

# Evaluation of the Strengths and Difficulties Questionnaire-Dysregulation Profile (SDQ-DP)

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The Dysregulation Profile (DP) has emerged as a measure of concurrent affective, behavioral and cognitive dysregulation, associated with severe psychopathology, and poor adjustment. While originally developed with the Child Behavior Checklist, more recently the DP has also been defined on the Strengths and Difficulties Questionnaire (SDQ), mostly with a 5-item, but also a 15-item, SDQ-DP measure. This study evaluated the SDQ-DP by examining its factor structure, measurement invariance, and construct validity. Different SDQ-DP operationalizations were compared. In a United States longitudinal community sample ( $N = 768$ ), a bifactor model consisting of a general Dysregulation factor and three specific factors of Emotional Symptoms, Conduct Problems, and Hyperactivity-Inattention fitted best, across three different developmental periods (early childhood, middle childhood, and adolescence) and across three different reporters (parents, teachers, and youth). Measurement invariance across reporter, gender, and developmental period was demonstrated. These findings indicate that the SDQ-DP, like the CBCL-DP, reflects a broad syndrome of dysregulation that exists in addition to specific syndromes of emotional symptoms, conduct problems, and hyperactivity-inattention. SDQ-DP bifactor scores were strongly related with scores on the 5- and 15-item SDQ-DP measures and similarly concurrently associated with two markers of self-regulation, ego-resiliency and effortful control, and longitudinally with antisocial behavior and disciplinary measures. As reliability, validity, and stability was weaker for the SDQ-DP 5-item measure, use of all 15 items is recommended. Advantages of using a bifactor approach are discussed as well as the potential of the SDQ-DP as an easy screening measure of children at risk for developing serious psychopathology.

## Public Significance Statement

The Strengths and Difficulties Questionnaire (SDQ) can be used to measure a broad syndrome of affective, behavioral, and cognitive dysregulation: the SDQ-Dysregulation Profile. Preferably a bifactor operationalization is used. The 15-item SDQ-DP measure is preferred over the SDQ-DP 5-item measure given greater reliability, validity, and stability.

**Keywords:** children's emotional and behavioral problems, confirmatory factor analysis, measurement invariance, behavioral assessment, emotional dysregulation

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A considerable number of children and adolescents referred for clinical treatment present a complex picture of co-occurrence of affective, behavioral, and cognitive dysregulation, causing significant diagnostic and therapeutic challenges for clinicians. The Dysregulation Profile (DP), based on the Child Behavior Checklist (hence the term CBCL-DP), has emerged as a reliable, valid, and relatively simple dimensional measure of this complex phenotype of dysregulation (Althoff, Ayer, Rettew, & Hudziak, 2010; Ayer et al., 2009). The CBCL-DP is not linked to a specific disorder such as attention-deficit-hyperactivity disorder (ADHD), or juvenile bipolar disorder (Diler et al., 2009; MCGough et al., 2008). Rather, the DP broadly characterizes dysregulation, which is presupposed to be underlain by deficits in self-regulation as self-regulation is thought to be impaired in all the psychopathological symptom domains measured with the DP (Althoff, Ayer, et al., 2010; Althoff, Verhulst, Rettew, Hudziak, & van der Ende, 2010; Ayer et al., 2009).

More recently, the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), has also been validated as a measure to capture the dysregulation phenotype (Holtmann, Becker, Banaschewski, Rothenberger, & Roessner, 2011). The SDQ, like the CBCL, is a behavioral screening questionnaire with equivalent forms for parents, teachers, and youth self-reports. Although the CBCL and SDQ have been found to correspond well (Goodman & Scott, 1999; Stone, Otten, Engels, Vermulst, & Janssens, 2010), they also differ. The SDQ, in contrast to the CBCL, is freely available online and significantly shorter (25 vs. 113 items). The brevity of the SDQ might make it more practical for quick screening or regular short-term monitoring of children's emotional and behavioral problems.

Given that the SDQ is increasingly being used in research, and the exponential growth in the past decade of research on childhood emotional and behavioral dysregulation using the CBCL-DP (see Bellani, Negri, & Brambilla, 2012 and Caro-Cañizares, García-Nieto, & Carballo, 2015, for reviews), it can be expected that the SDQ-DP will be used in many more studies to come. Research evaluating the structure and psychometric properties of the SDQ-DP, however, is lacking, leading to a scarcity of evidence for the use of the SDQ-DP as a screening measure either to identify at-risk children in the general population or to identify subgroups of high-risk patients with greater clinical severity (Carballo et al., 2014). The aim of this study is, therefore, to examine the factor structure, reliability, measurement invariance, and validity by examining concurrent associations of the SDQ-DP with measures of self-regulation in early childhood as well as longitudinal outcomes of early childhood SDQ-DP. Furthermore, correspondence between different operationalizations of the SDQ-DP in terms of overlap, reliability and validity will be examined as to advise on the use in research and clinical practice.

### Operationalization of the DP on the CBCL and SDQ

Both the CBCL-DP and SDQ-DP have been operationalized using scores on scales characterized by dysregulation of affect (Anxiety/Depression or Emotional Symptoms), behavior (Aggressive Behavior or Conduct Problems), and cognition (Attention Problems or Hyperactivity-Inattention, see also (Althoff, Ayer, et al., 2010; Winsper & Wolke, 2014). For the SDQ-DP, in addition, a short 5-item measure has been developed using stepwise linear discriminant analyses and receiver operating characteristic (ROC) analysis of all 25 SDQ items (Holtmann, Becker, et al., 2011). This SDQ-DP 5-item measure is a summed score of 5 items from the Emotional Problems

(2 items), Conduct Problems (2 items), and Hyperactivity-Inattention (1 item) scales. It was highly correlated with CBCL-DP scores operationalized as summed *T* scores of the AAA-scales ( $r = .75$ ; Holtmann, Becker, et al., 2011). This SDQ-DP 5-item measure has been used in most of the research using the SDQ-DP so far. However, low reliability ( $\alpha = .52$ ) has been reported for the 5-item SDQ-DP measure (Holtmann, Becker, et al., 2011). The use of all 15 items representing emotional symptoms, conduct problems, and hyperactivity-inattention, either summed or within a factor model, might result in a more reliable measure of SDQ-DP. Correspondence between different measures of the SDQ-DP as well as potential differences in validity are, therefore, examined in this study.

### The Factor Structure of the SDQ-DP

Factor analytic studies can provide insight into how the DP can best be conceptualized. Recent studies used Confirmatory Factor Analysis (CFA) to examine the factor structure of the CBCL-DP, and showed that a bifactor model consisting of a general DP factor and three specific factors of Anxiety/Depression, Aggression, and Attention Problems best described the CBCL-DP (Deutz, Geeraerts, van Baar, Deković, & Prinzie, 2016; Geeraerts et al., 2015). This study aimed to replicate this research as it is important to examine consistency in theoretical conceptualization of DP, regardless of whether the CBCL or the SDQ is used to measure emotional and behavioral symptoms. We tested three competing factor models of SDQ-DP that each conceptualize the DP differently. The simplest model is the one-factor model (Figure 1a), in which symptoms (items) describing emotional, conduct, and hyperactivity-inattention problems all load onto one factor of Dysregulation, representing the idea that the DP is a unidimensional syndrome. In a second-order model (Figure 1b), specific first-order factors represent distinct problems of emotional symptoms, conduct problems and hyperactivity-inattention. A second-order DP factor then accounts for the communalities between the factors, a perspective in line with the idea that dysregulation represents comorbidity (Carlson, 2007). The third model is the bifactor model (Figure 1c), in which symptoms of behavioral and emotional problems load onto one general dysregulation factor, as well as onto specific factors of Emotional Symptoms, Conduct Problems, and Hyperactivity-Inattention. While both a one-factor and bifactor model describe dysregulation as one broad syndrome, they differ on whether they suggest that distinguishing between different types of self-regulatory problems is useful (bifactor model) or unnecessary (one-factor model). A bifactor model in general suggests that there might be both shared and nonshared etiological factors and that treatment should be tailored to symptom profile (Martel, von Eye, & Nigg, 2010).

Evaluation of the factor structure of the SDQ-DP is particularly useful because factor scores have several advantages over sum scores. While all items representing symptoms are given equal weight when sum scores are calculated, factor scores are computed based on different weights for different items. Factor scores, therefore, reflect the fact that some symptoms might be more characteristic of dysregulation than others, corroborating the idea that the DP is more than merely the sum of its components (Boomsma et al., 2006). Factor scores can also reduce measurement error and, therefore, result in a purer measure of the DP. It is very relevant to examine whether a bifactor approach can also be used to describe the SDQ-DP given that bifactor models have more

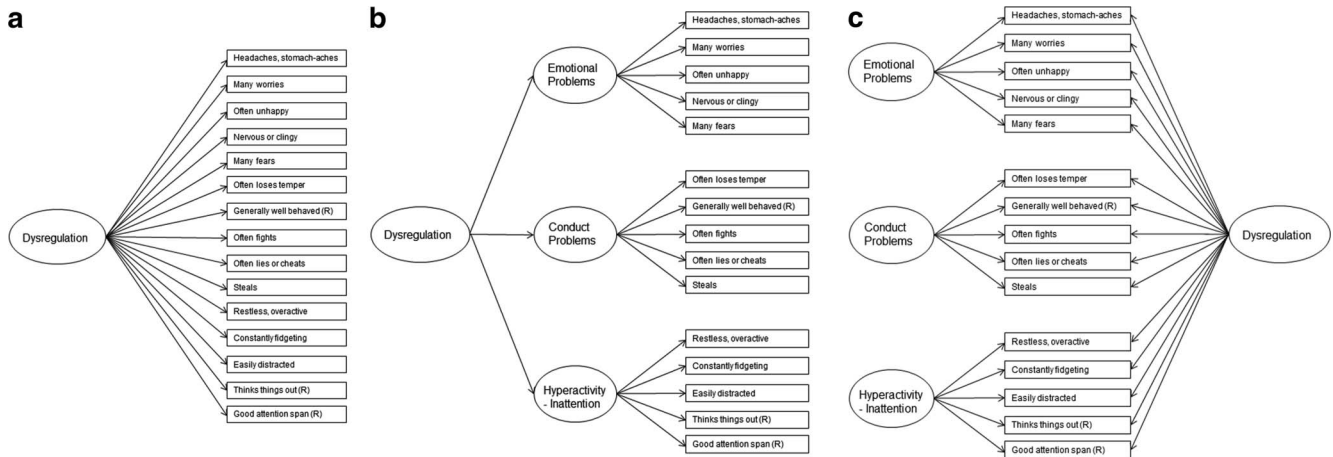


Figure 1. (a) One-factor Strengths and Difficulties Questionnaire-Dysregulation Profile (SDQ-DP) model. (b) Second-order factor SDQ-DP model. (c) Bifactor SDQ-DP model.

recently been rediscovered as an effective approach to examine multidimensionality, that is, determining whether a set of items (symptoms) reflect a common underlying construct (Reise, 2012). Notwithstanding these advantages, factor scores are less useful in clinical practice as these are based on groups, whereas sum scores can easily be computed for each individual. Furthermore, factor scores are dependent upon characteristics of the dataset whereas individual sum scores are more comparable across studies.

### Concurrent Construct and Longitudinal Predictive Validity of the SDQ-DP

The CBCL-DP and SDQ-DP have been associated with a wide range of negative adjustment outcomes such as greater psychiatric comorbidity and functional impairment, reduced psychosocial functioning, worse family functioning, more frequent parental psychiatric history, and sleeping problems (Althoff, Verhulst, et al., 2010; Carballo et al., 2014; Caro-Cañizares, Serrano-Drozdzowskyj, Pfang, Baca-García, & Carballo, 2017; Legenbauer, Heiler, Holtmann, Fricke-Oekermann, & Lehmkuhl, 2012; Holtmann, Buchmann, et al., 2011). Consequently, both the CBCL- and SDQ-DP have been described as indices of overall psychological severity and functional impairment (Bellani et al., 2012; Carballo et al., 2014). However, little research used a bifactor approach to examine such relationships of the DP, while bifactor models come with the major advantage of parsing out specific and overlapping risk factors and outcomes for general dysregulation versus more specific forms of psychopathology. Bifactor models, therefore, provide a more refined way to examine predictors and outcomes, and can give purer estimates of constructs. This would aid our understanding of the construct of dysregulation. In this study, construct validity was evaluated by examining associations between the DP and two markers of self-regulation: ego-resiliency and effortful control. Whereas the DP has consistently been described as resulting from self-regulatory deficits, only a handful of studies have examined associations between the DP and measures indicative of self-regulation such as inhibition (Geeraerts et al., 2015) and emotion regulation (Legenbauer et al., 2016). The concept of ego-resiliency has its roots in the Ego-Control/Ego-Resiliency Model (Block & Block, 1980), a theoretical model of self-regulation. Ego-

control refers to the inhibition/expression of impulses whereas ego-resiliency describes the ability to modulate these impulses flexibly and adaptively. Effortful control can be defined as children's ability to inhibit predominant responses to activate subdominant ones (Kochanska, Murray, & Harlan, 2000). Longitudinal or predictive validity was evaluated by examining associations with negative adjustment outcomes in adolescents, namely antisocial behavior and disciplinary measures.

### The Current Study

The objective of this study is to evaluate the SDQ-DP by: (a) examining the factor structure of the SDQ-DP, (b) as a prerequisite for valid comparisons, examining measurement invariance of the best-fitting model to determine whether the SDQ-DP is similarly defined across reporters (parents, teachers, and youth), gender and developmental period (early childhood, middle childhood, and adolescence), (c) examining correspondence between the SDQ-DP best-fitting factor model, the 5-item SDQ-DP measure (Holtmann, Becker, et al., 2011) and the 15-item summed SDQ-DP score (Winsper & Wolke, 2014), and (d) investigating construct and predictive validity by examining relations with markers of self-regulation and negative adjustment outcomes. Given that a bifactor model best described the CBCL-DP (Deutz et al., 2016; Geeraerts et al., 2015), we expect that a bifactor model also represents SDQ-DP best. This hypothesis is further supported by research demonstrating that a bifactor model can adequately describe the structure of the full SDQ including prosocial and peer problems factors (Caci, Morin, & Tran, 2015; Kóbor, Takács, & Urbán, 2013), although no research as yet has been conducted on the factor structure of the SDQ-DP specifically.

### Method

#### Procedure and Participants

The present study is part of a 12-year longitudinal cohort study (2000–2012) called “Project Achieve” (see Hill & Hughes, 2007), aimed at examining relations between grade retention and aca-

ademic achievement. Project Achieve was approved by the Research Ethics Board of Texas A&M University. Originally, 1,374 children from three different school districts (one urban, two small city districts) in Texas were targeted, based on several inclusion criteria: (a) scoring below the median of the school district on a state-approved district-administered literacy test, (b) not having received special education, and (c) not having been retained at first grade. The project's focus on children with relatively low academic readiness skills was because these children are known to be at increased risk for the development of emotional and behavioral problems and, therefore, represent a population of concern. Out of those 1,374 eligible participants, parents of 784 children (65%) provided consent across two sequential cohorts in 2000 and 2001 (449 for Cohort 1 and 335 for Cohort 2). Children with and without consent did not differ on a broad array of variables such as age, gender, ethnicity, and socioeconomic status (Hill & Hughes, 2007). Parents, teachers (all waves) and children (only in adolescence) received a monetary reward of \$25 for their participation at each wave of data collection.

This study included participants for whom SDQ data (either parent- or teacher-report) was available for at least one of the included waves. This resulted in a final sample of 768 children (52.5% male) that was ethnically diverse (37.5% Hispanic, 34.4% White, 22.8% African American, and 5.3% other: e.g., Asian). There were 476 children (62.5%) who were classified as economically disadvantaged based on children's eligibility to receive free or reduced school lunch.

For this study, we used data from three measurement waves representing three distinct developmental periods namely: early childhood (T1,  $M_{\text{age}} = 6.57$ ,  $SD = 0.39$ ), middle childhood, (T2,  $M_{\text{age}} = 9.57$ ,  $SD = 0.39$ ), and adolescence (T3,  $M_{\text{age}} = 13.57$ ,  $SD = 0.39$ ). At T1, SDQ-data were available for 496 parents (35.4% missing), and 678 teachers (11.7% missing). For 451 children (58.7%) both parent- and teacher-reported data was available at T1, while for 45 children (5.9%) no parent- or teacher-reported SDQ-data was available at T1. At T2, data were available for 446 parents (41.9% missing) and 528 teachers (31.3% missing). For 359 children (46.7%) both teacher- and parent-reported data was available. At T3, data were available for 352 parents (54.2% missing), 437 teachers (43.1% missing), and 505 adolescents (34.2% missing), with 272 children (35.4%) having data for all reporters at T3. Participants for whom SDQ-data was available at all time points (for at least one reporter per time point: 458 children, 40.4%) did not differ statistically from participants who had missing data on any of the waves (310 children, 59.6%) on gender, socioeconomic status (SES), or T1 parent- and teacher-reported scores on the Emotional Symptoms, Conduct Problems, and Hyperactivity-Inattention scales of the SDQ as well as the 5- and 15-item SDQ-DP measures. They only differed on ethnicity with Hispanic children being slightly more likely to have missing data on any of the waves.

## Instruments

**Strengths and Difficulties Questionnaire.** The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) is a brief 25-item behavioral screening questionnaire asking to what extent both positive and negative psychological attributes of the child were true in the past six months, using a 3-point scale (0 = *not true*, 1 = *somewhat true*, 2 = *certainly true*). The SDQ has good psycho-

metric properties (Stone et al., 2010), and has parallel forms for parents, teachers, and children aged 11 and over. In this study, parents and teachers completed age-equivalent forms of the SDQ at all three time points, while youth reported on the SDQ in adolescence (T3) only.

The SDQ consists of five subscales, each consisting of five items: Prosocial Behavior, Hyperactivity-Inattention, Emotional Symptoms, Conduct Problems, and Peer Relationships. In this study, we used items from three subscales to estimate the DP factor models: Emotional Symptoms, Conduct Problems, and Hyperactivity-Inattention. After reverse coding of positively worded items, Cronbach's  $\alpha$  on these subscales ranged from .70 to .80 (mean  $\alpha = .74$ ) across reporters and time points.

In addition, scores for the SDQ-DP 5-item measure were computed according to the study of Holtmann, Becker, et al. (2011), by summing scores on five items: two items from the Emotional Symptoms scale (13: often unhappy, down-hearted, or tearful; 8: many worries, often seems worried), two items from the Conduct Problems scale (12: often fights with other children or bullies them, 22: steals from home, school, or elsewhere) and one item from the Hyperactivity-Inattention subscale (2: restless, overactive, cannot stay still for long). Cronbach's  $\alpha$ 's were low, ranging from .54 to .65 across reporters and time points (mean  $\alpha = .59$ ). A cut-off point of  $\geq 5$  is suggested to identify children exhibiting clinical levels of problems (Holtmann, Becker, et al., 2011). Using this cut-off, on average 9.40% of children in the study met this criterion (averaged across reporters and developmental periods). The SDQ-DP 15-item measure as used by Winsper and Wolke (2014) was computed by summing scores on the 15 items of the Emotional Symptoms, Conduct Problems, and Hyperactivity-Inattention scales, with Cronbach's  $\alpha$  ranging from .80 to .87 across reporters and time points (mean  $\alpha = .85$ ).

## Validity Measures

Measures of ego-resiliency and inhibitory control were only assessed at T1; therefore, examination of construct validity was limited to T1. Longitudinal outcomes were assessed at T3.

**Ego-resiliency.** The measure of ego-resiliency (the ability to express and modulate impulses effectively and adaptively) was derived from a selection of items of the California Child Q-Set (Caspi et al., 1992), filled out by teachers at T1 using a 1–5 Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). In a previous study on this dataset (Kwok, Hughes, & Luo, 2007) exploratory and confirmatory factor analyses resulted in the development of a 7-item ego-resiliency scale consisting of four items describing ego-resiliency (resourceful in initiating activities; curious, eager to learn, open; self-reliant, confident; persistent, does not give up easily) and three items describing ego-brittleness (becomes rigidly repetitive; falls to pieces under stress; rapid mood shifts, emotionally labile). After reverse-coding the ego-brittleness items, we computed a mean score of these 7 items with higher scores representing higher ego-resiliency. The measure showed good internal consistency (Cronbach's  $\alpha = .85$ ).

**Effortful control.** At T1, trained research assistants individually administered tasks from a behavioral battery designed to assess behavioral self-regulation by tapping into the ability to deliberately slow down motor activity (Kochanska, Murray, & Coy, 1997). This study used data from three tasks: Telephone

Poles, Stars, and Walk-a-Line. In the Walk-a-Line task, children were asked to walk along a ribbon that was taped onto the floor. In the Telephone poles tasks, children were asked to draw wires (i.e., straight lines) to connect telephone poles for the squirrels to sit on using a ruler. In the Star task children were given a picture of a star and were asked to draw the shape staying in the lines. In each of the tasks children participated in three trials: a baseline trial with no instructions regarding speed, a fast trial in which children were asked to be as fast as possible and the third trial was a slow trial, in which children were asked to slow or inhibit their (gross or fine motor) behaviors. As effortful control is defined as the ability to inhibit a predominant response to perform a subdominant response (Kochanska et al., 2000), differences between the fast trial and the slow trial (in which children had to deliberately slow down motor behavior after preceding instructions to be as fast as possible) were averaged across the three tasks ( $\alpha = .75$ ) to create the effortful control score. Higher scores indicate higher effortful control.

### Longitudinal Construct Validity

**Antisocial involvement.** At T3, students were interviewed individually and were asked to briefly report by saying yes or no on whether they have been involved in each of four antisocial activities (i.e., been caught by the police, taken part in a fight, destroyed things, and skipped school) during the past year. This 4-item Antisocial Involvement Questionnaire is adapted from an 8-item measure used by Mahoney and Stattin (2000). Data were available for 505 adolescents.

**Disciplinary actions.** At T3, teachers reported whether any of the five following disciplinary actions occurred for the student: sent to the office for disciplinary reasons, assigned to in-school-suspension, assigned to disciplinary alternative education, judicial placement outside school district, and expelled from school (all answered as yes or no). At each time point, scores on the five disciplinary actions were summed. Data were available for 437 adolescents.

### Statistical Analyses

All analyses were conducted in Mplus 7.4 (Muthén & Muthén, 2012) using the Weighted Least Squares Means and Variances adjusted estimator (WLSMV) with Delta parameterization to account for categorical symptom ratings and resulting nonnormality. First, three competing SDQ-DP factor models (bifactor, second-order, one-factor; see Figure 1a, 1b, and 1c) were compared in three developmental periods (early childhood, middle childhood, and adolescence) and across three different reporters (parents, teachers, and youth) using CFA. The least restricted model in terms of degrees of freedom is the bifactor model (see Figure 1c), in which the 15 items loaded both onto one of three orthogonal first-order factors (Emotional Symptoms, Conduct Problems, and Hyperactivity-Inattention), as well as on a general factor of Dysregulation. This model was restricted into a second-order model (Figure 1b), in which the 15 items loaded onto one of three first-order factors which in turn loaded onto a second-order Dysregulation factor. The second-order model is statistically indistinguishable from a three-factor correlated model. Finally, the second-order model was restricted into a one-factor model (Figure 1a), in which all items loaded only onto one Dysregulation factor.

Second, measurement invariance (MI) of the best-fitting model across reporter, gender, and developmental period was tested following recommendations of Muthén and Muthén (2012) for testing MI with categorical (ordinal) indicators using the WLSMV estimator and Delta parameterization.

Finally, correlations between the Dysregulation factor scores of the best-fitting model, and scores on the 5-item and 15-item SDQ-DP measures were computed, to examine overlap. Construct and predictive validity was examined with regression analyses in Mplus, controlling for gender, SES, and three dummy-variables for ethnicity (African American vs. White, Hispanic vs. White, Other vs. White).

Model fit was evaluated using three primary and widely used fit indices: the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis index (TLI), at the following thresholds for good fit: RMSEA  $\leq .05$ , and CFI/TLI  $\geq .95$  (Cheung & Rensvold, 2002; Hu & Bentler, 1999). Chi-square is reported, but not interpreted as it is nearly always significant in larger samples and/or complex models (Kline, 2006). Changes in RMSEA ( $\Delta$ RMSEA) and CFI ( $\Delta$ CFI) are used as the main criterion to define invariance as they are much less sensitive to sample size and more sensitive to a lack of invariance than  $\chi^2$ -based tests of MI (Meade, Johnson, & Braddy, 2008). Measurement invariance holds if the changes in fit statistics between Model 1 and 2 are  $\leq .015$  for  $\Delta$ RMSEA  $\leq .01$  for  $\Delta$ CFI (Chen, 2007).

## Results

### Factor Structure

Factor scores for the early childhood models (both parent- and teacher-reported) could not be saved because in each model,  $R^2$  for one item (10, 18, or 25) could not be computed. This warning was checked and in each model the factor loading of the specific item was restricted to the value closest to the original factor loading until the warning disappeared (e.g., for the parent-reported model this meant that the factor loading of item 25, which was .785, was constrained to .70; thus, adding 1 *df*).

Table 1 presents the results for the CFA analyses. Values for CFI and TLI indicated that the bifactor models generally showed a very good fit whereas RMSEA values were acceptable across developmental period and reporters, while the second-order models fit adequately and the one-factor models showed poor fit overall. Chi-square difference testing for WLSMV estimator was used to statistically compare the nested models, with significant values indicating worse model fit of the more restricted model. From these analyses, it can be concluded that the bifactor SDQ-DP models statistically described the data better than the second-order and one-factor models across developmental periods and regardless of informant.

### Factor Loadings

To further evaluate the quality and content of the models, factor loadings for the SDQ-DP bifactor models were inspected. Table 2 presents factor loadings for the bifactor SDQ-DP model at T1 (early childhood), T2 (middle childhood), and T3 (adolescence) using different reporters. Inspection of the standardized factor loadings showed that the DP factor loadings were all positive and statistically significant (all  $p < .001$ ) and moderately high with an

Table 1  
Fit Indices for the One-Factor, Second-Order, and Bifactor SDQ-DP Models in Three Developmental Periods Across Three Different Reporters

| Reporter | Developmental period | Model        | <i>N</i> | $\chi^2$ | <i>df</i> | RMSEA | RMSEA 90% CI | CFI  | TLI  | $\Delta\chi^2$  |
|----------|----------------------|--------------|----------|----------|-----------|-------|--------------|------|------|---|
| Parents  | Early childhood      | Bifactor     | 498      | 231.901  | 76        | .064  | [.055-.074]  | .954 | .937 | 2 vs. 1 (11) = 79.451, $p < .001$<br>3 vs. 2 (3) = 177.426, $p < .001$<br>2 vs. 1 (11) = 55.004, $p < .001$<br>3 vs. 2 (3) = 163.070, $p < .001$<br>2 vs. 1 (11) = .38.286, $p < .001$<br>3 vs. 2 (3) = 63.568, $p < .001$<br>2 vs. 1 (11) = 125.433, $p < .001$<br>3 vs. 2 (3) = 427.096, $p < .001$<br>2 vs. 1 (12) = 196.821, $p < .001$<br>3 vs. 2 (3) = 252.397, $p < .001$<br>2 vs. 1 (12) = 114.941, $p < .001$<br>3 vs. 2 (3) = 149.534, $p < .001$<br>2 vs. 1 (12) = 97.898, $p < .001$<br>3 vs. 2 (3) = 164.440, $p < .001$ |
|          |                      | Second-order | 498      | 315.327  | 87        | .073  | [.064-.081]  | .933 | .919 |   |
|          |                      | One-factor   | 498      | 697.866  | 90        | .116  | [.108-.125]  | .822 | .793 |   |
|          | Middle childhood     | Bifactor     | 446      | 223.789  | 76        | .066  | [.056-.076]  | .953 | .935 |   |
|          |                      | Second-order | 446      | 280.757  | 87        | .071  | [.062-.080]  | .938 | .925 |   |
|          |                      | One-factor   | 446      | 634.314  | 90        | .116  | [.108-.125]  | .826 | .797 |   |
|          | Adolescence          | Bifactor     | 352      | 144.659  | 76        | .051  | [.038-.063]  | .975 | .966 |   |
|          |                      | Second-order | 352      | 182.130  | 87        | .056  | [.044-.067]  | .966 | .959 |   |
|          |                      | One-factor   | 352      | 315.673  | 90        | .084  | [.074-.095]  | .919 | .905 |   |
| Teachers | Early childhood      | Bifactor     | 678      | 327.900  | 76        | .070  | [.062-.078]  | .982 | .975 |   |
|          |                      | Second-order | 678      | 504.522  | 87        | .084  | [.077-.091]  | .969 | .963 |   |
|          |                      | One-factor   | 678      | 1771.837 | 90        | .166  | [.159-.173]  | .877 | .857 |   |
|          | Middle childhood     | Bifactor     | 528      | 277.347  | 75        | .071  | [.063-.081]  | .974 | .964 |   |
|          |                      | Second-order | 528      | 565.903  | 87        | .102  | [.094-.110]  | .939 | .927 |   |
|          |                      | One-factor   | 528      | 1274.537 | 90        | .158  | [.150-.166]  | .850 | .825 |   |
|          | Adolescence          | Bifactor     | 437      | 210.401  | 75        | .064  | [.054-.075]  | .978 | .969 |   |
|          |                      | Second-order | 437      | 353.954  | 87        | .084  | [.075-.093]  | .957 | .948 |   |
|          |                      | One-factor   | 437      | 752.857  | 90        | .130  | [.121-.138]  | .892 | .875 |   |
| Children | Adolescence          | Bifactor     | 505      | 232.328  | 75        | .064  | [.055-.074]  | .944 | .922 |   |
|          |                      | Second-order | 505      | 345.062  | 87        | .077  | [.068-.085]  | .908 | .889 |   |
|          |                      | One-factor   | 505      | 647.086  | 90        | .111  | [.103-.119]  | .801 | .768 |   |

Note. SDQ-DP = Strengths and Difficulties Questionnaire-Dysregulation Profile; RMSEA = root mean square error of approximation; CI = confidence interval; CFI = comparative fit index; TLI = Tucker-Lewis Index. Degrees of freedom can differ because of restriction of factor loadings because of errors (see main text).

average loading of .58. For Emotional Symptoms, all scale-specific loadings were positive and statistically significant ( $p < .001$ ), and moderately high (average = .59). The scale-specific loadings of Conduct Problems and Hyperactivity-Inattention were generally lower than the scales-specific loadings for Emotional Problems, and both scales also had several nonsignificant scale-specific loadings as well as some negative loadings (of which three were statistically significant at  $p < .05$ ).

Within the bifactor model, the five items used to calculate the SDQ-DP 5-item measure (Holtmann, Becker, et al., 2011) had moderate to high DP-loadings averaging .56 across developmental periods and reporters, with averages ranging from .33 (*many worries*) to .76 (*restless, overactive*). However, these items also had fairly high scale-specific loadings (average .53) compared with other items. For example, many worries had an average (across developmental periods and reporters) scale-specific loading of .69 and an average DP-loading of .33, suggesting that this item better describes specific emotional symptoms than general Dysregulation.

Table 3 presents the factor loadings of the one-factor, second-order, and bifactor models in early childhood (parent-report) side by

side, to demonstrate changes in the salience of items from a one-factor model in which all items load on one factor, to grouping the items into specific factors (second-order model) and then adding a general Dysregulation factor (bifactor model). In the second-order model almost all loadings were high and significant, but in the bifactor model, especially the loadings of Conduct Problems and Hyperactivity-Inattention decreased in size. Two of the Hyperactivity-Inattention items (“restless, overactive,” “constantly fidgeting or squirming”) and one Conduct Problems item (“generally obedient,” reverse-coded) now had nonsignificant loadings, while they had moderate to high DP factor loadings, suggesting that these items more directly predict the underlying general factor of Dysregulation.

### Measurement Invariance Across Reporter, Gender, and Developmental Period

A series of measurement invariance analyses were conducted, examining configural versus scalar invariance in line with recommended procedures for testing MI with categorical indicators using WLSMV estimation and Delta parametrization (Muthén & Muthén,

Table 2  
Standardized Factor Loadings for the SDQ-DP Bifactor Models across Three Reporters and Developmental Periods

| Items  | T1 (early childhood) |             |             |             | T2 (middle childhood) |             |             |             | T3 (Adolescence) |             |             |             |             |             |
|--|----------------------|-------------|-------------|-------------|-----------------------|-------------|-------------|-------------|------------------|-------------|-------------|-------------|-------------|-------------|
|  | Parents              |             | Teacher     |             | Parents               |             | Teacher     |             | Parents          |             | Teachers    |             | Youth       |             |
|  | S-FL                 | DP-FL       | S-FL        | DP-FL       | S-FL                  | DP-FL       | S-FL        | DP-FL       | S-FL             | DP-FL       | S-FL        | DP-FL       | S-FL        | DP-FL       |
| <b>Emotional Problems</b>                    |                      |             |             |             |                       |             |             |             |                  |             |             |             |             |             |
| 3. Often complains of headaches              | <b>.524</b>          | <b>.224</b> | <b>.406</b> | <b>.230</b> | <b>.401</b>           | <b>.305</b> | <b>.477</b> | <b>.411</b> | <b>.340</b>      | <b>.520</b> | <b>.482</b> | <b>.467</b> | <b>.414</b> | <b>.333</b> |
| 8. Many worries                              | <b>.652</b>          | <b>.330</b> | <b>.802</b> | <b>.176</b> | <b>.573</b>           | <b>.333</b> | <b>.757</b> | <b>.277</b> | <b>.526</b>      | <b>.544</b> | <b>.768</b> | <b>.301</b> | <b>.726</b> | <b>.330</b> |
| 13. Often unhappy, downhearted               | <b>.581</b>          | <b>.468</b> | <b>.642</b> | <b>.475</b> | <b>.365</b>           | <b>.608</b> | <b>.644</b> | <b>.487</b> | <b>.417</b>      | <b>.594</b> | <b>.604</b> | <b>.455</b> | <b>.666</b> | <b>.490</b> |
| 16. Nervous or clingy in new situations      | <b>.487</b>          | <b>.452</b> | <b>.611</b> | <b>.334</b> | <b>.525</b>           | <b>.443</b> | <b>.745</b> | <b>.435</b> | <b>.345</b>      | <b>.467</b> | <b>.669</b> | <b>.420</b> | <b>.483</b> | <b>.267</b> |
| 24. Many fears                               | <b>.659</b>          | <b>.361</b> | <b>.820</b> | <b>.212</b> | <b>.692</b>           | <b>.310</b> | <b>.813</b> | <b>.269</b> | <b>.527</b>      | <b>.540</b> | <b>.815</b> | <b>.294</b> | <b>.565</b> | <b>.256</b> |
| <b>Conduct Problems</b>                      |                      |             |             |             |                       |             |             |             |                  |             |             |             |             |             |
| 5. Often has temper tantrums or hot tempers  | <b>.429</b>          | <b>.492</b> | <b>.477</b> | <b>.614</b> | .162                  | <b>.726</b> | <b>.514</b> | <b>.627</b> | -.012            | <b>.732</b> | <b>.525</b> | <b>.732</b> | <b>.316</b> | <b>.609</b> |
| 7. Generally obedient (R)                    | .131                 | <b>.554</b> | <b>.373</b> | <b>.798</b> | .103                  | <b>.653</b> | <b>.234</b> | <b>.793</b> | .128             | <b>.674</b> | <u>.200</u> | <b>.833</b> | .096        | <b>.556</b> |
| 12. Often fights with other children         | <b>.520</b>          | <b>.582</b> | <b>.587</b> | <b>.678</b> | <u>.285</u>           | <b>.741</b> | <b>.498</b> | <b>.688</b> | <u>.272</u>      | <b>.775</b> | <b>.606</b> | <b>.737</b> | <b>.664</b> | <b>.488</b> |
| 18. Often lies of cheats                     | <b>.589</b>          | <b>.558</b> | <b>.546</b> | <b>.615</b> | <b>.700</b>           | <b>.643</b> | <b>.654</b> | <b>.628</b> | <b>.618</b>      | <b>.666</b> | .155        | <b>.827</b> | <b>.341</b> | <b>.593</b> |
| 22. Steals from home, school, or elsewhere   | <b>.568</b>          | <b>.510</b> | <b>.684</b> | <b>.527</b> | <b>.534</b>           | <b>.526</b> | <b>.656</b> | <b>.575</b> | <b>.500</b>      | <b>.581</b> | .269        | <b>.628</b> | <b>.412</b> | <b>.521</b> |
| <b>Hyperactivity-Inattention</b>             |                      |             |             |             |                       |             |             |             |                  |             |             |             |             |             |
| 2. Restless, overactive                      | -.109                | <b>.830</b> | <b>.363</b> | <b>.868</b> | <b>.426</b>           | <b>.688</b> | <b>.616</b> | <b>.720</b> | .168             | <b>.801</b> | <b>.707</b> | <b>.708</b> | <b>.490</b> | <b>.685</b> |
| 10. Constantly fidgeting or squirming        | -.116                | <b>.850</b> | <b>.500</b> | <b>.855</b> | <b>.390</b>           | <b>.708</b> | <b>.608</b> | <b>.727</b> | .210             | <b>.758</b> | <b>.580</b> | <b>.669</b> | <b>.477</b> | <b>.591</b> |
| 15. Easily distracted, concentrating wanders | .151                 | <b>.796</b> | .063        | <b>.855</b> | <b>.557</b>           | <b>.566</b> | <u>.214</u> | <b>.826</b> | <b>.374</b>      | <b>.683</b> | <b>.390</b> | <b>.740</b> | <b>.262</b> | <b>.768</b> |
| 21. Thinks things out before acting (R)      | <b>.411</b>          | <b>.512</b> | -.074       | <b>.815</b> | <b>.468</b>           | <b>.373</b> | -.161       | <b>.856</b> | <b>.307</b>      | <b>.596</b> | -.029       | <b>.816</b> | -.489       | <b>.710</b> |
| 25. Sees tasks through to the end (R)        | <b>.700</b>          | <b>.665</b> | -.083       | <b>.864</b> | <b>.658</b>           | <b>.462</b> | .048        | <b>.856</b> | <b>.800</b>      | <b>.581</b> | .091        | <b>.871</b> | -.150       | <b>.598</b> |

Note. SDQ-DP = Strengths and Difficulties Questionnaire-Dysregulation Profile; S-FL = scale-specific factor loadings; DP-FL = factor loadings on the general DP bifactor. Items followed by (R) are reverse-coded. Factor loadings in bold are significant at  $p < .001$  level, underlined at  $p < .01$  level, and italicized at  $p < .05$ .

2012). This procedure consists of testing two models. Model 1 was the least restrictive model that tested for configural invariance, in which factor loadings and thresholds were freely estimated, scale factors were fixed at one, and factor means were fixed at zero. Model 2 was the more restricted scalar invariance model constraining factor loadings (metric invariance) and thresholds (scalar invariance) jointly, and in which scale factors were fixed at one in one group and free in the other, and factor means were fixed at zero in one group and free in the other. Because in bifactor models factor indicators load on more than one factor (specific and general factor), and we set the metric of the factors by fixing factor variances to one, testing the metric model separately was not allowed (see Mplus User Guide version 7 page 486, or version 8 page 544). When needed (because of errors), factor loadings were constrained to values previously identified when testing the factor models. Results for these analyses are reported in Tables s1, s2, and s3 in the online supplemental material. Values of  $\Delta$ RMSEA and  $\Delta$ CFI indicated that measurement invariance across reporter, gender, and developmental period was demonstrated.

### Relations Among SDQ-DP Measures

At each time point and for each reporter, (saved) SDQ-DP bifactor scores were most highly correlated with the SDQ-DP 15-item sum scores (mean  $r = .92$ , range = .90–.96), while they were lower, but still highly correlated with the SDQ-DP 5-item score (mean  $r = .78$ , range = .68–.83). Stability of all measures

was moderate across an 8-year period, and highest for the SDQ-DP bifactor scores ( $r = .57/.38$  for parent- and teacher-report, respectively), followed by the SDQ-DP 15-item measure ( $r = .55/.40$ ) and the SDQ-DP 5-item measure ( $r = .39/.35$ ). Interrater agreement for all measures was moderate and again highest for the DP bifactor scores ( $r = .36$ ), followed by  $r = .35$  for the SDQ-DP 15-item measure and  $r = .25$  for the SDQ-DP 5-item measure. Boys consistently had significantly higher DP scores (regardless of operationalization), except for youth self-report when no significant differences emerged (tables for these analyses can be requested from the first author).

### Construct and Longitudinal Validity

Construct validity results are presented in Table 4. For all SDQ-DP measures, lower ego-resiliency and effortful control similarly predicted higher DP, for both parent- and teacher-reports. In addition, ego-resiliency also predicted lower teacher-reported specific Emotional Symptoms, Conduct Problems and higher Hyperactivity-Inattention, whereas effortful control predicted lower Emotional Symptoms also.

Longitudinal validity was examined by regressing all factors of the T1 bifactor model, 5-item SDQ-DP and 15-item SDQ-DP (in separate models) on disciplinary measures and antisocial behavior measured at T3 (for results see also Table 4). Higher levels of DP predicted more disciplinary measures and antisocial behavior, for

Table 3  
Standardized Factor Loadings for the SDQ-DP One-Factor, Second-Order, and Bifactor Model for Parent-Reports in Early Childhood

| Items  | One-factor model | Second-order model |             | Bifactor model |             |
|--|------------------|--------------------|-------------|----------------|-------------|
|  | DP-FL            | S-FL               | S-O FL      | S-FL           | DP-FL       |
| Emotional Problems                           |                  |                    | <b>.582</b> |                |             |
| 3. Often complains of headaches              | <b>.350</b>      | <b>.505</b>        |             | <b>.524</b>    | <b>.224</b> |
| 8. Many worries                              | <b>.486</b>      | <b>.672</b>        |             | <b>.652</b>    | <b>.330</b> |
| 13. Often unhappy, downhearted               | <b>.599</b>      | <b>.794</b>        |             | <b>.581</b>    | <b>.468</b> |
| 16. Nervous or clingy in new situations      | <b>.547</b>      | <b>.728</b>        |             | <b>.487</b>    | <b>.452</b> |
| 24. Many fears                               | <b>.516</b>      | <b>.709</b>        |             | <b>.659</b>    | <b>.361</b> |
| Conduct Problems                             |                  |                    | <b>.858</b> |                |             |
| 5. Often has temper tantrums or hot tempers  | <b>.548</b>      | <b>.644</b>        |             | <b>.429</b>    | <b>.492</b> |
| 7. Generally obedient (R)                    | <b>.541</b>      | <b>.631</b>        |             | .131           | <b>.554</b> |
| 12. Often fights with other children         | <b>.661</b>      | <b>.769</b>        |             | <b>.520</b>    | <b>.582</b> |
| 18. Often lies of cheats                     | <b>.650</b>      | <b>.756</b>        |             | <b>.589</b>    | <b>.558</b> |
| 22. Steals from home, school, or elsewhere   | <b>.628</b>      | <b>.716</b>        |             | <b>.568</b>    | <b>.510</b> |
| Hyperactivity                                |                  |                    |             |                |             |
| 2. Restless, overactive                      | <b>.778</b>      | <b>.822</b>        | <b>.844</b> | -.109          | <b>.830</b> |
| 10. Constantly fidgeting or squirming        | <b>.800</b>      | <b>.833</b>        |             | -.116          | <b>.850</b> |
| 15. Easily distracted, concentrating wanders | <b>.790</b>      | <b>.823</b>        |             | .151           | <b>.796</b> |
| 21. Thinks things out before acting (R)      | <b>.537</b>      | <b>.588</b>        |             | <b>.411</b>    | <b>.512</b> |
| 25. Sees tasks through to the end (R)        | <b>.679</b>      | <b>.732</b>        |             | <b>.700</b>    | <b>.665</b> |

Note. SDQ-DP = Strengths and Difficulties Questionnaire-Dysregulation Profile; S-FL = scale-specific factor loadings; DP-FL = factor loadings on the general DP bifactor. Items followed by (R) are reverse-coded. Factor loadings in bold are significant at  $p < .001$  level, and italicized at  $p < .05$ .

all operationalizations of the DP and for both parent- and teacher-reports. For the bifactor model, significant associations between the specific factors and the outcomes emerged. For parent-reports, lower Emotional Symptoms predicted higher antisocial behavior, and higher Conduct Problems predicted both antisocial behavior and disciplinary measures. For teacher-reports, lower Emotional Symptoms and Hyperactivity-Inattention predicted lower antisocial behavior, whereas Conduct Problems predicted higher disciplinary measures.

## Discussion

The objective of this study was to evaluate the SDQ-DP, measuring a broad syndrome of child and adolescent difficulties in regulating affect, behavior and cognition that can reflect overall psychopathology severity and functional impairment (Holtmann,

Buchmann, et al., 2011). Specifically, we examined the factor structure, reliability, measurement invariance, and construct and predictive validity of the SDQ-DP. We compared the best-fitting factor model with the previously developed 5 and 15-item SDQ-DP measures (Holtmann, Becker, et al., 2011; Winsper & Wolke, 2014) to recommend when to use which operationaliza-

The results of this study replicate findings of previous studies on the CBCL-DP (Deutz et al., 2016; Geeraerts et al., 2015), by demonstrating that a bifactor model described the SDQ-DP better than a one-factor or second-order model. This bifactor SDQ-DP model suggests that the DP reflects a broad syndrome of dysregulation that exists in addition to specific syndromes of emotional symptoms, conduct problems, and hyperactivity-inattention. Importantly the bifactor model best described the data across three different

Table 4  
Regression Coefficients for Construct Validity Analyses

| Validity analyses     | Parent-reports |              |                   |              |             |       | Teacher-reports |              |                   |              |              |              |  |
|-----------------------|----------------|--------------|-------------------|--------------|-------------|-------|-----------------|--------------|-------------------|--------------|--------------|--------------|--|
|                       | 5-item DP      | 15-item DP   | DP bifactor model |              |             |       | 5-item DP       | 15-item DP   | DP bifactor model |              |              |              |  |
|                       |                |              | DP                | ES           | CP          | H-I   |                 |              | DP                | ES           | CP           | H-I          |  |
| Construct validity    |                |              |                   |              |             |       |                 |              |                   |              |              |              |  |
| Ego-resiliency        | <b>-.309</b>   | <b>-.368</b> | <b>-.366</b>      | -.032        | -.084       | -.099 | <b>-.541</b>    | <b>-.624</b> | <b>-.553</b>      | <b>-.418</b> | <b>-.200</b> | <b>.251</b>  |  |
| Effortful control     | <b>-.164</b>   | <b>-.125</b> | <b>-.132</b>      | -.043        | -.095       | .068  | <b>-.103</b>    | <b>-.125</b> | <b>-.106</b>      | <b>-.107</b> | -.056        | .038         |  |
| Longitudinal validity |                |              |                   |              |             |       |                 |              |                   |              |              |              |  |
| Disciplinary measures | <b>.231</b>    | <b>.274</b>  | <b>.332</b>       | -.152        | <i>.231</i> | -.137 | <b>.231</b>     | <b>.286</b>  | <b>.273</b>       | -.095        | <b>.270</b>  | .009         |  |
| Antisocial behavior   | <b>.249</b>    | <b>.260</b>  | <b>.286</b>       | <i>-.151</i> | <b>.228</b> | -.045 | <b>.138</b>     | <b>.144</b>  | <b>.262</b>       | <b>-.177</b> | -.004        | <b>-.169</b> |  |

Note. ES = Emotional Symptoms; CP = Conduct Problems; H-I = Hyperactivity-Inattention. Five-item DP is the SDQ-DP 5-item measure, 15-item DP is a summed score of the items from the ES, CP, and H-I scales. Estimates (STDYX standardized  $\beta$ 's) in bold are significant at  $p < .001$  level, underlined at  $p < .01$  level, and italicized at  $p < .05$ .



developmental periods (early childhood, middle childhood, and adolescence) and across different reporters (parents, teachers, and youth). Measurement invariance across reporters, gender and developmental period was also demonstrated, showing that the DP bifactor model is constructed similarly regardless of reporter, gender, or developmental period, adding to the generalizability of the findings.

### Factor Loadings of the SDQ-DP Bifactor Models

Examination of the factor loadings gives further insight into the meaning of the underlying general Dysregulation factor. Symptoms of hyperactivity and inattention (e.g., “restless, overactive,” “constantly fidgeting or squirming”) seemed to contribute most directly to the underlying factor, while in research on CBCL-DP items concerning mood dysregulation (e.g., “Stubborn, sullen, or irritable,” “Sudden changes in mood or feelings”) seem to describe dysregulation most directly (Geeraerts et al., 2015). The brevity of the SDQ might explain these differences, as the SDQ includes only five key symptoms for emotional, conduct, and attention problems each, while symptoms of mood dysregulation and irritability are considered to be transdiagnostic (e.g., Kring, 2008). The only item directly describing emotional lability in the SDQ is the item “Often has temper tantrums or hot tempers,” which loaded fairly high on the Dysregulation bifactor. One might also wonder whether symptoms of hyperactivity and inattention truly form a unique factor. However, research has shown that ADHD is under unique genetic influence (Dick, Viken, Kaprio, Pulkkinen, & Rose, 2005), and post hoc analyses we conducted showed that models in which items of Hyperactivity-Inattention did not load on a specific factor but rather only directly on the Dysregulation factor, did not fit better. Furthermore, symptoms of hyperactivity and inattention have been previously found to strongly contribute to DP, next to symptoms of mood lability (Althoff, Ayer, et al., 2010a; Geeraerts et al., 2015), showing that the DP reflects not only affective dysregulation, but also behavioral and cognitive dysregulation.

The SDQ-DP bifactor scores were most strongly related with SDQ-DP 15-item scores, and less strong, but still highly related with scores on the most often used SDQ-DP 5-item measure (Holtmann, Becker, et al., 2011), regardless of reporter and developmental period. Stability and interrater agreement were moderate and highest for the SDQ-DP bifactor scores and lowest for the SDQ-DP 5-item scores. Furthermore, reliability of the SDQ-DP 5-item measure was low in our and previous studies (Holtmann, Becker, et al., 2011). Inspection of factor loadings showed that the five items that make up the SDQ-DP 5-item measure did not necessarily load very highly on the Dysregulation bifactor and/or contribute most directly to the Dysregulation bifactor (as would be indicated by low scale-specific factor loadings), further questioning the validity of the SDQ-DP 5-item measure.

### Construct and Longitudinal Predictive Validity

The SDQ-DP was concurrently associated with lower ego-resiliency and lower effortful control, for both teacher- and parent-reports and regardless of operationalization of the SDQ-DP. This evidence for construct validity was rather robust because the self-regulation measures were quite distinct. Effortful control was assessed with behavioral tasks tapping into more cognitive aspects of self-regulation, primarily slowing down motor control. Ego-

resiliency was teacher-reported and tapping into emotional self-regulation with items such as “Rapid mood shifts, emotionally labile.” The DP furthermore predicted more disciplinary measures and antisocial behavior 7 years later, behaviors of which dimensions of emotion and self-regulation are thought to be disrupted (Hyde, Shaw, & Hariri, 2013), demonstrating longitudinal validity (again for both parent- and teacher-report and for all operationalizations of the DP). This study is one of the few so far providing empirical evidence for the notion that the DP is indeed related to self- and emotion regulation difficulties. Concurrent construct and longitudinal predictive validity of the SDQ-DP bifactor, 5-item and 15-item measures was generally comparable across operationalizations, but associations between the specific factors and correlates were controlled for in the bifactor model, possibly attenuating the strength of these associations. In addition, significant associations between the specific factors of the SDQ-DP bifactor model and the external correlates emerged, with especially the specific Conduct Problems factor predicting additional variance in the longitudinal outcomes. Unexpectedly, ego-resiliency positively predicted specific Hyperactivity-Inattention, which could be the result of cross-over suppression (Paulhus, Robins, Trzesniewski, & Tracy, 2004). In the early childhood teacher-reported SDQ-DP bifactor model, items representing symptoms of Hyperactivity-Inattention contributed most directly to dysregulation, with several scale-specific factor loadings being nonsignificant. Thus, while ego-resiliency and hyperactivity-inattention are generally negatively related (e.g., Martel & Nigg, 2006), after accounting for general Dysregulation, specific Hyperactivity-Inattention (for T1 teacher-report primarily defined by being restless and fidgety), might no longer be positively related with ego-resiliency.

### Implications and Conclusions

A bifactor model best described the SDQ-DP, conceptualizing the DP as broad syndrome of dysregulation that exists next to specific problems of emotional symptoms, conduct problems and hyperactivity-inattention. This research adds to the growing notion that different types of emotional and behavioral problems can be (largely) explained by one underlying factor of dysregulation (or general psychopathology, see, e.g., Caspi et al., 2014; Patalay et al., 2015). This is consistent with recent findings showing that different psychiatric conditions partly share the same genetic origin (Pettersson, Larsson, & Lichtenstein, 2016). Given increasing consensus on the presence of a general factor of dysregulation/psychopathology already at an early age (e.g., Geeraerts et al., 2015; Olin, Dougherty, Bufferd, Carlson, & Klein, 2014), the availability of the SDQ as a short and freely available well-validated measure of core symptoms of psychopathology, including those that are central to the CBCL-DP, across developmental age-groups is highly important, for both research and clinical purposes.

The consistency of our results with previous work on the CBCL-DP furthermore shows that the DP is constructed similarly regardless of which questionnaire is used to measure behavioral and emotional symptoms. This suggests that the DP is indeed a unique phenotype that can probably be established with any broad behavioral screening measure. Future research could examine whether Severe Mood Dysregulation (SMD) and the Disruptive Mood Dysregulation Disorder (DMDD), aimed at capturing patterns

of severe dysregulation as expressed in symptoms such as hyperarousal, mood instability, temper outbursts, and chronic irritability (Althoff, 2010; Leibenluft, 2011; Zepf & Holtmann, 2012), represent the extreme end of the dimensional spectrum of the DP, as the DP is thought to capture symptoms broadly overlapping with these clinical presentations (Dougherty et al., 2014; Legenbauer et al., 2016; Zepf & Holtmann, 2012).

While the three different SDQ-DP operationalizations were more alike than different, the bifactor SDQ-DP scores were consistently best in terms of stability, reliability, and validity, while the 5-item measure persistently performed poorest. Use of all 15 items representing Emotional Symptoms, Conduct Problems, and Hyperactivity-Inattention within a bifactor model, or using summed scores (Winsper & Wolke, 2014) is recommended as this might result in a more reliable and stable assessment of the DP. When possible in sufficiently large samples, we advise using bifactor modeling. Bifactor models are highly useful in psychopathology research (Snyder & Hankin, 2017), as etiology factors and outcomes can be examined in a more refined way. The SDQ-DP 5-item measure might, however, be a simple and efficient screening measure of dysregulation in practice, which could aid in early identification of children at risk for serious psychopathology, after which a more in-depth clinical assessment can be done. Also, the SDQ-DP 5-item measure could be used as an identifier in clinical populations (e.g., children with ADHD) to identify children at greater risk for difficulties with treatment adherence and recovery (Caro-Cañizares et al., 2017). It would be useful to examine whether a shorter set of CBCL-items could similarly be developed and used as a screening measure of dysregulation.

### Limitations and Future Directions

Strengths of this study include the systematic approach adopted to evaluating the SDQ-DP by examining competing factor models across different developmental periods and different reporters in a longitudinal sample, as well as testing statistically whether the best-fitting model was equivalent across gender, reporters, and developmental period by examining measurement invariance. These factors strengthen the generalizability of the results. However, several limitations must also be noted. First, no direct comparison was possible with the CBCL-DP as the CBCL was not assessed in the study from which the data were derived. However, previous research showed high overlap between the CBCL-DP and SDQ-DP (albeit not operationalized within a bifactor model), and good correspondence between the CBCL and SDQ generally (Goodman & Scott, 1999; Stone et al., 2010). For determination of the DP specifically it might, however, be relevant to examine the impact of the presence of items describing more transdiagnostic emotional regulatory problems (e.g., “Stubborn, sullen, or irritable”), that are known to strongly contribute to the DP (e.g., Geeraerts et al., 2015) in the CBCL. A systematic comparison of the CBCL-DP and the SDQ-DP in the same dataset would be useful.

Second, although we validated the SDQ-DP with measures of self-regulation and antisocial outcomes, future research should also validate the SDQ-DP bifactor model using clinical diagnostic measures of psychopathology such as in-depth diagnostic interviews. Such research is needed to determine the usefulness of the SDQ-DP bifactor model in clinical research and to further validate the specific factors. Third, children in the study were selected

based on their below-median performance on literacy. In that sense, this was not a true community study, which likely explains that the prevalence rate of children exceeding the recommended clinical threshold of the SDQ-DP 5-item measure was around 10%, which is higher than previously reported numbers of 2.6% for SDQ-DP (Holtmann, Becker, et al., 2011), and around 1% for CBCL-DP (Holtmann et al., 2007; Hudziak, Althoff, Derks, Faraone, & Boomsma, 2005). Children scoring below the median of a statewide literacy measure, however, do still form a large portion of the children in schools, but nonetheless, replication of our findings in large epidemiological samples as well as clinical samples is desirable.

The DP might have its roots in infant and toddler regulatory problems as expressed in sleeping and feeding problems and excessive crying (Winsper & Wolke, 2014). Future research could examine these early predictors of dysregulation to prevent maladaptive pathways resulting in dysregulation and eventually psychopathology. Given that the SDQ is brief and can be filled out in about five minutes, this measure has great potential to determine a DP.

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