

The impact of temperamental dimensions on change in symptoms of oppositional defiant  
disorder from preschool to first grade

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## Forord

Denne hovedoppgaven ble utført ved NTNU, psykologisk institutt i perioden juni 2013 til februar 2014.

I løpet av denne perioden har jeg lært utrolig mye om statistikk og akademisk skriving, samt at jeg har forbedret mitt engelske ordforråd betraktelig.

Jeg vil gjerne takke min veileder Lars Wichstrøm. I tillegg til grundige tilbakemeldinger, gode råd og oppmuntring, har hans fremragende kunnskaper om forskningsmetode og statistikk vært til uvurderlig hjelp gjennom denne prosessen. Jeg setter også stor pris på å ha fått lov til å være en del av prosjektet Tidlig Trygg i Trondheim.

Jeg vil tilslutt takke min familie og min samboer Borgar for mange oppmuntrende ord og støtte.

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### Abstract

Oppositional defiant disorder (ODD) is often present already at preschool age. Previous research has established the association between temperament and broad categories of behavioral disorders. However, no longitudinal research has studied the potential impact of temperament on changes in ODD symptoms in preschool and early school years. Two birth cohorts of 4-year olds living in the city of Trondheim, Norway, were screened for emotional and behavioral problems and a subsample oversampled for such problems was drawn to take part in the study; 82.1% consented. Parents of 1000 children were interviewed with the Preschool Age Psychiatric Assessment, and ratings of children's temperament were provided using the Child Behavior Questionnaire (CBQ). Children were reassessed after 2 years (N = 797). The temperamental dimensions Surgency (SU) and Negative Affectivity (NA) were positively correlated with initial level of ODD symptoms, and predicted an increase in symptoms from age 4 to 6. High Effortful Control (EC) was associated with little ODD symptoms at age 4, but did not predict change in such symptoms. However, in interaction with NA, EC was associated with lower initial levels of ODD symptoms and predicted a decrease in symptoms from age 4 to 6. More precisely, the protective effect of EC was very strong for children high on NA but lower for children low to moderate on NA. The findings suggest that NA and SU function as risk factors whereas EC protects against ODD in young children. NA serves as a moderator of EC, in that among children high in NA, EC had a large protective effect, whereas among children with lower levels of NA, EC did protect to a lesser degree against ODD symptoms. Results of this study have theoretical implications linking temperament to ODD in preschoolers, and clinical applications utilizing temperament assessment to identify children at risk, prevent development of ODD and match treatment modalities to the child's specific temperamental strengths and weaknesses.

*Keywords:* temperament, oppositional defiant disorder, preschool, longitudinal.

The impact of temperamental dimensions on change in symptoms of oppositional defiant disorder from preschool to first grade

A large body of studies have addressed environmental factors in the quest for predictors of behavior problems, in particular family interaction (Campbell, Pierce, Moore, & Marakovitz, 1996; Lindahl, 1998; Meunier, Bisceglia, & Jenkins, 2012). Although family processes are undoubtedly important, as shown for example by the efficiency of family based treatments for behavior problems (Kazdin, 1997; Kling, Forster, Sundell, & Melin, 2010; Sanders, 1999), other research suggest that organismic factors intrinsic to the child may increase the probability of behavior problems. Among such organismic factors temperament has a pivotal role (Caspi, Henry, McGee, Moffitt, & Silva, 1995; Egger & Angold, 2006; Frick & Morris, 2004; Nigg, 2006; Stringaris, Maughan, & Goodman, 2010). Temperament has been defined as “constitutionally based, individual differences in reactivity and self-regulation” (Rothbart, Ahadi, Hershey, & Fisher, 2001, p. 1395), and temperamental traits have been found to be relatively stable over time and increasingly so with age (Roberts & DelVecchio, 2000). Despite the overall consensus that temperament plays an important role in the development of behavior disorders in general (Frick & Morris, 2004; Garstein, Putnam, & Rothbart, 2012; Nigg, 2006; Rettew & McKee, 2005), its role in the most prevalent behavioral disorders in childhood – oppositional defiant disorder (ODD) – is yet under-researched and thus undecided. The importance of temperament in the development of ODD is therefore the focus of the present inquiry.

There has been increasing evidence of longitudinal relations between children’s temperamental characteristics and their general maladjustment (Rothbart & Bates, 2006). However, the vast majority of studies on temperament and behavioral disorders have used the taxonomy of ‘difficult’ and ‘easy’ temperament (Frick & Morris, 2004), which does not capture the full heterogeneity and nuances in temperament. More specifically, several researchers have argued that both emotionality and regulatory aspects of temperament play a central role in problem behavior (Blair, Denham, Kochanoff, & Whipple, 2004; Eisenberg et al., 2000; Lengua, 2003; Muris & Ollendick, 2005), and I have therefore, in addition to surgency/extraversion, addressed both emotionality and regulatory aspects.

Rettew and McKee (2005) underline that the majority of research on the link between temperament and psychopathology is centered on each temperamental dimension acting alone. Research addressing under which conditions a specific trait may exert its effect has mainly explored temperament x environment interactions, e.g. between parent temperamental

traits or parenting styles and child temperament (Bates, Pettit, Dodge, & Ridge, 1998; Belsky, Hsieh, & Crnic, 1998; Morris et al., 2002; Russel, Hart, Robinson, & Olsen, 2003). Little research has, however, been devoted to the possibility that temperament traits may interact with each other in increasing or reducing the risk of psychopathology (Rettew & McKee, 2005) – and this is thus an avenue possibly leading towards greater understanding of the temperamental contributions to ODD that I will follow in this inquiry.

### **Oppositional defiant disorder**

ODD is among the most common psychiatric disorders in young children (Wichstrøm et al., 2012; Egger & Angold, 2006). Egger and Angold found that the rate of ODD in various US populations was 4 to 16.8% (Egger & Angold, 2006), a Spanish study reported prevalence figures between 4.7 and 5.6% (Ezpeleta, la Osa, Granero, Domènech, & Reich, 2011), whereas two studies indicate considerable lower rates in Norway, i.e. 1.8% and 2.5% (Wichstrøm et al., 2012; Heiervang et al., 2007). Even though rates may differ between countries, ODD is among the most prevalent disorders in each country. Although ODD is not an age-limited disorder, it generally manifests before 8 years of age (American Psychiatric Association, 1994). ODD and sub-clinical oppositional defiant *symptoms* are, however, usually evident prior to this age: Most commonly, ODD is evident in late preschool, with symptoms and oppositional defiant-type behaviors appearing 2 to 3 years earlier (Garstein et al., 2012; Steiner & Remsing, 2006). One can therefore detect children with ODD or ODD symptomatology in early preschool. Despite this, the majority of research on ODD has focused on school children. Relatively little attention has been paid to examine ODD during the period which it is most likely to emerge, i.e. the preschool years, and thus our understanding of the nosology and course of preschool ODD is less complete than desired.

Even though treatments for behavior problems, including ODD, are effective, they are only moderately so (i.e. Cohen's  $D = .25$  to  $.35$ ) (Dretzke et al., 2005; Kaminski, Valle, Filene, & Boyle, 2008). There is hence a need for developing interventions with greater efficiency. Such early interventions should preferably be informed by etiological knowledge. Although a burgeoning literature has provided important knowledge about broad categories of behavior problems in young children, such as 'externalizing behavior problems' or 'disruptive behavior disorders' (DBD), Steiner and Remsing (2006) underline that most empirical evidence supports a distinction between ODD and other DBD's such as conduct disorder (CD), and studies indicate different trajectories and different predictors of oppositional type problems as opposed to other types of behavior problems (for an overview, see Loeber, Burke, Lahey, Winters, & Zera, 2000). Hence, research on behavior problems in

general do not necessarily translate into ODD – therefore research addressing ODD specifically is needed. However, few studies have focused exclusively on ODD, which I will do in the research reported herein.

It is not until recently that diagnostic interviews for the assessment of psychopathology in young children have become available (Dougherty et al., 2011). Accordingly, the majority of research on behavior disorders in early childhood has used checklists such as the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). Although quick and cost-effective, checklists do not provide sufficient information about the severity, frequency or duration of symptoms needed to make good clinical judgments (Egger et al., 2005). Furthermore, symptom checklists may be heavily influenced by parents' subjective judgments, personality and/or psychopathology. A clinical interview includes the frequency, onset, duration and intensity of symptoms and behaviors, which are necessary units to make a thorough assessment of preschool ODD. Although diagnostic interviews may also be biased by parental factors, the interviewer – in interviewer-based interviews - seeks to minimize these by asking elucidating follow-up questions and elicit examples of behaviors. The present study therefore used interviewer-based and semi-structured diagnostic interviews to make judgments concerning ODD.

**Early onset ODD.** Compared to individuals with later onset, children with an early onset of ODD symptoms have a greater risk of developing later conduct disorder (CD) and ultimately antisocial personality disorder (APD; Blair et al., 2004; Hobbel & Drugli, 2012; Loeber et al., 2000). To understand the 'early onset' of ODD, we can start no later than the preschool period. Consequently, it is important to identify behavior problems in preschool to develop preventive measures to combat maladjusted development in these children.

This is especially important as early intervention is preferable to later intervention for children with ODD, because early interventions are more likely to succeed and to shift the children away from potentially damaging developmental paths (Steiner & Remsing, 2006). Possibly, the greater success rate is due to preschoolers being more plastic in terms of behavior and neurodevelopment, and regulatory skills are still emerging. Moreover, the problem behaviors may be less entrenched (Hughes & Ensor, 2008). Effective forms of treatment have been developed to treat children as young as 4 years old (Hobbel & Drugli, 2012; Webster-Stratton, Reid, & Hammond, 2004), and some parent training programs are even directed towards toddlers. However, with the lacking knowledge on the epidemiology of ODD in preschoolers, it is difficult to intercept these children and initiate interventions as early as to be desired. We do know that the development in regulatory capacities is rapid

during this period (Rothbart, 2007). Importantly, interventions need to be tailored to fit the specific developmental period. Conclusively, understanding the early origins of ODD is an urgent challenge for research (Hughes & Ensor, 2008). More knowledge on this field renders possible earlier assessment and intervening, which is found to be preferable in regards to outcome.

**Dimension versus diagnosis.** ODD has been viewed either categorically or continuously. The diagnostic classification systems represent the former, and seek to identify disorders by symptoms, severity, persistence and impairment, and have clear thresholds for deciding what constitutes a diagnosis and what does not. A dimensional approach views disorders as extremes on a distribution of symptoms, behavior or traits. Pickles and Angold (2003) state that it is important to recognize and acknowledge that psychopathology can manifest itself both categorically and continuously, and the central question is ‘under what circumstances’ does it make sense to regard psychopathology as being categorical or continuous, respectively. The development of ODD is relatively continuous, with symptoms and ODD behaviors building up during the early childhood years (Keenan, Shaw, Delliquadri, Giovannelli, & Walsh, 1998). In fact, researchers have found that subthreshold externalizing disorders and aggression predict later diagnosis (Keenan et al., 1998). Additionally, preschoolers with subclinical ODD may be as impaired as children with ODD (Keenan et al., 1998). Consequently, it is valuable for research to include not just children with the ODD diagnosis, but also children with different degrees of ODD behaviors and symptoms. Etiological knowledge about children with any number of ODD symptoms may inform preventive work and interventions for children who are subthreshold for diagnostic caseness, but still experience impairment and significant difficulties. The outcome in the present investigation is therefore number of DSM-IV defined ODD symptoms.

### **Temperamental dimensions and ODD**

Many blueprints for the structure of temperament in children have been proposed (for an overview, see Rothbart & Bates, 2006), but basic behavioral traits are not yet agreed upon in terms of definition and content (Nigg, 2006; Rothbart, Ahadi, & Evans, 2000). Nevertheless, many scholars converge in identifying three basic dimensions: 1) approach/surgency/extraversion/exuberance (SU), 2) negative affectivity/negative emotionality (NA), and 3) effortful control (EC; Putnam, Ellis, & Rothbart, 2001; Rothbart et al., 2001; Rothbart & Bates, 2006; Rothbart, Sheese, & Posner, 2007; Shiner & Caspi, 2003). The vast majority of the literature reports that specific dimensions of temperament may relate in a differentiated way to the development of externalizing problem behaviors, but at present

we do not, as previously noted, know to which extent this also relates to DSM-IV defined symptoms of ODD.

SU relates to a tendency toward novelty and sensation seeking, high energy and positive emotions, extraversion, and impulsivity (Rettew & McKee, 2005). NA can be described as the degree of sensitivity to signals of punishment and the propensity for a person to experience negative emotions such as sadness, fear, anger, irritability, and anxiety (Gouze, Lavigne, Hopkins, Bryant, & Lebailly, 2012; Rettew & McKee, 2005), and has frequently been predictive of externalizing problems in children (and adults). EC refers to the volitional or self-regulatory aspects of temperament; the child's capacity to inhibit a dominant response and initiate a subdominant response, persist, pay attention, delay gratification, plan and modulate emotional responses (Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Rettew & McKee, 2005). Similarly to NA, EC has been associated with externalizing behaviors, though negatively. Low EC is associated with higher aggression, more frequent behavior problems and general psychopathology (Muris & Ollendick, 2005).

In a recent prospective study, Garstein and colleagues (2012) examined the contributions of temperament attributes to toddler- and preschool-age behavior problems, and found associations between externalizing difficulties and different dimensions of temperament both alone and in interaction. More specifically, they reported that high levels of NA and low levels of EC were linked to externalizing difficulties, higher SU was associated with an increased risk for externalizing behaviors, and NA was most closely related to behavior problems when EC was low or SU was high (Garstein et al., 2012). Although not so thoroughly studied as NA and EC (Gouze et al., 2012; Lengua, 2003), high SU has been associated with externalizing problem behaviors (Garstein et al., 2012; Rothbart & Bates, 2006; Rydell, Berlin, & Bohlin, 2003), anger (Rothbart, Derryberry, & Hershey, 2000) and ODD symptoms rated by both parent and teacher (Martel, Gremillion, & Roberts, 2012). Interestingly, Garstein et al. (2012) reported an association between preschool SU and concurrent externalizing difficulties, but found that SU failed to predict such difficulties in a multivariate analysis model. Rydell and colleagues (2003) found that high levels of positive emotionality, analogous to SU, and low regulation of these emotions were related to externalizing problem behaviors. Despite this, Muris and Ollendick (2005) point out that both NA and EC appear to be more critical to the development of psychopathology than SU, whose impact to a large degree vary by and within disorders (Rettew & McKee, 2005). Stringaris et al. (2010) found that ODD was predicted by the temperamental dimension 'activity', but not



‘sociability’, and both dimensions have conceptual overlap with SU. It may thus be less decided if, and how, SU may be related to behavior problems.

The effects of NA and EC have been studied extensively. A number of studies report positive associations between NA and externalizing problems (Eisenberg, Sadovsky et al., 2005; Eisenberg, Valiente, Spinrad et al., 2009; Rothbart, Ahadi, & Hershey, 1994, Stringaris et al., 2010). In a study by Martel et al. (2012), high NA was significantly associated with symptoms of ODD. Eisenberg and colleagues investigated predictors of change in externalizing disorders, and found that changes in ‘anger’ and ‘sadness’, subscales of NA, predicted change in externalizing problems: children who moved from no disorder at initial testing to having an externalizing disorder later either did not decrease in NA or experienced an increase in this dimension (Eisenberg, Sadovsky et al., 2005; Eisenberg, Valiente, Spinrad et al., 2009). In addition, there was a tendency for these children to be lower on EC (Eisenberg, Sadovsky et al., 2005; Eisenberg, Valiente, Spinrad et al., 2009). Furthermore, children who moved in the opposite direction (from having an externalizing disorder to no disorder) showed a reversed pattern (Eisenberg, Sadovsky et al., 2005; Eisenberg, Valiente, Spinrad et al., 2009). Thus, it appears that stable or increasing levels of NA are associated with externalizing disorders. However, we do not know to which degree the findings of Eisenberg and colleagues (2005; 2009) applies to ODD, specifically. Negative correlations between EC and externalizing problems have been shown repeatedly (Brock, Rimm-Kaufmann, Nathanson, & Grimm, 2009; Eisenberg, Sadovsky et al., 2005; Eisenberg, Valiente, Spinrad et al., 2009; Hughes & Ensor, 2011; Olson et al., 2005), although Martel and colleagues (2012) did not find evidence that low levels of EC was correlated with symptoms of ODD. The lack of findings in the latter study may be due to the small sample size (N=109) or differences in rater sensitivity in their study. However, they found that low ‘reactive control’, defined as a less voluntary aspect (in contrast to EC) of the self-regulatory part of temperament (Valiente et al., 2003), was curvilinearly associated with ODD symptoms, and that high NA together with low reactive control was connected to general DBD’s (Martel et al., 2012), indicating interactive effects between aspects of EC and NA.

Indeed, such interactional effects of NA and EC on externalizing behavior have been found in a number of other studies (Dodge, Lochman, Harnish, Bates, & Pettit, 1997; Dougherty et al., 2011; Eisenberg, Fabes, Guthrie, & Reiser, 2002; Moran, Lengua; & Zalewski, 2013). For example, in two studies on externalizing behavior, researchers concluded that children prone to experience intense negative emotion, and who were also low in regulation, can be expected to be especially high on externalizing problem behavior with

negative emotion (Dodge et al., 1997). In line with this, Moran and colleagues (2013) discovered that children with higher observed frustration and lower EC showed higher externalizing problems than children with higher observed fear and delay ability. In a community study of preschoolers, Dougherty and colleagues (2011) examined the associations between observed temperament and various psychiatric disorders, and found that ODD was cross-sectionally associated with disinhibition and ‘dysphoria’; equal to low EC and high NA, respectively. Furthermore, the combination of high NA and low EC in preschoolers has been found to predict later global behavior problems (Lemery, Essex, & Smider, 2002). In line with this, Eisenberg et al. (1996; 2002) reported that negative temperament predicted increasingly greater problem behavior as levels of self-regulation declined. Eisenberg speculated that such results were attributable to the possibility that children who can modulate the intensity and duration of their negative emotions (high EC) may be better fit to manage their emotions internally, and are therefore relatively unlikely to express their negative emotions in behavioral outburst (Eisenberg et al., 2000), as seen in ODD. EC may, however, be linked to ODD regardless of the level of NA, simply because well regulated children would be expected to be low in behavioral problems even if they were very emotional (Eisenberg et al., 2000). To sum up, current findings suggest that NA is positively correlated with externalizing behavior problems, while EC is negatively correlated with externalizing behavior problems. How SU relates to problem behavior is less decided. Furthermore, the reviewed research indicates that interaction effects between NA and EC more accurately than direct linear effects may predict young children’s development of behavior problems in general, in that NA predicts increasingly greater problem behaviors as levels of EC declines.

Thus, some important steps have been made towards investigating temperament and behavior disorders. To our knowledge, however, no longitudinal research on the effects of dimensions of temperament, and their interactions, on the stability and change in symptoms of ODD has been conducted. This study aims at widening the knowledge base concerning ODD by examining the temperamental precursors of change and stability in symptoms of ODD in the developmental period where the emergence of ODD is most likely to take place i.e. in the late preschool and early school years.

The development of ODD is, like other psychiatric disorders, characterized by multifinality and equifinality, indicating that it can go in multiple directions. Some children who display many symptoms of ODD in first grade may have started out with a high symptom level in preschool age, whereas such a high level of ODD symptoms in school may

be relatively new to other children. Similarly, some children may have many symptoms in preschool, but ‘outgrow’ them during the late preschool years. Hence, when analyzing the stability and change, the initial level of ODD needs to be adjusted for. I will therefore examine both the initial level (intercept) and changes (slope) – adjusted for intercept - in symptoms of ODD.

**Gender.** Few gender differences in preschool behavior disorders have been reported (Dougherty et al., 2011). Before the age of 4, boys and girls have been rated exactly the same on aggression, although boys have been reported to hit their peers more often than girls (Hay, Castle, & Davies, 2000). Interestingly, a tendency for boys to exhibit more symptoms of behavior problems than girls becomes more apparent with increasing age. After the age of 4 there is an increasing divergence in the prevalence of problem behavior (Keenan & Shaw, 1997), and gender differences are well-documented in later childhood, with more externalizing disorders in boys and more internalizing disorders in girls (Dougherty et al., 2011). Researchers have also found temperamental gender differences. A meta-analysis found a large gender difference in EC favoring girls, whilst SU showed a difference favoring boys and NA showed no apparent gender differences (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). Because of these reported gender differences in both temperament and ODD, I included gender as a covariate to adjust for possible confounding.

### **The present study**

Based on previous studies it is reasonable to expect that the three temperamental dimensions SU, NA and EC correlate with symptoms of ODD. More specifically, based on research reporting a tendency for SU to be positively correlated with externalizing disorders, I expect the same tendency to be evident in this study: I hypothesize that SU will be positively correlated with level of ODD (intercept), and that it will predict an increase in ODD symptoms from T1 to T2 (slope). As previously indicated I hypothesize that children high on NA at age 4 will have a higher level of ODD initially, and that they will evidence greater increase in symptoms as opposed to children with less NA. I predict that EC will be negatively correlated with the initial level of ODD and that it will predict a decrease in ODD symptoms from T1 to T2. Furthermore, I hypothesize that the contribution of NA and EC will be associated with both initial ODD symptoms and predict change in them. More specifically, I expect children who are low on NA and EC to display fewer initial ODD symptoms than children with high NA and low EC, and assume that high NA and low EC will predict an increase in symptoms. Next, it is reasonable to hypothesize that EC will be a more important predictor of ODD for children who are predisposed to experience negative emotions than for

other children. Conversely, EC may be a poorer predictor of ODD for children low in NA than for those who are higher on this dimension, because children who are low in NA do not experience as much or as intense negative emotions as other children. Regarding ODD, prior research has depicted gender differences from the age of 4 and onwards. I therefore hypothesize that boys will have a higher level of ODD symptoms than girls at T2, but not T1.

## Method

### Participants and Recruitment

Details about the study have been described previously (Wichstrøm et al., 2012; Wichstrøm, Belsky, & Berg-Nielsen, 2013), but will be shortly outlined here. Two birth cohorts (born in 2003 and 2004) of 4-year old children with their parents living in the city of Trondheim, Norway, were invited to participate in the study. Due to the interview methods, parents with insufficient proficiency in Norwegian were not invited to participate.

Trondheim is a university town and the country's third largest city with approximately 200.000 residents – including students. A flow-chart describing the recruitment procedure and participant flow is depicted in Figure 1. The total difficulties score of the Strengths and Difficulties Questionnaire (SDQ) version 4-16 (Goodman, Ford, Simmons, Gatward, & Meltzer, 2000) was used for screening. Scores were divided into four strata (0-4, 5-8, 9-11, 12-40), and by means of a random number generator defined proportions of parents in each stratum (0.37, 0.48, 0.70, and 0.89, respectively) were drawn to participate in a further study. At T1 (age 4), the mean age of children was 4.4 years ( $SD = .18$ ), and the majority were attending state-sponsored day-care centers (95.0%). All children were in school at T2 ( $M$  age = 6.7 years,  $SD = .17$ ). As might be expected in a university town, parents' educational level were generally high (6.7% had not finished high-school; 17.3% high-school graduates; 17.2% with some post high-school education; 58.3% college graduates), though comparable to the level in the general Norwegian population of parents of 4-year olds (Wichstrøm et al., 2012). The drop-out rate after consenting at the well-child clinic (T1) did not differ across the SDQ strata,  $t(1,250) = .28, p = .78$  or gender,  $\chi^2 = 0.23, df = 1, p = .37$ . Although preschool teachers rated participant children at T2 slightly higher on social competence than nonparticipating ones (Means: 57.24,  $SD = 12.43$  vs. 53.35,  $SD = 12.69$ ;  $t [851] = 3.69, p < .001$ ), the attrition rate from T1 to T2 was unselective to any of the study variables.

### Procedure

Research procedures were approved by the Regional Committee for Medical and Health Research Ethics. At the age-4 health checkup at the public health center, the parents

were informed about the study and informed consent was obtained. Parents completed a structured diagnostic interview, followed by testing and observation at the University with their child. The retesting took place 2 years later.

### Measures

**Symptoms of ODD.** Symptoms of ODD were captured using the Preschool Age Psychiatric Assessment (PAPA; Egger & Angold, 2004), which is a semi-structured parent interview for diagnosing psychiatric disorders in preschool children ages 2-5 years. The PAPA uses a structured protocol that consists of both required questions and optional follow-up questions. It includes potentially relevant symptoms and behaviors experienced by preschoolers and their families (Egger & Angold, 2004). Frequency, onset, duration and intensity of symptoms are recorded. Diagnoses are generated by computer algorithms using criteria defined by the Diagnostic and Statistical Manual of Mental Disorders (fourth edition; DSM-IV; American Psychiatric Association, 1994). DSM-IV uses the term ‘often’ to define symptoms of ODD, i. e. ‘often loses temper’. No guidelines are given to determine what is considered ‘often’. In accordance with Egger and Angold (2006) ‘often’ was therefore defined as the 10-percent highest frequency, defined post-hoc in the present sample after weighting back the results to population estimates. As described previously by Wichstrøm and colleagues (2012), the interviewers had at least a bachelor’s degree in related fields plus comprehensive experience in working with children and families. Nine percent of the interview audio recordings were recorded by independent and blind raters. For ODD, the inter-rater reliability between multiple raters was  $ICC = .97$ .

**Temperament.** The Children’s Behavior Questionnaire (CBQ; Rothbart et al., 2001) was used to measure NA, EC and SU. CBQ is a theory-derived report measure for completion by caregivers of children ages 3-7 years. Its goal is to provide a differentiated assessment of temperamental characteristics of preschool and early school-age children. The long form of the CBQ was used. The caregivers were asked to rate their children on each item based on the last 6 months, using a 7-point Likert scale ranging from ‘extremely untrue of your child’ to ‘extremely true of your child’. Based on factor analysis (Rothbart et al., 2001), the CBQ operates with a tripartition of temperamental factors based on 15 scales. The first factor, Negative Affectivity, is defined by loadings for the scales of Discomfort, Sadness, Fear, Anger/Frustration, and Soothability (negatively loaded). Surgency is measured by the scales of Impulsivity, High Intensity Pleasure, Activity Level, and, loading negatively, Shyness. Effortful control loads on five subdimensions: Smiling/Laughter, Inhibitory Control, Attentional Focusing, Low Intensity Pleasure and Perceptual Sensitivity. The Cronbach’s  $\alpha$

values for the factors NA, EC and SU were .87, .84, and .91, respectively, in the present study.

## Results

All analyses were weighted (i.e. low screen scorers were ‘weighted up’; high screen scorers were ‘weighted down’) to adjust for the screen stratification to generate unbiased general population estimates. Analyses were performed in Mplus7.11 using a Robust Maximum Likelihood estimator, which makes estimates robust to non-normality, which is important due to the right-skewed nature of ODD symptoms and provide corrected standard errors for the population. The sample consisted of those providing data at least on one occasion ( $n = 1,036$ ). Missing data were handled with a Full Information Maximum Likelihood Procedure.

Table 1 displays means and standard deviations for the study variables. The mean number of symptoms of ODD was somewhat higher on T2 than T1. To test whether this increase was significant, a growth model of ODD was created. To accommodate a growth curve using only two time points, the error terms of ODD symptoms at T1 and T2 were fixed to zero, resulting in observed growth rather than latent growth. To account for differing trajectories according to the initial level of ODD, the slope was regressed on the intercept. The mean of the resulting slope (growth) was positive and highly significant,  $M = .37$   $p < .001$ .

### Correlational analysis

Correlations were conducted to determine the relations between the variables; ODD symptoms at T1 and T2, SU, NA, EC, an interaction variable of NA and EC, and gender. Correlations are portrayed in Table 2. As can be seen, a moderate stability of symptoms of ODD was observed.

Small to moderate correlations between the other variables were found: ODD symptoms at T1 and T2 were positively correlated with NA and SU and negatively correlated with EC. Furthermore, EC was negatively correlated with both NA and SU; and SU and NA were negatively correlated. As regards the interaction variable, there was a small negative correlation with ODD symptoms at both times.

### Temperament predicting level and change in symptoms of ODD

The CBQ variables (NA, SU and EC) were mean centered to avoid contamination due to multicollinearity when analyzing interactions. To study the temperamental predictors of level and change in symptoms of ODD, I used the growth curve model described above. Note

that this is a saturated model, which could not be evaluated according to common fit indices. Both level and change had significant variances, estimate = 1.20 and .47, respectively,  $p < .001$ . The two growth parameters, level (intercept) and change (slope) were regressed on SU, NA and EC allowing the temperamental dimensions to correlate, and adjusting for gender as well. Table 3 portrays the results of these regressions. As can be seen, main effects of SU and NA on both intercept and slope were seen. EC was a significant predictor for intercept, but not slope. Conversely, being male versus female predicted a slight increase in ODD, but not the intercept. The interaction between NA and EC was studied adding a multiplicative term to the model, using mean centered variables. As can be seen, the  $NA \times EC$  variable predicted change in ODD symptoms.

To investigate the latter finding further, I divided the NA scale into three equally sized groups, regressing level and change in ODD symptoms on gender, SU and EC. As regards level of ODD symptoms, there was a moderate effect of EC in the low and moderate NA groups,  $\beta = -.26, p = .02$ , and  $\beta = -.36, p = .03$ , respectively, whereas a very strong effect of EC was seen in the high NA group,  $\beta = .80, p < .001$ . A similar pattern emerged with regard to slope. Here, however, there was no effect of EC in the low NA group,  $\beta = -.04, p = .64$ , and the moderate NA group,  $\beta = -.10, p = .32$ , whereas a moderate to strong effect of EC was seen in the high NA group,  $\beta = -.35, p = .02$ .

**Gender.** As can be seen in Table 2 there were no gender differences in symptoms of ODD at T1, but boys had more symptoms than girls at T2. These results were mirrored in the growth of ODD where gender was unrelated to the intercept,  $\beta = -.01, p = .70$ , but being male predicted a slight increase in ODD,  $\beta = .07, p = .02$ . Although gender differences existed in temperament (Table 2), as can be seen in Table 3, the gender effect in growth in ODD (slope) remained when temperament was adjusted for.

## Discussion

Past research has demonstrated that temperament predicts global behavioral problems. Because different behavior problems may have different predictors (Martel et al., 2012; McKinney & Renk, 2006) it is yet unknown whether temperamental dimensions also predict change in ODD symptoms specifically. I therefore tested whether temperamental surgency, negative affectivity and effortful control predicted levels and change in ODD symptoms from age 4 to first grade in a large community sample. Consistent with my hypotheses, SU and NA were positively correlated with initial level of ODD symptoms, and predicted an increase in symptoms from T1 to T2. As predicted, EC was negatively correlated with symptom level,

but did not, as hypothesized, predict changes in symptoms. As expected, the results provided support for the assumption that the effect of EC is different depending on level of NA: EC was a stronger protective factor for both level and change in ODD symptoms among children high in NA than in children with moderate or low NA. As predicted, girls had higher levels of EC whereas boys were higher on SU. I predicted that the level of NA would be similar in boys and girls, but the results revealed that girls did in fact score higher on this dimension. Boys had, as hypothesized, a significantly higher level of ODD symptoms at T2, but not at T1.

**Surgency.** Finding SU and ODD to be positively correlated is in keeping with previous research on broadly defined behavior problems (Garstein et al., 2012; Martel et al., 2012; Rydell et al., 2003). Importantly, though, the present study also found that SU predicted increased ODD symptoms over time. Garstein and colleagues (2012) did not find that SU could predict broadly defined behavior problems when other temperamental traits were adjusted for. Hence, the present result adds to the literature by finding that SU predicts ODD specifically, even when other temperamental traits are taken into account, and by identifying SU as a predictor of *increased* ODD – even when adjusting for the initial level of ODD.

Possibly, the association between SU and ODD should be interpreted in light of what is known about the motivational limbic systems. A part of this system is the appetitive/approach system, which is reward sensitive (Derryberry & Rothbart, 1997). Behaviorally, the appetitive system mobilizes approach to stimuli that predict positive events (Derryberry & Rothbart, 1997), and promotes irritation and aggression when goals are blocked (Depue & Iacono, 1989). The neurotransmitter dopamine encodes the responsivity to the stimuli, and individual differences in the functioning of the system are believed to result from dopaminergic variation (Rothbart & Bates, 2006). Furthermore, individual differences in this system have been related to extraversion (Depue & Iacono, 1989), a personality trait similar to temperamental SU. Stated differently, individuals high on SU may be more prone to approach reward-related stimuli, and to react with aggression when goals are blocked, as often seen in children with ODD. In addition, these temperamentally vulnerable individuals may be less likely to stop or avoid when facing potential punishment, and rather act spontaneously because of potential rewards in the environment (Gray, 1970). Thus children high in SU are presumably not as sensitive to the negative attention and punishment from caregivers and teachers that result from oppositional behavior. Additionally, children high in SU are more likely to behave impulsively, making them prone to continuously exhibit symptoms of ODD. These notions and the results in the present study are supported by the finding that extraverts



are prone to respond more to positive than negative stimuli (Canli et al., 2001), and that approach in preschoolers is related to impulsive behavior in adolescence (Caspi & Silva, 1995). It should be kept in mind that SU is a general overarching construct, in the present study consisting of different subdimensions: Approach, Impulsivity, Sensitivity Seeking, Activity Level and (loading negatively) Shyness (Rothbart et al., 2001). Possibly, and perhaps even likely, some aspects of SU may be more important to the development of ODD than others. Building on the findings of Stringaris et al. (2010), I suggest that activity-related aspects of SU, like Impulsivity and Activity Level, may be more related to ODD than more 'sociable' aspects like Approach. However, Garstein et al. (2012) found that all the fine-grained components of SU were linked to preschool externalizing problems. It would be valuable for a deeper understanding of the SU → ODD relationship to study these fine-grained aspects of SU to determine if and how they relate differently to ODD. Unfortunately, this was beyond the scope of this work.

**Negative affect.** Similarly to SU, NA was, as expected, associated with both higher level of and an increase in ODD symptoms. This finding goes hand in hand with the established association between the propensity to experience negative emotions and externalizing behaviors in general as shown by i.e. Eisenberg, Sadovsky et al. (2005); Eisenberg, Valiente, Spinrad et al. (2009); Garstein et al. (2012); Martel et al. (2012); and Rothbart et al. (1994). Importantly, the results show that this previously identified association also applies to symptoms of ODD, more specifically. Although relating to temperamental characteristics, the present results may be interpreted within Patterson's theory of coercive family processes (Patterson, DeBaryshe & Ramsey, 1989). The theory states that oppositional problem behavior is a result of a mutual reinforcement process where caregivers reinforce children's difficult behaviors, which in turn elicit negative and harsh parenting, which again promotes defiance and aggression in the child, which is negatively and intermittently reinforced by inconsistent parenting – i.e. parents occasionally 'giving in' to the child (Patterson et al., 1989). Furthermore, through these interactions the child learns a negative pattern of relating to others which transfers to other arenas involving peers and teachers. Recent research supporting coercion theory has found that early coercive interactions seem to be an important amplifying factor in the development of behavior problems from early childhood to school age (Smith et al., 2013). The cycle often begins when the child reacts with anger or refuses to comply with the caregivers' directives (Snyder, Edwards, McGraw, Kilgore, & Holton, 1994), which can be thought to happen with easily provoked and angry children. Hence, children high on NA may be more likely to engage in coercive cycles with

their parents, and thereby increase the risk of future ODD. Moreover, children high on NA are expected to more often have parents who are easily provoked or react inconsistently due to the heritability of NA (Rothbart & Bates, 2006) and related constructs such as neuroticism (Evans & Rothbart, 2007), which in turn may fuel the coercive cycle. However, these are speculations that need empirical investigation. Future studies should thus examine the relation between NA and coercive caregiver interactions.

One must keep in mind that NA consists of both ‘internalizing’ aspects, such as sadness, and ‘externalizing’ aspects, such as anger. While the link between the externalizing aspects of NA and ODD seem self-explanatory, i.e. the influence of anger on aggressive behavioral propensities and via coercive processes, the association between internalizing aspects of NA and ODD behaviors appear less evident. However, internalizing aspects of NA have also been linked with externalizing problems, indicating that children with high levels of internalizing-type NA also run a heightened risk of ODD. Eisenberg, Zhou et al. (2005) found that sadness was related to both higher externalizing problems and internalizing problems. A possible explanation is that children with behavior problems frequently experience sadness due to social rejection and resulting loneliness; supported by the high comorbidity of internalizing and externalizing problems in children (Egger & Angold, 2006; Wichstrøm et al., 2012). Despite this, future research may benefit from dissecting NA and studying the relative impact of the different subscales in relation to ODD.

**Effortful control.** As expected, children high on EC had lower initial levels of ODD. This is in correspondence with other studies using rating scales addressing more general behavior problems. EC has been thought to provide attentional flexibility (Derryberry & Rothbart, 1997), allowing the children to voluntarily control their motivation, attention, and actions (Eisenberg & Morris, 2003). Children lower on this trait will have difficulties adapting to changing circumstances in flexible and appropriate ways (Eisenberg & Morris, 2003). Another potential avenue of causality is via emotion regulation skills, which is important in nearly all aspects of functioning. EC predicts better emotion regulation (Eisenberg et al., 2002). For example, children with especially poor emotion-related regulation may be rejected by peers and thereby have less opportunity to learn socially appropriate behaviors, be less likely to stay in school and ultimately experience problems with social adjustment, including evidencing ODD-like problems.

**Interaction between negative affect and effortful control.** Whereas EC was correlated with the initial symptom level, interestingly, EC did not predict changes in ODD symptoms from T1 to T2. This may lead one to think that EC is only important for the level of

symptoms, but not for change and development over time. However, this study showed that EC moderated the effect of NA on ODD symptoms. An interactional relationship between these temperamental dimensions is consistent with prior research on global behavior problems (Eisenberg et al., 2000; Valiente et al., 2003). The interaction effect suggests that high NA does not necessarily lead to the development of ODD in itself if the child also has a moderate or high ability to regulate these negative emotions in flexible and socially acceptable ways (Moran et al., 2013).

However, if regulatory abilities are low and NA is high, a heightened risk of developing ODD will be present (Moran et al., 2013). In line with this, the results showed that EC was a stronger predictor for children who displayed high versus moderate or low levels of NA. This finding is in accordance with the formulation of Eisenberg et al. (2000) that children who are well-regulated are low in behavioral problems even if they are high in NA, because they manage to regulate their emotions internally and not externalize them. Only children who are high in NA and low in EC will find it difficult to adequately deal with negative emotions and react with i.e. aggression (Muris & Ollendick, 2005). Conversely, children high in EC will use more strategic, flexible and effective coping strategies and will thus be more capable to regulate negative feelings (Lengua & Long, 2002). Children with high levels of NA may have a greater risk of developing ODD directly because of the influence NA has on behavioral propensities. As a result of this increased risk children with high levels of NA ‘need’ regulatory abilities such as EC more than children lower in NA to reduce the behavioral expression of their strong negative emotions. Nigg (2006) presents an analogy: When the speed of a car is controlled by two separate systems; acceleration and brakes, slow speed would be the result of either low acceleration (NA) and minimal input from the brakes (EC), or high levels of both acceleration and brakes (high NA and high EC). Furthermore, this may explain the cumulative finding with regard to slope. There was no effect of EC in the low NA group, and according to the argument outlined above, possibly because children low on NA didn’t have sufficiently strong negative emotions to regulate that it would have an impact on changes in ODD symptoms. Stated differently, it can be hypothesized that these children would probably not develop ODD regardless of EC because they experienced low levels of negative emotions. A modest effect of EC appeared in the moderate NA group, whereas EC was moderately to highly important for children high in NA. Here the negative emotions might have been strong enough for EC to have an impact on the change in ODD symptoms. With regard to the initial level of ODD symptoms, EC was to a certain degree important for all groups of NA, but only moderately so for the low and moderate NA groups, and most

strongly for children with high levels of NA. Although EC was generally more important for the initial symptom level than the change in symptoms, the same explanatory mechanisms may be applied for changes in symptoms as for the initial level.

Although the findings indicate both direct and interactional effects of the temperamental dimensions on ODD, it is possible that temperament affects ODD through other processes than the above-mentioned parenting and emotional regulation pathways. Temperament is closely linked to the way that children react and adjust to stress (Rothbart & Bates, 2006). In fact, it has been suggested that temperamental regulatory abilities and coping are somewhat conceptually overlapping (Skinner, Edge, Altman, & Sherwood, 2003). However, researchers have claimed that temperamental regulatory abilities based on EC precede coping styles and rather contribute to their development (Eisenberg, Valiente, & Sulik, 2009), indicating that they are separate constructs. Furthermore, coping is often initiated by stressful experiences such as negative life events and socioeconomic, maternal and environmental risk factors, which have been found to predict externalizing behaviors such as ODD (Carson & Bittner, 1994; Jackson & Warren, 2000; Lengua, Bush, Long, Kovacs, & Trancik, 2008). However, research indicates that the effects of these risk factors may depend on child characteristics such as temperament (Carson & Bittner, 1994; Creasey, Mitts, & Catanzaro, 1995; Lengua et al., 2008; Lengua & Long, 2002). In other words, temperamental traits may influence how children cope with risk factors and stress, and children with ineffective coping strategies that continue to experience stress may have a heightened risk of developing externalizing problem behavior. Temperamental characteristics, especially regulatory abilities, may therefore serve as key factors when facing contextual risk. In support of this notion, Lengua et al. (2008) found that socioeconomic risk was particularly problematic for the emotional and behavioral adjustment of children with low levels of EC, but stress was not associated with increasing externalizing behavior in children high in EC. Eisenberg et al. (2009) state that temperamental constructs such as planning and focusing attention are crucial for active, adaptive coping. Lengua and Long (2002) found that self-regulation, similar to temperamental EC, was negatively related to negative life events, predicted the use of active coping strategies and lower adjustment problems, whereas children who had experienced negative life events had heightened negative emotionality, which engendered non-adaptive coping strategies that predicted behavior problems. To sum up, the association between the temperamental dimensions NA and EC and symptoms of ODD may lie in the temperamental influence on coping strategies. It will be useful for future research to

study how temperamental dimensions and coping abilities relate to one another longitudinally, and their effect on ODD.

**Gender.** Despite the strong association between NA and externalizing behaviors, girls were higher on NA but exhibited lower levels of ODD symptoms than boys in first grade, but not at age 4. But why do gender differences in ODD emerge during the preschool and early school years? Else-Quest et al. (2006) state that gender differences in temperament will increase with age because children are exposed to more cumulative socialization in same-gender peer groups, leading to more gender role socialization. This is in line with social learning theory, which states that gender differences in aggression should initially be small and increase as a result of socialization experiences (Archer, 2004). The exposure to socialization through participation in organized peer groups especially increases in school age (Else-Quest et al., 2006), thus gender differences in temperament can be expected to occur and magnify at this age, affecting the development of ODD. An important part of this socialization is play. Although gender differences in playtime preferences have been observed in children down to 12 months (Servin, Bohlin, & Berlin, 1999), perhaps due to different fetal testosterone levels (Auyeung et al., 2009), research have confirmed that the different preferences between genders increase as children progress into middle childhood (Golombok & Hines, 2002). Among boys, playtime interactions often include rough and tumble play, competition, risk-taking and striving to obtain dominance, sometimes with direct or indirect aggression, while girls tend to interact more reciprocally in so-called ‘collaborative discourses’, responding to the behavior or opinion of the other and maintaining harmony while still trying to accomplish their own goals (Maccoby, 2002). Additionally, parents and teachers react differently to aggression in boys and girls, encouraging boys more and giving them fewer restraints than girls (Archer, 2004). Research has found that in middle childhood, girls tend to use more indirect aggression (e.g. ostracism, relational aggression) than boys (Loeber & Hay, 1997), indicating that girls’ expressions of anger and aggression may be different than the typical ODD behaviors. In sum, there seem to be differences in socialization practices that reinforce gender differences over time, and the interplay between gender and socialization may explain that gender differences in ODD were present at T2 but not T1. However, one must keep in mind the gradual nature of this tendency. The gender difference at T2 was not large. Previous studies on older school children and adolescents suggest that boys have a slightly higher rate of ODD (i.e. Fleitlich-Bilyk, & Goodman, 2004; Ford, Goodman, & Meltzer, 2003, Loeber et al., 2000), and that the magnitude of gender differences increase with age (Keenan & Shaw, 1997). This indicates that the findings of the present study perhaps

show the beginning of a process that can be expected to develop further with age.

Understanding how gender differences in ODD change with age is an essential component to understanding the epidemiology of ODD. Hence, for future research, it will be important to expand the understanding of gender differences across age.

### **Conceptual considerations**

The position that temperament influences child psychopathology, here represented by ODD, can be criticized by the allegedly tautological, dependent nature of the two constructs (Muris & Ollendick, 2005), resulting in potentially significant methodological and conceptual problems. This is not just the case for behavior problems and temperament; confounding of personality traits and measures of symptomology has long been a significant and well-debated problem in psychology (Lengua, West, & Sandler, 1998). Whereas some argue that temperament and psychopathology are qualitatively distinct entities, others see psychopathology as extremes on continuous temperamental dimensions. From the latter view, one may argue that the extremes of temperament may in many cases qualify as disorders themselves (Egger & Angold, 2006). Consequently, anxiety or an avoidant personality disorder would be considered to be the extreme end of an inhibited temperamental dimension (Frick, 2004) and ADHD as an extreme of 'activity level' (Lahey, 2004). In the present case, if symptoms of ODD represent extremes of temperament, e.g. of NA, measurement confounding arises as a problem, because research measures of both constructs tap behaviors. In fact, Lahey, Waldman and McBurnett (1999) actually refer to symptoms of ODD as 'oppositional temperament' due to their nonspecific, early-appearing, and heritable nature. Furthermore, ODD includes a number of symptoms resembling the NA subscales Anger and Irritability (e.g. 'often loses temper'; 'is often angry and resentful'), making it difficult to decide whether temperament influences ODD or if the relationship between the two are inflated due to measurement confounding. Such item overlap is in addition to being a methodological issue, also a theoretical one which raises questions about how different extremes of temperament and diagnoses are if parallel language is used to assess both (Rettew, Copeland, Stanger, & Hudziak, 2004). Nevertheless, sizable amounts of research support the distinct nature of temperamental characteristics and behavior problems. Lemery and colleagues (2002) had experts sort out overlapping items from various scales measuring temperamental characteristics and behavior problems, and found that items for the most part were assigned to the correct construct. Furthermore, they found that after removing conceptually overlapping items between the measures of temperament and the different preschool-age behavior problem scales, there was still a significant relationship between

temperament and externalizing behavior problems, indicating that the relationship between the two was not fully due to measurement confounding, as did Lengua, West and Sandler (1998) in another study. Furthermore, several observational studies (Hughes, Cutting, & Dunn, 2001; Hughes, White, Sharp, & Dunn, 2000), where overlaps in wording are insignificant, confirm the associations between temperament and behavior problems. Additionally, behavioral genetic studies (Gjone & Stevenson, 1997; Nigg & Goldsmith, 1998) have found that genetic and environmental effects have different impacts on individuals with extreme or disorder level of a trait versus those with lower levels, contradicting a tautological relationship between the two. Despite the importance of these studies, Lahey (2004) underlined that it may be useful in research on psychopathology to develop new measures of temperament that are free of overlapping items. In the present study, the initial level of ODD was controlled for, meaning that the findings on the impact of temperamental dimensions on *changes* in ODD symptoms reflect temperament alone beyond the effect of initial ODD. Although a tautological relationship between temperament and ODD cannot be fully ruled out; there appear to be an empirically related, but different relation between the two constructs. Conclusively, the findings in the present study that temperamental composition affects changes in ODD cannot be explained by measurement confounding alone.

Due to the fact that high NA and low EC seem to co-occur in many disorders of childhood and have wide cross-sectional associations with a range of developmental outcomes (e.g. Eisenberg et al., 1997; Eisenberg et al., 2001; Rydell et al., 2003; Valiente et al., 2003), it is reasonable to speculate if the composition of high NA and low EC can be considered a general vulnerability in children. It also offers a plausible explanation to the high comorbidity rate that seems to be a central feature of general psychopathology in preschoolers (Egger & Angold, 2006; Muris & Ollendick, 2005), and of children with ODD specifically (Stringaris & Goodman, 2009; Stringaris et al., 2010). However, it is only in recent years that interactions between NA and EC have been the focal point of temperament research. Hence, more research is needed on the co-occurrence and interactional relationship of NA and EC to determine whether this composition may be regarded as a vulnerability for the development of various psychopathologies.

One must keep in mind that one cannot draw firm causal conclusions from the present study. Although two important criteria for causation are met, namely co-variation of the variables and a time-order relationship, elimination of other plausible explanations for the associations is impossible. For instance, we do not know whether and to which degree environmental effects have influenced the changes in ODD symptoms, if temperament and

ODD behaviors have shared genetic influences, or if certain temperamental compositions elicit different types of environments which result in different exposures (Rutter, 1997). Using twin-study data, Gjone and Stevenson (1997) found that genetics significantly contributed to the relationship between temperamental emotionality and aggressive behaviors. The finding could indicate that both temperament and ODD stem from a common biological vulnerability, or that temperament may represent a link between a genetic vulnerability and later behavior problems.

### **Methodological Considerations**

Although this study has several strengths, such as a large community-based sample, prospectively collected data, and the use of methodologically strong measures, several limitations should be noted. First, as is usually the case for longitudinal studies, there was attrition from T1 to T2. Although the attrition rate was not large and to a very limited degree systematic according to study variables, there was a slight tendency that participating children were rated higher on social competence by teachers than nonparticipating ones. It may therefore be that the results are more likely to apply to certain children in certain families. However, I used robust full information maximum likelihood estimation to address missingness and nonnormality of data, which is a state-of-the-art method for addressing missing at random.

Second, even though a semi-structured interviewer-based interview was applied (i.e. the PAPA), recordings of both temperament and ODD were ultimately based on parent-reports. This is the case for the majority of the previous research on temperament and behavior problems, with notable exceptions (Eisenberg et al., 2000; Eisenberg et al., 2001; Gilliom & Shaw, 2004; Olson et al., 2005). The reliance on parents may have introduced a common method variance inflating the correlation between temperament and ODD. Nevertheless, parental reports of child temperament may have superior predictive validity relative to other sources of information addressing child temperament, including structured observations (Pauli-Pott, Mertesacker, Bade, Haverkock, & Beckmann, 2003). Moreover, the interviewer in the PAPA does not take the parents' answers at face value but rather probes until she or he can determine whether the symptom is present or not. Although a common method variance, which cannot be ruled out in the present data, may inflate the concurrent association between temperament and ODD, i.e. the association between temperament and the intercept of ODD, it is more difficult to see how this might have affected the prediction of change in ODD since the covariation between temperament and initial ODD already has been



adjusted for. Hence, the temperament → ODD intercept may have been exaggerated, whereas it is less likely that the temperament → ODD slope have been affected.

Third, although the sample was diverse, lack of proficiency in Norwegian was used as an exclusion criterion. Consequently, cultural diversity may have been compromised perhaps resulting in an underrepresentation of i.e. immigrants. As shown by Ahadi, Rothbart and Ye (1993), there are cultural differences in temperament. For example, whereas the negative correlation between NA and EC is well established in western countries, no correlation between NA and EC was found in a Chinese sample (Ahadi et al., 1993). This indicates that the dynamics between temperamental dimensions are not given, but guided by what is culturally valued (low distress in western countries; low outgoing behavior in China; Rothbart, 2007), thus the interactional effects of the dimensions upon ODD may also be culturally dependent. By excluding recently arrived immigrants from this study, the results may have been biased by cultural homogeneity and may thereby be in risk of threatening the possibility for generalization.

Fourth, the present study investigated symptoms of ODD rather than the full diagnosis. The associations and predictors found in the present study are related to symptoms of ODD, which are necessary, but not sufficient for a full diagnosis. Pickles and Angold (2003) underline that just as light has both wave and particle-like properties, both categorical and dimensional approaches can be used to describe ODD. However, in a large meta-analysis, Markon, Chmielewski and Miller (2011) found that the use of continuous measures yields more reliable measures of psychopathology, including externalizing disorders, than discrete measures. This indicates that the investigation of symptoms, a continuous measure, may be regarded as strength of the present study.

Finally, the impairment criterion was not applied in the present study. This raises the question of whether generalization to children with ODD is possible. As noted earlier, studies have found that preschoolers with sub-syndromal ODD can also be highly impaired (Keenan et al., 1998), indicating that the threshold for diagnosis may be too strict. In sum, the present findings do not necessarily generalize to the diagnosis of ODD – a task awaiting future research.

### **Clinical Implications**

The findings from this study speak plainly. They suggest that temperamental SU and NA are associated with higher initial levels of ODD as well as an increase in ODD symptoms from age 4 to 6. EC is associated with lower initial levels of ODD, but does not predict changes in ODD symptoms alone. However, EC protected against increased ODD in children

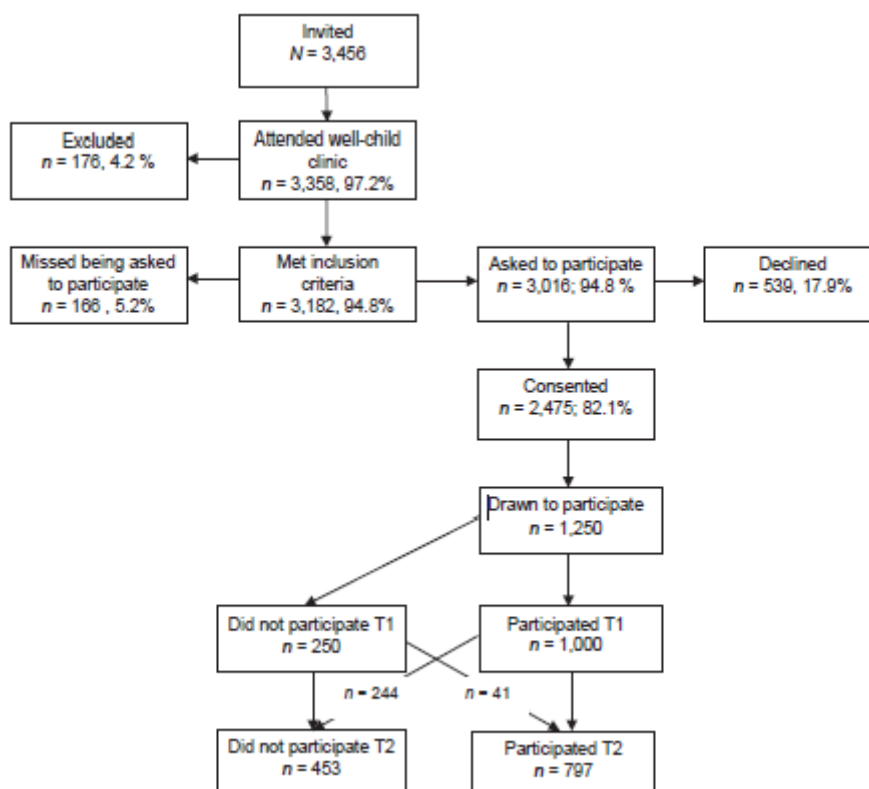
with moderate and, particularly, high levels of NA. The results reported herein thus provide knowledge concerning children that may be at particular risk of developing ODD – information valuable to researchers and clinicians working with preschoolers.

As noted earlier, evidence suggests that early interventions are effective in the prevention and/or treatment of ODD. Considering the strong relationship between ODD and temperament, interventions may benefit from also targeting temperamental dimensions. Although temperament is found to be largely biologically based, this does not mean it cannot be influenced by environmental factors (Posner, Rothbart, Sheese, & Tang, 2007). Temperamental outcomes are dependent on culture and experiences (Ahadi et al., 1993; Rothbart, 2007). For example, Bakermans-Kranenburg and van Ijzendoorn (2006) found that externalizing behaviors in preschoolers were predicted by level of maternal sensitivity in interaction with the 7-repeat allele of DRD4, which is a gene suggested to be associated with the executive attention system and therefore related to EC (Rothbart, 2007). A temperament-based selection for intervention may thus help define those at higher risk (Rettew & McKee, 2005), and it may also prove effective to match treatment modalities to the child's specific temperamental strengths and weaknesses. Interventions such as attention training programs show promising results in enhancing executive attention in children (Posner, Rothbart, & Sheese, 2007), and Rothbart (2007) suggests that EC and distress proneness may be altered with longer training. As noted by Rothbart (2004), EC is a key to adaptive and maladaptive development, and should therefore be a target in prevention and intervention strategies. For example, efforts could be made to enhance the dimension of EC due to its strong moderating role on NA, especially for children who are high on the latter dimension. Greater EC may then help overcome the behavioral expression of high NA. Early in treatment, children with high NA may need more help to reduce the amount of environmental stressors than those who are lower on this particular dimension (Rettew & McKee, 2005). Furthermore, children with high NA and high EC may be better suited to benefit from learning coping strategies, such as distraction or cognitive restructuring, than children lower on EC (Rettew & McKee, 2005). Anger control training; a cognitive-behavioral intervention, has been found to be an effective treatment modality for children with disruptive behaviors (Eyberg, Nelson, & Boggs, 2008). The main components of the program include learning and practicing problem solving skills in anger provoking situations; appropriate responses and self-statements; and increasing the children's emotional awareness. The abilities needed to inhibit aggressive responses, pay attention to the situation and one's emotions, and plan appropriate responses are self-

regulatory abilities resembling components of EC. Hence, training and strengthening of EC may be a key to effective treatments of ODD, whether or not this is a declared objective.

**Conclusions**

Early individual behavioral differences in aggression and disruptive behavior have been associated with physiological differences and with different environmental characteristics (Calkins & Fox, 2002). Thus there seem to be risk factors operating at both a micro, behavioral, and environmental level, and complex interactions exist between them. The present study is a contribution to the understanding of the complex relationship between temperament and ODD, and how temperamental dimensions interact in predicting changes in ODD. The results show that the temperamental dimensions of NA and SU function as risk factors for ODD, whereas EC protects against ODD in young children with moderate and high levels of NA. A better understanding of these interactions and the interplay between temperamental factors over time in the development of ODD in children is needed to help with an earlier identification of children in risk, as well as in designing effective treatment interventions.



**Figure 1** Recruitment and follow-up (as reported by Wichstrøm et al., 2013)

Table 1

*Means and Standard Deviations of Study Variables*

	Mean	S.D.	Min	Max
Symptoms of ODD at age 4	.86	1.27	0	7
Symptoms of ODD at age 6	1.14	1.34	0	6
Negative affectivity	3.70	.47	1.66	5.08
Surgency	4.55	.61	2.10	6.37
Effortful control	4.82	.45	2.33	6.27

*Note.* Figures are weighted back to represent population estimates.

Table 2

*Summary of Intercorrelations*

Variables	1	2	3	4	5	6	7
1. Symptoms of ODD at age 4	–						
2. Symptoms of ODD at age 6	.29***	–					
3. Negative affectivity	.24***	.25***	–				
4. Surgency	.07*	.10**	-.20***	–			
5. Effortful control	-.24***	-.22***	-.30***	-.23***	–		
6. Negative affectivity x effortful control	-.07*	-.08*	.11	-.05	-.10	–	
7. Gender	-.01	-.08*	.10**	-.14***	.21***	.04	–

\* $p < .05$ , \*\* $p < .01$ , \*\*\*  $p < .001$ .

Table 3

*Sample Regression Table: Predictors of Change in ODD Symptoms From Temperamental Dimensions*

Variable	Intercept			Slope		
	B	S.E.	$\beta$	B	S.E.	$\beta$
Gender	.03	.07	.01	-.09*	.04	-.06*
Surgency	.16*	.06	.08*	.10*	.04	.09*
Negative affectivity	.50***	.08	.21***	.26***	.05	.18***
Effortful control	-.41***	.10	-.16***	-.10 <sup>†</sup>	.06	-.06 <sup>†</sup>
Negative affectivity x Effortful control	-.51***	.13	-.11***	-.22*	.10	-.08*

<sup>†</sup> $p < .1$ , \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

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