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ORIGINAL PAPER

Patricia Trautmann-Villalba · Miriam Gschwendt · Martin H. Schmidt · Manfred Laucht

Father–infant interaction patterns as precursors of children's later externalizing behavior problems

A longitudinal study over 11 years

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Abstract *Aim* This study examined the extent to which fathers' and infants' interaction behavior were related to children's externalizing behavior problems at age 8 and 11 years. *Methods* In a prospective longitudinal study of children at risk for later psychopathology, 72 fathers and their 3-month-old children were videotaped and evaluated during a standardized playing and nursing situation. Externalizing behavior problems at age 8 and 11 years were assessed using Achenbach's Child Behavior Checklist. *Results* In the high externalizing group, fathers were found to be less responsive and less sensitive (the latter only with respect to girls) during early interaction than fathers of the low externalizing group, while children were more positive with their fathers. Furthermore, low scores on the interaction pattern of "sensitive fathering/negative infant" and high scores on the "nonresponsive fathering or active infant" pattern were associated with more externalizing problems. *Conclusion* These findings suggest that father and infant interaction behaviors during early infancy may predict later problem behaviors at school age, although the mechanisms underlying this relationship have yet to be identified.

Key words child psychiatry · externalizing behavior problems · father–infant interaction · longitudinal study

Introduction

Previous research on parenting emphasized the role of the mother and her impact on child's mental health. In the last few decades, the influence of the father has been increasingly acknowledged, reflecting the changes in family structure and the father's role. However, even in studies where the father's impact on child development has been a major research issue, the emphasis has often been on father's absence, psychopathology, antisocial personality, substance abuse, or criminality and its genetic transmission (DeKlyen et al. 1998a). Frequently, the differences in the mother–child and father–child interactions have been the focus of interest (Bus et al. 1997; Lamb 1977; Lindsay et al. 1997). Evidence suggests that mothers and fathers engage in different types of interaction with their infants and thus they employ different verbal and nonverbal communication and stimulation skills. For example, Lamb (1997) reported that mothers held their babies most frequently in order to perform caretaking functions, while fathers mostly held their babies in order to play with them. In a longitudinal study, during a home visit when the child was 2–10 months old, Grossmann et al. (2002) observed that fathers do not manage the distress of the infant. Most fathers interacted with the infant only when the baby was in a pleasant mood. They preferred physical play, and if the infant became distressed most fathers would hand over the infant to the mother.

Clarke-Stewart (1978) also found that fathers tended to engage in more physically stimulating and unpredictable play than mothers. Such interaction elicited more positive responses from infants, which means that children welcomed this type of behavior from fathers and reinforced it. Infants responded more positively to being held by fathers than by mothers, probably because mothers picked them up for caregiving, whereas fathers picked them up to play (Belsky 1979). On the other hand, babies preferred their mothers in more stressful situations (Lamb 1977). These facts suggest that infants develop different expectations and learn different behavior pat-

P. Trautmann-Villalba · M. Gschwendt
M.H. Schmidt · Dr. M. Laucht (✉)
Central Institute of Mental Health
Department of Child and Adolescent Psychiatry and Psychotherapy
P.O. Box 122120
68072 Mannheim, Germany
E-Mail: laucht@zi-mannheim.de

EAPCN 642

terns from each parent and that these two relationships have differential consequences for children's socioemotional development. However, although mothers and fathers provide different kinds of experiences for their infants, there appear to be more similarities than differences between them.

In recent years, the father–infant attachment, as a central aspect of fathering, has received increasing attention in psychological research. Although ample evidence supports the fact that infants develop attachments to their fathers, studies that focused on the significance of the father–infant attachment quality for the socioemotional development of the child have shown only weak or no significant effects of father–infant security of attachment. It was argued that the strange situation, a standard procedure to assess the security of attachment, does not capture the specific qualities of the child–father ecology, even though it is an adequate method for the assessment of the attachment to the mother (Grossmann et al. 2002). The few empirical studies about father–infant attachment and later child development that did report significant results demonstrated an independent influence of father–infant attachment on child development (Lamb 1997).

Another aspect that has attracted the attention of researchers is the level of fathers' engagement in activities with their children. Father involvement, i.e., the amount of time fathers spend with their children or the extent of their caregiving responsibilities, has been directly related to paternal sensitivity, which has in turn been found to positively influence cognitive, emotional, and behavioral child outcomes in different phases of life (NICHD 2000; Flouri and Buchanan 2003; Kindler 2002). In addition to rejection, lack of warmth and unaffectionate father–child interactions (Baker and Heller 1996), the lack of paternal involvement has also been associated with child externalizing problems, such as aggressive or antisocial behavior (DeKlyen et al. 1998a, b; Denham et al. 2000). However, most of these studies are constrained by the fact that the information about father involvement and children's problem behavior was normally obtained from the same source, which is usually the mother.

The parenting quality has been shown to play a decisive role in the development of children's conduct problems. Children who display disruptive behavior in school age, adolescence, or even early adulthood have a long history of behavior problems reaching back to early childhood (Maughan and Rutter 1998). Studies on externalizing behaviors revealed that more negative and less positive parenting would predict more externalizing problems (Belsky et al. 1998; Campbell et al. 2000). The absence of positive involvement, insensitive and intrusive control strategies, and harsh, coercive and punitive parenting are strongly implicated in the development and stability of conduct disorders, while warmth, responsiveness and sensitivity, i.e., dimensions of parenting that promote and reinforce prosocial behaviors in children, are associated with lower rates of later behavior problems.

However, involvement, as well as many parental attitudes and practices that have been linked with the onset of conduct problems, are mediated by environmental variables such as stress, social support, SES, or marital systems (DeKlyen et al. 1998a; Flouri and Buchanan 2003). In addition, several studies have described the influence of early negative emotionality or difficult temperament on problem behavior in later phases of development (Belsky et al. 1998; Burgess et al. 2003).

The primary aim of the present study was to examine associations between father–infant interaction patterns in early infancy and later externalizing behaviors in boys and girls. First, we explored the impact of fathers' behavior in the interaction with their children at the age of 3 months on the presence of externalizing behaviors at the ages of 8 and 11 years. As child characteristics (such as difficult temperament) in the first years of life may predict later conduct problems, we also analyzed the link between observed child behavior in the interaction with their fathers and later externalizing problems. Finally, we established the association between patterns of father–child interaction and child problems. Sex of the child was included in the analyses as this factor could moderate the effect of the observed behaviors on the presence of externalizing problems as well as the interaction quality, which in turn may affect the development of externalizing behaviors. All analyses were controlled for possible confounding effects of family background.

Methods

Sample

Participants in this investigation are members of the Mannheim Study of Risk Children, an ongoing longitudinal study of infants at risk for later psychopathology (Laucht et al. 1997, 2000). The initial sample consisted of 362 infants born at 8 collaborating hospitals from the Rhine-Neckar region of Germany between February 1986 and February 1988. Only firstborn singletons without severe physical handicaps, obvious genetic defects, or metabolic diseases of German-speaking parents were included in the sample. In addition, parents and infants were required to meet criteria intended to enrich and control the risk status of the sample. According to the criteria defined, the severity of organic (pre- and perinatal complications) and psychosocial risk (family adversity) was independently rated as none, moderate or severe, resulting in a 3×3 factorial design. The nine cells were of roughly equal size and sex was evenly distributed. The attrition rate was very low, with only 15 children (4.14%) being lost during the course of the study.

Of the original sample of 314 fathers living with the family at child age of 3 months, 91 agreed to participate in an additional father–infant video session in our lab. Only data from 71 father–infant dyads who fulfilled the requirements of child without severe handicaps by the age of 8 or 11 years, Child Behavior Checklist CBCL available at the 8-year and 11-year assessments, and father

Table 1 Demographic and clinical characteristics in groups with high and low externalizing behavior by age 11 years

	Low externalizing (n = 47)	High externalizing (n = 25)	$F_{(1,68)}$	P
Father's age at child birth: mean (SD)	30.8 (5.2)	29.8 (5.7)	0.54	0.466
Mother's age at child birth: mean (SD)	28.1 (3.9)	26.3 (2.4)	3.12	0.082
Psychosocial risk score[1]: mean (SD)	1.11 (1.51)	1.64 (1.58)	1.84	0.180
Obstetric risk score[2]: mean (SD)	1.57 (1.39)	1.04 (1.02)	2.38	0.128
Paternal education: mean (SD)[3]	3.07 (1.25)	2.80 (1.53)	0.81	0.370
Maternal education: mean (SD)[3]	2.83 (0.90)	2.88 (1.17)	0.86	0.357

[1] "Enriched" family adversity index as proposed by Rutter and Quinton measuring the presence of 11 adverse family factors covering characteristics of the parents, the partnership, and the family environment during a period of 1 year prior to birth

[2] Obstetric adversity score counting the presence of nine adverse conditions during pregnancy, delivery, and postnatal period such as preterm labor, asphyxia or seizures

[3] Score assessing the highest school graduation of mother or father on a 6-point scale

living with the family at these assessments were utilized in this investigation. This subgroup did not differ from the remaining sample on a number of demographic and clinical characteristics (such as noted in Table 1) except the obstetric risk score. Infants in this group had experienced a significantly higher number (P = 0.009) of adverse conditions during pregnancy, delivery, and postnatal period such as preterm labor, asphyxia, or seizures than infants of nonparticipating fathers.

Assessments

The data presented in this report were collected across an 11-year period, ranging from the time the infant was 3 months old until 11 years of age. At the age of 3 months, fathers and infants completed a 5-min standardized nursing and playing situation at our laboratory. In order to provide objective data regarding father–infant interaction patterns, videotapes of the 5-min session were recorded and rated by trained raters (kappa > 0.70) using the Categorical System for Micro-Analysis of the Early Mother–Child Interaction (Jörg et al. 1994) which had been adapted for father–infant interactions. A total of 15 measures of father–infant interaction behavior were coded, including: amount (in sec) of father's (1) smiling at the infant, (2) looking at the infant, (3) nursing (versus playing), (4) being loving, (5) being close, (6) verbal and vocal communication, (7) emotional nonresponsiveness, (8) bodily actions; and amount of infant's (9) positive vocalization, (10) negative vocalization, (11) reactive vocalization, (12) looking at the father, (13) smiling, (14) bodily actions, and (15) not calming down. For purposes of data reduction, a series of principal component analyses was conducted in order to create factorial scales of fathers' and infants' behaviors during interaction (separate analyses of father and infant measures) as well as of father–infant interaction patterns (concurrent analysis of father and infant measures). Screen plots of eigenvalues indicated the emergence of three paternal factors, two infant factors, and three interaction factors accounting for 61.4% (fathers), 56.1% (infants), and 48.5% (interaction patterns) of the common variance, respectively. Factor loadings were used to mark each factor when they met a 0.45 criterion. For fathers, a factor of positive emotionality (marked by high scores of smiling and looking at the infant and low nursing), a factor of sensitive fathering (loving, close, and vocalizing), and a factor of nonresponsive fathering (emotionally nonresponsive, bodily active) were extracted. The infant factors included a factor of positive emotionality (positive and reactive vocalization, looking at the father) and a factor of negative emotionality (negative vocalization, not calming down). The interaction factors covered a pattern of father sensitive and infant negative, a factor of positive reciprocity, and a factor of father nonresponsive and infant active.

Externalizing behavior problems were assessed using Achenbach's rating scales (Achenbach 1991) when the children were 8 and 11 years old. The CBCL was completed by the children's mother. Scores of the Externalizing Problems Scale (summarized aggressive behavior and delinquent behavior subscales) were used to assign children to groups of high versus low externalizing behavior. The high externalizing group (n = 25, 14 boys and 11 girls) was defined by T-scores ≥60 (i.e., borderline clinical range) on either assessment, while the low externalizing group (n = 47, 23 boys and 24 girls) had T-scores <60 on both assessments.

Psychosocial adversity was determined according to a risk index measuring the presence of adverse family factors. The 11 items of this index, which is an "enriched" family adversity index as proposed by Rutter and Quinton (1977), encompass characteristics of the parents, the partnership, and the family environment. Operational definitions of the risk items are reported elsewhere (Laucht et al. 1997). The number of adverse family factors was summed up yielding a family adversity score varying from 0 to 6.

Statistical analysis

In order to examine differences between high versus low externalizing children by age 11 years (as measured by the CBCL) as a function of father–infant interaction behaviors, a series of 2 (externalizing behavior group) × 2 (gender) analyses of covariance of father–infant interaction factor scores were conducted, with externalizing behavior group and gender as the between-subjects factors and family adversity as the covariate.

Results

Demographic and clinical characteristics for the externalizing behavior groups are presented in Table 1. Results indicated that groups did not differ significantly regarding maternal and paternal age and education, family adversity and obstetric risk. Results on the father's behavior during father–infant interaction (see Table 2) revealed a significant main effect of externalizing group for "sensitive" as well as for "nonresponsive" fathering ($F_{(1,67)}$ = 8.24, P = 0.005), and $F_{(1,67)}$ = 5.17, P = 0.026, respectively), but not for the father's positive emotionality ($F_{(1,67)}$ = 0.21, P = 0.886). No significant main effects emerged of gender and paternal psychosocial adversity (all P's > 0.20). At the age of three months, children from the high externalizing group had less "sensitive" and less "responsive" fathers during early interaction than low externalizing children. Fathers of the high externalizing group were found to be less close, less loving, and less communicative with their infants and appeared to be less emotionally responsive and more bodily active in the interaction with their infants than fathers of low externalizing children. In addition, a

Table 2 Father's behavior during father–infant interaction as a function of externalizing group by age 11 years: mean factor scores and SE (in parenthesis) adjusted for psychosocial risk

	Boys (n = 37)		Girls (n = 35)		Total (n = 72)	
	Low externalizing (n = 23)	High externalizing (n = 14)	Low externalizing (n = 24)	High externalizing (n = 11)	Low externalizing (n = 47)	High externalizing (n = 25)
Positive emotionality	−0.06 (0.22)	−0.09 (0.28)	0.08 (0.22)	0.03 (0.31)	0.01 (0.15)	0.03 (0.21)
Sensitive fathering	−0.12 (0.20)	−0.32 (0.26)	0.52 (0.20)	−0.66 (0.29)	0.21 (0.14)	−0.49 (0.19)
Non responsive fathering	−0.26 (0.20)	0.10 (0.26)	−0.19 (0.20)	0.54 (0.29)	−0.22 (0.14)	0.32 (0.19)

Table 3 Infant behavior during father–infant interaction as a function of externalizing group by age 11 years: mean factor scores and SE (in parenthesis) adjusted for psychosocial risk

	Boys (n = 37)		Girls (n = 35)		Total (n = 72)	
	Low externalizing (n = 23)	High externalizing (n = 14)	Low externalizing (n = 24)	High externalizing (n = 11)	Low externalizing (n = 47)	High externalizing (n = 25)
Positive emotionality	−0.10 (0.21)	0.46 (0.27)	−0.29 (0.21)	0.24 (0.30)	−0.19 (0.15)	0.35 (0.20)
Negative emotionality	−0.03 (0.21)	−0.22 (0.28)	0.25 (0.22)	−0.19 (0.31)	0.11 (0.15)	−0.20 (0.21)

Table 4 Patterns of father–infant interaction as a function of externalizing group by age 11 years: mean factor scores and SE (in parenthesis) adjusted for psychosocial risk

	Boys (n = 37)		Girls (n = 35)		Total (n = 72)	
	Low externalizing (n = 23)	High externalizing (n = 14)	Low externalizing (n = 24)	High externalizing (n = 11)	Low externalizing (n = 47)	High externalizing (n = 25)
Father sensitive & infant negative	−0.10 (0.21)	−0.31 (0.27)	0.45 (0.22)	−0.51 (0.30)	0.18 (0.15)	−0.41 (0.21)
Father positive & infant positive	0.05 (0.19)	0.30 (0.24)	0.31 (0.19)	−0.16 (0.27)	0.18 (0.13)	0.07 (0.18)
Father nonresponsive & infant active	−0.18 (0.18)	0.11 (0.23)	−0.20 (0.18)	0.38 (0.26)	−0.19 (0.12)	0.24 (0.17)

significant externalizing group × gender interaction with "sensitive" fathering was found ($F_{(1,67)}$ = 4.21, P = 0.044), indicating that only the fathers of the high externalizing girls behaved less sensitively as compared to fathers of girls from the low externalizing group.

As presented in Table 3, a significant main effect of externalizing group for infant behavior during father–infant interaction emerged for positive emotionality, indicating that high externalizing children showed more positive vocalization and looked more at their fathers during interaction than low externalizing children ($F_{(1,67)}$ = 4.71, P = 0.034). There were no significant group differences regarding negative emotionality ($F_{(1,67)}$ = 1.52, P = 0.222). Furthermore, no significant main effects of gender and paternal family adversity were obtained (all P's >0.30). Tests of the interaction revealed no significant externalizing group x gender interactions (all P's >0.60).

Results on father–infant interaction patterns (see Table 4) revealed a significant main effect of externalizing group for the factor of "sensitive fathering and negative infant" ($F_{(1,67)}$ = 5.23, P = 0.025) and for the factor of "nonresponsive fathering and active infant" ($F_{(1,67)}$ = 4.16, P = 0.045). No significant group effect could be found for the pattern of positive reciprocity ($F_{(1,67)}$ = 0.23, P = 0.632). Thus, the early father–child interaction of high externalizing children appeared to be characterized by two similar interaction patterns, one involving fathers being less close, less loving, and less communicative while infants are less negative, the other involving fathers behaving in an emotionally unresponsive manner and being bodily active towards their infant when the infant is more vocally and bodily active. No significant main effects of gender and paternal psychosocial adversity and no significant externalizing group × gender interactions were observed (all P's >0.10).

Discussion

This study explored the extent to which characteristics of the early father–child interaction predicted later externalizing behavior problems of boys and girls at school age. The results indicated that both father and infant interaction behavior as well as patterns of interaction in early infancy were related to

later problem behaviors at the ages of 8 and 11 years. When the single effect of the father's behavior was evaluated, children who were in the high externalizing group at age 8 or 11 years were found to have fathers who had been less responsive during early interaction. In addition, the fathers of girls in this group were observed to be less sensitive in the interaction at 3 months. This finding suggests a higher susceptibility in young girls to a father parenting style that is characterized by a lack of positive emotionality. It could also be suggested that if externalizing behaviors in childhood and adolescence are associated with early negativity and difficult temperament (Belsky et al. 1998; Burgess et al. 2003), the lack of sensitivity could reflect a gender-specific response of the father to girls' noncompliant behavior during the interaction.

Children who experience responsive and warm parenting learn appropriate prosocial strategies for influencing others and for managing emotions (DeKlyen 1998a). On the other hand, children showing externalizing behaviors face an increased risk of being involved in negative parent–child exchanges. The presence of externalizing behaviors could be stressful for parents and elicit negative, insensitive, or inconsistent parenting (Campbell et al. 2000, Keenan and Wakschlag 2001). The experience of an insensitive, intrusive, negative and unresponsive parent may exacerbate the child's own negativity, which in turn will contribute to aggravate this problem-inducing parenting style. Thus a cycle of negative reinforcement might be established (Patterson 1982). This process has been shown to be particularly relevant for the occurrence of conduct disorders (Morrell and Murray 2003) and has been associated with high levels of family adversity and stress (i.e., poverty, adverse family structural characteristics, young age of mother, and stressful life events).

Accordingly, in addition to the father's behavior, the child's interaction behavior at 3 months was found to be associated with later outcome, although in an unexpected way: Contrary to the literature suggesting that child negativity predicts later externalizing behavior (Campbell et al. 2000; Stormashak and Bierman 1998), the high externalizing children in our study showed more positive behavior in the interaction with their fathers than less externalizing children. However, this behavior has to be interpreted in the light of the corresponding interaction pattern, which indicated that in later externalizing children less negative and more positive infant behavior was associated with less paternal sensitivity. Thus, a possible explanation relates to the phenomenon of negative reciprocity between infant and caregiver behavior (Bell and Harper 1977). More positive engagement of the infant might reflect a compensatory response to the father's insensitivity, which has been shown to be predictive of later behavior problems. A similar self regulatory response of the infant has been described in the still-face experiment, which involves a lack of vocalization as well as a suspension of facial and other gestures while the caregiver maintains eye contact with the infant (Toda and Fogel 1993). Infants typically respond by making bids to reengage their interaction partner, and only when this fails they show less smiling and become neutral to negative in affect. The suggestion that negative reciprocity may underlie the behavior of later externalizing children in interaction with their fathers was further supported by the finding that a second interaction pattern characterized by nonresponsive fathering and higher infant activity was associated with more externalizing problems in children aged 8 and 11 years.

Most of the results presented here are in accordance with the previous research that identified the role of negative parenting as a predictor for conduct disorders (DeKlyen et al. 1998a; Denham et al. 2000; Maughan and Rutter 1998; Belsky et al. 1998; Patterson 1982; Pettit et al. 1997). The majority of these studies, however, described the interaction with toddlers or older children and their mothers. Externalizing problems could begin as early as the toddler period, thereby stressing the child's own contribution to the development of later behavior problems. In this paper we report on the interaction between 3-month-old babies and their fathers, indicating a very early beginning of dysfunctional parent–child relationships (in this case with the father), which have a significant influence on the long-term development of children. This finding highlights the importance of early intervention in order to prevent problem behaviors in later years.

These results have to be considered in light of several limitations of the study. The fathers and their children were observed during a 5-min session in a standardized laboratory setting. Questions arise about whether observational data gathered under these restricted conditions might reflect natural or typical interaction behavior of the participants. So far, the literature is inconsistent as to the validity of direct observational techniques in artificial settings (Gardner 2000). The results presented here are in line with evidence from different settings and show plausible and expected differences in patterns of interaction and their association with later child development. Another potential limitation is that a personality factor, e.g., temperament, may underlie both the child externalizing behavior and the differences in father–child interactions. Further investigation is needed to determine how individual characteristics of the child could affect the exchange between fathers and their children. Finally, the sample size of fathers participating in this investigation is small compared to the total study sample and might be selective. Due to the fact that infants in this subgroup had experienced a significantly higher number of adverse pre- and perinatal conditions than infants of nonparticipating

fathers, it remains uncertain whether the results can be generalized.

In conclusion, our results provide further evidence for the father's contribution to the occurrence of psychopathology in his children. The influence of the father–child interaction appears to be similar to that of the mother–child interaction: Parenting practices and patterns of interaction are substantial factors for later child maladjustment. However, the differential mechanisms through which these effects are exerted by mothers and fathers have not yet been clarified. To disentangle the separate and combined contributions of paternal and maternal characteristics as well as to identify moderating variables remains an important target of future research on the father's role in child and adolescent psychopathology.

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