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# Maternally Administered Tactile, Auditory, Visual, and Vestibular Stimulation: Relationship to Later Interactions between Mothers and Premature Infants

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Thirty-three mother-infant pairs were randomly assigned to one of three groups: control, talking, or interactive (RISS). The later treatment included massage, talking, eye contact and rocking. The intervention (RISS) was administered to determine whether mothers and their preterm infants who actively interacted with each other would differ on later maternal and infant behaviors. The talking and RISS treatments were administered at specified time intervals 24 hours after delivery. Prior to hospital discharge, mother-infant interaction was assessed during a feeding. Significant differences were identified among the three groups for maternal ($p < .03$) and infant ($p < .05$) behaviors. These results suggest that active maternal interaction with the premature infant may enhance specific components of mother-infant interaction.

Among the factors that may contribute to altering mother-infant interactions for premature infants are delayed maternal tactile contact, maternal and/or infant health status, alteration in infant state, and the infant's decreased responsiveness to social stimuli (Als, Lester, & Brazelton, 1979). Investigators have documented an increased incidence of interactive disorders after periods of separation in the neonatal period (Bensel & Paxson, 1977; Field, 1977; Jeffcoate, Humphrey, & Lloyd, 1979; Leiderman & Seashore, 1975; Leifer, Leiderman, Barnett, & Williams, 1972; Lynch, 1975). Often, initial contacts between a mother and her premature infant are delayed and minimal during the immediate postpartum period. When contact occurs, it may be characterized by passive interaction, involving little or no stimulation of the infant.

Previous researchers hypothesized that premature infants are deprived of appropriate stimulation (Greeg, Haffner, & Korner, 1976; Rose, Schmidt, Riese, & Bridges, 1980; Solkoff, Yaffe, Weintraub, & Blase, 1969). Several interventions have been proposed for improving the growth and development of premature infants (Field, 1980). The results of infant stimulation studies have been encouraging, particularly in the areas of neurobehavioral functioning (Barnard, 1973; Neal, 1977; Rausch, 1981) and improved

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weight gain (Scafidi, et al., 1986; White-Traut & Tubeszewski, 1986).

The development of mother-infant interaction is an adaptative process (Barnard, 1978b). Interventions aimed at altering this process may improve mother-infant interaction more than other attempts to change a mother's intrinsic behavioral characteristics or attempts to alter an infant's behavior by means of routine stimulation protocols. For mothers of premature infants deprived of early maternal contact, selecting an intervention that contains natural components of early mother-infant interaction may improve the outcome for this high-risk group. The purpose of this study was to focus on a *maternally* administered intervention using massage, rocking, talking, and eye-to-eye contact as a means of improving the interaction between mother and premature infant. The present study differs from previous work by directly modifying the interaction between mother and infant via maternally administered intervention rather than concentrating on nursery based stimulation of the infant.

## METHOD

### Sample

The study sample consisted of 33 mother-infant pairs from one institution. Between 12 and 24 hours after delivery, mothers were approached, the study was described, and informed consent was obtained from the parent(s). Mother-infant dyads were then randomly assigned to one of three groups: control; talking treatment; or interactive (massage, rocking, talking and eye-to-eye contact). Maternal inclusion criteria included the ability to speak and understand English, vaginal delivery of the infant, and an age of at least 16 years. Women who experienced multiple births were not eligible to participate. Infant inclusion criteria included gestational age between 28 and 35 weeks, birth weight appropriate for gestational age, and absence of ventilatory assistance by 24 hours after delivery. Infants with suspected or diagnosed chromosomal abnormalities were excluded. All mothers visited their healthy premature babies by 12 hours of infant age. All infants remained in the Special Care Nursery for the duration of the mother's hospitalization.

The sample is described according to maternal and infant variables in Table 1. Maternal variables compared included maternal age, obstetrical complications score, socioeconomic status, educational level, race, parity, and marital status. Infant variables analyzed included birth weight, gestational age, postnatal complications, infant sex, and phototherapy treatment. Analysis of variance and chi-square statistical techniques were conducted among the three groups to determine equivalency of the groups prior to intervention. There were no significant differences among the groups on either maternal or infant variables prior to intervention.

### Independent Measures

This study employed three independent measures: routine nursery care, an unstructured talking treatment, and the Rice Infant Sensorimotor Stimulation Technique (RISS) (Rice, 1977). Routine nursery care included a consistent feeding schedule of feedings every three or four hours, handling for procedures, and periodic (occasional) opportunities for nonnutritive sucking. Parental visiting was encouraged and open visiting hours were in effect. Family members and staff often placed visual stimuli in the incubator or bassinet. Primary nursing was in effect. In addition, mothers assigned to the Routine Care Group received a didactic discussion on infant clothing for the premature infant. This discussion served two purposes: it provided information relevant to the care of a premature infant, and allowed the investigator to spend an equal amount of time with mothers in each of the three groups, diminishing the possibility of a generalized Hawthorne effect.

Mothers assigned to the Talking Group also received the same discussion on infant clothing. Mothers in this group were instructed to talk or sing to their infants for 15 minutes at the specified time intervals. Mothers administered the talking treatment according to a uniform protocol in a controlled setting (infant in the incubator or under the infant warmer). Three mothers insisted on holding their infants for the talking treatment, and some of the other

**Table 1. Characteristics of Mothers and Infants by Treatment Group**

| | Group[a] | | |
|---|---|---|---|
| | Routine Care | Talking | RISS |
| Mother | | | |
| Age | 20.82 | 21.82 | 22.18 |
| OCS[b] | 35.45 | 35.70 | 35.40 |
| SES[c] | 2.09 | 1.45 | 1.73 |
| Education (years) | 12.73 | 12.73 | 12.45 |
| Race (Black/White) | 10/1 | 10/1 | 11/0 |
| Marital status (S/M)[d] | 7/4 | 8/3 | 9/2 |
| Parity (Primip/Multip) | 7/4 | 4/7 | 2/9 |
| Infant | | | |
| Birth Weight (grams) | 1864.55 | 1956.18 | 1949.09 |
| Gestational age (weeks) | 33.18 | 34.18 | 33.91 |
| PCS[e] | 6.91 | 8.18 | 7.27 |
| Sex (male/female) | 5/6 | 5/6 | 6/5 |
| Phototherapy | 7 | 3 | 5 |

[a]N = 11 per group.
[b]OCS—Obstetrical Complications Scale (Littman and Parmelee, 1974a) (Highest = 41; Lowest = 0).
[c]SES—Socio-Economic Status (Hollingshead, 1975) (Highest = 5; Lowest = 1).
[d]S/M—Single/Married.
[e]PCS—Postnatal Complications Scale (Littman and Parmelee, 1974b) (Highest = 10; Lowest = 0).

mothers engaged in some touching of their infants. These three infants were wrapped tightly in a blanket and presented to their mothers, and all touching and stroking by any of the mothers was recorded by the investigator who sat obscurely in the corner of the nursery. Nine of the eleven mothers touched their infants, but only three mothers briefly touched their infants more than 4 times in three to four sessions. One mother touched her infant consistently, while the other two touched their infants 8 and 10 times, respectively. Virtually all touching was on the face or head; just one touch occurred to either the heel or the abdomen of two babies. In summary, some touching occurred in the Talking Group, but averaged just 3.2 touches per hour for 10 of the 11 infants.

The RISS infant massage technique was the third independent variable. The technique provided tactile contact, vestibular motion, auditory stimulation and eye-to-eye contact (visual stimulation) and promoted active interaction between mother and infant. The RISS technique was administered as a sequential cephalocaudal progression of massaging the infant's body for 10 minutes followed by rocking (vestibular stimulation) for 5 minutes.

Developed by Rice (1977), this technique has been used on premature infants both at home and in the hospital (White-Traut & Tubeszewski, 1986). When used by mothers at home, greater weight gain, improved Bayley scores, and greater maturational development by reflex measures were identified (Rice, 1977). The RISS technique was chosen for several reasons. The technique encourages eye-to-eye contact and auditory stimulation and promotes active interaction between mother and infant. The RISS was chosen because it is a specific and structured technique and is more likely to yield a higher level of intra-user reliability than a less structured technique.

Reliability of the RISS technique was addressed in several ways. Mothers in the RISS Group were taught how to administer the RISS by the first author. Verbal instructions, pic-

tures that illustrated the technique, and demonstration of the technique on a doll, were used for teaching the RISS. Mothers had to demonstrate proficiency on a doll prior to administration on their infants. A RISS reliability checklist was used to guarantee an agreement score of 85% or greater during the maternal demonstration prior to administration of the technique on the infant. Maternal consistency on the RISS ranged from 86% to 100%, with a mean of 96%. This reliability score during the treatment sessions was calculated as the percent of agreement on all treatment sessions with the RISS reliability checklist (White-Traut, 1983).

### *Dependent Measure*

The dependent variable was maternal-infant interaction. An interaction during a feeding situation was chosen because of its central importance in the early relationship of mothers and infants (Brody, 1956). The Nursing Child Assessment Feeding Scale (NCAFS) (Barnard, 1978a) was selected to measure feeding interactions. This scale was chosen because it measures the bidirectional exchange of maternal and infant behaviors and the sensitivity of each partner within the feeding situation. The six subscales of the NCAFS contain components of parental and infant behaviors including: parental sensitivity towards the infant's cues, parental response to distress, cognitive growth fostering behaviors, social emotional growth fostering behaviors, clarity of infant cues, and infant responsiveness to parent.

Internal consistency reliability estimates for the feeding scale are reported by Barnard and Bee (in press). These estimates for the total parent behavior score for infants 1 through 12 months of age were .83, and for the total infant behavior score were .73. The stability of the scores for ages 1, 4, 8, and 12 months was also calculated using a generalizability coefficient and these scores were .75 and .51 respectively for the total parent and infant behavior scores.

Reliability in scoring the feeding interactions was determined prior to assessments of feeding interactions and during the data collection period. The investigator and the research assistants were certified to administer the NCAFS prior to data collection. To obtain certification, an inter-rater agreement score of 85% or greater had to be maintained for five observations. The feeding interactions were observed by a research assistant (who was blind to the subjects' group assignment) or the investigator. To assure continued inter-rater reliability throughout data collection, 25% of the observations were selected periodically and scored by two observers. Inter-rater reliability was computed based on percentage of agreement between the two observers (a minimum of one observer was blind to group assignment). Inter-rater reliability in scoring of feeding interactions was maintained at 88%.

### *Instruments*

The Obstetrical Complications Scale (OCS) (Littman & Parmelee, 1974a) was selected to obtain information related to pregnancy, labor, delivery, and the immediate neonatal period. Research assistants were trained to reliability >.85 prior to initiation of the study. Inter-rater reliability was determined by calculating the percentage of agreement between the two observers. Inter-rater reliability was periodically checked for 25% of the subjects and was maintained at 87%. The OCS data were obtained from the medical record.

The Postnatal Complications Scale (PCS) (Littman & Parmelee, 1974b) was selected to obtain information relating to the initial neonatal period. Research assistants were trained to the same criteria as the OCS prior to initiation of the study. Inter-rater reliability was periodically checked for 25% of the subjects and was maintained at 93% agreement between two observers. These data were recorded from the infants' medical records by the research assistants.

### *Procedures*

Thirty-three mother-infant pairs were randomly assigned to one of three groups. Infants assigned to the Routine Care Group received routine hospital care. Mothers assigned to the Routine Care Group received a didactic discussion on infant clothing for the premature infant. The mother-infant pairs assigned to the Talking Group received the

same treatment as the subjects in the Routine Care Group. In addition, these mother were instructed to engage in 15 minutes of unstructured talking (or singing) to their infants during the following post birth periods: 24 to 36, 37 to 48, 49 to 60, and 61 to 72 hours. Mothers assigned to the RISS Group were taught to administer a tactile-vestibular stimulation technique, incorporating talking and eye-to-eye contact. These mothers did not receive the presentation on infant clothing. The RISS was administered by the mother at the same time intervals as the talking treatment. On the day prior to the infant's discharge or on the day of discharge to home, mother-infant interaction was assessed during a feeding.

When this project was begun, the average postpartum hospitalization was three days. Two months after data collection began, the average maternal postpartum hospitalization was decreased to two days. The number of treatments had to be reduced to adjust for this change, resulting in only three treatments for two infants in the Talking Group and six infants in the RISS Group.

## *RESULTS*

An analysis of variance was conducted for both maternal and infant behavior scores to determine whether mothers and infants who actively interacted with each other differed significantly on maternal and infant behaviors from mother-infant pairs who received the talking treatment or routine care.

There were significant differences among the three groups on the total maternal behavior raw score [$F$ (2, 30) = 4.34, $p < .03$]. A follow-up Scheffé analysis indicated significant differences between the Talking Group and the RISS Group for maternal behavior [$F$ (1, 30) = 3.98], $p < .05$]. The mean maternal and infant behavior scores by group is represented in Figure 1.

Separate analyses of the four individual subscales of maternal behavior also were conducted. Significant differences via a one-way analysis of variance were identified for the sensitivity to infant cues subscale [$F$ (2, 30) = 5.02, $p < .02$] and the cognitive growth fostering subscale [$F$ (2, 30) = 3.82, $p < .04$]. Student's $t$ tests were computed to determine individual groups' differences for the maternal behavior subscales. Significant differences were identified between the Routine Care and the RISS Groups [$t$ (20) = −3.360, $p < .004$] for maternal sensitivity towards the infant, and between the Routine Care and the RISS Groups [$t$ (20) = −2.885, $p < .01$] and the Talking and the RISS Groups [$t$ (20) = −2.337, $p < .03$] for the cognitive growth fostering behavior subscale.

A one-way analysis of variance among the three groups was computed for the total infant behavior raw score. Significant differences were found [$F$ (2, 30) = 3.46, $p < .05$]. A Scheffé analysis did not reveal significant differences between the groups, indicating that infant behavior was significantly altered by maternally administered intervention, but not different between the Talking and RISS Groups. Based on the Scheffé results, individual group comparisons were not examined for these data.

The two subscales of infant behavior were analyzed separately by one-way analyses of variance. Significant differences were not identified for the clarity of infant cues subscale [$F$ (2, 30) = 3.21, $p < .06$] or the infant's responsiveness to his/her parent subscale [$F$ (2, 30) = 1.32, $p < .30$].

In summary, analyses of variance obtained main effects for both maternal and infant behaviors. The major hypothesis was supported. Mothers in the RISS Group who massaged, talked, rocked, and had eye-to-eye contact with their infants received significantly higher maternal-infant interaction scores. These mothers were significantly different in regards to maternal sensitivity towards the infant and cognitive growth fostering behaviors from mothers who either talked to their infants or received routine care. The infants who received the talking or RISS treatments scored higher on the NCAFS than the infants who received routine care, but neither intervention alone was sufficient to produce significant changes in infant behavior.

During the administration of the RISS technique, it was observed that infants reliably came to the quiet alert state (Wolff, 1959) by the conclusion of the treatment. State changes were documented for a total of 49 treatments,

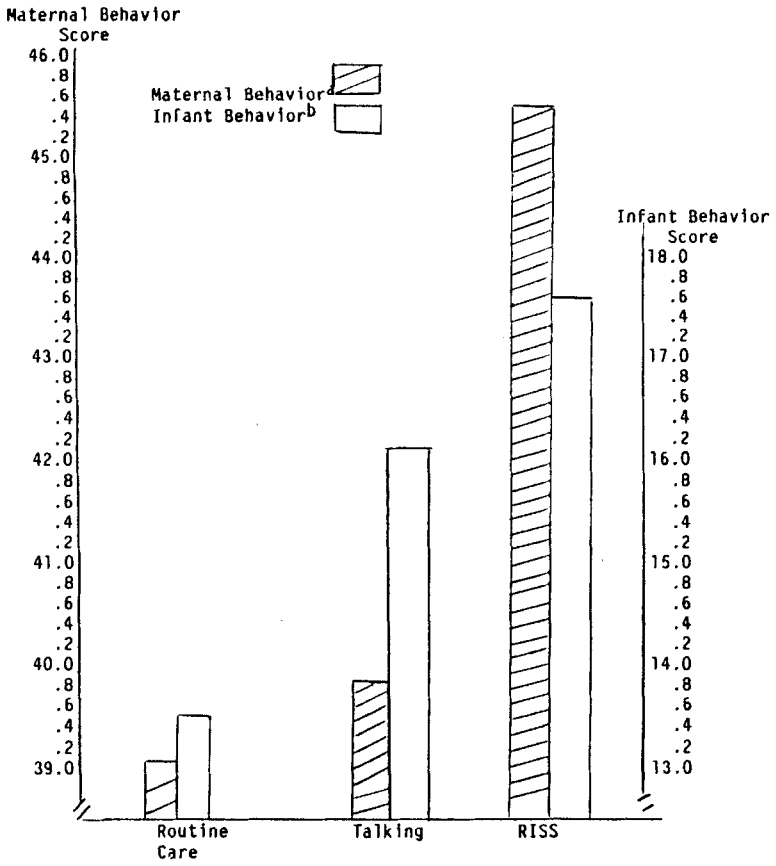


**Figure 1. Mean scores of maternal and infant behavior by group.**

**Note:** Summary of group means for the Infant Behavior and the Maternal Behavior Scores of the NCAFS. [a]NCAFS Total Maternal Behavior Score (Barnard, 1978a) (Highest = 50; Lowest = 0) [b]NCAFS Total Infant Behavior Score (Barnard, 1978a) (Highest = 26; Lowest = 0)

and it was observed that infants achieved the quiet alert state 80% of the time after completion of the RISS technique.

### *DISCUSSION*

An analysis of variance identified significant differences among the three groups for both maternal and infant behaviors (Figure 1). Mothers in the Routine Care Group received the lowest mean score on the total maternal behavior score, but did not differ from the Talking Group. Individual comparisons revealed significant differences between the Routine Care and the RISS Groups. The mothers in the RISS Group were taught to actively interact with their infants, and this early active interaction may have helped these mothers to continue to develop the quality of interaction. By contrast, the mothers in the Talking Group were not taught to actively interact with their infants and showed a lower maternal behavior score despite equal interaction time with their infants.

Subscale analyses identified significant differences for two of the four maternal behavior subscales: maternal sensitivity to the infant's cues, and cognitive-growth-fostering behaviors. These findings together suggest that maternal sensitivity toward the infant developed after mothers were taught to active-

ly interact with their infants using the RISS technique, and that mothers using the RISS were better able to provide cognitive-growth-fostering behaviors.

Maternal perception of the different treatments may have influenced the results. Several mothers in the Talking Group stated that not touching or holding their infants during the talking treatment was difficult. This type of interaction may have been perceived as artificial by the mothers in the Talking Group, and may not have helped them in developing positive patterns of mother-infant interaction. On the other hand, mothers assigned to the RISS Group were taught a massage technique that allowed a guided opportunity for maternal tactile contact. This contact is a natural component of early mother-infant interaction.

The differences between the groups were not due to the amount of mother-investigator contact time which was held constant. During the observational phase of the study, all Groups were observed for equal durations by the experimenter(s), yet the Talking and RISS Groups differed significantly on cognitive growth fostering behaviors. This difference between the Talking and RISS Groups decreases the possibility of any specific Hawthorne effect of investigator presence during the observational phase of the study.

With regard to infant behaviors, a large difference on the infant scale was apparent between the Routine Care and the Talking Groups, while the Talking and RISS Groups appeared to differ very little. A main effect of treatment suggested that infant behavior was significantly altered by the treatments used in the present study. However, the absence of significant individual comparisons prevents us from identifying any specific treatment-related changes in infant behavior. Further research with larger groups might permit the identification of detailed changes in infant behavior. At least, the present study supports for this subject population that structured opportunities for mothers to talk to their infants may be sufficient to alter infant behavior, especially when tactile stimulation is added. Further study with a larger sample will also increase the ability to generalize the results beyond the subjects in this sample.

In general, the literature shows tactile and auditory stimulation to be beneficial for the infant (Als et al., 1979; Rice, 1977; Rose et al., 1980; Scafidi et al., 1986; White-Traut & Tubeszewski, 1986). The findings of this study are consistent. The findings also suggest that active maternal interaction is more beneficial for the mother in enhancing mother-infant interaction than it is for the infant. Whether the specific treatment used here (the RISS) is *most* beneficial in the development of mother-infant interaction cannot be answered by this study. However, the results suggest that the use of the RISS intervention with this subject population is sufficient to enhance components of mother-infant interaction involving maternal sensitivity towards the infant and cognitive growth fostering behaviors. Further study is needed to evaluate the effects of other methods of interaction and stimulation techniques on mother-infant interactions. Blackburn (1983) suggested that the most appropriate type of stimuli are those that are sensitive to infant cues. Evaluation of infant physiological and behavioral responses to specific intervention stimuli may help to identify more appropriate interventions based on infants' cues. White-Traut and Goldman (1987) recently studied physiological responses to the RISS technique, and found that infants show significant acceleration of heart rate and respiratory rate suggesting an effect of the RISS on infant arousal level.

Our data on state transitions in the RISS group suggest that this intervention reliably brings premature infants to the quiet-alert state. This technique may have an organizing effect on the infant partly by arousing the infant. This suggests the utility of routine tactile, auditory, visual, and vestibular stimulation prior to mother-infant interactions to enhance the quality of mother-infant interactions. Recent conditioning research with the newborn infant used the Brazelton evaluation (for this purpose) to produce adaptative arousal prior to learning trials (Field, Cohen, Garcia, & Greenberg, 1984).

This study had several limitations. The cost of conducting the study was a limiting factor and should be considered if the research is to be replicated. Low socioeconomic mothers comprised the sample. Their limited financial resources were apparent from their visiting

patterns which decreased after their very short hospitalization and in their ability to communicate with staff via the telephone. Often telephone service was disconnected or not available in their households making it difficult to schedule appointments. Often scheduled appointments were missed due to lack of transportation and this made it necessary for the investigator or the research assistants to wait several hours for parents to arrive in the nursery. Additional costs for transportation and research assistant time should be considered for future study with this population.

In summary, our findings suggest that mothers benefited the most from active interaction with their newly born premature infants. By altering maternal behavior, a positive relationship between active maternal interaction with the premature infant and the quality of mother-infant interactions was identified. In view of the infants' apparent responsiveness to alternative forms of stimulation, it would appear that further research is needed to identify whether the specific RISS technique or active maternal interaction in general is of most benefit to mothers and their premature infants.

## REFERENCES


Als, H., Lester, B.M., & Brazelton, T.B. (1979). Dynamics of the behavioral organization of the premature infant: A theoretical perspective. In T.M. Field, A.M. Sostek, S. Goldberg, & H.H. Shuman (Eds.), *Infants Born at Risk* (pp. 173–192). New York: Medical and Scientific Books.

Barnard, K.E. (1973). The effect of stimulation on the sleep behavior of the premature infant. In M.B. Batey (Ed.), *Communicating Nursing Research* (Vol 6., pp. 12–40). Colorado: WICHE.

Barnard, K.E. (1987a). *Nursing child assessment feeding scale.* Seattle, Washington.

Barnard, K.E. (1987b). *Nursing child assessment training learning resource manual.* Seattle, Washington.

Barnard, K.E. & Bee, H. (in press). Measurements and meaning of parent-child interaction. In F.J. Morrison, C.E. Lord, and D.P. Keating (Eds.) *Applied Developmental Psychology* (Vol 3). New York: Academic Press.

Bensel, R.W. ten & Paxson, C.L. (1977). Child abuse following early postpartum separation. *Journal of Pediatrics, 90,* 490–491.

Blackburn, S. (1983). Fostering behavioral development of high-risk infants. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, Supplement,* 76S-86S.

Brody, S. (1956). *Patterns of Mothering, Maternal Influences during Infancy.* New York: International Universities Press.

Field, T.M. (1977). Effects of early separation, interactive deficits, and experimental manipulation on infant-mother face-to-face interaction. *Child Development, 48,* 763–771.

Field, T.M. (1980). Supplemental stimulation of preterm neonates. *Early Human Development, 4,* 301–314.

Field, T.M., Cohen, D., Garcia, R., & Greenberg, R. (1984). Mother-stranger face discrimination by the newborn. *Infant Behavior and Development, 7,* 19–25.

Greeg, C., Haffner, M., & Korner, A. (1976). The relative efficacy of vestibular proprioceptive stimulation and the upright position in enhancing visual pursuit in neonates. *Child Development, 47,* 309–314.

Hollingshead, A. (1975). *Four-Factor Index of Social Status.* Connecticut: Yale University.

Jeffcoate, J.A., Humphrey, M.E., & Lloyd, J.K. (1979). Disturbances in parent-child relationships following preterm delivery. *Developmental Medicine and Child Neurology, 21,* 344–352.

Leiderman, P.H. & Seashore, M.J. (1975). Mother-infant neonatal separation: Some delayed consequences, In *Parent-Infant Interaction.* New York: Elsevier/Excerpta Med./North Holland.

Leifer, A.D., Leiderman, P.H., Barnett, C.R., & Williams, J.A. (1972). Effects of mother-infant separation on maternal attachment behavior. *Child Development, 43,* 1203–1213.

Littman, B. & Parmelee, A.H. (1974a). *Manual for Obstetrical Complications.* Los Angeles: UCLA Department of Pediatrics.

Littman, B. & Parmelee, A.H. (1974b). *Manual for Postnatal Complications.* Los Angeles: UCLA Department of Pediatrics.

Lynch, M. (1975). Ill-health and child abuse. *Lancet, 16,* 317–319.

Neal, M.V. (1977). Vestibular stimulation and development of the small premature infant. In M.B. Batey (Ed.), *Communicating Nursing Research (Vol 8., pp. 291–301). Colorado: WICHE.*

Rausch, P.B. (1981). Effects of tactile and kinesthetic stimulation on premature infants. *Journal of Obstetric, Gynecologic and Neonatal Nursing, 10,* 34–37.

Rice, R.D. (1977). Neurophysical development in premature infants following stimulation. *Developmental Psychology, 13,* 69–76.

Rose, S.A., Schmidt, K., Riese, M.L., & Bridger, W.H. (1980). Effects of prematurity and early intervention on responsivity to tactile stimuli: A comparison of preterm and full-term infants. *Child Development, 51,* 416–425.

Scafidi, F.A., Field, T.M., Schanberg, S.M., Bauer, C.R., Vega-Lahr, N., Garcia, R., Poirier, J., Nystrom, O., & Cuhn, C.M. (1986). Effects of tactile/kinesthetic stimulation on the clinical course and sleep/wake behavior of preterm neonates. *Infant Behavior and Development, 9,* 91–105.

Solkoff, N., Yaffe, S., Weintraub, D., & Blase, B. (1969). Effects of handling on the subsequent development

of premature infants. *Developmental Psychology, 1*, 765–768.

White-Traut, R.C. (1983). Maternal-infant interaction as a function of maternal stimulation of the premature infant initiated at twenty-four hours of infant age. Doctoral Dissertation, University Microfilms, Ann Arbor, Michigan.

White-Traut, R.C. & Goldman, M. (1987). *Premature infant massage: Is it safe?* Manuscript submitted for publication.

White-Traut, R.C. & Tubeszewski, K.A. (1986). Multimodal stimulation of the premature infant. *Journal of Pediatric Nursing, 1*, 91–95.

Wolff, P.H. (1959). Observations on newborn infants. *Psychosomatic Medicine, 21*, 110–118.