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AUTHOR Ramey, Craig T.; Mills, Pamela J.
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ABSTRACT

This study examined the effect of a day care program on mother-child interaction patterns and attachment behaviors, and compared these patterns of behavior with those obtained from a matched sample of more advantaged home-reared infants. Subjects were 60 infants, ranging in age from 3 1/2 to 9 1/2 months, and their mothers. There were three groups of mother-infant dyads: (1) the high-risk experimental group (HRE), comprising 15 high-risk infants who had attended a day care facility for 8 hours per day since they were approximately 2 months of age, and their mothers; (2) the high-risk control group (HRC), comprising 15 high-risk infants and their mothers living together at home; and (3) 30 dyads selected at random from birth records for the local community. Data were collected by home observation and by interaction process analysis of 25-minute videotapes of mother-child interaction in a home-like laboratory setting. Results indicated that infants in the HRE group vocalized more and were generally more responsive than infants in the HRC group; these findings reflected basic differences in the infants rather than in the mothers, who differed only on measures of maternal concern for optimal child development. The HRE infants and their mothers were found to have a similar social relationship to that between infants and mothers in the general population group, suggesting that intervention has a positive effect on mother-child interaction in disadvantaged families. (GO)

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Craig T. Ramey and Pamela J. Mills

University of North Carolina at Chapel Hill

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Craig T. Ramey and Pamela J. Mills

Frank Porter Graham Child Development Center

University of North Carolina at Chapel Hill

The influence of developmental day-care for disadvantaged infants on early mother-child interaction patterns is a topic of considerable controversy. Those who approach this issue from an attachment perspective (e.g. Bowlby, 1958;) are concerned that a prolonged period out of the home and away from the mother each day will negatively affect the quality of the mother-child relationship.

Such concern is both warranted and constructive in view of rapidly expanding day care services in this country. However, the majority of evidence which suggests that negative effects are associated with early group care comes from institutionalized infants and does not necessarily apply to day care situations that exist in the United States today.

The most recent relevant evidence on attachment and day care is inconclusive. Caldwell, Wright, Honig and Tannenbaum (1970) found no difference in attachment behavior in infant day care and home reared children measured at 30 months of age using maternal interviews and rating scales. Blehar (1974), however, found what she termed anxious, ambivalent and avoidant attachment behaviors in day care attending children compared with home-reared children. Unlike the children from

the Caldwell et al study, however, the children that Blehar studied had not begun day care until they were two or three years of age, and had been in care only five months when observed; hence the results are not directly relevant to the issue of infant day care. In neither the Blehar nor the Caldwell et al studies were children and mothers examined during the developmental period when they were presumably forming attachments to their caregivers. Further, Caldwell et al's study which is the more directly relevant of the two relied upon maternal reports from mothers of day care attending infants instead of actually observing mother-infant interactions. The extent to which these mothers may have consciously or unintentionally distorted their verbal reports of their relationships with their children is simply unknowable. Thus, the present study was conducted to examine the ways mothers and children actually behaved toward one another during the time when attachment bonds are being formed. Further the present study sought to determine the impact of a day care intervention program upon the interaction patterns of mothers and infants during the infants first year of life. This study also sought to compare those patterns with ones obtained from a matched sample drawn from the general population of same-aged but more advantaged home-reared infants.

Subjects

The subjects for this study were sixty infants and their mothers representing three groups. The first two groups were composed of infants at risk for non-organic developmental retardation who were participants in the Frank Porter Graham Child Development Center's Abecedarian Project.

Group I, the High Risk Experimental group (HRE) consisted of fifteen mother-infant dyads. All infants in this group had attended an eight hour per day day care facility beginning at approximately two months of age. Group II, the High Risk Control (HRC) consisted of fifteen mother-infant dyads representing a home-control sample. Group III, consisted of thirty mother-infant dyads representing a stratified sample of the general population (GPS) and selected at random from the birth records for the local community.

The high risk groups were matched on the variables of age of infant, sex, race, socio-economic status, number of siblings, and mother's measured intelligence prior to being randomly assigned to groups. The group representing the general population was matched to the high risk groups on age and sex of infant and live birth parity. The infants in all three groups ranged from 3-1/2 to 9-1/2 months of age, with a mean age of approximately 200 days.

Table 1 contains a summary of selected characteristics of the High-Risk and general population samples.

Procedure

Home Observation. Each family was visited at home to gather information concerning the demographic characteristics of the families. In addition, part of the time in the home was spent conducting Caldwell's Home Observation for Measurement of the Environment (HOME), An Inventory of Infants (1968). This observation and interview inventory was used to assess the factors of maternal warmth, the absence of punishment and hostility, the organization of the physical and temporal environment, the appropriateness of toys provided, maternal involvement with the child and the opportunity for variety in daily stimulation. These factors, ordered as to their importance, represent "certain aspects of the quantity and quality of social, emotional and cognitive support available to a young child (birth

to three years) within his home" (Instruction Manual).

One-third of the forty-three items were obtained through talking with the mother and two-thirds were obtained through actual observation. Inter-observer reliability for the HOME was based upon independent scoring of each item of the same interviews by three raters. An overall 93.6% agreement was achieved.

Laboratory Measurements. In addition to home observation specific behaviors of the mother and infant were assessed in a controlled naturalistic environment similar to the one used by Lewis and Goldberg (1969). A twenty-five-minute video-tape was made of the interaction between mother and infant in a room furnished with comfortable, home-like furniture. All infants and mothers in this study had never been in this situation before and therefore, they were in a novel setting. Available within the room was a crib and toys for the child and a television and current magazines for the mother. The mothers were informed that this part of the study was being conducted to determine the activity level of babies when they were with their mothers in a new and different setting.

Mother-Infant Interaction: Procedure of Taping:

1. On the day of taping, the mother and infant were escorted into the observation room. The videocamera and microphone were pointed out to the mother, and she was told we were taping so that we could analyze the data at a later date.

2. The television and magazines were pointed out, and the mother was told that she should respond to the child's needs as she would at home. The currency and type of magazines were manipulated to allow for positive valence and as an attempt at a controlled naturalistic observation.

3. The mother-infant dyad was taped for twenty-five minutes.

Categories of Behavior

Behavior was recorded into Esterline Angus Event records for each of the following categories. Both frequency and duration were recorded.

Mother

Talk to Child: Any vocalization made by mother that was directed toward child.

Touch Child: Any physical contact to mother toward child, including responses by mother which were child-care oriented e.g. wiping nose, helping child to sit up. Holding child was not considered to be touching.

Hold Child: Mother had child in arms or on lap, supporting weight of child.

Demonstrate Toys: Any time mother demonstrated toy to child, including winding toy, listening to or talking about toy to child, thumbing through book if not actually reading to child.

Interact with Child Without Toys: Any reciprocal interaction[1] between mother and child that did not involve a non-social object. It might have included actual touch, but touch was not required.

Read to Self: Any time mother read to herself.

Read to Child: Any time mother read to child from book or magazine.

Television On: Any time television set was turned on, regardless of whether or not child or mother was watching.

Child

Vocalizations: Any non-fussy vocal sounds by child.

Fuss/Cry: Any fussy noisemaking or cry by child, including vocalizations to protest.

Playing with Toys Alone: Any time child manipulated or attended to pre-specified object, including actually touching toys plus watching or attending to toys.

Interacting with Mother and Toys Simultaneously: Any time child and mother were playing together and non-social object was involved. Child was playing with toy and mother or attending to mother's involvement with toy. It involved reciprocal interaction of mother and child.

On Furniture: Any time child was on furniture, which included sofa and chair. It also included mother's sitting in chair and holding child on lap.

In Crib: Any time child was in infant crib.

Feeding/Sleeping: Any time child was drinking, eating, or sleeping. Included were times child was not moving arms, legs, and head, whether or not observer could tell if child were actually sleeping.

Interaction Reliability

Inter-observer reliability was based upon independent scoring by three trained observers. Prior to beginning the study, categories of behavior were discussed and operational definitions were determined. Practice tapes were scored, coding the behavior for both mother and infant.

Four complete sessions were checked for reliability, one for each high risk group and two for the general population (one out of fifteen). Random ten-minute tape segments were coded for both mother and infant, scoring one out of every five tapes. Three ten-minute segments for the general population sample. (Twenty percent of the tapes in each group were checked for reliability.)

Mean inter-observer reliability across categories for the three observers was 95.6%, with a range from 91% to 100%.

Results

Home Observation for Measurement of the Environment

Mean comparisons on the six factors of the HOME across three groups were made using a multivariate analysis of variance. Scores on each of the

six factors were analyzed to determine the differences among groups. The multivariate F test showed a significant difference (F mult. $_{12/104}$ = 7.486, $p < .001$) as did the univariate F tests of each factor ($p < .001$). The results of this analysis are presented in Table 2.

Insert Table 2 about here

HRC vs. GPS. One special contrast entailed comparing the high risk control group with the general population sample. Differences between the two groups were the same as between all three; each of the six factors were significant at the .001 level, with the GPS scoring higher.

HRE vs. HRC. Comparisons between the two high risk groups demonstrated no significant differences. The only factor to approach significance was that of maternal involvement ($p < .055$), with the day care group scoring higher.

Laboratory Results

Duration of Behavior. Mean comparisons on fifteen criterion variables (duration of behavior) across three groups again involved using the multivariate analysis of variance (Cramer, 1971) technique. Duration of behavior in each category was used as the lowest level of data analysis, using time accumulation during the twenty-five-minute taping session.

Table 3 presents, by groups, the means and standard deviations of each category of behavior coded for the infants.

Insert Table 3 about Here

Table 4 presents, by groups, the means and standard deviations for

the mothers' behavior.

Insert Table 4 about here

Multivariate comparison of all three groups simultaneously. The mother-infant interaction data was analyzed to determine the significance of overall differences among the groups for both mothers and infants in the same analysis. The results indicated a significant difference among groups ($F\ mult_{30/86} = 2.748$, $p < .001$).

In order to determine which categories contributed to the overall significant difference, univariate F tests were used. Due to the large variances on most variables, square root transformations of scores were employed.

Univariate F tests revealed significant differences among groups in the behaviors of child vocalization ($F_{2,57} = 3.621$, $p < .033$), child interacts with mother and toys ($F_{2;57} = 4.523$ $p < .015$), mother talks to child ($F_{2,57} = 6.931$, $p < .002$), mother reads to child ($F_{2,57} = 4.814$, $p < .012$), and mother interacts with child without toys ($F_{2,57} = 3.414$, $p < .040$), but exact locations of differences were not indentified. Special contrast analyses were used to identify group differences.

HRC vs. GPG. Significant differences were found in favor of the GPS in the areas of child vocalization ($F_{1,57} = 4.498$, $p < .038$), child interacts with mother and toys ($F_{1,57} = 6.305$, $p < .015$), mother talks to child ($F_{1,57} = 13.414$ $p < .001$), and mother reads to child ($F_{1,57} = 6.419$ $p < .014$).

HRE vs. GPS. Special contrast comparisons between the high risk day care groups and the general population sample identified only one significant difference and that was in the behavior of mother reads to child ($F_{1,57} = 6.419$, $p < .014$).

The means indicated that GPS mothers read to their infants more than HRE others. Thus, except for this one variable the experimental group and the general population group appear quite comparable.

HRE vs. HRC. Comparison between the high risk center-attending and the high risk home-reared infants demonstrated differences favoring the day care group. The two high risk groups showed significant differences in the areas of child vocalization ($F_{1,57} = 6.641$, $p < .013$), child interacts with mother and toys ($F_{1,57} = 7.848$ $p < .007$), and mother interacts with child without toys ($F_{1,57} = 6.775$, $p < .012$). On each of these variables the HRE scored significantly higher than did the HRC.

Frequency of simultaneous behavior. Another level of analysis of the interaction data involved a comparison among groups using frequency of occurence of behavior. Utilizing a ten-second unit of time, behaviors were coded as to their simultaneous occurence. Mean comparisons on multiple measures across the three groups for each paring of mother and infant behaviors identified differences that were not discernible in the analyses involving duration summaries.

Multivariate comparison of behavioral pairings for all three groups simultaneously. Table 5 identifies the simultaneous behavioral pairings that were significant at less than the .05 level when all three groups were compared.

Insert Table 5 about here

HRC vs. GPS: Behavioral pairings. Comparison between the high risk control and general population samples demonstrated significant differences on several pairings. The GPS mothers were found to demonstrate toys more while their infants were vocalizing (DemVocF $_{1,57}$ = 5.027, $p < .029$), to

have their infants interact with them more while the mothers were demonstrating toys (DemIntF $_{1,57}$ = 4.677 $p<.035$), to have the infants vocalize more while the mothers were talking (TalkVocF $_{1,57}$ = 6.551, $p<.013$), and to have the infants interacting with the mothers with toys while the mothers were talking (TalkIntF $_{1,57}$ = 10.143, $p<.002$).

The HRC mothers were found to read more to themselves while their infants fussed (ReadAlone-FussF $_{1,57}$ = 9.381 $p<.003$).

HRE vs. GPS: Behavioral pairing: When comparing the high risk day care group with the general population, only two significantly different pairings were found. There results identified the GPS mothers as demonstrating toys more while their infants played alone (DemPlay F $_{1,57}$ = 4.183, $p<.045$) and as talking more while their infants played alone (TalkPlay F $_{1,57}$ = 5.145, $p<.027$).

HRE vs. HRC: Behavioral pairings. The two high risk groups were found to differ significantly on five behavioral pairings. The home-reared high risk infants played alone more while their mothers demonstrated toys (DemPlayF $_{1,57}$ = 9.479, $p<.003$) and fussed more while their mothers read to themselves (ReadAlone-FussF $_{1,57}$ = 6.929 $p<.011$). The center attending high risk infants vocalized more while their mothers interacted with them without toys (IntW/OVocF $_{1,57}$ = 6.036, $p<.017$).

Since the maternal behavior "interacts with child without toys" requires a reciprocal reaction on the part of the infant, this behavior was included in the behavioral pairings with both mother and infant behaviors. The high risk day care mothers were found both to talk and to touch more while they interacted with their infants without toys (IntW/OTalkF $_{1,57}$ = 5.828, $p<.019$ and IntW/OTouchF $_{1,57}$ = 5.603 $p<.021$).

Thus, these analyses indicate that the GPS and HRE samples perform quite similarly. It does appear that the GPS mothers, however, do make

more attempts to capture the infants attention while he is playing alone by talking to him and by attempting to demonstrate toys to him. Nevertheless, these attempts do not appear to alter the frequency of the child's behavior.

The comparison of the HRE and the HRC groups seems to show that the HRE mothers, similar to the CPS mothers, had more difficulty in attracting the infants attention by demonstrating toys. Further, the experimental group mothers appear more involved with their infants compared to the control group as indexed by more infant vocalizations when interacting with their mothers without toys. Finally when the HRE mothers did interact without toys they both talked to and touched their infants more frequently.

Discussion

On measures of mother-infant interaction patterns, significant variations were found among groups. Although there were not substantial differences in basic amounts of maternal caretaking behaviors (e.g. touching, holding, infant feeding/sleeping), in infants playing alone or fussing/crying, or in mothers demonstrating toys or reading to themselves, differences were found in certain contrasts involving vocalization and interactive behaviors.

The high risk group receiving day care was found to more closely approximate the general population sample than the high risk home-reared groups in the area of infant vocalization. High risk infants in day care were found to vocalize at the same time as their mothers with similar frequency as the general population infants. High risk infants being reared at home had less vocalization occurring in the same time interval as their mothers.

The high risk day care group was also found to interact more with their mothers both with and without toys. This group responded more to their mothers' demonstration of toys and vocalized more when their mothers interacted with them without toys.

The general population sample scored higher on the HOME than either high risk group. The two high risk groups were found to have deprived homes, according to assessment by the HOME. The one factor indicating marginally significant differences between the high risk samples was that of maternal concern for the development of the infant (maternal involvement) with the center attending children receiving higher scores.

In conclusion, high risk infants in day care were found to have a social relationship with their mothers similar to that of the general population infants. Apparently there is not a negative relationship between being enrolled in a day care program during the first year of life and having a high quality of interaction with the mother. The data would lead us to conclude that the intervention program has had a positive effect on the relationship between mother and infant for disadvantaged families.

This dissimilarity between the two high risk groups seemed to reflect basic differences in the infants, rather than in the mothers. Also, vocalization appeared to be a particularly sensitive behavior differentiating among groups. The high risk infants in day care were found to vocalize with similar frequency to the general population infants. While there were no significant differences between the two high risk groups in the frequency count of mother vocalizing alone, there were significant differences in the frequency count of mother and infant vocalizing during the same time interval. Regardless of the direction of reinforcement (whether the mothers' vocalization reinforced the infants' vocalization or vice versa), there was a significant difference between the day care

and home control high risk groups on the measure of mother and infant vocalizing together.

Also, the finding that high risk day care infants interacted more with their mothers while the mothers were demonstrating toys indicates a higher degree of responsivity on the part of these day care infants. The high risk day care infants were found to respond with a greater frequency than were either the general population or high risk home-reared infants.

Even though the high risk mothers with infants enrolled in day care behaved differently toward their infants during the observation taping in the controlled setting, there was limited generality to the home setting. Few differences were found when comparing the interaction between high risk mothers and infants in their own homes. The one area in which differences were identified was that of maternal concern for optimal child development (HOME maternal involvement factor). The mothers with high risk infants enrolled in day care appeared more interested in the infants' development. They reflected greater concern for providing a setting which would stimulate developmental advance.

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Table 1

Selected Characteristics of the High Risk Groups Compared with the General Population Sample

Characteristic	High Risk	General
Number of Families	30	30
Race of Families	100% Black	20% Black
Age of Child (Average)	6.5 months	6.6 months
Percent Male	33%	33%
Percent First Born	50%	50%
Percent Breast Fed	3.3%	36.7%
Age of Mother (Average)	22.20 years	27.33 years
Mother's Education (Percentage of Persons)		
1-8 years	3.3%	3.3%
9-11 years	63.3%	3.3%
High School Graduate	33.3%	10%
13-15 years	0%	23.3%
College Graduate	0%	30%
Graduate Education	0%	30%
Father's Education (Average)	10th grade	College Graduate*
Family Income (Average)	$1500 yearly	$10,780 yearly

* 70% of the general population fathers had graduate education.

Table 2

Home Observation for Measurement of the Environment:

High-Risk Groups Compared to General Population

MANOVA

Multivariate F Test

Test of Roots	F	DFHYP	DFERR	p
1 through 2	7.486	12.000	104.000	0.001
2 through 2	1.609	5.000	52.500	0.174

Univariate F Tests

Variable	F(2,57)	MS	p
Maternal Warmth	12.122	27.432	0.001
Absence of Punishment	8.996	8.275	0.001
Org of Environment	14.576	10.817	0.001
Appropriate Toys	31.948	90.425	0.001
Maternal Involvement	28.755	48.900	0.001
Opportunity for Var	12.163	14.767	0.001

Table 3

Means and Standard Deviations of Time in Seconds of Categories of Infants Behavior in Mother-Infant Interaction Observation

GROUP		VARIABLES						
		Sleep	Child Voc	In Crib	Child Play	Int M&Toys	On Furn	Fuss/Cry
HRE	M	58.267	136.333	14.467	413.067	540.467	71.000	68.600
	SD	161.307	86.685	56.029	350.282	253.378	182.802	98.263
IRC	M	104.533	71.467	26.333	547.333	303.200	263.800	145.800
	SD	185.310	85.652	77.099	437.924	310.040	404.142	250.367
GPS	M	99.000	113.333	74.167	519.067	498.567	98.733	94.600
	SD	213.800	85.479	199.221	439.641	342.321	210.042	156.711

Table 4

Means and Standard Deviations of Time in Seconds of Categories of Mothers' Behavior in Mother-Infant Interaction Observation

GROUP		VARIABLES							
		Dem Toy	Mat Talk	TV On	Read Child	Read Self	Touch	Hold	Int No Toys
ERE	M	522.867	232.933	365.134	0.0	266.133	350.467	238.600	103.267
	SD	303.189	206.234	629.758	0.0	336.162	396.717	344.352	145.410
IRC	M	447.800	140.867	363.067	0.0	241.333	260.267	224.533	10.133
	SD	281.916	137.754	628.639	0.0	414.788	384.454	404.704	23.099
PS	M	573.467	331.400	102.700	18.767	176.200	169.133	266.200	42.867
	SD	352.855	192.299	303.112	35.052	269.929	174.168	342.556	68.200

Table 5

Behavior Pairings Significant Across Three Groups

BEHAVIORAL PAIRINGS (MOTHER/INFANT)	p
Demonstrate Toys/Play	0.012
Talk/Vocalize	0.045
Talk/Interact w/M & Toys	0.006
Read/Fuss	0.008