4	.64**	1													
3. Get even: age 4	.41**	.46**	1												
4. Temper: age 4	.43**	.47**	.39**	1											
5. Argues: age 4	.36**	.35**	.27**	.50**	1										
6. Defies: age 4	.40**	.42**	.43**	.48**	.52**	1									
7. Annoys: age 4	.38**	.36**	.52**	.37**	.30**	.47**	1								
8. Blames: age 4	.30**	.29**	.37**	.28**	.23**	.31**	.35**	1							
9. CSI generalized anxiety: age 4	.43**	.41**	.33**	.35**	.31**	.44**	.29**	.29**	1						
10. DISC-YC generalized anxiety: age 4	.29**	.29**	.21**	.18**	.15**	.17**	.17**	.23**	.44**	1					
11. CSI separation anxiety: age 4	.34**	.34**	.27**	.23**	.21**	.27**	.19**	.24**	.55**	.36**	1				
12. CSI major depression: age 4	.45**	.45**	.36**	.27**	.24**	.31**	.26**	.25**	.63**	.46**	.50**	1			
13. DISC-YC major depression: age 4	.41**	.39**	.31**	.27**	.21**	.30**	.27**	.25**	.56**	.59**	.38**	.60**	1		
14. CSI dysthymia: age 4	.44**	.45**	.36**	.26**	.24**	.31**	.28**	.23**	.63**	.43**	.50**	.93**	.57**	1	
15. Touchy: age 5	.40**	.36**	.25**	.25**	.19**	.29**	.17**	.19**	.26**	.20**	.20**	.25**	.25**	.22**	1
16. Angry: age 5	.30**	.35**	.24**	.25**	.17**	.23**	.16**	.13**	.25**	.08**	.23**	.24**	.20**	.22**	.54**
17. Get even: age 5	.20**	.29**	.40**	.27**	.21**	.26**	.34**	.25**	.21**	.13**	.18**	.19**	.20**	.20**	.30**
18. Temper: age 5	.28**	.26**	.24**	.48**	.34**	.30**	.22**	.15**	.24**	.07**	.11**	.10**	.17**	.12**	.31**
19. Argues: age 5	.23**	.23**	.18**	.34**	.43**	.31**	.19**	.08**	.26**	0.06	.17**	.12**	.15**	.15**	.21**
20. Defies: age 5	.27**	.29**	.26**	.34**	.36**	.42**	.28**	.22**	.30**	.08**	.22**	.20**	.20**	.21**	.24**
21. Annoys: age 5	.21**	.20**	.28**	.23**	.16**	.26**	.42**	.19**	.14**	.09**	0.04	.11**	.16**	.13**	.30**
22. Blames: age 5	.14**	.17**	.21**	.22**	.16**	.22**	.26**	.37**	.21**	.16**	.19**	.15**	.21**	.16**	.30**
23. CSI generalized anxiety: age 5	.38**	.32**	.26**	.29**	.27**	.31**	.24**	.26**	.59**	.33**	.37**	.38**	.38**	.35**	.40**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
24. DISC-YC generalized anxiety: age 5	.22**	.22**	.18**	.13**	.09*	.15**	.14**	.22**	.39**	.51**	.27**	.40**	.45**	.37**	.26**
25. CSI separation anxiety: age 5	.24**	.23**	.17**	.17**	.17**	.18**	.09**	.16**	.37**	.21**	.53**	.27**	.22**	.25**	.21**
26. CSI major depression: age 5	.34**	.34**	.24**	.17**	.15**	.24**	.19**	.16**	.42**	.34**	.33**	.48**	.40**	.44**	.38**
27. DISC-YC major depression: age 5	.26**	.26**	.22**	.19**	.15**	.23**	.21**	.20**	.42**	.44**	.28**	.45**	.57**	.41**	.29**
28. CSI dysthymia: age 5	.36**	.36**	.25**	.19**	.20**	.24**	.21**	.14**	.42**	.34**	.33**	.45**	.40**	.43**	.41**
29. Touchy: age 6-7	.30**	.29**	.23**	.28**	.18**	.21**	.20**	.15**	.22**	.12**	.17**	.16**	.19**	.16**	.40**
30. Angry: age 6-7	.30**	.37**	.26**	.32**	.25**	.25**	.22**	.14**	.25**	.12**	.15**	.21**	.17**	.21**	.34**
31. Get even: age 6-7	.20**	.21**	.37**	.26**	.20**	.27**	.30**	.29**	.20**	.10**	.19**	.19**	.18**	.18**	.27**
32. Temper: age 6-7	.28**	.30**	.26**	.50**	.36**	.38**	.29**	.20**	.27**	.12**	.14**	.20**	.23**	.20**	.29**
33. Argues: age 6-7	.21**	.23**	.20**	.33**	.41**	.31**	.21**	.12**	.23**	.11**	.17**	.14**	.15**	.16**	.20**
34. Defies: age 6-7	.24**	.28**	.28**	.33**	.30**	.396**	.25**	.21**	.29**	.12**	.20**	.19**	.20**	.18**	.21**
35. Annoys: age 6-7	.19**	.18**	.28**	.23**	.20**	.25**	.38**	.22**	.13**	.07**	.10**	.13**	.13**	.11**	.23**
36. Blames: age 6-7	.21**	.20**	.20**	.26**	.22**	.24**	.25**	.34**	.19**	.17**	.17**	.17**	.19**	.18**	.18**
37. CSI generalized anxiety: age 6-7	.31**	.31**	.26**	.30**	.24**	.33**	.22**	.24**	.52**	.26**	.33**	.33**	.32**	.33**	.31**
38. DISC-YC generalized anxiety: age 6-7	.25**	.26**	.20**	.18**	.15**	.17**	.15**	.26**	.40**	.41**	.38**	.39**	.37**	.36**	.17**
39. CSI separation anxiety: age 6-7	.17**	.19**	.13**	.08**	.04	.11**	.07**	.14**	.30**	.17**	.42**	.23**	.15**	.23**	.16**
40. CSI major depression: age 6-7	.32**	.31**	.28**	.25**	.19**	.26**	.21**	.23**	.42**	.29**	.30**	.44**	.35**	.39**	.32**
41. DISC-YC major depression: age 6-7	.25**	.26**	.24**	.21**	.119**	.24**	.23**	.24**	.41**	.34**	.26**	.43**	.53**	.39**	.20**
42. CSI dysthymia: age 6-7	.32**	.32**	.30**	.26**	.20**	.27**	.20**	.21**	.42**	.28**	.30**	.42**	.34**	.41**	.32**

	19	16	17	18	20	21	22	23	24	25	26	27	28	29	30
16. Angry: age 5		1													
17. Get even: age 5		.38**	1												
18. Temper: age 5		.35**	.27**	1											
19. Argues: age 5	1	.32**	.25**	.57**											
20. Defies: age 5	.51**	.28**	.35**	.43**	1										

	19	16	17	18	20	21	22	23	24	25	26	27	28	29	30
21. Annoys: age 5	.26**	.30**	.45**	.30**	.34**	1									
22. Blames: age 5	.20**	.33*	.35**	.23**	.27**	.34**	1								
23. CSI generalized anxiety: age 5	.22**	.37**	.25**	.34**	.25**	.18**	.26**	1							
24. DISC-YC generalized anxiety: age 5	0.05	.18**	.11**	.14**	.15**	0.06	0.18	.48**	1						
25. CSI separation anxiety: age 5	.10**	.27**	.14**	.18**	.13**	0.006	.17**	.50**	.30**	1					
26. CSI major depression: age 5	.15**	.39**	.22**	.20**	.21**	.21**	.20**	.56**	.43**	.35**	1				
27. DISC-YC major depression: age 5	.10**	.29**	.17**	.17**	.17**	.17**	.22**	.43**	.57**	.22**	.55**	1			
28. CSI dysthymia: age 5	.17**	.43**	.23**	.25**	.20**	.20**	.22**	.57**	.45**	.54**	.91**	.54**	1		
29. Touchy: age 6-7	.20*	.34**	.26**	.25**	.23**	.22**	.21**	.26**	.15**	.14**	.18**	.16**	.22**	1	
30. Angry: age 6-7	.25**	.39**	.27**	.29**	.28**	.24**	.20**	.37**	.18**	.27**	.39**	.29**	.43**	.34**	1
31. Get even: age 6-7	.22**	.28**	.49**	.24**	.29**	.34**	.25**	.25**	.11**	.14**	.22**	.17**	.23**	.30**	.38**
32. Temper: age 6-7	.41**	.27**	.32**	.50**	.37**	.32**	.24**	.27**	.11**	.11**	.18**	.17**	.21**	.40**	.41**
33. Argues: age 6-7	.53**	.22**	.24**	.40**	.38**	.22**	.17**	.22**	0.02	.10**	.15**	.10**	.17**	.32**	.32**
34. Defies: age 6-7	.36**	.25**	.34**	.33**	.51**	.25**	.23**	.25**	.07*	.13**	.21**	.17**	.20**	.32**	.34**
35. Annoys: age 6-7	.24**	.16**	.34**	.22**	.28**	.49**	.23**	.14**	0.02	0.04	.08**	.08*	.09**	.29**	.34**
36. Blames: age 6-7	.24**	.15**	.30**	.26**	.25**	.24**	.40**	.22**	.13**	.16**	.08*	.12**	.12**	.28**	.24**
37. CSI generalized anxiety: age 6-7	.32**	.29**	.20**	.27**	.37**	.17**	.20**	.43**	.35**	.34**	.40**	.32**	.40**	.38**	.33**
38. DISC-YC generalized anxiety: age 6-7	.14**	.20**	.12**	.16**	.18**	0.04	.13**	.43**	.55**	.36**	.36**	.36**	.39**	.22**	.17**
39. CSI separation anxiety: age 6-7	.07*	.14**	.07*	.09*	.11**	0.02	.11**	.32**	.24**	.58**	.25**	.19**	.24**	.17**	.18**
40. CSI major depression: age 6-7	.27**	.29**	.20**	.17**	.30**	.13**	.15**	.40**	.33**	.32*	.46**	.35**	.47**	.343**	.40**
41. DISC-YC major depression: age 6-7	.16**	.22**	.20**	.09**	.26**	.13**	.21**	.32**	.39**	.16**	.35**	.48**	.38**	.33**	.28**
42. CSI dysthymia: age 6-7	.29**	.30**	.20**	.19**	.30**	.14**	.15**	.36**	.32**	.31**	.43**	.33**	.46**	.37**	.42**

	31	32	33	34	35	36	37	38	39	40	41	42
31. Get even: age 6-7	1											
32. Temper: age 6-7	.40**	1										
33. Argues: age 6-7	.34**	.56**	1									

	31	32	33	34	35	36	37	38	39	40	41	42
34. Defies: age 6–7	.42**	.51**	.55**	1								
35. Annoys: age 6–7	.43**	.36**	.39**	.40**	1							
36. Blames: age 6–7	.37**	.34**	.31**	.33**	.39**	1						
37. CSI generalized anxiety: age 6–7	.28**	.38**	.32**	.37**	.19**	.30**	1					
38. DISC-YC generalized anxiety: age 6–7	.14**	.18**	.14**	.18**	0.05	.18**	.48**	1				
39. CSI separation anxiety: age 6–7	.12**	.09**	.07*	.11**	0.04	.13**	.45**	.37**	1			
40. CSI major depression: age 6–7	.32**	.33**	.27**	.30**	.23**	.22**	.48**	.51**	.26**	1		
41. DISC-YC major depression: age 6–7	.24**	.25**	.16**	.26**	.17**	.21**	.48**	.51**	.26**	.52**	1	
42. CSI dysthymia: age 6–7	.32**	.33**	.29**	.30**	.22**	.22**	.61**	.47**	.38**	.94**	.52**	1

Note:

* P < .05;

** P < .01