ABSTRACT: Patterns of interaction between parents and 7-month-old boys at familial risk for attention deficit/hyperactivity disorder (ADHD) and a comparison group were studied during a warm-up and two play episodes. The sample included 78 (47 at-risk, 31 comparison) mother–child and 45 (27 at-risk, 18 comparison) father–child dyads. A coding system developed by G. Kochanska (1997, 1998) was used. Infants in the risk group did not differ from the comparison group in the rate of emission of infant-related events. However, they received less adequate responsivity from both their fathers and their mothers to these events, and specifically to negative emotions or distress, than did the comparison group. Maternal psychopathology did not account for these findings. Mothers were more adequately responsive than were fathers, especially for physiological needs. The association between nonoptimal interaction in infancy and the development of ADHD is discussed.
RÉSUMÉ: Les patterns d’interaction entre les parents et des garçons de 7 mois à risque familial de TDAH et un groupe de comparaison ont été étudiés durant une séance d’échauffement et deux épisodes de jeu. L’échantillon a compris 78 dyades mère-enfant (47 à risque ; 31 pour la comparaison) et 45 dyades père-enfant (27 à risque et 18 pour la comparaison). Un système de codage développé par Kochanska (1997, 1998) a été utilisé. Le groupe des bébés à risque n’a pas différé du groupe de comparaison pour ce qui concerne le taux d’émission d’événements liés au bébé. Cependant, ces bébés ont reçu une réaction à ces événements moins adéquate à la fois de leurs pères de de leurs mères et spécifiquement aux émotions négatives ou à la détresse que le groupe de comparaison. La psychopathologie maternelle n’expliquait pas ces résultats. Les mères réagissaient de manière moins adéquate que les pères, surtout pour les besoins physiologiques. L’association entre l’interaction non-optimale chez les nourrissons et le développement du TDAH est discutée.


抄録：ADHDの家族性のリスクのある親と7ヶ月男児の間の相互交流パターンと、対照群のパターンが、準備段階と2つのプレイ・エピソードで研究された。対象には78組（47組の危険群と31組の対照群）の母子と45組（27組の危険群と18組の対照群）の父子が含まれていた。Kochanska (1997, 1998)によって開発されたコード化システムが使われた。乳児に関連した出来事の放出率について、危険群は対照群と差がなかった。しかしながら、危険群はこれらの出来事に対して、特に否定的な情緒や苦痛に対して、父親と母親の両者から適切な反応性を受けすることが、対照群よりも少なかった。母親の精神病理は、これらの所見を説明しなかった。母親は、特に生理的なニーズに対しては、父親よりも適切に反応的だった。乳児期の至適ではない相互交流とADHDの発展との間の関連について、考察される。

* * *

Attention deficit/hyperactivity disorder (ADHD) has been found to run in families (Biederman et al., 1995; Smalley et al., 2000). The theory is that a genetic neurodevelopmental vulnerability underlies the disorder, especially when ADHD persists into adolescence and adulthood (Biederman et al., 1995; Faraone, Biederman, & Monuteaux, 2000; Price et al., 2005). However, organic environmental factors, familial factors (Befera & Barkley, 1985; Fischer, 1990; Milberger, Biederman, Faraone, Guite, & Tsuang, 1997); and less optimal patterns of interaction between parents and children were found to be associated with ADHD.
Most interaction studies of ADHD are of preschool and school-age children and their parents, especially their mothers. Mothers of children with ADHD were found to be more intrusive, demanding, more negative and aversive, less approving and encouraging, and expressed less positive affect than were comparison groups of mothers (Anderson, Hinshaw, & Simmel, 1994; Barkley, 1985; Buhrmester, Camparo, Christensen, Shapiro Gonzalez, & Hinshaw, 1992; Campbell, 1995; DuPaul, McGoy, Eckert, & Vanbrakle, 2001; Keown, & Woodward, 2002; Mash & Johnston, 1982). Children with ADHD were found to express more negativity and anger, to demand more help and attention, and to be less compliant with their mothers’ instructions and requests than were the children in comparison groups (Buhrmester et al., 1992; Campbell, 1995; DuPaul et al., 2001; C. Johnston, 1996; Mash & Johnston, 1982; Tallmadge & Barkley, 1983).

In the few studies on fathers’ interaction with ADHD children, fathers, like mothers, were more directing of the child’s activities relative to those in a comparison group. However, children with ADHD were found to be more compliant with and less antagonistic and resistant to fathers than they were to mothers (Buhrmester et al., 1992; Calzada, Eyberg, Rich, & Querido, 2004; Tallmadge & Barkley, 1983).

It was found that when medication (Barkley, 1989; Humphries, Kinsbourone, & Swanson, 1978) or a combination between medication and behavior therapy (Wells et al., 2000) attenuated the child’s symptoms at preschool and school age, the pattern of parent–child interaction improved. These findings supported an approach that the nonoptimal parent–child interaction patterns were mostly the result of the parents’ reactions to the child’s behavior; however, at this age of the children, it is already impossible to know how and when the impaired dyadic pattern of interaction started.

About 50 to 60% of children with ADHD also are diagnosed with conduct disorder and oppositional defiant disorder (Biederman, Newcorn, & Sprich, 1991; Campbell, 2000; DuPaul et al., 2001). However, it has been found that more negative reactive behavior, greater rejection-coercion, and fewer positive parenting strategies were used both for those ADHD children who rated high on oppositional defiance disorder and for those who scored low on this disorder (C. Johnston, 1996; Lindahl, 1998).

ADHD is a developmental disorder that in many cases persists from childhood into adolescence and adulthood (Campbell, 2002; Hechtman, 2000; Price et al., 2005). It has been found that about 60% of parents with ADHD are likely to have a child with ADHD (Biederman et al., 1995; Biederman, Faraone, & Monuteaux, 2002; Lombroso, Pauls, & Leckman, 1994). However, not only does having a parent with ADHD increase genetic risk for the disorder but the high number of symptoms of inattention, impulsiveness, and overactivity in a parent also can lead to less optimal parenting.

In the above mentioned interaction studies the parent’s own ADHD status was not systematically assessed. Recently, more attention has been directed to exploring differences in parenting behavior between adults with and without ADHD. Murray and Johnston (2006) examined parenting behavior of mothers of children with ADHD, comparing those mothers who had ADHD themselves to those mothers who did not. They found that the former group was poorer at monitoring child behavior and less consistent disciplinarians. These mothers scored lower on the effectiveness or quality of solutions they gave for problems and in the level of planning involved in those solutions. This direction of findings persisted when controlling for conduct behavior and oppositional disorder in the children and for comorbidity in the mothers. In a similar vein, Harvey, Danforth, McKee, Ulaszek, and Friedman (2003) found that the father’s
and mother’s self-report of inattention and impulsiveness was associated with their self-report of lax parenting.

Psychopathology has been found to be more prevalent in adults diagnosed with ADHD than in the general population (Biederman, Faraone, Monuteaux, Bober, & Cadogen, 2004; Harvey et al., 2003; Minde et al., 2003; Murray & Johnston, 2006; Ninowski, Mash, & Benzies, 2007). However, although this comorbidity is related to patterns of parenting, it does not explain all differences found between the parenting of parents with ADHD and comparison groups (Murray & Johnston, 2006; Woodward, Taylor, & Dowdney, 1998).

The above research on parenting relates to preschool- and school-age children with ADHD. To better understand the influence that parents with ADHD symptomatology have on the development of their children with respect to ADHD, parenting behavior should be studied as early as possible. In their review, J. Johnston and Mash (2001) suggested that perhaps “extremely responsive and sensitive family environments can serve as a protective factor that facilitate the development of self-regulation and may attenuate or even terminate ADHD symptoms in children with a biological predisposition for the disorder” (p. 185). On the other extreme, it has been found that intrusive, rejecting, and coercive parenting in infancy was associated with ADHD and with hyperactive symptoms in preschool children, and that this nonoptimal caregiving behavior could not be attributed to observed infant behavior (Carlson, Jacobvitz, & Sroufe, 1995; Jacobvitz & Sroufe, 1987; Morell & Murray, 2003).

The possible disruptive effect of parental ADHD on infant’s development also can be deduced from Ninowski et al. (2007), who studied expectations related to parenting in a group of first-time expectant women with ADHD symptoms. They found that even after controlling for comorbidity in the mothers, ADHD symptoms predicted less positive prenatal expectations regarding the infant, future maternal role, and self-efficacy. These expectations could not be related to the child’s behavior. The study did not, however, examine the pattern of interaction between the infants and these mothers and the fathers.

The aim of the present study, one of a series of studies which are part of an ongoing prospective longitudinal study of infants at familial risk for ADHD (Auerbach, Atzaba-Poria, Berger, & Landau, 2004; Auerbach et al., 2005), was to assess patterns of mother–infant and father–infant interaction of 7-month-old boys in two groups: infants at familial risk for ADHD (due to father’s symptoms) and infants in a comparison group.

Boys were chosen as subjects because ADHD is more prevalent in boys than in girls, with a ratio of 3:1 to 9:1 (Barkley, 1990; Danckaerts & Taylor, 1995) and because, according to J. Johnston and Mash (2001), familial and genetic factors may influence boys and girls in a different way. The distinction between comparison and risk groups was based on father’s symptoms because it was found that children are more affected if the affected parent is of their gender (Minde et al., 2003).

During infancy in most of the families, mothers are the main caregivers of the infants. In the present study, the mothers did not have ADHD symptomatology; it was their spouses who are affected. However, it has been found that ADHD in one parent changes the regulation of the whole family system and impairs family and marital functions regardless of the gender of the affected parent (Biederman, Faraone, & Monuteaux, 2002; Minde et al., 2003; Weiss, Hechtman, & Weiss, 2000). A new infant calls for a reorganization of the family system and the behavior of each of the participants. Having a disorganized, nonattentive, and hyperactive husband at this time can disrupt this reorganization and also impair the parenting behavior of the mothers who do not have ADHD symptoms.
Considering the findings on familial genetic liability for ADHD, the behavior of older children with ADHD, and parenting behavior in families in which a parent has ADHD symptomatology, the hypotheses for this study were:

**H1:** During interaction with their parents, the group of infants at risk for ADHD would be more often distressed, and need their parent’s attention and instrumental help more often than would infants not at risk for ADHD.

**H2:** During interaction with their infants, both parents would react less adequately to the infant’s distress and needs for attention and help in the risk group for ADHD than for infants in the comparison group.

**METHOD**

**Participants**
Recruitment to this study was conducted in the Maternity Ward of Soroka Medical Center. At the hospital, during 4 years, information about newly born infants was assessed. Infants with a history of prenatal, perinatal, or postnatal complications, including low birth weight and prematurity, were excluded. Parents who were native-born or immigrants who had studied in the country and spoke the language of the country were asked to participate in the study. All parents were married at the time of recruitment.

For those families who agreed to participate, fathers were then asked to complete a questionnaire assessing ADHD current symptomatology composed for the present study. In this questionnaire, 18 items were symptoms of ADHD taken from the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* (*DSM-IV*; American Psychological Association, 1994) and worded to be suitable for use with adults (Cronbach $\alpha = .80$). An additional 19 items from the Tridimensional Personality Questionnaire (Cloninger, 1987) with a similar format were spread among the ADHD items so that at this visit to the maternity ward, the fathers would not have to complete a questionnaire consisting only of items indexing psychopathology. Entry into the ADHD risk group versus the comparison group was based on the number of positive responses (yes–no format) only to the ADHD items.

The present prospective study is not a clinical-based study; rather, it consists of families recruited from the general population. The criterion for recruitment was a score of $\geq 7$ for the risk group and $\leq 3$ for the comparison group. This cutoff score for the risk group was chosen because it was high enough above the mean ($M = 4.16$, $SD = 3.73$) to indicate moderate symptomatology, but low enough to ensure a large-enough risk sample for longitudinal tracking. The validity of this sampling procedure can get some support from the findings of Faraone and Biederman (2005). They found that 2.9% of their sample met diagnostic criteria for ADHD; however, when the criteria was broadened to include cases showing milder impairing symptoms of the disorder, they found a prevalence of 16.4%, which is similar to the percentage in the current study (19.11%).

As only about 60% of children were expected to be affected with ADHD, more risk families than comparison families were recruited to optimize the probability that there would eventually be enough boys in the study with a diagnosis of ADHD. The recruited comparison families were matched to those in the risk group.

When the infants were 2 to 3 weeks old, 186 families agreed to participate in a home visit in which the Neonatal Behavior Assessment Scale (Brazelton & Nugent, 1995) and the Infant
Chart of the Number of Subjects in the Different Samples

2-3 weeks first home visit - N=186 infants

Number of infants - Risk group: N= 111 Comparison group: N= 75
N. father's symptoms - M=9.73 SD=2.34 M=1.47 SD=1.12

7 months at the laboratory

a. All mothers in this study and their boys - N=78

Number of infants - Risk group: N= 47 Comparison group: N= 31
N. father's symptoms- M=9.70 SD=2.00 M=1.61 SD=1.12

b. Only mothers without pathology in this study and their boys - N=62

Number of infants - Risk group: N= 38 Comparison group: N= 24
N. father's symptoms- M=9.61 SD=2.03 M=1.62 SD=1.13

c. Mothers, fathers and their boys in this study - N=45

Number of infants - Risk group: N= 27 Comparison group: N= 18
N. father's symptoms- M=9.59 SD=1.97 M=1.33 SD=1.08

Note. b and c are subgroups of a and partially overlap.

FIGURE 1. Chart of the number of participants/subjects in the different samples.

Behavior Questionnaire (Rothbart, 1981) were administered. At this visit, the parents received a more detailed description of the study. The number of infants in both the risk group and the comparison group and the mean level of symptoms for the 186 fathers are presented in Figure 1.

When the infants were between 6 and 7 months old, parents and infants were invited to the laboratory at the university for a warm-up session and two play episodes, during which their interaction with each of the parents was studied and a series of infant tasks was administered. The scheduled date of lab assessment was contingent on the ability of the infant to sit up by himself. Only 2 infants in the risk group and 3 in the comparison group could not sit up by 8 1/2 months, and thus were not invited to this assessment. The present report relates to the last part of the warm-up and to the two episodes of parent–child interaction.

The sample of the present report included seventy-eight 7-month-old boys ($M = 6.94$, $SD = .61$) and their mothers. The number of infants in each of the groups and the number of symptoms in the spouses of these mothers are presented in Figure 1. For 45 of these boys, data also were available with regard to their interaction with fathers. The number of infants in each group and the number of symptoms of these fathers also are presented in Figure 1.
Attrition rate between the home visit and the present study was quite high because of the following reasons: Some families (19 in the risk group, 4 in the comparison group) did not want to come to the lab. In each of the groups, 4 families could not be found, and divorce, illness, or death occurred in additional 6 families. The other families were not included in the present report because of technical problems with the equipment and because the present study only included children who completed all three episodes (warm-up and both play episodes). Infants and parents in the sample who did not participate in the present study (ns = 186 and 78, respectively) and the sample of the present study did not differ in background variables or in the percentage of first-born infants (36 and 34%, respectively) nor did they differ in the proportion of risk to comparison infants.

Mothers were not assessed for ADHD at the maternity ward in which they stayed for a short time after delivery; however, when the infants were between 2 and 6 months old, a psychiatric interview with each of the parents was conducted at their home. At this time, they also completed the Conners Adult ADHD Rating Scale (CAARS; Conners, Erhardt, & Sparrow, 1998) on themselves and on their spouses. The interviews were conducted by two fifth-year medical students and two clinical psychology students trained and supervised by a psychiatrist, using the Structured Clinical Interview for DSM-IV Axis I Disorders [SCID (I); First, Spitzer, Gibbon, Williams, & Benjamin, 1996]. As that does not include questions on ADHD, they also administered the ADHD module from the Schedule of Affective Disorder and Schizophrenia for School-Age Children, Epidemiologic Version (K-SADS-E; Orvashal & Puig-Antich, 1987), worded in a way appropriate for adults.

The interviews were analyzed by the psychiatrist and a clinical psychologist. First, each of them independently diagnosed the same 32 interviews. In four cases (12.5%), they disagreed on the diagnosis. These disagreements were resolved by discussion, and the rest of the interviews were divided between them for diagnosis. The interviewers and the diagnosticians were blind to the previous assessment of the fathers and to their group assignment. In the sample of the present study, 2 mothers and 10 fathers were diagnosed with ADHD, all in the risk group (26%).

The following mental disorders were found in the assessment: depression, adjustment disorder, posttraumatic stress disorder, bipolar disorder, obsessive-compulsive disorder, dysthymia, panic disorder, generalized anxiety disorder, social phobia, and substance abuse. Participants were considered to have psychopathology if diagnosed during their life with at least one of these disorders.

No differences were found in frequency of psychiatric disorders between the 78 mothers who participated in the present study and the mothers who were visited at home but did not participate in this study (20 and 14%, respectively), χ²(1) = 1.03, p < .31. The spouses of the mothers in the two samples also did not differ in rates of psychiatric diagnosis (14 and 17%, respectively).

Within the sample of 78 families, no differences were found between risk and comparison groups for fathers, mothers, and infants in background variables (Table 1) or percentage of first-born infants (risk group: 38%, comparison group: 35%) nor did the groups differ in maternal psychopathology (risk group: 17%, comparison group: 23%). However, more fathers in the risk group were diagnosed with psychopathology than those in the comparison group (24 and 6%, respectively), χ²(1) = 4.02, p = .045. These fathers had various kinds of psychopathology, but predominantly a depression episode.

Only 45 fathers participated in the present study. No significant differences were found in parental background variables or frequency of psychiatric diagnosis between this sample of 45
TABLE 1. *Child, Mother, and Father Background Information in Risk and Comparison Groups (n = 78)*

<table>
<thead>
<tr>
<th></th>
<th>Risk (n = 47)</th>
<th>Comparison (n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Child</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (months)</td>
<td>6.88</td>
<td>.63</td>
</tr>
</tbody>
</table>
| Gestation age (weeks)
|                 | 39.00        | 2.03                | 39.52           | 1.40 (−0.9)|
| Weight at birth (g)
|                 | 3344.24      | 472.14              | 3360.00        | 453.67 (−1.1)|
| Birth order     | 2.20         | 1.12                | 2.10            | 1.04 (−0.4)|
| **Mother**       |              |                     |                 |           |
| Age              | 28.67        | 5.06                | 28.11           | 5.39 (0.5)|
| Years of education | 12.13     | 1.88                | 13.00           | 1.84 (−0.3)|
| **Father**       |              |                     |                 |           |
| Age              | 32.50        | 6.14                | 32.68           | 4.94 (−0.2)|
| Years of education | 12.24     | 1.90                | 13.00           | 1.82 (−1.8)|

*a* Information on 4 children in each group is missing.

*b* Information on 1 child in each group is missing.

*c* Information on 2 children in the risk group is missing.

fathers (and their spouses) and the 33 fathers (and their spouses) who did not participate. Infant background variables did not differ between the two samples, other than a difference in mean age: In the group of 33 infants whose fathers did not participate in the study, the mean age was significantly higher, \( t(79) = −3.24, p = .001 \). This difference reflects the need for more rescheduling with some families in which it was difficult and sometimes impossible for fathers to reconcile work requirements and the time that was optimal for their infants to come to the lab.

Within the sample of 45 families, no differences were found between risk and comparison groups for fathers, mothers, and infants on background variables or in percentage of first-born infants. The groups also did not differ in the number of mothers and fathers with psychopathology.

**Procedure**

**Observation settings.**

1. **Warm-up.** Together, the parent, the infant, and the experimenter entered the room in the lab. On the rug were spread soft cloth toys and various rattles. The mother was told to put the child on the rug near the toys, with which the child could play as he wanted. The experimenter invited the mother to sit with him on the rug near the infant. The experimenter explained the laboratory session to the parent, showed pictures of the play episodes to come, and asked the parent to rate his or her expectations regarding the infant’s reactions to those episodes. The warm-up lasted 15 min, of which the last 7 min in which the parent was occupied by the experimenter were coded.

2. **Face-to-face interaction without toys (3 min).** The child sat in an infant seat placed on a table. The parent sat in a chair facing the infant. The parent was told:
Play with your child freely, as you do at home. After 3 min, the experimenter will knock on the window, and then you are to take the toy that is under the table and use it to play with the child as you would at home.

3. Face-to-face interaction with toy (3 min), during which the parent played with the infant using a Fisher Price Stacker.

As infants approached the age of 6 months, families were contacted to arrange a date for a visit to the developmental lab. Because of the scope of the observations, two sessions were necessary. Each session started with the warm-up episode and was followed by the face-to-face interactions. For reasons related to other aspects of the longitudinal study, the mother was present with the infant during all three episodes in the first session, and the father in the second session. The two sessions were, on average, 14 days apart. In each session, the interaction without the toy preceded the interaction with the toy. Both sessions were videotaped. The experimenters were psychology graduate students who were blind to the group assignment of the infants. Both parents signed informed consent forms for their participation and that of their son. At the end of the session, the infant was given a small gift.

**Coding of episodes.** The three episodes were coded for the infant’s behavior and parental responsivity using a coding system developed by Kochanska (1997, 1998). We chose this coding system because it has been used extensively in longitudinal studies with infants and toddlers from the general population and was predictive of developmental outcomes (Kochanska, 1997; Kochanska, Forman, & Coy, 1999), it relates to aspects of interaction and developmental outcomes that were found to be less optimal in children with ADHD, and each event in which the infant needs help is carefully identified and assessed twice (by two different teams of observers). In addition, parental response to each of these need-related events is evaluated.

**The Observation System**

**Infant’s behavior.** Every event of the infant’s negative affect/distress, bid for attention, need for instrumental help, and physiological signal (“child-related events”) were coded in 60-s segments. Because of its low frequency (<1%), the event “attempt to influence” was not included in the analyses. For events where infant’s behavior could not be classified into one of the five categories, a global code was assigned. The reliability between two independent coders in classifying the infant’s behavior for 12 of the mother–child dyads (14%), as measured by $\kappa$, was .87 to .88. For 11 (23%) of the father–child dyads, it was .87 to .89.

**Parental responsivity.** A second team of coders went back to each previously coded infant-related event, identified it, and evaluated it again. In the few cases of disagreement with the first team, each event was discussed and agreed upon. Parental response to each of these infant-related events was rated by the second team using four mutually exclusive codes: poor, fair, good, or exceptional. These categories were based on a combination of dimensions that have been described in the literature as components of responsivity (Kochanska, 1998): emotional availability (support for the child, primarily in stressful situations but also when positive affect and stimulation are needed), sensitivity (detection, correct interpretation, and response to infant’s behavior), acceptance (warm support, affection, and pleasure in reaction to the infant),
cooperation (accepting the child’s choices, feelings, and individuality, in contrast to interference and lack of respect for the child’s timing), and adjust the level of stimulation to the needs of the child’s temporary state. The $\kappa$s ranged from .75 to .79 for the mother–infant sample and from .89 to.91 for the father–infant sample. All the coders, including the researchers, were blind to the infant’s group assignment until all coding was completed.

**Data Analysis**

For each child across the three episodes (warm-up, play without toy, play with toy), the number of all child-related events belonging to the same type of event was tallied. Then, the instances were tallied when the mother responded poorly, fairly, well, or exceptionally to the child’s events in each type, and each tally was divided by the total number of events in that type. Next, each of the scores of kind of responsivity in each type was weighted: that of poor by $-2$, that of fair by $-1$, that of good by $+1$, and that of exceptional responses by $+2$. A higher score denoted more adequate responsivity. Data were analyzed by an analysis of variance (ANOVA) and by $t$ tests. Effect size of all ANOVA results was evaluated with partial $\eta^2$ and $t$-test results with Hedges’ $g$.

**RESULTS**

**Infants and All Mothers**

As mentioned earlier, more mothers than fathers participated in the study. Thus, data for mothers were analyzed first separately by an ANOVA, with group as the between-subject variable and type of infant-related event as the repeated measure. This first analysis was conducted to test the hypothesis that there are group differences on the set of all four types of infant-related events (all events) studied while controlling for multiple comparisons. In this analysis, it was found that the difference between the risk and comparison groups was not significant, $F(1, 76) = 0.02$, $p = .90$, $\eta^2 = .001$. Thus, no further analysis was performed on group differences on the separate types of infant-related events. These findings refute the first hypothesis. The difference in frequency of type of infant-related events in the two groups was significant, $F(3, 288) = 32.44$, $p = .001$, $\eta^2 = .30$. As indicated in Table 2, in both groups there were more bids for attention than negative emotions/distress or needs for instrumental help, with physiological signals very infrequent.

Another similar ANOVA was run to analyze the adequacy of maternal responsivity on the set of all types of infant-related events (all events). In this analysis, significant differences were found for group, $F(1, 76) = 4.32$, $p = 0.04$, $\eta^2 = .054$. Mother’s responsivity for type of infant-related event also was significant, $F(3, 228) = 5.36$, $p = .001$, $\eta^2 = .066$. The interaction between group and type of infant-related event was not significant. In keeping with the second hypothesis, it was found that mother’s score of responsivity to the set of all infant-related events was less adequate for the risk group than it was for the comparison group. As indicated in Table 2, mothers in the risk group responded less adequately to all types of infant-related events than did mothers in the comparison group. Because the groups differed on all types of infant-related events, separate ANOVAs were conducted for each type. In this analysis, only the differences in negative emotion/distress was significant.

**Infant and Mothers Without Pathology**

Although the groups did not differ in percentage of mothers with at least one psychiatric disorder, we reanalyzed the data for the 62 mothers without pathology (38 in the risk group, 24 in the
Parenting and Attention Deficit/Hyperactivity Disorder Risk

TABLE 2. Number of Infant-Related Events When Interacting With Mother, and Maternal Responses, in Risk and Comparison Groups, per Type of Event (n = 78)

<table>
<thead>
<tr>
<th>Type of Event</th>
<th>Risk (n = 47)</th>
<th>Comparison (n = 31)</th>
<th>t(76) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
</tr>
<tr>
<td>Child behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative emotions/distress</td>
<td>4.89 (5.13)</td>
<td>4.71 (5.17)</td>
<td>0.15 (.04)</td>
</tr>
<tr>
<td>Bids for attention</td>
<td>8.64 (6.53)</td>
<td>8.42 (7.37)</td>
<td>0.14 (.03)</td>
</tr>
<tr>
<td>Needs for instrumental help</td>
<td>5.21 (4.84)</td>
<td>5.71 (5.29)</td>
<td>-0.43 (.14)</td>
</tr>
<tr>
<td>Physiological events</td>
<td>0.77 (1.37)</td>
<td>1.00 (1.15)</td>
<td>-0.78 (.18)</td>
</tr>
<tr>
<td>All events</td>
<td>19.53 (11.16)</td>
<td>19.94 (11.54)</td>
<td>-0.15 (.35)</td>
</tr>
<tr>
<td>Mother Behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative emotions/distress</td>
<td>0.15 (0.63)</td>
<td>0.54 (0.65)</td>
<td>-2.57** (.60)</td>
</tr>
<tr>
<td>Bids for attention</td>
<td>0.36 (0.73)</td>
<td>0.52 (0.71)</td>
<td>-0.99 (.12)</td>
</tr>
<tr>
<td>Needs for instrumental help</td>
<td>0.19 (0.85)</td>
<td>0.41 (0.60)</td>
<td>-1.30 (.30)</td>
</tr>
<tr>
<td>Physiological events</td>
<td>-0.01 (0.76)</td>
<td>0.07 (0.81)</td>
<td>-0.39 (.09)</td>
</tr>
<tr>
<td>All events</td>
<td>0.14 (0.36)</td>
<td>0.31 (0.35)</td>
<td>-2.15* (.49)</td>
</tr>
</tbody>
</table>

* p = .035. ** p = .011.

comparison group) to test whether psychopathology accounts for some of the differences. These findings replicated the main findings of the 78 mothers and infants for both infants and mothers. No group differences were found in frequency of all infant-related events, and a significant difference was found for type of infant-related event, $F(3, 180) = 24.32, p = .001, \eta^2_p = .29$. The interaction between group and type of infant-related event was not significant. Maternal responsivity on the set of all types of infant-related events was less adequate in the risk group than it was in the comparison group, $F(1, 60) = 6.33, p = .015, \eta^2_p = .10$. As indicated in Table 3, mothers in the risk group responded less adequately to all types of infant-related events

TABLE 3. Number of Infant-Related Events When Interacting With Mothers Without Psychopathology, and Maternal Responses, in Risk and Comparison Groups, per Type of Event (n = 62)

<table>
<thead>
<tr>
<th>Type of Event</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>t(60)</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative emotions/distress</td>
<td>4.89</td>
<td>4.65</td>
<td>5.17</td>
<td>5.35</td>
<td>-0.21</td>
<td>.05</td>
</tr>
<tr>
<td>Bids for attention</td>
<td>8.37</td>
<td>6.86</td>
<td>8.38</td>
<td>7.49</td>
<td>-0.01</td>
<td>.01</td>
</tr>
<tr>
<td>Needs for instrumental help</td>
<td>4.92</td>
<td>4.72</td>
<td>6.67</td>
<td>5.61</td>
<td>-1.32</td>
<td>.34</td>
</tr>
<tr>
<td>Physiological events</td>
<td>0.50</td>
<td>0.92</td>
<td>1.17</td>
<td>1.24</td>
<td>-2.42**</td>
<td>.62</td>
</tr>
<tr>
<td>All events</td>
<td>18.71</td>
<td>10.94</td>
<td>21.38</td>
<td>11.28</td>
<td>-0.92</td>
<td>.24</td>
</tr>
<tr>
<td>Mother behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative emotions/distress</td>
<td>0.10</td>
<td>0.66</td>
<td>0.64</td>
<td>0.64</td>
<td>-3.21***</td>
<td>.83</td>
</tr>
<tr>
<td>Bids for attention</td>
<td>0.37</td>
<td>0.68</td>
<td>0.57</td>
<td>0.74</td>
<td>-1.09</td>
<td>.28</td>
</tr>
<tr>
<td>Needs for instrumental help</td>
<td>0.05</td>
<td>0.88</td>
<td>0.45</td>
<td>0.51</td>
<td>-2.03*</td>
<td>.52</td>
</tr>
<tr>
<td>Physiological events</td>
<td>-0.06</td>
<td>0.78</td>
<td>-0.04</td>
<td>0.85</td>
<td>-0.04</td>
<td>.01</td>
</tr>
<tr>
<td>All events</td>
<td>0.09</td>
<td>0.36</td>
<td>0.32</td>
<td>0.34</td>
<td>2.51**</td>
<td>.65</td>
</tr>
</tbody>
</table>

* p < .05. ** p < .02. *** p < .01.
than did mothers in the comparison group; however, when the mothers with psychopathology were excluded from the analysis, the difference between the groups in maternal responsivity in the separate ANOVAs was significant for need of instrumental help in addition to the difference in negative emotion/distress.

### Infants, Mothers, and Fathers

For the 45 families with both mother and father data, an ANOVA was run with group as the between-subject variable, parent as the within-subject variable, and the set of the four types of infant-related events as the repeated measure. The findings of this analysis were similar to the main findings of the sample of 78 mothers without the fathers; the difference between the risk and comparison groups in total frequency of infant-related events was not significant, $F(1, 43) = .16, p = .69, \eta^2 = .003$. The difference in the frequency of infant-related events when interacting with the mother and when interacting with the father also was not significant, $F(1, 43) = .251, p = .12, \eta^2 = .055$, nor was the interaction between group and parent significant, $F(1, 43) = .02, p = .89, \eta^2 = .001$. In all, these findings do not confirm the first hypothesis.

For quality of maternal and paternal responsivity to the set of all infant-related events, significant differences were found for group, $F(1, 43) = 5.05, p = .03, \eta^2 = .105$; for parent, $F(1, 43) = 4.45, p = .04, \eta^2 = .094$; and for type of infant-related event, $F(3, 129) = 4.90, p = .003, \eta^2 = .102$. The interaction effect between parent and group, group and event type, and parent and type of event were not significant. The findings that there is no significant interaction between group and parent and the descriptive data in Table 4 indicate that the less adequate responsivity in the risk group than that in the comparison group was due to both mother and father behavior. When each type of infant event was analyzed separately, it was found that just as for mothers alone, parental responsivity to all types of infant events was less adequate in the

| TABLE 4. Number of Infant-Related Events When Interacting With Mother and Father and Adequacy of Mothers’ and Fathers’ Responsivity, in Risk and Comparison Groups (Total No. of Couples: $n = 45$) |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Type of Event                   | Risk Mother ($n = 27$) | Father ($n = 27$) | Comparison Mother ($n = 18$) | Father ($n = 18$) |
|                                 | $M$ (SD)         | $M$ (SD)        | $M$ (SD)        | $M$ (SD)        |
| Infant-related events           |                 |                 |                 |                 |
| Negative emotions/distress      | 4.56 (5.10)     | 4.89 (5.24)     | 3.94 (5.77)     | 4.33 (2.79)     |
| Bids for attention              | 7.30 (4.79)     | 7.89 (6.58)     | 5.94 (5.17)     | 7.83 (8.38)     |
| Needs for instrumental help     | 4.81 (3.89)     | 6.63 (6.61)     | 5.61 (5.92)     | 6.72 (7.66)     |
| Physiological events            | 0.81 (1.47)     | 1.00 (1.66)     | 0.72 (1.02)     | 0.83 (1.47)     |
| All events                      | 17.48 (9.88)    | 20.41 (10.61)   | 16.22 (11.20)   | 19.72 (9.84)    |
| Maternal responsivity          |                 |                 |                 |                 |
| Negative emotions/distress      | .14 (.66)       | .16 (.84)       | .60 (.49)       | .43 (.74)       |
| Bids for attention              | .33 (.82)       | −.14 (.97)      | .45 (.84)       | .34 (.56)       |
| Needs for instrumental help     | .15 (.85)       | .12 (.71)       | .50 (.52)       | .27 (.81)       |
| Physiological events            | .19 (.63)       | −.36 (.74)      | .06 (.73)       | −.04 (.60)      |
| All events                      | .16 (.42)       | −.03 (.31)      | .43 (.29)       | .20 (.29)       |

*Infant Mental Health Journal DOI 10.1002/imhj. Published on behalf of the Michigan Association for Infant Mental Health.*
risk group than it was in the comparison group, and that on the separate ANOVAs, only the difference for negative emotion/distress was significant, \( F(1, 43) = 4.42, p = .041, \eta^2_p = .09 \). These findings are in accordance with the second hypothesis for fathers as well as for mothers.

The only significant difference between parents in adequacy of response to the various types of infant-related event was for physiological needs, \( F(1, 43) = 4.47, p = .04, \eta^2_p = .09 \). Mothers were more adequately responsive than were fathers.

**DISCUSSION**

Unexpectedly and contrary to the first hypothesis, we found that at 7 months, during the combined three different contexts (warm-up, play without toy, and play with toy), boys in the risk group did not emit more distress/negative emotions and did not require more attention and help than those of the comparison group. This was the case in all three partially overlapping samples: 78 mothers, 62 of the same mothers without psychopathology, and 45 fathers and mothers from the sample of 78. However, in accordance with the second hypothesis, the adequacy of responsivity to all infant-related events and especially to distress/negative emotions was significantly lower for both mothers and fathers in the risk group than it was in the comparison group during the studied episodes.

Children with ADHD have been found to regulate negative emotions less optimally than children in the general population (Melnick & Hinshaw, 2000). Self-regulation of negative emotions develops gradually, in part through the maturation of inborn capacities; however, parental regulation is crucial to this development in infancy, with the power to improve or disrupt it (Kopp, 1989). Negative emotionality also has been related to less disengagement of attention in infancy (Rothbart, Ziaie, & O’Boyle, 1992). Disengagement of attention is part of the developmental process of attention, which is one of the symptoms of ADHD. It is probable that less adequate responsivity by the parent to the infant’s needs, including stress/negative emotions, in families in which one of the parents has ADHD symptomatology contributes to the less optimal regulation of negative emotions found in older children with ADHD. This disrupted regulation of negative emotions also can contribute to the impairment of some aspects of the developmental process of attention.

Adequacy of parental responsivity was evaluated using a scale that is composed of parental support in stressful situations, sensitivity, emotional availability, acceptance, cooperation, and so on (Kochanska, 1998). In this scale, parental intrusiveness is a characteristic of inadequate responsivity; thus, from a different angle, our findings lend indirect support to a possible association between early intrusiveness and ADHD (Jacobvitz & Sroufe, 1987).

The current results are in line with previous findings on impaired parental-interaction patterns with preschool- and school-aged children with ADHD (Anderson et al., 1994; Barkley, 1985; Mash & Johnston, 1982). In these studies, about 35% of the parents of children with ADHD were expected to have ADHD themselves (Biederman, Faraone, Keenan, & Tsuang, 1991). The present findings suggest that this less adequate parental responsivity may date from infancy and be a consequence of their ADHD symptomatology, and moreover, at least in some situations, be independent of the infant’s behavior.

No difference was found between risk and comparison groups in the percent of maternal psychiatric disorders, and our findings held even when the comparisons were limited to those mothers in both groups without psychopathology. These findings are in line with those of
Woodward et al. (1998) and of Murray and Johnston (2006), according to which psychopathology does not account for all the differences in lax parenting in families at risk for ADHD.

The findings that both mother and father responsivity was less adequate in the risk group than it was in the comparison group, even though only fathers had on average about 10 ADHD symptoms, are in line with previous findings that parental functions are disrupted in families in which one of the parents has ADHD (Biederman et al., 2002; Minde et al., 2003; Weiss et al., 2000). Moreover, our findings hint at the possibility that the “direction of effects” in lax parenting is not necessarily always due to the child’s behavior. Rather, the findings are more compatible with studies that point to an association between parenting in infancy and the increased risk for ADHD in early childhood (Carlson et al., 1995; Jacobvitz & Sroufe, 1987; Morell & Murray, 2003). These findings, and those of Ninowski et al. (2007), indicate that as a preventive measure, perhaps more attention should be directed to families in which a parent has ADHD and that the intervention should begin when the child is an infant.

Differences were found between mothers and fathers in the two groups. Mothers were more adequately responsive overall than were fathers, and especially so when the infant was in physiological need. These findings are similar to previous studies in which mothers were found to be more sensitive than were fathers (Field, Vegar-Lahr, Goldstein, & Scafidi, 1987; Jacobs, 1998; Lamb, 1997).

Attrition rate in this study was quite high, mostly due to technical problems with the equipment during one of the three tasks and not related to the participants (We used three cameras to cover the room and the interactions.) However, note that more families in the risk group ($n = 19$) than those in the comparison group ($n = 4$) did not agree to come to the laboratory. Although the subgroups in the present study did not differ in the main demographic characteristics and number of father’s symptoms from the sample assessed at home, we do not know if and how the results were affected by this attrition rate.

**Limitations of the Study**

At this point of the longitudinal study, we cannot tell which of the children will develop ADHD. When diagnosed, it will be of interest to study the correspondence between the parent’s behavior and that of the children who do and who do not develop ADHD. As is true of many high-risk studies starting in early infancy, the sample size is small, especially for the sample of fathers. In addition, only boys were assessed in this study.

As mentioned, mother–infant interaction episodes occurred in the first laboratory session and father–infant interaction episodes in the second session. Thus, the findings of no interaction between group and parent gender could be a result of the order effect or the older age of the infant. In addition, although three parent-interaction contexts were studied, information from additional contexts in the lab and at home with other infants and other coding systems as well as information on infant’s temperament and other parental relevant variables are needed to support these findings.

In conclusion, based on interaction in the warm-up and two play sessions, it was found that although 7-month-old infants at risk for ADHD did not differ from a comparison group in the rate of emission of distress/negative emotions and other infant-related events, they received less adequate responsivity from their parents to these events than did comparison-group infants, especially for distress/negative emotions. These findings indicate that already at a very early age, children in a family in which one of the parents has ADHD symptomatology are at risk for less
optimal parenting than are infants in the general population. This study invites speculations that less optimal parenting can increase the likelihood of ADHD where there is genetic liability or can, as implied by Sroufe (1997), in some cases even cause ADHD symptoms in their children without such a liability.

REFERENCES


