

Children's Health Care

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/hchc20

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To cite this article: Ayhan Bilgiç, Necati Uzun, Ümit Işık, Sadettin Burak Açıkel, Fatma Çoşkun & Ömer Faruk Akça (2021): The relationships of parent- and child-related psychiatric conditions with oppositional defiant disorder and conduct disorder symptoms in children with ADHD, Children's Health Care, DOI: 10.1080/02739615.2021.1894938

To link to this article: https://doi.org/10.1080/02739615.2021.1894938

Published online: 01 Apr 2021.

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CHILDREN'S HEALTH CARE
https://doi.org/10.1080/02739615.2021.1894938

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The relationships of parent- and child-related psychiatric conditions with oppositional defiant disorder and conduct disorder symptoms in children with ADHD

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ABSTRACT

This cross-sectional study evaluated the impacts of maternal and paternal affective temperament traits, maternal and paternal ADHD, depression and anxiety symptoms, parenting styles, child's depression and anxiety disorder symptoms, and child's autistic traits on the oppositional defiant disorder (ODD) and conduct disorder (CD) symptoms of children with attention-deficit/hyperactivity disorder (ADHD). Analysis showed a positive relation of maternal anxious and irritable temperament and child inattention, hyperactivity–impulsivity and obsessive-compulsive disorder (OCD) scores on ODD scores. However, there was a negative relationship between parental acceptance/involvement and ODD scores. Regarding CD scores, maternal irritable and paternal cyclothymic and hyperthymic temperament scores and child ODD and autistic trait scores showed a positive relationship, whereas maternal ADHD showed a negative relationship on CD scores. Certain parental affective temperaments, parenting styles, child's OCD and autistic traits, and maternal ADHD may be important for the severity of disruptive behavioral disorder symptoms in children with ADHD.

KEYWORDS

Parents; temperament; parenting; conduct disorder; oppositional defiant disorder

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a prevalent neurodevelopmental disorder characterized by symptoms of hyperactivity, impulsivity and inattention that lead to impairment in social and academic functioning in children. ADHD is highly comorbid with disruptive behavior disorders (DBD) such as oppositional defiant disorder (ODD) and conduct disorder (CD) (Bauermeister et al., 2007). While ODD refers to a pervasive pattern of angry/irritable, defiant, and hostile behaviors toward others and conflict with authority figures that leads to functional impairment, CD is defined as

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behaviors that violate the rights of others or societal rules (Connor, Steeber, & McBurnett, 2010). Both ODD and CD are chronic conditions that cause significant difficulties for patients, their families and society (Connor et al., 2010). Indeed, the presence of coexisting ODD or CD substantially increases the risk for negative outcomes of ADHD, including crime and substance abuse (Connor et al., 2010). Therefore, a deeper understanding of the underlying developmental processes in each of the DBD is crucial for children with ADHD.

A variety of familial and environmental factors have been related to the occurrence of DBD in children with ADHD. Studies have led to an increased recognition of the significance of the link among parental psychopathology, parenting styles, life stress and DBD symptoms in childhood (Breaux & Harvey, 2019). Prospective studies that addressed the long-term behavioral outcome of maternal psychopathology observed the predictive effect of maternal depression and anxiety on the development of antisocial behavior in their offspring (Chronis et al., 2007; Ettekal, Eiden, Nickerson, Molnar, & Schuetze, 2020; Hay, Pawlby, Waters, Perra, & Sharp, 2010; Loomans et al., 2011). An association between paternal psychiatric disorders such as depression and anxiety disorders and child behavioral problems was also reported (Dave, Sherr, Senior, & Nazareth, 2008; Herbert, Harvey, Lugo-Candelas, & Breaux, 2013). Research showed that parents having other psychiatric problems such as ADHD, antisocial behavior and alcoholism is also related to a significantly higher risk for behavioral problems in their offspring (Eiden, Colder, Edwards, & Leonard, 2009; Goulter, McMahon, Pasalich, & Dodge, 2019).

Though many studies reported the negative outcomes of parental psychiatric disorders on child behavioral symptoms (Chronis et al., 2007; Dave et al., 2008; Eiden et al., 2009; Ettekal et al., 2020; Goulter et al., 2019; Hay et al., 2010; Herbert et al., 2013; Loomans et al., 2011), the majority of psychiatric disorders generally impact only certain parts of parents' life spans and they usually do not have a stable influence on children's mental health during the entire childhood. As distinct from the majority of axis-I psychiatric disorders, temperament traits are defined as innate individual differences in the reactivity to environmental and internal stimuli and the mood of a person, which remain relatively stable over the lifespan (Atzaba-Poria, Deater-Deckard, & Bell, 2014). Therefore, to show the effect of a parental psychiatric status on behavioral problems, an investigation into the relationship between parental temperament features and DBD may be helpful (Atzaba-Poria et al., 2014; Bilgic et al., 2018).

Affective temperament is one of the most useful temperament models and is characterized by five main affective dimensions: depressive, anxious, irritable, cyclothymic and hyperthymic (Akiskal et al., 2005a). Its dimensions lie on a continuum from normality to pathology, and they can frequently serve as markers of vulnerability for mood and anxiety disorders. Depressive

temperament is related to depressive mood and low level of energy. Anxious affective temperament is regarded to reflect increased tendencies to worry. Irritable temperament seems to be less consistent compared to others and related to a tendency to being aggressive and litigious. Cyclothymic temperament is an inherent disposition of affective dysregulation and emotional overactivity, and it involves change from periods of abundant energy and self-confidence to periods of self-doubt and lack of energy, Hyperthymic temperament includes being overoptimistic, overtalkative, grandiose, self-assured, uninhibited and people-seeking (Akiskal, Akiskal, Haykal, Manning, & Connor, 2005b). To our knowledge, only our previous study has examined the link between parental temperament and child behavioral problems and showed associations between paternal cyclothymic and maternal irritable temperaments and the child's ODD symptoms, and maternal depressive temperament and the child's CD symptoms (Bilgic et al., 2018). However, this study did not take into account the effects of potential confounding factors such as paternal depression and anxiety, child psychiatric status and parenting styles.

Because parents are fundamental to raising a child, there has been considerable interest in parenting styles to explain the development of DBD in ADHD subjects. A large body of studies has detected that families of children with ADHD experience more difficulties in parenting and there is a closer link between parenting styles and coexisting behavioral problems in these children (Breaux & Harvey, 2019; Chronis et al., 2007; El Nokali, Bachman, & Votruba-Drzal, 2010; Mezulis, Hyde, & Clark, 2004). Though the link between parenting and a child's behavioral problems has not been fully understood, research has long showed a reciprocal association between the two (Breaux & Harvey, 2019). Some studies provide evidence for the causal influences of child ADHD and DBD on later parenting (Breaux & Harvey, 2019; Keown, 2012; Wymbs, Wymbs, & Dawson, 2015). Accordingly, children exhibiting behavioral problems impair the parenting styles of their parents. There is also some longitudinal evidence for the effects of earlier criticism/rejection, control, intrusiveness, warmth/sensitivity, inconsistent discipline, and the involvement of parents on children's ADHD and DBD symptoms (Breaux & Harvey, 2019; Mezulis et al., 2004). However, research that has detected support for child or parent effects did not generally test the potential effects of comorbid child or parent psychiatric problems (Breaux & Harvey, 2019; Wymbs et al., 2015).

Besides ODD and CD, the prevalence of comorbid internalizing disorders such as depression and anxiety disorders is also high in children with ADHD (Bauermeister et al., 2007; Mick, Biederman, Santangelo, & Wypij, 2003). A handful of studies have proposed that the presence of depression, anxiety disorders, or obsessive-compulsive disorder (OCD) is a risk factor for the development of behavioral problems (Bubier & Drabick, 2009; Cerda, Tracy, Sanchez, & Galea, 2011; Coskun, Zoroglu, & Ozturk, 2012). Alternatively,

other studies have shown that children with DBD are at increased risk for subsequent depression, anxiety disorders, and OCD in the future (Bloch et al., 2009; Frick, Lilienfeld, Ellis, Loney, & Silverthorn, 1999; Stringaris, Lewis, & Maughan, 2014). Research suggests that these apparently disparate disorders may share common underlying etiopathogenesis such as problems in emotion regulation, information processing or parenting practices (Fraire & Ollendick, 2013). Alternatively, a vicious circle among externalizing and internalizing disorders can exist in ADHD subjects (Bilgic et al., 2013). Therefore, when investigating the association between parental psychiatric variables and child DBD symptoms, taking into account the coexisting internalizing symptoms of children could be crucial.

The present cross-sectional study aimed to evaluate the relationships among parental affective temperament traits, parental psychiatric problems, child-related psychiatric conditions and DBD symptoms in children with ADHD with using a sequential process model. According to the hypothesized model, parental affective temperament traits, parental ADHD, child ADHD and autistic traits would affect parenting styles and parental depression and anxiety, which would affect the depression, anxiety and OCD severities of the children that would influence ODD and CD symptoms in the children (Figure 1). In addition, socioeconomic factors such as family income and parental educational levels, ages and sexes were taken into account because of their possible influence on behavioral problems in these children. The hypotheses of this study as follows: i) while depression and anxiety disorders generally impact only certain parts of life spans,

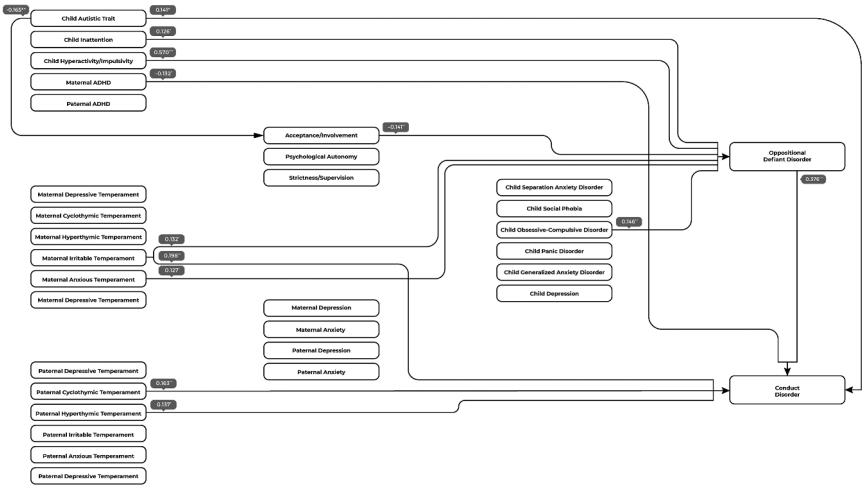


Figure 1. The relationships between affective temperament, ADHD, depression and anxiety scores of parents, parenting style scores, ADHD, depression, anxiety, OCD and autistic trait scores of children and child ODD and CD scores in children with ADHD. The model only showed the significant regression relationships on ODD or CD symptoms of children with ADHD.

compared to parental depression and anxiety symptoms, parental affective temperament traits and ADHD symptoms would have more pronounced enhancing effects on child's DBD symptoms via directly or causing impairments on parental mental health, parenting styles or child's internalizing symptoms, ii) besides child ADHD symptoms, child autistic traits would also show an increasing effect on child DBD symptoms via directly or affecting parental mental health, parenting styles or child's internalizing symptoms, iii) parenting styles and parental depression and anxiety symptoms would have enhancing effects on child's DBD symptoms via directly or increasing child's internalizing symptoms and iv) child internalizing symptoms would have increasing effects on child's DBD symptoms in children with ADHD.

Materials and methods

Participants

All consecutive referrals for ADHD to child and adolescent psychiatry outpatient clinics at four distinct regional centers in Turkey were enrolled in this study. All participants were Caucasian, six to 18 years of age, and living with both of their biological parents. Exclusion criteria included the diagnosis of a major physical or neurological illness, schizophrenia, bipolar disorder, autism spectrum disorder, intellectual disability and/or substance abuse/dependence. Patients were also excluded if their parents had an educational level of less than 5 years. Children who had a history of taking psychiatric medications were also excluded.

Measures/instrumentation

Kiddie schedule for affective disorders and schizophrenia-present and lifetime version (K-SADS-PL)

The K-SADS-PL is a semi-structured diagnostic interview tool that inquires about current and past episodes of child and adolescent psychiatric disorders (Kaufman et al., 1997). The Turkish version of the K-SADS-PL was reported to have a good test-retest and inter-rater reliability (Unal et al., 2019). For the current study, the ADHD module of the K-SADS-PL was used to make the ADHD diagnoses.

Turgay DSM-IV-based child and adolescent behavioral disorders screening and rating scale (T-DSM-IV-S)

The T-DSM-IV-S was developed by Turgay and evaluates the severity of inattention, hyperactivity-impulsivity, oppositional-defiant disorder and conduct disorder symptoms based on the DSM-IV diagnostic criteria (Turgay,

1994). The scale was completed by parents. It was adapted for the Turkish population (Ercan, Amado, Somer, & Cıkoglu, 2001).

Revised child anxiety and depression scales – child version (RCADS-CV)

The RCADS is a self-report questionnaire consists of 47 items developed to measure DSM-IV based symptoms of anxiety disorders and depression in children (Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000). The subscales correspond to separation anxiety disorder, social phobia, generalized anxiety disorder, panic disorder, OCD and major depressive disorder. The validity and reliability of RCADS-CV for Turkish children have been shown by Gormez et al. (2017).

Social reciprocity scale (SRS)

The SRS is designed to evaluate autism trait severity (Constantino, Przybeck, Friesen, & Todd, 2000). Factor analysis supported a unidimensional measure for Turkish children (Ayaz, Ayaz, & Yazgan, 2013). In the current study, the scale was fulfilled by parents.

Temperament evaluation of memphis, Pisa, Paris, San Diego autoquestionnaire (TEMPS-A)

The TEMPS-A was originally developed by Akiskal et al. (2005b) to assess dimensions of affective temperament. It covers five temperament dimensions: depressive, cyclothymic, hyperthymic, irritable, and anxious temperaments. The validity and reliability of TEMPS-A for Turkish speakers have been proven by Vahip et al. (2005).

Beck depression inventory (BDI)

The BDI is a self-report scale that was developed by Beck to determine the severity of depression symptoms in adults (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The reliability and validity of the BDI were reported by Hisli (1989).

Beck anxiety scale (BAS)

The BAS is a self-report scale developed by Beck to measure the severity of anxiety symptoms in adults (Beck, Epstein, Brown, & Steer, 1988). The reliability and validity of the BAS for Turkish populations were reported by Ulusoy, Şahin, and Erkmen (1998).

The adult ADHD self-report scale (ASRS)

The ASRS is a self-report inventory that consists of inattention and hyperactivity subscales (Adler et al., 2006). The reliability and validity of the ASRS for Turkish populations has been proven (Dogan, Oncu, Varol-Saracoglu, & Kucukgoncu, 2009). Mothers and fathers each completed the ASRS to assess the severity of their current ADHD symptoms.

Parenting style scale (PSS)

It comprises three subscales: acceptance/involvement, strictness-supervision, and psychological autonomy (Lamborn, Mounts, Steinberg, & Dornbusch, 1991). The factor analysis showed that factor pattern of PSS is similar to the original scale for the Turkish elementary and high school subjects (Yılmaz, 2000).

Sociodemographic variables

The family income status of respondents was measured by monthly family income and divided into six categories: (1) ≤ 1600 Turkish Lira (TL), (2) 1600–2499 TL, (3) 2500–3999 TL, (4) 4000–5999 TL, (5) 6000–10000 TL and (6) ≥10,000 TL. Maternal and paternal educational levels were categorized as primary school, secondary school, high school, two-year vocational high school, undergraduate, graduate and doctorate.

Procedures

Ethical approval for the study was obtained from the local ethical committee. Parents of children who agreed to participate in the study gave informed written consent. Verbal consent was also given by all the children and their parents. All the study procedures were in accordance with the Declaration of Helsinki and local laws and regulations. At the first step, both the target child and a parent were interviewed by a child and adolescent psychiatrist using the K-SADS-PL, and ADHD diagnoses were made according to the DSM-5 criteria. At the second step, the T-DSM-IV-S was completed by the parents of the children, and both fathers and mothers were requested to fill out the TEMPS-A, BDI, BAS, and ASRS scales. On all the questionnaires, a higher score indicated greater symptomatology. Information on the demographics of the family was also obtained.

Statistical analysis

The analysis of the data was performed using SPSS 22.0-AMOS statistical software (SPSS, Inc., Chicago, IL, USA). Zero-order bivariate Pearson or Spearman correlation coefficients were calculated to examine the relationship between the psychiatric test scores. Structural equation modeling (SEM) was further conducted to determine the relationship between psychiatric test scores. To evaluate the goodness of fit of a model, the relative/normed chi-square ($\chi 2/df$), the root mean square error of approximation (RMSEA) statistic, the comparative fit index (CFI), and Tucker Lewis Indexes (TLI) were used (Hu & Bentler, 1999; Tabachnick & Fidell, 2007). Although there is no consensus regarding an acceptable ratio for the $\chi 2/df$, authors typically recommend that it be under 2.0. For RMSEA, the lower limit is close to 0, and the

upper limit should be less than 0.08 for a well-designed model. For CFI and TLI, a cutoff criterion of ≥0.95 has been recommended. An acceptable model would fulfill all these parameters (Hu & Bentler, 1999; Tabachnick & Fidell, 2007). Estimates of the path coefficient in SEM analyses reflect the strength of the path between predictor and outcome variables and were calculated by standardized regression coefficients (i.e., β value). The significance was set at a level of 0.05 (two-tailed) in this analysis.

Results

A total of 246 children and their parents were approached, but 15 of the parents refused to participate, and only 231 provided written consent. Twenty-six participants were excluded based on the exclusion criteria. Thus, the sample consisted of 205 children who satisfied the DSM-5 symptom and impairment criteria for ADHD. The mean age of the children was 11.0 ± 2.5 years (range = 7–18 years); the sample consisted of 152 (74.1%) boys and 53 (25.9%) girls. The mean age of the mothers and fathers in the sample was 36.8 ± 6.4 years (range = 24–58 years) and 40.5 ± 7.5 years (range = 30–66 years). The median mothers' and fathers' educational levels were high school graduate. The median family monthly income was between 2500 and 3999 TL. Means, standard deviations, and zero-order correlations for the psychological test scores are given in Table 1.

The association between socioeconomic variables, parental affective temperament, ADHD, depression and anxiety scores, parenting style scores, child ADHD, depression, anxiety, OCD, and autistic trait scores and child ODD and CD scores were examined in a structural equation model. The model fit the data satisfactorily (p = .001, $\chi 2/df$ = 1.217, RMSEA = .033, TLI = .952 and CFI = .960). The relationships between variables that showed statistically significant effects on ODD or CD are presented in Figure 1. This model showed a positive relation of child inattention (β = .13, p = .021), hyperactivity–impulsivity (β = .57, p < .001) and OCD (β = .15, p = .004) scores, and maternal anxious (β = .13, p = .019) and irritable (β = .13, p = .016) temperament scores on ODD scores, and a negative relation of PSS acceptance/involvement (β = −.14, p = .005) scores on ODD scores. Child autistic traits did not have a direct association with ODD scores but had a negative effect on PSS acceptance/involvement scores (β = −.17, p = .008). Regarding CD scores, child ODD (β = .38, p < .001) and autistic trait scores (β = .14, p = .022), maternal irritable temperament (β = .13, p = .016) and paternal cyclothymic (β = .16, p = .006) and hyperthymic (β = .14, p = .023) temperament scores showed a positive relation, whereas maternal ADHD (β = −.13, p = .030) showed a negative relation on CD scores. All regression relationships between study variables are given in Table 2.

Table 1. Intercorrelations among psychiatric variables.

		Mean ± SD	Range	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
(1)	Parent T-DSM-IV-S Inattention	14.±6.1	2–27	.41***	.42***	.30***	.14*	.13	−.01	.15*	.21**	.05	.12	−.04	.07	.12	.10	.06	.18*	−.01	.13	.12	−.08	.02	−.15*	.36***	.15*	.05	.13	.26***	.10	.22**
(1)	Parent T-DSM-IV-S HI	14.5 ± 7.5	0–53		.65***	.36***	.05	.17*	−.01	.26***	.20**	−.02	−.03	−08	.05	−.02	.01	.12	.21**	.03	−.01	−.03	.01	−.08	−.06	.45***	.05	−.13	.03	.16*	−.02	.08
(1)	Parent T-DSM-IV-S ODD	11.1 ± 5.7	0–24			.49***	.14*	.26***	−.03	.34***	.34***	.01	.06	.01	.11	.07	.16*	.24**	.28***	.10	.01	.05	−.18*	.02	−.17*	.37***	.16*	.06	.20**	.25***	.15*	.27***
(1)	Parent T-DSM-IV-S CD	3.4 ± 6.0	0–41				.19**	.16*	.01	.35***	.22**	.10	.21**	.12	.12	.05	.05	.15*	.07	.08	.02	−.01	.15*	.08	−.09	.33***	.12	.05	.15*	.19**	.09	.22**
(1)	Maternal TEMPS-A Depressive	6.6 ± 3.9	6–19					.55***	−.02	.35***	.24***	.09	.14*	.05	.04	.06	.26***	.53***	.21**	.10	.10	.08	−.13	.18**	−.11	.19**	.18*	.16*	.19**	.14*	.19**	.24**
(1)	Maternal TEMPS-A Cyclothymic	7.8 ± 4.8	0–27						.15*	.47***	.32***	.12	.20**	.13	.11	.16*	.38***	.54***	.39***	.05	.20**	.12	−.09	.19**	−.07	.25**	.20	.24**	.26***	.19**	.31***	.29***
(1)	Maternal TEMPS-A Hyperthymic	8.8 ± 4.4	0–20							.12	−.05	.03	.05	.14*	−.09	.06	.12	−.12	−.07	−.03	−.07	.09	.09	.06	.17*	−.08	.12	−.02	.07	−.01	.08	−.03
(1)	Maternal TEMPS-A Irritable	4.0 ± 3.6	0–16								.41***	−.03	.11	.01	.07	.12	.23**	.33***	.27***	.14*	.03	−.02	−.12	−.02	.02	.29***	.06	−.01	−.05	.05	.03	.13
(1)	Maternal TEMPS-A Anxious	8.3 ± 6.3	0–24									.03	.09	−.15*	.06	.12	.21**	.27***	.63***	.15*	.04	−.01	−.10	−.05	−.02	.20**	.16*	.11	.15*	.22**	.12	.24**
(1)	Paternal TEMPS-A Depressive	7.3 ± 7.5	0–38										.56***	.01	.37***	.50***	.21**	.04	−.01	.12	.56***	.34	.05	.19**	−.01	.05	.12	.05	.05	.06	.07	.09
(1)	Paternal TEMPS-A Cyclothymic	6.1 ± 4.6	0–19											.18*	.40***	.57***	.24***	.17*	.04	.22**	.51***	.46***	−.01	.24***	−.04	.06	.08	.12	.07	.08	.10	.08
(1)	Paternal TEMPS-A Hyperthymic	9.7 ± 4.8	0–24												−.02	.01	.21**	−.08	−.20**	−.12	−.06	−.02	.06	.32***	−.01	−.09	.12	.11	.08	.03	.14*	−.01
(1)	Paternal TEMPS-A Irritable	4.3 ± 4.0	0–18													.50***	.15*	.17*	.05	.17*	.29***	.25***	−.08	−.10	.16*	.09	−.01	−.01	.06	.16*	.03	.11
(1)	Paternal TEMPS-A Anxious	4.9 ± 5.5	0–32														.16*	.15**	.04	.15*	.42***	.52***	.03	.06	.11	.10	.02	.07	.03	.13	.09	.10
(1)	Maternal ASRS	19.7 ± 11.2	0–57															.20**	.29***	−.02	.13	.18**	−.01	.16*	−.02	.06	.21**	.23**	.17*	.17*	.24***	.27***
(1)	Maternal BDI	13.1 ± 10.5	0–52																.44***	.18*	.22**	.11	−.15*	.01	−.10	.24**	.11	.09	.09	.10	.13	.20**
(1)	Maternal BAI	14.8 ± 13.2	0–61																	.07	.14*	.07	−.01	−.05	.05	.22**	.15*	.14*	.15*	.20**	.16*	.24**
(1)	Paternal ASRS	20.8 ± 10.8	0–45																		.30***	.28***	−.18*	−.02	−.10	.10	.03	−.05	−.09	−.02	−.04	.02
(1)	Paternal BDI	7.3 ± 7.5	0–38																			.53***	.04	.14	−.03	.10	.06	.12	.03	.12	.12	.15*
(1)	Paternal BAI	7.2 ± 8.9	0–56																				.03	.12	−.05	.06	.11	.13	.10	.12	.15*	.08
(1)	PSS Acceptance/ Involvement	25.4 ± 4.4	14–32																					−.10	.15*	−.17*	−.03	−.13	−.09	−.10	−.18*	−25***
(1)	PSS Psychological Autonomy	18.6 ± 4.8	7–30																						−.18*	−.10	.13	.23***	.21**	.05	.21***	.17*
(1)	PSS Strictness-Supervision	20.7 ± 5.3	9–26																							−.13	−.08	−.21**	−.20**	−.13	−.17*	−.17*
(1)	SRS	84.8 ± 31.1	14–165																								.05	−.02	.07	.13	.02	.14*
(1)	RCADS-CV SAD	6.0 ± 4.7	0–21																									.58***	.54***	.50***	.58***	.51***
(1)	RCADS-CV SP	9.6 ± 6.2	0–27																										.69***	.63***	.77***	.72***
(1)	RCADS-CV OCD	6.3 ± 4.3	0–18																											.66***	.71***	.76***
(1)	RCADS-CV PD	6.6 ± 6.2	0–27																												.68***	.76***
(1)	RCADS-CV GAD	6.7 ± 4.2	0–17																													.75***
(1)	RCADS-CV Depression	8.5 ± 6.5	0–29																													

T-DSM-IV-S Turgay DSM-IV-Based Child and Adolescent Behavioral Disorders Screening and Rating Scale, HI = Hyperactivity-Impulsivity; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder; TEMPS-A = Temperament Evaluation of Memphis, Pisa, Paris, San Diego Autoquestionnaire; ASRS = Adult ADHD Self-Report Scale. BDI = Beck Depression Inventory, BAI = Beck Anxiety Inventory, PSS = Parenting Style Scale, SRS = Social Reciprocity Scale, RCADS-CV = Revised Child Anxiety and Depression Scales – Child Version, SAD = Seperation Anxiety Disorder, SP = Social Phobia, OCD = Obsessive Compulsive Disorder, PD = Panic Disorder, GAD = Generalized Anxiety Disorder

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

Table 2. Standardized regression weights between variables according to structural equation modeling.

	β	P
SRS → PSS Acceptance/Involvement	−.165	.008
SRS → T-DSM-IV-S CD	.142	.022
T-DSM-IV-S HI → T-DSM-IV-S ODD	.570	<.001
T-DSM-IV-S HI → RCADS-CV SP	−.167	<.001
T-DSM-IV-S Inattention → T-DSM-IV-S ODD	.126	.021
Maternal TEMPS-A Anxious → T-DSM-IV-S ODD	.127	.019
Maternal TEMPS-A Anxious → Maternal BAI	.508	<.001
Maternal TEMPS-A Irritable → T-DSM-IV-S CD	.198	.001
Maternal TEMPS-A Irritable → T-DSM-IV-S ODD	.132	.016
Maternal TEMPS-A Hyperthymic → RCADS-CV SAD	.119	.013
Maternal TEMPS-A Hyperthymic → Maternal BDI	−.124	.011
Maternal TEMPS-A Hyperthymic → Paternal BDI	−.127	.016
Maternal TEMPS-A Depressive → Maternal BDI	.369	<.001
Maternal TEMPS-A Cyclothymic→ Maternal BAI	.194	<.001
Maternal TEMPS-A Cyclothymic→ Maternal BDI	.353	<.001
Maternal TEMPS-A Cyclothymic→ RCADS-CV GAD	.077	.047
Paternal TEMPS-A Anxious → Paternal BAI	.354	<.001
Paternal TEMPS-A Irritable → PSS Strictness-Supervision	.173	.009
Paternal TEMPS-A Hyperthymic → PSS Psychological Autonomy	.307	<.001
Paternal TEMPS-A Hyperthymic → RCADS-CV Depression	−.106	.004
Paternal TEMPS-A Hyperthymic → Maternal BAI	−.151	.002
Paternal TEMPS-A Hyperthymic → T-DSM-IV-S CD	.138	.023
Paternal TEMPS-A Depressive → Paternal BDI	.380	<.001
Paternal TEMPS-A Cyclothymic→ T-DSM-IV-S CD	.162	.006
Paternal TEMPS-A Cyclothymic→ Paternal BDI	.249	<.001
Paternal TEMPS-A Cyclothymic→ Paternal BAI	.215	.047
Maternal ASRS → Parent T-DSM-IV-S CD	−.132	.030
Maternal ASRS → RCADS-CV Depression	.104	.005
Paternal ASRS → Paternal BDI	.203	<.001
Paternal ASRS → Paternal BAI	.187	.001
PSS Psychological Autonomy →RCADS-CV PD	−.119	.003
PSS Acceptance/Involvement→ T-DSM-IV-S ODD	−.141	.005
PSS Acceptance/Involvement→ RCADS-CV Depression	−.137	<.001
RCADS-CV OCD → T-DSM-IV-S ODD	.146	.004
T-DSM-IV-S ODD → T-DSM-IV-S CD	.377	<.001

T-DSM-IV-S Turgay DSM-IV-Based Child and Adolescent Behavioral Disorders Screening and Rating Scale, HI = Hyperactivity-Impulsivity; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder; TEMPS-A = Temperament Evaluation of Memphis, Pisa, Paris, San Diego Autoquestionnaire; ASRS = Adult ADHD Self-Report Scale. BDI = Beck Depression Inventory, BAI = Beck Anxiety Inventory, PSS = Parenting Style Scale, SRS = Social Reciprocity Scale, RCADS-CV = Revised Child Anxiety and Depression Scales – Child Version, SAD = Seperation Anxiety Disorder, SP = Social Phobia, OCD = Obsessive Compulsive Disorder, PD = Panic Disorder, GAD = Generalized Anxiety Disorder

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

Discussion

This cross-sectional study has provided evidence for the increased effect of maternal anxious and irritable temperaments and child OCD symptoms on ODD symptoms, and for the maternal irritable temperament and paternal cyclothymic and hyperthymic temperaments and child autistic traits on CD symptoms in children with ADHD. Additionally, our findings showed the decreased effects of parental acceptance/involvement and maternal ADHD symptoms on ODD and CD symptoms, respectively. This study did not support the mediating role of parental depression and anxiety, parenting

styles, or child's depression and anxiety between parental temperaments and child's DBD.

The present study showed the increased effect of maternal anxious temperament on child oppositional-defiant behaviors in children with ADHD. In line with this data, our previous study also indicated a positive relationship between maternal anxious temperament and child's oppositional behaviors (Bilgic et al., 2018). Research that investigated the effect of maternal anxiety on child's mental health also provided evidence for the negative impacts of maternal anxiety on offspring behavioral outcomes (Loomans et al., 2011; Middeldorp et al., 2016). These impacts seem to begin in infancy and continue during childhood and adolescence. Several longitudinal studies showed the negative effects of elevated maternal anxiety over the antenatal period on offspring behavioral problems (Leis, Heron, Stuart, & Mendelson, 2014; Loomans et al., 2011). An association between maternal anxiety and higher ODD symptoms was also reported in school-aged children and adolescents (Middeldorp et al., 2016). Though the mechanisms of the association between maternal anxiety or anxious temperament and oppositional-defiant behaviors are not clear, it has been suggested that maternal anxiety may show its escalating effects on oppositional-defiant behaviors through negatively affecting the parenting practices (Kashdan et al., 2004). However, our study did not support the potential mediating roles of parenting styles on the link between maternal anxious temperament and child ODD. Also, our study did not show a link between maternal anxiety symptoms and child behavioral problems. Our findings have suggested that, compared to maternal anxiety symptoms, having a mother who has elevated anxious temperament may be more crucial for the emergence of ODD in children with ADHD. When considering that affective temperament has a strong hereditary component (Borkowska et al., 2015), we have suggested that our findings about the link between maternal anxious temperament and child ODD symptoms may reflect the transition of some biological dispositions that are related to both maternal anxious temperament and child ODD, such as high levels of negative affectivity from mother to child.

Our study demonstrated an increasing effect of maternal irritable temperament on both child ODD and CD symptoms. Although irritability commonly occurs as a symptom of a variety of psychiatric disorders, such as ODD, depression, and anxiety disorders, little data has existed about the impact of parental irritability on their offspring (Bilgic et al., 2018). Concurrent with this study, our previous report supported a positive relationship between maternal irritability and ODD symptoms in their children (Bilgic et al., 2018). In this study, we speculated that maternal irritable temperaments may prevent the use of effective parenting styles through causing an impairment in parental emotion regulation, and consequently may lead to the development or escalation of ODD symptoms. However, the present study did not support the potential

mediating roles of parenting practices on the link between a maternal irritable temperament and childhood ODD. Given that irritability is a core symptom of ODD, we have suggested that our findings about the link between maternal irritable temperament and child ODD symptoms may reflect the biological transition of the irritability from mother to children. Additionally, maternal irritable temperament may increase children's exposure to marital problems or relationship conflicts and other contextual stressors that may trigger the development of ODD and CD.

In our sample, the severity of OCD symptoms showed a positive association with ODD symptoms. Previously, a variety of studies demonstrated that OCD and ODD may have a strict relationship (Bloch et al., 2009; Coskun et al., 2012; Theriault et al., 2018, 2014). Coskun et al. (2012) detected that 48% of a clinical sample of preschool children with OCD had comorbid diagnoses of ODD. A longitudinal cohort study in children with OCD indicated that the presence of comorbid ODD is a risk factor for the persistence of OCD symptoms into adulthood (Bloch et al., 2009). ODD irritability has been shown to be associated with obsessive-compulsive behavior in children with Tourette syndrome (Theriault et al., 2014). A longitudinal prediction of ODD dimensions of irritability on OCD in early adulthood was also reported (Theriault et al., 2018). Though the association between OCD and ODD is not well-known, it may be suggested that common causal pathways such as inhibitory control may account for the etiopathogenesis of both disorders.

Our results indicated that paternal cyclothymic and hyperthymic temperaments had increased effects on the CD symptoms of ADHD children. Like this study, our previous study also showed a positive relationship between paternal cyclothymic temperament and offspring CD symptoms (Bilgic et al., 2018). However, it did not indicate a link between paternal hyperthymic temperament and CD symptoms of their children. In our previous study, we had suggested cyclothymic temperament features may cause fathers to have difficulty organizing parenting tasks and cause them to use a more dysfunctional and wavering parenting style, which can lead to the development of behavioral problems in children. However, the present study did not support the potential mediating roles of parenting practices on the link between paternal cyclothymic and hyperthymic temperaments and childhood CD. We have considered that children who have fathers with higher cyclothymic and hyperthymic temperament features may be at greater risk for having biological vulnerabilities to conduct disorder. Alternatively, elevated levels of these temperaments in fathers may increase the risk of the child's exposure to some uncontrolled environmental variables.

This study showed that autistic traits have a direct relationship with increased CD symptoms in children with ADHD. Additionally, autistic traits have a relationship with increased ODD symptoms through negatively affecting parental acceptance/involvement. These results suggest that having more

autistic traits increases rule violations in ADHD. In line with our data, a handful of studies reported the link between autistic traits and antisocial behaviors (Gilmour, Hill, Place, & Skuse, 2004; Loureiro et al., 2018). A recent study showed that the presence of autistic traits is an independent risk factor for imprisonment in adults (Loureiro et al., 2018). Gilmour et al. (2004) indicated that deficits in pragmatic abilities and autistic-like behaviors are related to CD in children. As well as autistic traits, the link between the presence of autism spectrum disorder (ASD) and CD was also evaluated and detected that children with ASD were more likely to show persistent CD than other children (Emerson et al., 2014). Though the link between autistic traits and antisocial behaviors has not been clear, it has been hypothesized that impaired motor and cognitive empathy may be responsible for both conditions (Bons et al., 2013). The role of emotion regulation about the association between autistic traits and CD was also evaluated, but no correlation was found between the two (Schoorl, Van Rijn, De Wied, Van Goozen, & Swaab, 2016).

Our study indicated a decreasing effect of parental involvement/acceptance on child's ODD symptoms. In line with our findings, a wealth of literature has documented the importance of parent involvement for offspring behavioral outcomes (Chronis et al., 2007; El Nokali et al., 2010; Mezulis et al., 2004). It seems that both mothers and fathers play a unique role in the development of a child's socioemotional skills by involvement through different means, such as physical play or joining a conversation (El Nokali et al., 2010). In a longitudinal study, Mezulis et al. (2004) demonstrated the moderating role of fathers in reducing the adverse effects of maternal depression on later child behavioral problems. Another longitudinal study also showed the crucial role of parent involvement for the decline in behavioral problems in school-aged children (El Nokali et al., 2010). However, the data are not consistent, and Rodriguez Ruiz, Holgado-Tello, and Carrasco (2017) found that father involvement is related to internalizing symptoms, but not the externalizing symptoms in a clinically-referred sample. The exact mechanism of how parent involvement impacts child behavioral outcomes is not clear. However, it was detected that children experiencing low father involvement and maternal depression in infancy show elevated behavioral, autonomic and adrenocortical reactivity, which are risk factors for the occurrence of mental health problems in middle childhood (Boyce et al., 2006). Additionally, the low involvement of fathers may decrease the intrinsic motivation of children to comply with their parents' demands (Kochanska, Forman, Aksan, & Dunbar, 2005).

On the contrary of our *a priori* expectations, the present study showed a decreasing effect of maternal ADHD on child CD symptoms. Gradually increasing studies demonstrated that not all symptoms of ADHD are related to functional impairments, and this condition may have some benefits in adults (Mahdi et al., 2017; Sedgwick, Merwood, & Asherson, 2019). In a multicenter

international study, Mahdi et al. (2017) explored the abilities in ADHD, and the participants reported a number positive aspects of ADHD such as high levels of energy and drive, creativity, hyper-focus, agreeableness, empathy, and a willingness to assist others. In order to describe the positive aspects of ADHD from the perspective of successful adults with ADHD, Sedgwick et al. (2019) used a phenomenological approach with open-ended interviews and reported that cognitive dynamism and energy are positive constructs specific to ADHD. Only a few studies have been available so far regarding the effect of maternal ADHD symptoms on child behavioral symptoms (Breaux et al., 2017; Efron, Furley, Gulenc, & Sciberras, 2018; Woods, Mazursky-Horowitz, Thomas, Dougherty, & Chronis-Tuscano, 2021). These studies have generally shown that maternal ADHD has negative effects on child behavioral and emotional outcomes through impairing parenting styles (Breaux et al., 2017; Woods et al., 2021). ADHD in adults is related to a variety of unfavorable factors such as the presence of comorbid psychiatric disorders, poor parenting styles, low education level and low family income (Efron et al., 2018; Franke et al., 2018), which may be responsible for poor offspring behavioral outcomes. Because our study took into account all of these potential confounders, it might display the beneficial aspects of the core symptoms of maternal ADHD.

Some limitations of the present study should be addressed. One of the main limitations of this study is its cross-sectional nature, which has the standard limitations on drawing conclusions about the link between variables in ADHD subjects. Because we planned to examine the association between the temperaments of biological parents on child behavioral outcomes, we could not include children who did not live with both of their biological parents. These criteria prevent our sample from being fully representative of families with children with ADHD. Additionally, the fact that the sample of this study is composed of children with a clinical diagnosis of ADHD may affect the generalization of the findings, which cannot be extrapolated to the general population.

Implications for Clinical Practice

Little information is available about the relationship between parental temperament and child ODD and CD symptoms in ADHD. Findings from the present study implicated that certain parental affective temperaments, but not parental depression and anxiety symptoms, may have an increasing effect on child ODD and CD symptoms. This study also suggested that lower parental acceptance/involvement and maternal ADHD, and higher child OCD symptoms and autistic traits, may escalate coexisting behavioral problems in children with ADHD. Factors that are related to ADHD may be of crucial importance when determining treatment and intervention strategies that can

improve the prognosis of the disorder. Therefore, taking into account the abovementioned variables during the assessment of the child may have important clinical implications. Future research is needed to better understand the mechanisms underlying the disruptive behavioral disorder symptoms in children.

Disclosure statement

No potential conflict of interest was reported by the authors.

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