Croat Med J 2005;46(1):36-44

Maternal Ratings of Temperamental Characteristics of Healthy Premature Infants are Indistinguishable from Those of Full-Term Infants

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Aim To investigate whether prematurity itself, if not accompanied with serious medical risks, affects early temperamental characteristics, as measured by maternal ratings.

Methods Mothers' reports on temperamental characteristics of 104 low-risk, healthy premature infants were compared with those from a comparable sample of 120 full-term infants. Mothers completed the Infant Behavior Questionnaire (IBQ) when their infants were 6 or 12 months old (corrected for prematurity for premature infants).

Results Two groups of infants significantly differed only in one of six IBQ scales, the Activity Level scale, with premature infants being rated by their mothers as more active than full-term infants (ANOVA, $P=0.026$). Most of the interactions of prematurity with age and sex were insignificant, as well as the main effects of age and sex. Furthermore, effect sizes (Cohen's d) were relatively small, even for statistically significant effects. Correlation analyses performed within the premature sample showed that premature infants' gestational ages at birth did not significantly correlate with IBQ scales, except with Duration of Orienting scale, on which more premature infants were rated as having shorter periods of orienting ($r=0.21$, $P=0.036$).

Conclusion Ratings of premature infants' mothers on five out of six temperament dimensions measured in the study were indistinguishable from those of full-term infants' mothers. As the study had high power of achieving significant effects of prematurity if they really existed, it can be concluded that prematurity per se, if not accompanied with serious medical problems, did not have profound influence on mothers' ratings of infant temperament.

During the last few decades, there has been a growing research interest in consequences that premature birth as the most frequent biological risk factor may have on various aspects of infant and child development (1-4). Whereas there are numerous studies dealing with motor and cognitive development of premature children, showing that their early development is less favorable than the development of full-term infants (1,3), the impact of premature birth on early temperamental characteristics has not received enough research attention.

Temperament is a concept used to describe individual differences in behavior tendencies that are biologically rooted, present early in life, and relatively stable across various situations as well as over the course of time (5-11). Although temperament can be conceptualized and measured at different levels of analysis, including various levels of physiological functioning, the majority of studies are carried out on behavioral level, with caregiver reports as most frequently used measures for infants.

There are several theoretical approaches to early temperament, two of which have been mostly used in studies with premature infants: Thomas' and Chess's conception of temperament as behavioral style and three types of temperament

– difficult, easy, and slow-to-warm-up (12), and Rothbart's conception of temperament as constitutionally-based individual differences in reactivity and self-regulation (13-15). In the present study, temperament was conceptualized within Rothbart's theory and measured by her Infant Behavior Questionnaire (16). This questionnaire has been proven to be one of the psychometrically most sound instruments for measuring early temperament and also the instrument that has moved away from stylistic to a more psychobiological definition of temperament (6,10,11).

Regardless of the theoretical framework, the hypothesis in the studies dealing with temperamental characteristics of premature children is that their biological immaturity and vulnerability may have an impact on their temperamental characteristics. However, whereas some researchers reported that premature infants differed in their temperament from full-term infants (17-25), others have found premature/full-term differences neither in infancy (26-31), nor in the preschool period (32). Besides that, it is very difficult to compare the results of various studies, because they differ considerably in their methodology – theoretical standpoints, measures of temperament, size and age of the sample, research designs (longitudinal vs cross-sectional), and ways of calculating the age of premature infants.

Several authors (3,26-28) have emphasized the importance of the health status of premature infants. It is well known that, according to the type and severity of medical hazards experienced, premature infants are not homogenous but rather very heterogeneous group. Some of them, except being born earlier than expected and lighter than average, are healthy and do not need any medical intervention, whereas others are seriously medically compromised.

It should not be ignored that the vast majority in the population of premature children is of low-risk for developmental problems, ie they are relatively healthy (26,27,33). It is therefore somewhat surprising that more research has been conducted on high-risk than on low-risk healthy prematures. Although it is of great theoretical and practical importance to investigate the developmental course of high-risk premature infants, it is also important to note that differences between high-risk prematures and healthy full-terms cannot be attributed to the impact of prematurity per se. To disentangle the impact of those two factors and to examine the impact of prematurity itself, more research is needed on healthy prematures.

The aim of the present study was to investigate whether there were differences between healthy premature infants and a comparable sample of full-term infants in Rothbart temperament dimensions. Two main research questions were addressed: 1) Do healthy premature infants differ from full-term infants in Rothbart temperament dimensions? and 2) Is the degree of prematurity, as defined by gestational age at birth, related to temperament dimensions?

Subjects and Methods

Subjects

The sample consisted of 224 infants (115 boys, 109 girls) who were recruited from the four maternity wards in Zagreb, Croatia. There were 120 (53.6%) full-term infants, and 104 (46.4%) born prematurely. Data for 53 (51%) premature infants were collected when they were 6 months of corrected age, whereas 51 (49%) were assessed at 12 months of corrected age (age was corrected for the degree of prematurity). Among the full-term sample, 60 (50%) infants were assessed at 6 months of age and 60 (50%) at 12 months of age. This age-stratification was made in order to examine possible age-effects on temperamental differences between premature and full-term infants. Thus, the whole sample consisted of four subgroups: premature infants aged 6 months, premature infants aged 12 months, full-term infants aged 6 months, and full-term infants aged 12 months.

In the premature infants group we selected those who had been born before the 37th week of gestation and who did not have any congenital or chromosomal abnormalities, or any kind of severe medical complications, especially a diagnosis that would suggest damage to the central nervous system, such as severe perinatal asphyxia, intraventricular hemorrhage, seizures, or severe respiratory illness. They were all born from single pregnancies. Gestational age was determined both by mother's report of her last menstrual period, and by routinely performed pediatric examination (34). The correlation between the two measures was 0.86 in premature group, 0.62 in full-term group, and 0.96 in the whole sample, indicating their high convergence. However, in further anal-

yses only pediatric estimates were used. According to these estimates, the mean gestational age (±standard deviation) of premature infants was 35.5±1.50 weeks, with total range from 29 to 37. Their mean birth weight was 2,429±436.2 g, range 1,300-3,350 g. Although our sample of prematures covers a wide range of gestational ages and birth weights, the vast majority of children (79.8%) were born only 3 to 5 weeks earlier than expected (their gestational ages were 35-37 weeks), and with a birth weight which was not very low. In addition, all but 14 prematures had birth weight appropriate to gestational age. Being small or appropriate for gestational age was not considered as a relevant distinction in this study, since a research suggested that this variable did not place the infant at risk for deviance in behavior considered as temperament (35). It should also be noted that infants with birth weight greater than 2,500 grams were not excluded from the study, insofar as they were estimated to be born before the 37th week of gestation, both by last menstrual period and pediatric estimates. Mean 5-min Apgar in premature sample was 9.4±0.9, ranging from 6 to 10, whereas the mean duration of premature infants' hospitalization was 14.4±11.6 days. Only 9 (8.7%) out of 104 premature children were hospitalized for more than 30 days, with the main reason for their prolonged hospitalization being their birth weight below 2,500 g, and not other medical complications. At the time of discharge, all premature infants were considered by pediatricians to be "healthy prematures" and to have a high likelihood of normal development.

The criteria for the selection of full-term infants were the same as those for premature infants, except the gestational age, which ought to be greater than 37 weeks. According to pediatric estimates, mean gestational age in the full-term sample was 39.9±0.5 weeks, range from 39 to 41. Mean full-term infants' birth weight was 3,649±332.2 g, range 3,050-4,510 g. They all had 5-minute Apgar score greater or equal to 9. On average, they were hospitalized for 4.0±1.5 days, and when discharged, they were evaluated by pediatricians as "healthy newborns."

Expectedly, premature infants differed from their full-term counterparts in birth weight ($t=23.7$, $P<0.001$), gestational age ($t=30.2$, $P<0.001$), 5-min Apgar ($t=6.3$, $P<0.001$), and duration of hospitalization ($t=9.7$, $P<0.001$). However, the four groups studied (premature infants aged 6 months, premature infants aged 12 months, full-term infants aged 6 months, and full-term infants aged 12 months) did not differ in the gender of the child, birth order, mother's marital status, mother's and father's age at infant's birth, and mother's and father's education or occupational status (Table 1).

Instruments

Infant temperamental characteristics were assessed by mothers' reports on the Rothbart's Infant Behavior Questionnaire, IBQ (16). The IBQ consists of 90 items designed to refer to specific concrete behaviors of the infant, which are rated on 7-point scales (from 1=never present to 7=always present). The items compose 6 scales, ie 6 behavioral dimensions of temperament: 1) Activity Level (17 items) – child's gross motor activity; 2) Smiling and Laughter (15 items) – smiling or laughter from the child in any situation; 3) Fear (16 items) – the child's distress and latency to approach a sudden or novel stimulus; 4) Distress to Limitations/Frustration (20 items) – child's distress during caretaking maneuvers or when prevented access to a goal object; 5) Soothability (11 items) – child's reduction of fussing and crying in response to soothing efforts; 6) Duration of Orienting/Attentional Persistence (11 items) – child's degree of focus on a single object for extended periods of time.

The IBQ was translated from English into Croatian, and the translation was then checked by having a native English speaker translate it back into English. The back-translation was compared with the original questionnaire and minor differences were adjusted. The permission for using the instrument as well as the instrument itself were obtained from the author.

To determine the internal consistency of the translated IBQ, Cronbach alphas were computed separately in the four groups of infants, as well as in the whole sample. Internal consistencies of translated IBQ-scales were completely satisfying and similar across all subsamples. Alpha coefficients ranged from 0.65 to 0.88, which is in agreement with data obtained on American infants (16,28). It can be concluded that Croatian mothers of premature and full-term infants find IBQ-dimensions to be coherent constructs for describing their infants' behavior.

Table 1. Perinatal medical and socio-demographic characteristics of the premature and full-term infants

Characteristic	Premature		Full-terms	
	aged 6 months (n=53)	aged 12 months (n=51)	aged 6 months (n=60)	aged 12 months (n=60)
Perinatal (mean±SD):				
birthweight	2,422±366.9	2,437±501.8	3,615±353.7	3,683±308.6
gestational age	35.7±1.3	35.3±1.7	39.9±0.5	39.9±0.5
Apgar, 5 min	9.4±1	9.4±0.9	9.97±0.2	9.98±0.1
days hospitalized	14.6±10.3	14.2±12.9	4.5±1.8	3.5±0.8
Socio-demographic:				
infant's sex (boys/girls)	25/28	25/26	35/25	30/30
infant's birth-order (first-/second-/later-borns)	21/24/8	28/14/9	24/28/8	25/28/7
mother's age (mean±standard deviation)	30.5±6.2	29.2±5.2	29.7±4.8	28.0±4.2
father's age (mean± standard deviation)	33.6±7.6	32.4±5.8	32.3±6.3	30.5±4.8
parental marital status (both parents/single mother)	50/3	47/4	57/3	57/3
Mother's education (No. of mothers):				
university level	14	14	22	29
high school level	34	32	35	29
elementary school level	5	5	3	2
Father's education (No. of fathers):				
university level	17	15	24	28
high school level	29	30	33	28
elementary school level	4	2	–	1
Mother's employment (employed/unemployed)	38/15	37/14	46/14	43/17
Father's employment (employed/unemployed)	49/1	43/4	54/3	56/1

To check the structure of the IBQ, intercorrelations among IBQ-scales were computed for premature (n=104) and full-term (n=120) groups separately, and both intercorrelation matrices were submitted to principal components analyses with Varimax rotation. In both groups of infants, the analysis resulted in extraction of two components with eigenvalues above one, which accounted for 60% of the total variance. The two components were virtually the same in premature and full-term group, which was confirmed by the computation of Tucker's coefficients of congruence between corresponding components: the coefficients of congruence were 0.97 and 0.96 for the first and the second principal component, respectively. The two factors extracted could be labeled Negative and Positive Reactivity. Negative Reactivity had significant loadings on Activity, Distress to Limits, and Fear, whereas Positive Reactivity had significant loadings on Smiling, Orienting, and Soothability. The same 2-factor structure of the IBQ was found by Rothbart (36), except that in her study activity level clustered with positive emotions, not with negative ones like in our study.

Procedure

The subjects were recruited from hospital records. Main perinatal data were also collected from hospital records. Mothers of 244 infants who fitted the selection criteria were contacted either by phone or by post, and were explained the purpose and procedure of the study. Those who agreed to participate (response rate was 92%) were visited in their homes when their infant was 6 or 12 months of age (±15 days, corrected for the degree of prematurity for premature infants). If both parents were at home, their independent assessments of infant behavior on the IBQ scales were collected. Data on socio-demographic variables were obtained from structured interviews with parents. On average, assessment sessions lasted 60-90 minutes.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences software version 10.0 (SPSS Inc., Chicago, IL, USA). In all the analyses statistical significance was set at 0.05 level. Two main sets of analyses were performed, with the aim of answering the research questions.

Firstly, to examine the effects of prematurity status, age, and sex on temperament scores, three-way analyses of variance were run, in which prematurity status (full-term vs prematures), child's age (being 6 or 12 months old), and sex had the status of independent variables, whereas maternal ratings on the IBQ-scales had the status of dependent variables. Altogether six ANOVAs were performed, one for each of the six IBQ-scales. In addition to testing the main effects of independent variables on temperamental characteristics, these ANOVAs also enabled checking their interactional effects. Testing the effects of two-way interac-

tion between prematurity and child's age enables us to see whether the effects of prematurity are same for children of different ages. In addition, two-way interaction of prematurity and child's sex could reveal whether prematurity differently affected boys' and girls' temperament. Similarly, two-way interaction of child's age, and sex could show us whether age differences in temperament are the same for boys and girls or, *vice versa*, whether sex differences are of the same magnitude in older and younger age group. Finally, three-way interaction of prematurity, age and sex can reveal whether there are complex relations between our independent and dependent variables (e.g. that prematurity has the strongest impact on younger boys and the weakest impact on older girls). For statistically significant main and interaction effects in ANOVAs, the effect sizes, namely the Cohen's *d*, were also calculated (37), in order to describe differences between the groups more precisely and to assess whether the findings are of practical importance. Cohen defines *d* as the standardized difference between the two groups of subjects, which is calculated as the difference between group means divided by standard deviation of either group or by pooled standard deviation. Effect sizes lower than 0.2 are usually considered small, those between 0.3 and 0.5 are regarded medium, while those greater or equal to 0.8 are regarded as large. One way of interpreting effect sizes is in terms of the percent of nonoverlap of the two groups' scores. When an effect size is 0.0, the distributions of scores for two groups overlap completely, ie there is 0% of nonoverlap. An effect size of 0.8 indicates a nonoverlap of 47% in the two distributions, whereas an effect size of 1.7 shows that there is a 75% of nonoverlap between the group distributions.

The second set of analyses consisted of correlational analyses which were performed within the premature sample, with the aim of answering the second research question. Relations between degree of prematurity (ie gestational ages) and temperament scores were determined by Pearson's correlation coefficients.

Results

Differences between Premature and Full-term Infants on Infant Behavior Questionnaire Scales

The main effect of prematurity was significant only on Activity Level ($F = 5.05$, $P = 0.026$), with mothers of premature children rating their infants as more active than mothers of full-term infants (Table 2). Cohen's *d* for this analysis was 0.31, indicating that the difference between premature and full-term infants groups, although statistically significant, could be regarded as small to medium. There was only around 20% of nonoverlap between premature and full-term infants' distributions of scores. The main effect of age was significant only on Distress to Limitations scale ($F = 5.33$, $P = 0.022$), with older infants being rated by their mothers as more distressed to limitations than younger ones. Cohen's *d* for this analysis was 0.32, indicating a low to medium effect of age, with almost 80% of overlap of distributions. The main effect of sex approached statistical significance also only on Distress to Limitations scale ($F = 3.74$, $P = 0.055$), with boys rated by their mothers as somewhat more prone to frustration than girls.

Interaction of prematurity with age was significant on Fear scale ($F = 5.38$, $P = 0.021$). Mean values indicated that in younger age group premature infants were rated as more fearful than full-terms, whereas in the older age group prematures were rated as less fearful than full-terms. Cohen's *d* between premature and full-term infants were 0.24 and -0.49 in younger and older group, respectively. Thus, at six months of age, the difference between premature and full-term in-

Table 2. Mother ratings (mean±SD) on the Infant Behavior Questionnaire (IBQ) scales for premature and full-term boys and girls (6 and 12 months)

IBQ scale characteristic	Premature				Full-term			
	aged 6 months (n=53)		aged 12 months (n=51)		aged 6 months (n=60)		aged 12 months (n=60)	
	boys	girls	boys	girls	boys	girls	boys	girls
Activity	4.4±1.0	4.6±1.0	4.7±0.8	4.7±0.9	4.3±0.9	4.1±1.1	4.4±1.0	4.3±1.0
Distress	3.6±1.0	3.3±0.7	3.8±0.7	3.5±0.9	3.4±0.7	3.3±1.0	3.8±0.8	3.6±0.8
Fear	2.6±1.0	2.3±0.8	2.4±0.8	2.3±0.7	2.4±0.6	2.2±0.7	2.5±0.6	2.8±0.7
Smiling	5.1±0.8	5.4±1.0	5.4±0.7	5.5±0.6	5.3±0.8	5.1±0.8	5.3±0.8	5.2±0.8
Orienting	3.3±1.0	4.0±1.0	3.5±0.9	3.3±0.9	4.1±1.3	3.5±0.9	3.4±1.2	3.8±1.0
Soothability	4.8±1.1	4.9±1.1	4.6±1.0	4.8±1.1	4.9±0.8	4.6±1.2	5.0±0.9	4.7±1.0

fants is slight and could be regarded as practically unimportant (less than 20% of nonoverlap between distributions), whereas at 12 months of age the effect size is medium, with 33% of nonoverlap between distributions. Interaction of prematurity with gender approached statistical significance on Soothability scale ($F = 3.04$, $P = 0.082$), with premature girls rated as somewhat easier to soothe than full-term girls, whereas premature boys were perceived as more difficult to soothe than full-term boys. Interaction of age and sex was significant only on Fear scale ($F = 4.06$, $P = 0.045$), with younger boys showing more fear than older ones, whereas younger girls manifested less fear than older ones. Cohen's *d* between means for girls and boys were 0.36 and -0.23 in younger and older age group, respectively. This means that the difference between younger boys and girls was of medium size (about 25% of nonoverlap between distributions), whereas the difference between older boys and girls was slight (about 15% of nonoverlap). Finally, interaction of prematurity, age, and sex was significant on Duration of Orienting scale ($F = 10.64$, $P<0.001$). For this analysis, Cohen's *d* were calculated between premature and full-term infants from the following four groups: younger boys, younger girls, older boys, and older girls. *Ds* for the four groups were, respectively, -0.60, 0.51, 0.08, and -0.49. Hence, distributions of 12-months premature and full-term boys overlapped almost completely. For the other three groups, however, effect sizes were medium, indicating 33% (for younger and older girls) to 38% (for younger boys) of nonoverlap between premature and full-term distributions. Preterm boys at 6 months of age and preterm girls at 12 months of age were rated as having shorter periods of orienting than their full-term counterparts. In contrast, preterm girls at 6 months of age were rated as having longer periods of orienting than full-term girls of the same age.

Correlations between Gestational Age and Temperament in Premature Infants Group

To investigate the relationship between the degree of prematurity and temperamental characteristics within the group of premature infants, Pearson correlations between gestational ages at birth (as estimated by pediatricians) and scores on six IBQ-scales were computed. Of the six computed correlation coefficients, only one was statistically significant, namely that for the Duration of Orienting scale ($r = 0.21$, $P = 0.036$), indicating that the less premature infants tended to be rated by their mothers as having longer periods of orientation. Other IBQ-scales did not correlate with gestational age (correlations were in the range between -0.03 and 0.06). Overall, the obtained correlations indicated that there was no relation between the degree of prematurity and temperament dimensions.

Discussion

The present study showed that premature infants differed from full-term infants only in activity level, with prematures being rated by their mothers as motorically more active than full-terms. Higher activity level of prematures compared to full-term infants, which could suggest inclination towards temperamental irritability and difficulty (12), was also found by other researchers (17,28). Since premature infants in our study were healthy and with low risk for developmental abnormalities, their higher activity level could be seen as a "true" effect of prematurity. However, this finding should be interpreted cautiously, because effect size calculation showed that the difference, although statistically significant, is of low practical importance as there was only about 20% of nonoverlap between premature and full-term infants' distributions. Our results also showed that prematurity itself did not affect other dimensions of temperament, as measured in the present study.

It should also be pointed out that our findings mostly do not support the hypothesis about differential effects of prematurity on children of different age or gender, because most of the interactions of prematurity with age and gender of the child were insignificant. Two exceptions, however, need to be discussed, especially with regard to their practical relevance. These are the interaction of prematurity with age on fear, and the interaction of prematurity, age, and sex on duration of orienting. Effect-size calculations showed that following differences between premature and full-term infants could be considered practically important: difference among 12-month-old infants on fear and differences among 6- and 12-month-old girls, as well as among 6-month-old boys on duration of orienting. One-year old prematures were rated as less fearful than full-terms of same age (33% of nonoverlap between distributions).

This finding could be explained by slower cognitive development of premature in comparison with full-term infants (1,3) and the role of cognitive development in the development of fears. It is known that the most frequent fears during the second half of the first year of life (and hence those that are measured by the IBQ) are fears of novel stimuli, including unfamiliar adults. Because older and cognitively more advanced infants are better at distinguishing familiar from unfamiliar events, it can be expected that they show more fears than their younger or cognitively slower-developing counterparts. Regarding the differences in duration of orienting, results showed that preterm boys at 6 months of age and preterm girls at 12 months of age were rated as having shorter periods of orienting than their full-term counterparts (with 33 and 38% of nonoverlap between distributions, respectively). This is an expected finding which probably reflects biological and developmental immaturity of prematures. However, the finding that prematurely born 6-month old girls were rated as having longer periods of orienting than full-term girls of the same age (33% of nonoverlap of distributions) is somewhat surprising. Perhaps it reflects the inability of premature girls to divert their attention from an object (38), rather than the ability to be voluntarily focused for a prolonged period of time.

Within the group of premature infants, the degree of prematurity was not related to temperament scores, except for the duration of orienting, with less premature infants having longer periods of orienting. Using different temperament questionnaires, other researchers also have failed to find significant relationships between degree of prematurity and temperamental characteristics (30,33). However, caution should be taken when interpreting these correlations, because due to selection criteria the range of gestational ages in our sample was somewhat restricted. Since our sample of prematures consisted only of healthy infants and because it is known that the more premature the infant is, the greater the likelihood of serious medical complications, the exclusion of medically compromised, high-risk infants also resulted in the exclusion of infants with very short gestations. This, in turn, could lead to lower correlations. However, as we have already pointed out, the majority of premature infants are neither very premature nor very sick, and our sample of prematures was in that sense ecologically valid.

Boys and girls, as well as younger and older children from our study, did not profoundly differ in their temperamental characteristics. In respect to sex differences, our findings are consistent with those of most other researchers (16,25,27-29,33,36). In contrast, age differences found in other studies (25,36,39) were usually greater than those found in our study. It seems that this could be attributed to research design, ie other studies were longitudinal, whereas our research was cross-sectional. The cross-sectional study performed by Plunkett and colleagues (28) supports such an explanation, since they also failed to find greater age differences.

In summary, the results of the present study have shown that prematurity itself, if not accompanied by serious medical problems, affects only one out of six temperament dimensions measured, namely the dimension of activity, with premature infants being rated by their mothers as motorically more active than their full-term counterparts. However, even for this significant difference, the effect size was relatively small. The failure to obtain significant effects of prematurity in the current study could be seen as a true indication of nonexistence of such effects, because the study had high power to demonstrate the effects if they really existed (40). More specifically, in this study there was around 90% power of achieving significant (at 0.05 level) effects of prematurity if in fact the effects were at least medium-sized ($d = 0.5$). In other words, it is highly unlikely that we would have obtained nonsignificant results if in fact there were at least medium-sized effects. Hence, our results could be interpreted as supporting the hypothesis about no temperamental differences between low-risk prematures and full-term infants. This finding is in agreement with results of most other studies performed on relatively healthy, low-risk prematures (26-31,33). In our opinion, inconsistencies found in previous research could at least partially be attributed to the varied health status of prematures. When healthy premature infants are compared with full-term infants, their temperamental characteristics are indistinguishable. On the other hand, when differences were observed (18,19,21-24), they were the result of medical complications rather than the effects of prematurity *per se*. It seems that premature birth does not

directly affect temperamental characteristics. Rather, it increases the likelihood of serious medical complications, and when it is accompanied by such medical problems, complete behavioral organization, including temperament, could be affected. On the other hand, if infants born prematurely are relatively healthy, it seems that behaviors considered temperament are mostly not affected.

The finding that temperamental characteristics of healthy premature infants were indistinguishable from those of full-terms has not only theoretical but also important practical implications. It implies that insofar as early temperamental characteristics contribute to infant's interactions with his or her both physical and social environments, we can suppose that those interactions are similar for all healthy infants, full-terms as well as those born prematurely. Our findings can thus encourage parents of healthy prematures, who often worry about interactional capacities and specificities of their children. Healthy premature infants, though somewhat more active than full-terms, are equally prone to positive and negative emotions, equally easy (or difficult) to soothe, and equally focused on objects and events in their environments as are their full-term counterparts. In addition, this seems to be true for almost all prematures, regardless their age, sex and degree of prematurity, as long as they are medically healthy.

Several limitations of our findings, along with suggestions for future research, should be pointed out. Firstly, temperament was measured only on the basis of the mothers' reports. It is possible that mothers as observers of their infants are not sensitive enough to subtle differences in the child's behavior and that with more sensitive measures greater differences would be observed. In future, researchers should try to employ various measures of temperament within single study-design to obtain a more objective picture of premature infants' temperament. Secondly, studies dealing with the cognitive development of prematures have warned us that correcting the age for the degree of prematurity might result in an overly optimistic picture of premature children's development (41). The same could hold for their temperamental characteristics. Since in this study premature infants' age was corrected, the possibility that the results are too optimistic cannot be ruled out. The impact of correcting the age in studies dealing with social and emotional development of premature children should be tested more directly in future studies. Thirdly, our samples of both premature and full-term infants were somewhat biased toward higher socioeconomic levels. Therefore, they cannot be generalized to the premature infants from lower socioeconomic status, especially given the findings that premature infants' development depends to a large degree on the quality of their environments (1). Similarly, our results are limited to infants in the second half of the first year of life and cannot be generalized to other age groups. Future researchers should preferably include in their studies both older children and children from lower socioeconomic status. Finally, longitudinal studies are needed in future, because cross-sectional studies as this one, cannot address the question of impact of prematurity on stability of early temperament.

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