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Attachment Quality in Very Low-Birthweight Premature Infants in Relation to Maternal Attachment Representations and Neurological Development

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SYNOPSIS

Objective. To study the development of attachment in very low-birthweight preterm infants with respect to neurological development and maternal attachment representations. ***Design.*** Emotional development in a high-risk sample (N = 79) of very low-birthweight preterm infants (≤ 1,500 g) is reported. The quality of attachment in preterm infants was classified using the Strange Situation Procedure at 14 postnatal months (corrected for prematurity) and was associated with maternal attachment representation assessed with the Adult Attachment Interview at 6 postnatal months. Neurological development at 14 months was taken into account. ***Results.*** The distribution of the quality of attachment in preterm infants (60.3% secure, 23.5% insecure – avoidant, 2.9% insecure – ambivalent, 10.3% insecure – disorganized, and 2.9% not classifiable) was comparable with results of studies of term infants. There was no correspondence between maternal representations of attachment and infant quality of attachment. However, neurologically impaired infants were more often insecurely than securely attached. ***Conclusions.*** Very low-birthweight preterm infants more often develop an insecure quality of attachment if their neurological outcome is impaired. Therefore, minimizing risk factors for the development of neurological deficits may have a preventive effect both on the somatic and on the emotional development of high-risk infants.

INTRODUCTION

The results of neonatal intensive care are impressive in terms of improvements in morbidity and mortality rates in very low-birthweight (< 1,500 g) and even extremely low-birthweight (< 1,000 g) infants. Parents and neonatologists are concerned about the consequences of the survival of such

very immature infants in terms of motor, mental, behavioral, and emotional development. The risks of later neurological impairment (such as cerebral palsy) and of behavioral problems are well known (Hille et al., 2001; Huber et al., 1996; Knorpp et al., 1997; Riegel, Orth, Wolke, & Österlund, 1995; Saigal, Stoskopf, Streiner, & Burrows, 2001; Sajaniemi et al., 2001; Stewart, Rifkin, Maess, & Kirkbride, 1999; Waber & McCormick, 1995; Weisglas-Kuperus, Koot, Baerts, Fetter, & Sauer, 1993; Wolke, Ratschinski, Orth, & Riegel, 1994).

Studies of emotional development during the first year of life have focused on behavioral and emotional organization, or on mother – child interaction during the first 3 months, and on the interaction patterns of parents and children during the first 12 months (Barnard, Osofsky, Beckwith, Hammond, & Appelbaum, 1998; Garner & Landry, 1992; Landry & Chapieski, 1988; Stevenson, Roach, ver Hoeve, & Leavitt, 1990). These studies have found differences in the behavioral organization of preterms in comparison to term infants. Among other things, preterms are less attentive, display less positive affect, and exhibit a prolonged reaction time to stimuli.

Other studies have focused on long-term development and the effects of social factors on mental and motor development (Largo, 1996; Largo, Graf, Kundu, Hunziker, & Molinari, 1990; Sticker, Brandt, & Höckey, 1998). These studies have consistently shown that social and socioeconomic circumstances of parents are positively correlated with motor and mental development in preterm infants weighing more than 1,500 g at birth (Laucht, Esser, & Schmidt, 1997; Weisglas-Kuperus, 1992). Studies conducted until school age have demonstrated that stressors in the environment and a lack of age-appropriate stimulation can undermine the developmental prognosis of very low-birthweight premature infants (Barnard et al., 1998; Escalona, 1982; Minde, 1993; Sandén Eriksson & Pehrsson, 2002; Spiker, Ferguson, & Brooks-Gunn, 1993).

Maternal behavior can, on its own, affect the development of mother – child interaction, and the postnatal psychological state of the mother has a well-known effect on development (Coleman, Nelson, & Sundre, 1999; Cooper, Murray, Hooper, & West, 1996; Murray, 1992; Osofsky & Emde, 1993). During the first 3 months, the quality of mother – child interaction can be a very important predictor of infant development, and together with psychosocial and organic factors it partly explains variance in motor and mental development of infants with biological and social risk factors (Esser et al., 1990; Laucht, Esser, & Schmidt, 1993, 2003).

Attachment Research and Prematurity

In their longitudinal research on German term infants, K. E. Grossmann, Grossmann, Huber, and Wartner (1981) found that 63% were securely and

37% were insecurely attached to their mothers. This distribution of term-infant attachment quality is consistent with data reported in a meta-analysis by van IJzendoorn and Kroonenberg (1988).

There have been several studies of attachment development in high-risk children, but the results on attachment quality of preterm infants, in particular very and extremely low-birthweight preterms, are inconsistent and contradictory (see review by Buchheim, Brisch, & Kächele, 1999). Some studies have found no differences in attachment quality between preterm and term infants. Rode, Chang, Nian, Fisch, and Sroufe (1981) found that 70.8% had secure, 12.5% insecure – avoidant, and 16.7% insecure – ambivalent attachment. The findings of Minde, Corter, and Goldberg (1985) were quite similar, with 71% of term infants being securely attached. Comparable results were documented by Goldberg, Perrotta, Minde, and Corter (1986; 75% secure and 25% insecure attachment); Butcher, Kalverboer, Mindera, van Doormaal, and Wolde (1993; 71% secure attachment); and Easterbrooks (1989; 63% secure attachment; see comparable results in Frodi, 1983; Frodi & Thompson, 1985). On the other hand, some studies have found differences in attachment quality between term and preterm infants, with a higher percentage of insecure attachment among preterms than among term infants. Plunkett, Klein, and Meisels (1988) found a higher percentage of insecure preterm infants, especially in infants with a high medical risk score (37% insecure – ambivalent) in contrast to children with low-risk factors (only 5% insecure – ambivalent). Berlin (1991) reported more insecure attachment, but unfortunately that study did not differentiate between attachment classifications, nor did it indicate percentages. Furthermore, no details about medical complications were reported, so the validity of the study is open to question. Wille (1991) focused on mothers from low socioeconomic backgrounds (uneducated, highly stressed single mothers with little social support) and on their high-risk infants who had received long-term ventilator support or who had suffered intraventricular hemorrhage. These infants more often showed an insecure attachment. Furthermore, Wille (1988, 1991) examined mother – child interaction in term and preterm infants at 6 months and at 1 year. Mothers of term infants displayed more positive affect and less anxiety toward their infants than did mothers of preterms. In this study, the medical status of the preterm (more or fewer neonatal risk factors) did not differentiate between secure or insecure quality of attachment.

Prematurity, low socioeconomic status, and psychosocial factors combine risk for emotional development (Weisglas-Kuperus, 1992). Minde (1993) reanalyzed a sample of preterm infants at age 4 years who had been classified as insecurely attached at 12 months in the Strange Situation Procedure. Retrospectively, he found that many children fit Main's (Main & Solomon, 1986) *D* classification (disorganization and disorientation). However, the sample was too small to permit generalization. A study by

Mangelsdorf et al. (1996) found no significant differences in quality of attachment between term and preterm infants at 14 months (corrected age for prematurity), but at 19 months (corrected age for prematurity) there were significant differences, with less secure attachment patterns in preterms than in term infants (47% of preterms with secure, 26.5% with insecure – avoidant, 26.5% with insecure – ambivalent attachment). Unfortunately, although Mangelsdorf et al. stated that perinatal and postnatal risk factors were recorded, the researchers neither reported the data, nor were they taken into account in the statistical evaluation.

In summary, published results demonstrate that the question of attachment quality in preterm infants is not yet decided. Furthermore, research on the development of attachment quality must take into account parental attachment representations along with perinatal and postnatal risk factors with complications during inpatient and subsequent treatment. None of the reported studies examined maternal attachment representation as a moderating variable in the development of preterm infant attachment. In studies of term infants, mothers with secure attachment representations were found to be more sensitive in reading their infants' signals and more often had securely attached infants. Therefore, the status of maternal attachment may partly explain the attachment quality of infants via maternal sensitivity in the mother – infant interaction. Because the signals of preterm infants are more difficult to read, maternal attachment and sensitivity could be an even more important factor in the development of attachment quality in very low-birthweight preterm infants than it was found to be in term infants. Very low-birthweight preterm infants may be at higher risk to develop an insecure, disorganized pattern of attachment as mother – preterm interaction could be more difficult for two potential reasons: maternal anxiety about the development of the preterm infant, and neonatal risk factors such as lack of oxygen, which can directly affect the maturation and functioning of the preterm infant's brain.

Developmental Risk Model

This study is based on a developmental risk model. Preterm delivery is considered to have as strong an impact on caregivers as on the preterm infant (Affleck, Tennen, & Rowe, 1991). Parental representations of attachment and caregiving could serve as risk or protective factors, affecting parent – child interaction and the infant's motor, mental, and emotional development. Severity of prematurity and neonatal complications (such as duration of ventilation, surgery, or cerebral hemorrhage) are seen as factors that can affect long-term development. The fundamental model of the study is transactional, which implies that the process of development and the quality of the outcome can be influenced by parent – child interaction,

and that the development of the child influences the parents' behaviors as well (Wijnroks, 1999).

For parents, extreme preterm delivery (for example, after only 24 weeks of gestation) can be a traumatizing experience that is followed by a phase of extreme psychological disturbance (Calam, Lambrenos, Cox, & Weindling, 1999). Many parents feel shocked and depressed over the unexpected termination of the pregnancy, which they had hoped would result in a normal delivery at term. In terms of diagnostics with the International Classification of Diseases, these parents show some signs of posttraumatic stress disorder (Jotzo, 2001). In our clinical experience, flash backs; intrusions; feelings of anger, guilt, and shame; anxiety; depression; and deterioration in self-esteem and self-confidence are often diagnosed (Brisch, Kächele, & Pohlandt, 1993; Pianta, Marvin, & Morong, 1999). Some parents even begin anticipatory mourning as if they had already lost their child, regardless of the infant's actual state of health. Preterms, particularly those with very low or even extremely low birthweight, are prone to greater risk during their stay in the neonatal intensive care unit (NICU), leaving the parents in a very anxious and uncertain state, not knowing whether they will lose their child, e.g., to infection or cerebral hemorrhage. Furthermore, parents feel detached and separated from their infants, as they cannot or do not feel that they can interact as freely with their infant as they would do with a term infant at home. Many years ago, clinicians such as Kaplan and Mason (1960) pointed out that, at the very least, mothers who show signs of an acute emotional crisis need some kind of psychotherapeutic support. Some parents report more stress than others, as previous indexes of loss and separation were reactivated by the preterm delivery and by the unexpected separation from their infant (Brisch, 2002a, 2002b). If parents do not cope with these experiences, they may remain distressed by their old memories and may not feel free to interact with their infant and to concentrate on building a relationship (Ainsworth & Eichberg, 1991). Furthermore, if former parental conflicts are reactivated then the attachment process with their newborn could deteriorate, and this could in the long term affect the development of the child (Pierrehumbert, Nicole, Muller-Nix, Forcada-Guex, & Ansermet, 2003).

The somatic, cognitive, behavioral, and emotional development of very low-birthweight premature infants were evaluated in a longitudinal study at different points in time during the first 24 months of life. Maternal state of mind with respect to attachment was assessed at 6 months of infant's corrected age. At 14 months (corrected for prematurity) the attachment quality of the infants and their neurological development were examined. We tested the hypothesis that preterm infants are more prone to insecure attachment quality than are term infants. We predicted that mothers with secure attachment representations would more often have securely at-

tached preterm infants than would mothers with insecure ones. Perinatal and postnatal risk factors and neurological outcome were expected to have a deleterious effect on infant motor, mental, and emotional development.

METHODS

Recruitment and Sample Description

Based on the reported statistical strength of association between quality of infant attachment and maternal state of mind with respect to attachment in studies involving term infants (such data being unavailable for preterm infants), a total sample size of 80 mothers and preterm infants was calculated by power analysis (Cohen, 1988), assuming a medium effect size. If preterm infants met the inclusion criterion of very low birthweight, infants and their mothers were recruited from the NICU and from the maternity ward several days after delivery. A total of 80 middle-class German mothers with 99 very low-birthweight premature infants were recruited to take part in the longitudinal study. One mother was excluded after recruitment because of drug addiction. The total sample size available for analysis at the first point in time of the study was 79 mothers with their infants. Other exclusion criteria included language difficulties, a history of psychiatric problems, and treatment for psychiatric disorders.

During the follow-up period, 10 singletons dropped out, 3 because the infants died, and 7 others because the mothers felt that the follow-up evaluations would be too stressful (the family had moved away). In addition, 7 twins dropped out, 3 because of death during the first year of life. Because of the varying numbers of dropouts at different points during the follow-up period, the sample size varied, but all participants available at a specific point in time were included for statistical analysis. For purposes of comparison, only the data on the firstborn child are reported in this paper (that is, in the case of triplets, for example, only the firstborn infant was considered). The birthweights in the subsamples of singletons and multiplets showed no statistically significant differences, $t(77) = -1.55$, *ns*; nor did the weeks of gestation, $t(77) = -1.07$, *ns*.

The mean birthweight of the firstborn infants was 944 g (*SD* = 284, *range* = 320–1490), and the mean weeks of gestation was 27.6 (*SD* = 2.7, *range* = 23–35). The sex distribution of the firstborn preterm infants was 45.6% male and 54.4% female. The mean birthweight of the firstborn infants of the mothers in the dropout group was 970 g (*SD* = 294, *range* = 320–1410), and the mean weeks of gestation was 26 (*SD* = 1.8, *range* = 24–30). There were no differences between the study and the dropout groups:

birthweight, $t(77) = .09$, *ns*; weeks of gestation, $t(77) = .85$, *ns*. All infants were high-risk, very low-birthweight preterm infants who spent a mean duration of 91 days in hospital (*SD* = 69.33, *range* = 8–383) and were intubated and ventilated for a mean duration of 10 days (*SD* = 17.3, *range* = 0–88). All perinatal and postnatal risk factors showed a mean of 3.5 points (*SD* = 3.5, *range* = 0–20) on the summary score of the Nursery Neurobiologic Risk Score (NBRS; Brazy, Eckerman, Oehler, Goldstein, & O'Rand, 1991).

The mean maternal age was 31 years (*SD* = 4.5s, *range* = 18–41). Most of the mothers (86.1%) lived with a partner, 10.1% were single mothers, 2.5% were separated from their partners, and 1.3% gave no information. Regarding education, 75.9% of the mothers had at least 10 years of schooling, 22.8% had a high school diploma, and 1.3% had no secondary school qualifications. In terms of professional training, 10.1% had a university degree, 74.7% had completed an apprenticeship or advanced technical college, and 15.2% had not completed any professional training.

Maternal Attachment Representations

Maternal attachment representations were assessed with the Adult Attachment Interview (AAI; George, Kaplan, & Main, 1985), a semistructured interview that asks the adult to remember childhood experiences with attachment figures, especially with parents; to describe attachment-related experiences from childhood; and to evaluate the importance of these experiences for their development, current functioning, and parenting. Verbatim transcriptions of the audiotaped interviews were used for the assessment. Main and Goldwyn (1982) guidelines were used. Two independent raters who were trained in the Kobak Q-sort coding and classification system coded the interviews (Kobak, 1993; Kobak, Cole, Ferrez-Gilles, Fleming, & Gamble, 1993). The coders had no information about the mothers. Interrater reliability among the coders was satisfactory, $r_s = .83$; a third independent coder adjudicated disagreements. The correspondence between the Main and Goldwyn coding system and the Kobak Q-sort method when looking at secure versus insecure classifications was 91%, and 79% when comparing a threefold attachment classification (secure, dismissing, preoccupied), $\kappa = .65$. The interview was assessed by two independent raters based on four ideal prototypes. Based on the correlation between the rated Q-sort and the ideal prototype Q-sort, the interview was classified as *secure*, *dismissing*, or *preoccupied*.

Mothers were interviewed at home using the AAI when their preterm infant was 6 months old (corrected age for prematurity). This age was chosen so that the AAI would not be influenced by the acute turmoil of the ex-

perience of giving birth prematurely. At that age some infants already exhibited obvious developmental delays, indicating that something in their neurological development might be impaired as sequelae of perinatal or postnatal risk conditions. Such developmental delay was a source of great worry for the infants' mothers. Because of this, maternal state of mind with respect to attachment might also be affected by the neurological developmental of their infants, even when performing the AAI.

Infant Attachment

Infant attachment quality was measured using the Strange Situation Procedure (SSP; Ainsworth, Blehar, Waters, & Wall, 1978), which was carried out at 14 months (corrected age for prematurity). The SSP is a videotaped, standardized laboratory observation consisting of eight increasingly stressful episodes that involve the mother, the preterm infant, and a female stranger. During the procedure, the mother is twice asked to leave her infant, and twice they are reunited. Based on the videotape, the infant's behavior toward the mother is classified into one of four attachment strategies: *secure* (*B*), *avoidant* (*A*), or *ambivalent/resistant* (*C*), using the criteria of Ainsworth et al. The fourth category of *disorganized attachment* (*D*) is rated according to criteria provided by Main and Solomon (1990). If the scoring for disorganized behavior in the SSP was ≥ 5 on a 9-point scale, the infant was assigned to the *D* classification. This coding implies that the level of disoriented and disorganized behavior observed and coded during the *entire* sequence of the videotape of the SSP justified the infant's assignment to the *D* classification (Barnett et al., 1999; Main & Solomon, 1986). Disorganized infant behavior patterns are characterized by contradictory behavior patterns, interrupted movement, freezing and stilling, slowed movement, stereotypes, strong fear in presence of the parent, among other behaviors (Main & Solomon, 1990). Infants who could not be classified were placed in a *not classifiable* (*NC*) category.

The coders were blinded and received no information about the mother or the infant. The coders were, however, informed of any severe vision or hearing impairment (Barnett et al., 1999).

Neurological Development

At the follow-up, when the SSP was complete, all infants were given an extensive neurological examination by a child neurologist. The neurological examination was based on a very differentiated examination manual that forced the examiner to test in detail all central and peripheral neurological systems, including hearing, vision, coordination, muscle tone, and

all types of pareses. A total score was derived from the scoring of the results in the neurological subsystems, which formed the basis for the classification of the level of neurological impairment (e.g., impairment in the motor system, central nervous system, signs of ataxia, sensory deficits). A score was given based on the quantity and severity of symptoms, resulting in a summary score of neurological impairment, from 0 (*minimal*) to 27 (*maximal*). Based on the summary score a categorical classification was derived that resulted in the four categories of *healthy* neurological development (0 points), *functional* neurological impairment (1–2 points), *mild* neurological deficit (3–6 points), *severe* neurological deficit (7–10 points), *very severe* neurological deficit (> 10 points). These categories followed the classification system of Hagberg, Hagberg, and Olow (1975a, 1975b). There was a significant association between the results of the scoring and classification system of neurological impairment and the clinical diagnosis of neurological deficit, $H = 60.03$ (4), $p < .001$.

Perinatal and Postnatal Risk Factors

All important perinatal and postnatal risk factors were recorded, and a total score was derived using the NBRS (Brazy et al., 1991; Brazy, Goldstein, Oehler, Gustafson, & Thompson, 1993). This scoring is based on a summary score that was derived using information on quantity as well as quality of possible perinatal and postnatal risk factors, such as birthweight, weeks of gestation, gestational age, Apgar scores, acidosis, days of ventilation, hypoglycemia, epilepsy, intraventricular hemorrhages, periventricular leucomalacia, and days in hospital. In previous studies, the results of the NBRS predicted outcome of very low-birthweight infants (Brazy et al., 1991; Thompson et al., 1994).

RESULTS

Attachment Quality of Preterm Infants

The findings of the classification of attachment quality ($n = 70$) revealed 64.7% of the preterm infants were classified as secure (*B*), 23.6% as insecure – avoidant (*A*), 8.8% as insecure – ambivalent (*C*), and 2.9% as not classifiable (*NC*). An additional classification of disorganized attachment (*D*) was assigned to 7 infants, 3 infants with secure and 4 infants with insecure – ambivalent quality of attachment. All infants placed in the *NC* category ($n = 2$) were neurologically disabled, but none showed sufficient signs of organized attachment behavior to be assigned to categories *B*, *A*, or *C*, nor

sufficient disorganized behavior to be assigned to the *D* category. If disorganized attachment is considered as a separate insecure category of attachment, the frequency of attachment quality of the infants displayed the following distribution: 60.3% secure, 23.6% insecure – avoidant, 2.9% insecure – ambivalent, 10.3% disorganized, and 2.9% not classifiable.

Maternal Attachment Representations

From the total sample, data were obtained on 71 mothers using the AAI. The results showed that 56.3% of the mothers could be classified as autonomous – secure, 26.8% as dismissing, and 16.9% as preoccupied.

Based on the Kobak Q-sort, 33.8% of the mothers' interviews were classified into the *indexes-of-loss* category. In the group of mothers who were assigned to the indexes-of-loss category, 40.9% were classified as autonomous – secure, 22.7% as dismissing, and 36.4% as preoccupied. Statistical analysis revealed significant group differences between maternal attachment representation and the values of indexes-of-loss scoring in the Kobak evaluation, $F(2, 66) = 3.82$, $p = .03$. Mothers with a preoccupied attachment classification were significantly more often assigned to the indexes-of-loss category than were mothers who had a secure or dismissive attachment representation, χ^2 (2, $N = 66$) = 6.62, $p = .04$.

The perinatal and postnatal neurobiological risk factors of the infants showed no significant group differences within the distribution of maternal attachment representations, $H = 3.96$ (3), $p = .27$, nor did the values of the Kobak classification system of maternal attachment correlate with the total NBRS. However, the values of the Kobak classification system of maternal attachment revealed a small but significant correlation with the summary score of the infants' neurological examination at 14 months (corrected age): The lower the score for symptoms of neurological impairment, the higher was the Kobak classification value for a secure maternal representation, $r_s(64, N = 66) = –.28$, $p = .02$. Similarly, the higher the score for symptoms of neurological impairment, the higher was the Kobak classification value for a preoccupied maternal state of mind with respect to attachment, $r_s(64, N = 66) = .27$, $p = .03$.

Attachment Quality of Preterm Infants and Maternal Attachment Representation

The proportional distribution of securely or insecurely attached preterm infants is similar and comparable to what was found in samples of term infants, and the proportional distribution of maternal representations of attachment is comparable to that found in no-risk samples of mothers with term infants. However, in our high-risk sample, no correspondence

between attachment quality of preterm infants and maternal attachment representation was found, χ^2 (1, N = 66) = .48, *ns* (two-tailed), Fisher's Exact Test p = .60 (one-tailed).

Mothers with secure representations of attachment had more securely (64.9%) than insecurely attached infants (35.1%). Mothers with an insecure representation of attachment also had more securely than insecurely attached infants (71.4% vs. 28.6%), χ^2 (1, N = 65) = .58, (two-tailed), Fisher's Exact Test p = .39 (one-tailed).

Perinatal and Postnatal Risk Factors and Neurological Outcome

The mean perinatal and postnatal risk factors revealed a mean score of 3.22 (*SD* = 2.98, *range* = .00–11.00) in the NBRS (Brazy et. al., 1993). The total scores for perinatal and postnatal risk factors showed significant mean group differences within the five different levels of neurological outcome, H = 12.99 (4), p = .01. At 14 months (corrected for prematurity), 31.9% of the preterm infants showed healthy neurological development, but 40.6% had functional impairments, 18.8% were mildly disabled, 7.2% were severely disabled, and 1.4% (n = 1 infant) was very severely disabled.

Infant Attachment Quality and Perinatal and Postnatal Risk Factors

Despite significant group differences of the mean scores of perinatal and postnatal risk factors within the groups of neurological outcome, there was no significant group difference in mean scores for perinatal and postnatal risk factors within the distribution of secure versus insecure attachment quality of the preterm infants such as was found for neurological outcome, t(63) = .02, *ns* (two-tailed), d = 0.06.

Infant Attachment Quality and Neurological Outcome

There was a significant correspondence between infant attachment and neurological development at 14 months (corrected for prematurity), χ^2 (1, N = 66) = 8.73, p = .003 (two-tailed), Fisher's Exact Test p = .001 (one-tailed): 45.5% of the securely attached infants showed normal development and 54.5% impaired neurological development, whereas among the insecurely attached infants, only 9.1% were healthy and 90.9% were neurologically impaired. The two infants who were in the *NC* category were both disabled.

DISCUSSION

The Attachment Quality of Preterm Infants

In this study, 64.7% of preterm infants were classified as secure, 23.5% as insecure – avoidant, and 8.8% as insecure – ambivalent, which is comparable to the distribution found in studies with the Regensburg sample of German term infants (Grossmann, Fremmer-Bombik, Rudolph, & Grossmann, 1988). Similar results were reported by van IJzendoorn and Kroonenberg (1988) from a meta-analysis of nine studies of term infants (66% secure, 28% insecure – avoidant, 6% insecure – ambivalent attachment with mother). Even though this was a high-risk sample with neurobiological risk factors affecting brain maturation, we found that only 10.3% of infants had insecure with disorganized attachment, which also is comparable to the findings of studies on term samples (van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). If the disorganized category was due to cerebral imbalances and damage during brain maturation, we would expect a higher percentage of disorganized attached infants in our extremely high-risk sample. As our findings are comparable to data in studies on term infants, it is more probable that disorganized infant attachment is the result of a specific interactional process in the mother – infant dyad (Hesse & Main, 2000; Main, 2000; Main & Solomon, 1986).

Maternal Attachment Representation

The distribution of maternal attachment representations in this study of mothers who experience a preterm delivery is comparable to data for parents in middle-class samples from other longitudinal studies on term infants (van IJzendoorn & Bakermans-Kranenburg, 1996). This result is important, as clinicians sometimes make a general psychodynamic argument based on a single-case experience that mothers of preterm infants should be more ambivalent and avoidant with respect to attachment, and that this could unconsciously be the cause of the preterm birth.

One third (33.8%) of the mothers reported experiences of loss, revealing a significant correlation between the rated Q-sorts of maternal attachment representations and experiences of loss; 66.7% of mothers with a preoccupied attachment representation, but only 25% of mothers with secure attachment representations, and only 27.8% of those with dismissing representation showed stronger indexes of loss. Thus, mothers with a preoccupied representation of attachment were particularly prone to high indexes of previous loss experiences. This finding could be important for intervention and counseling, as unresolved effects of previous losses could

be triggered in the mother by the experience of the preterm delivery, complicating the maternal bonding process. These hypotheses should be tested using Main and Goldwyn's (1982) evaluation method, which allows one to differentiate between unresolved versus resolved states of mind with respect to previous experiences of loss and trauma.

Although there were no significant group differences for perinatal and postnatal risk factors within maternal attachment representations at 6 months (corrected age for prematurity), results showed a significant correlation between a secure or a preoccupied maternal state of mind with respect to attachment and the neurological outcome at 14 months (corrected age). Infants with neurological deficits at 14 months could have been developmentally delayed at 6 months when the mothers were interviewed with the AAI. Worries about the developmental outcome of their infants could have interfered with their narrative during the interview. This could explain why mothers with higher values of secure attachment had infants with healthier neurological development at 14 months (corrected age) and why mothers with higher degrees of preoccupied attachment had infants with more symptoms of neurological deficit.

Maternal Representations of Attachment and Attachment Quality of Preterm Infants

Many longitudinal studies of term infants have found a correspondence between postnatally assessed maternal attachment representations and infant attachment quality when the infants were examined in the SSP (van IJzendoorn & Bakermans-Kranenburg, 1997). Mothers with secure attachment representations had corresponding securely attached infants approximately 75% of the time (George et al., 1985; Grossmann et al., 1988; Steele & Steele, 1994; Steele et al., 1996; van IJzendoorn, 1995; van IJzendoorn & Bakermans-Kranenburg, 1997). In addition, prenatally assessed maternal state of mind with respect to attachment predicted quality of attachment in term infants, thus indicating a high intergenerational transmission rate, although the transmission process is not clear (Steele & Steele, 1994; Steele et al., 1996).

In contrast to studies of term infants, this study revealed no significant correspondence between maternal attachment representation and the attachment quality of very low-birthweight preterm infants in the SSP. This result points to the possibility that in very high-risk groups like preterm infants the well-known correspondence between maternal and infant attachment may not occur. Thus, securely attached mothers may not be more likely to have securely attached preterm infants than insecurely attached mothers.

Securely attached mothers had a high percentage of securely attached infants. But in complete contrast to our hypothesis, insecurely attached mothers had a high percentage of securely attached infants too. This result may be partly explained by the setting of the NICU and the interaction between parents and nurses: Avoidant mothers tend not to visit their preterm infants often or stay for long intervals in the NICU. In some cases they are hesitant to touch and caress their infants. If a mother with a more avoidant behavioral pattern does not visit her preterm in the NICU, she gets a phone call from the NICU team and is invited to come and stay with her infant. If she is reluctant to touch her baby, a nurse supports her and promotes greater contact and touch. Thus, mothers with a dismissive pattern with respect to attachment are less likely to display avoidant behavior with their preterm. The active support from the NICU staff allows them to be closer and more related with their preterm than they might have been with a term infant at home. Preoccupied mothers are very anxious and tend to stay at the NICU for long periods at any time. They seek reassurance from the staff whenever possible. When they leave their baby late at night to go home they may phone an hour later to be reassured by the nurse that their preterm is "still alive." Twenty-four-hour reassurance by the NICU staff may serve as a "secure base" for these preoccupied mothers, who are emotionally very involved with their preterm infant. If these mothers were at home with a term infant, they would have to cope with their anxiety on their own. Unfortunately, interactions between nurses and mothers were not assessed in a systematic way. This is a limitation that is common to all studies of term infants where interactions within the family and between family members and mother and infant are not reported or not assessed systematically.

Neurological Development and Attachment Quality of the Infant

Neurological development appears to play an important role in the development of the infant's attachment quality. There were significant group differences between mean scores of perinatal and postnatal risk factors and categories of neurological outcome, but not within the categories of the infants' attachment quality directly. However, neurological outcome could be more important for infant attachment quality than perinatal and postnatal risk factors, as infants with neurological deficits were significantly more often insecurely attached. Even mothers with a secure attachment may not be sufficiently able to overcome the effects on their infant of neurological impairment by sensitive interactive behavior or elaborated coping (Eisengart, Singer, Fulton, & Baley, 2003). Having a preterm infant who

shows signs of retardation or even of neurological impairment during the first year of life can be a permanent trigger for the mother, keeping her in a state of alert and anxiety, contributing to the insecure development of the infant's attachment. Furthermore, mothers with a dismissing attitude toward attachment may be more resistant and have a more perfect psychological defense against the traumatic experience of the preterm delivery, against the confrontation with the high-tech atmosphere of the NICU, and against the psychological stress of being confronted with a disabled child. This hypothesis is supported by preliminary results of a study of Kanninen, Punamäki, and Qouta (2003). Their findings indicate that adults with an insecure state of mind with respect to attachment may be more resistant to extreme traumatic experiences. If mothers with such an attitude toward attachment can cope and defend themselves better against hyperarousal and high levels of anxiety, then mother – child interactions might be less disturbed by these overwhelming maternal feelings and may result in a secure pattern of infant attachment.

Limitations

There are several limitations to this study: It would have been an advantage to have a control group of term infants instead of relying on normative data from other studies with term infants, to have data on the neurological development of the preterm infants at 6 months, and to have information on NICU quality characteristics to study the suggested effect of the NICU setting on mothers of very low-birthweight infants. It is possible too that informing the raters of the SSP about bilateral hearing (n = 2) and vision handicaps (n = 2) of the very low-birthweight infants might have biased their ratings.

Conclusions

Preterm delivery can be a traumatizing experience for many parents. Being securely attached can be a protective factor for the further development of the preterm infant, especially given the potential risks of prematurity and of neonatal treatment. Our results suggest that prematurity in and of itself does not generally put preterm infants at a higher risk than term infants of developing an insecure attachment. However, infants with impaired neurological development more often revealed an insecure quality of attachment than did healthy infants. In attachment studies with term infants, neurological problems were not reported or taken into account; the infants were not even examined with respect to their neurological status as healthy development was taken for granted. But in a

German sample of term infants with delays in motor development, results comparable to those in our study were found (Kißgen, 2002). In the future, the parents of these neurologically impaired infants should be targeted for psychological support (Brisch, Bechinger, Betzler, & Heinemann, 2003). However, further detailed data analysis is necessary to resolve unanswered questions regarding the interplay among somatic development, neurological risk factors, and emotional development. Furthermore, the importance of unresolved maternal loss and trauma as well as infants' disorganized attachment quality must be evaluated. In addition, a follow-up evaluation will take into account late-onset changes in the course of attachment development (Mangelsdorf et al., 1996).

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REFERENCES

Affleck, G., Tennen, H., & Rowe, J. (1991). *Infants in crisis. How parents cope with newborn intensive care and its aftermath.* New York: Springer.

Ainsworth, M. D. S., Blehar, M., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Ainsworth, M. D. S., & Eichberg, C. G. (1991). Effects on infant-mother attachment of mother's unresolved loss of an attachment figure, or other traumatic experience. In C. M. Parkes, J. Stevenson-Hinde, & P. Marris (Eds.), *Attachment across life cycle* (pp. 160–183). London: Tavistock.

Barnard, K., Osofsky, J., Beckwith, L., Hammond, M., & Appelbaum, M. (1998). A collaborative effort to study mother-child interaction in three risk groups: Social risk mother, adolescent mother, preterm infant. *Infant Mental Health Journal, 17,* 293–301.

Barnett, D., Hill Hunt, K., Butler, C. M., McCaskill, J. W. I., Kaplan-Estrin, M., & Pipp-Siegel, S. (1999). Indices of attachment disorganization among toddlers with neurological and non-neurological problems. In J. Solomon & C. George (Eds.), *Attachment disorganization* (pp. 189–212). New York: Guilford.

Berlin, M. A. (1991). A comparison of attachment in high-risk preterm and full-term infants using home Q-sort and strange situation assessment methods. *Dissertation Abstracts International, 51*(7-B), 3554-B.

Brazy, J. E., Eckerman, C. O., Oehler, J. M., Goldstein, R. F., & O'Rand, A. M. (1991). Nursery neurobiologic risk score: Important factors in predicting outcome in very low birth weight infants. *Journal of Pediatrics, 118,* 783–792.

Brazy, J. E., Goldstein, R. F., Oehler, J. M., Gustafson, K. E., & Thompson, R. J. J. (1993). Nursery neurobiologic risk score: Levels of risk and relationships with non-medical factors. *Journal of Developmental and Behavioral Pediatrics, 14,* 375–380.

Brisch, K. H. (2002a). Bindung und trauma in der entwicklung von sehr kleinen frühgeborenen [Attachment and trauma in the development of very low birthweight preterm infants]. *Kinder- und Jugendmedizin, 2*, 48.

Brisch, K. H. (2002b). *Treating attachment disorders. From theory to therapy.* New York: Guilford.

Brisch, K. H., Bechinger, D., Betzler, S., & Heinemann, H. (2003). Early preventive attachment-oriented psychotherapeutic intervention program with parents of a very low birthweight premature infant: Results of attachment and neurological development. *Attachment & Human Development, 5,* 120–135.

Brisch, K. H., Buchheim, A., Köhntop, B., Kunzke, D., Kächele, H., Schmücker, G., et al. (1996). Early preventive psychotherapeutic intervention program for parents after the delivery of a very small premature infant: The Ulm study [Special ICIS issue]. *Infant Behavior and Development, 19,* 356.

Buchheim, A., Brisch, K. H., & Kächele, H. (1999). Die klinische bedeutung der bindungsforschung für die risikogruppe der rrühgeborenen: Ein überblick zum neuesten forschungsstand [Clinical importance of attachment research for the risk group of preterm infants: A review]. *Zeitschrift für Kinder- und Jugendpsychiatrie, 27*, 125–138.

Butcher, P. R., Kalverboer, A. F., Mindera, R. B., van Doormaal, E. F., & Wolde, Y. (1993). Rigidity, sensitivity and quality of attachment: The role of maternal rigidity in the early socio-emotional development of premature infants. *Acta Psychiatrica Scandinavia, 375/88*, 4–38.

Calam, R. M., Lambrenos, K., Cox, A. D., & Weindling, A. M. (1999). Maternal appraisal of information given around the time of preterm delivery. *Journal of Reproductive and Infant Psychology, 17,* 267–280.

Cohen, J. (1988). *Statistical power of analysis for the behavioral sciences*. New York: Academic.

Coleman, P., Nelson, E. S., & Sundre, D. L. (1999). The relationship between prenatal expectations and postnatal attitudes among first-time mothers. *Journal of Reproductive and Infant Psychology, 17,* 27–40.

Cooper, P. J., Murray, L., Hooper, R., & West, A. (1996). The development and validation of a predictive index for postnatal depression. *Psychological Medicine, 26,* 627–634.

Easterbrooks, M. (1989). Quality of attachment to mother and to father: Effects of perinatal risk status. *Child Development, 60,* 825–830.

Eisengart, S. P., Singer, L. T., Fulton, S., & Baley, J. E. (2003). Coping and psychological distress in mothers of very low birth weight infants. *Parenting: Science and Practice, 3,* 49–72.

Escalona, S. K. (1982). Babies at double hazard: Early development of infants at biologic and social risk. *Journal of Pediatrics, 70,* 670–676.

Esser, G., Laucht, M., Schmidt, M., Löffler, W., Reiser, A., Stöhr, R.-M., et al. (1990). Behaviour problems and developmental status of 4-month-old infants in relation to organic and psychosocial risks. *European Archives of Psychiatry and Neurological Sciences, 239,* 384–390.

Frodi, A. (1983). Attachment behavior and sociability with strangers in premature and full term infants. *Infant Mental Health Journal, 4,* 13–22.

Frodi, A., & Thompson, R. (1985). Infants' affective responses in the strange situation: Effects of prematurity and of quality of attachment. *Child Development, 56,* 1280–1291.

Garner, P. W., & Landry, S. H. (1992). Preterm infants' affective responses in independent versus toy-centered play with their mothers. *Infant Mental Health Journal, 13,* 219–230.

George, C., Kaplan, N., & Main, M. (1985). *The attachment interview for adults*. Unpublished manuscript, University of California, Berkeley.

Goldberg, S., Perrotta, M., Minde, K., & Corter, C. (1986). Maternal behavior and attachment in low birth-weight twins and singletons. *Child Development, 57,* 34–46.

Grossmann, K., Fremmer-Bombik, E., Rudolph, J., & Grossmann, K. E. (1988). Maternal attachment representations as related to patterns of infant-mother attachment and maternal care during the first year. In R. A. Hinde & J. Stevenson-Hinde (Eds.), *Relationships within families* (pp. 241–262). Oxford, England: Oxford Science Publications.

Grossmann, K. E., Grossmann, K., Huber, F., & Wartner, U. (1981). German children's behavior towards their mothers at 12 months and their fathers at 18 months in Ainsworth's Strange Situation. *International Journal of Behavioral Development, 4,* 157–181.

Hagberg, B., Hagberg, G., & Olow, I. (1975a). The changing panorama of cerebral palsy in Sweden 1954–1970. I. Analysis of the general changes. *Acta Peadiatrica Scandinavica, 64,* 187–192.

Hagberg, B., Hagberg, G., & Olow, I. (1975b). The changing panorama of cerebral palsy in Sweden 1954–1970. II. Analysis of the various syndromes. *Acta Peadiatrica Scandinavica, 64,* 193–200.

Hesse, E., & Main, M. (2000). Disorganized infant, child, and adult attachment: Collapse in behavioral and attentional strategies. *Journal of the American Psychoanalytic Association, 48,* 1097–1127.

Hille, E. T. M., den Ouden, L. A., Saigal, S., Wolke, D., Lambert, M., Whitaker, A., et al. (2001). Behavioural problems in children who weigh 1000 g or less at birth in four countries. *The Lancet, 357,* 1641–1643.

Huber, S., Brisch, K. H., Pohlandt, F., Eckert, D., Knorpp, D., Mauch, D., et al. (1996). Entwicklungsneurologische Befunde bei Frühgeborenen mit einem Geburtsgewicht unter

1000 g im Alter von 2–4 Jahren [Neurological development of former preterm infants with birthweight less then 1,000g at age 2–4 years]. In G. Gross-Selbeck (Ed.), *Aktuelle Neuropädiatrie 1995* (pp. 309–312). Weinheim: Ciba Geigy.

Jotzo, M. (2001). Elterliche Traumatisierung durch die Frühgeburt des Kindes [Parental traumatization by delivery of a preterm infant]. *Psychotraumatologie, 2*(1), 34.

Kanninen, K., Punamäki, R. L., & Qouta, S. (2003). Personality and trauma: Adult attachment and posttraumatic distress among former political prisoners. *Peace and Conflict: Journal of Peace Psychology*, *9*, 97-126.

Kaplan, D. M., & Mason, E. A. (1960). Maternal reactions to premature birth viewed as an acute emotional disorder. *American Journal of Orthopsychiatry, 30,* 539–552.

Kißgen, R. (2002). Bindungsqualität einjähriger motorisch entwicklungsverzögerter Kinder [Attachment quality of one-year old infants with delay in motor development]. *Heilpädagogische Forschung, 28,* 118–130.

Knorpp, D., Mauch, A., Bode, H., Huber, S., Paschke, R., Pohlandt, F., et al. (1997). Querschnittsuntersuchung zur somatischen, kognitiven und sozialen entwicklung von ehemals extrem kleinen frühgeborenen (< 1000 g) im alter von 2—4 jahren [Cross-sectional evaluation of the somatic, cognitive, and social development of former extremely low birthweight premature infants (< 1,000g) aged 2–4 years]. *Zeitschrift für Geburtshilfe und Neonatologie, 23*(201), 191.

Kobak, R. R. (1993). *The attachment Q-sort*. Unpublished manuscript, University of Delaware.

Kobak, R. R., Cole, H. E., Ferrez-Gilles, R., Fleming, W. S., & Gamble, W. (1993). Attachment and emotion regulation during mother-teen-problem solving: A control theory analysis. *Child Development, 64,* 231–245.

Landry, S. H., & Chapieski, M. L. (1988). Visual attention during toy exploration in preterm infants: Effects of medical risk and maternal interactions. *Infant Behavior and Development, 11,* 187–204.

Largo, R. H. (1996). Entwicklung von frühgeborenen [Development of preterm infants]. *Psychoscope, 2,* 7–11.

Largo, R. H., Graf, S., Kundu, S., Hunziker, U., & Molinari, L. (1990). Predicting developmental outcome at school age from infant tests of normal, at-risk and retarded infants. *Developmental Medicine and Child Neurology, 1990*(32), 30–45.

Laucht, M., Esser, G., & Schmidt, M. H. (1993). Adverse temperamental characteristics and early behaviour problems in 4-months-old infants born with different psychosocial and biological risks. *Acta Paedopsychiatrica, 56,* 19–24.

Laucht, M., Esser, G., & Schmidt, M. H. (1997). Developmental outcome of infants born with biological and psychosocial risks. *Journal of Child Psychology and Psychiatry and Allied Disciplines,* (38), 843–854.

Laucht, M., Esser, G., & Schmidt, M. H. (1998). Differential development of infants at risk: Role of early mother-child interaction. *Developmental Medicine & Child Neurology, 43,* 292–300.

Main, M. (2000). The organized categories of infant, child, and adult attachment: Flexible vs. inflexible attention under attachment-related stress. *Journal of the American Psychoanalytic Association, 48,* 1055–1096.

Main, M., & Goldwyn, R. (1982). *Adult attachment interview: Scoring and classification manual.* Unpublished manual, Department of Psychology, University of California, Berkeley.

Main, M., & Solomon, J. (1986). Discovery of an insecure-disorganized/disoriented attachment pattern: Procedures, findings and implications for the classification of behavior. In T. B. Brazelton & M. W. Yogman (Eds.), *Affective development in infancy* (pp. 95–124). Norwood, NJ: Ablex.

Main, M., & Solomon, J. (1990). Procedures for identifying infants as disorganized/disoriented during the Ainsworth Strange Situation. In M. T. Greenberg, D. Cicchetti, & E. M. Cummings (Eds.), *Attachment in the preschool years* (pp. 121–160). Chicago: University of Chicago Press.

Mangelsdorf, S. C., McHale, J. L., Plunkett, J. W., Dedrick, C. F., Berlin, M., Meisels, S. J., et al. (1996). Attachment security in very low birth weight infants. *Developmental Psychology, 32,* 914–920.

Minde, K., Corter, C., & Goldberg, S. (1985). The contribution of twinship and health to early interaction and attachment between premature infants and their mothers. In J. D. Call, E. Galenson, & P. I. Tyson (Eds.), *Frontiers of infant psychiatry* (pp. 160–175). New York: Basic Books.

Minde, K. K. (1993). The social and emotional development of low-birthweight infants and their families up to age four. In S. Friedman & M. Sigman (Eds.), *The psychological development of low-birthweight children: Advances in applied developmental psychology* (pp. 157–185). Norwood, NJ: Ablex.

Murray, L. (1992). The impact of postnatal depression on infant development: A naturalistic study. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 33,* 543–561.

Osofsky, J. D., & Emde, R. N. (1993). Prenatal and postnatal maternal perception of infant emotions and quality of mother-infant interaction. In R. N. Emde, J. D. Osofsky, & P. M. Butterfield (Eds.), *The IFEEL pictures: A new instrument for interpreting emotions* (pp. 237–251). Madison, CT: International Universities Press.

Pianta, R. C., Marvin, R. S., & Morong, M. C. (1999). Resolving the past and present: Relations with attachment organization. In J. Solomon & C. George (Eds.), *Attachment disorganization* (pp. 379–398). New York: Guilford.

Pierrehumbert, B., Nicole, A., Muller-Nix, C., Forcada-Guex, M., & Ansermet, F. (2003). Parental posttraumatic reactions after premature birth: Implications on sleeping and eating problems. *Archives of Disease in Childhood: Fetal and Neonatal Edition, 88,* 400–404.

Plunkett, J. W., Klein, T., & Meisels, S. J. (1988). The relationship of preterm infant-mother attachment to stranger sociability at 3 years. *Infant Behavior and Development, 11,* 83–96.

Riegel, K., Orth, B., Wolke, D., & Österlund, K. (1995). *Die Entwicklung gefährdet geborener kinder bis zum 5. lebensjahr* [The development of high risk born children until the age of 5 years]. Stuttgart, Germany: Enke.

Rode, S. S., Chang, P., Nian, P., Fisch, R. O., & Sroufe, L. A. (1981). Attachment patterns of infants separated at birth. *Development Psychology, 17,* 188–191.

Saigal, S., Stoskopf, B. L., Streiner, D. L., & Burrows, E. (2001). Physical growth and current health status of infants who were of extremely low birth weight and controls at adolescence. *Pediatrics, 108*(2), 407–415.

Sajaniemi, N., Hakamies-Blomqvist, L., Mäkelä, J., Avellan, A., Rita, H., & von Wendt, L. (2001). Cognitive development, temperament and behavior at 2 years as indicative of language development at 4 years in pre-term infants. *Child Psychiatry and Human Development, 31,* 329–346.

Sandén Eriksson, B., & Pehrsson, G. (2002). Evaluation of psycho-social support to parent with an infant born preterm. *Journal of Child Health Care, 6*(1), 19—33.

Spiker, D., Ferguson, J., & Brooks-Gunn, J. (1993). Enhancing maternal interactive behavior and child social competence in low birth weight, premature infants. *Child Development, 64,* 754–768.

Steele, H., & Steele, M. (1994). Intergenerational patterns of attachment. *Advances in Personal Relationships, 5,* 93–120.

Steele, H., Steele, M., & Fonagy, P. (1996). Associations among attachment classifications of mothers, fathers, and their infants. *Child Development, 67,* 541–555.

Stevenson, M., Roach, M., ver Hoeve, J., & Leavitt, L. (1990). Rhythms in the dialogue of infant feeding: Preterm and term infants. *Infant Behavior and Development, 13,* 51–70.

Stewart, A. L., Rifkin, L., Maess, P. N., & Kirkbride, V. (1999). Brain structure and neurocognitive and behavioural function in adolescents who were born very preterm. *Lancet, 353,* 1653–1657.

Sticker, E. J., Brandt, I., & Höckey, M. (1998). Längsschnittstudie: Lebensqualität sehr kleiner frühgeborener bis ins erwachsenenalter [Life quality of very preterm infants from birth until adulthood]. *Kindheit und Entwicklung, 7,* 143–153.

Thompson, R. J., Jr., Goldstein, R. F., Oehler, J. M., Gustafson, K. E., Catlett, A. T., & Brazy, J. E. (1994). Developmental outcome of very low birth weight infants as a function of biological risk and psychosocial risk. *Developmental and Behavioral Pediatrics, 15,* 232–238.

van IJzendoorn, M. H. (1995). Of the way we are: On temperament, attachment, and the transmission gap: A rejoinder to Fox (1995). *Psychological Bulletin, 117,* 411–415.

van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (1996). Attachment representations in mothers, fathers, adolescents and clinical groups: A meta-analytic search for normative data. *Journal of Consulting and Clinical Psychology, 64,* 8–21.

van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (1997). Intergenerational transmission of attachment: A move to the contextual level. In L. Atkinson & K. J. Zucker (Eds.), *Attachment and psychopathology* (pp. 135–170). New York, London: Guilford.

van IJzendoorn, M. H., Schuengel, C., & Bakermans-Kranenburg, M. J. (1999). Disorganized attachment in early childhood: Meta-analysis of precursors, concomitants and sequelae. *Development and Psychopathology, 11,* 225–249.

van IJzendoorn, M. J., & Kroonenberg, P. M. (1988). Cross-cultural patterns of attachment: A meta-analysis of the strange situation. *Child Development, 59,* 147–156.

Waber, D. P., & McCormick, M. C. (1995). Late neuropsychological outcomes in preterm infants of normal IQ: Selective vulnerability of the visual system. *Journal of Pediatric Psychology, 20,* 721–735.

Weisglas-Kuperus, N. (1992). *Biological and social factors in the development of the very low birthweight child.* Unpublished doctoral dissertation, Department of Pediatrics, University Rotterdam, Rotterdam, the Netherlands.

Weisglas-Kuperus, N., Koot, H. M., Baerts, W., Fetter, W. P. F., & Sauer, P. J. J. (1993). Behavioral problems of very low-birthweight children. *Developmental Medicine and Child Neurology, 35,* 406–416.

Wijnroks, L. (1999). Maternal recollected anxiety and mother-infant interaction in preterm infants. *Infant Mental Health Journal, 20,* 393–409.

Wille, D. (1988). The role of newborn characteristics, maternal social support and stress, and mother-infant interaction in the development of attachment. *Dissertation Abstracts International, 49*(6-B), 2397–2398.

Wille, D. E. (1991). Relation of preterm birth with quality of infant-mother attachment at one year. *Infant Behavior and Development, 14,* 227–240.

Wolke, D., Ratschinski, G., Orth, B., & Riegel, K. (1994). The cognitive outcome of very preterm infants may be poorer than often reported: An empirical investigation of how methodological issues make a big difference. *European Journal of Pediatrics, 153,* 906–915.