

## ORIGINAL ARTICLE

# High rate of insecure attachment patterns in preterm infants at early school age

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## Abstract

**Aim:** In preterm infants, insecure attachment is associated with behavioural and emotional problems but data on attachment beyond toddler age are scarce. This study assessed attachment security at 6–8 years in very and moderate or late preterm infants. The results were compared to a non-clinical full-term sample.

**Methods:** Attachment security of 38 very and 20 moderate or late preterm infants was assessed during a home visit with the German version of the Attachment Story Completion Task. Attachment patterns of 28 full-term controls were taken from a previous study. Primary outcomes were attachment security and attachment security score. Secondary outcomes for the preterm groups were infant behavioural problems, parental stress, perceived social support, maternal depressive symptoms, and infant development.

**Results:** Very preterm infants had the highest rate of insecure attachment (81%) compared to moderate or late preterm infants (60%) and full-term infants (47%); ( $p = 0.013$ ). Attachment security scores differed significantly between very preterm and full-term infants ( $p = 0.001$ ). Secondary outcomes were similar in very and moderate or late preterm cohorts.

**Conclusion:** Prematurity was associated with an increased risk of insecure attachment at early school age. Interventions targeting attachment security are reasonable considering the high rate of behavioural problems following premature birth.

## KEYWORDS

attachment security, attachment story completion task, moderate or late preterm infants, school age, very preterm infants

## 1 | INTRODUCTION

In the 1970s, Mary Ainsworth introduced three different patterns of mother–child attachment: secure, insecure-avoidant and insecure-ambivalent/resistant attachment.<sup>1</sup> A fourth classification,

disorganised attachment was added later and was set in contrast to the organised attachment patterns. Attachment security was associated with important developmental functions such as emotional regulation and social skills competence.<sup>2</sup> Intriguingly, in preterm infants, secure attachment may reduce the risk of behavioural problems and

**Abbreviations:** CBCL, Child Behaviour Checklist; NICU, neonatal intensive care unit; SSC, skin-to-skin contact.

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impaired neurodevelopment.<sup>3,4</sup> However, studies on the association of attachment and developmental or behavioural outcomes specifically addressing preterm infants are still scarce.<sup>5</sup>

Providing a sensitive, regulating parenting style at the neonatal intensive care unit (NICU) is limited because the caregiver does not have spontaneous and unrestricted access to the infant. Naturally, the caregiver regulates the infant's attachment behavioural system which is activated by fear of separation by being available and responsive to the infant's need.<sup>1</sup> This sensitive response to the infant's demands is essential for the development of a secure attachment pattern.

However, the emotional stress caused by fear for the immature infant's well-being may impair parental sensitive behaviour.<sup>6</sup>

Taking this into account, it was suspected that preterm infants are at an increased risk of insecure attachment patterns compared to low-risk full-term samples. Interestingly, previous studies addressing this question yielded inconclusive results.<sup>7</sup>

In contrast to studies comparing secure and insecure attachment patterns, reports focusing on organised and disorganised attachment, consistently describe a higher risk for disorganised attachment quality in immature infants.<sup>8</sup> As a likely explanation, attachment disorganisation was reported to be associated with brain damage which puts the most immature infants at the highest risk. In contrast to attachment organisation, attachment security is assumed to be primarily influenced by parenting style and may be targeted by interventions aiming at parental sensitivity.

More mature preterm infants born at more than 32 weeks of gestation are not necessarily admitted to a NICU after birth. Nonetheless, these moderate or late preterm infants are at an increased risk for short-term morbidities and frequently need medical treatment exposing both, infants and parents to stress and separation.<sup>9</sup>

Taking this into account, we aimed to assess attachment security of very preterm and moderately or late preterm infants and compared the results to data from a low-risk full-term sample. We chose to assess attachment at early school age. Attachment patterns in preterm infants are predominantly tested in toddlers with Ainsworth's strange situation procedure. Data beyond this age are scarce, and attachment security may change over time.<sup>10</sup> Consequently, testing attachment at school age may add information on attachment patterns in preterm infants that are difficult to identify at an earlier age.

## 2 | METHODS

### 2.1 | Participants

In total, 58 preterm infants at the age of 6–8 years were included in the study. Of these, 38 were born very preterm born at 25+0 to 32+0 weeks of gestation. An additional 20 infants were moderate or late preterm infants born at 33+0 weeks to 36+6 weeks of gestation. All were firstborn singletons. Infants were excluded if they

### Key Notes

- Premature birth increases the risk of insecure attachment at early school age.
- Attachment insecurity correlates with gestational age, putting the most immature infants at the highest risk.
- Moderate or late preterm has lower attachment security scores compared to full-term infants and should receive special attention.

needed primary resuscitation, had severe underlying diseases, or had mothers with mental disorders or lack of German skills.

The very preterm infants were former participants of the interventional "delivery room skin-to-skin study."<sup>11</sup> In this study, 88 infants had been enrolled.

The moderate or late preterm infants were former participants of the observational "trauma and depression in moderate or late preterm infants" study.<sup>12</sup> Originally, 69 infants had been enrolled. Of these, 36 were firstborn singletons and were eligible for recruitment in this study.

Families were informed in written form about the purpose of the study.

We compared the attachment results of both preterm groups to data from a group of 28 children born full term. These infants had originally been recruited as healthy controls showing no signs of behavioural, developmental, or regulative problems.<sup>13</sup>

The study was registered NCT 03366285.

### 2.2 | Primary outcome

The primary outcome of our study was to assess and compare attachment security for both groups of preterm infants. Furthermore, these results were compared to a dataset on attachment of a full-term low-risk sample assessed by the same raters and the same technique.

Two of the authors (C.N. and L.R.) scheduled a home visit to conduct and videotape the testing for the assessment of attachment security.

Attachment was analysed using the German version of the Attachment Story Completion Task.<sup>14</sup> The test was validated by Gloger-Tippel in 2016.<sup>15</sup> The investigator provided the child with the beginning of five different stories by playing them with a family of dolls. The children were asked to continue the stories. The stories were set up to induce attachment behaviour. For example, the child in the story was spilling juice, was afraid of monsters under the bed, or was separated from the parents. The child's reactions to the situation were supposed to reflect his or her attachment pattern.

As defined by Ainsworth,<sup>1</sup> and extended by Main and Salomon in 1990,<sup>16</sup> there are four patterns of infant-mother attachment: Three

organised patterns termed secure, insecure-avoidant and insecure-ambivalent/resistant and one disorganised pattern.

For every child, two reliable investigators assessed both, the attachment pattern and an attachment security score between 0 and 4. The higher the score, the more secure the attachment was rated. Interrater reliability was 87%.

### 2.3 | Secondary outcomes

For the preterm samples, we assessed potential cofactors of attachment such as socioeconomic status, infant development, infant behaviour, parental stress, and maternal depression. Self-reporting questionnaires were sent to the parents shortly before the home visit.

Depressive symptoms were assessed with the German long form of the Centre for Epidemiological Studies Depression Scale.<sup>17</sup> Cut-off for being at risk of clinical depression was 23 points. Perceived social support was assessed with the short version of the F-SozU scale.<sup>18</sup> For the assessment of parenting stress, the German version of the Parenting Stress Index was used.<sup>19</sup> A score >60 points indicated a high level of parental stress.

Infant behaviour and emotional problems were assessed with the German version of the Child Behaviour Checklist for 6–18 years (CBCL).<sup>20</sup> It comprised of eight subscales addressing anxious/depressed, depressed, and somatic complaints, social, thought and attention problems, rule-breaking and aggressive behaviour. These subscales can be grouped into internalising and externalising problems and summed up to a total problems score. Cronbach's alpha for internal consistencies is internalising ( $\alpha = 0.90$ ), externalising ( $\alpha = 0.94$ ) behaviours, total problems score ( $\alpha = 0.97$ ).

Information on infant development and head circumferences was acquired from the preventive medical examination forms that are mandatory in Germany.

Basic data on the neonatal course (gestational, age, birthweight, Apgar score, complications of prematurity, intraventricular haemorrhage > grade 2, periventricular leukomalacia, NICU days, skin-to-skin contact within the first hours after birth, breastfeeding) were available from the original studies.

Our neonatal department offers family-centred developmental care with focusses on early and frequent skin-to-skin contact, timely integration of parents in care activities, and reduction of external stress and painful stimuli.

### 2.4 | Statistics

Statistical analysis was performed using IBM SPSS Statistics 27 for Windows (IBM Corp.). Variables are described as median (IQR), mean  $\pm$  standard deviation or absolute and relative frequency. Differences between groups were compared by *t*-test for normally distributed data, Wilcoxon-Mann-Whitney test for other metric data or Fisher's exact test for categories. A two-sided *p*-value <0.05

was defined as significant. All analyses were regarded as explorative. Odds ratios for continuous variables were calculated by binary logistic regression and describe the difference in odds for an increase of one unit of the continuous variable. Bonferroni correction was used in multiple testing. For correlations, Spearman's rho was used.

### 2.5 | Ethics

All parents signed a declaration of consent. The study was approved by the Ethics committee of the University of Cologne.

## 3 | RESULTS

In total, 58 preterm infants moderate or late were included in the study. Of these, 38 were born very preterm and 20 moderately or late preterm. The basic characteristics of both preterm groups are presented in Table 1a. As expected, there were significant differences in birthweight, gestational age, NICU days, and Apgar score. Of note, no differences were identified between groups regarding skin-to-skin contact (SSC) within the first 3 h after birth.

Basic sociodemographic data of both, preterm and full-term infants, are presented in Table 1b. There were no significant differences in infant sex, maternal age, number of children and status as single parent. Fewer mothers had a high school degree in the full-term sample ( $p = 0.002$ ).

The attachment patterns for the three groups of infants are presented in Table 2. More than 50% of full-term infants were securely attached compared to 40% of moderate or late preterm infants and only 19% of very preterm infants ( $p = 0.013$ ). There were no significant differences in disorganised attachment between the groups.

In a binary logistic regression analysis, attachment security was predicted by group affiliation [very preterm, moderate/late preterm, full-term; OR 2.2 (CI 1.3–3.8,  $p = 0.005$ )]. In our sample, secure but not disorganised attachment was predicted by gestational age [OR (secure/insecure) 1.12 (CI 1.0–1.2;  $p = 0.021$ ); OR (organised/disorganised) 0.9 (CI 0.8–1.1)].

The attachment security scores for each group are presented in Figure 1. *p*-Values are 0.02 for comparison for all groups and 0.001 for comparison of very preterm and full-term infants. Gestational age correlated positively with the attachment security score ( $p = 0.02$ ; Spearman's rho 0.326).

Possible cofactors of attachment security for preterm infants are presented in Table 3. All moderate or late preterm infant started primary school at regular age. In contrast, school enrolment was deferred in a quarter of very preterm infants. There was a trend to a higher number of total problems in the CBCL for very preterm infants ( $p = 0.076$ ). No differences in parental stress were identified between very and moderate or late preterm infants. All moderate or late preterm infants and all but three infants who were born very preterm showed normal development at the age of 4–5 years. Of these, two were classified disorganised and one insecure-avoidant.

TABLE 1 Basic characteristics of a: very and moderate or late preterm infants, b: very, moderate or late preterm and full-term infants.

a: Baseline characteristics (preterm infants only)				
	Very preterm, n = 38	Moderate or late preterm infants, n = 20		p-Value
Gestational age <sup>a</sup>	29 [27–31]	35 [33–36]		<0.001
Birthweight <sup>a</sup>	1165 [875–1558]	2510 [2118–2882]		<0.001
Apgar 5 <sup>a</sup>	8 [7–8]	8 [8–9]		0.112
Apgar 10 <sup>a</sup>	8 [8–9]	9 [9–10]		0.002
NICU days <sup>a</sup>	11 [7–24]	1 [1–2]		<0.001
Breastfed	31/38 (82%)	19/20 (95%)		0.241
Breastfeeding months <sup>a</sup>	7 [2–13]	8 [6–10]		0.571
Early skin-to-skin contact	19 (50%)	9 (45%)		0.466
b: Baseline sociodemographic characteristics (preterm and full-term infants)				
	Very preterm, n = 38	Moderate or late preterm, n = 20	Full-term, n = 28	p-Value
Maternal age <sup>a</sup>	39 [37–40]	39 [38–42]	41 [39–42]	0.064
Number of children <sup>a</sup>	1 [1–2]	2 [1–2]	2 [1–2]	0.120
High school	32/37 (87%)	18/20 (90%)	15/28 (54%)	0.02
Single parent	4/38 (11%)	1/20 (5%)	0/28	0.19
Male	16/38 (42%)	11/20 (55%)	19/28 (68%)	0.115

Abbreviation: NICU, neonatal intensive care unit.

<sup>a</sup>Median [IQR].

TABLE 2 Attachment security qualities for very, moderate or late preterm and full-term infants.

	Very preterm, n = 37 <sup>a</sup>	Moderate or late preterm, n = 20	Full-term, n = 28	p-Value
Secure	7 (19%)	8 (40%)	15 (53%)	0.013
Insecure-avoidant	17 (46%)	7 (35%)	10 (36%)	secure vs. insecure
Insecure-ambivalent/resistant	6 (16%)	3 (15%)	1 (4%)	
Disorganised	7 (19%)	2 (10%)	2 (7%)	0.339 organised vs. disorganised

<sup>a</sup> 1 not evaluable.

To identify factors associated with disorganised attachment, we compared cofactors of attachment for infants with organised attachment pattern to infants with disorganised attachment (Table 4). Disorganised attachment was associated with higher parental stress (total child scale, ( $p = 0.034$ ), child subscales acceptance ( $p = 0.044$ ) and hyperactivity ( $p = 0.034$ )), and a trend to developmental delay at 4–5 years ( $p = 0.064$ ). Of note, no infant with disorganised attachment had severe cerebral morbidities (intraventricular haemorrhage > grade 2, periventricular leukomalacia).

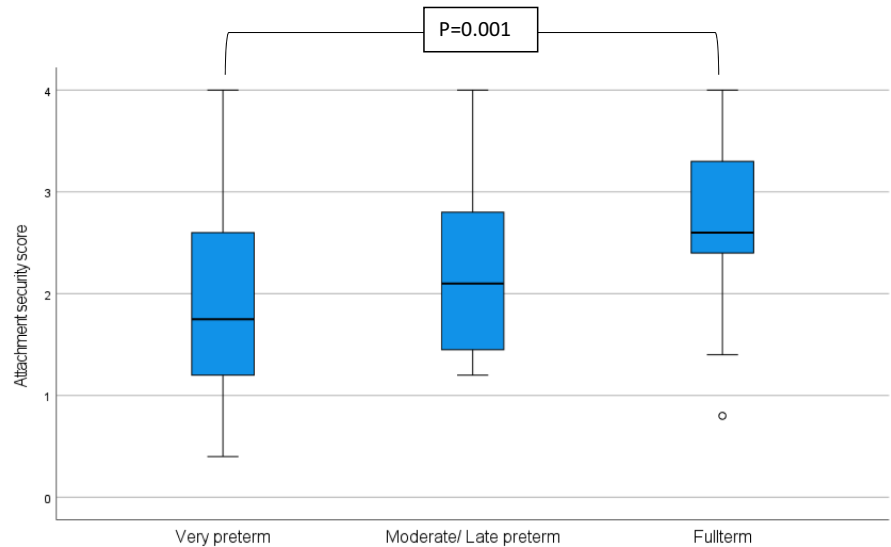
## 4 | DISCUSSION

Our study found that preterm infants were less likely to have a secure attachment pattern at 6–8 years of age compared to full-term infants. Furthermore, very preterm infants were at a higher risk of attachment insecurity compared to moderate or late preterm infants.

We used an attachment story completion task to assess attachment styles in 6- to 8-year-old children. Although these tests have been criticised for reduced sensitivity in comparison to procedures such as Ainsworth's strange situation procedure, the use of separation reunion tests is limited beyond an age of 3–4 years.

In our very preterm sample, only one in five infants was securely attached, which is a dramatically low number.<sup>8</sup> However, comparability is limited because most studies report results from the strange situation procedure in toddlers. Furthermore, although the pattern of attachment has been reported to stay constant from infancy to early school age,<sup>21</sup> this correlation is significantly lower if life spans of more than 5 years are compared and if samples at risk are assessed. In high-risk samples, securely attached children frequently lost attachment security over time.<sup>10</sup> In detail, infants with a birthweight below 1500 g showed a decrease in secure attachment from 54% at 12 months to 25% at 7 years.<sup>22</sup> In adolescents born with a birthweight below 1500 g, only one of three infants was securely attached.<sup>23</sup>

**FIGURE 1** Attachment security score in very preterm, moderate or late preterm and full-term infants.



**TABLE 3** Cofactors of attachment for very preterm and moderate or late preterm infants.

	Very preterm, n = 38	Moderate or late preterm, n = 20	p-Value
<b>Infant development</b>			
Started primary school at regular age	28 (74%)	20 (100%)	0.042
Hearing impairment	1 (3%)	0	1
Vision impairment	7 (18%)	4 (20%)	1
Normal development at 1 year	26/30 (87%)	18/18 (100%)	0.282
Normal development at 2 years	30/34 (88%)	20/20 (100%)	0.285
Normal development at 4–5 years	34/37 (92%)	20/20 (100%)	0.545
Head circumference at 4–5 years <P10	9/35 (26%)	2/20 (10%)	0.236
<b>Infant behaviour CBCL score</b>			
Externalising problems	11/38 (30%)	4/20 (20%)	0.541
Internalising problems	14/38 (37%)	5/20 (25%)	0.397
Total problem scale	15/38 (40%)	3/20 (15%)	0.076
<b>Parental stress index</b>			
Parental stress index total >60	18/38 (47%)	8/20 (40%)	0.782
Parental stress index child >60	17/38 (45%)	8/20 (40%)	0.786
Parental stress index >60	11/38 (29%)	5/20 (25%)	1
<b>Perceived social support</b>			
Social support <sup>a</sup>	4.6 [4.3–4.9]	4.8 [4.5–4.9]	0.302
<b>Maternal depressive symptoms</b>			
ADSL >23 <sup>a</sup>	1/38 (3%)	1/20 (5%)	1

Abbreviations: ADSL, German long form of the Centre for Epidemiological Studies Depression Scale; CBCL, Child Behaviour Checklist.  
<sup>a</sup>Median [IQR].

It is a matter of ongoing discussion if prematurity itself increases the risk for attachment insecurity.<sup>7</sup> The idea is intriguing. The forming of a secure attachment pattern in early childhood is promoted by maternal sensitivity. Premature delivery induces maternal anxiety and stress due to separation and fear for the infant's safety.<sup>24,25</sup> Both may impair maternal sensitivity and alter the quality of mother–child interaction and parenting.<sup>7,26</sup> Consequently, preterm mothers are at risk to develop a problematic parenting style followed by an insecure attachment pattern. In contrast, reports studying preterm attachment

in toddlers yielded conflicting results. A recent study,<sup>27</sup> as well as a meta-analysis published in 2012, found no differences in attachment security between preterm and full-term samples in seven out of eight included studies.<sup>7</sup> However, only two studies exclusively enrolled infants with a birthweight below 1500g. Of note, these studies all addressed attachment in toddlers. An Italian study comparing the results of a dynamic-maturational model of attachment and adaptation at school age described a significantly higher risk for maladaptation due to less optimal attachment for the preterm sample.<sup>28</sup>

TABLE 4 Characteristics of infants with organised/disorganised attachment.

	Organised, <i>n</i> = 48	Disorganised, <i>n</i> = 9	<i>p</i> -Value
Gestational age <sup>a</sup>	31 [28–35]	31 [29–34]	0.768
Birthweight <sup>a</sup>	1525 [955–2243]	1550 [980–1800]	0.835
Male gender	22/48 (46%)	5/9 (56%)	0.722
Maternal high school	42/48 (88%)	8/8 (100%)	0.578
Head circumference at 4–5 years <P10	10/46 (21%)	1/8 (12.5%)	0.576
Normal development at 4–5 years	46/47 (98%)	7/9 (78%)	0.064
Parental stress index total >60	20/48 (42%)	6/9 (67%)	0.275
Parental stress index parent >60	11/48 (23%)	5/9 (56%)	0.099
Parental stress index child >60	18/48 (38%)	7/9 (78%)	0.034
Parental stress index subscale child acceptance	10/48 (21%)	5/9 (56%)	0.044
Parental stress index subscale child hyperactivity	18/48 (38%)	7/9 (78%)	0.034
Externalising problems	11/48 (23%)	4/9 (44%)	0.223
Internalising problems	16/48 (33%)	3/9 (33%)	1
Total problem scale	15/48 (31%)	3/9 (33%)	1

<sup>a</sup>Median [IQR].

Taking the changes in attachment security over time and the inconclusive results of the studies at toddler age into account, it may be intriguing to focus further research on school age or adolescence.

In contrast to attachment insecurity, disorganised attachment is not associated with parenting style but with neonatal brain injury and neurodevelopmental delay.<sup>8</sup> Although none of the infants with disorganised attachment in our study had a severe cerebral pathology, changes in cerebral volume or complexity are rarely detectable by sonography and no routine MRIs were done. Disorganised attachment has been identified as a predictor for emotion regulation and externalising problems.<sup>29</sup> This is in line with our results from the child scale of the Parental Stress Index that showed significant differences between infants with organised and disorganised attachment.

Surprisingly, moderate or late preterm infants differed impressively from full-term infants regarding attachment security. These infants are at a higher risk of short-term and long-term morbidities compared to full-term infants. However, their postnatal course differs distinctly from very preterm infants. Moderate or late preterm infants do not necessarily have to be admitted to the NICU and rarely need incubator care or prolonged respiratory support. Consequently, establishing contact to a moderate or late preterm infant is easier for the parent compared to a very immature infant. Nonetheless, parents of moderate or late preterm infants have been reported to suffer from a high degree of parental stress, depression, and trauma.<sup>12</sup> These factors of parental mental well-being seem to influence attachment security more than severity of the infant's illness. Of note, late preterm infants have an increased risk of low school performance.<sup>30</sup> For that reason, interventions targeting attachment may help to moderate this effect.

The main limitation of the study was that the infants were enrolled in previous interventional or observational trials, and we

cannot exclude that this participation might affect our findings. Explicitly, early SSC, the primary outcome of the delivery room skin-to-skin trial may influence both, mother-child interaction and attachment.<sup>11</sup> To address this potential confounder, we analysed the number of infants with early SSC in both preterm groups and found no differences. Secondly, the study was limited by the small sample size which is a consequence of enrolment in the original studies. Thirdly, the parents' attachment representation that may affect infant attachment was not addressed. In addition, families with low socioeconomic status were underrepresented. Finally, although our hospital had a policy of non-separation, there was only limited information available beyond the first hours after birth for the moderate or late preterm group. Of note, duration of Kangaroo mother care and rooming in days were assessed in the very preterm group and did not differ significantly in relation to attachment security.

In conclusion, both, very and moderate or late preterm infants, had an increased risk for insecure attachment at the age of 6–8 years compared to full-term controls. Therefore, interventions addressing maternal sensitivity, parental style, and attachment should be an integral part in post-discharge care of preterm infants.

#### FUNDING INFORMATION

The study did not receive any specific funding.

#### ACKNOWLEDGEMENT

Open Access funding enabled and organized by Projekt DEAL.

#### CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

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**How to cite this article:** Mehler K, Heine E, Kribs A, Schoemig C, Reimann L, Nonhoff C, et al. High rate of insecure attachment patterns in preterm infants at early school age. *Acta Paediatr.* 2023;00:1-7. <https://doi.org/10.1111/apa.16700>