

Factor Analytic Structure and Cross-Informant Agreement for Childhood Disruptive Behaviour Scale

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Attention-deficit/hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD) co-occur frequently. However, the comorbidity of these two childhood disruptive behavior disorders has not been satisfactorily explained at either a structural or etiological level. The current study evaluates and compares three distinct models to improve understanding of the structural relationship between ADHD and ODD using Urdu translation of parent and teacher versions of Disruptive Behavior Disorders Rating Scale (DBDRS). Participants were 201 teachers and 144 parents of school children who were given parent and teacher versions of the DBDRS. The two factor model obtained in the present study combining the hyperactivity and ODD as single factor, while keeping the inattentive type as a separate factor has shown to be the best fit for parent version in comparison to other suggested models. This may help explain common patterns of comorbidity between ADHD and ODD and also supports the ongoing debate that ADHD-Predominantly Inattentive type must be considered a distinct disorder and not as subtype of ADHD.

Keywords. Hyperactivity-impulsivity, inattention, disruptive behavior disorders, Pakistani sample

The criteria for defining Attention-deficit/hyperactivity disorder (ADHD) and associated disruptive behavior like oppositional defiant behaviors have undergone significant reconstruction during last four decades to its present conceptualization in the Diagnostic and Statistical Manual for Mental Disorders-IV (DSM IV; American Psychiatric Association [APA], 1994) and DSM-V (APA, 2013). The

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diagnostic criteria for ADHD and other childhood disruptive behavior disorders posited in the earliest versions of the DSM were only partly informed or influenced by empirical research (Bird, 1994; Millon, 1991). However, later on numerous factor-analytic studies examining the nature and structure of childhood externalizing disorders have been published (for reviews see Hinshaw, 1987; Lahey et al., 1994; Lahey et al., 2008). These research findings were considered in developing the most recent update of the DSM, and have significantly influenced current conceptualizations of the linkages between various dimensions of ADHD. Although, the primary purpose of these papers was to test or review the competing ADHD models which gives three conceptualizations of ADHD found in the last three versions of the DSM that is DSM-III, DSM-III-R (APA, 1987), and DSM-IV (APA, 1994) which continues to be the same in DSM-V (APA, 2013). Beginning with DSM-III, ADHD was conceptualized as having three dimensions: Attention problems, impulsivity, and hyperactivity. In the DSM-III-R, however, the dimensions were believed to correlate so highly that ADHD was defined as an unidimensional construct. Subsequently, critics argued that this single-factor conceptualization of ADHD could increase rates of diagnostic errors. For example, Atkins, Pelham, and Licht (1985, 1989) argued that a unidimensional symptom list might increase the false-positive rate for ADHD diagnoses. In light of such criticism, it has been argued that there may be some utility in moving back toward a multidimensional model of ADHD. Based on many of the factor-analytic studies and other considerations, the DSM-IV (APA, 1994) was revised to include the two-dimensional structure of Hyperactivity-impulsivity and Inattention. The debate has implications for both theory and assessment, however, the general consensus of researchers and clinicians remains around the two dimensional approach of ADHD.

The other important debate is around whether oppositional-defiant disorder (ODD) symptoms should be considered as a part of Attention-deficit/hyperactivity disorder (ADHD) diagnosis given the significant comorbidity among the disorders. This point involves another area of debate about extent of relationship between ADHD and the remaining disruptive behavior disorders, that is, whether a single dimension of behavioral undercontrol underlies these disorders. ADHD and ODD are common childhood disruptive behavior (DB) disorders that co-occur in nearly 50% of diagnosed cases (Angold, Costello, & Erkanli, 1999; Jensen, Martin, & Cantwell, 1997; Nock, Kazdin, Hiripi, & Kessler, 2007). As defined by the DSM-IV-TR (APA, 2000) and DSM-V (APA, 2013), ADHD is characterized by behavioral symptoms of inattention and hyperactivity-impulsivity.

ODD is characterized by negativistic interactions with others, including behavioral symptoms of opposition and defiance (APA, 2000, 2013). Whereas, the initial partial distinction between conduct problems/aggression and hyperactivity/ inattention was established by seminal reviews over 2 decades ago (Hinshaw, 1987), the relations between ODD and ADHD remain poorly described, and the reason for their extremely high co-occurrence is still debated (Connor & Doerfler, 2008; Jensen et al., 1997). Clarifying the relation between ADHD and ODD is important for improving specificity of diagnostic assessment and treatment protocols and has particular relevance for improving developmental outcomes as evidence also suggest that symptoms of hyperactivity later on lead to oppositional defiant disorder (Burns & Walsh, 2002). There is an ongoing debate among researchers and clinicians to consider ODD as a subtype of ADHD (e.g., Ghanizadeh, 2011; Poulton, 2010). Clarifying this relationship is also important because children with ADHD and ODD are often more impaired than children with either disorder alone (Biederman et al., 2008; Connor & Doerfler, 2008; Gadow & Nolan, 2002). Prior factor analytic studies, using confirmatory factor analysis, have also found out that by postulating a three factor model in which inattention factor existed as a separate factor and for the second factor hyperactivity/impulsivity, impulsivity items were allowed to cross load on both ODD and hyperactivity/impulsivity scales; a new factor model was obtained which provided for a better fit than the classic three factor model based on the DSM-IV conceptualization (Burns, Boe, Walsh, Sommers-Flanagan, & Teegarden, 2001; Pillow, Pelham, Hoza, Molina, & Stultz, 1998).

Linked with the same debate some researchers also argue that ADHD-predominantly inattentive type should be considered as a distinct disorder (Barkley, 2001, 2006; Diamond, 2005; Hartman, Willcutt, Rhee, & Pennington, 2004; Milich, Balentine, & Lynam, 2001). The debate also surrounds the heterogeneous nature of inattention showing that predominantly inattentive type of ADHD is characterized by hypoactivity, lethargy, daydreaming, and fewer externalizing symptoms (Milich et al., 2001). These children usually have more internalizing symptoms such as unhappiness, anxiety, depression, social withdrawal, and more information processing errors than ADHD-Combined type (ADHD-C; Carlson & Mann, 2002; Milich et al., 2001). Laboratory studies also suggest that these children exhibit significant errors with information processing, focused attention, and memory retrieval that are not manifest in ADHD-C (Milich et al., 2001).

However, before concluding that hyperactivity-impulsivity and ODD items load onto the same factor, it is important to consider the possibility that such factorially complex solutions may result as a statistical artifact. One potential solution to this problem is to use confirmatory factor analysis (CFA), as opposed to exploratory, data-driven strategies, to determine whether these cross-loadings represent significant theoretical issues regarding the overlap between disorders, or constitute analytical artifacts produced by forcing orthogonality between highly correlated constructs. A key advantage of using CFA is that CFA can be used to explicitly compare alternative, theoretically plausible models to decide which model best represents the interrelationships among the items (i.e., symptoms).

In recent years, broad band assessment scales like CBCL (Child Behavior Checklist) and Strengths and Difficulties Questionnaires (SDQ) that assess behavioral and emotional problems of children were translated and adapted for Pakistani population (Hussein, 2010; Samad, Hollis, Prince, & Goodman, 2005; Syed, Hussein, & Azam, 2009). Moreover, Tariq and Hanif (2007) designed a scale for children and adolescents that evaluate those behaviors that are difficult. This instrument is valid and reliable. Loona and Kamal (2011) also translated and adapted disruptive behavior disorder rating scale developed by Pelham, Gnagy, Greenslade, and Milich (1992). However the theoretical underpinnings of these DSM based diagnostic categories along with the ongoing debate of diagnostic controversies related to the categorization have not been addressed with regard to Pakistani population. The present study provides the first confirmatory analysis from Pakistani population based explicitly on the most heated debate of conceptualization of inattentive and hyperactive dimension of ADHD and various theoretical models related to possible diagnostic overlap of hyperactivity, impulsivity and ODD. The purpose is mainly to see which suggested models have a greater theoretical relevance for Pakistani population. As most of the evidence generated in this area comes from western studies, the study would enhance our understanding of structural overlap of ADHD and ODD symptoms for Pakistani population. Furthermore, the current study will also look for the correlation of teacher ratings and parent ratings for these disruptive behaviors disorders (DBD); this is done for validity check and cross-informant agreement for the symptom ratings. Since the DSM-V (APA, 2013) and International Classification of Diseases (ICD-10; World Health Organization, 1992) requires morbidity to be present in more than one setting to warrant the diagnosis of DBD, thus necessitating the need for including

multiple informants from more than one setting such as school and home to insure the presence or absence of the disorder.

Method

Sample

Parents and teachers of 450 participants from school settings were selected for the study, 201 complete ratings of Disruptive Behavior Disorders-Teacher Version (DBDRS-TV) were obtained, and 144 complete ratings were obtained for Disruptive Behavior Disorders- Parent Version (DBDRS-PV). Based upon the recommendations with regard to minimum sample size, Mundfrom Shaw, & Tian (2005) suggest that variable to factors (p/f) ratio should be taken into account while doing power estimation for factor analyses. They have further suggested that the ratios of variables to factors should be at least 7:1. Based on their paper, 75-100 should be the minimum sample size for 3 factors model, while around 60 is mentioned for 2 factors with 7 or more variables. Present study meets the mentioned criteria.

Inclusion criteria. The inclusion criteria for parents and teachers of children between the ages 5 and 12 years with no prior history of any neurological impairments seizure history, head injury with a loss of consciousness, or other major medical conditions, history of intellectual disability or autism. Information about these conditions was collected from parents by using a specific set of questions.

Materials

Child and Family Information Form helped in obtaining basic information about child's name, date of birth, school address, parents' names and places of employment, their marital status, number of siblings of the child, his/her physician name and address. Questions with regard to prior history of any neurological impairments seizure history, head injury with a loss of consciousness, other major medical conditions, and history of intellectual disability autism were also included.

Disruptive Behavior Disorder Rating Scale-Parent and Teacher Versions (DBDRS; Barkley, 1997, 2006) was used as an instrument for the research. The Urdu translation of these scales was

used in the study (Malik, Rooney, Chronis-Tuscano, & Tariq, 2013). Sub-scales/factors of Inattention symptoms of ADHD (9 items), Hyperactivity-Impulsivity symptoms of ADHD (9 items), and symptoms of ODD (8 items) were assessed. DBDRS is a rating scale that has four response choices beginning from 0 (*never or rarely*), 1 (*sometimes*), 2 (*often*), and ends at 3 (*very often*). For screening purpose, it follows the criteria of DSM-IV-TR (APA, 2000) and DSM-V (APA, 2013). For ODD symptoms answers of those items are counted which are scored either 2 or 3 as 1 and 0 are considered normal, and if 2 or 3 score is obtained for more than 4 items then it may indicate the presence of the disorder. Similarly, for Inattention and Hyperactivity-Impulsivity symptoms those item scores are considered that are encircled 2 or 3, and if this score is obtained for more than six items for either of the type then it may indicate presence of that type of ADHD, respectively.

Procedure

The sample was collected from private schools of Rawalpindi city of Pakistan. Initially, the heads of school administration were contacted in person in order to get their permission. All children between the given age range were contacted and the consent form was sent to their parents for informed consent. After taking their permission, Parent Version of DBDRS (DBDRS-PV) was sent to their homes. Also, all teachers of these schools working with this age group were contacted. Total 201 forms of DBDRS-Teacher Version were collected after teacher's willingness for participation in the study.

Results

A series of confirmatory factor analyses were estimated by using AMOS software package. Three factor model based on Inattention (ATT), Hyperactivity (HYP), and ODD; two factor based on ADHD and ODD, and two factor model based on ODD/HYP and ATT model (HYP-ODD & ATT), were estimated sequentially. Goodness of fit was evaluated with chi-square (χ^2) fit statistics, root-mean-square error of approximation (RMSEA), and comparative fit index (CFI). Generally nonsignificant chi-square (χ^2), RMSEA equal to or below .05, and CFI above .9 indicates reasonable fit (Kline, 2005).

Three-factor of ADHD Inattention, Hyperactivity–impulsivity, and ODD Model (ATT, HYP, & ODD)

First, a three-factor model was estimated in which inattention, hyperactivity–impulsivity, and oppositional-defiance symptoms were hypothesized to load onto three separate factors. In this model, it was assumed that the three correlated DBD symptom domains best captured the variance of individual DB symptoms. This model exhibited relatively poor fit as indicated by values of chi-square statistic, RMSEA, and CFI (Table 1).

Two-factor ADHD and ODD Model (ADHD & ODD)

Second, a two factor model was estimated in which all ADHD symptoms were hypothesized to load onto a single factor that is ADHD and all ODD symptoms were hypothesized to load onto another second factor. Shown in Table 1 this model exhibited a relatively poor fit as indicated by large significant value of chi-square and an RMSEA value around .09.

Two-factor Hyperactivity-ODD and Inattention Model (HYP-ODD & ATT)

Third, a two-factor Inattention and Hyperactivity-ODD model was estimated in which being externalizing in nature symptoms of hyperactivity-Impulsivity and ODD were hypothesized to load onto a single factor and all Inattention symptoms were hypothesized to load onto a second factor.

Shown in Table 1, this model exhibited the best fit compared to the other models. Although, the chi-square value remained significant it was much lower and RMSEA value was .05 indicating close fit to the data for parent version. RMSEA value for teacher's version in this model was .09 which would indicate a mediocre fit given that RMSEA values between .08 and .1 indicate an acceptable model but more recent studies have found RMSEA values below .07 as acceptable and this is the preponderant view (Hooper, Coughlan, & Mullen, 2008). On the contrary comparative fit index (CFI) value for teacher's version was found to be .90 which indicates an acceptable model (Kline, 2005).

All three-factor and two factor models were conducted separately for parent and teacher ratings. The results of teacher ratings also

showed almost same pattern of results as depicted by parent ratings (see Figure 1 & 2).

Table 1

Confirmatory Factor Analysis Fit Statistics for Parent and Teacher Symptom Ratings

| Model | | χ^2 | df | CFI | RMSEA |
|----------------|----------------------|------------|-----|-----|-------|
| Parent Rating | | | | | |
| I | Three-factor model | 468.03*** | 283 | .90 | .09 |
| II | Two-factor Model (1) | 811.70*** | 298 | .71 | .09 |
| III | Two-factor Model (2) | 403.82*** | 273 | .93 | .05 |
| Teacher Rating | | | | | |
| I | Three-factor model | 1003.61*** | 298 | .85 | .11 |
| II | Two-factor model (1) | 1385.23*** | 298 | .77 | .14 |
| III | Two-factor model (2) | 774.06*** | 296 | .90 | .09 |

*** $p < .001$.

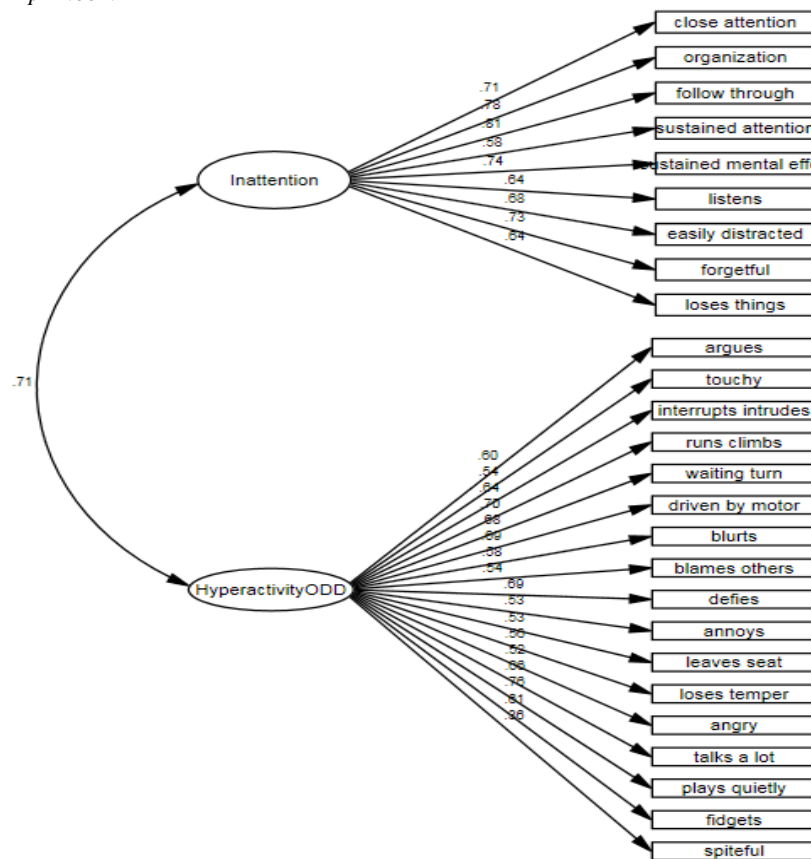


Figure 1. Two-factor HYP-ODD and Inattention model (HYP-ODD & ATT) for DBDRS-PV

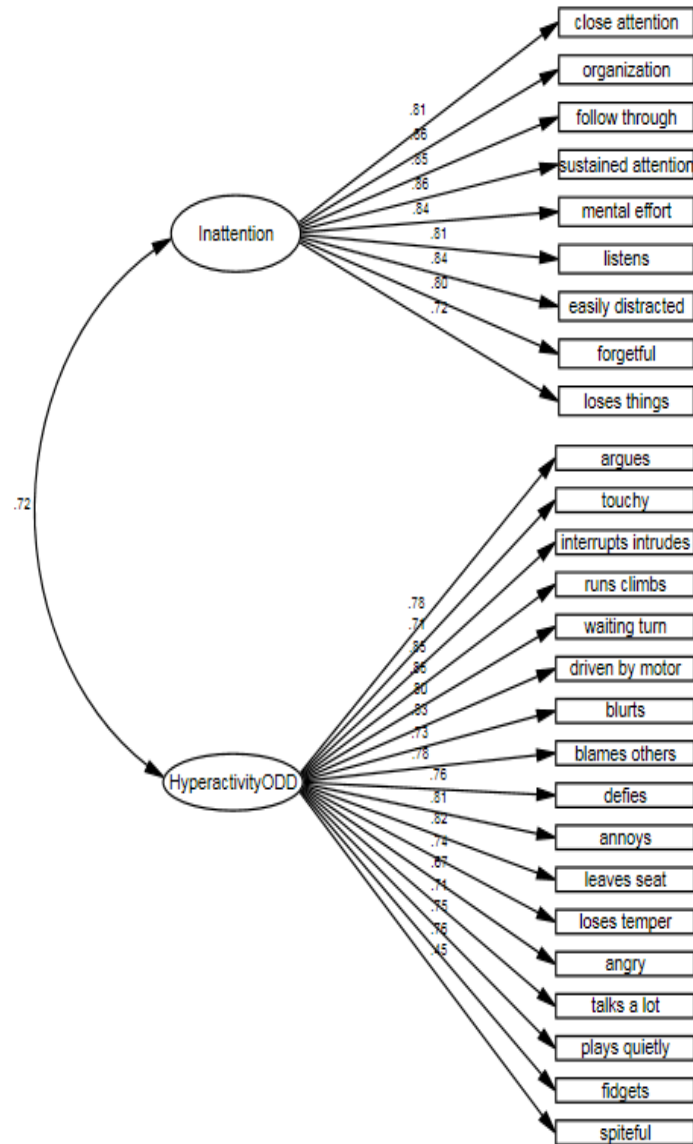


Figure 2. Two-factor Hyp-ODD and Inattention model (HYP-ODD & ATT) for DBDRS-TV

Internal consistency of the entire DBDRS-PV and DBDRS-TV scale was assessed using Cronbach's alpha.

Table 2
Internal consistency of the DBDRS-PV (N=144) and DBDRS-TV (N=201) total scale and factors of the scales

| Cronbach's Alphas | Three factor solution | | | Two factor solution | | Two factor solution | | Total scale |
|-------------------|-----------------------|-----|-----|---------------------|-----|---------------------|-----|-------------|
| | ATT | HYP | ODD | ATT/HYP | ODD | ATT/HYP | ODD | |
| DBDRS-PV | .90 | .89 | .82 | .91 | .80 | .91 | .90 | .92 |
| DBDRS-TV | .95 | .95 | .91 | .92 | .92 | .96 | .95 | .97 |

Note. ATT = Inattention; HYP = Hyperactivity-Impulsivity; ODD = Oppositional Defiance Disorder.

Cronbach's alpha for DBDRS-PV and for DBDRS-TV suggests an excellent internal consistency for both of these versions. Furthermore, Cronbach's alpha was computed for each of the factor model suggested in Table 2. The internal consistency for two factor model (HYP-ODD & ATT) is slightly better than for the other models (Table 2).

To look for the cross-informant agreement, correlation matrix was computed. Significant correlation for parent ($n = 144$) and teacher ($n = 201$) ratings is observed for all of the subscales mentioned (see Table 3).

Table 3
Pearson Correlation Matrix for DBDRS-PV (N=144) and DBDRS-TV (N=201)

| Variables | 1 | 2 | 3 | 4 |
|---------------------|-------|------|-------|---|
| 1. DBDRS-PV-ATT | - | | | |
| 2. DBDRS-PV-HYP/ODD | .64** | - | | |
| 3. DBDRS-TV-ATT | .24** | .10 | - | |
| 4. DBDRS-TV-HYP/ODD | .17* | .15* | .68** | - |

Note. ATT = Inattention; HYP = Hyperactivity-Impulsivity; ODD = Oppositional Defiance Disorder.

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

Discussion

In order to elucidate the structure of common childhood disruptive behaviors, a series of confirmatory factor analyses was conducted for parent and teacher rated ADHD and ODD symptoms. Three factor, two factor models were compared based on theoretical

underpinnings of the constructs and their relevance for Pakistani population was observed. A two factor model keeping the Hyperactivity-ODD symptoms as single factor and Inattention as a separate factor provided the best fit to the data suggesting that the dimension of Hyperactivity-Impulsivity combined with ODD captures a unique individual variance. Although significant, the smallest chi square value is observed in 2 factor model (2) as compared to the rest of the two models along with the CFI value around .90 (Hooper et al., 2008). Thus 2 factor model (2) seems a better fit as compared to rest of the two models for teacher's version (Table 1). This supports the existing ongoing debate and evidence in favor of conceptualizing Hyperactivity-Impulsivity and ODD together. Research suggests that symptoms of hyperactivity later on lead to oppositional defiant behavior (Burns & Walsh, 2002).

By postulating a three factor model some prior factor analytic studies have also found out that impulsivity items loaded on both ODD and HYP subscales and inattention existed as a separate factor. This provided to be a significantly better model than the DSM based models (Burns et al., 2001; Pillow et al., 1998). These findings are also in accord with the empirical findings and suggestions of researchers that ADHD classification should broaden to include ODD as subtype of ADHD (e.g., Ghanizadeh, 2011; Poulton, 2010).

Cross-informant agreement was further assessed and parent and teacher ratings of DBDRS were correlated to investigate the agreement between both ratings on subscale level. Significant correlations were obtained for all three inattention, hyperactivity/impulsivity and oppositional defiance subscales. These findings are consistent with the findings by Antrop, Roeyers, Oosterlaan, & Oost (2002) who also investigated agreement between parents and teachers ratings of DBDRS. Antrop et al. (2002) found significant correlations on ODD, and CD scale, but inattention scale and hyperactivity/impulsivity scale did not correlate significantly. On the contrary, the present study found significant correlations on the scales of inattention, hyperactivity/impulsivity, and oppositional defiance.

Moreover, Loona and Kamal (2011) also assessed correlations among subscales of DBDRS in their study and found positive and significant correlations among all the subscales. Moreover correlation among the new factors HYP/ODD of DBDRS-TV and HYP/ODD of DBDRS-PV was also explored and it also turned out to be positive and significant.

Conclusion and Implications

The present study was specifically aimed at exploring the factor structure of DBDRS including ADHD and ODD using confirmatory factor analysis on Pakistani population. The study is the stepping stone towards the heated debate with regards to various models suggested for classification of disruptive behaviors, addressing the diagnostic controversies for childhood disruptive behaviors especially, with Pakistani sample. There were some thought provoking outcomes, whereby the best model was obtained when hyperactivity/ impulsivity scale was combined with ODD as a single factor and inattention as a separate factor. This is consistent with the notion that ADHD predominantly inattentive type be considered as a distinct disorder (Barkley, 2001, 2006; Diamond, 2005; Hartman et al., 2004; Milich et al., 2001) as well as the suggestion that ADHD classification should broaden to include ODD owing to their high comorbidity (e.g., Ghanizadeh, 2011; Poulton, 2010).

The two factor model obtained in this study has opened doors for future research focussing on clinical settings and samples. One important future direction would be to validate this model with clinical correlates that are associated generally to disruptive behaviors or those which are specific to inattention, hyperactivity, and ODD. For example, children which are hyperactive and oppositional are reported to have higher levels of negative emotions (Martel & Nigg, 2006). While, poor behavioral inhibition is specific to children who are hyperactive, but not for those who have problems of inattention (Barkley, 2006). Thus, future work might attempt to validate the constructs in association with other relevant clinical correlates including information processing, executive functioning, and parent-child interactions. Finally, the current model could be examined in relation to internalizing symptoms particularly mood problems and anxiety which cooccur more frequently with symptoms of inattention.

The supported two factor model in the current study is limited by the fact that conduct disorder symptoms were not included because of the relatively young age of the children included in this study, however, extending this modeling approach to include conduct disorder will be an important next step for future work. The two factor model of ADHD should be further examined with the clinically referred samples and larger samples to assess generalizability. Moreover, the current study is cross sectional and could not provide direct evidence for developmental changes in symptoms expression. This is an area that could be examined with more sophisticated longitudinal designs.

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