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Teacher-Reported Irritable and Defiant Dimensions of Oppositional Defiant Disorder: Social, Behavioral, and Academic Correlates

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Abstract Previous research suggests that the symptoms of oppositional defiant disorder (ODD) reflect both a general diagnostic construct and two distinct symptom dimensions, irritability and defiant behavior. Recent studies have found that these two symptom dimensions exhibit different patterns of correlates and outcomes (e.g., irritability linked to depressive symptoms, defiant behavior linked to conduct problems). The present study investigated common and unique correlates of the irritable and defiant dimensions of ODD symptoms in a sample of 706 school-age children (49 % female, ages 5–12) in grades K-5. Classroom teachers rated their students' ODD symptoms, proactive and reactive aggression, relational and physical aggression and victimization, withdrawn/depressed symptoms, peer rejection, and academic performance. Multilevel regression models—controlling for grade level, gender, and shared variance between symptom dimensions and variable subtypes—showed that teacher-reported irritability and defiant behavior exhibit common correlates of physical and relational aggression, relational victimization, and peer rejection. With respect to differential correlates, irritability was uniquely associated with physical victimization and withdrawn/depressed symptoms, whereas defiant behavior was uniquely associated with proactive aggression and hyperactive–impulsive symptoms. Further, reactive aggression was more strongly linked to irritability than to defiant behavior. These findings provide further support for a multidimensional conceptualization of ODD symptoms within the school context and suggest that irritability and defiant behavior have important implications across several domains of children's social–emotional development.

Keywords Oppositional defiant disorder (ODD) · Irritability · Defiant behavior · Aggression and victimization · Teacher report

Introduction

Oppositional defiant disorder (ODD) is a behavioral disorder affecting approximately 11–14 % of boys and 9–13 % of girls at some point in childhood and adolescence (Merikangas et al., 2010; Nock, Kazdin, Hiripi, & Kessler, 2007). The essential features of ODD include a persistent pattern of defiant, disobedient, negativistic, and provocative behavior toward authority figures, such as parents and teachers (American Psychiatric Association (APA), 2013; World Health Organization (WHO), 2015). DSM-5 and its predecessors list eight symptom criteria for ODD, of which four must be present for a diagnosis of ODD (APA, 2013). The validity of this monothetic, diagnostic conceptualization of ODD is supported by a great deal of prior research (e.g., Frick & Nigg, 2012; Loeber, Burke, Lahey, Winters, & Zera, 2000). Recent research extends upon (but does not contradict) this well-established model of ODD, lending support to a multidimensional conceptualization of ODD symptomatology.

Children who exhibit ODD symptoms are at an increased risk of an array of psychosocial problems, including the development of more severe externalizing and internalizing problems over time (Loeber & Burke, 2011; Nock et al., 2007). The link between ODD symptoms and internalizing problems seems to be at least partially

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explained by heterogeneity of ODD symptomatology, which includes affective as well as behavioral components (Boylan, Vaillancourt, Boyle, and Szatmari, 2007; Burke and Loeber, 2010; Burke, Loeber, Lahey, and Rathouz, 2005). More specifically, recent evidence supports two distinct but correlated dimensions of ODD symptoms: irritability and defiant behavior. However, these questions have scarcely been examined among school populations or using teacher report; nor has much attention been given to the potential implications thereof for school mental health. The goal of the present study was to examine teacher-reported irritable and defiant dimensions of ODD symptoms in relation to several social, behavioral, and academic correlates.

Dimensions of Oppositional Defiant Disorder

Among the earliest studies investigating the dimensions of ODD, Stringaris and Goodman (2009a, b) hypothesized defiant, irritable, and hurtful dimensions[1] of ODD symptoms, with results demonstrating differential correlates and longitudinal outcomes. Subsequently, this particular model was adopted by other research groups (e.g., Kolko & Pardini, 2010, Whelan, Stringaris, Maughan, & Barker, 2013) and codified in DSM-5 (APA, 2013). However, the three-dimensional model of ODD lacks strong empirical support (Burke et al., 2014a; Ezpeleta et al., 2012). In particular, the "hurtful" dimension, consisting of only one symptom (spiteful/vindictive), has not demonstrated reliable measurement and predictive properties, especially compared to irritable and defiant dimensions (e.g., Burke et al., 2014a; Whelan et al., 2013). By contrast, several studies (e.g., Burke et al., 2010a, 2014a; Burke & Stepp, 2012; Kuny et al., 2013; Lavigne, Bryant, Hopkins, & Gouze, 2015; Rowe et al., 2010) have found evidence for a two-dimensional model of ODD symptoms, which has also influenced the draft formulations of ODD in the forthcoming eleventh revision of the *International Classification of Diseases* (Lochman et al., 2015; WHO, 2015).

Research offers the strongest and most consistent support for two particular dimensions: irritability (e.g., often losing temper and being easily annoyed) and defiant behavior (e.g., often arguing and refusing to comply). Several comparative factor analyses have yielded similar results, finding a better fit for models comprised of irritable and defiant dimensions (Burke et al., 2014a; Ezpeleta et al., 2012; Krieger et al., 2013; Lavigne et al., 2015). For example, Burke et al. (2014a) examined several models of parent-reported ODD symptom dimensions across five large community samples (aggregate $N = 16{,}280$). Confirmatory factor analyses clearly supported a correlated bifactor model, with three latent factors: (a) irritability, comprised of three ODD symptoms (touchy or easily annoyed; angry and resentful; loses temper); (b) oppositional behavior, comprised of the other five symptoms (argues; defies or refuses to comply; blames others; deliberately annoys; spiteful or vindictive); and (c) a common factor of ODD, comprised of all eight symptoms. Considering the strong evidence supporting Burke et al.'s (2014a) two-factor model, we adopt a similar model for this study.

Measurement variations notwithstanding, research on these two symptom dimensions has yielded generally consistent results; after controlling for their shared variance, irritability and defiant behavior exhibit several differential correlates and outcomes. Perhaps most notably, the irritable dimension of ODD has been reliably linked to internalizing symptoms across childhood and adolescence. Stringaris and Goodman (2009a, b) found that irritability was positively associated with depression and anxiety, both cross-sectionally and at three-year follow-up. Further, parent-reported irritability symptoms in adolescence predicted self-reported major depressive disorder (MDD), generalized anxiety disorder (GAD), and dysthymia 20 years later in adulthood, even after controlling for baseline psychopathology (Stringaris, Cohen, Pine, & Leibenluft, 2009). Other studies have yielded similar findings, lending further support for the link between ODD irritability and internalizing problems (Barker & Salekin, 2012; Burke et al., 2010a; Drabick & Gadow, 2012; Rowe et al., 2010; Whelan et al., 2013).

In contrast, the defiant dimension of ODD has been linked to externalizing, but not internalizing, problems. Defiant behavior at age 10 was associated with conduct problems and callous attitude at 16 (Whelan et al., 2013). Among preschoolers, only the defiant dimension was related to other disruptive behavior disorders (Ezpeleta et al., 2012). Phenotypic and genetic evidence have also linked defiant behavior to delinquency both cross-sectionally and longitudinally (Stringaris, Zavos, Leibenluft, Maughan, & Eley, 2012).

Findings have been somewhat less consistent regarding the relations between ODD dimensions and ADHD symptoms and diagnoses. While some studies have found that the irritable dimension is uniquely associated with ADHD symptoms (Aebi et al., 2013; Kolko & Pardini, 2010), others have found a stronger association for the defiant dimension (Krieger et al., 2013; Stringaris & Goodman, 2009a, b). However, most of these studies have

[1] Researchers have used a variety of different names to represent dimensions of ODD symptoms (e.g., "irritable" vs. "negative affect"; "defiant" vs. "headstrong"). In most cases, these differences are in name only; the dimensions themselves are very similar in item content. For clarity, we use the terms "irritable" and "defiant" throughout this paper to represent the two dimensions, each comprised of particular ODD symptoms (defined below).

examined clinical diagnoses of ADHD or composite measures of ADHD symptoms; little is known about the distinct contributions of attention problems and hyperactive–impulsive behaviors, which may help further elucidate the nature of these associations.

The large majority of the research on dimensions of ODD to date has relied primarily on parent reports of behavior in clinical or community samples. As a result, some of the most striking gaps in this literature include a paucity of teacher-reported data and limited consideration of non-clinical measures of academic and social functioning. Of all the recent studies on ODD dimensions (over two dozen to date), only a few have utilized teacher reports—for example, among preschool-age samples (Ezpeleta et al., 2012), clinical samples (e.g., Drabick & Gadow, 2012; Kolko & Pardini, 2010), or secondary analyses of community sample data (e.g., Burke et al., 2010a). Yet in each case, teacher-reported data were limited to diagnostic and clinical variables (e.g., Stringaris & Goodman, 2009b), with little insight into the link between ODD dimensions and social and academic adjustment. These are important omissions because teachers provide a key perspective on certain domains of functioning, and may be the best reporters for particular kinds of variables (e.g., peer relations, academics).

Oppositional Behavior in the School Context

Clinical assessments of disruptive behavior problems must consider whether the symptoms are present in more than one setting. When a child's behaviors are causing problems at school *in addition to* at home, this indicates a more severe level of psychopathology (APA, 2013). Moreover, there may be significant variations in symptom presentation between home and school. Teachers are in a unique position to observe several different components of child behavior in relation to ODD symptoms and are therefore essential for accurate diagnostic assessment. Teachers have been shown to be reliable and valid reporters of children's ODD symptoms (Drabick, Gadow, & Loney, 2007; Ise, Gortz-Dorten, & Dopfner, 2014). Evidence suggests modest interrater agreement between teacher and parent reports of ODD symptoms, underscoring the importance of gathering teacher ratings of ODD symptoms (Drabick et al., 2007; Munkvold, Lundervold, Atle Lie, & Manger, 2009). Teacher-reported ODD symptoms are associated with increased social impairment and antisocial behavior disruptive to the learning process (Drabick et al., 2007; Munkvold et al., 2009), whereas parent-only reports of ODD symptoms indicate higher levels of family dysfunction (Drabick et al., 2007; Drabick, Bubier, Chen, Price, & Lanza, 2011; Munkvold et al., 2009). For instance, Drabick et al. (2007) found that teacher-reported ODD symptoms were related to social difficulties, whereas parent-reported ODD symptoms were related to maternal detachment.

Indeed, children with ODD symptoms appear to have an array of social problems, such as having poor peer interactions and being less preferred by their peers (Burke, Waldman, & Lahey, 2010b; Munkvold, Lundervold, & Manger, 2011; Pardini & Fite, 2010). Children with high levels of ODD symptoms are more likely to experience physical and relational forms of victimization as well as to engage in bullying behavior (Fite, Evans, Cooley, & Rubens, 2014). Overall, the level of social dysfunction among children with ODD is greater than that of children with other psychiatric disorders (Greene et al., 2002). One longitudinal study that followed youth from ages 7–12 to age 24 found that ODD symptoms in childhood predicted pervasive interpersonal challenges in adulthood, (e.g., problems with peers and romantic partners, not having someone to list as a character reference; Burke, Rowe, & Boylan, 2014b).

Although ODD symptoms are also related to aggressive behaviors, the nature of this association is not well understood. Further clarity might be obtained by distinguishing among different types of aggression, particularly because distinct functions of aggressive behavior have been linked to distinct risk factors, correlates, and developmental sequelae (Vitaro & Brendgen, 2012). Specifically, reactive aggression refers to impulsively aggressive behaviors in response to a perceived threat; proactive aggression refers to calculated aggressive behaviors intended to achieve a goal (Fite, Rathert, Colder, Lochman, & Wells, 2012). These two types of aggression, though highly correlated, are theoretically and empirically distinct (Fite, Colder, & Pelham, 2010; Little, Henrich, Jones, & Hawley, 2003; Vitaro & Brendgen, 2012). To our knowledge, the relations among dimensions of ODD symptoms and functions of aggressive behavior have not been directly examined; however, extant evidence does support some initial hypotheses. Given that reactive aggression is linked to emotional and social problems (Fite et al., 2012; Vitaro & Brendgen, 2012) and shares commonalities with irritability (e.g., losing temper), a link between reactive aggression and irritability seems likely. Conversely, proactive aggression and defiant/hurtful behavior are both linked to conduct problems (Fite et al., 2012; Stringaris & Goodman, 2009a, b; Vitaro & Brendgen, 2012) and represent a form of deliberate externalizing behavior; thus, an association between defiant behavior and proactive aggression seems likely. In contrast, extant evidence does not suggest clear hypotheses regarding ODD dimensions in relation to forms of aggression (relational/physical), forms of victimization (relational/physical), and peer rejection.

Lastly, while the link between externalizing problems and poor academic performance is well established

(Biederman et al., 1996), much of this association appears to be accounted for by ADHD symptoms, particularly inattention (Pardini & Fite, 2010). However, even after controlling for ADHD symptoms, ODD symptoms uniquely predict lower academic attainment (Burke et al., 2014b), suggesting that there may be a link between ODD symptoms and academic performance that is not entirely due to ADHD symptoms. Research has not yet examined whether ODD symptom dimensions play particular a role in this association.

Further understanding of ODD symptom dimensions in school settings could offer practical implications for school mental health efforts in a number of ways. Disruptive behavior in schools is often identified by virtue of the disruption that it causes in the classroom, perhaps with less attention given to the function underlying those behaviors. If the present study finds that ODD symptom dimensions have differential patterns of associations with other meaningful aspects of children's functioning at school, these results would contribute to a growing body of evidence that seems to be disentangling the heterogeneous nature of oppositionality. To illustrate, consider that two children could meet the diagnostic criteria of ODD (APA, 2013) while sharing no symptoms in common; further, one child may exhibit behaviors that are exclusively defiant in nature, whereas another child may exhibit a predominately irritable presentation. These two patterns of behavior may cause similar disruptions in the classroom, but if they are characterized by different causes, maintainers, correlates, and outcomes, then it follows that different methods of assessment, prevention, and treatment should be considered. For example, children who exhibit a predominately defiant pattern of behavior may benefit from interventions that train teachers and parents in effective behavior management skills (e.g., Barkley, 2013), whereas youth with irritability or anger might benefit from cognitive-behavioral interventions that focus on coping skills and emotion regulation training (e.g., Lochman, Powell, Boxmeyer, & Jimenez-Camargo, 2011). Before such hypotheses can be tested, further evidence is needed to support the tenability of previous findings within the school context.

Overview of the Present Study

Considering the limitations of previous research, the aim of the present study was to better understand irritability and defiant behavior in the school context. Specifically, we collected teacher-reported data on a large sample of children in grades K-5. After estimating correlated two-factor model of ODD symptom dimensions, we examined the behavioral, social, emotional, and academic correlates of irritability and defiant behavior. As described above, the literature supported the following hypotheses: (a) Irritability would be associated with withdrawn/depressed symptoms and reactive aggression; (b) defiant behavior would be associated with proactive aggression; (c) both dimensions would be linked to peer rejection; and lastly, (d) no specific hypotheses regarding inattention, hyperactivity–impulsivity, academic performance, and relational and physical aggression and victimization.

Methods

Participants and Procedures

Participants included 36 kindergarten through fifth-grade primary classroom teachers from an elementary school located in a small, rural Midwestern community in the USA. Teachers reported on the students in their classrooms as part of a larger project examining the impact of peer victimization and aggression on children's psychological and social adjustment. All teachers at the participating school were recruited for inclusion in the study, and 100 % ($N = 37$) provided written informed consent prior to their participation; however, one teacher later elected not to complete the measures. Each teacher was asked to report on all students in his/her classroom (i.e., every student would be rated exactly once by the educator most familiar with his/her day-to-day behavior, academic performance, and social–emotional functioning).

In total, teachers rated 706 (95.5 %) of the 739 eligible students at the school, including 347 boys and 359 girls between 5 and 12 years of age. Each teacher completed ratings for between 6 and 23 children ($M = 19.61$, $SD = 2.92$). The grade distribution of students was as follows: 109 (15.4 %) in kindergarten, 111 (15.7 %) in first grade, 126 (17.8 %) in second grade, 119 (16.9 %) in third grade, 137 (19.4 %) in fourth grade, and 104 (14.7 %) in fifth grade. School records indicated that the racial composition of students attending the elementary school was predominantly Caucasian, with less than 21 % of children identifying as an ethnic minority (9 % African American, 6 % Hawaiian/Pacific Islander, 4 % American Indian, 2 % Asian). Although information regarding children's socioeconomic status was not available, approximately 35 % of students at the school were eligible for free or reduced-price lunch. According to the US Census Bureau (2010), per capita income for the community in which the school was located was approximately $25,369, with 5 % of individuals living below the federal poverty line.

Teachers rated students' behaviors by completing a brief (approximately 10 min) online survey for each of the students in their class. Data were reported using a randomly assigned, de-identified number that was later matched to a unique study identification number. Teachers received $7 as

compensation for each completed survey. Considering that (a) the information that teachers were asked to report (e.g., bullying behaviors, peer difficulties, academic functioning) was already routinely assessed and reported at school, (b) no child was singled out by teacher participation, (c) the researchers received no identifying information, and (d) the data were presented back to school only in aggregate, this school-wide teacher data collection was considered inconsequential for individual students. Thus, parental consent and child assent were not necessary. All data collection and consent procedures were approved by the researchers' institutional review board as well as by school administrators prior to data collection. Data collection occurred over a one-month period in October and November 2012.

Measures

ODD and ADHD Symptoms

Teachers completed the ODD and ADHD items from the Disruptive Behavior Disorder Rating Scale (DBD; Pelham, Gnagy, Greenslade, & Milich, 1992). The DBD[2] assesses the presence and severity of ODD symptoms (eight items) and ADHD symptoms (18 items), such that items map directly onto the diagnostic criteria for these diagnoses in DSM-IV and DSM-5. This also facilitates the measurement of ODD symptom dimensions and ADHD presentation subtypes. All items are rated on a Likert-type scale from 1 (*Not at all*) to 4 (*Very much*). Following Burke et al.'s (2014a) model of ODD symptom dimensions, irritability was measured by three items (touchy or easily annoyed; angry and resentful; loses temper) and defiant behavior by the other five items (argues; defies or refuses to comply; blames others; deliberately annoys; spiteful or vindictive). Similarly, the ADHD subscales were used to assess inattention (nine items, e.g., easily distracted, difficulty sustaining attention) and hyperactivity–impulsivity (nine items, e.g., fidgets/squirms, interrupts/intrudes on others). Internal consistency was good for inattention ($\alpha = .96$), hyperactivity–impulsivity ($\alpha = .95$), and overall ODD symptoms ($\alpha = .93$); and acceptable for irritability ($\alpha = .86$) and defiant behavior ($\alpha = .88$).

[2] The 15-item Conduct Disorder Scale from the DBD was not administered. These items represent delinquent behaviors (e.g., destruction of property, deceitfulness/theft, serious rule violations), which many elementary teachers would be unlikely to observe—for example, because the behaviors are committed at home, in the community, covertly, or infrequently. Thus, teachers would not be ideal reporters of these variables in this sample. For this reason, and due to the practical constraints on teachers' time, we decided that these items were not justified for the present study. However, in light of past research, the link between ODD dimensions and conduct problems remains an important topic for future school mental health research.

Proactive and Reactive Aggression

Teachers completed the Proactive/Reactive Aggression Scale (PRA; Dodge & Coie, 1987), a six-item measure assessing the two functions of aggressive behavior: proactive aggression (three items, e.g., threatens or bullies others to get his/her own way) and reactive aggression (three items, e.g., when teased or threatened, he/she gets angry easily and strikes back). Items are rated on a Likert scale from 1 (*never*) to 5 (*almost always*). Previous research supports the validity and reliability of the PRA as a teacher-reported measure (Dodge & Coie, 1987; Dodge, Lochman, Harnish, Bates, & Pettit, 1997). Internal consistency was acceptable for proactive ($\alpha = .87$) and good for reactive ($\alpha = .93$) aggression.

Relational and Physical Aggression

Relational and physical aggression was evaluated via teacher report based on an adapted version of Crick and Bigbee's (1998) measure. The aggression subscale consists of six items and includes three items assessing physical aggression (e.g., hits, kicks, punches others) and three items assessing relational aggression (e.g., when mad, gets even by keeping the person from being in their group of friends, tries to make other kids not like a certain person by spreading rumors about them). Each item is rated on a Likert-type scale ranging from 1 (*Never*) to 5 (*Almost Never*). Both subscales, relational and physical aggression, demonstrated acceptable internal consistency ($\alpha = .85$ and .78, respectively).

Relational and Physical Victimization

Relational and physical victimization was measured by teacher report using the victimization subscale of Crick and Bigbee's (1998) measure, which rephrases the six-item aggression subscale to assess the extent to which students are victims of physical aggression (three items, e.g., gets pushed or shoved by others, gets hit, kicked, punched by others) and relational aggression (three items, e.g., gets ignored by other kids when someone is mad at them, other kids tell rumors about them behind their backs). Each item is rated on the same Likert-type scale as the relational/physical aggression items. Both relational ($\alpha = .86$) and physical ($\alpha = .83$) subscales demonstrated acceptable internal consistency.

Peer Rejection

Peer rejection was assessed via four items on the Teacher Report Form (TRF; Achenbach & Rescorla, 2001). Teachers reported on individual students' experience with

various forms of social rejection (e.g., teasing, interpersonal problems) on a Likert-type scale ranging from 1 (*not true*) to 3 (*very or often true*). Previous work has provided evidence for the convergent, divergent, and criterion-related validity for this scale in relation to other aspects of social functioning (e.g., Fite, Hendrickson, Rubens, Gabrielli, & Evans, 2013). The internal consistency for the peer rejection subscale was acceptable ($\alpha = .76$).

Withdrawn/Depressed Symptoms

Similarly, teachers' ratings of depressive symptoms and withdrawn behaviors were assessed via the subscale of the same name from the TRF (Achenbach & Rescorla, 2001). The withdrawn/depressed subscale includes eight items that assess various observable, behavioral indicators of depression (e.g., sadness, psychomotor retardation) and evidence of social withdrawal (e.g., prefers to be alone). The withdrawn/depressed subscale exhibits strong reliability and validity (Achenbach & Rescorla, 2001). Internal consistency in the present study was acceptable ($\alpha = .87$).

Academic Performance

Teachers completed three items rating students' academic performance: (a) "relative to other students in your class," (b) "overall academic performance (reputation based on all their classes)," and (c) "what letter grade best reflects this student's academic performance." The first two items are evaluated on a Likert-type scale ranging from 1 (*well below average*) to 5 (*well above average*). For the third item, teachers selected a letter grade on a five-point scale from 1 (*A*) to 5 (*F*), which was subsequently reverse-coded to align with the other two items. Thus, higher mean scores reflect better academic performance. Previous work has utilized comparable items to assess academic performance, offering support for reliability and validity of this method (e.g., Becker et al., 2014; Evans et al., 2015; Fite et al., 2013). These items demonstrated good internal consistency ($\alpha = .94$).

Analytic Plan

Descriptive statistics and univariate and bivariate characteristics of the data were examined prior to analyses. Through the use of forced-response survey prompts, the level of missing data was negligible (<1 %) and handled via listwise deletion. Confirmatory factor analyses (CFA) were conducted in Mplus 7.2 (Muthén & Muthén, 2012) to estimate a correlated two-factor model of ODD symptoms. Robust estimation was used to accommodate non-normality (Kline, 2011), and the cluster option in Mplus was used to account for the nested features of the data. Model fit was evaluated using the χ^2 test statistic, root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), Confirmatory Fit Index (CFI), and Tucker-Lewis Index. Approximate thresholds for acceptable model fit are RMSEA $< .08$, SRMR $< .10$, CFI $> .90$, and TLI $> .90$, with values closer to .00 (RMSEA/SRMR) or 1.00 (CFI/TLI) indicating better fit (Hu & Bentler, 1999; Kline, 2011).

Next, the proposed associations of study variables with irritability and defiant behavior were examined through a series of multilevel regression models. In order to detect truly unique associations, models also controlled for grade, gender, and the shared variance among correlated variables' subtypes (e.g., controlling for the association with proactive aggression when estimating an association with reactive aggression). To avoid possible type I errors due to estimating a large number of correlations within a moderately large sample, a conservative alpha ($p < .01$) was used in all regression and correlation analyses. In multilevel analyses, all students were modeled as being nested within the 36 classrooms (per classroom, $M = 19.61$, SD $= 2.92$). A hierarchical analytic approach was employed, starting with an empty means, random intercept model, and then adding the model-specified predictors as fixed effects in a second model. That is, the mean of the intercept was allowed to randomly vary across classrooms (i.e., random intercepts), while the relations between the predictors and outcome were held constant (i.e., fixed effects). The effects of nesting were assessed through the intraclass correlation coefficient (ICC), or the ratio of between-classroom variance to total variance. The significance of fixed effects was evaluated with individual Wald tests (estimate/SE). Effect size was evaluated with the total R^2, calculated as the square of the correlation between the observed outcomes and the model-predicted outcomes. Thus, multilevel models allowed for estimation of the proportion of variance accounted for by classroom effects, and then by the variables of interest.

In addition to traditional *nonzero* null hypothesis testing logic—where, for any regression coefficient B_1, the null hypothesis (H_0) is $B_1 = 0$, and the alternative hypothesis (H_1) is $B_1 \neq 0$—we were interested in the common and differential correlates of ODD dimensions, which require a slightly different form of statistical inference. Specifically, for coefficients B_1 and B_2, we adopt a hypothesis-testing framework wherein *common correlates* are defined as follows: H_1: $B_1 > 0 < B_2$ (or, alternatively, $B_1 < 0 > B_2$); and H_0: B_1 and/or $B_2 = 0$. Further, for any significant first-order predictor B_1 (i.e., $B_1 \neq 0$), we identify B_1 as a *differential correlate* of B_2 as follows: H_1: $B_1 \neq B_2$; H_0: $B_1 = B_2$. To estimate comparisons between these parameter estimates, we used a *t* test specifically adapted for this purpose (Cohen, Cohen, West, & Aiken, 2003). It is

important to note that common and differential correlates are not mutually exclusive. For example, if the regression coefficient for irritability predicting reactive aggression were significant (greater than zero, $p < .01$), then we would also be interested in whether the magnitude of this effect is greater than that of the parallel association between defiant symptoms and reactive aggression, regardless of the direction, magnitude, or significance of the coefficient for defiant symptoms. Further, given the manner with which covariates were included, regression coefficients should be interpreted as specific, granular estimates of the relations between variables, after controlling the effects of any corresponding dimension/subtype variables from which they are to be distinguished (e.g., the relation between defiant behavior and hyperactivity–impulsivity, after controlling for inattention, irritability, and demographic covariates).

Results

Confirmatory Factor Analysis

The correlated two-factor model fit the data well, χ^2 ($df = 19$) = 96.182, $p < .001$, RMSEA = .076 (95 % CI .067–.091), CFI = .929, TLI = .895, SRMR = .041).[3] Standardized factor loadings ranged from .67 to .90 (all $p < .001$), with a strong correlation ($r = .93$) between the defiant and irritable latent factors. Thus, results supported the use of mean scores for irritable and defiant symptoms in subsequent analyses.

Descriptive Statistics and Correlations

The observed means, standard deviations, and bivariate correlations for all study variables are presented in Table 1. Across all students, the irritable ($M = 1.31$, SD = .58) and defiant ($M = 1.28$, SD = .52) dimensions of ODD symptoms were highly correlated with one another. As shown in Table 1, both irritability and defiant behavior were significantly associated with all other variables in a direction reflecting less favorable functioning for children with higher levels of symptoms. Correlations for both dimensions were in the moderate to high range for all *social* and *behavioral* measures, including proactive and reactive aggression, relational and physical aggression and victimization, peer rejection, and hyperactive–impulsive and inattentive symptoms. Only for *emotional* and *academic* variables—i.e., perceived withdrawn/depressed symptoms and academic performance—were the correlations of small magnitude. Boys exhibited higher means and greater variation in both irritability ($M = 1.45$, $SD = .70$) and defiant behavior ($M = 1.40$, SD = .59) compared to girls ($M_{\text{irritable}} = 1.16$, SD = .37; $M_{\text{defiant}} = 1.17$, SD = .40; ts (704) = 6.91 and 5.98; ps $< .001$). Regarding other correlates, gender showed small-to-moderate correlations with inattention and hyperactivity–impulsivity, proactive and reactive aggression, physical aggression and victimization, and peer rejection; and a marginal correlation with academic performance. In each case, male gender was associated with less favorable levels of the correlate. No other gender differences were found. Grade showed small but significant positive correlations with academic performance and relational victimization, and negative correlations with physical aggression, with a similar trend for physical victimization.[4]

Although the present study does not involve making clinical or proxy diagnoses, it is nonetheless informative to consider the percentages of children who may be exhibiting clinically significant levels of different forms of psychopathology. Overall, teachers endorsed four or more ODD symptoms (the minimum threshold for a diagnosis of ODD, per DSM-5) at clinically significant levels for 5.1 % of students. Similarly, teachers rated 14.3 % of students as exhibiting six or more symptoms of hyperactivity–impulsivity, inattention, or both (2.6, 6.1, and 5.7 %,

[3] Two other models were evaluated: (a) the one-factor model, with all eight ODD symptoms loading onto a general factor, χ^2 ($df = 20$) = 107.366, $p < .001$, RMSEA = .079 (95 % CI .064–.094), CFI = .919, TLI = .887, SRMR = .039; and (b) Stringaris and Goodman's three-factor model, χ^2 ($df = 18$) = 75.051, $p < .001$, RMSEA = .067 (95 % CI .052–.083), CFI = .947, TLI = .918, SRMR = .037. Notably, the two-factor model showed a significant improvement in model fit over the one-factor model, χ^2 ($\Delta df = 1$) = 7.928, $p < .01$ (using a robust estimation χ^2 difference test; Muthén & Muthén, 2012). However, for empirical and theoretical reasons (Kline, 2011), the three-factor model is not directly comparable to the other two models. The third "factor"—the spiteful/vindictive dimension—is in fact a manifest item (not a latent factor) comprised of only a single four-point ordinal item (not a continuous variable). Therefore, results of the three-factor model should be interpreted cautiously because such a model effectively treats this single item as a continuous, latent dimension, as if it were directly comparable to the defiant and irritable dimensions (both of which are continuous, latent factors). Because this third dimension was measured so differently from the other two—likely with more measurement bias and less precision/reliability (Kline, 2011)—it was considered statistically inappropriate to interpret the results for all three dimensions in a similar way. For these same reasons, the three-factor model could not be directly compared to the other two models. Therefore, the two-factor model was considered the most parsimonious model, providing good fit to the data and better fit than the one-factor model.

[4] Importantly, caution is advised in interpreting the zero-order correlations among study variables. Estimates may be somewhat inflated due to the nestedness of students within teacher raters. The multilevel models below support this possibility and statistically control for these effects. Further, note that the zero-order correlations of irritability with other variables do not partial out the effects of defiant behavior, and vice versa.

Table 1 Descriptive statistics and correlations for all study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Irritable	–												
2. Defiant	.84**	–											
3. H-I sx	.61**	.70**	–										
4. Inattentive sx	.52**	.59**	.79**	–									
5. Proactive agg	.69**	.72**	.50**	.43**	–								
6. Reactive agg	.84**	.81**	.63**	.57**	.72**	–							
7. Relational agg	.59**	.58**	.39**	.38**	.74**	.61**	–						
8. Physical agg	.67**	.66**	.52**	.43**	.73**	.68**	.53**	–					
9. Relational vic	.49**	.46**	.39**	.42**	.58**	.53**	.70**	.43**	–				
10. Physical vic	.51**	.42**	.39**	.36**	.51**	.53**	.47**	.64**	.45**	–			
11. Dep sx	.22**	.17**	.05	.19**	.11*	.13**	.14**	.14**	.20**	.10*	–		
12. Peer rejection	.68**	.67**	.52**	.48**	.51**	.63**	.48**	.49**	.58**	.35**	.32**	–	
13. Academic	−.17**	−.19**	−.32**	−.45**	−.15**	−.22**	−.14**	−.16	−.21**	−.15**	−.18**	−.22**	–
14. Male	.25**	.22**	.30**	.31**	.15**	.24**	.03	.24**	.00	.24**	.01	.11*	−.08^{+}
15. Grade	−.03	−.02	−.04	.06	.05	−.06	.04	−.14**	.14**	−.09^{+}	.04	.05	.15**
M	1.31	1.28	1.48	1.60	1.22	1.59	1.27	1.16	1.22	1.11	1.17	1.14	3.46
SD	.58	.52	.72	.77	.57	.99	.62	.47	.50	.33	.32	.32	1.08

H-I = hyperactive–impulsive, sx = symptoms, agg = aggression, vic = victimization, dep = withdrawn/depressed

$^{+}$ $p < .05$; * $p < .01$; ** $p < .001$

respectively), suggesting clinically significant levels of ADHD symptoms.[5] Although such estimates are not possible for withdrawn/depressed items (as they do not map directly onto any diagnostic category), raw scores place 13.8 % of the sample in the "at-risk" category (T-score ≥ 60), roughly in line with the TRF normative sample (Achenbach & Rescorla, 2001). We emphasize that these estimates do not account for key considerations such as functional impairment across settings and therefore should not be interpreted as real or proxy diagnoses.

Multilevel Regression Models

The unique associations of irritable and defiant dimensions of ODD with other study variables were examined in a series of multilevel regression models. Across all models, variance inflation factors were within an acceptable range (1.00–4.56; Mdn = 1.83), suggesting tolerable levels of multicollinearity. Table 2 presents the results of all multilevel models, with ICCs for the effects of classroom nesting (i.e., empty means, random intercept models) and the parameter estimates and R^2 for the full models (i.e., fixed effects models). As anticipated, nesting effects were present and accounted for 6–23 % (Mdn = 12.4 %) of the variance in each variable. Thus, multilevel analytic techniques were justified; however, a large majority of the variance in each model remained unexplained. With the addition of fixed effects (including grade, gender, and variable subtypes), models accounted for 6–76 % (Mdn = 50.0 %) of the variance.

After controlling for nesting, covariates, and the shared variance between ODD symptom dimensions and (where applicable) between subtyped variables, several common and differential associations were observed. With regard to common correlates, both teacher-reported irritability and defiant behavior showed significant positive associations with relational, physical, and reactive aggression; relational victimization; and peer rejection. With regard to differential associations, defiant behavior (controlling for

[5] For reference, compare to three-month point estimate (2.7 %) and lifetime prevalence estimate (10.2 %) of ODD in national epidemiological samples of children and adolescents (Costelllo et al., 2003; Nock et al., 2007), and a meta-analytic prevalence estimate of ADHD (11.4 %) based on teacher-reported symptom criteria only (Wilcutt, 2012).

Table 2 Multilevel regression models of ODD dimensions predicting correlates

B (B SE) β	ADHD symptoms (subtypes)		Aggression functions (subtypes)		Aggression forms (subtypes)		Victimization forms (subtypes)		Aca	Rej	Dep
	1. Hyp	2. Ina	1. Pro	2. Rea	1. Rel	2. Phy	1. Rel	2. Phy			
Irritable	.03^{+}	−.01	.06	.81**^{a,b}	.23**	.22**	.20**	.17**^{a}	−.09	.22**	.12**^{a}
	(.08)	(.06)	(.05)	(.06)	(.06)	(.04)	(.05)	(.03)	(.13)	(.03)	(.04)
	.03	−.01	.07	.47	.22	.27	.23	.30	−.05	.41	.23
Defiant	.45**^{a}	.14^{+}	.43**^{a,b}	.50**	.36**	.27**^{b}	.18**	.00	−.25	.22**	−.05
	(.06)	(.07)	(.05)	(.07)	(.06)	(.05)	(.05)	(.03)	(.14)	(.03)	(.04)
	.33	.09	.39	.26	.30	.30	.18	.00	−.12	.35	−.08
Grade	−.03^{+}	.05*	.03^{+}	−.03^{+}	.03	−.04**	.05*	−.02	.09*	.01^{+}	.01
	(01)	(.02)	(.01)	(.02)	(.02)	(.01)	(.02)	(.01)	(.03)	(.01)	(.02)
	−.07	.10	.09	−.05	.08	−.13	.18	−.11	.14	.07	.05
Male	.05	.14**	−.04	.06	−.17**	.10**	−.16**	.10**	−.11	−.04^{+}	−.02
	(.03)	(.04)	(.03)	(.04)	(.04)	(.03)	(.03)	(.02)	(.14)	(.02)	(.02)
	.08	.18	−.07	.06	−.27	.20	−.32	.32	−.10	−.13	−.06
Subtype	–	.75**	–	.34**	–	.14**	–	.16**	–	–	–
1	–	(.04)	–	(.05)	–	(.03)	–	(.02)	–	–	–
	–	.70	–	.20	–	.18	–	.25	–	–	–
Subtype	.53**	–	.19**	–	.23**	–	.39**	–	–	–	–
2	(.02)	–	(.03)	–	(.05)	–	(.06)	–	–	–	–
	.57	–	.34	–	.18	–	.25	–	–	–	–
ICC	.101	.121	.127	.119	.184	.124	.213	.213	.076	.058	.225
R^2	.713	.647	.579	.762	.420	.526	.360	.346	.059	.500	.053

To examine the unique and differential associations of ODD dimensions with subtyped variables, models were estimated controlling for the effects of subtype 1 (as a predictor) on subtype 2, and vice versa

Hyp = hyperactive–impulsive symptoms, ina = inattentive symptoms, pro = proactive, rea = reactive, rel = relational, phy = physical, aca = academic performance, rej = peer rejection, dep = withdrawn/depressed, ICC = intraclass correlation coefficient

$^{+}$ $p < .05$; * $p < .01$; ** $p < .001$

[a] Estimate is greater than that of *the other ODD dimension* in the same model, $p < .01$

[b] Estimate is greater than that of *the outcome variable's other subtype* in the same model, $p < .01$

irritability and other model covariates) was uniquely associated with proactive aggression and hyperactivity–impulsivity; the converse was not true for irritability. On the other hand, irritability (controlling for defiant behavior and other model covariates) was uniquely associated with teachers' perceptions of physical victimization and withdrawn/depressed symptoms; the converse was not true for defiant behavior.

Although both ODD symptom dimensions were associated with reactive aggression, the magnitude of the effect for irritability was significantly greater than that of both defiant behavior (t (704) = 3.434, $p < .001$) and proactive aggression (t (704) = 6.111, $p < .001$). Conversely, the association between defiant behavior and proactive aggression was significantly greater than that of irritability (t (704) = 5.034, $p < .001$) and reactive aggression (t (704) = 4.035, $p < .001$). And while irritability, defiant behavior, and relational aggression were all uniquely linked to physical aggression, the magnitude of the association between defiant behavior and physical aggression was significantly greater than the association between relational and physical aggression, (t (704) = 2.293, $p < .01$). Marginally significant associations were found between irritability and hyperactivity–impulsivity ($p < .05$) and between defiant behavior and inattention ($p < .05$). Neither dimension was uniquely related to academic performance.

Discussion

This study sought to extend the literature on ODD symptom dimensions by examining common and differential correlates of teacher-reported irritable and defiant symptoms in the school context. Consistent with previous research conducted primarily among community and

clinical samples (e.g., Burke et al., 2014a; Ezpeleta et al., 2012; Lavigne et al., 2015), we found that a correlated two-factor model fit the data acceptably well. Several significant and strong correlations were found at the zero-order level, reflecting the broad aspects of social and behavioral impairment associated with ODD. When we examined the unique effects of symptom dimensions—after controlling for age, gender, variable subtypes and dimensions, and classroom-teacher nesting effects—the magnitude of associations diminished, but several patterns of common and distinct correlates remained. Specifically, irritability was uniquely linked to teacher-perceived levels of reactive aggression, physical victimization, and withdrawn/depressed symptoms, whereas defiant behavior was uniquely linked to teacher-perceived levels of proactive aggression and hyperactive–impulsive behavior. Both dimensions showed common correlates with physical and relational aggression, relational victimization, and peer rejection.

Overall, these results reflect both the monothetic and the multidimensional nature of ODD symptoms. There appears to be a strong, general pattern of social problems commonly linked to both ODD symptom dimensions. These include problems with peer rejection, the relational and physical *forms* of aggression, and the relational form of victimization. On the other hand, the *functions* of aggression reveal a more differential pattern of associations with ODD symptom dimensions. Defiant behavior, but not irritability, was uniquely associated with proactive aggression, whereas irritability demonstrated a stronger link to reactive aggression.

These findings are consistent with the theoretical rationale and empirical basis underlying the distinctions among ODD symptom dimensions (e.g., Burke et al., 2014a) and subtypes of aggressive behavior (e.g., Vitaro & Brendgen, 2012). That is, the proactive and reactive functions of aggression appear to be generally consistent with the defiant and irritable dimensions of ODD, respectively. Both proactive aggression and defiant behavior represent disruptive behavior directed toward others in the pursuit of achieving a goal (Vitaro & Brendgen, 2012; Whelan et al., 2013). By contrast, both reactive aggression and irritability represent emotional and reactive disruptive behavior directed toward others in response to frustration or irritation (Burke et al., 2014a; Vitaro & Brendgen, 2012). In other words, both pairs of variables appear to represent a distinction based on the function of the behavior, and possibly certain neurocognitive and temperamental characteristics (Fite et al., 2012) Consistent with this hypothesis, the common associations between the two ODD dimensions and the two *forms* of aggression may reflect the reality that aggressive behaviors can take a variety of overt or covert forms. It is possible that the particular form that the aggression takes may be less consequential than the general presence, severity, and function of the aggression. Notably, grade and gender appear to be stronger predictors of the relational and physical of aggression than irritable or defiant dimension; the opposite was the case for the proactive and reactive of aggression.

Although the regression model only accounted for about 5 % of the variance in teacher-reported withdrawn/depressed symptoms, it is noteworthy that irritability was uniquely and differentially correlated with this outcome. This finding is consistent with prior research on ODD dimensions (e.g., Stringaris & Goodman, 2009a, b). Two explanations might help account for the small effect size. First, while teachers are strong reporters of behavioral problems, they may not be the most accurate reporters of withdrawn/depressive symptoms, as compared to self- or parent reports (e.g., Konold, Walthall, & Pianta, 2004). Second, rates of depressive symptoms and disorders are relatively low among elementary school-age children as compared to adolescents (Costello et al., 2003). In this age group, it is possible that irritability might be a stronger predictor of subsequent, rather than concurrent, depressive symptoms. Indeed, diagnostic conventions (e.g., APA, 2013) have long included irritable mood as one way in which depression might manifest differently in children and adolescents as compared to adults. Importantly, the withdrawn/depressed measure used in the present study did not include items relating to irritability, which rules out the possibility of inflated correlations due to similar item content. Further research is needed to disentangle irritability from depressed mood, as well as associations with other diagnoses and symptoms. Additionally, the lack of association between gender and withdrawn/depressed symptoms is not surprising considering that the low prevalence of depression in childhood has been found to be relatively similar across boys and girls, with the female–male prevalence gap emerging and widening in adolescence (Hankin et al., 1998).

There appears to be a unique association between defiant behavior and hyperactivity–impulsivity; however, there were only marginal associations between defiant behavior and inattention, and between irritability and hyperactivity–impulsivity. It should be noted that these analyses controlled for the shared variance (approximately 49 %) between the inattention and hyperactive–impulsive dimensions of ADHD. The strong general correlation with ADHD symptoms may have attenuated the specific associations between ODD symptom dimensions and inattention and hyperactivity–impulsivity. This analytic approach was used in order to examine truly unique associations among symptom dimensions, as was done for the other subtype variables in the present analyses—and for this reason, we refrained from estimating alternative models for ADHD symptoms. Nevertheless, zero-order correlations

indicate moderate to high correlations ($rs = .52–.70$, $ps < .001$) among the symptom dimensions of ADHD and ODD, reflecting the well-established association between ODD and ADHD symptoms more generally.

Finally, it is interesting that ODD symptom dimensions did not show significant unique associations with teachers' ratings of academic performance. To our knowledge, the connection between ODD symptom dimensions and academic performance has not been previously examined. While ODD-related behavior problems can adversely affect academic performance and educational attainment (Burke et al., 2014b), there does not appear to be a cross-sectional relationship between symptom dimensions and performance, after controlling for teacher effects, grade, and gender, which is consistent with prior research (e.g., Pardini & Fite, 2010). At the same time, results indicate that ODD symptom dimensions are associated with observably poorer social, behavioral, and academic functioning at school. To the extent that social-emotional functioning is both an educational goal and a foundation for future academic progress, ODD symptoms may be linked to poorer educational outcomes in the future, if not concurrently.

Limitations

Several limitations of this study should be noted. First, all study variables were assessed exclusively by teacher report. As previously noted, teachers appear to be valid reporters of children's externalizing behaviors and social functioning, particularly in the school context (e.g., Konold et al., 2004). Nevertheless, future research would benefit from including self-, peer-, and parent reports of behavior, including variables included in the present study, as well others which we did not assess but warrant further investigation (e.g., conduct problems, callous–unemotional traits, anxiety, categorical diagnostic constructs). Moreover, researchers should consider incorporating more objective measures of academic, psychological, and social functioning (e.g., semester grades, standardized test scores, IQ/achievement testing, school discipline records), which can be an area of strength and potential for school mental health research. It is also important, particularly in secondary school settings, to obtain multiple teacher ratings of each child to overcome the systematic discrepancies documented by previous research (Schultz & Evans, 2012). Any of these methods may help overcome mono-informant biases, reduce measurement error, and provide a more complete picture of children's functioning.

Second, the cross-sectional design precludes conclusions regarding temporal or causal associations between ODD dimensions and other variables. Longitudinal research is therefore needed to further explore these questions across development (age) and education (grade levels). Third, the present sample was comprised of predominantly Caucasian children from a small community in the Midwestern region of the USA. Additional work is needed to examine the generalizability of findings in ethnically and socioeconomically diverse populations. Finally, our measurement of aggressive behavior did not allow us to examine forms and functions of aggression simultaneously; future research should examine the interplay among reactive, proactive, physical, and relational types of aggression.

Implications

These results also have important implications for school mental health. In elementary school classrooms, oppositional students are often identified due to the disruptive nature of their behavior; however, a common reason for referral does not necessarily reflect a common underlying problem, especially in light of the heterogeneous nature of ODD symptoms. School and child mental health professionals should assess the patterns of oppositional behavior displayed, insofar as different patterns may convey different information for prevention and treatment. Indeed, recent advancements underscore the clinical significance of the distinction between defiant behavior with, versus without, severe irritability/anger (e.g., Lochman et al., 2015). Children showing signs of irritability may need to be monitored for depressive symptoms and physical victimization, whereas those exhibiting defiant behaviors may benefit from screening for ADHD and treatment tailored to address proactive aggression. Both patterns appear to convey risk of general problems with aggression, victimization, and peer rejection. Longitudinal investigations may further elucidate the developmental pathways associated with these behavior problems. Finally, there is a need for intervention research and clinical work specifically targeting the dimensions of ODD. Closer attention to the varying presentations of irritable and defiant oppositionality may help facilitate more appropriate, effective, and efficient services for children with behavior problems.

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