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ABSTRACT

Findings from three studies that used a laboratory procedure to assess individual differences in various dimensions of infant temperament in relation to later Brazelton scores are presented. Participants included 59 healthy, full-term and sick, preterm infants. The sick, preterm infants included infants who developed respiratory or neurological complications during the perinatal period. Discussion addresses relationships between: (1) neonatal measures and behavioral observations of infant temperament; (2) medical high-risk variables and behavioral observations of infant temperament; (3) behavioral observations and concurrent parental reports; and (4) the stability of behavioral observations during infants' third through seventh months. The studies indicated that neonatal characteristics, including Brazelton behavioral scores, cry acoustic characteristics, and medical status affect infants' temperament. Both individual and group differences were observed. There was some stability in behavioral observations between 3 and 7 months of age. Magnitudes of correlations were small except for soothability. Findings suggest that a great deal of change occurs in infant temperament during the first year of life. Moderate agreement was found between parents' reports and behavioral observations; this attested to the concurrent validity of the measures. (RH)

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EARLY INFANT TEMPERAMENT: THE SALIENCY OF POSITIVE AND NEGATIVE AFFECT

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Early Infant Temperament: The Saliency Of Positive And Negative Affect

Traditionally, most research on infant temperament has relied on parental reports as their main source of data. Recent studies, however, have found that parental reports, primarily questionnaires, are subject to biases which are reflective of the respondent's personality and demographic characteristics (Bates, Freeland and Lounsbury, 1979; Vaughn, Deinard and Egeland, 1980). Other studies have found lack of stability over time in parental reports or have failed to obtain significant correlations, among different reporters or with independent behavioral observations of the child (e.g. Sameroff, Seifer, and Elias, 1982; Vaughn et al, 1980). Based on these findings, strong criticisms have been raised against the validity of parental reports as a measure of temperament and of the construct of infant temperament itself (Hubert, Wachs, Peters-Martin and Gandour, 1982; Vaughn, Taraldson, Crichton and Egeland, 1981; Daniels, Plomin and Greenhalgh, 1984).

By contrast, studies using direct behavioral observations, multimethods including parental reports and/or aggregation of several behavioral categories have provided evidence for the stability and validity of various temperamental characteristics (Garcia Coll, Kagan and Reznick, 1984; Kagan, Reznick, Clark, Snidman, and Garcia Coll, 1984; Matheny, Wilson and Nuss, 1984; Wilson and Matheny, 1983). These studies have been primarily conducted with older infants, toddlers and preschool children and have excluded the early infancy period. An exception has been the work by Rothbart (1986), where she reported relative stability of positive reactivity and activity level during the first year of life based on home observations, and moderate correlations between these observations and parental reports. Thus, direct behavioral measures have provided clear support to the validity and stability of individual differences in temperament.

We have developed a laboratory procedure to assess individual differences in various salient infant temperamental dimensions, as suggested by the previous theoretical and empirical literature. Today,

I would like to present to you, findings from three studies and address the following issues:

(1) The relationship between neonatal measures and behavioral observations of infant temperament

(2) The relationship of medical high risk variables with behavioral observations of infant temperament

(3) The stability of behavioral observations between 3 and 7 months.

(4) The relationship between behavioral observations and concurrent parental reports

The first table shows the order of presentation and nature of the stimuli used at 3 months of age. The order of presentation is fixed and is designed to gradually increase the intensity and number of sensory modalities involved. The stimuli were chosen not only to sample various modalities but also to represent various areas of responsiveness (eg, reactions to social stimulation, care-giving activities, discrepant or novel stimulation). Several pilot studies were conducted to determine the order and nature of the stimuli to be presented and their adequacy in eliciting individual differences in the behavioral dimensions of interest.

A similar procedure was developed for 7 months old infants (see table 2). The procedures at both ages take approximately 15 minutes during which time an experimenter presents each stimulus for 30 seconds to the infant who is sitting on an infant chair or a high chair. The procedure is usually videotaped.

The total frequency of each of the following behaviors is coded in response to each stimulus presentation: gross motor movements (legs, arms, and head movements, and squirming or cuddling in reaction to being picked up); facial expressions coded as positive (smiling), neutral (staring), or negative (frowning); vocalizations (positive, negative, or crying); and more subtle responses (eye widening, eye movements, blinking, increases in respiration).

In addition, after each episode of crying, soothing interventions

that are required to calm the infant are rated as (1) self-quieting, (2) examiner talks, (3) talking and touching/ or pacifier, (4) pick-up, (5) mother intervenes, and (6) inconsolable.

Several summary variables are derived for statistical analyses:

1. Positive responses: absolute total frequency of smiles, positive vocalizations, and any gross motor movements accompanied by a smile or positive vocalizations, in addition to reaching or orienting toward stimulus or cuddling while being held. A high score reflects a more positive response to stimuli.

2. Similarly, negative responses: absolute total frequency of frowns, negative vocalizations (including crying), or any gross motor movements accompanied by a frown or negative vocalization (including crying), in addition to turning away or pushing away from stimulus or squirming as a response to cuddling. A high score reflects more negative responses to stimuli.

3. Sociability: absolute total of all positive responses (smiles, positive vocalizations, etc) during examiner's face and voice, cuddling in arms and cuddling at shoulders. A high score indicates more sociable behavior. In addition, summary variables for soothability and activity are derived.

In the first study we have examined the relationship between neonatal measures and behavioral observations of infant temperament. The next two tables (3 & 4) show the significant correlation coefficients between behavioral observations of infant temperament at 3 months and neonatal measures at 40 (above diagonal) and 44 weeks (below diagonal) (corrected age) for a group of 59 full-term and healthy and sick preterm infants, below 1750 grams and 34 weeks gestation. The sick preterm group include infants who developed during the perinatal period respiratory and/or neurological complications. On table 3 we are showing the significant correlations with the Brazelton scale scores on the whole sample derived from the administration of the scales at 40 & 44 weeks of age. All correlations are on the expected direction, meaning the more optimal Brazelton scores during the

neonatal period the more positive, less negative, more social and easier to soothe the infant is at 3 months. Most correlations are significant with the 44 weeks exam, pointing out this examination as either a more reliable measure of individual differences than an earlier one at 40 weeks, or as a measure of early transactions between the initial infant characteristics and the caregiving environment.

On table 4 we show the significant correlation coefficients between behavioral observations of temperament at 3 months and acoustic cry characteristics at 40 & 44 weeks (corrected age) in the same sample. Infants who had stronger cries and lower second formant during the neonatal period were found to be more positive at 3 months. Infants with lower first formant are found to be more negative. Infants with shorter cries and more variability in resonance frequencies were more difficult to soothe. Finally, more variability in the first formant is related to less activity at 3 months of age.

It seems that tension in the vocal tracts which affects resonance frequencies is associated with less positive, less active, and more difficult to soothe. Better respiratory effort, ie, cries with longer duration and more energy are related to more positive, easier to soothe infants.

Thus, in this study, we have found some significant relationships between neonatal behavior as measured on the Brazelton Scale and cry characteristics and behavioral observations of infant temperament at 3 months of age.

The next issue we examined is the effects of medical risk on temperamental dimensions. Table 5 shows the significant differences observed in the same study between healthy and sick prematures and full-term infants at 3 months of age. Premature infants, regardless of their perinatal problems are less positive at 3 months corrected age.

Premature infants who suffer from respiratory or neurological problems are also less sociable than full-term infants at 3 months

corrected age (see table 6). Thus, both prematurity and perinatal complications affect the infant's temperament.

In a different study, we have also compared groups of preterm infants who did or did not suffer different degrees of intraventricular hemorrhage, a perinatal complication associated with prematurity where blood gets into the ventricles, and a control group of full-term infants at 3 & 7 months of age. As in the previous study, all preterm infants, regardless of presence or severity of intraventricular hemorrhage, showed less positive responses at 3 & 7 months of age (see table 7).

Similarly, all preterm infants showed less overall activity in response to stimulation at 3 & 7 months (see table 8).

In addition all preterm infants were less social than full-term infants at 7 months (see table 9).

In general, infants with IVH I-II were more negative, less sociable and less soothable at 3 months of age, but these differences disappeared by 7 months (see table 10). Thus, group differences are seeing at 3 & 7 months of age between high risk infants and low-risk infants in most dimensions of temperament. However, we speculate that as the effects of perinatal insults resolve over time, the negative aspects of the temperamental infants characteristics disappear.

In addition, in this study we were able to assess the stability of the behavioral observations from 3 to 7 months (see table 11). Low to moderate stability was observed in positive, sociability and soothability scores between 3 and 7 months of age for the whole sample of preterm and full-term infants. Soothability stands out and shows the strongest correlation between 3 & 7 months of age.

Next we turn to the relationship between behavioral observations and parental reports. Table 12 shows the statistically significant correlation coefficients found in three different studies between

behavioral scores of infant temperament and maternal reports as assessed by the bates infant characteristic questionnaire, for the first two dimensions derived from this questionnaire: fussy-difficult and unadaptable. In the first study the correlation coefficients are based on 67 preterm infants below 1750 grams and 34 weeks of gestation. In the second study, the 49 infants include healthy preterm, sick preterm and full-term infants. In the last study only healthy, full-term infants were included (44). Out of 30 possible correlations, fourteen were statistically significant and in theoretically predicted directions. Thus, higher maternal scores on fussy difficult and unadaptable are related to less positive, more negative, less sociable and less soothable responses. The most consistent relationships were between behavioral ratings of soothability and parental reports: infants who are found to be less soothable are rated more fussy difficult and unadapatable across the three studies.

Although above chance, fewer and less consistent correlations are observed between the behavioral observations and the dimensions of unpredictability and dullness from the ak. Thus, we find some convergence between behavioral observations and parental reports, most consistently in the soothability dimension.

In summary, our studies suggest that neonatal characteristics, including Brazelton behavioral scores; cry acoustic characteristics, and medical status affects the infant's temperament. Both individual differences and group differences are observed. We also found some stability in our behavioral observations between 3 and 7 months of age.

However, aside from soothability, the magnitude of the correlations are small. Thus, although some stability is observed, our findings suggest that a great deal of change is observed in infant temperament during the first year of life. These findings are consistent with previous reports using various methodologies (e.G. Rothbart, 1981, Riese, 1987) and points out the need to investigate what are the determinants of change in temperamental characteristics over time.

Finally, we also observe moderate agreement between parent's reports and our behavioral observations, attesting to the concurrent validity of these measures.

TABLE 1

BEHAVIORAL ASSESSMENT OF INFANT TEMPERAMENT
ORDER OF STIMULUS: 3 MONTHS

- EXAMINER'S FACE AND VOICE
- CUDDLING IN ARMS
- CUDDLING AT SHOULDER
- DANGLE TOY
- TALK WHILE DANGLE TOY
- BRUSH HAIR
- WASH FACE
- PUT ON HAT
- BELL/2 TIMES
- SCARY MASK AND VOICE
- HUMAN MASK AND VOICE
- JACK-IN-THE-BOX/ 2 TIMES
- INFANT CRY
- OVERWHELMING TOY

TABLE 2

BEHAVIORAL ASSESSMENT OF INFANT TEMPERAMENT
ORDER OF STIMULUS: 7 MONTHS

- EXAMINER'S FACE AND VOICE
- CUDDLING IN ARMS
- MIRROR
- ATTRACTIVE TOY
- TALK AND RATTLE
- WASH FACE
- HAT
- BELL
- SCARY MASK
- HUMAN MASK
- JACK-IN-THE-BOX
- INFANT CRY
- OVERWHELMING TOY

TABLE 3

CORRELATIONS BETWEEN BEHAVIORAL OBSERVATIONS AT 3 MONTHS AND NEONATAL BEHAVIOR AT 40 & 44 WEEKS (CORRECTED AGE)

	POSITIVE	NEGATIVE	SOCIABILITY	SOOTHABILITY
BRAZELTON SCALE				
MOTOR	/.34**	/-.28*		/-.27*
STATE REGULATION				/-.28*
AUTONOMIC	/.35**	/-.34**		-.25*/
REFLEXES	/-.36**		-.26*/-.28*	

40 WKS/44WKS
* P<.05
** P<.01
n=59

TABLE 4

CORRELATIONS BETWEEN BEHAVIORAL OBSERVATIONS AT 3 MONTHS AND CRY CHARACTERISTICS AT 40 & 44 WEEKS (CORRECTED AGE)

	POSITIVE	NEGATIVE	SOOTHABILITY	ACTIVITY
CRY				
DURATION			/-.27*	
M ENERGY	/.29*			
FIRST FORMANT		/-.28*		
VAR FIRST FORMANT			.26*/	-.28*/
SECOND FORMANT	-.26*/			

40 WKS/44 WKS
* P<05
n=59

TABLE 5

Group Differences in Behavioral Observations of Temperament

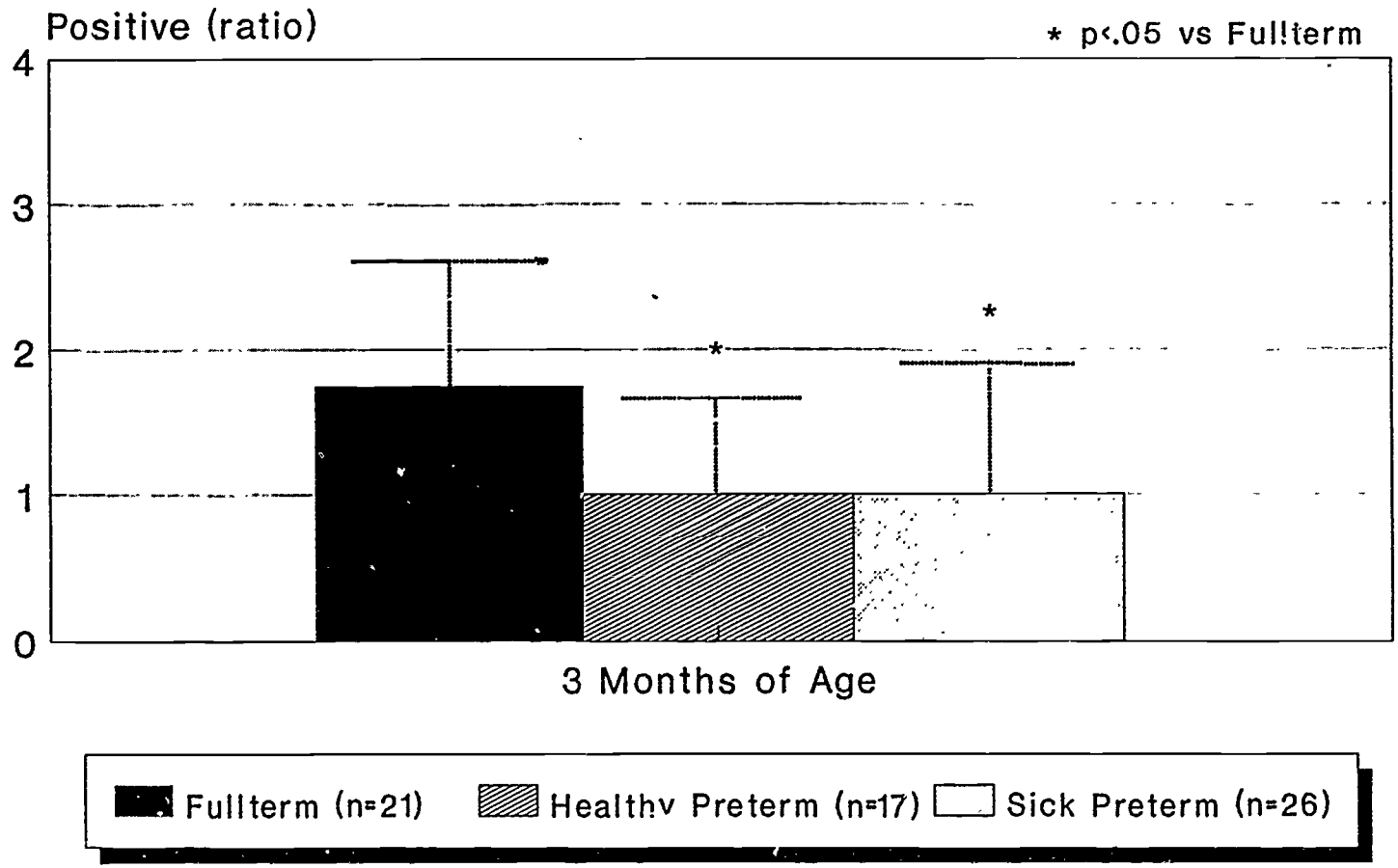

TABLE 6

Group Differences in Behavioral Observations of Temperament

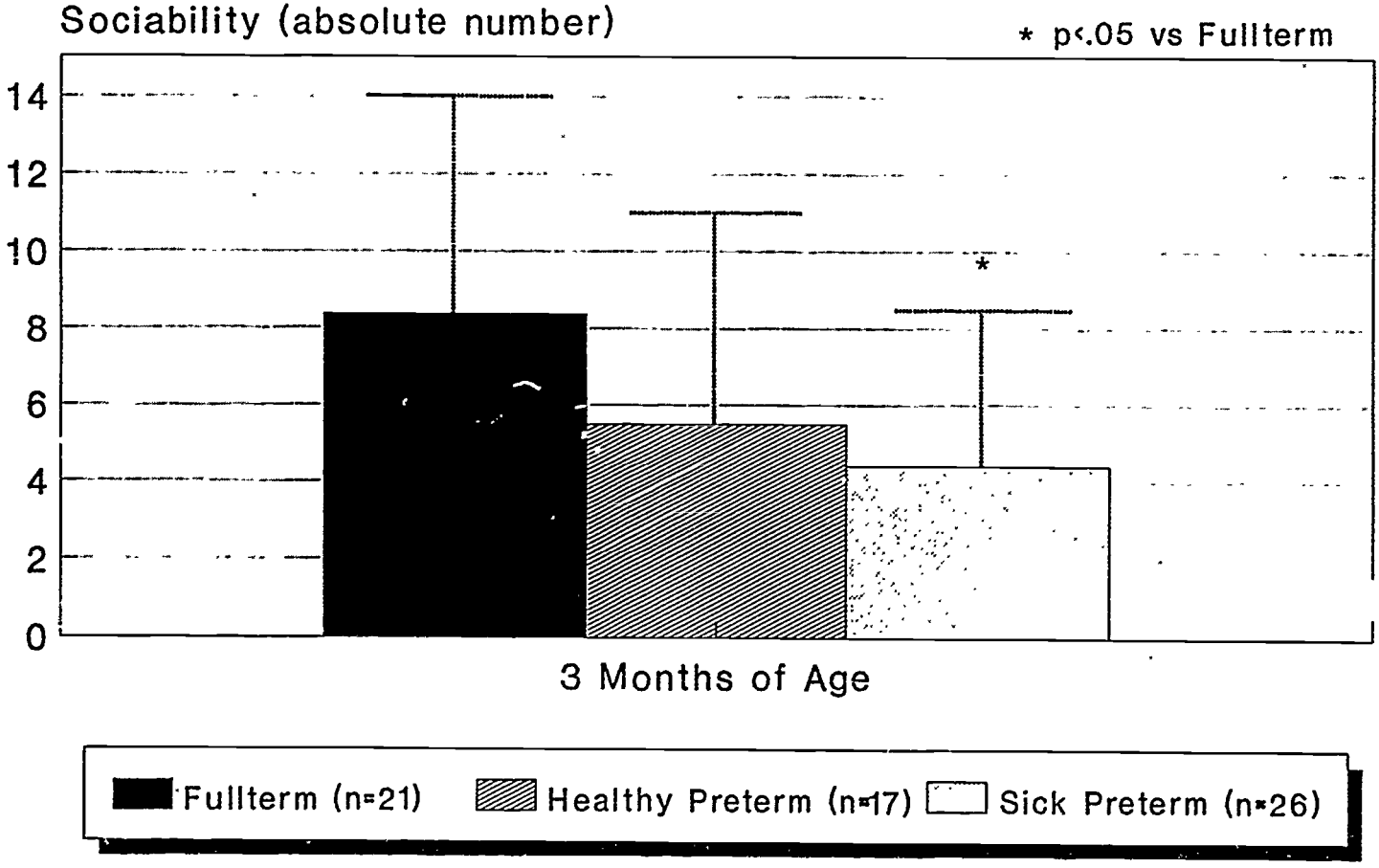

TABLE 7

Group Differences in Behavioral Observations of Temperament

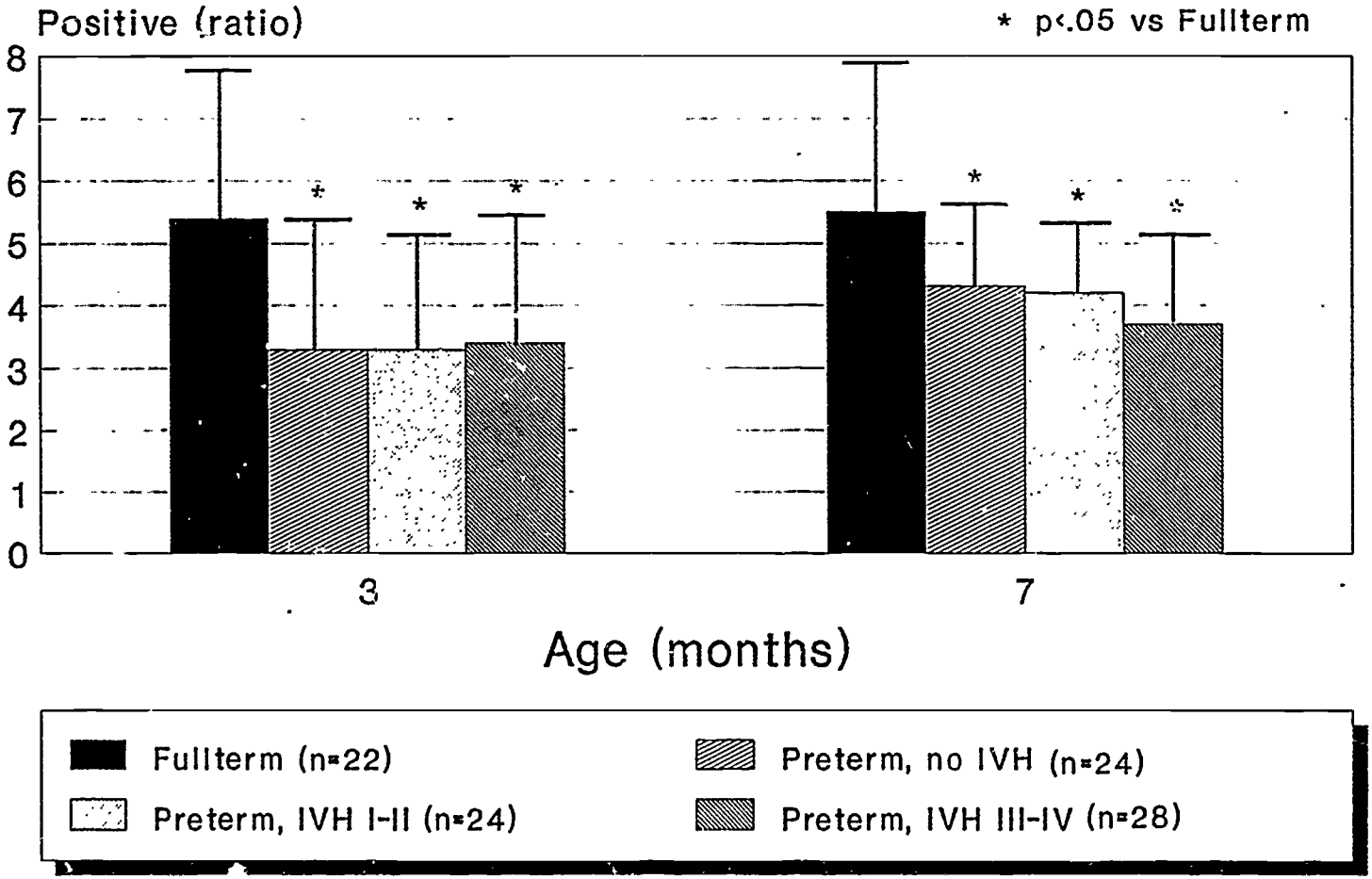

TABLE 8

Group Differences in Behavioral Observations of Temperament

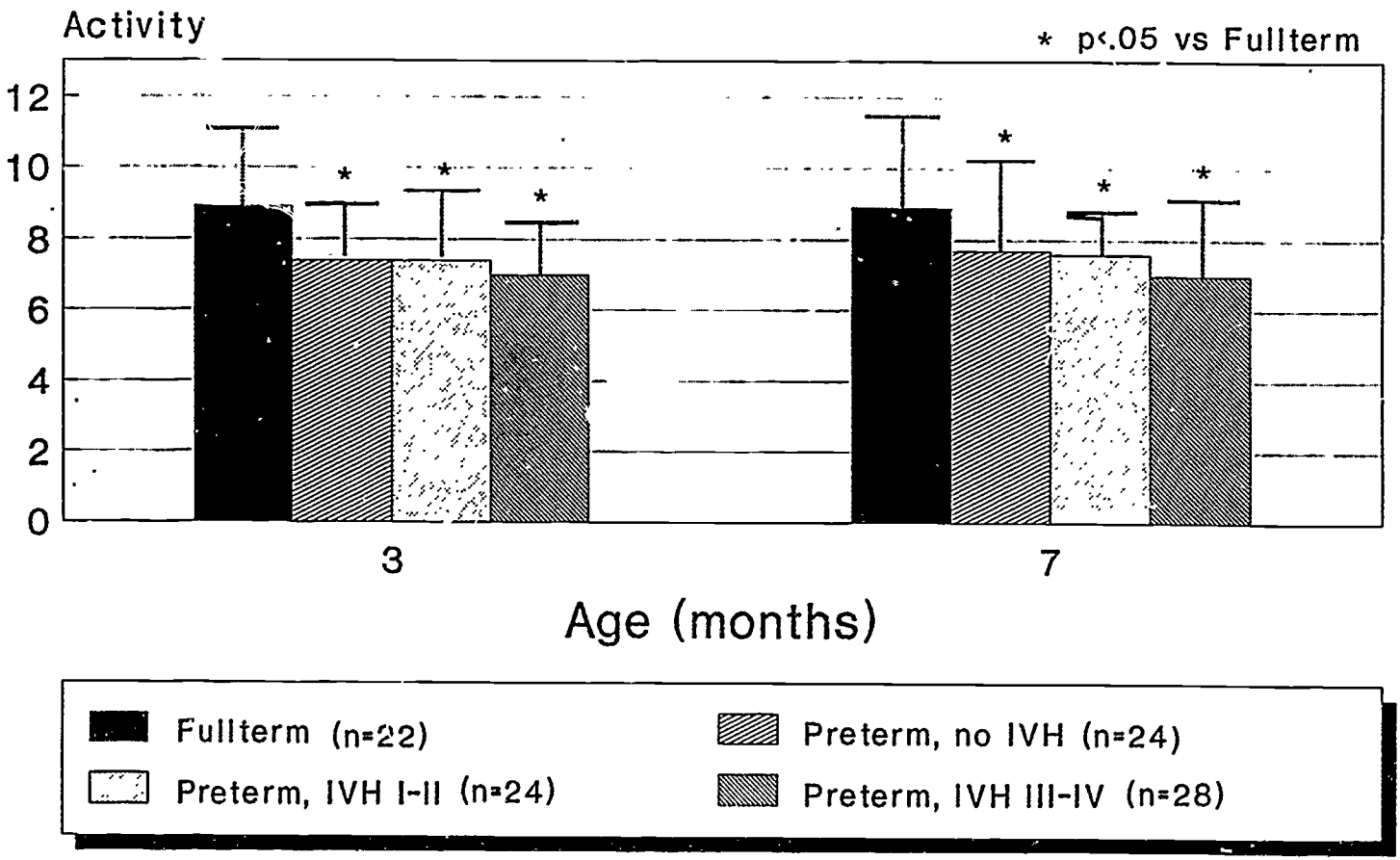

TABLE 9

Group Differences in Behavioral Observations of Temperament

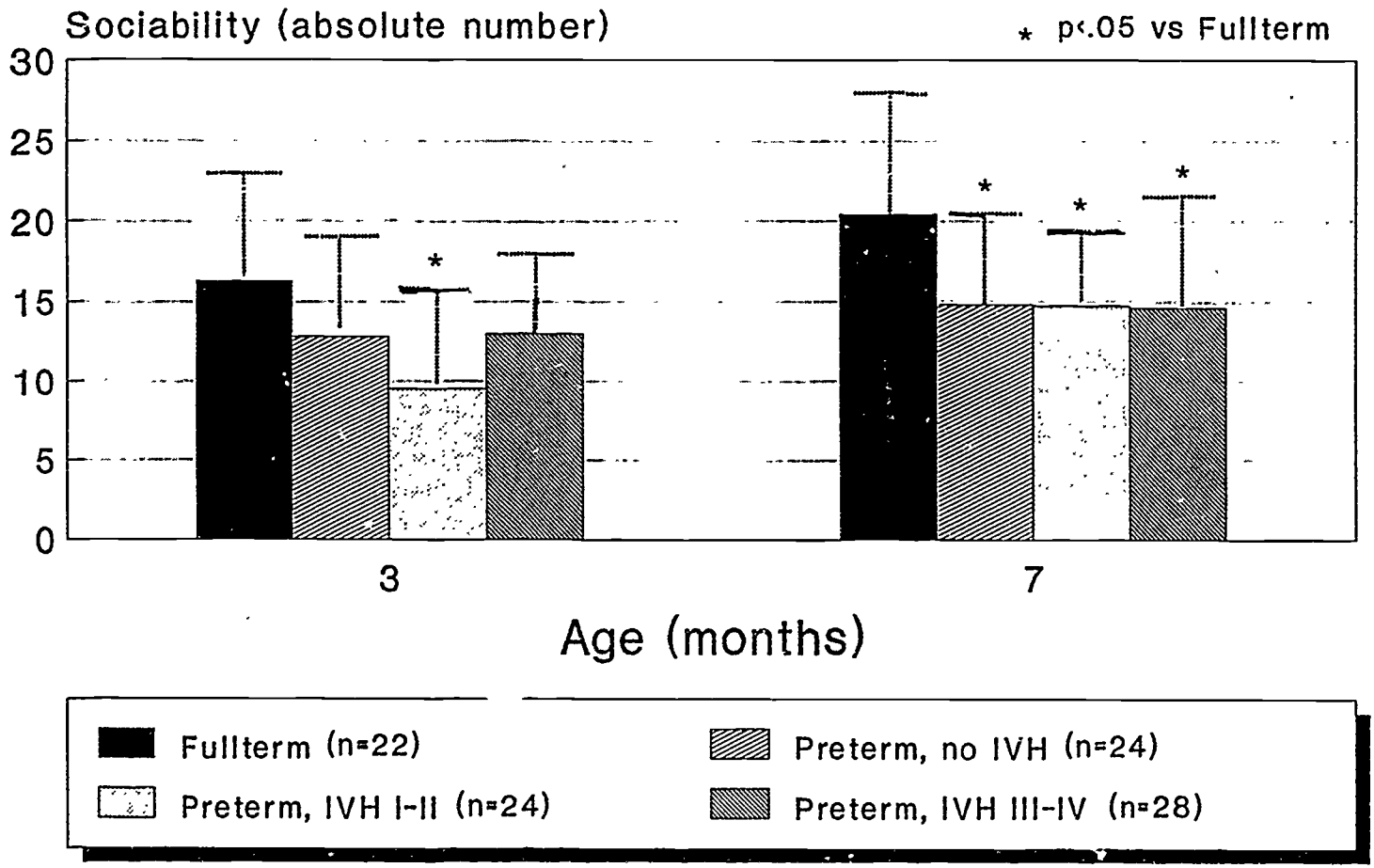

TABLE 10

Group Differences in Behavioral Observations of Temperament

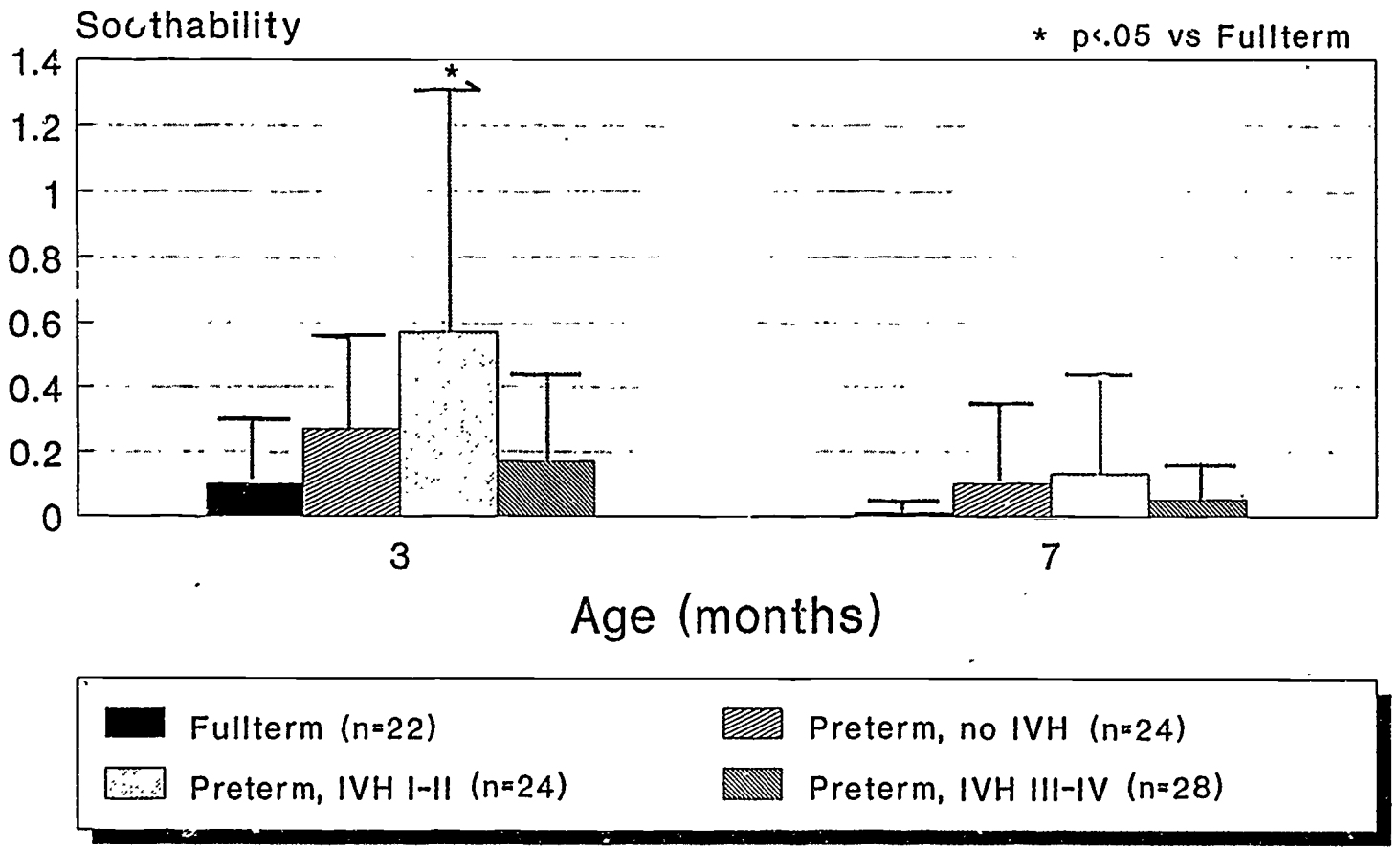

TABLE 11

CORRELATIONS BETWEEN 3 & 7 MONTHS BEHAVIORAL OBSERVATIONS OF INFANT TEMPERAMENT

POSITIVE	NEGATIVE	SOCIABILITY	SOOTHABILITY	ACTIVITY
.24*	N.S.	.21*	.49***	N.S.

* p<.05
* p<.01
* p<.001
n=98

TABLE 12

CORRELATIONS BETWEEN BEHAVIORAL OBSERVATIONS AND MATERNAL REPORTS OF INFANT TEMPERAMENT (BATES ICQ) AT 3 MONTHS

BATES ICQ	STUDY	POSITIVE	NEGATIVE	SOCIABILITY	SOOTHABILITY	ACTIVITY
FUSSY-DIFFICULT	1	-.34*	.44**	-.34**	.49**	N.S.
	2	N.S.	N.S.	N.S.	.39**	N.S.
	3	N.S.	N.S.	N.S.	.48**	N.S.
UNADAPTABLE	1	-.33*	.26*	-.39**	.37**	N.S.
	2.	N.S.	N.S.	-.28*	.39**	N.S.
	3.	N.S.	.46**	N.S.	.52**	N.S.

STUDY
1=(n=67, PRETERM)
2=(n=49, PRETERM & FULL-TERM)
3=(n=44, FULL-TERM)

* P<.05
**p<.01