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Testing Multiple Conceptualizations of Oppositional Defiant Disorder in Youth

Thomas H. Ollendick¹, Jordan A. Booker², Sarah Ryan¹, Ross W. Greene¹

Thomas H. Ollendick: tho@vt.edu; Jordan A. Booker: Jordan.Booker@emory.edu, jordan.booker@vt.edu; Sarah Ryan: sryan42@vt.edu; Ross W. Greene: drrossgreene@gmail.com

¹Child Study Center, Department of Psychology, Virginia Tech, 460 Turner St, Collegiate Square, Blacksburg, VA 24061

²Department of Psychology, Emory University, 36 Eagle Row, Atlanta, GA 30322

Abstract

Introduction—Recent theories conceptualize Oppositional Defiant Disorder (ODD) as a two-dimensional construct with angry/irritable (i.e., affective) and argumentative/defiant (i.e., behavioral) components. This view has been supported by studies of non-referred youth (Burke et al., 2014; Lavigne et al., 2015) but not yet examined in clinic-referred youth.

Objective—In a reanalysis of data regarding children who received one of two psychosocial ODD treatments (Ollendick et al., 2016), we examined multiple conceptualizations of ODD; whether children showed improvements across these ODD dimensions; and whether main and joint effects of ODD dimension improvement predicted clinical outcome.

Methods—One-hundred thirty-four clinic-referred youth (ages 7 – 14 years, 38% female, 84% white) who met DSM-IV criteria for ODD received one of two psychosocial treatments. At pre-treatment, one-week follow-up, and six-month follow-up, mothers reported child aggression and conduct problems, clinicians reported global clinical impairment and clinical improvement, and ODD symptom counts were collected from a semi-structured diagnostic interview with mothers. Baseline ODD symptom were used to test previously supported multi-dimensional models (e.g., Burke et al., 2014).

Results—One- and two-factor conceptualizations were supported; however, the two-factor solution was preferred. With this solution, each dimension significantly and similarly improved across treatment conditions. Improvements across affective and behavioral ODD factors also had significant effects on clinician- and mother-reported clinical outcomes.

Please address correspondence to Thomas H. Ollendick, Child Study Center, Department of Psychology, Virginia Tech, Blacksburg, VA 24061-0436, or tho@vt.edu.

Compliance with Ethical Standards

Ethical approval. All procedures performed in the current study were in accordance with the ethical standards of the institutional review board at the site of study and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent. For each participating family, consent was obtained from the participating child's caregiver(s) and assent was obtained from the participating child.

Public Health Significance Statement. The current study provides support for a re-conceptualization of ODD as a bi-dimensional construct, using a clinical sample of youth. Both dimensions of ODD showed improvement following completion of a randomly assigned ODD intervention (PMT; CPS).

Conflict of Interest: The remaining authors have no conflicts of interest concerning this study.

Conclusions—The current findings provide empirical support for the ongoing study of multi-dimensional ODD conceptualizations in clinic-referred youth.

Keywords

oppositional defiant disorder; angry/irritable mood; argumentative/defiant behavior; randomized control trial; children and adolescents

Introduction

Oppositional-defiant disorder (ODD) is a commonly diagnosed childhood psychiatric condition that is characterized by a pattern of negativistic, hostile, and defiant behavior (American Psychiatric Association, 1994, 2013; Loeber, Burke, Lahey, Winters, & Zera, 2001; Murrihy, Kidman, & Ollendick, 2010) that can impact social, emotional, and academic performance during childhood and persist into adulthood if left untreated (Burke, Rowe, & Boylan, 2014). Further, ODD is frequently comorbid with and a precursor to other externalizing disorders (e.g., conduct disorder), internalizing (e.g., anxiety and depression) disorders, substance abuse, and school drop-out (Burke, Loeber, Lahey, & Rathouz, 2005; Loeber et al., 2001; Rowe, Maughan, & Eley, 2006). Although there is strong support linking ODD with problems in current functioning and long-term adjustment, researchers have questioned whether the unidimensional structure of ODD symptoms put forth in the DSM-IV (APA, 1994) best accounted for these associations or whether ODD would be more accurately characterized by multiple dimensions (Burke, 2012; Burke, Boylan, et al., 2014; Drabick & Gadow, 2012).

Multiple two- (Burke & Loeber, 2010; Burke et al., 2005) and three-dimension (Aebi et al., 2010; Burke, Hipwell, Loeber, 2010; Stringaris & Goodman, 2009a) structures of ODD have recently been proposed. These structures have slight differences in the placement of symptom items, but share an affective dimension and a behavioral dimension. The three-dimension structures have also proposed a hurtful or antagonistic dimension composing spitefulness (Stringaris & Goodman, 2009a) and annoying others (Aebi et al., 2010). The DSM-5 (APA, 2013) recently affirmed the three-factor re-conceptualization, describing three of the eight ODD symptoms as indicators of angry/irritable mood and four of the five remaining symptoms as indicators of argumentative/defiant behavior. The eighth symptom, vindictiveness, is not included in either of these two dimensions and is designated as a stand-alone symptom. In two-factor models, vindictiveness is generally included in the argumentative/defiant behavior dimension. Recently, support for two-dimensional models over one-dimensional and three-dimensional models has been found (Herzoff & Tackett, 2016; Lavigne, Bryant, Hopkins, & Gouze, 2015; Burke, Boylan, et al., 2014).

Across community samples of preschool children (e.g., Ezpeleta, Granero, de la Osa, Penelo, & Doménech, 2012), middle-age children (e.g., Burke et al., 2010; Lavigne et al., 2015; Herzhoff & Tackett, 2016; Rowe et al., 2010), and adolescents (e.g., Aebi et al., 2010; Rowe et al., 2010), results support distinct affective and behavioral dimensions of ODD. Most studies used parent and child reports to test these conceptualizations (e.g., Aebi et al., 2010; Burke et al., 2010; Lavigne et al., 2015); however, support has also been found using

teacher reports (e.g., Stringaris & Goodman, 2009a, b) and semi-structured clinical interviews (e.g., Burke, 2012; Ezpeleta et al., 2012; Herzoff & Tackett, 2016; Kolko & Pardini, 2010; Lavigne et al., 2015).

Tests of measurement in variance have shown minimal model differences based on age and gender for younger (Lavigne et al., 2015) and older children (Herzoff & Tackett, 2016), suggesting that items for ODD dimensions show similar meaning and appear to measure the same aspects of ODD across children within similar reporters. However, variance has been shown between parent- and teacher-reports for preschoolers (Ezpeleta & Penelo, 2015), suggesting that the *source* of symptom reports may be important with younger children.

The two most widely supported dimensions of ODD have been hypothesized to have distinct implications for children's long-term clinical outcomes, with the affective dimension predicting internalizing symptoms and the behavioral dimension predicting externalizing symptoms. These associations have been supported in several studies (Burke, 2012; Burke & Loeber, 2010; Drabick & Gadow, 2012; Ezpeleta et al., 2012; Kolko & Pardini, 2010; Rowe, Costello, Angold, Copeland, & Maughan, 2010; Stringaris, Cohen, Pine, & Leibenluft, 2009; Stringaris & Goodman, 2009a,b; Stringaris, Zavos, Leibenluft, Maughan, & Eley, 2012). However, there have been exceptions to these trends. The angry/irritable dimension has also predicted externalizing problems of conduct disorder in community samples of children (see Burke, et al., 2010; Stringaris & Goodman, 2009b). Moreover, this dimension has not always shown associations with internalizing symptoms in children with comorbid diagnoses of ADHD and ODD (Mick, Spencer, Wozniak, & Biederman, 2005). Nonetheless, as noted by Stringaris and Goodman (2009b), the broader pattern of findings help inform the understanding of the diverse etiological pathways to this disorder and its subsequent treatment.

To date, studies have examined multidimensional and bifactor conceptualizations of ODD primarily in large community samples of children (e.g., Burke, Boylan, et al., 2014) but rarely in clinic-referred samples of children receiving treatment for ODD. Further, though most ODD interventions address both affect- and behavior-related symptoms, no known studies have addressed the pattern of change within each dimension and the impact of dimension-specific changes on clinical outcomes. We sought to address these gaps. Although family-based ODD interventions have been successful in addressing disruptive behaviors among many children and adolescents (Kazdin, 1997), a sizeable proportion of children do not improve beyond clinical severity of symptoms or are nonresponsive to treatment (see Greene & Doyle, 1999). In addition to the consideration of child (e.g., comorbid diagnoses) and environmental (e.g., family dysfunction) factors that can contribute to multiple pathways of ODD and impact the likelihood of treatment response (Burke, Loeber, & Birmaher, 2002; Greene & Doyle, 1999; Kazdin, 1995), we are interested in better understanding the implications of different ODD symptom displays in predicting behavioral and emotional outcomes for treatment-seeking children. Hence, we addressed the existence and implications of multiple ODD factors using the four steps outlined below.

First, using a clinical sample, we aimed to test and confirm the two-dimensional nature of ODD, as supported in community samples (Burke, Boylan, et al., 2014). That is, we tested

for affective and behavioral dimensions of ODD in this sample. These configurations were based on structures from Stringaris and Goodman (2009a) and were widely supported in Burke and colleagues' (2014) analyses.

Second, we aimed to test changes in each dimension of ODD. In the original study, we addressed changes across the eight symptoms—not for the affective and behavioral dimensions separately—and randomly assigned children to either Parent Management Training (PMT; Barkley, 1997) or Collaborative & Proactive Solutions (CPS; Greene, 1998, 2010). PMT is an evidence-based treatment that is frequently referred to as the “gold standard” of treatment for youth with ODD (Brestan & Eyberg, 1998; Eyberg, Nelson, & Boggs, 2008; Murrihy et al., 2010; Ollendick & King, 2012). CPS, an emerging evidence-based treatment, emphasizes lagging skills as the primary factor contributing to oppositional behavior and encourages the collaborative and proactive resolution of the problems causing that behavior (see Greene, 2010; Greene & Doyle, 1999). Since both treatments in the original study demonstrated similar efficacy across the total number of symptoms (Ollendick et al., 2016), we expected comparably robust reductions for each ODD dimension across treatments.

Third, we aimed to test the main effects of change in ODD dimensions on clinical outcomes. Past studies have shown the affective dimension of ODD to be associated with internalizing symptoms and the behavioral dimension of ODD to be associated with externalizing symptoms. We expected these associations to be found in the current study as well. We expected greater dimension specificity with mother reports of aggression and conduct problems, such that changes in angry/irritable symptoms would be more closely associated with improvement in aggressive behaviors and reductions in argumentative/defiant behavior symptom would be more closely associated with improvement in conduct problems. Across multiple manifestations (e.g., physical fighting, verbal aggression), aggression in children typically involves negative emotion regulation and greater reactivity (Loeber & Hay, 1997). Hence, we expected these reactive difficulties would be more closely aligned with the irritability dimension of ODD, which involves greater emotional lability and negativity. Alternatively, conduct problems typically involve effortful and proactive disruptive behaviors (e.g., lying, talking back, cheating; Hinshaw, 1987; White, Jarrett, & Ollendick, 2013). We expected the argumentative/defiant behavior dimension would more closely align to broader reports of disruptive behavior problems. Alternatively, we expected both dimensions to contribute to general clinical severity and global clinical improvement, as these outcomes were broader reflections of general ODD symptomatology and child adjustment.

Fourth, we aimed to test joint effects between ODD dimensions on general clinical outcomes and specific outcomes of aggression and conduct problems. We examined this possibility using interactions between improvements in angry/irritable mood symptoms and improvements in argumentative/defiant behavior symptoms. Studies of moderation in ODD samples typically address covariates that might influence risks and treatment response for ODD, including child gender, comorbid diagnoses, emotional callousness, and family environment (Burt, Krueger, McGue, & Iacono, 2001; Lavigne et al., 2007; Wootton, Frick, Shelton, & Silverthorn, 1997). However, we know of no efforts to address possible

synergistic patterns of change between ODD dimensions on longitudinal clinical outcomes. We expected improvements across both angry/irritable and argumentative/defiant dimensions to predict optimal outcomes.

Method

Participants

Families of children with oppositional problems were referred by family physicians, mental health professionals, and school personnel from rural, suburban, and urban communities across southwest Virginia. Families that appeared eligible following a phone screen ($n = 164$) were informed of the intent and procedures of the study, including the treatment randomization process. Parents and children then underwent a comprehensive assessment to confirm the ODD diagnosis and determine associated comorbid disorders ($n = 134$, See Figure 1). Parents and children provided written informed consent and assent, as approved by our institutional IRB.

Inclusion criteria included children meeting age (7 – 14 years) and diagnostic criteria (ODD). ODD was the reason for referral in all cases: 64% of children had ODD as their primary diagnosis; 30% as a secondary diagnosis; and 6% as a tertiary diagnosis. As is common in clinical samples, most referred children presented with secondary (99%) and tertiary (83%) diagnoses. The most common comorbid diagnoses were ADHD (67.9%) and anxiety disorders (ADs; 56.0%). Of the 134 participants, 33 (25%) were on stable doses of stimulant medication, 11 (8%) on non-stimulant but stable medication for ADHD, 5 (4%) on stable anti-psychotic medication, 4 (3%) on stable anti-depressant medication, 4 (3%) on stable anti-anxiety medication, and 1 (<1%) on an anti-seizure medication (used to treat anxiety).

Exclusion criteria included children meeting full diagnostic criteria for conduct disorder, autism spectrum disorder, intellectual impairment, or current suicidal or homicidal ideation. While ODD is frequently associated with and a precursor to conduct disorder (APA, 2013; Burke et al., 2005), children with CD were excluded as we expected they would be in need of more intensive treatment that could better address the callous and unemotional characteristics that frequently occur in such youth (APA, 2013; Frick, Cornell, Barry, Bodin, & Dane, 2003; Hawes & Dadds, 2005). Overall, 134 children (38% female) and their parents (84% Caucasian, 80% two-parent families, 38% fathers college-educated, 56% mothers college-educated) met both inclusion and exclusion criteria and participated in study randomization.

Procedures

Children were randomly assigned to one of the two active treatment groups or a waitlist control condition. Children in the waitlist who did not improve were subsequently re-assigned randomly to one of the two active treatment conditions, resulting in $n = 67$ for each treatment condition (see original study, Ollendick et al., 2016). Children were re-assessed one-week following treatment and six months thereafter. Families received \$50 for each assessment.

At each assessment, two clinicians were assigned to each family. One clinician interviewed the parent while the other clinician interviewed the child. All clinicians were supervised research assistants who were graduate students in clinical psychology in an APA-approved clinical science doctoral program or postdoctoral fellows. All were trained to requisite levels of competence to ensure reliability and validity of assessment data (Ollendick et al., 2016). None of the assessment clinicians served as therapists for the families they assessed.

Measures

Anxiety Disorders Interview Schedule for DSM-IV, Child and Parent Versions—(ADIS-C/P; Silverman & Albano, 1996). The ADIS-C/P is a semi-structured diagnostic interview designed to diagnose a range of psychiatric disorders in children and adolescents. Clinicians interviewed parents to determine the presence of each ODD symptom and its interference in home, school, and community settings. That is, binary presence/absence scores were formed for each of the eight ODD symptoms. These criteria were used to develop a clinician severity rating (CSR) with a CSR of 4 or greater on a 0–8 scale indicating a clinical diagnosis. The ADIS-C/P has been shown to be reliable and valid for the diagnosis of ODD, ADHD, and ADs, the diagnoses of particular interest in the current study (Anderson & Ollendick, 2012; Jarrett, Wolff, & Ollendick, 2007). In addition, the ADIS-C/P has shown acceptable test-retest reliability (Silverman, Saavedra, & Pina, 2001) and inter-rater agreement (Grills & Ollendick, 2003).

Clinicians were trained in conducting the ADIS-C/P through a three-hour workshop, two practice interviews with an experienced trainer, and two live observations of administered ADIS-C/P with a trained clinician. All diagnostic interviews with families were videotaped and 20% of pre-treatment interviews were reviewed by a second clinician to compute Kappa. Agreements on diagnoses were .77, .85, and .86 for primary, secondary, and tertiary diagnoses, respectively.

For all assessments, consensus diagnoses were formed based on independent reports from the ADIS-C and ADIS-P clinicians, as well as information regarding academic records, previous psychological assessments, and treatment histories. Consensus meetings were held weekly with the two ADIS clinicians and the doctoral-level clinical psychologist supervising assessments.

Clinical Global Impression – Severity and Improvement—(CGI-S and CGI-I; Guy, 1976). The CGI-S and CGI-I were completed by clinicians who completed the ADIS-IV at the designated assessment intervals. The CGI-S includes a rating, on a 7-point Likert scale, of the child's overall impairment (1 = *normal, not impaired* to 7 = *very seriously impaired*). The CGI-I includes a rating, on a 7-point Likert scale, of the degree to which the child's symptoms improved since the beginning of treatment (1 = *very much improved* to 7 = *markedly worse*).

Behavior Assessment System for Children-2—(BASC; Reynolds & Kamphaus, 2004). The BASC was completed by mothers at pre-treatment, post-treatment, and follow-up. This scale measures children's externalizing behaviors, internalizing behaviors, and adaptive skills from the perspectives of multiple reporters. For the current study, we

evaluated mothers' reports on children's aggression at each time point ($\alpha_s = .82 - .84$) and conduct problems ($\alpha_s = .85 - .86$).

Treatment

PMT—In the PMT condition, six Masters' level therapists (2 males, 4 females) provided treatment based on Barkley's (Barkley, 1997) training program. In its original format, this program provides nine weekly sessions for parents with one additional session four weeks after the last session to review and consolidate treatment gains. Based on pilot work with families in our community, we extended the program to 12, 75-minute sessions and implemented the follow-up session two weeks after the last regularly scheduled session, rather than four weeks later. In addition, we modified the program to include the child in each session so that parents could practice the skills learned in the clinic prior to implementing them at home. The program includes an explicit description of the goals and content for each session, along with standard handouts. Treatment consisted of the following components: (a) educating parents about the causes of defiant, non-compliant behavior; (b) instructing parents on positive attending through use of "special time"; (c) training parents to use attending skills to increase compliant behavior; (d) increasing the effectiveness of parental requests/commands; (e) implementing a contingency management program; (f) using the time-out procedure, if needed; (g) managing children's behavior in public places; and (h) using a daily school-home "report-card." Therapists received a 4-hour training workshop in PMT prior to the start of the project and supervision for 75 minutes each week from a doctoral level clinical psychologist experienced in applying this model.

CPS—In the CPS condition, eight Masters' level therapists (4 males, 4 females) provided treatment based on Greene's CPS model (Greene, 1998; 2010). CPS is organized into four treatment modules: (1) identification of lagging skills (e.g., emotion regulation, problem solving skills) and unsolved problems (e.g., completing homework, doing chores) that contribute to oppositional episodes, and discussion of how existing parental responses may be counterproductive; (2) prioritization – helping parents prioritize which unsolved problems will be the focal point of initial problem-solving discussions; (3) introduction of the Plans framework, which organizes parental responses to problems into three categories: Plan A (solving a problem unilaterally, through imposition of adult will and often accompanied by adult-imposed consequences); Plan B (solving a problem collaboratively and proactively); and Plan C (setting aside low-priority problems for now); and (4) implementing Plan B – helping parents and children become proficient in the use of Plan B and discontinuing use of Plan A. While the clinician actively guides the problem-solving process initially, the goal of treatment is to help the child and parents increasingly and independently incorporate Plan B. CPS was delivered in 12, 75-minute sessions with a follow-up session two weeks after the last regularly scheduled session. As with PMT, the child and parent were present in each session so that the skills learned could be practiced in session prior to implementing at home. The therapists received a 4-hour training workshop in CPS prior to the start of the project and supervision for 75 minutes each week from a doctoral level clinical psychologist experienced in applying the model.

Treatment Adherence—Treatment adherence for both treatments was assessed with a 6-item checklist completed by the clinical supervisors and based on the verbalizations and behaviors of the therapists as observed in session videotapes and reviewed in supervision. The checklist, completed following each session, included three prescriptive and three proscriptive items for each treatment. Representative items included “Therapists and the parents discussed implementation of a contingency contracting system to monitor specific behaviors and to reinforce and consequate behaviors according to the contracting system” for PMT, and “Therapists instructed parents on three potential response options for dealing with their child’s behaviors and helped them implement Plan B strategies (e.g., how to solve problems collaboratively taking into consideration identifying lagging skills in the child)” for CPS.

Collapsed across the three prescriptive items, the mean number of items checked was 2.94 for PMT and 2.92 for CPS (range = 0 – 3), indicating that the therapists focused on the prescribed treatment elements for their respective treatments much or most of the time. For the three proscriptive items, the means were 0.3 and 0.2 (range = 0 – 3), respectively, indicating that PMT therapists were not using CPS treatment elements and CPS therapists were not using PMT treatment elements. Thus, both treatments were delivered as specified and there was limited crossover in the therapeutic strategies used.

Attrition—Defined as completing six or fewer treatment sessions, 13 of the 67 participants randomly assigned to PMT dropped out of treatment (19.4%) and 15 of the 67 participants randomly assigned to CPS dropped out of treatment (22.4%). The criterion for completer status, defined as completing seven or more treatment sessions, was used because all treatment strategies for CPS and PMT were introduced by that time, with later sessions dedicated to the refinement of learned skills. The 106 “completer” families (79.1%) were seen for an average of approximately 12 sessions ($M = 11.80$, $SD = 1.60$). The number of treatment sessions was determined by clinical need, which led to some variation in number of sessions completed (range = 9 – 14). The 28 youth (20.9%) who dropped out from treatment were seen for an average of approximately three sessions ($M = 2.69$, $SD = .47$) and did not differ from the 106 who completed treatment on pre-treatment clinical measures. Furthermore, those who dropped out from treatment did not differ in child or family demographics (all $ps > .156$). However, treatment dropouts did have fewer mothers ($\chi^2(1, N = 134) = 9.87$, $p < .001$) and fathers ($\chi^2(1, N = 134) = 10.31$, $p < .001$) who graduated from college.

Of the 106 participants who completed treatment, 89 completed post-treatment assessment (83.96%) and 55 (51.9%) returned for six-month follow-up. The primary reasons for not completing later assessments included insufficient time on the part of the family to complete assessments or a stated disinterest in the “need” for assessment. Although the number of participants who did not participate in post-treatment and follow-up assessments was substantial, the percentages did not differ from those reported in other studies with children diagnosed with ODD (Murrihy et al., 2010). Pre-treatment difference analyses were conducted for those who completed post-treatment assessment. There were significant differences on income ($t(1, 112) = -2.18$, $p < .05$), mother education ($\chi^2(1, N = 133) = 8.43$, $p < .001$), and father education ($\chi^2(1, N = 123) = 13.01$, $p < .001$). Those who did not

complete post-treatment assessment had fewer mothers and fathers who graduated from college and lower family income. Attrition did not differ significantly by treatment condition ($\chi^2(1, N = 134) = .18, p = .671$).

Pre-treatment difference analyses were also conducted for those participants available at six-month follow-up. There were significant differences in six-month follow-up availability based on income ($t(1, 112) = -3.11, p < .05$) and father education ($\chi^2(1, N = 123) = 18.16, p < .001$). Those who did not participate had fewer college-educated fathers and lower family income. Additionally, there were significant differences based on family structure ($\chi^2(1, N = 133) = 4.16, p < .05$). Those who did not complete six-month assessment included fewer two-parent family homes. Attrition did not differ by treatment condition ($\chi^2(1, N = 134) = .12, p = .725$).

Analytical Plan

Analyses are grouped by study aim. For Aim 1, tetrachoric correlations were formed between baseline ODD symptoms and confirmatory factor analyses tested one-dimensional, multidimensional (two and three correlated factors), and bifactor structures of ODD. The purpose of this approach was to determine whether a) two specific dimensions of ODD were supported and whether b) a bifactor model structure—incorporating item loadings on specific ODD factors as well as a general ODD factor—contributed to significantly improved model fit relative to other uni-dimensional and multidimensional configurations. Two-dimensional and bifactor tests were structured along the findings of Burke and colleagues (2014), and a three-dimensional structure was tested from the a priori theory of Stringaris and Goodman (2009a). Tetrachoric correlations and CFAs were tested using the R statistical program (R Core Team, 2015), *psych* package (Revelle, 2016), and *lavaan* package (Rosseel, 2012). As shown below, there was support for the one-factor and two-correlated factor models.

Data imputation and preliminary analyses (bivariate correlations; two-way ANOVAs of gender by age group [7 – 11 years; 12 – 14 years]) were then conducted. For Aim 2, a repeated measures MANCOVA tested change in each ODD dimension, accounting for treatment condition and controlling for age group, gender, and comorbid ADHD and AD statuses. Hierarchical regressions were used to address Aims 3 (main effects of ODD dimension change on clinical outcomes) and 4 (interaction effects between ODD dimension changes on clinical outcomes), addressing clinician- and mother-reported outcomes at post-treatment and six-month follow-up.

Results

Aim 1: Confirming Models

Preliminary Tetrachoric Correlations—Table 1 presents tetrachoric correlations among the binomial pre-treatment ODD symptom reports. Chi-square tests were used to test significant associations between each pair of symptom reports. There was a significant association between Temper and Argues ($\chi^2(1, N = 134) = 13.40, p < .001$); Defiant and Annoys ($\chi^2(1, N = 134) = 6.90, p = .009$); Defiant and Blames ($\chi^2(1, N = 134) = 10.92, p < .$

001); Defiant and Angry ($\chi^2(1, N = 134) = 5.52, p = .019$); Annoys and Blames ($\chi^2(1, N = 134) = 8.87, p = .003$); and Grouchy and Angry ($\chi^2(1, N = 134) = 5.97, p = .015$).

Confirmatory factor analyses of ODD dimensions—Confirmatory factor analysis (CFA) is a hypothesis-testing approach that has been used in previous studies addressing structural reconceptualizations of ODD (e.g., Burke, Boylan, et al., 2014). For the current study, CFA was used to systematically test multiple, hypothesis-driven structures of ODD symptoms and address the fit of multiple models (see Brown, 2006). CFA models included one-, two-, three-, and bi-factor models of ODD, using binomial, pre-treatment indicators from the ADIS-IV P/C. The two-factor, three-factor, and bifactor models included an Angry/Irritable Mood (Ang/Irr) factor including *having a short temper, being touchy, and often being angry*. The two-factor and bifactor models included an Argumentative/Defiant Behavior (Arg/Def) factor including *arguing with others, defying authority, annoying others, blaming others, and being spiteful*. The three-factor solution included spitefulness as a separate item from the Ang/Irr and Arg/Def dimensions (Burke, Boylan, et al., 2014; Stringaris & Goodman, 2009b).

Diagonally weighted least squares (DWLS) estimation was used for each model. This estimation approach is considered appropriate for binomial data (Christoffersson, 1975). Using this approach, only the one-factor and two-factor models successfully converged. Table 2 shows fit indices, un/standardized loadings, thresholds, and variances of each model.

¹ Both the one-factor and two-factor models showed similar and adequate fit across multiple indicators. Given *a priori* interest in a two-dimensional configuration of affective and behavioral ODD symptoms, the two-factor structure of ODD was considered in ongoing regression models. Nearly all children had at least one angry/irritable mood symptom and at least one argumentative/defiant behavior symptom. Only two children did not have any angry/irritable mood symptoms.

Preliminary analyses with ODD dimensions—Given study attrition (See Figure 1), missing data at post-treatment and six-month follow-up were imputed by SPSS 24.0 (IBM, 2016). Multiple imputation is meant to provide unbiased, statistically valid representations of parameter estimates, given the observed data (Rubin, 1996). Following work by Graham and colleagues (2007), 40 datasets were imputed and averaged, with model predictors incorporating pre-treatment scores, demographic covariates, and the number of completed treatment sessions. These authors found that larger imputation sets contribute to less parameter variance and larger power in ongoing regression analyses. For the current imputations, a linear regression model with a maximum of 5,000 case draws and 2,000 parameter draws was used.

Given the high percentage of youth with ADHD and ADs, bivariate correlations between pre-treatment ODD dimensions and comorbidity with ADHD and ADs were explored. First,

¹Fit indices included measures of : absolute fit (χ^2 , WRMR), relative fit, (TLI), and a non-centrality-based indicator (RMSEA). The recommendations of Hu and Bentler (for TLI and RMSEA; 1999) and Yu and Muthén (for WRMR; 2002) were used to evaluate model indices. Non-significant chi-square values, WRMR values of 1.00 or lower, TLI values of .95 or greater, and RMSEA values of .06 or lower support adequate model fit. Ninety-five percent confidence intervals can also be tested for RMSEA values, with smaller intervals supporting confidence in model fit.

the two ODD dimensions were positively and significantly, albeit only modestly, correlated with one another ($r = .24, p = .005$). Second, baseline Ang/Irr was negatively associated with ADHD comorbidity ($r = -.17, p = .044$), but not with AD comorbidity ($r = -.04, p = .631$). Third, baseline Arg/Def was not associated with either form of comorbidity ($r = -.11, p = .089$).

Next, two-way ANOVAs examined gender and age group differences on pre-treatment symptom counts. For total ODD symptoms ($F(3, 129) = .97, p = .411$, partial $\eta^2 = .022$), Ang/Irr mood symptoms ($F(3, 130) = .53, p = .663$, partial $\eta^2 = .012$), and Arg/Def behavior symptoms ($F(3, 130) = .79, p = .503$, partial $\eta^2 = .018$), there were no main ($p = .310$; partial $\eta^2 = .008$) or interaction effects ($p = .198$; partial $\eta^2 = .013$) of gender or age group.

Aim 2: Change in Dimensions across Time

A one-way, repeated-measures MANCOVA was conducted to test changes in Ang/Irr and Arg/Def symptoms out to six-month follow-up. Tests included the independent variable of treatment condition with the covariates of child gender, child age group, comorbid AD status, and comorbid ADHD status. Mauchly's test suggested the condition of sphericity assumption was not met for reductions in Arg/Def (Mauchly's $W = .93; \chi^2(2) = 9.03, p = .011$; Greenhouse-Geisser = .94). The Huynh-Feldt correction was used for later univariate tests. Multivariate tests supported within-subjects effects on time (Wilks' $\Lambda = .95, F(4, 510) = 3.17, p = .014$, partial $\eta^2 = .024$). Univariate tests supported a main effect of time for Ang/Irr symptoms ($F(2, 256) = 6.32, p = .002$, partial $\eta^2 = .047$), but not Arg/Def symptoms ($F(1.97, 252.48) = 1.70, p = .186$, partial $\eta^2 = .013$). For Ang/Irr symptoms, univariate tests supported within-person effects of gender over time ($F(2, 256) = 3.49, p = .032$, partial $\eta^2 = .027$) and age group over time ($F(2, 256) = 3.33, p = .037$, partial $\eta^2 = .025$). Girls showed attenuated reductions in Ang/Irr symptoms over time. Both older and younger children showed initial improvements in Ang/Irr symptoms to post-treatment, but older children showed poorer maintenance of improvements at six-month follow-up. For Arg/Def symptoms, a univariate effect of AD comorbidity over time was supported ($F(1.97, 252.48) = 3.28, p = .040$, partial $\eta^2 = .025$). Children with AD comorbidity showed lower initial drops in symptoms and met children without comorbidity at six-months. Tests did not support effects of treatment group (as reported in the original paper).

Aims 3 and 4: Main (3) and Joint Effects (4) of Improvements in ODD Dimensions

Partial correlations—Table 3 depicts partial correlations among study variables and reductions in each dimension of ODD (controlling for child demographics, ADHD and AD comorbidities, and treatment condition). Overall, trends suggest that reductions in symptoms from pre-treatment to post-treatment follow-up were often associated with improved clinician- and mother-reported outcomes at one-week and six-month follow-ups.

Regressions of clinician reports—Table 4 presents all regression results. Clinician reports of child clinical severity and improvement on the CGI following treatment were regressed on child covariates and pre-treatment scores (Step 1), main effects of ODD

symptom reductions (Step 2), and the interaction between ODD symptom reductions (Step 3).

The model omnibus was significant for CGI-Severity at post-treatment ($F(9, 115) = 10.28$, $p < .001$) and six-month follow-up ($F(9, 115) = 5.61$, $p < .001$). At post-treatment, main effects showed that reductions in Ang/Irr and Arg/Def symptoms predicted improved clinical severity. There was no interaction effect. At six-month follow-up, there was a main effect for reductions in Arg/Def symptoms. Again, no interaction effect was supported.

For CGI-Improvement, the model omnibus was significant for post-treatment ($F(8, 115) = 13.16$, $p < .001$) but not six-month follow-up ($F(8, 125) = 1.66$, $p = .114$). At post-treatment, main effects showed that reductions in Ang/Irr and Arg/Def symptoms predicted greater improvement. There was not support for an interaction effect.

Regressions of maternal reports—Mother reports of child aggression and conduct problems at post-treatment and six-month follow-up were examined as above.

The model omnibus was significant for aggression at post-treatment ($F(9, 113) = 6.75$, $p < .001$) and six-month follow-up ($F(9, 113) = 10.57$, $p < .001$). At one-week follow-up, there was a main effect for reductions in Ang/Irr predicting lower reports of aggression. No interaction effect was supported. At six-month follow-up, there were main effects of Ang/Irr and Arg/Def predicting lower reports of aggression. There was not support for an interaction effect.

The model omnibus was significant for conduct problems at post-treatment ($F(9, 113) = 10.57$, $p < .001$) and six-month follow-up ($F(9, 113) = 6.95$, $p < .001$). At one-week follow-up, there were main effects for Ang/Irr and Arg/Def. In each case, greater reductions predicted lower reports of conduct problems. No interaction effect was supported. At six-month follow-up, there was only a main effect for Arg/Def. Again, larger reductions were associated with lower reports of conduct problems. No interaction effect was supported.

Discussion

In a reanalysis of findings from our original study (Ollendick et al., 2016), we examined four conceptualizations of ODD symptom structures in a clinic-referred sample of 134 youth who met DSM-IV (APA, 1994) criteria for an ODD diagnosis. Tests of multiple ODD dimensions have not been addressed among treatment-seeking samples of youth and there have not been opportunities to test whether improvements in affective and behavioral ODD symptoms continue to coincide with improvements in internalizing and externalizing problems, respectively. Inasmuch as the eight symptoms are the same and the six-month duration criterion remains the same for both DSM-IV and DSM-5 (APA, 1994, 2013), the youth also met criteria for DSM-5 diagnosis. Our findings can be summarized as follows. First, the one- and two-factor solution of the ODD symptoms were similarly supported using CFAs (Aim 1). The two-factor solution supported angry/irritable mood and argumentative/defiant behavioral factors, as suggested in previous studies (Aebi et al., 2010; Burke & Loeber, 2010; Stringaris & Goodman, 2009a, b). However, the models did not successfully converge when considering a general ODD factor in addition to the two correlated factors, nor when

considering a third correlated factor. In contrast to DSM-5, vindictiveness was combined with the argumentative/defiant behavior dimension; though this symptom did not align well with the other items in either one- or two-dimensional models, it was not supported as a third factor item. Although the percent of youth who met each of the eight criteria varied from 37.3% (is spiteful or vindictive) to 94.8% (often loses temper), all children met at least 4 criteria (with the average being 6.2 criteria) and only two children met full criteria for ODD on the basis of the argumentative/defiant behavioral symptoms alone (1.5%). In addition, both PMT and CPS treatments produced comparable decrements in the angry/irritable mood and argumentative/defiant behavioral symptoms (Aim 2). Further, regression analyses showed that changes in the angry/irritable and argumentative/defiant symptoms (Aim 3) resulted in meaningful clinician- and parent-rated outcomes. While both dimensions robustly contributed to post-treatment clinician reports, six-month aggression reports, and post-treatment conduct problem reports, there was additional dimension specificity from these effects. Notably, reductions in angry/irritable symptoms robustly predicted post-treatment aggression reports, whereas argumentative/defiant symptoms robustly predicted six-month clinical severity and six-month conduct problems. Although this specificity was not robust across follow-up periods, patterns do lend support to expectations and previous findings among non-referred samples of youth. While main effects of Aim 3 were well supported, hypothesized interactive effects between affective and behavioral symptom reductions were not supported (Aim 4).

Our confirmatory models supported expectations that the symptoms of ODD were well-supported by two correlated factors, but this model was not clearly better fitting than the single-factor structure of ODD. While the separate affective and behavioral dimensions do contribute to some differing outcomes—Ang/Irr robustly predicting post-treatment aggression and Arg/Def robustly predicting post-treatment clinical severity and six-month conduct problems—the current results lend limited support for relying on a two-dimensional reconceptualization of ODD over the original unidimensional conceptualization. However, the current results underscore the importance of addressing additional conceptualizations of ODD among clinical samples. The possibility remains that ODD is a more complex, multidimensional category that captures a wider range of symptoms that extend beyond disruptive, oppositional behavior and involves emotion regulation difficulties as well. With additional support, such findings could have implications both for understanding the etiology of the disorder and its treatment (as suggested by Stringaris & Goodman, 2009b, Stringaris et al., 2012; and Greene & Doyle, 1999).

Although we did not address possible differential etiological pathways to the affective and behavioral dimensions of ODD, we did examine the response of these two dimensions to two psychosocial interventions—Collaborative & Proactive Solutions (CPS; Greene, 2010) and Parent Management Training (PMT; Barkley, 2007). Both treatments resulted in significant changes in the angry/irritable mood and argumentative/defiant behavioral dimensions (as well as across all eight symptoms as reported in our original study, Ollendick et al., 2016), providing further evidentiary support for the efficacy of these two treatments for both dimensions of ODD. However, the comparable efficacy of these two treatments across both dimensions does not lend additional support for the need of a two-dimensional view of ODD for treatment purposes; rather, our findings suggest children with differing

patterns of ODD symptomatology benefit from either of these psychosocial treatments. Of course, it is possible the two dimensions would respond differentially to pharmacologic or other psychosocial interventions (Stringaris et al., 2012; Whelan, Stringaris, Maughan, & Barker, 2013). This possibility awaits investigation.

Our regression analyses revealed that post-treatment changes in angry/irritable symptoms and changes in argumentative/defiant symptoms had implications for clinical outcomes, often in accordance with expectations. Reductions in both sets of symptoms were related to lesser clinical severity and improved conduct problems at one-week follow-up, as well as lesser clinical severity at six-month follow-up. There were also main effects specific to each set of symptoms. Reductions in Ang/Irr were the only robust predictor of improved aggression at one-week follow-up, whereas reductions in Arg/Def were the only robust predictors of clinical improvement at one-week follow-up and conduct problems at six-month follow-up.

The current study possesses both strengths and weaknesses. Strengths include the examination of separate angry/irritable and argumentative/defiant symptom dimensions of ODD, use of psychometrically sound assessment measures, examination of effects for two psychosocial treatments, employment of carefully trained assessors and therapists, and use of statistical procedures that addressed missing data.

Weaknesses associated with the generalization of our findings include reliance on a sample of largely middle class, Caucasian families and conducting the study in a university research setting with carefully trained and supervised clinicians (which may not be reflective of other clinical samples or treatment settings). As a result, future research is required to evaluate our findings in more diverse samples and in other treatment settings. We also lack follow-up data on the effects of our interventions beyond six months. In addition, not all of our youth had a primary diagnosis of ODD. Still, ODD was the principal reason for referral for all youth and diagnosis of ODD was always one of the top three diagnoses in this highly comorbid sample. We suggest that not limiting the sample to a primary diagnosis of ODD may better reflect “real-world” applicability of these treatments (see Ollendick, Jarrett, White, White, & Grills, 2016).

Another weakness involves the number of families who dropped out of treatment and/or failed to return for post-treatment assessment(s). As noted, these families differed from families who completed treatment (less education) and who were available for post-treatment assessment and follow-up assessment (less education, lower income, and single parent family status). Although the failure of families with these characteristics to return for assessment is a significant shortcoming, we did employ analytic procedures to address missing data. As noted by Salim, Mackinnon, Christensen, and Griffiths (2008), this approach is generally acceptable even when dropout rates are “substantial” as with this study and we attempted to incorporate a larger number of imputations, given the extent of missing data (Graham et al., 2007). Furthermore, the current guidelines of the Consolidated Standards of Reporting Trials (CONSORT) recommend use of data imputation when outcome data are missing (Moher et al., 2010). Still, it remains important to address this

shortcoming and to explore issues of engagement in future treatment studies, as suggested by Nock and Kazdin (2005) and Nock and Ferriter (2005).

Questions remain on why we did not find support for the more complex bifactor and three-dimensional models in the current sample. Our sample is considered small for incorporating DWLS estimation and one of the models (three-factor CFA) included a single indicator for the vindictiveness factor. These are both notable limitations. Recent CFAs addressing multidimensional structures of ODD have found support using larger, community samples of children (e.g., Burke et al., 2014); yet, previous simulations suggest DWLS models with smaller sample sizes ($N = 200$) and models with fewer indicators per factor are less likely to converge (Forero, Maydeu-Olivares, & Gallardo-Pujol, 2009). In order to better address these patterns in a clinical context, a larger study or multi-site comparison is likely needed.

Although the present study possesses these limitations, to our knowledge this is the first attempt to examine the angry/irritable and argumentative/defiant dimensions of ODD separately in a clinic-referred sample and to examine how changes in these dimensions relate to improvement following two different psychosocial treatments. The differential response of these unique but inter-related dimensions to other treatments, if present, awaits other forms of intervention including pharmacological ones.

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Figure 1.
Participant recruitment and attrition from pre- to post-treatment.

Table 1

Tetrachoric Correlations among Pre-Treatment ODD Symptom Reports

	1.	2.	3.	4.	5.	6.	7.	8.
1. Temper	--							
2. Argues	.64 ^a	--						
3. Defiant	.38	.25	--					
4. Annoys	-.25	.15	.45 ^a	--				
5. Blames	.34	.33	.54 ^a	.44 ^a	--			
6. Grouchy	.23	.21	.20	.23	-.07	--		
7. Angry	.22	.37	.47 ^a	.14	.28	.36 ^a	--	
8. Spiteful	-.24	-.03	-.01	.21	.06	.07	.15	--
Tau	-1.62	-1.44	-1.30	-.53	-.86	.64	.09	.32

Note.

^a = symptom pairs with significant associations at the $\alpha = .05$ level, as determined by chi-square tests.

Table 2
Fit Indices and Item Loadings for One-Factor and Two-Factor CFA Models of ODD Symptoms at Pre-Treatment

	One Factor		Two Correlated Factors			
	Df					
χ^2	20	19.61			19	18.75
WRMR		.738				.722
TLI		1.000				1.000
RMSEA		.000				.000
95% CI of RMSEA		.000, .073				.000, .075
Loadings	Unstd.	Std.	Unstd.	Std.	Unstd.	Std.
	ODD Factor		Ang/Irr Factor		Arg/Def Factor	
Temper	1.00	.53	1.00	.59		
Argues	1.13 (.40)	.60**			1.00	.59
Defiant	1.47 (.50)	.78**			1.35 (.46)	.80**
Annoys	.92 (.46)	.49*			.86 (.38)	.51*
Blames	1.16 (.38)	.62**			1.08 (.36)	.64**
Grouchy	.63 (.35)	.33 [†]	.68 (.38)	.40 [†]		
Angry	1.03 (.36)	.55**	1.12 (.42)	.66**		
Spiteful	.20 (.32)	.11			.19 (.27)	.12
Thresholds	Unstd.	Std.	Unstd.	Std.	Unstd.	Std.
Temper	-1.62 (.18)	-1.62**	-1.62 (.18)	-1.62**		
Argues	-1.44 (.16)	-1.44**	-1.44 (.16)	-1.44**		
Defiant	-1.30 (.15)	-1.30**	-1.30 (.15)	-1.30**		
Annoys	-.54 (.12)	-.54**	-.54 (.12)	-.54**		
Blames	-.86 (.13)	-.86**	-.86 (.13)	-.86**		
Grouchy	-.63 (.12)	-.63**	-.63 (.12)	-.63**		
Angry	.10 (.11)	.10	.10 (.11)	.10		
Spiteful	.32 (.11)	.32**	.32 (.11)	.32**		

Covariances	One Factor		Two Correlated Factors	
	Ang/Irr ↔ Arg/Def	--	Unstd.	Std.
Ang/Irr ↔ Arg/Def			.26 (.12) [*]	.76 [*]
Variances	Unstd.	Std.	Unstd.	Std.
Temper	.72	.72	.66	.66
Argues	.64	.64	.84	.84
Defiant	.39	.39	.57	.57
Annoys	.76	.76	.65	.65
Blames	.62	.62	.36	.36
Grouchy	.89	.89	.74	.74
Angry	.70	.70	.59	.59
Spiteful	.99	.99	.99	.99
ODD Factor	.28 (.15) [†]	1.00 [†]	--	--
Ang/Irr Factor	--	--	.34 (.21)	1.00
Arg/Def Factor	--	--	.35 (.21) [†]	1.00 [†]

Note.

[†] $p < .10$,

^{*} $p < .05$,

^{**} $p < .01$.

All item intercepts were .00. Unstd. = Unstandardized; Std. = Standardized. Y* variance distribution scaling was set to 1.00 for all models.

Table 3
Descriptives and Partial Correlations among Study Variables (Controlling Child Demographics, Comorbidity, and Treatment)

	Mean (SD)	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. CGI Severity (Pre)	4.43 (.86)	.20*	.22*	-.04	.23*	.13	.14	.31**	.17	.06	.12	-.11	-.12
2. CGI Severity (Post)	3.36 (.91)	--	.30**	.56**	.07	-.09	.40**	.12	.01	.47**	.27*	-.52**	-.56**
3. CGI Severity (Six Mo)	4.00 (1.07)	--	--	.24*	.75**	.04	.32**	.27*	.21*	.36**	.41**	-.30**	-.33**
4. CGI Improvement (Post)	2.57 (.79)			--	.08	.04	.26*	.18*	.14	.38**	.02	-.56**	-.56**
5. CGI Improvement (Six Mo)	3.21 (.99)				--	.13	.40**	.26*	.23*	.32	.45**	-.04	-.12
6. Aggression (Pre)	70.78 (11.47)					--	.39**	.29*	.46**	.04	.06	-.09	-.12
7. Aggression (Post)	59.50 (8.19)						--	.54**	.24*	.61**	.52**	-.31**	-.27*
8. Aggression (Six Mo)	60.93 (7.40)							--	.26	.49**	.51**	-.39**	-.34**
9. Conduct Problems (Pre)	71.51 (12.89)								--	.49**	.47**	-.13	-.17
10. Conduct Problems (Post)	59.80 (8.73)									--	.70**	-.45**	-.39**
11. Conduct Problems (Six Mo)	60.40 (8.96)										--	-.13	-.27*
12. Reductions in Ang/Irr	.81 (1.32)											--	.53**
13. Reductions in Arg/Def	1.16 (1.80)												--

Note.

* $p < .05$,

** $p < .01$.

Scores for Aggression and Conduct Problems are T -values.

Table 4

Regressions of Clinician Reports on Dimension Changes in the ADIS

	Post-Treatment				Six-Month Follow-Up			
	<u>CGI-Severity</u>		<u>CGI-Improvement</u>		<u>CGI-Severity</u>		<u>CGI-Improvement</u>	
	<i>R</i> ²	β	<i>R</i> ²	β	<i>R</i> ²	β	<i>R</i> ²	β
Step 1	.07		.07 [†]		.19 ^{**}		.07 [†]	
Step 2	.37 ^{**}		.38 ^{**}		.11 ^{**}		.01	
Reduction in Ang/Irr		-.32 ^{**}		-.37 ^{**}		-.16		.03
Reduction in Arg/Def		-.41 ^{**}		-.37 ^{**}		-.24 [*]		-.14
Step 3	.01		.00		.01		.01	
Reduction in Ang/Irr X Reduction in Arg/Def		.03		.03		-.10		-.10
<i>F</i> -value	10.28 ^{**}		13.16 ^{**}		5.61 ^{**}		1.66	
	<u>Aggression</u>		<u>Conduct Problems</u>		<u>Aggression</u>		<u>Conduct Problems</u>	
	<i>R</i> ²	β	<i>R</i> ²	β	<i>R</i> ²	β	<i>R</i> ²	β
Step 1	.27 ^{**}		.28 ^{**}		.14 ^{**}		.32 ^{**}	
Step 2	.08 ^{**}		.17 ^{**}		.17 ^{**}		.04 [*]	
Reduction in Ang/Irr		-.20 [*]		-.31 ^{**}		-.26 ^{**}		.03
Reduction in Arg/Def		-.15		-.18 [*]		-.24 [*]		-.22 [*]
Step 3	.01		.01		.01		.00	
Reduction in Ang/Irr X Reduction in Arg/Def		.01		-.09		.08		.00
<i>F</i> -value	6.75 ^{**}		10.57 ^{**}		5.77 ^{**}		6.95 ^{**}	

Note.

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

Step 1 includes child age, child gender, treatment condition, AD and ADHD comorbidity statuses, and pre-treatment outcome score. Main effects of ODD symptom reductions were mean-centered.