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Dimensions of oppositional defiant disorder in 3-year-old preschoolers

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Conflict of interest

The authors have no conflict of interest

Abstract

Background: To test the factor structure of oppositional defiant disorder (ODD) symptoms and to study the relationships between the proposed dimensions and external variables in a community sample of preschool children. **Method:** A sample of 1341 three-year-old preschoolers was randomly selected and screened for a double-phase design. In total, 622 families were assessed with a diagnostic semi-structured interview and questionnaires on psychopathology, temperament and executive functioning completed by parents and teachers. **Results:** Using categorical and dimensional symptoms of ODD it was possible to confirm, cross-informant and cross-method, distinct dimensions for defining the structure of ODD: one made up of *irritable* and *headstrong* and the other of *negative affect*, *oppositional behaviour* and *antagonistic behaviour*. Specific associations with DSM-IV disorders were found, and *irritable* was associated with anxiety disorders, whereas *headstrong* was associated with disruptive disorders, including aggressive and non-aggressive CD symptoms. Also, *negative affect* was associated with anxiety disorders and non-aggressive CD symptoms, *oppositional behaviour* with disruptive disorders and aggressive CD symptoms, and *antagonistic behaviours* with disruptive disorders and, in boys, with mood disorders. The dimensions correlated with specific scales of psychopathology, temperament and executive functioning. **Conclusions:** ODD is a heterogeneous disorder from preschool age. Different dimensions, with moderate to acceptable reliability and convergent and discriminant validity with other psychological constructs, can be identified early in life.

KEYWORDS: comorbidity; dimensions; headstrong; irritability; negative affect; oppositional defiant disorder; preschool.

Introduction

Oppositional defiant disorder (ODD) has been postulated as a complex multidimensional category that encompasses not only disruptive behaviour, but also other psychopathological difficulties, such as mood and emotional dysregulation (Boylan, Vaillancourt, Boyle, & Szatmari, 2007; Burke & Loeber, 2010; Stringaris & Goodman, 2009b). The underlying structure of ODD symptoms has been studied in an attempt to understand the nature of the high comorbidity of ODD with other conditions and to determine whether particular “dimensions” of the disorder have specific associations with comorbid disorders. Several theoretical or empirical dimensions have been proposed, and are shown to have internal and external validity. Stringaris and Goodman (2009b) proposed an *a priori* hypothesis of three dimensions of ODD symptoms to explain the varied comorbidity of the disorder: 1) *irritable*, including loses temper, angry and touchy; 2) *headstrong*, including argues, defies, annoys and blames, and 3) *hurtful*, including spitefulness and vindictiveness. They tested it cross-sectionally in a community sample of parents and teachers of 5 to 16-year-old children, ODD symptoms being assessed through a diagnostic interview. Adjusted for age and sex, the *irritable* dimension was associated with emotional disorders, *headstrong* with attention deficit/hyperactivity disorder (ADHD), and *hurtful* with conduct disorder (CD) aggressive symptoms. When these results were replicated longitudinally, irritable predicted depression and anxiety 3 years later, headstrong predicted CD, and hurtful was associated with aggressive CD symptoms (Stringaris & Goodman, 2009a). Burke, Hipwell, and Loeber (2010) described two dimensions of ODD in a sample of referred boys: 1) *negative affect*, containing the symptoms touchy, angry and spiteful, which predicted later depression, and 2) *oppositional behaviour*, including loses temper, defies and argues, which predicted later CD (blames and annoys were not associated with either factor). This structure was replicated in a community sample of 5 to 8-year-old girls followed-up for 5 years (Burke et al., 2010) using

dimensional measures of psychopathology. Exploratory factor analysis with dichotomous symptoms yielded 3 factors: 1) *negative affect*, containing the symptoms touchy, angry and spiteful, which predicted later depression for the entire sample and CD in Caucasian girls; 2) *oppositional behaviour*, including loses temper, defies and argues, predicting CD; and 3) *antagonistic behaviour*, including annoys and blames, which predicted CD. Finally, Rowe, Costello, Angold, Copeland, and Maughan (2010) factor analyzed (exploratory) ODD symptoms in a community sample followed up from age 9 to age 16 and found a two-factor solution: 1) *irritable*, including loses temper, angry and touchy, which predicted later CD and anxiety, and 2) *headstrong*, including argues, defies, annoys, blames, and spitefulness, which predicted later CD, depression and substance disorders.

ODD dimensions were shown to have predictive validity in a sample of 6 to 11-year-old children treated for disruptive behaviour disorders: *hurtful* (only one symptom in this study) at pretreatment increased the risk of CD diagnosis and of more ODD and CD symptoms at posttreatment, whereas *irritable* increased the risk of ODD, ADHD, higher levels of internalizing and social problems and poorer global functioning following treatment, and *headstrong* yielded no significant predictions (Kolko & Pardini, 2010).

Previous work on ODD dimensions and their specific associations has focused on children between the ages of 5 and 16, and has shown that dimensions of oppositionality in community and clinical samples differ significantly in their association with categorical and dimensional measures of psychopathology. This line of research improves our understanding of the “mechanisms” of ODD comorbidity. It has been proposed that *irritable* shares negative affect with emotional disorder and behavioural disorder, *headstrong* shares delay aversion with ADHD, and *hurtful* shares callous and premeditated behaviour with CD (Stringaris & Goodman, 2009b). No substantial sex differences have been reported in these relationships.

Currently, there are no reports of dimensionality of ODD symptoms prior to age 5. Stringaris and Goodman (2009b) pointed out that the dimensions are suggestive of different trajectories in the origin of oppositionality, as well as different trends of persistence; consequently, assessing and identifying them could help the detection and modification of dysfunctional trajectories. Also, there is agreement in epidemiological studies on the fact that ODD is the most prevalent disorder in the preschool period (Bufferd, Dougherty, Carlson, & Klein, 2011; Ezpeleta, Osa, & Doménech, Submitted; Lavigne, Lebailly, Hopkins, Gouze, & Binns, 2009). Therefore, it is necessary to study whether the proposed dimensions can be identified early in life and to ascertain whether they have internal and external validity. The goal of this work is to test the internal structure of ODD symptoms as proposed by Stringaris and Goodman (2009b), Rowe et al. (2010) and Burke et al. (2010), and to provide evidence based on their relations with external variables in a community sample of preschool children.

Method

Participants

The data are from the first assessment of a large-scale longitudinal study of behavioural problems in preschool children from age 3 (Ezpeleta et al., submitted). A cross-sectional two-phase design started with the selection of a random sample of 2,283 children from the census of preschoolers in grade P3 (3-year-olds) in Barcelona. A total of 1,341 families (58.7%) agreed to participate in the first phase, of which 33.6% were of high socioeconomic status, 43.1% middle and 23.3% low. Children's mean age was 3.0 years ($SD=0.18$), 683 were boys (50.9%) and 89.3% were white. There were no sex differences ($p=.95$) between those who agreed to participate and those who declined, but semi-public schools were significantly more likely to refuse to participate than public ones ($p<.001$), and high socioeconomic status families participated more than low status families ($p<.001$). The

parents of children participating in this first phase completed the SDQ³⁻⁴ parents' version, which was used for screening purposes.

In the second phase, all children with a positive screening for behavioural problems and a random sample of 30% of children with a negative screening were invited to continue. The final second phase sample included 622 families (10.6% of those invited refused to participate in the second phase). No differences were found on comparing participants and refusals by sex ($p=.82$) or by type of school ($p=.85$). Ninety-four teachers from 54 schools answered the SDQ³⁻⁴. Children's mean age was 3.0 ($SD=0.16$), 311 were boys (50.0%) and 89.5% were white, while 33.8% were of high socioeconomic status, 44.9% middle, and 21.3% low. Weighted DSM-IV prevalences in the sample were as follows: 3.7% of the children presented ADHD, 6.9% ODD, 1.4% CD, 0.4% major depression, 3.0% minor depression, 2.2% SAD, 3.7% specific phobia and 1.9% social phobia.

Children showing intellectual disability or pervasive developmental disorders were excluded, as were three types of families: those with difficulties with Spanish or Catalan, those without a primary caregiver who could report about the child, and those that were moving to another city within a year.

Instruments

The *Diagnostic Interview for Children and Adolescents for Parents of Preschool and Young Children* (DICA-PPYC; Ezpeleta, de la Osa, Granero, Domènech, & Reich, 2011) is a computerized semi-structured diagnostic interview for assessing the most common psychological disorders at ages 3-7 years according to the DSM-IV-TR criteria. After the assessment of the symptoms of each disorder, the following information is obtained: clustering, age at onset and at remission of symptoms, duration criteria, consultation and treatment received, impairment at home, at school and with friends, distress, and family

burden. Diagnoses are generated by means of computerized algorithms following the DSM-IV-TR criteria. Disruptive disorders included ADHD and CD; mood disorders included major and minor depression; and anxiety disorders included separation anxiety (SAD), specific phobia and social phobia. Disorders are assessed over the lifetime. The instrument has shown acceptable test-retest agreement and moderate convergence with other measures of psychopathology, as well as the ability to differentiate preschoolers and young children who had used mental health services, were more impaired, and presented more severe psychopathology (Ezpeleta et al., 2011).

Based on the dimensions proposed by previous authors, ODD scores grouping the items as described in Figure 1 were generated. CD symptoms were grouped in two categories: aggressive (bullying, fighting, weapon use, cruelty to people, cruelty to animals, stealing with confrontation, and forced sex) and non-aggressive (fire-raising, vandalism, breaking and entering, lying, and stealing without confrontation).

The *Strengths and Difficulties Questionnaire* (SDQ)³⁻⁴ (Goodman, 1997) was used for screening and was answered by all the parents in the first phase of the study ($N=1338$) and by teachers of the children participating in the second phase. The SDQ³⁻⁴ has 25 items. Four items of the scale for conduct problems related to DSM-IV ODD symptoms (Often has temper tantrums or hot tempers; Generally obedient, usually does what adults request; Often argumentative with adults; Can be spiteful to others), plus four items from the DSM-IV definition of ODD (Often deliberately annoys others; Often blames others for his/her mistakes or bad behaviour; Is easily offended by things others say; Is often angry and resentful) not included in the questionnaire but added to the list of questions with the same response format, were used for the analyses of the dimensions (below we refer to these 8 ordinal symptoms as ODD-questionnaire-symptoms- ODD-QS). Reverse items were coded in the direction of higher scores indicating more psychopathology. Cut-off for screen positive was an SDQ³⁻⁴ ≥ 4

(Percentile 90 in community samples) on the conduct problems scale or a response option of 2 (“certainly true”) in any of the 8 DSM-IV parent’s self-reported oppositional defiant symptoms.

The *Children’s Global Assessment Scale* (CGAS; Shaffer et al., 1983; Ezpeleta et al., 1999) is a global measure of functional impairment. Scale scores range from one (maximum impairment) to 100 (normal functioning). Scores above 70 indicate normal adaptation.

The *Child Behavior Checklist* (CBCL 1^{1/2}-5; Achenbach & Rescorla, 2000) measures behavioural and emotional problems through 100 items answered by parents (Table S1 online).

The *Children’s Behaviour Questionnaire* for ages 3-7 years (CBQ³⁻⁷; Rothbart, 2001) measures reactive and self-regulative temperament, with 94 items answered by parents and 15 scales clustered in 3 broad dimensions of temperament: negative affectivity (anger-frustration, discomfort, fear, sadness, soothability), effortful control (Attention Focusing, Inhibitory Control, Low-intensity Pleasure, Perceptual Sensitivity), and surgency (Activity Level, High-intensity Pleasure, Impulsivity, Shyness) (Table S1 online).

The *Children’s Aggression Scale* (CAS; Halperin & McKay, 2008) assesses aggressive behaviour with 22 items. It is structured in 7 primary factors: verbal aggression, aggression against objects and animals, use of weapons, provoked physical aggression, initiated physical aggression, aggression towards peers and aggression towards adults. This questionnaire was applied tentatively to preschool teachers so as to provide a baseline in aggressive behaviour for the longitudinal study (Table S1 online).

The *Inventory of Callous-Unemotional traits* (ICU; Frick, 2004) measures callous-unemotional traits, with 24 items structured in three dimensions: unemotional, callousness and uncaring. It was applied tentatively to preschool teachers to provide a baseline in callousness-unemotionality for the longitudinal study (Table S1 online).

The Behavior Rating Inventory of Executive Function for Preschool Children (BRIEF-P; Gioia, Isquith, Guy, & Kenworthy, 2000) measures executive functions, with 63 items organized in the following scales: inhibit, shift, emotional control, working memory, plan-organize, plus four global indexes. It was answered by teachers (Table S1 online).

Procedure

The longitudinal project was approved by the ethics review committee of the authors' institution. Heads of the participating schools and parents were provided with a full description of the study. Families were recruited at the schools and gave written consent. All parents of children from grade P3 at the participating schools were invited to answer the SDQ³⁻⁴, which was completed by families at home and returned to the schools. Families who agreed to participate and met the screening criteria were contacted by telephone and interviewed at the school. Interviewers were previously trained and were blind to the children's screening group. After the interview parents answered the questionnaires, and the questionnaires were then applied to the teachers.

Statistical analysis

The statistical analysis was carried out with SPSS18 and Mplus6. Because of the multistage sample, data from the second phase were analyzed through Complex Samples in SPSS (plan file with sampling weights inversely proportional to the probability of participant selection) and with the case weighting procedure in Mplus6.

Confirmatory Factor Analysis (CFA) tested the factor structure for the ODD symptoms, separately for the data from the diagnostic interview and parents' and teachers' ODD-QS. Weighted Least Squares Means and Variance (WLSMV) adjusted for the categorical data method of estimation was used. Given that missing values in any symptom

accounted for less than 5% of cases, listwise deletion was applied (3 and 7 cases excluded for parents' and teachers' *ODD-QS* responses, respectively) (Graham, 2009). The four models depicted in Figure 1 were tested. Goodness-of-fit was assessed with the Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA); moderate adjustment was considered for CFI>0.85 and RMSEA<0.10, and good adjustment for CFI>.90 and RMSEA<.06 (Marsh, Hau, & Wen, 2004). Chi-square tests compared nested models. Internal consistency of the derived scores was measured with Cronbach's α and, given the brevity of some scales, with the mean-inter-item correlation (R_M) following Nunnally and Bernstein (1994).

INSERT FIGURE 1

The association between ODD dimensions and other DSM disorders (disruptive disorders, mood disorders and anxiety disorders) was analyzed through binary logistic regressions adjusted for other comorbidities, not included in the model; all of the ODD dimensions were entered together. To assess differences in the relationships for boys and girls, the models included the interactions of ODD dimensions*sex. The specific association between ODD dimensions and the two CD dimensions *aggressive* and *non-aggressive* was analyzed with General Linear Models (GLM), adjusted for other comorbidities and the sum of CD symptoms other than those analyzed. GLM models included the interaction of ODD dimensions*sex, and single effects were estimated separately if $p \leq .10$.

The association between ODD dimensions and raw scores on the questionnaires was calculated with Pearson's correlation. Given the large sample size and the high statistical power, low correlations tended to be significant, and only r-coefficients with good effect sizes ($|r| \geq .30$) were considered relevant.

Results

Confirmatory Factor Analysis for ODD symptoms and Internal Consistency

There were no sex differences for ODD distribution, and factor analysis was carried out jointly for boys and girls. For all the models tested (Figure 1), factor loadings were statistically significant ($p < .001$) and exceeded the .40 value on their factor (Table 1). It would seem, therefore, that they are all suitable potential candidates for defining the structure of ODD symptoms.

Results for data based on parents' diagnostic interview obtained the best goodness-of-fit indexes (the highest CFI and lowest RMSEA values), with non-significant differences between models A and B ($p = .217$), whereas model D yielded an inappropriate-inadmissible solution. Internal consistency was moderate, and better for the total score.

Results for data based on *ODD-QS* obtained moderate goodness-of-fit, for both parents and teachers, though slightly better for teachers' ratings. With regard to parents' reports, model D achieved the best goodness-of-fit indexes, followed by models B and C ; however, regarding teacher's reports, CFI and RMSEA were better for model B than for models A, C, and D. In relation to chi-square comparisons between nested models within each group of responses (parents and teachers), model D improved the fit when compared to model C ($p < .001$ for both ratings), which in turn showed a better fit than model A ($p = .015$ and $p < .001$, respectively). Internal consistency was moderate for parents' data and very good for those of teachers.

INSERT TABLE 1

Correlations between dimensions

For model B, the correlation between the direct scale scores on Irritable-Headstrong based on diagnostic interview data was .57. For parents' and teachers' ODD-QS the correlations were, respectively: irritable-headstrong .48 and .58, irritable-hurtful .30 and .49,

and headstrong-hurtful .27 and .37. Based on Model C, the correlation between irritable and headstrong+spiteful was .51 for parents' ODD-SQ and .64 for teachers' ODD-SQ. And based on Model D, parents' and teachers' ODD-QS correlations were, respectively: negative affect-oppositional .37 and .52, negative affect-antagonistic .34 and .53, and oppositional-antagonistic .37 and .59 (all r values with $p < .001$).

Association of ODD dimensions with DSM-IV disorders

Table 2 shows the results of logistic regressions on the specific contribution of each ODD dimension (Models B, C and D), adjusted for each other and for other comorbidity, to other DSM-IV disorders, and GLM for the two CD dimensions (aggressive and non-aggressive) and for functional impairment (CGAS score), including the interaction of sex.

INSERT TABLE 2

Briefly, for Model B, high *irritable* scores were associated with high risk of ADHD and of separation anxiety for girls and with anxiety disorders, specific and social phobia for both sexes. High scores in *headstrong* were associated with disruptive disorder, ADHD (the association was stronger for girls) and both CD dimensions (aggressive and non-aggressive). *Hurtful* was positively associated with high risk of ADHD and CD-non aggressive scores in boys and girls, and with mood disorders in girls.

For model C, *irritable* showed the same associations as in model B, and *headstrong+spiteful* was related to disruptive disorders, ADHD and aggressive and non-aggressive CD dimensions. In Model D, *negative affect* was associated with anxiety disorders, SAD, social phobia (in girls), aggressive CD symptoms (in boys), and non-aggressive CD symptoms; *oppositional behaviour* was related to disruptive disorders, ADHD, aggressive CD symptoms, and low risk of minor depression in boys, and *antagonistic behaviour* yielded

significant associations only for girls in disruptive disorders, ADHD, mood disorders and minor depression.

High scores in the dimensions of the three models were predictive of high global impairment. Complete Tables with p values of the sex interactions and all the confidence intervals for OR and B coefficients are available online (See S2).

Convergent validity of ODD dimensions with other psychological measures

Table S1 (available online) shows the associations between ODD dimensions and psychopathology, temperament, aggressive behaviour, callous-unemotional, and executive functioning. It was expected that *irritable* and *negative affect* would be associated with temperamental difficulties in the area of negative affectivity and with difficulties in executive functioning in the area of emotional control, whereas *headstrong*, *oppositional behaviour* and *antagonistic behaviour* would be associated with temperamental difficulties in the area of effortful control and surgency and with difficulties of executive functioning in the area of inhibitory self-control.

Globally, *Irritable* (models B and C), was most strongly associated with CBCL 1^{1/2}-5 emotionally reactive, anxious-depressed and internalizing, CBQ negative affectivity, anger and low soothability, BRIEF shift, emotional control, and FI index; *headstrong* was associated with CBCL 1^{1/2}-5 aggressive behaviour, externalizing problems and callous-unemotional, CBQ activity level ($r=.29$) and low inhibitory control, CAS aggressive behaviour (all the scales except use of weapons), ICU callousness and uncaring and BRIEF inhibit, working memory, plan/organize, and all global indexes; and *hurtful* (single spiteful-vindictive item) (model B), obtained significant but weaker associations than with the other dimensions. Moreover, correlations for *headstrong+spiteful* (model C) were similar to those found for *headstrong* (model B). Finally, for model D, *negative affect* correlated with CBCL

1^{1/2}-5 emotionally reactive, anxious-depressed and internalizing, CBQ negative affectivity ($r=.27$), and BRIEF shift, emotional control, and FI index; *oppositional behaviour* correlated with CBCL 1^{1/2}-5 aggressive behaviour, externalizing problems and callous-unemotional, CBQ anger and low inhibitory control, CAS verbal aggression, aggression towards objects-animals and towards adults, ICU callousness and uncaring, and BRIEF inhibit, working memory, plan/organize, and global indexes; while *antagonistic behaviour* correlated with CAS aggression towards peers and provoked and initiated aggression, and ICU callousness.

Description of scores by sex

Tables S3a-b-c (available online) show the description of ODD dimensions based on models B, C and D. No differences by sex emerged.

Discussion

Using categorical and dimensional symptoms of ODD in 3-year-old preschool children from the general population, it was possible to confirm distinct suitable dimensions for defining the structure of ODD: *irritable* and *headstrong* on the one hand, and *negative affect*, *oppositional behaviour* and *antagonistic behaviour* on the other. Specific associations with DSM-IV disorders were found for both categorical and dimensional dimensions derived, cross-informant and cross-method, and *irritable* and *negative affect* were associated with anxiety disorders, *headstrong* was associated with disruptive disorders (ADHD, and aggressive and non-aggressive CD symptoms), *oppositional behaviour* was associated with disruptive disorders and aggressive CD symptoms, while *antagonistic behaviour* was associated with disruptive and mood disorders. Furthermore, the dimensions correlated with the specific scales of psychopathology, temperament and executive functioning (which were those theoretically most strongly related to the dimensions), and with functional impairment.

Factor analysis permitted the confirmation of two potential dimensions, out of the three proposed by Stringaris and Goodman (2009b), two by Rowe et al. (2010) and three proposed by Burke et al. (2010), as components of ODD with well-fitting indexes. A 2-factor model and a 3-factor model provided as good a fit as the conventional 1-factor model, since goodness-of-fit indexes for the different solutions were quite similar; in this sense, there is no compelling reason to accept a two- or three-factor solution as opposed to the one-factor model. What is desirable is to find “a model that explains the data substantially better than a simpler alternative model (i.e., models with fewer factors) but does as well or nearly as well as more complex alternative models (i.e., models with more factors)” (Fabrigar, Wegener, MacCallum, & Strahan, 1999, p. 279). However, for decisions on number of factors it is necessary to balance parsimony against plausibility and to bear in mind that overfactoring introduces much less error than underfactoring (Fabrigar et al. 1999). Furthermore, since the purpose of research on ODD dimensions is to disentangle their underlying structure, identifying two- and three-factor solutions could prove very useful in clinical contexts, and would be in accordance with the heterogeneity of ODD found in previous research.

The present study supports the convergent validity of the ODD dimensions in preschool children, in line with the findings of previous research. As in Stringaris and Goodman (2009a, 2009b) and Rowe et al. (2010), the *irritable* dimension, controlling for the presence of the other dimensions and for other comorbidity, was associated with anxiety disorders. Stringaris (2011) has pointed out the role of irritability as a mood dimension present in various psychopathological conditions, including depression, anxiety and oppositional defiant disorder. He warns about the risk of confusing the behavioural consequences (i.e., being defiant or oppositional) with their possible causes (anger or easy annoyance) if irritable mood is included in diagnostic criteria for ODD. This caveat might be taken into account from as early as the preschool years, since an *irritable* dimension is

identified with some of the symptoms of ODD. Also, the associations of *headstrong* coincide with those from results with older children, and this dimension was related, consistently across the three measures, with ADHD and CD (aggressive and non-aggressive symptoms). Dimensions defined in this way derived from parents, but not those derived from teachers, were associated with functional impairment. Unshared informants (impairment coming from parents and dimensions coming from teachers) or unshared contextual effects might explain differing results. Regarding Burke et al.'s (2010) model, the *negative affect* dimension was associated not with depression but with anxiety disorders, and there was agreement on the association with CD symptoms; *oppositional behaviour* was associated with disruptive disorders and aggressive CD symptoms as in the original model, and there was agreement on the relationship between *antagonistic behaviour* and disruptive disorders, though according to teachers this behaviour was also associated with minor depression in our results. These three dimensions derived from parents are related to functional impairment, but only *negative affect* and *oppositional behaviour* are associated with it in the case of teacher's reports.

As expected, Models B and C (which differ in that model C includes the spiteful symptom in the *headstrong* dimension and model B does not, since it forms a distinct dimension called *hurtful*) were very similar in the associations with other disorders and in the relationships with other measures. With a view to exploring the external validity of the original Stringaris and Goodman (2009b) dimensions, we analyzed the association of the spiteful-vindictive (*hurtful*) symptom (model B). This symptom showed the least consistent associations according to reporters, and was related to disruptive disorders, ADHD, and mood disorders (in this last case only for girls) according to parents, and with social phobia according to teachers. The young age of the children in our sample and the use of only one symptom to assess this dimension could be related to the heterogeneity found. Children show increasing understanding of others' emotions and of their own emotional reactions with age

(Hughes, Tingle, & Sawin, 1981), and at age 3 these cognitive and affective processes are still in the process of development. In fact, this symptom was not found to be present in any of the children in the diagnostic interview.

In addition to the relationships with DSM-IV disorders, we also presented evidence of convergent and discriminant validity with dimensional psychological constructs potentially related to the specific ODD dimensions. Thus, the *irritable* dimension was correlated in the psychopathology area with internalizing scales, in the temperament area with negative affect, and in the executive functioning area with difficulties in flexibility for modulating emotional control. On the other hand, the *headstrong* dimension was correlated in the psychopathology area with externalizing scales and callousness-unemotional, in the temperament area with difficulties in effortful control and surgency, and in the executive functioning area with difficulties in inhibitory self-control. Regarding model D, the *negative affect* dimension showed the same pattern of associations as those found for the *irritable* dimension mentioned above, while the *oppositional behaviour* dimension showed similar associations to those for the *headstrong* dimension mentioned above; furthermore, in the temperament area it was correlated with anger but not with surgency. Finally, in contrast to what was expected, the *antagonistic behaviour* dimension yielded few relevant associations, the most important being in the psychopathology area (aggressive behaviour). The temperamental dimensions of emotionality and activity at age 38 months have been shown to be predictive of ODD at age 91 months (Stringaris, Maughan, & Goodman, 2010), and we found that temperament was also concurrently associated at age 3 with ODD dimensions.

Direct scores based on the sum of symptoms were moderately related to one another, which indicates that although ODD is a heterogeneous disorder, the constructs are not totally independent; indeed, the strongest association was between *irritable* and *headstrong* and between *oppositional behaviour* and *antagonistic behaviour*.

The few differences by sex found in this study merit thorough examination in longitudinal research, but appear to be indicative of a somewhat stronger association of *headstrong* and *antagonistic behaviour* with disruptive disorders and of *irritable* with anxiety in girls. Thus, according to diagnostic interview symptoms, we found a relationship between ADHD and irritability in girls only. Emotional lability symptoms are reported as more relevant among 6-18 year-old girls than boys (Sobanski et al., 2010) and symptoms of ADHD plus behavioural problems at baseline predict persistence of ADHD at 5-year follow-up in 6-17 year old girls (Mick et al., 2008). Therefore, to find this association from age 3 is highly relevant to an understanding of ADHD in girls, particularly in view of the fact that preschool girls (compared to boys) present a more severe and deviant pattern of ADHD than same sex and age peers (Posner et al., 2007).

Some limitations should be taken into account on interpreting the present results. We recruited cases from a healthy general population, resulting in a response rate of 59%; even so, given the purpose of the study, which was to assess associations, the participation rate did not adversely affect the results. Since we studied a very young sample of the general population, and psychopathology is not very frequent in community samples, we found few cases of major depression and of conduct disorders, so that we could not derive independent models for these disorders. Nevertheless, these disorders were included in the broad categories of mood or disruptive disorders. Also, in our clinical experience it is uncommon for a preschool child to meet the 5-symptom requirement of DSM-IV major depression (only six children had 5 or 6 symptoms), so that we used as an alternative the less stringent diagnosis of minor depression. Gaffrey, Belden and Luby (2011) pointed out the need to modify developmentally the DSM-IV definition of major depression for preschoolers because a high percentage of children with clinically significant symptoms of major depression were not identified by formal DSM-IV criteria. Given the few children identified as depressed, we

also analyzed the associations of subthreshold depression (defined as the presence of any impairment at home, at school or in social relationships associated with “any” symptom of major depression in the diagnostic interview) with the ODD dimensions, but the relationships were in the same directions as those shown in Table 2. Consequently, we assume that the lack of association between depression and ODD dimensions in the direction previously reported (high scores on the dimension associated with higher risk of depression) might not be due to the definition. Rather, it might be explained by the fact that previous studies have focused on older children and have used combined information from children and parents, or by the lack of statistical power when considering the diagnoses of mood disorders (CBCL anxious-depressed was positively and relevantly associated with the *irritable* dimension). Furthermore, the cross-sectional nature of the data precludes us from inferring causal relationships. Finally, it should also be mentioned that few families of low socioeconomic status participated, and this could have led to bias.

Dimensions can be seen as risk markers for different disorders, and their identification may help in the prevention of later psychopathology. On the basis of our results, indicated preventive programs could be administered to preschoolers with high scores in the *irritable* or *negative affect* dimensions to prevent anxiety, and to those with high scores in the *headstrong*, *oppositional behaviour* or *antagonistic behaviour* dimensions to prevent disruptive disorders. Furthermore, knowing the dimensions profile of a child diagnosed with ODD can help in the planning of treatments and in decisions about the amounts of specific components (frequency or duration of the sessions, length of the treatment, etc.) to be included in the treatment programme. Finally, research on ODD dimensions can also be helpful for the classification and definition of psychopathology.

Key points:

- For defining the structure of ODD in 3-year-old children, distinct dimensions are confirmed: 1) *irritable and headstrong plus hurtful*, and 2) *negative affect, oppositional behaviour and antagonistic behaviour*.
- Identifying two- and three-factor solutions could prove very useful in clinical contexts, and would be in accordance with the heterogeneity of ODD found in previous research.
- The dimensions are specifically associated with the DSM-IV and other psychological constructs.
- The identification of dimensions early in life can help improve the understanding and prevention of ODD comorbidity.

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Table 1. Confirmatory Factor Analysis for ODD-dimensions.

	Diagnostic interview* (N=622)		ODD-QS parents (N=1338)			ODD-QS teachers (N=615)			Model D for ODD-QS items***				
	Model A**	Model B	Model A	Model B	Model C	Model A	Model B	Model C	Parents (N=1338)	Teachers (N=615)			
<i>Irritable</i>		.949		.969	.989		.873	.894	<i>Negative affect</i>	.799	.836		
6: Touchy-easily annoyed	.557	.566	.469	.472	.482	.709	.746	.740	6: Touchy-easily annoyed	.537	.764		
7: Angry and resentful	.730	.741	.716	.712	.738	.854	.866	.886	7: Angry and resentful	.846	.938		
1: Loses temper	.915	.956	.667	.717	.689	.804	.850	.833	8: Spiteful/vindictive	.555	.684		
<i>Headstrong</i>		.987		.914	.936		.940	.982	<i>Oppositional behaviour</i>	.884	.989		
8: Spiteful/vindictive ¹	--	--	.491	--	.496	.644	--	.662	1: Loses temper	.705	.844		
2: Argues with adults	.905	.919	.714	.760	.728	.732	.789	.758	2: Argues with adults	.762	.762		
3: Defies adults' requests	.792	.799	.501	.527	.508	.613	.648	.628	3: Defies adults' requests	.530	.638		
									<i>Antagonistic behaviour</i>	.892	.929		
4: Annoys people	.617	.620	.583	.585	.592	.818	.875	.844	4: Annoys people	.676	.875		
5: Blames others	.463	.467	.483	.483	.489	.747	.767	.763	5: Blames others	.549	.783		
Goodness-of-fit indexes:	CFI	.990	.990	.943	.955	.945	.959	.979	.967	Goodness-of-fit indexes:	CFI	.974	.975
	RMSEA	.039	.040	.069	.071	.069	.094	.078	.086		RMSEA	.050	.079
Cronbach's α (mean inter-item r)										Cronbach's α (mean inter-item r)			
ODD total score	.71 (.25)	.71 (.25)	.70 (.23)	.69 (.24)	.70 (.23)	.82 (.37)	.81 (.39)	.82 (.37)		ODD total score	.70 (.23)	.82 (.37)	
F1 (irritable)	--	.45 (.26)	--	.51 (.28)	.51 (.28)		.73 (.49)	.73 (.41)		F1 (negative affect)	.51 (.28)	.69 (.44)	
F2 (headstrong)	--	.58 (.25)	--	.57 (.25)	.58 (.22)		.73 (.41)	.73 (.35)		F2 (oppositional behaviour)	.61 (.34)	.63 (.38)	
										F3 (antagonistic behaviour)	.42 (.26)	.69 (.53)	

In italics: second-order factor loadings. CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation. ¹ Not included for DSM-IV symptoms due the lack of cases

Model A: 8-item and 1-factor first-order model (** for diagnostic interview, does not include item-8 because it was absent for all participants).

Model B: 7-item and 2-factor second-order model, excluding item-8 as monofactor (based on Stringaris's model).

Model C: 8-item and 2-factor second-order model (based on Rowe's model) (* for diagnostic interview, model C was not estimated because item-8 was absent for all participants).

Model D: 8-item and 3-factor second-order model (based on Burke's model) (***) results for diagnostic interview not included, because the solution was not admissible)

Table 2. Association of ODD dimensions (Models B, C, D) with DSM-IV disorders.

		Model B			Model C		Model D		
		Irritable	Headstrong	Hurtful	Irritable	Headstrong +Spiteful	Negative affect	Oppositional behavior	Antagonistic behavior
		Odds ratio (OR)							
DSM Symptoms; parents (N=622)	Disruptive	1.01	4.58^G						
			1.90^B						
	ADHD	3.14^G	1.99						
		0.93 ^B							
	Mood disorders	1.21	0.68						
	Minor depression	1.19	0.68						
	Anxiety disorders	1.87	0.87						
	SAD	1.50	1.10						
Specific phobia	1.97	0.82							
Social phobia	1.63	0.55							
ODD-QS; parents (N=622)	Disruptive	0.89	1.89	1.67	0.89	1.84	0.92	1.52	2.90^G
									1.65 ^B
	ADHD	1.00	2.61^G	1.87	1.01	2.60^G	1.07	1.75	3.21^G
			1.55^B			1.56^B			1.32 ^B
	Mood disorders	1.34	0.38^G	2.46^G	1.24	0.85	1.37	0.87	0.26^G
			1.34 ^B	0.47 ^B					1.59 ^B
	Minor depression	1.40	0.37^G	2.14 ^G	1.35	0.76	1.33	0.80	0.33^G
			1.31 ^B	0.18 ^B		1.33			1.83 ^B
Anxiety disorders	1.49	0.82	1.45	1.47	0.92	1.48	0.97	0.89	
SAD	2.40^G	0.97	1.18	2.43^G	1.00	1.42	1.23	0.95	
		1.29 ^B			1.29 ^B				
Specific phobia	1.13	0.73	1.39	1.09	0.74	1.01	0.89	0.90	
Social phobia	1.78	0.68	1.27	1.79	0.77	2.66^G	0.56 ^G	0.62	
						1.44 ^B	1.09 ^B		
ODD-QS teachers (N=615)	Disruptive	0.94	1.56	1.02	0.92	1.48	0.92	1.43	1.45
	ADHD	1.09	1.49	0.63	1.04	1.38	0.92	1.53	1.28
	Mood disorders	1.00	1.05	0.93	0.99	1.03	1.00	1.11 ^G	0.67 ^G
	Minor depression	0.98	1.01	0.95	0.98	1.00	1.06	0.41^B	3.15^B
								0.83	0.81 ^G
	Anxiety disorders	0.98	0.86	1.35	1.01	0.92	0.97 ^G	0.83	2.01 ^B
							1.46^B		0.83
	SAD	1.04	0.86	1.47	1.08	0.93	1.28	0.61	1.25
Specific phobia	0.88	0.83	1.34	0.91	0.89	1.10	0.89	0.69	
Social phobia	0.92	0.90	0.94 ^G	0.92	1.02	1.12	1.10	0.69	
			3.34^B						
		Irritable	Headstrong	Hurtful	Irritable	Headstrong +Spiteful	Negative affect	Oppositional behavior	Antagonistic behavior
		Coefficient B							
DSM sym.	Aggressive	-0.53	0.10						
	Non-aggressive	.001	0.12						
	CGAS:total	-3.01	-2.43						
ODD-QS parents	Aggressive	0.05 ^G	0.03	0.04	0.05 ^G	0.04	0.03 ^G	0.03	0.03
		0.01 ^B			0.01 ^B		-0.06^B		
	Non-aggressive	-0.02	0.01	0.03	-0.02	0.01	0.04	0.02	0.02
CGAS:total	-0.91	-0.90	-1.30	-0.92	-0.96	-0.90	-0.95	-0.98	
ODD-QS teach.	Aggressive	0.02 ^G	0.06^G	-0.02	0.01	0.06^G	0.02	0.06 ^G	0.05
		-0.03 ^B	0.01 ^B			0.01 ^B		-0.02 ^B	
	Non-aggressive	0.02	0.03	0.08	0.01	0.05	-0.01	0.02	-0.01
CGAS:total	-0.46	-0.22	-1.17	-0.52	-0.34	-0.72	-0.69	0.30	

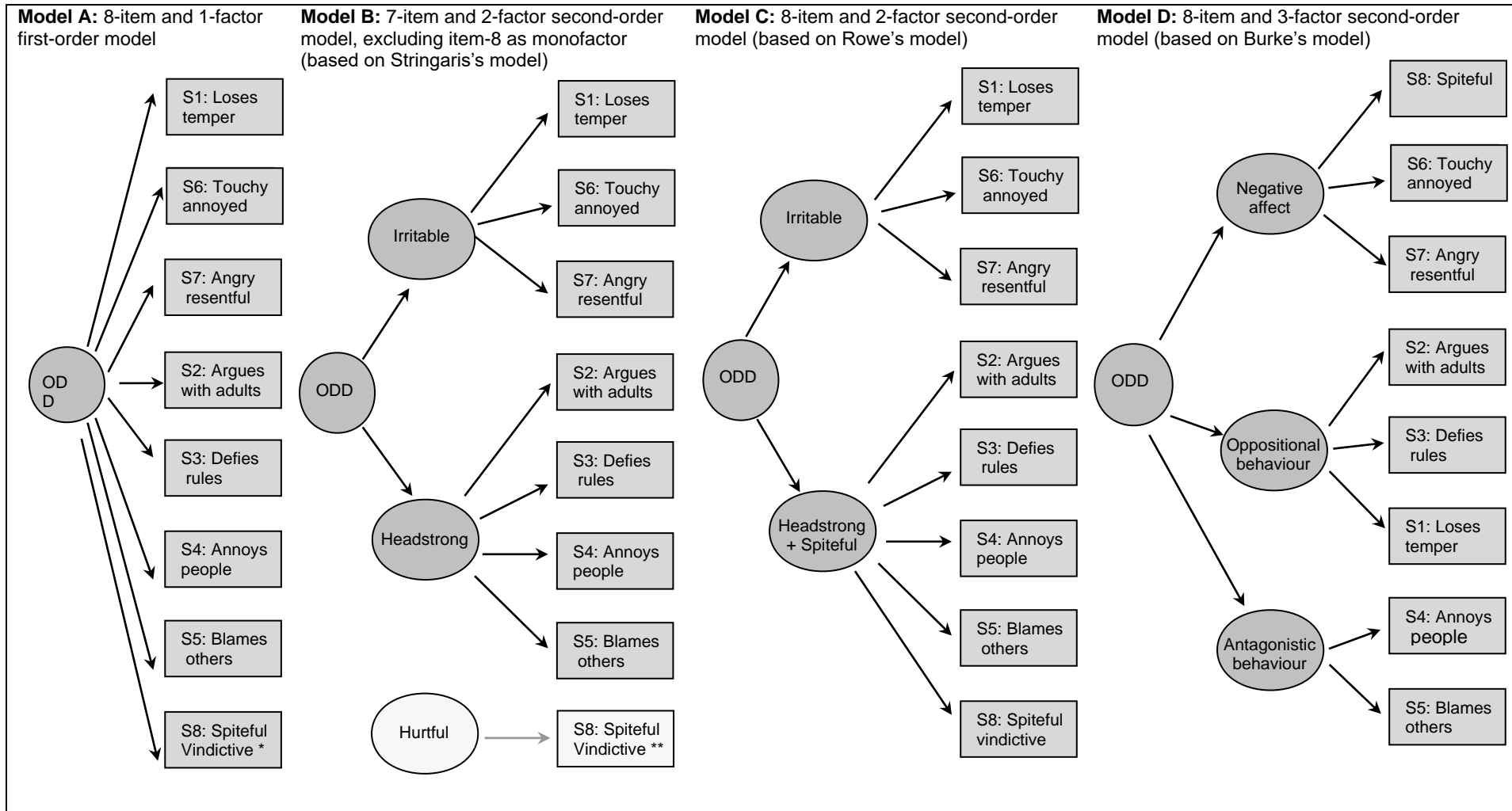
^BSingle effect for boys. ^GSingle effect for girls. In bold: significant parameter.

95% confidence intervals of OR and B, and p of sex interaction are in Table S2 online

ADHD: attention-deficit/hyperactivity disorder. SAD: separation anxiety disorder. Disruptive: ADHD or Conduct disorder.

Mood: major or minor depression

Figure 1. Models tested with Confirmatory Factor Analyses.



*except for data based on diagnostic interview, which did not include symptom 8 because it was absent for all participants

**symptom 8 could not be included as a hurtful monofactor

S1. Association of ODD Dimensions (Models B-C-D) with Psychological Measures and Reliability of the Measures.

	α	Model B (Stringaris et al.) DSM-symptoms Parents, N=622		Model B (Stringaris et al.) ODD-QS						Model C (Rowe et al.) ODD-QS				Model D (Burke et al.) ODD-QS					
				parents, N=1338			Teachers, N=615			parents, N=1338		Teachers, N=615		parents, N=1338			Teachers, N=615		
		Irrita.	Head.	Irrita.	Head.	Hurtf.	Irrita.	Head.	Hurtf.	Irrita.	Head. +Spit.	Irrita.	Head. +Spit.	Aff-	Opp.	Antag.	Aff-	Opp.	Antag.
CBCL: Emotionally reactive	.68	.35	.25	.31	.16	.22	.10	.06	.13	.31	.21	.10	.08	.34	.16	.13	.13	.06	.06
CBCL: Anxious-depressed	.62	.34	.23	.31	.16	.28	.02	-.01	.05	.31	.23	.02	.01	.39	.14	.13	.05	-.03	.01
CBCL: Somatic complaints	.41	.18	.13	.12	.11	.17	.06	-.04	.05	.12	.15	.06	-.02	.18	.07	.11	.07	.00	-.05
CBCL: Withdrawn	.58	.21	.12	.23	.12	.17	.07	.07	-.02	.23	.17	.07	.05	.26	.14	.07	.04	.05	.08
CBCL: Sleep problems	.74	.25	.24	.10	.05	.06	-.02	-.05	-.01	.10	.06	-.02	-.04	.10	.08	-.01	-.02	-.02	-.06
CBCL: Attention problems	.62	.18	.20	.12	.27	.08	.11	.21	.08	.12	.26	.11	.20	.09	.26	.16	.11	.16	.19
CBCL: Aggressive behavior	.84	.48	.53	.40	.47	.19	.12	.18	.15	.40	.47	.12	.20	.29	.51	.30	.15	.14	.17
CBCL: Internalizing	.83	.36	.24	.32	.18	.27	.08	.02	.07	.32	.25	.08	.04	.39	.17	.15	.09	.02	.03
CBCL: Externalizing	.85	.45	.50	.37	.47	.19	.13	.21	.15	.37	.47	.13	.22	.27	.50	.29	.16	.16	.20
CBCL: Total	.92	.45	.42	.37	.33	.24	.10	.10	.09	.37	.37	.10	.11	.35	.34	.23	.11	.09	.10
CBCL: Callous-unemotional ¹	.47	.19	.30	.16	.33	.09	-.01	.08	.05	.16	.32	-.01	.08	.10	.31	.23	.02	.03	.09
CBQ: Activity Level	.74	.16	.18	.11	.29	.10	.09	.21	.04	.11	.29	.09	.19	.06	.27	.21	.06	.20	.17
CBQ: Anger	.73	.37	.26	.29	.23	.09	.01	.06	.07	.29	.23	.01	.07	.18	.33	.11	.02	.07	.03
CBQ: Approach-Positive anticipat.	.48	.01	.06	.10	.21	.05	-.03	.07	-.03	.10	.20	-.03	.05	.06	.17	.18	-.05	.06	.05
CBQ: Attentional Focusing	.69	-.14	-.16	-.11	-.20	-.04	-.08	-.24	.01	-.11	-.19	-.08	-.20	-.03	-.23	-.12	-.05	-.18	-.21
CBQ: Discomfort	.68	.10	.01	.15	-.01	.10	.03	-.13	.12	.15	.03	.03	-.08	.19	.00	.00	.08	-.06	-.14
CBQ: Soothability	.63	-.30	-.20	-.28	-.12	-.13	-.09	-.11	-.12	-.28	-.15	-.09	-.13	-.23	-.22	-.04	-.09	-.16	-.07
CBQ: Fear	.63	.12	.04	.09	.01	.06	-.05	-.07	.07	.09	.02	-.05	-.05	.14	-.02	.01	-.02	-.03	-.09
CBQ: High Intensity Pleasure	.65	.08	.18	.03	.24	.07	.00	.12	.01	.03	.23	.00	.11	.02	.17	.19	-.01	.09	.11
CBQ: Impulsivity	.61	-.05	.07	-.02	.24	-.02	.11	.16	.05	-.02	.20	.11	.15	-.08	.17	.21	.08	.16	.15
CBQ: Inhibitory Control	.61	-.21	-.26	-.13	-.30	-.06	-.09	-.18	-.02	-.13	-.28	-.09	-.17	-.02	-.33	-.19	-.06	-.17	-.15
CBQ: Low Intensity Pleasure	.56	-.04	-.08	-.04	-.01	-.10	-.08	-.13	-.02	-.04	-.02	-.08	-.11	-.01	-.05	.01	-.06	-.11	-.10
CBQ: Perceptual Sensitivity	.69	.04	.02	.03	.01	.02	.02	-.04	.03	.03	.01	.02	-.03	.05	.02	-.02	.03	-.04	-.01
CBQ: Sadness	.50	.12	.06	.17	.09	.06	.00	.01	.05	.17	.10	.00	.03	.16	.08	.09	.03	.02	.00
CBQ: Shyness	.79	.12	.02	.13	-.04	.13	-.06	-.08	-.01	.13	.01	-.06	-.08	.19	-.02	-.03	-.04	-.09	-.06
CBQ: Smiling and Laughter	.56	-.05	-.03	-.08	-.01	-.13	.03	-.02	.03	-.08	-.05	.03	-.01	-.15	.00	-.02	.02	.02	-.02
CBQ: Surgency (2 nd order)	.74	.02	.14	-.02	.27	-.01	.09	.21	.04	-.02	.24	.09	.19	-.08	.21	.21	.06	.19	.17
CBQ: Negative affectivity (2 nd order)	.71	.30	.16	.29	.13	.13	.02	-.01	.13	.29	.16	.02	.02	.27	.18	.07	.06	.04	-.05
CBQ: Effortful control (2 nd order)	.79	-.14	-.18	-.10	-.20	-.04	-.08	-.22	.00	-.10	-.19	-.08	-.19	-.01	-.23	-.13	-.05	-.18	-.18
CAS: Verbal aggression	.73	.07	.09	.11	.17	-.02	.42	.54	.32	.11	.14	.42	.55	.02	.19	.10	.37	.53	.47
CAS: Aggression objects-animals	.32	.15	.15	.09	.14	-.02	.31	.39	.21	.09	.11	.31	.39	.03	.15	.09	.25	.40	.34
CAS: Use of weapons	.44	.12	.08	.08	.05	-.02	.09	.12	.13	.08	.04	.09	.14	.03	.09	.01	.10	.13	.10
CAS: Provoked physical aggress.	.36	.07	.06	.03	.15	-.04	.42	.51	.29	.03	.11	.42	.52	-.07	.19	.06	.38	.44	.52

	α	Model B (Stringaris et al.) DSM-symptoms Parents, N=622		Model B (Stringaris et al.) ODD-QS parents, N=1338 Teachers, N=615						Model C (Rowe et al.) ODD-QS parents, N=1338 Teachers, N=615				Model D (Burke et al.) ODD-QS parents, N=1338 Teachers, N=615					
		Irrita.	Head.	Irrita.	Head.	Hurtf.	Irrita.	Head.	Hurtf.	Irrita.	Head. +Spit.	Irrita.	Head. +Spit.	Aff-	Opp.	Antag.	Aff-	Opp.	Antag.
CAS: Initiated physical aggress.	.37	.06	.12	.02	.17	-.04	.36	.51	.25	.02	.13	.36	.51	-.07	.16	.13	.31	.44	.52
CAS: Aggression towards peers	.84	.08	.11	.07	.20	-.03	.47	.59	.36	.07	.16	.47	.61	-.04	.22	.11	.44	.51	.59
CAS: Aggression towards adults	.62	.09	.07	.12	.08	-.01	.24	.34	.18	.12	.07	.24	.35	.06	.11	.05	.20	.41	.21
ICU: Callousness	.79	.07	.11	.09	.17	.02	.41	.63	.28	.09	.16	.41	.62	.04	.19	.09	.36	.55	.57
ICU: Uncaring	.88	.07	.11	.13	.23	.02	.36	.56	.26	.13	.21	.36	.55	.05	.22	.16	.32	.51	.47
ICU: Unemotional	.83	.04	-.01	.03	-.03	.04	-.02	.02	.04	.03	-.01	-.02	.03	.06	-.01	-.03	.00	.00	.02
BRIEF: Inhibit (I)	.93	.06	.09	.08	.25	-.01	.48	.64	.23	.08	.22	.48	.62	.00	.25	.15	.39	.62	.55
BRIEF: Shift (S)	.87	.14	-.01	.05	-.06	.08	.32	.12	.21	.05	-.02	.32	.16	.09	.00	-.09	.33	.19	.08
BRIEF: Emotional Control (EC)	.88	.19	.10	.15	.13	.06	.73	.46	.40	.15	.14	.73	.51	.11	.17	.06	.65	.59	.39
BRIEF: Working Memory (WM)	.95	.11	.04	.10	.17	.07	.26	.33	.07	.10	.17	.26	.30	.07	.20	.08	.20	.33	.25
BRIEF: Plan/Organize (PO)	.89	.14	.03	.12	.16	.07	.27	.33	.08	.12	.16	.27	.31	.09	.18	.07	.21	.34	.25
BRIEF: ISCI (I+EC)	.94	.10	.07	.08	.19	.03	.53	.57	.27	.08	.21	.53	.65	.04	.25	.13	.53	.68	.56
BRIEF: FI index (S+EC)	.91	.19	.05	.12	.05	.08	.60	.33	.34	.12	.07	.60	.38	.11	.10	-.01	.55	.44	.27
BRIEF: EMI index (WM+PO)	.96	.12	.04	.11	.17	.07	.27	.34	.07	.11	.17	.27	.31	.08	.20	.08	.21	.34	.26
BRIEF: GEC index (global exec.)	.97	.14	.07	.12	.19	.06	.50	.51	.23	.12	.19	.50	.50	.08	.22	.09	.42	.54	.41

In bold, $|r| \geq .30$. α : Cronbach's alpha.

Irrita.: Irritable. Head: Headstrong. Hurtf.: Hurtful. Spit.: Spiteful. Aff-: Negative affect. Opp.:oppositional behavior. Antag.: antagonistic behavior.

¹ Willoughby MT, Waschbusch DA, Moore GA, Propper CB. Using the ASEBA to screen for callous unemotional traits in early childhood: Factor structure, temporal stability, and utility. *Journal of Psychopathology and Behavioral Assessment*. 2011:19-30.

S2a. Association of ODD dimensions (Model B) with DSM-IV disorders.

		Interaction with sex (p)			Irritable		Headstrong		Hurtful	
		Irri.	Head.	¹ Hurt.	OR	95% CI (OR)	OR	95% CI (OR)	OR	95% CI (OR)
DSM Symptoms; parents (N=622)	Disruptive	.984	.022		1.01	0.60÷1.68	4.58 ^{G***}	2.76÷7.60 ^G		
	ADHD	.034	.322		3.14 ^{G***}	1.65÷5.96 ^G	1.90 ^{B**}	1.24÷2.90 ^B		
	Mood disorders	.795	.419		0.93 ^B	0.56÷1.55 ^B	1.99 ^{***}	1.45÷2.73		
	Minor depression	.996	.625		1.21	0.62÷2.37	0.68	0.39÷1.16		
	Anxiety disorders	.146	.342		1.19	0.58÷2.45	0.68	0.37÷1.25		
	SAD	.113	.600		1.87 ^{**}	1.23÷2.86	0.87	0.62÷1.22		
	Specific phobia	.436	.147		1.50	0.68÷3.33	1.10	0.62÷1.97		
	Social phobia	.117	.418		1.97 ^{**}	1.17÷3.33	0.82	0.56÷1.19		
	² CGAS:total	.245	.192		1.63	0.78÷3.40	0.55	0.26÷1.18		
ODD-QS parents (N=622)	Disruptive	.269	.266	.407	0.89	0.63÷1.25	1.89 ^{***}	1.45÷2.45	1.67 [*]	1.03÷2.71
	ADHD	.317	.026	.127	1.00	0.70÷1.45	2.61 ^{G***}	1.77÷3.84 ^G	1.87 [*]	1.08÷3.24
	Mood disorders	.381	.004	.044	1.55 ^{B*}	1.08÷2.22 ^B	0.38 ^{G**}	0.21÷0.70 ^G	2.46 ^{G*}	1.06÷5.70 ^G
	Minor depression	.486	.006	.020	1.34 ^B	0.90÷2.00 ^B	1.37 ^{G**}	0.20÷0.67 ^G	0.47 ^B	0.10÷2.14 ^B
	Anxiety disorders	.210	.945	.718	1.40	0.99÷1.98	1.31 ^B	0.82÷2.09 ^B	2.14 ^G	0.90÷5.05 ^G
	SAD	.081	.727	.510	1.49 ^{***}	1.19÷1.87	0.82	0.63÷1.06	1.45	0.92÷2.29
	Specific phobia	.896	.674	.897	2.40 ^{G***}	1.66÷3.48 ^G	0.97	0.69÷1.35	1.18	0.52÷2.71
	Social phobia	.860	.587	.136	1.29 ^B	0.91÷1.83 ^B	0.73	0.48÷1.12	1.39	0.74÷2.62
	² CGAS:total	.164	.259	.112	1.78 ^{**}	1.14÷2.75	0.68	0.45÷1.02	1.27	0.57÷2.85
ODD-QS teachers (N=615)	Disruptive	.688	.563	.302	0.94	0.67÷1.33	1.56 ^{***}	1.25÷1.94	1.02	0.46÷2.28
	ADHD	.759	.450	.918	1.09	0.74÷1.61	1.49 ^{**}	1.16÷1.92	0.63	0.30÷1.35
	Mood disorders	.473	.402	.825	1.00	0.73÷1.31	1.05	0.77÷1.42	0.93	0.39÷2.22
	Minor depression	.668	.580	.656	0.98	0.72÷1.33	1.01	0.71÷1.44	0.95	0.36÷2.55
	Anxiety disorders	.514	.706	.214	0.98	0.77÷1.25	0.86	0.65÷1.13	1.35	0.69÷2.63
	SAD	.773	.701	.312	1.04	0.67÷1.61	0.86	0.48÷1.52	1.47	0.34÷6.40
	Specific phobia	.369	.819	.713	0.88	0.62÷1.25	0.83	0.62÷1.13	1.34	0.63÷2.88
	Social phobia	.802	.664	.069	0.92	0.64÷1.33	0.90	0.54÷1.49	0.94 ^G	0.30÷2.92 ^G
	² CGAS:total	.171	.258	.990	-0.46	-1.06÷0.15	-0.90 ^{***}	-1.37÷-0.42	3.34 ^{B*}	1.10÷10.2 ^B
		Interaction with sex (p)			Irritability		Headstrong		Hurtful	
		Irri.	Head.	¹ Hurt.	B	95% CI (B)	B	95% CI (B)	B	95% CI (B)
DSM sym.	CD dimension									
	Aggressive	.467	.800		-0.53	-0.12÷0.01	0.10 ^{***}	0.04÷0.16		
	Non-aggressive	.591	.583		.001	-0.04÷0.05	0.12 ^{***}	0.08÷0.16		
ODD-QS Parents	Aggressive	.032	.824	.441	0.05 ^G	-0.00÷0.10 ^G	0.03 ^{**}	0.01÷0.06	0.04	-0.05÷0.12
	Non-aggressive	.992	.844	.238	0.01 ^B	-0.04÷0.02 ^B	0.01	-0.01÷0.03	0.03	-0.03÷0.08
ODD-QS teach.	Aggressive	.098	.071	.128	0.02 ^G	-0.02÷0.06 ^G	0.06 ^{G***}	0.02÷0.10 ^G	-0.02	-0.07÷0.03
	Non-aggressive	.112	.387	.587	-0.03 ^B	-0.06÷0.00 ^B	0.01 ^B	-0.01÷0.04 ^B	0.08 [*]	0.01÷0.14

¹Not included for DSM-IV symptoms due the lack of cases. ²Generalized Linear Models B and 95% CI for B.

^BSingle effect for boys. ^GSingle effect for girls. * p<.05; ** p<.01; *** p<.001

ADHD: attention-deficit/hyperactivity disorder. SAD: separation anxiety disorder. Disruptive: ADHD or Conduct disorder.

Table S2b. Association between ODD dimension (Model C) with DSM-IV disorders.

Model C (Rowe)		Interaction with sex (p)		Irritability			Headstrong+Spiteful		
		¹ Headstrong		p	OR	95% CI (OR)	p	OR	95% CI (OR)
		Irri.	+Spiteful						
ODD-QS parents (N=622)	Disruptive ADHD	.277 .326	.147 .002	.501 .966	0.89 1.01	0.64; 1.25 0.70; 1.45	.001 .010 ^G .002 ^B	1.84 2.60 ^G 1.56 ^B	1.49; 2.27 1.91; 3.56 ^G 1.18; 2.48 ^B
	Mood disorders	.303	.203	.203	1.24	0.89; 1.73	.282	0.85	0.62; 1.15
	Minor depression	.551	.198	.091	1.35	0.95; 1.90	.115	0.76	0.55; 1.07
	Anxiety disorders	.301	.629	.001	1.47	1.17; 1.85	.409	0.92	0.74; 1.13
	SAD	.064	.471	.001 ^G .160 ^B	2.43 ^G 1.29 ^B	1.69; 3.50 ^G 0.91; 1.84 ^B	.983	1.00	0.72; 1.40
	Specific phobia	.958	.580	.651	1.09	0.76; 1.56	.271	0.74	0.61; 1.15
	Social phobia	.881	.658	.009	1.79	1.16; 2.78	.133	0.77	0.56; 1.08
	² CGAS: total	.180	.753	.002	-0.92	-1.48; -0.35	.001	-0.96	-1.39; -0.54
ODD-QS teachers (N=615)	Disruptive ADHD	.747 .727	.347 .435	.630 .833	0.92 1.04	0.66; 1.29 0.71; 1.54	.001 .008	1.48 1.38	1.19; 1.84 1.08; 1.66
	Mood disorders	.536	.399	.940	0.99	0.76; 1.30	.809	1.03	0.81; 1.31
	Minor depression	.760	.685	.871	0.98	0.72; 1.32	.985	1.00	0.76; 1.32
	Anxiety disorders	.376	.894	.917	1.01	0.81; 1.27	.476	0.92	0.73; 1.16
	SAD	.856	.474	.723	1.08	0.72; 1.60	.713	0.93	0.62; 1.38
	Specific phobia	.310	.914	.565	0.91	0.65; 1.27	.461	0.89	0.66; 1.21
	Social phobia	.738	.836	.670	0.92	0.64; 1.34	.897	1.02	0.75; 1.40
	² CGAS: total	.194	.256	.086	-0.52	-1.10; 0.73	.134	-0.34	-0.79; 0.11
CD dimension		Interaction with sex (p)		Irritability			Headstrong+Spiteful		
		¹ Headstrong		p	B	95% CI (B)	p	B	95% CI (B)
		Irri.	+Spiteful						
ODD-QS parents	Aggressive	.033	.878	.067 ^G .334 ^B	0.05 ^G 0.01 ^B	-0.00; 0.10 ^G -0.04; 0.01 ^B	.006	0.04	0.01; 0.06
	Non-aggressive	.830	.762	.163	-0.02	-0.04; 0.01	.121	0.01	-0.00; 0.03
ODD-QS teach.	Aggressive	.115	.009	.721	0.01	-0.03; 0.09	.001 ^G .613 ^B	0.06 ^G 0.01 ^B	0.03; 0.09 ^G -0.03; 0.02 ^B
	Non-aggressive	.104	.257	.953	0.01	-0.02; 0.22	.001	0.05	0.03; 0.06

¹Excluded in diagnostic interview definition due to the lack of cases with the spiteful-vindictive symptom present.

²Parameters: B and 95% CI for B (Generalized Linear Models). ^BSingle effect for boys. ^GSingle effect for girls.

ADHD: attention-deficit/hyperactivity disorder. SAD: separation anxiety disorder. Disruptive: ADHD or Conduct disorder. Conduct disorder excluded due to the low prevalence in sample. Mood disorders includes major and minor depression.

S2c. Association between ODD dimension (Model D) with DSM-IV disorders.

Model D (Burke)	Interaction with sex (p)			Negative affectivity			Oppositional behavior			Antagonistic Behaviour			
	Aff-	Opposit.	Antag.	p	OR	95% CI (OR)	p	OR	95% CI (OR)	p	OR	95% CI (OR)	
Ordinal symptoms; parents (N=622)	Disruptive	.628	.163	.061	.637	0.92	0.65; 1.31	.008	1.52	1.12; 2.07	<.001 ^G	2.90 ^G	1.62; 5.20 ^G
	ADHD	.578	.949	.086	.652	1.07	0.79; 1.46	<.001	1.75	1.31; 2.33	.067 ^B	1.65 ^B	0.96; 2.83 ^B
	Mood disorders	.684	.478	.005	.093	1.37	0.95; 1.98	.373	0.87	0.63; 1.19	.001 ^G	3.21 ^G	1.65; 6.24 ^G
	Minor depression	.559	.759	.004	.140	1.33	0.91; 1.95	.307 ^B	1.32 ^B	0.77; 2.26 ^B	.008 ^G	0.26 ^G	0.10; 0.71 ^G
	Anxiety disorders	.599	.718	.522	.001	1.48	1.16; 1.89	.169 ^B	1.59 ^B	0.82; 3.08 ^B	.495	0.89	0.63; 1.25
	SAD	.650	.373	.439	.038	1.42	1.02; 1.98	.289	1.23	0.84; 1.81	.876	0.95	0.51; 1.79
	Specific phobia	.719	.525	.565	.978	1.01	0.66; 1.52	.503	0.89	0.62; 1.26	.674	0.90	0.57; 1.45
	Social phobia	.075	.091	.544	<.001 ^G	2.66 ^G	1.88; 3.77 ^G	.156 ^G	0.56 ^G	0.26; 1.24 ^G	.142	0.62	0.32; 1.18
	¹ CGAS: total	.929	.456	.259	.169 ^B	1.44 ^B	0.86; 2.41 ^B	.664 ^B	1.09 ^B	0.73; 1.65 ^B	.021	-0.98	-1.82; -0.15
	Ordinal symptoms; teachers (N=615)	Disruptive	.766	.806	.500	.627	0.92	0.65; 1.29	.001	-0.95	-1.53; -0.38	.092	1.45
ADHD		.473	.124	.823	.676	0.92	0.60; 1.39	.019	1.53	1.07; 2.18	.275	1.28	0.82; 1.97
Mood disorders		.739	.024	.001	.998	1.00	0.67; 1.50	.732 ^G	1.11 ^G	0.61; 2.02 ^G	.127 ^G	0.67 ^G	0.42; 2.02 ^G
Minor depression		.909	.370	.032	.761	1.06	0.72; 1.57	.001 ^B	0.41 ^B	0.24; 0.70 ^B	.003 ^B	3.15 ^B	1.47; 6.75 ^B
Anxiety disorders		.043	.462	.813	.873 ^G	0.97 ^G	0.69; 1.37 ^G	.438	0.83	0.52; 1.32	.469 ^G	0.81 ^G	0.47; 1.42 ^G
SAD		.565	.569	.919	.015 ^B	1.46 ^B	1.08; 1.97 ^B	.365	0.83	0.54; 1.16	.365	0.83	0.54; 1.25
Specific phobia		.118	.590	.686	.274	1.28	0.82; 2.00	.487	1.25	0.67; 2.35	.487	1.25	0.67; 2.35
Social phobia		.311	.875	.338	.551	1.10	0.80; 1.50	.608	0.89	0.56; 1.40	.144	0.69	0.42; 1.14
¹ CGAS: total	.138	.691	.568	.729	1.12	0.60; 2.08	.747	1.10	0.61; 2.01	.247	0.69	0.37; 1.30	
	.138	.691	.568	.031	-0.72	-1.37; -0.06	.032	-0.69	-1.33; -0.06	.506	0.30	-0.58; 1.17	
Ordi.s.; parents	CD dimension	Interaction with sex (p)			Negative affectivity			Oppositional behavior			Antagonistic Behaviour		
		Aff-	Opposit.	Antag.	p	B	95% CI (B)	p	B	95% CI (B)	p	B	95% CI (B)
	Aggressive	.017	.109	.408	.099 ^G	0.03 ^G	-0.01; 0.07 ^G	.016	0.03	0.01; 0.05	.152	0.03	-0.01; 0.07
	Non-aggressive	.290	.641	.106	.005 ^B	-0.06 ^B	-0.10; -0.02 ^B	.107	0.02	-0.01; 0.05	.208	0.02	-0.01; 0.06
Ordi.s.; teach.	Aggressive	.550	.006	.142	.301	0.02	-0.01; 0.05	.066 ^G	0.06 ^G	-0.01; 0.12 ^G	.067	0.05	-0.01; 0.11
	Non-aggressive	.388	.764	.894	.512	-0.01	-0.03; 0.02	.236 ^B	-0.02 ^B	-0.06; 0.02 ^B	.702	-0.01	-0.04; 0.03

¹Parameters: B and 95% CI for B (Generalized Linear Models). ^BSingle effect for boys. ^GSingle effect for girls.

Aff-: Negative affect dimension. Opposit.:oppositional behavior dimension. Antag.: antagonistic behavior dimension.

ADHD: attention-deficit/hyperactivity disorder. SAD: separation anxiety disorder. Disruptive: ADHD or Conduct disorder.

Conduct disorder excluded due to the low prevalence in sample. Mood disorders includes major and minor depression.

S3a. Description of ODD dimensions (Model B).

MODEL B (Stringaris)		Total (N=622)		Girls(N=311)		Boys(N=311)		Sex
DSM-symptoms (parents)		N	%	N	%	N	%	p
Irritability (Raw total score)	0	350	65.0%	172	63.3%	178	66.6%	.344
	1	193	25.6%	102	27.9%	91	23.3%	
	2	64	7.8%	32	7.9%	32	7.7%	
	3	15	1.7%	5	1.0%	10	2.3%	
<i>Mean (SD)</i>		0.46	(0.71)	0.47	(0.68)	0.46	(0.74)	
Headstrong (Raw total score)	0	347	61.8%	182	62.6%	165	61.1%	.557
	1	125	18.7%	57	17.0%	68	20.4%	
	2	101	13.7%	44	13.3%	57	14.1%	
	3	38	4.5%	23	5.7%	15	3.3%	
	4	11	1.3%	5	1.4%	6	1.2%	
<i>Mean (SD)</i>		0.65	(0.96)	0.66	(1.00)	0.63	(0.92)	
SDQ ítems (parents)		Total (N=1338)		Girls(N=657)		Boys(N=681)		Sex
		N	%	N	%	N	%	p
Irritability (Raw total score)	0	209	15.6%	94	14.3%	115	16.9%	.220
	1	376	28.1%	176	26.8%	200	29.4%	
	2	400	29.9%	217	33.0%	183	26.9%	
	3	202	15.1%	99	15.1%	103	15.1%	
	4	102	7.6%	50	7.6%	52	7.6%	
	5	36	2.7%	17	2.6%	19	2.8%	
	6	13	1.0%	4	0.6%	9	1.3%	
<i>Mean (SD)</i>		1.83	(1.32)	1.85	(1.27)	1.81	(1.36)	
Headstrong (Raw total score)	0	254	19.0%	131	19.9%	123	18.1%	.764
	1	326	24.4%	164	25.0%	162	23.8%	
	2	317	23.7%	161	24.5%	156	22.9%	
	3	208	15.5%	94	14.3%	114	16.7%	
	4	132	9.9%	64	9.7%	68	10.0%	
	5	73	5.5%	30	4.6%	43	6.3%	
	6	20	1.5%	10	1.5%	10	1.5%	
	7	6	0.4%	2	0.3%	4	0.6%	
	8	2	0.1%	1	0.2%	1	0.1%	
<i>Mean (SD)</i>		1.99	(1.57)	1.91	(1.54)	2.05	(1.59)	
Hurtful (Raw total score)		995	74.5%	494	75.4%	501	73.7%	.111
		267	20.0%	119	18.2%	148	21.8%	
		73	5.5%	42	6.4%	31	4.6%	
SDQ ítems (teachers)		Total (N=615)		Girls(N=306)		Boys(N=309)		Sex
		N	%	N	%	N	%	p
Irritability (Raw total score)	0	214	36.2%	106	35.3%	108	37.1%	.932
	1	190	31.1%	96	30.2%	94	32.1%	
	2	86	13.3%	42	13.5%	44	13.2%	
	3	58	9.4%	29	10.5%	29	8.3%	
	4	40	6.1%	17	6.1%	23	6.0%	
	5	18	2.6%	9	2.6%	9	2.5%	
	6	9	1.3%	7	1.8%	2	0.8%	
<i>Mean (SD)</i>		1.31	(1.44)	1.37	(1.49)	1.25	(1.39)	
Headstrong (Raw total score)	0	238	40.5%	135	45.8%	103	35.4%	.137
	1	124	19.8%	64	19.9%	60	19.7%	
	2	80	12.7%	34	10.3%	46	15.1%	
	3	66	10.6%	31	10.1%	35	11.0%	
	4	53	7.8%	21	6.2%	32	9.3%	
	5	33	6.0%	16	6.3%	17	5.6%	
	6	14	2.0%	2	0.8%	12	3.1%	
	7	6	0.6%	2	0.4%	4	0.8%	
	8	1	0.1%	1	0.2%	0	0%	
<i>Mean (SD)</i>		1.54	(1.75)	1.36	(1.69)	1.72	(1.80)	
Hurtful (Raw total score)	0	399	68.0%	189	64.2%	210	71.6%	.164
	1	187	28.7%	104	32.4%	83	25.0%	
	2	26	3.4%	11	3.4%	15	3.3%	

S3b. Description of ODD dimensions (Model C).

MODEL C (Rowe)		Total (N=1338)		Girls(N=657)		Boys(N=681)		Sex
SDQ ítems (parents)		N	%	N	%	N	%	p
Head+spiteful	0	223	16.7%	118	18.0%	105	15.4%	.150
(Raw total score)	1	290	21.7%	145	22.1%	145	21.3%	
	2	306	22.9%	154	23.4%	152	22.3%	
	3	204	15.2%	93	14.2%	111	16.3%	
	4	134	10.0%	57	8.7%	77	11.3%	
	5	108	8.1%	59	9.0%	49	7.2%	
	6	46	3.4%	19	2.9%	27	4.0%	
	7	17	1.3%	7	1.1%	10	1.5%	
	8	8	0.6%	4	0.6%	4	0.6%	
	9	1	0.1%	1	0.2%	0	0%	
	10	1	0.1%	0	0%	1	0.1%	
<i>Mean (SD)</i>		2.29	(1.80)	2.22	(1.79)	2.36	(1.81)	
SDQ ítems (teachers)		Total (N=615)		Girls(N=306)		Boys(N=309)		Sex
		N	%	N	%	N	%	p
Head+spiteful	0	195	33.4%	105	36.3%	90	30.5%	.113
(Raw total score)	1	128	21.3%	70	23.0%	58	19.7%	
	2	89	14.0%	43	12.5%	46	15.5%	
	3	57	9.1%	25	7.7%	32	10.4%	
	4	53	8.3%	25	7.4%	28	9.3%	
	5	45	7.0%	20	6.7%	25	7.2%	
	6	29	4.2%	12	4.4%	17	4.1%	
	7	11	1.9%	4	1.6%	7	2.1%	
	9	5	0.5%	0	0%	5	1.0%	
	8	3	0.3%	2	0.4%	1	0.2%	
<i>Mean (SD)</i>		1.90	(2.01)	1.75	(1.97)	2.04	(2.05)	

S3c. Description of ODD dimensions (Model D).

MODEL D (Burke)		Total (N=1338)		Girls(N=657)		Boys(N=681)		Sex
SDQ ítems (parents)		N	%	N	%	N	%	p
Negativity affect (Raw total score)	0	403	30.1%	182	27.7%	221	32.5%	.432
	1	489	36.5%	252	38.4%	237	34.8%	
	2	259	19.4%	132	20.1%	127	18.6%	
	3	102	7.6%	50	7.6%	52	7.6%	
	4	57	4.3%	27	4.1%	30	4.4%	
	5	20	1.5%	11	1.7%	9	1.3%	
	6	8	0.6%	3	0.5%	5	0.7%	
<i>Mean (SD)</i>		1.26	(1.23)	1.29	(1.21)	1.24	(1.25)	
Oppositional beh. (Raw total score)	0	207	15.5%	106	16.1%	101	14.8%	.424
	1	291	21.7%	138	21.0%	153	22.5%	
	2	316	23.6%	154	23.4%	162	23.8%	
	3	313	23.4%	167	25.4%	146	21.4%	
	4	138	10.3%	63	9.6%	75	11.0%	
	5	58	4.3%	22	3.3%	36	5.3%	
	6	15	1.1%	7	1.1%	8	1.2%	
<i>Mean (SD)</i>		2.09	(1.43)	2.06	(1.40)	2.12	(1.46)	
Antagonistic beh. (Raw total score)	0	653	48.8%	331	50.4%	322	47.3%	.070
	1	416	31.1%	206	31.4%	210	30.8%	
	2	203	15.2%	92	14.0%	111	16.3%	
	3	53	4.0%	25	3.8%	28	4.1%	
	4	13	1.0%	3	0.5%	10	1.5%	
<i>Mean (SD)</i>		0.77	(0.91)	0.73	(0.87)	0.82	(0.95)	
SDQ ítems (teachers)		Total (N=615)		Girls(N=306)		Boys(N=309)		Sex
		N	%	N	%	N	%	p
Negativity affect (Raw total score)	0	202	34.6%	92	32.5%	110	36.7%	.082
	1	199	33.4%	104	32.6%	95	34.2%	
	2	96	14.9%	51	15.7%	45	14.1%	
	3	63	9.3%	28	9.5%	35	9.1%	
	4	34	5.1%	20	6.4%	14	3.9%	
	5	15	1.9%	7	2.2%	8	1.6%	
	6	6	0.8%	4	1.2%	2	0.4%	
<i>Mean (SD)</i>		1.26	(1.33)	1.38	(1.40)	1.16	(1.25)	
Oppositional beh. (Raw total score)	0	261	43.0%	142	47.2%	119	38.9%	.054
	1	147	24.0%	68	21.1%	79	26.9%	
	2	102	17.0%	57	19.2%	45	14.9%	
	3	52	8.4%	19	6.5%	33	10.3%	
	4	36	5.1%	15	5.0%	21	5.2%	
	5	10	1.8%	3	0.6%	7	2.9%	
	6	7	0.7%	2	0.4%	5	1.0%	
<i>Mean (SD)</i>		1.17	(1.36)	1.05	(1.26)	1.29	(1.43)	
Antagonistic beh. (Raw total score)	0	334	56.6%	182	60.2%	152	53.0%	.227
	1	119	18.8%	54	16.9%	65	20.7%	
	2	112	16.6%	49	15.9%	63	17.3%	
	3	29	5.2%	12	4.0%	17	6.4%	
	4	18	2.8%	7	3.0%	11	2.5%	
<i>Mean (SD)</i>		0.79	(1.07)	0.73	(1.06)	0.85	(1.08)	