

Family Interactions in Children With and Without ADHD

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Abstract We used global ratings to compare the family (parent[s]-child) interactions of 51 clinic-referred children with ADHD and 32 non problem children. Children and parent(s) were videotaped while engaging in problem solving and game playing activities. Independent coders, blind to children's diagnostic status, rated the interactions using measures designed to assess interaction competence and quality. Significant group differences emerged between the ADHD and control groups during problem solving on the interaction quality measures of Warmth, Engagement and Communication. Comparisons of the interactions of families of children with ADHD, with (ADHD W) and without (ADHD W/O) comorbid disruptive behavior disorders, were non significant, although increased symptomology was associated with reduced Warmth and Engagement during problem solving. Irrespective of group membership family interactions were more positive during game playing versus problem solving.

Keywords ADHD · Family interaction · Comorbidity · Observation · Family assessment

Conceptualized as a neurodevelopmental disorder, Attention Deficit Hyperactivity Disorder (ADHD) is characterized by developmentally inappropriate inattention, impulsivity, and/or hyperactivity (American Psychiatric Association [APA], 1994). The disorder is estimated to occur in 3–5% of school-age children and is often associated with significant concurrent and long-term psychosocial difficulties and comorbidities with other psychiatric difficulties (APA, 1994). This association is especially true for children with ADHD, combined type and

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other comorbid disruptive behavior disorders such as Oppositional Defiant Disorder (ODD) or Conduct Disorder (CD) (Power, Costigan, Eiraldi, & Leff, 2004).

Research with families of children with ADHD is consistent with much research finding parent-child interactional differences between children referred for a variety of behavioral and developmental difficulties and typically developing children (Bell & Harper, 1977). Understanding parent-child interactions in families of children with ADHD is important for two reasons: (1) the potential role family functioning plays in long-term prognosis of children with ADHD (Ingram, Hechtman, & Morgenstern, 1999); and (2) the association of negative child behavior and parent-child interactions with parental adjustment in this population (Johnston & Mash, 2001).

Descriptive research on parent-child interactions of children with ADHD during the 70s (then known as “hyperactivity”) and 80s (ADD/H) found children with this disorder to be more negative and less compliant with their parents, and their parents to be more directive and negative with them, when compared to non-identified children and their parents (e.g., Barkley, 1998). However, several unresolved issues remained regarding the nature of these observed differences, including (1) the contributions of disruptive behavioral comorbidity to the observed interaction patterns, (2) potential constraints of the experimental paradigm, and (3) appropriate interpretation of the observed pattern of results (Johnston & Mash, 2001).

During the 1980s, evidence accumulated supporting attention disorders and CD as separate diagnostic constructs with significant comorbidity, raising the question of whether correlates of ADHD were due to ADHD or to comorbid behavioral difficulties (Hinshaw, 1987). Some research addressing family correlates of ADHD suggested that several family variables may be associated predominantly with general behavioral difficulties or CD (Barkley, 1998), with negative emotional climate, maternal hostility, and conflictual parent-child interactions more strongly associated with families in which the child has comorbid oppositional behavior (Barkley, 1998; Seipp & Johnston, 2005).

Most research on parent-child interactions of children with and without ADHD was conducted using parent-child dyads, typically mothers and sons (Johnston & Mash, 2001). Often parent-child interactions were observed in at least two situations—one, a more child led or play activity, the other a more adult led or task activity. Typically, differences between parent-child interactions of children with and without ADHD were more pronounced in task compared with free play settings (Barkley, 1998). Extensions of this work included dyads of fathers and sons (Johnston, 1996) or triads of parents and sons (Buhrmester, Compas, Christensen, Gonzalez, & Hinshaw, 1992). Interactions between boys with ADHD and their parents varied, depending on the constellation of participants (Buhrmester et al., 1992). Taken together, these findings suggest context influenced observed parent-child interactions of children with ADHD.

Dependent variables typically involved rates of behavior (e.g., rates of child compliance, frequency of maternal commands). Because children with ADHD behave differently than their non-referred peers, *quantitative* differences in parent-child interactions between children with ADHD and typically developing children would be expected from an interactionist perspective postulating bi-directional influences in parent-child interactions (Bell & Harper, 1977). Differences in parental behavior observed in parent-child interactions may be due to parental response to the behavioral differences of their children (Schaughency, Vannatta, & Mauro, 1993). Acknowledging that parent-child interactions of children with and without ADHD differ, anecdotally clinical researchers have observed potentially meaningful differences *among* families of children with ADHD in the *quality* of these interactions. While some family interaction patterns seemed coercive (Patterson, 1982), these professionals informally noted that other parents appeared to provide additional support and structure needed

by their children. For example, although interviewers occasionally noted lack of warmth and criticism in mother-child relations in a clinical sample of children referred for symptoms of ADHD, Tripp and Luk (1997) reported that these were present in a small minority of their sample.

Theoretically consistent with both a bi-directional view and developmental research highlighting the importance of parental coordination of their responses for child functioning (Schonkoff & Phillips, 2000), families of children with ADHD may differ in how well they adapt to their child's behavioral differences and needs and in the quality of their family functioning. This idea would be consonant with family stress and adaptation theory, a framework for understanding families of children with disabilities that asserts that families may adapt to the caregiving stress associated with the challenges of parenting children with disabilities (Lucyshyn, Dunlap, & Albin, 2002). Preliminary support for the suggestion that families of children with ADHD may differ in the quality of their parenting comes from a recent study finding differences in responsivity and over-reactivity of some mothers and their sons with ADHD during parent-child interactions compared to mothers of non problem boys but not others (Seipp & Johnston, 2005). To further address the issue of whether there are *qualitative* differences in parent-child interactions between parents of children with ADHD and non problem controls and to examine whether there are differences among families of children with ADHD, researchers recommended studies include less structured observations and more subtle, stylistic measures of parenting to compare parent-child interactions of children with ADHD with differing levels of comorbid oppositional behavior (Johnston, 1996).

We used global ratings to compare the family (parent[s]-child) interactions of children with and without ADHD, exploring the contributions of context and comorbid disruptive behavioral difficulties to obtained findings. Global ratings, rather than frequency counts, are used to capture the overall tone of the interaction and provide an entry level research strategy for evaluating the viability of these more subtle qualitative relationship constructs (Dishion & Snyder, 2004).

Based on our interpretation of the literature, we predicted: (1) The family interactions of children with ADHD will be less competent and supportive than those observed in the control families, given results of previous studies, comparing parent-child interactions in families of children with ADHD and those of non referred controls (Johnston & Mash, 2001). (2) The family interactions of children with ADHD and a comorbid disruptive behavior (ADHD W) disorder will be less effective and supportive than those of families of children with ADHD only (ADHD W/O), based on suggestions in the limited literature that directly examines this issue and the rich parent-child interaction literature exploring the association of parenting and child conduct problems (Dishion & Snyder, 2004). (3) Family interactions will be more positive during game playing compared with problem solving, due to the consistent pattern of context effects in the existing literature on parent-child interactions in families of children with ADHD (Barkley, 1998).

Methods

Participants

Participants were families (parent[s] and target child) of 51 children ($M = 7$ years 10 months, $SD = 1$ year 8 months) diagnosed with DSM-IV ADHD (APA, 1994) and 32 similarly aged children ($M = 7$ years 9 months, $SD = 1$ year 7 months) without behavioral difficulties (control group). All children had Full Scale IQ scores of at least 70 and were in general

education settings. Twenty-six (51%) of the children with ADHD had a comorbid disruptive behavior disorder. The demographic and diagnostic characteristics of the participating children and families are presented in Table 1.

We assigned participants to diagnostic groups based on accepted current practice in the diagnostic assessment of ADHD and other disruptive behavior disorders (APA, 1994). Inclusion criteria for the ADHD group were: DSM-IV diagnosis of ADHD, age range 5–12 years, full scale IQ of at least 70, and, to avoid possibly masking of effects due to medication status (Barkley, 1998), not currently prescribed psychotropic medication for ADHD or family willing to suspend medication use for 24 hours prior to the family interaction. Additional exclusion criteria were: presence of a neurological condition/disorder or evidence of psychosis. Inclusion/exclusion criteria for the control group were the same, with the additional exclusion criteria of a diagnosis of ADHD or one of the other disruptive behavior disorders (ODD or CD).

We recruited families of children with ADHD through the ADHD Research Clinic at the University of Otago in Dunedin, New Zealand. As part of its research activities this clinic provides comprehensive diagnostic assessments for children suspected of having ADHD. Following diagnosis of ADHD, we invited children and their parent(s) to participate in our study. We recruited families in the control group through targeted newspaper advertisements and letters sent home to parents of children attending local elementary schools.

Procedure

The research described was reviewed and approved by the appropriate ethical review committee. Parents provided written consent and children assent for assessment and research participation.

Diagnostic assessment

All participating children (ADHD and control) completed a comprehensive diagnostic assessment including standardized semi-structured parent, teacher, and child interviews, parent and teacher completed rating scales, and an assessment of the child's cognitive functioning. Three final-year doctoral students in clinical psychology trained by the first author (GT) conducted the interviews. Interviews, rating scales, and child behavior during the cognitive assessment were used in making a diagnosis. Diagnoses of disruptive behavior disorders were based on DSM-IV (APA, 1994) criteria. To receive the diagnosis of ADHD, the children were required to exhibit six or more symptoms of inattention and/or hyperactivity/impulsivity in one setting (home or school), together with evidence of symptoms in a second setting. Symptoms were required to onset before age 7, be developmentally inappropriate, cause clinically significant impairment in more than one setting, and not be better accounted for by another mental disorder. The graduate student interviewer made preliminary diagnoses, and these were reviewed by GT. Diagnostic disagreements were resolved through discussion until consensus.

Family assessment

We asked the children's parents to complete demographic questionnaires and self-report measures of depressive symptomatology and parenting stress.

Table 1 Demographic, diagnostic and family characteristics of control and ADHD participants

Demographic variable	Control (<i>n</i> = 32)	ADHD ^a (<i>n</i> = 51)	ADHD W/O (<i>n</i> = 25)	ADHD W (<i>n</i> = 26)
Age in years <i>M</i> (<i>SD</i>)	7.8 (1.6)	7.9 (1.8)	8.3 (1.6)	7.5 (1.8)
Sex <i>n</i> (%)				
Boys	27 (84)	43 (84)	22 (88)	21 (81)
Ethnicity <i>n</i> (%)				
NZ european	27 (84)	38 (74)	18 (72)	20 (77)
Māori	4 (13)	8 (16)	4 (16)	4 (15)
Other	1 (3)	0 (0)	0 (0)	0 (0)
Unknown	0 (0)	5 (10)	3 (12)	2 (8)
ADHD subtype <i>n</i> (%)				
Combined		38 (74)	14 (56)	24 (92)
Inattentive		11 (22)	11 (44)	0 (0)
Hyperactive/Impulsive		2 (4)	0 (0)	2 (8)
Referral source <i>n</i> (%)				
Pediatrics		32 (63)	16 (64)	16 (61)
CAFMHS		17 (33)	9 (36)	8 (31)
Special education		2 (4)		2 (8)
Family SES ^b <i>M</i> (<i>SD</i>)	3.2 (1.7)	4.2 (1.2)	3.8 (1.1)	4.6 (1.3)
Number of children in household ^c <i>M</i> (<i>SD</i>) <i>Mdn</i>	2.2 (0.9) 2.0	2.2 (1.0) 2.0	2.1 (0.8) 2.0	2.2 (1.2) 2.0
Family composition <i>n</i> (%)				
Two-parent	28 (87)	32 (63)	17 (68)	15 (58)
Single-parent	4 (13)	19 (37)	8 (32)	11 (42)
Parenting Stress ^d <i>M</i> (<i>SD</i>)				
Child domain	82.5 (13.0)	144.1 (25.9)	138.9 (28.6)	148.9 (22.6)
Parent domain	109.5 (20.4)	133.9 (27.7)	131.6 (27.8)	136.4 (28.1)
BDI ^e <i>M</i> (<i>SD</i>)	4.9 (4.5)	6.6 (6.9)	4.9 (5.6)	8.3 (7.8)
Adversity Score <i>M</i> (<i>SD</i>)	0.4 (0.6)	0.7 (0.7)	0.5 (0.7)	0.9 (0.7)
Present at interaction <i>n</i> (%)				
Two parents	21 (66)	25 (49)	12 (48)	13 (50)
One parent	12 (34)	26 (51)	13 (52)	13 (50)
Representativeness of Interaction <i>n</i> (%) ^f	25 (84)	40 (78)	20 (80)	20 (77)

Note. ADHD W/O = ADHD without comorbidity; ADHD W = ADHD with comorbidity.

Māori = indigenous New Zealander.

^aComorbid disruptive behavior disorder, ODD *n* = 20; CD *n* = 6.

^bElly and Irving (1985): 1–2 = professional/technical; 3–4 = trades; 5–6 = semiskilled/unskilled/unemployed.

^cControl *n* = 30.

^dPrimary caregiver Child Domain stress Control *n* = 27, ADHD W/O *n* = 20, ADHD W *n* = 21, ADHD *n* = 41, Parent Domain stress Control *n* = 27, ADHD W/O *n* = 20, ADHD W *n* = 20, ADHD *n* = 40.

^ePrimary caregiver Beck Depression Inventory (BDI) scores Control *n* = 27, ADHD W/O *n* = 19, ADHD W *n* = 19, ADHD *n* = 38.

^fIndicates number and percent of families for whom the number of parents present matched the actual family composition.

Parent-child interaction

We conducted parent-child interactions with the current naturalistic constellation of parent(s) and child, where possible (e.g., triad including both parents or parent and stepparent, or dyad of single parent and child, as appropriate). Parents and children participated in play and socially valid problem-solving sessions, to allow comparisons of interactions in less taxing vs. potentially conflictual situations (Fletcher, Fischer, Barkley, & Smallish, 1996; Brody et al., 1994; Brody, Stoneman, & Gauger, 1996).

Each family (parent[s] and child) engaged in a 40-minute family interaction in a quiet room at the Research Clinic, videotaped for later coding. For the first 20 min, families engaged in two problem-solving exercises. Parent(s) and child were asked to discuss one child-generated problem, followed by one parent-generated problem as described below. We requested that families discuss each problem until they agreed on a practical solution or until 10 min had elapsed. For the next 20 min, families played the board game “Trouble” (Gilbert Industries). Brody et al. (1994) report extensive use of this activity, which they describe as interesting and understandable to children in the study age range.

Measures

Diagnostic assessment

Parent, child, and teacher interviews. Parents completed a two part clinical interview, (1) a detailed description of the child’s behavioral difficulties and developmental and medical history, and (2) administration of the Anxiety Disorders Interview Schedule for children - parent version (ADIS-C, Silverman & Ollendick, 2005) to screen for presence of DSM-IV childhood disorders. Diagnoses made using the ADIS-C have demonstrated moderate levels of test-retest reliability and moderate to high levels of inter-rater reliability (Silverman & Ollendick, 2005). For our study, we modified the ADIS-C slightly to match the criteria for childhood disorders presented in DSM-IV. Structured child diagnostic interviews for DSM-IV were not available when data collection commenced. Each child’s teacher completed a telephone interview about the child’s behavior, academic, and social functioning. Children completed a semi-structured clinical interview assessing their perceptions of their behavior, academic performance, and peer relations at home and at school. Copies of the interview schedules are available from GT.

Parent and teacher ratings. Parents and teachers completed the Disruptive Behavior Disorders Rating Scale (DBD, available at <http://summertreatmentprogram.com>, Pelham, Gnagy, Greenslade, & Milich, 1992). The DBD assesses presence and severity of DSM-IV symptoms of ADHD, ODD, and CD. Respondents endorse one of four severity ratings for each symptom of these disorders (Not at All, Just a Little, Pretty Much, Very Much). We operationally defined symptom presence by endorsements of Pretty Much or Very Much. The DBD Rating Scale has demonstrated moderate to strong correlations with screening measures of hyperactivity (Molina, Pelham, Blumenthal, & Galiszewski, 1998).

Assessment of cognitive functioning. To ensure that cognitive functioning did not better account for symptoms, we assessed current level of intellectual functioning using age-appropriate Weschler Intelligence Scales (Weschler Intelligence Test for Children-3rd

Edition, Australian Adaptation, WISC-III, Wechsler, 1991; Wechsler Preschool and Primary Scale of Intelligence-Revised, WPPSI-R, Wechsler, 1989).

Family assessment

Parent psychological functioning. Parents' depressive symptomology was assessed with the Beck Depression Inventory (BDI, Beck & Steer, 1987), a 21-item questionnaire designed to assess the presence and severity of symptoms of depression in adolescents and adults. The BDI has high levels of internal consistency and test-retest reliability (Beck & Steer, 1987) and good discriminant, concurrent, and construct validity (Beck, Steer, & Garbin, 1988). The Parenting Stress Index (PSI, Abidin, 1995), a 120-item self-report questionnaire, was used to assess the levels of perceived parental stress in the parent-child dyad. The PSI yields Child Domain, Parent Domain, and Total Stress scores. The PSI has high internal consistency and moderate to high test-retest reliability (Abidin, 1995).

Parent-child interaction

Problem lists. Parents and children each identified three problems for possible discussion during the family problem solving exercise. During child diagnostic interviews, we asked children to identify problems that often caused arguments between them and their parent(s). The 44 item Issues Checklist (Robin & Foster, 1989) was used to identify problems of concern to parents(s). Reliability and validity data for this measure are adequate and scale scores correlate significantly with direct observations of parent-adolescent conflicts (Robin & Foster, 1989). Although designed for use with parents of older children, many problems listed apply to elementary age children (e.g., fighting with brothers or sisters, getting into trouble at school, bothering parents when they want to be left alone).

Coding systems. We used methodology from developmental psychology and developmental disabilities to assess the competence and degree of support in family interactions, selecting measures with good clinical sensitivity (Brody et al., 1994; Drumm, Carr, & Fitzgerald, 2000; Hampson, Hulgus, Beavers, & Beavers, 1988). We coded problem solving interactions using selected subscales from the Beavers Interactional Scales of Family Competence (Beavers & Hampson, 1990) and scales purported to assess the quality of family interactions (Brody et al., 1994; Brody et al., 1996). We coded game playing interactions using the latter scales only. For all scales/subscales, we based ratings on observation of each family interaction condition.

The Beavers Interactional Scales of Family Competence are an observational system designed to assess the health and competence of goal focused family interactions. Competence is defined by the scale developers as "how well the family performs its necessary tasks" (Beavers & Hampson, 1990, p. 14). There are 13 subscales, 12 measuring different aspects of family competence plus a global competence scale. These subscales discriminate between normative and clinical samples (Drumm et al., 2000; Beavers & Hampson, 1990). Inter-rater and internal consistency reliabilities for the competence scales range from 0.7 to 0.9 (Drumm et al., 2000).

In our study, we included only scales of interest that could be meaningfully rated for either one or two-parent family interactions. The scales that we selected were: *Closeness*, degree of acceptance and understanding amongst family members (from "indistinct boundaries" to "closeness with distinct boundaries"); *Goal-Directed Negotiation*, family's ability to negotiate problems successfully and achieve viable solutions (from "extremely efficient" to "extremely inefficient"); *Permeability*, ability of family members of acknowledge and accept

views of other members (from “very open” to “unreceptive”); *Unresolvable Conflict*, degree of conflict evident in family interaction (from “severe conflict” to “little, or no, unresolvable conflict”); *Empathy*, whether family members try to understand and sympathize with another family member’s emotion (from “consistent empathic responsiveness” to “none”); and *Global Health-Pathology*, overall rating of family’s competence during the interaction (from “pathological” to “healthy”). The competence subscales are rated on nine point Likert scales, from 1 to 5 with 0.5 increments. With the exception of Closeness and Unresolvable Conflict, low scores reflect greater competence. For ease of interpretation, we reverse scored these two scales in our study. Global Health-Pathology is rated from 1 (“healthy”) to 10 (“pathological”). Interrater reliabilities from .74 to .89 are reported for the subscales we used in our study (Beavers & Hampson, 1990).

The scales measuring interaction “quality” have been used extensively in developmental studies of family relationships (e.g., Brody et al., 1994; Brody et al., 1996). These scales are described as behavioral indicators of interaction quality and are designed to focus on the interacting dyad or triad, not the individual family members (Brody et al., 1994; Brody et al., 1996). The four dimensions assessed by these scales were: *Conflict-Harmony*, ranging from “conflicted, relationships are hostile and tense” to “harmonious, relationships warm/supportive, family members work together”; *Engagement*, ranging from “not at all engaged, family members do not speak to one another or interact with one another nonverbally” to “highly engaged, high rates of verbal and non verbal interaction”; *Warmth* ranging from “not at all characteristic, family members rarely or never display examples of warmth and involvement” to “highly characteristic, family members actively display high levels of concern, support, praise, encouragement etc”; *Communication*, ranging from “not at all characteristic, family members rarely explain or clarify comments” to “highly characteristic, family members ensure intentions/comments are understood.” The solutions reached during the problem solving interaction were rated with a *Quality of Solution Scale*, ranging from “no agreement on a solution” to “outstanding, solution is practical, feasible, and fair to all” (Brody et al., 1996). All five scales were rated from 1 to 7, with higher scores reflecting better quality. Reliability estimates reported for the five scales range from .79 for Quality of Solution to .97 for the Communication scale (Brody et al., 1994; Brody et al., 1996).

Two independent raters, blind to child diagnostic status, coded all videotaped interactions using the scales described above. With the exception of solution quality, the two problem solving interactions were coded together. Only the first 10 minutes of the game playing interaction were coded.

Each rater participated in 30 hours of training. This included a detailed discussion of the coding process and practice coding of videotapes. Inter-rater reliabilities were checked, using percentage agreement after 20 parent-child interactions had been coded. Five of these initial 20 interactions were re-coded as reliability was considered unacceptably low. To monitor for observer drift, reliability was checked for every 10 subsequent interactions coded. Once all videotaped interactions were coded, we submitted raters’ responses to reliability analyses. Inter-rater reliability coefficients for family interaction competence and quality scales were generally satisfactory, with alphas ranging from .79 (Conflict-Harmony, Game-Playing) to .92 (Conflict-Harmony, Problem-Solving).

Data analysis

Prior to carrying out analyses, we checked data to ensure they met the assumptions required for the use of parametric statistics. We corrected the data distributions for Empathy,

Conflict-Harmony, Engagement, and Quality of Solution via logarithmic transformation; Permeability and Unresolvable Conflict using inverse transformations. The distributions of the Communication scale could not be corrected; we analyzed these data nonparametrically.

Our preliminary analyses compared the groups on demographic, diagnostic, and family characteristics. We utilized mothers' BDI and PSI data in two-parent families, and data from the custodial parent in single parent families. Next, we compared the interaction ratings of families of children with and without ADHD, and families of children with ADHD with and without a comorbid disruptive behavior disorder. We conducted these analyses using planned comparisons, based on methodological recommendations for comparative analyses in the literature (Jaccard & Guilamo-Ramos, 2002a). We then assessed the effect of context on family interactions with a series of 2 (control vs ADHD) by 2 (problem solving vs game playing) repeated measures ANOVAs with the family interaction variables rated for both types of interaction. Where significant group differences were obtained, we conducted exploratory follow-up analyses to further elucidate results.

To balance Type I and Type II errors (Jaccard & Guilamo-Ramos, 2002b), we grouped the dependent variables as follows: Beavers Scales; "Quality" Scales, Problem Solution Scales (problem solving); "Quality" Scales (game playing) and we applied Hochberg's modified Bonferroni procedure (Hochberg, 1988) to the resulting p values within each group. This step-up method is more powerful than the traditional Bonferroni approach but still maintains adequate experiment wise error rates (Jaccard & Guilamo-Ramos, 2002b).

Results

Demographic and diagnostic characteristics

The control and ADHD groups differed significantly on measures of family composition $\chi^2 = 4.84$, $df = 1$, $p = .028$, socioeconomic status (SES, Elly & Irving, 1985) $t(49.5) = 2.84$, $p = .006$, and primary caregiver levels of parenting stress (child domain $t(65) = 12.93$, $p < .001$; parent domain $t(64) = 3.90$, $p < .001$). Compared to the control group the ADHD group included more single-parent families, had a lower mean SES, and higher levels of child domain and parent domain parenting stress. The ADHD W group had a lower mean SES than the ADHD W/O group $t(80) = 2.06$, $p = .042$. No other significant group differences were identified for the demographic variables assessed.

The two ADHD groups differed in ADHD subtype composition $\chi^2 = 15.62$, $df = 2$, $p < .001$. The ADHD W group was comprised predominantly of children meeting diagnostic criteria for ADHD, Combined Subtype, with no child receiving the diagnosis of ADHD, Predominantly Inattentive Subtype. In contrast, ADHD W/O was more evenly distributed across the Combined and Predominantly Inattentive Subtypes.

Family interaction ratings

Means and standard deviations of the untransformed family interaction variables for the control and ADHD groups (ADHD, ADHD W/O, ADHD W) are presented in Table 2, along with p values and effect sizes (d) from the planned comparisons.

When the ADHD and control groups were compared, after applying the modified Bonferroni procedure, significant group differences emerged during problem solving for ratings of Engagement $t(80) = 2.67$, $p = .009$, Warmth $t(80) = -2.46$, $p = .016$, and Communication $Z = -2.53$, $p = .011$. The interactions of the control group families were rated

Table 2 Mean ratings of family interaction competence and quality for participating control and ADHD families

Rating scale	Control (<i>n</i> = 32)	ADHD (<i>n</i> = 51)	ADHD W/O (<i>n</i> = 25)	ADHD W (<i>n</i> = 26)	C vs ADHD		W/O vs W		Linear trend <i>p</i>
					<i>p</i>	<i>ES</i> (<i>d</i>)	<i>p</i>	<i>ES</i> (<i>d</i>)	
Problem solving <i>M</i> (<i>SD</i>)									
Beavers scales ^a									
Closeness	1.9 (0.7)	2.2 (0.6)	2.1 (0.6)	2.2 (0.7)	.056	.46	.538	.15	.051
Goal-directed negotiation	2.0 (0.9)	2.4 (1.1)	2.1 (0.9)	2.6 (1.2)	.156	.40	.049	.47	.025
Permeability	1.5 (0.6)	1.8 (0.8)	1.7 (0.6)	1.9 (0.9)	.057	.42	.513	.26	.049
Unresolvable conflict	1.5 (0.7)	1.9 (1.1)	1.7 (0.9)	2.1 (1.2)	.069	.43	.382	.38	.059
Empathy	1.5 (0.6)	1.8 (0.8)	1.7 (0.6)	1.9 (0.9)	.075	.42	.373	.26	.047
Global health pathology	2.6 (1.2)	3.1 (1.5)	2.9 (1.3)	3.4 (1.7)	.090	.37	.278	.36	.044
Interaction quality ^b									
Conflict-harmony	5.7 (1.0)	5.2 (1.3)	5.3 (1.1)	5.1 (1.4)	.058	.43	.713	.16	.070
Engagement	5.9 (0.9)	5.2 (1.3)	5.4 (1.0)	5.0 (1.4)	.009	.61	.354	.33	.007
Warmth	5.6 (1.0)	4.9 (1.2)	5.2 (0.9)	4.7 (1.4)	.016	.64	.063	.42	.003
Communication ^c	6.8 (0.4)	6.2 (1.1)	6.4 (0.7)	6.0 (1.3)	.011	—	.360	—	—
Quality of solution 1	5.3 (2.1)	4.9 (2.1)	5.6 (1.5)	4.2 (2.4)	.270	.19	.044	.70	.065
Quality of solution 2 ^d	5.1 (2.0)	4.6 (2.1)	4.7 (2.1)	4.5 (2.0)	.256	.24	.659	.10	.231
Game-playing ^d <i>M</i> (<i>SD</i>)									
Interaction quality ^b									
Conflict-harmony	6.3 (0.8)	6.0 (0.9)	6.0 (0.8)	6.0 (1.0)	.152	.35	.877	.00	.188
Engagement	6.2 (0.6)	5.7 (0.9)	5.9 (0.7)	5.6 (1.1)	.018	.66	.317	.33	.031
Warmth	6.1 (0.9)	5.7 (0.9)	5.8 (0.8)	5.6 (1.0)	.071	.44	.608	.22	.071
Communication ^e	6.9 (0.4)	6.9 (0.3)	6.8 (0.4)	7.0 (0.0)	.765	—	.032	—	—

Note. C = Control; ADHD W/O and W/O = ADHD without comorbidity; ADHD W and W = ADHD with comorbidity; *ES* = effect size based on Cohen (1988) *d* = (Mean group 1 – Mean group 2)/pooled standard deviation. Bolded *p* values significant after modified Bonferroni, italicized *p* values significant at *p* = .05.

^aLower scores represent increased interaction competence.

^bHigher scores represent better interaction quality.

^cControl, ADHD, ADHD W/O *Mdn* = 7.0; ADHD W *Mdn* = 6.5.

^dControl *n* = 31, ADHD W comorbidity *n* = 25, ADHD *n* = 50.

^eFor all groups *Mdn* = 7.0.

as more engaged, warmer, and displaying better communication than those of children with ADHD. During game playing there was a trend toward lower levels of Engagement in the ADHD group ($d = .66$; $t(71.9) = -2.42$, $p = .018$).

No significant differences were found between the two ADHD groups (ADHD W/O and ADHD W) for any of the family interaction variables after applying the modified Bonferroni procedure. The moderate effect size for Quality of Solution for the child generated problem ($d = .70$; $t(49) = -2.06$, $p = .045$), suggests families of children with ADHD and a comorbid disruptive behavior disorder may reach poorer solutions than those with ADHD only.

Repeated measures ANOVAs for the Conflict-Harmony, Engagement and Warmth scales identified highly significant main effects for all three variables (Conflict-Harmony $F(1,79) = 15.42$, $p < .001$, partial $\eta^2 = .16$; Engagement $F(1,78) = 369.01$, $p < .001$, partial $\eta^2 = .82$; Warmth $F(1,78) = 36.21$, $p < .001$, partial $\eta^2 = .31$). Family interactions were rated as more harmonious, engaged, and warmer during game playing compared with problem solving. After correcting for multiple comparisons the main effect of group for Warmth approached significance ($F(1,79) = 5.26$, $p = .025$, partial $\eta^2 = .06$), while the main effect for Engagement showed a trend in this direction ($F(1,79) = 4.20$, $p = .044$, partial $\eta^2 = .05$). The task by group interaction for Engagement was significant $F(1,79) = 7.14$, $p = .009$, partial $\eta^2 = .08$. The change in ratings of Engagement from problem solving to game playing was larger for the ADHD group than the control group.

Follow-up analyses

Linear trend analysis

A review of mean interaction ratings across groups (control, ADHD W/O, ADHD W) suggested that the data might fit a linear trend, with more diagnoses predicting less positive family interactions. To test this hypothesis, we tested for linear and quadratic effects. The p values for the linear effects are presented in Table 2. None of the quadratic effects approached significance; these are not reported. After applying the modified Bonferroni procedure, significant linear trends were identified for Engagement $t(80) = 2.78$, $p = .007$ and Warmth $t(80) = -3.10$, $p = .003$ during problem solving.

Demographic characteristics

Group differences in family composition, SES, and parenting stress raise questions over the possible contribution of these factors to the obtained results. The relationships between these variables and ratings of Engagement, Warmth, and Communication during problem solving were explored for the whole sample together and for each group separately (Control, ADHD W/O, and ADHD W). When the groups were combined small, but significant, correlations were observed between both primary caregivers' Child Domain stress and SES and the interaction variables of Engagement (Child Domain stress, $r = -.31$, $p = .009$, $N = 68$; SES, $r = -.25$, $p = .02$, $N = 83$) and Communication (Child Domain stress, $r = -.26$, $p = .04$, $N = 68$; SES, $r = -.30$, $p = .005$, $N = 83$). For the ADHD W group, the correlation between family composition and Warmth was also significant ($r = .41$, $p = .036$, $n = 26$). No other correlations were significant.

As the impact of psychosocial risk factors is cumulative (Biederman, Faraone, & Monuteaux, 2002), we also calculated an adversity score for each participating family (see Table 1). We allocated 1 point for the presence of each the following: an SES rating of

6 (semiskilled/unskilled/unemployed), more than three children living at home, and single parent status. Adversity scores did not correlate significantly with ratings of Engagement, Warmth, or Communication during problem solving for the entire sample or for any of the groups separately.

Discussion

We used qualitative global ratings to compare the parent-child interactions of children with and without DSM-IV ADHD. Significant group differences were observed during the problem solving task for three of the dependent variables. The interactions of control group families were rated as warmer, more engaged, and with more effective communication than those of families with a child with ADHD. Comparisons of the interactions of families of children with ADHD, with and without a comorbid disruptive behavior disorder, were all non significant. Post hoc linear trend analyses suggested differences in family interactions may be associated with increasing symptomology rather than categorical differences per se. Across groups, family interactions were more positive during game playing compared with problem-solving. Together these findings provide qualified support for our three hypotheses.

Consistent with the previous literature (Barkley, 1998), context clearly influenced the observed family interactions. Ratings of Warmth, Engagement and Communication were higher (more positive) during game playing for both the ADHD and control families, an effect which most likely reflects the less taxing and less conflictual nature of the game playing activity. This context effect appeared somewhat larger for the families of children with ADHD, which could explain the absence of significant group differences for these variables during game playing.

The significant group differences that emerged during problem solving were restricted to variables reflecting emotional tone and participant involvement. Previous quantitative studies report that children with ADHD are less compliant and more negative, while their parents are more directive and negative. It is not difficult to see how such behaviors might translate to reduced levels of warmth, engagement, and communication. To avoid conflict, parents and children may distance themselves from one another, with parents opting to repeat instructions and avoid lengthy explanations. Decreased engagement could also reflect attentional difficulties of family members, given the significant heritability of ADHD (Consensus Statement on ADHD, 2002).

Ratings for variables designed to assess family interaction competence (i.e., Beavers Scales and Problem Solution Ratings) were not significantly different across groups. Mean ratings on the Beavers Scales for the control and ADHD groups were at generally similar levels, with overlapping distributions. Compared to ratings for families presenting for family therapy and non problem controls (Beavers & Hampson, 1988), mean ratings for both groups in the current study are similar to the levels reported for the non problem control families. Together these findings suggest that, on average, the family interaction competence of families in our ADHD group is not impaired.

The absence of group differences on the measures of family interaction competence may reflect the adaptive functioning of some families of children with ADHD. Consistent with this hypothesis, studies with families of children with other disabilities (e.g., mental retardation, childhood cancer) have shown, contrary to earlier expectations of dysfunction, that these families typically function well overall, demonstrating similar levels of competence to families of non disabled children (Hampson et al., 1988; Kazak et al., 1997). Certainly clinic families in our study were recruited as one of their children had ADHD, not because the families were identified as dysfunctional.

None-the-less, the results of previous quantitative studies would predict more differences between the ADHD and control families. We considered several possible methodological explanations for the similarity in ratings of interaction competence. In our study all of the participating families were volunteers. It is possible that only more competent families of children with ADHD were willing to participate in a study assessing parent-child interactions. However, the demographic data suggest that the children with ADHD and their families were similar to the larger population of families of children with ADHD (Phares & Lum, 1996). Although the interaction contexts were selected for their social validity, the interactions were videotaped in a research clinic, raising the possibility of reactivity. Further, the cues and constraints usually present during family activities were absent, potentially improving interaction competence and effectiveness. For example, the children's siblings were not present, removing competition for parent attention. Finally, task requirements were explicit and the situation was novel, factors likely to increase compliance in the children with ADHD. On the other hand, the significant differences for variables assessing emotional tone and involvement suggest that the research context alone does not explain the observed similarity in the interaction competence ratings.

Previous reports have been mixed regarding the effects of comorbid behavior problems on the family functioning of children with ADHD. In our study we failed to find significant differences between the two ADHD groups on variables assessing family interaction competence and emotional tone and involvement. With the exception of goal-directed negotiation and quality of solution, effect sizes for these comparisons were small suggesting the absence of significant differences is not a sample size problem. The larger effect sizes for these two variables may reflect the symptoms that define ODD and CD. It may be more difficult for children with these disorders to engage in effective problem solving activities. While the family interaction ratings for the two ADHD groups were not significantly different, the linear trend analyses indicate that an increasing number of disruptive behavior disorder diagnoses are associated with less supportive and less involved family interactions. These analyses also suggest increasing symptomology may contribute to less competent family interactions. Linear trend analyses for a number of the competence variables would be significant at the less conservative $\alpha = .05$. Together the reported findings are consistent with those of Seipp and Johnston (2005) who suggest that parent-child interactions appear most problematic in families of children with ADHD with comorbid conduct problems, least problematic in families of non problem children, with families of children with ADHD only falling in the mid-range, sometimes appearing different from non problem families and sometimes not.

In interpreting our findings, study limitations and the external validity of the results should be considered. The intended participants during the interaction were the target child and custodial parent(s). Both parents from two parent families were not always present at the interaction, consistent with other "high commitment-high stress" research (see Costigan & Cox, 2001, for discussion), and we do not know how such absences influenced the behavior of the child and attending parent. A similar proportion of the interactions, across groups, were representative of actual family composition, decreasing the likelihood that family constellation during the interaction (dyad versus triad) was responsible for the obtained results.

The families of the children with ADHD differed from the control families on a number of the demographic characteristics assessed. This raises the possibility that the observed differences in the family interactions variables are a consequence of these factors and not the presence of ADHD. Such an explanation seems unlikely, however, given the weak relationships between the demographic and interaction variables for each group. The exception was the relationship between family composition and warmth for the comorbid ADHD group which was moderate in size. For these families, having two parents in the home was

associated with greater displays of warmth. The comorbid behavioral problems of the children in this group may make interacting with them in a positive manner especially challenging for single parents who already face additional demands (Ackerman, Schoff D'Eramo, Umylny, Schultz, & Izard, 2001).

At the time of observation the children in the ADHD groups were not taking medication, as a consequence the findings may not represent family interactions when a child is under medication effects. Sample size and composition precluded subgroup analyses by ADHD subtype, gender, and ethnicity. Thus, the extent to which findings may differ for these subgroups is uncertain, and the generalizability to the populations of families with children with the less frequently occurring subtypes (ADHD, inattentive or hyperactive-impulsive subtypes), girls with ADHD, or Māori (indigenous New Zealander) families with a son or daughter with ADHD is unknown. The uneven distribution of subtypes across our ADHD groups is consistent with other research in the area (Seipp & Johnston, 2005).

In summary, differences between the results of our study and research using more quantitative methodology highlights the influence of family assessment methodology on results, and the finding that family interactions vary with the task demands of the situation highlights the importance of context when assessing family functioning. Increased symptomology was associated with less warmth and engagement during problem solving. However, results do not imply impaired family interaction competence or quality for a given child with ADHD.

To enable integration of the present findings with those from previous research with families of ADHD, future work is recommended in which both previously used quantitative assessment methodologies and qualitative methodologies are included. Moreover, future work could include potentially important moderator variables, such as coparenting (the extent to which caregivers cooperate as a team in rearing offspring, Schoppe, Frosch, & Mangelsdorf, 2001), that were not included in our study. Further, to better understand the effect of family functioning on child outcomes for children with ADHD, future longitudinal studies are recommended, given findings that suggest changes in family structure (Ackerman et al., 2001) and functioning (Johnson, 2003) may effect children's behavioral adjustment. As the construct of family interaction quality evolves, future work should operationalize this construct into a microsocial coding system capturing interactions in real time to further advance the field (Dishion & Snyder, 2004).

At the individual family level, findings of contextual differences in results have potential implications for assessment and intervention planning. Commenting on obtained differences in results of dyadic parent-child interactions, Haynes (2001) notes that assessment procedures may have differential content validity, depending on the goal of the assessment. Although assessment of "hot spots," such as in the problem-solving session, provide an efficient context for observing areas of family difficulty (Haynes, 2001), identification of areas in which family functioning is enhanced may provide clinically useful information for building upon family strengths (see Lucyshyn et al., 2002).

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