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The Effectiveness of Early Intervention for Premature Infants

James S. Gyurke
Loyola University Chicago

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THE EFFECTIVENESS OF EARLY INTERVENTION FOR PREMATURE INFANTS

by

James S. Gyurke, M.A.

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VITA

The author, James Stephen Gyurke, is the son of James M. Gyurke and Rita Louise (Zuzik) Gyurke. He was born July 13, 1960 in Greensburg Pennsylvania.

His elementary education was obtained at Saint Pius X School, Mount Pleasant, Pennsylvania, and secondary education at Father Geibel High School, Connellsville, Pennsylvania, where he graduated in 1978.

In September, 1978, he entered Saint Vincent College, Latrobe, Pennsylvania, and in May, 1982 received the degree of Bachelor of Arts Summa Cum Laude, with a major in Psychology. While attending Saint Vincent College, he was on the Dean's list for four years. In 1982, he received the Psychology Excellence Award for being the outstanding graduating senior in the department, the Saint Vincent College Distinguished Service Award for exemplary service to the campus community, and the Sarah Carr McComb Scholarship for outstanding scholarship and community service. In addition, he was also elected to Who's Who Among American Colleges and Universities.

In September of 1982 he was granted an assistantship in Developmental Psychology at Loyola University of Chicago. In of the Pennsylvania Psychological Association and a student 1983 he became an associate member Member of the Evaluation Network Society. In 1984 he became an

affiliate member of the American Psychological Association. Also in 1984 he completed a 300 hour practicum in infant assessment at the Developmental Evaluation Clinic, Prentice Women's Hospital. In 1985 he was granted the Master of Arts degree in Developmental Psychology from Loyola University of Chicago. Also in 1985 he was elected to Alpha Sigma Nu, National Jesuit Honor Fraternity. He also received the Arthur Schmitt Dissertation Fellowship and the President's Medallion for the Graduate School of Arts and Sciences, Loyola University of Chicago.

He has presented ten papers at professional meetings. These meetings include those of the American Psychological Association, International Conference on Infant Studies, International Conference on Infant Mental Health, Midwestern Psychological Association, Illinois Psychological Association and the Evaluation Network Society. In addition, he has co-authored with Dr. Deborah Holmes and Dr. Jill Reich a chapter in volume III, Applied Developmental Psychology. He has also published an article in a Mental Health/Mental Retardation column on wellness.

Presently, the author is employed as a Developmental Psychologist in the Infant Development Program at Polyclinic Medical Center, Harrisburg, PA. He is also finishing the requirements for a Doctoral Degree in Developmental Psychology at Loyola University of Chicago.

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CHAPTER I

INTRODUCTION

The last decade has seen a dramatic change in the nature and delivery of pediatric care for the preterm infant (Als, Lester, and Brazelton, 1979). As a consequence of these changes, more preterm infants (and in particular, smaller and sicker ones) as many as 80-85%, are surviving stressful labors and deliveries. With this new population of survivors comes many questions, not the least of which is that of their developmental outcome.

The assertion that premature birth is often associated with anomalous development is well documented (Caputo, Goldstein, and Taub, 1979). Delays in tactile processing (Rose, Schmidt, & Bridger, 1976), auditory processing (Krafchuk, Tronick and Clifton, 1983) and visual processing (Fantz & Fagan, 1975) all contribute to the cognitive delays shown by some premature infants. Because of the evidence suggesting that premature infants are at risk for cognitive delays, much work has been directed at providing intervention for these infants aimed at reducing and/or eliminating their deficits (Cornell & Gottfried, 1976).

CHAPTER II

REVIEW OF THE LITERATURE

Research on Stimulation Simulating Womb-Like Conditions

Although a number of different forms of intervention have been attempted, the most common are those that alter the environment of the preterm infant by providing stimulationexperiences similar to those of the normally developing fetus. These intervention programs are based on the assumption that the preterm infant is like an out-of-utero fetus, and thus is most lacking of womb-like stimuli. Therefore, these researchers have attempted to provide intervention in the form of stimulation patterns that simulate conditions in the womb.

Some of the earliest work of this type involved the use of tactile-kinesthetic stimulation. Korner, Kramer, Haffner, and Cosper (1975) employed oscillating waterbeds with a group of 10 premature infants (birthweight < 2000 gm., gestational age < 34 weeks). The results of this study show that as compared to a group of 11 control infants with comparable perinatal histories, the experimental infants showed no weight gain, but did manifest fewer apnea attacks. Kraemer and Pierpont (1976), employing similar logic, paired auditory stimulation (tape

recording of the maternal heartbeat) with the oscillating waterbed. Their results indicated that the stimulated group gained significantly more weight than the controls. In addition, the experimental group also showed greater growth in head circumference and biparietal head diameter. Barnard (1973), also employing a moving waterbed and heart rate recording, found greater weight gain, greater maturation (as assessed by the Dubowitz), and changes in state patterning in a treatment group of 7 premature infants (birthweight < 1500 gm., gestational age < 1500 gm). Other studies utilizing similar stimuli also reported positive effects such as higher motor and state control cluster scores on the Brazelton (Burns, Deddish, Burns, and Hatcher, 1983), greater quiescence (Hasslemeyer, 1964) and better DQ scores at 2 months (Neal, 1968).

Though appearing to have positive effects upon preterm infants, these intervention programs have received much criticism. One significant problem with all of the studies just cited is that the predictive validity of the outcome measures employed was questionable and that little follow-up of the samples was conducted. The longest any of these infants was followed was for a period of two months post-partum, not long enough to establish the long-term effectiveness of the treatment. Another major problem is that many of these studies suffer from methodological flaws which cast doubt on their results (Schaefer, Hatcher, and

Barglow, 1980). For example, a number of these studies (e.g., Korner et al., 1975; Barnard, 1973) suffer from problems of statistical conclusion validity due to small samples, while still others suffer from selection bias (e.g., Hasselmeyer, 1964). Further, problems arise when one attempts to duplicate the stimulus dimensions of the womb. As Cornell and Gottfried (1976) have so adroitly pointed out: it is impossible to fully duplicate the amount and kinds of stimulation that an infant received in utero. Moreover, the prematurely born infant is not a fetus and simulation of womb conditions may be inappropriate. Given the problems of duplicating the fetal environment and methodological flaws of such studies, the effectiveness of this type of interventionis, at best, suspect.

Research on Stimulation Simulating Experience of Term Neonate

In contrast to providing womb-like stimulation, some researchers have employed stimulation thought to be characteristic of the experience of the fullterm neonate. Scarr-Salapatek and Williams (1973) provided visual, tactile, and kinesthetic stimulation approximating good home conditions for normal newborns to a group of 15 premature infants ($\bar{X}$ birthweight = 1572 gm, gestional age =

32.6 weeks) born to low SES mothers. These infants were provided with additional play times consisting of rocking, talking, and patting, and attaching mobiles to their isolettes. The results indicated that the intervention infants received more optimal Brazelton scores at 4 weeks than did the control infants. Further, at one year, there was a significant difference ($F = 5.78$, $p < .02$) between the percentage of the experimental group children and control group children with DQ's less than 90. Many more control children (67%) than experimental children (22%) fell below this score, thus suggesting that early intervention may produce some long-term effects, at least for this high-risk, low SES population.

An earlier study by Freedman, Boverman, and Freedman (1966) examined the effects of rocking in 5 premature twin pairs. These authors provided 30 minutes of rocking 2 times daily for 7-10 days and found that the stimulated twins showed significantly greater weight gains, albeit a temporary difference.

Other studies based on similar rationale, employed slightly different stimulation in their interventions. Solkoff, Yaffe, Weintraub, and Blase (1969) provided a group of premature infants additional handling (stroking, rubbing, and flexing of limbs) for 5 minutes per hour, 24 hours a day. Upon comparison, Solkoff and her colleagues

found that the stimulated infants were more active and regained their birthweights more quickly. However, these results are tentative due to a lack of objective statistical procedures. In a later study by Solkoff and Matuszak (1975), similar stimulation was employed but the amount of stimulation per hour was increased from 5 to 6.5 minutes. Unlike the previous study, no significant difference in weight gain was noted, however, the stimulated infant did show more positive changes on the Brazelton Exam. Stimulated infants showed positive changes of 2 or more points on 11 of the 26 Brazelton items, whereas control infants, showed positive changes on only 2 of the 26 items. Another study by White and La Barba (1976), also employing stroking and flexing stimulation, found that the experimental infants (N = 6, Birthweight = 1500 - 2000 gm, gestational age less than 36 weeks) gained weight more rapidly, had significantly greater milk intake, and required fewer feedings. A final study by Kramer, Chamorro, Green, and Knudson (1975) similarly investigated this issue in a group of 14 premature infants (birthweight less than 1800 gm, gestational age less than 38 weeks). These investigators found that though the experimental
group did not gain significantly more weight than the control group, they did show significantly better motor

control at 2 months as measured by the Gesell Scale. However, this effect was not confirmed at later follow-up. These studies, though suggesting that early supplemental stimulation has a positive effect, also have a number of problems associated with them. The use of a number of stimulation types and outcome measures has resulted in confusion over which stimulus mode and what outcome measure or measures are effective.

Research on Uni-modal Stimulation

In order to resolve some of this confusion, researchers have examined the effects of single stimulus modes. Katz (1971) (N = 62, gestational age = 26 - 32 weeks) and Segall (1972) (N = 6, gestational age = 28 - 32 weeks) provided auditory stimulation in the form of a recording of the mother's voice. Both studies found that the stimulated group performed better (i.e., better DQ scores at 36 weeks gestation, habituated more quickly, etc.) than did the unstimulated group.

In a very ambitious effort, McNichol (1975) employed a 2x2 factorial design examining the contribution of visual and tactile forms of stimulation. Her four groups: visual enrichment, tactile enrichment, visual-tactile enrichment, and a control group, were provided different types of stimulation in an effort to sort out their differential

impact. She found that infants receiving tactile stimulation scored significantly higher on visual tracking tasks. Infants receiving visual stimulation were found to look for a shorter period of time at visual stimuli, suggesting habituation. No differences due to treatment were noted on weight gain, motor strength, muscle tone or the auditory scales of the Graham-Rosenblith test.

The failure of these types of studies to resolve the issue of which type or types of stimuli are effective raises several questions. One question centers around the stimulus dimensions investigated in these studies. Since no one particular mode of stimulation appears any better than another, it is possible that the modality stimulated is not important. A possible explanation for this failure to identify relevant stimulus dimensions is that intervention effects may be indirect and encompass not only the child but the parents and environment as well. This view would hypothesize that intervention initially produces an immediate effect upon the infant's behavior. This change in behavior then causes a change in the interaction patterns of the infant and the parents such that the infant is interacted with more and interacts more. This increase in interaction would result in improvements in the infant's cognitive, motor, social, and perceptual skills (Katz, 1971; Scarr-Salapatek & Williams, 1973). Though hypothetical,

this model does provide an explanation for the diversity of effects demonstrated by these intervention programs. A second question arises when considering the outcome measure used to assess the effectiveness of these intervention procedures. A variety of outcome measures ranging from weight gain and biparietal head circumference change to developmental quotients and performance on conditioning tasks have been employed. Since no consistent outcome measure has been employed it is difficult to equate the results of these studies. Without consistent outcome measures, and without the identification of relevant stimulus dimensions, further implementation of these types of intervention will only produce muddled results.

In addition to these unanswered questions, there are some methodological flaws inherent in these early stimulation programs. One such flaw is that, of all the programs just cited, none controlled for the infant's behavioral state prior to and during stimulation. This issue is particularly important (Brazelton, 1973) unless one is to assume that the intervention is effective regardless of whether the infant is awake or asleep, or crying, a situation which seems highly unlikely. Because of the failure to control for behavioral state, it is likely that effect due to stimulation was underestimated. A second flaw is that all of these studies, with the

exception of Katz (1971) and Segall (1972), have relatively small sample sizes causing some concern over their statistical conclusion validity. A final problem which may be considered methodological deals with the safety of stimulating the young premature infant. It has been suggested that early stimulation (prior to discharge from the hospital) of the premature infant can lead to intra-cranial hemorrhage, a condition associated with poor outcome (Long, Philip, & Lucey, 1980). With all the methodological flaws and unanswered questions surrounding this particular approach to intervention, it seems that much more work is needed before committing to a concerted effort in this direction.

Home Based Interventions

Because of the inherent practical and ethical issues involved in ICN-based programs, as well as the failure to document long-term benefits of such programs, there has been lessened interest in these types of interventions. Rather, researchers have turned their attention to the high-risk infant after he has gone home. Recent work has become extremely sensitive to the family environment and its impact on development (Healy, Keese, and Smith, 1985). Employing a combination of trained interventionists and parental involvement, these programs have sought, in

general, to improve and facilitate the interaction between mother and infant thus, indirectly, improving cognitive development. Programs of this nature for the premature infant have, by and large, been home based.

Bromwich and Parmelee (1979) attempted to affect caregiver behavior toward the infant so as to affect the infant's social, cognitive, and language development. In order to accomplish this goal, trained personnel began visiting the mother-infant dyad at 10 months and continued visiting until the infant was 24 months of age. During these visits parents were trained in providing appropriate developmental activities. Thirty infants (gestational age < 37 weeks; birthweight < 2500 gm; all SES groups) were enrolled in this intervention program. At 24 months the Bayley DQ scores of these 30 intervention infants were compared to those of a group of control infants. No differences were noted between the two groups' scores. The results of this study raise a very important issue. Namely, did the fact that these infants did not receive intervention until 10 months cause this intervention to be ineffective?

A study addressing this issue was conducted by Field and her colleagues (Field, Widmayer, Stringer, & Ignatoff, 1980). This study utilized 150 experimental and control infants and their lower class black mothers in a home based

intervention program. Home visitation was conducted on a biweekly basis for approximately 1/2 hour by a trained interventionist and a teenage, black, female work study student. At these visits, the the mothers were given information regarding developmental milestones. In addition, each mother was trained in caretaking practices and sensorimotor/cognitive exercises. Follow-up assessments of both intervention and control mothers were conducted at 4 and 8 months corrected age. Using a variety of outcome assessments, Field et al. found that intervention infants at 4 months were significantly heavier ($\bar{X}$ = 6730 gm vs $\bar{X}$ = 6003 gm), taller ($\bar{X}$ = 67 cm vs $\bar{X}$ = 63 cm), and had higher Denver DQ scores ($\bar{X}$ = 35 vs $\bar{X}$ = 31) than did control infants. Further, at 8 months, intervention infants received significantly higher Bayley Mental scores ($\bar{X}$ = 110 vs $\bar{X}$ = 101) than did control infants. Additionally, mothers of intervention infants expressed more realistic developmental expectations for their infants and had more desirable childrearing attitudes. Mother's also rated their infant's temperament more positively. The results of this study suggest that early intervention (prior to 10 months corrected age) is effective. The failure of the Bromwich & Parmelee (1979) intervention program may therefore have been due to the late point at which it was initiated.

A study which supports these conclusions was carried out by Rauh and her colleagues (Rauh, Nurcombe, Achenbach, Teti, Howell, Ruoff, 1984). Sixty-two preterm infants (birthweight < 2200 gm., gestional age < 37 weeks of age) and their mothers served as the intervention group for this study and 30 mother-infant dyads were used as controls. Intervention consisted of 11 sessions conducted by a trained nurse during the final week of hospitalization and continued in the home for a 3 month period. At each session, mothers were instructed on techniques to familiarize them with their infants' behavioral organization and typical modes of responding. In addition, mothers were also instructed on specific play and care techniques which were aimed at facilitating their infant's development. Analyses of the data suggest that at 6 months, intervention mothers were significantly more self-confident and had greater role satisfaction than did control mothers. There were also significant effects on temperament, as intervention mothers rated their infants more positively and as easier to care for. When assessed again at 2 years, similar effects were found, with the exception of temperament ratings where no significant difference emerged. No significant differences between the 2 groups were found at either 6 or 24 months on the Bayley Scales. However, when plotted, there was an increasing

divergence over time between the 2 groups. By 24 months this difference was 9.2 points in favor of the intervention group, narrowly missing significance but nevertheless suggesting a positive effect of early intervention.

Other home visitation programs, while accepting the basic principle of home intervention programs (i.e., by facilitating interaction we improve cognitive development), have attempted a slightly different approach. Rather than employing long term intervention with mothers and infants, these programs utilize the mother (or father) as primary programmer of the child in a less structured and intense program. One such program was initiated by Widmayer and Field (1981). They employed 30 healthy preterm infants of low SES black mothers randomly assigned to a control group ($\bar{X}$ gestational age = 35.6 weeks, $\bar{X}$ birthweight = 2517 gm), an intervention group 1 ($\bar{X}$ gestational age = 35.6 weeks, $\bar{X}$ birthweight = 2585 gm) or intervention group 2 (X gestational age = 35.1 weeks, $\bar{X}$ birthweight = 2606 gm). Both intervention groups were asked to administer the Mother's Assessment of the Behavior of Her Infant (MABI) on a weekly basis; however, only intervention group 1 mothers viewed an administration of the Brazelton Neonatal Behavioral Assessment (BNBAS) (MABI was adapted from this scale). This intervention began at birth and it was at this time the intervention group 1

mothers observed the administration of the BNBAS. It should be noted that no further interventions were provided. The only intervention provided for each infant was the mother's administration of the MABI. Follow-up assessments were scheduled at 1, 4 and 12 months in the home. At each of these follow-up points, infants of both intervention groups received significantly better DQ scores than did the control infants. At 1 month, intervention infants received better interactive processes scores on the Brazelton ($\bar{X}$ = 1.6) than did control infants ($\bar{X}$ = 2.4). And finally, at 12 months, intervention groups performed significantly better ($\bar{X}$ = 124.5) on the Mental scale of the Bayley than did control infants ($\bar{X}$ = 97). In addition, early differences were found in favor of the intervention group on interaction tasks; however, these differences did not persist over time. The mean MDI scores of the intervention groups, though apparently high, are consistent with MDI scores of the intervention group in the Rauh et al. study (Rauh, Nurcombe, Achenbach, Teti, Howell and Ruoff, 1984). These results suggest than an early, relatively brief, and cost effective intervention can facilitate cognitive development in preterm infants.

It has also been shown that relatively short term and cost effective intervention can effect changes in maternal variables as well. Recent work by Barrera, Rosenbaum and

Cunningham (1986) investigated the effects of a home based intervention program on a sample of randomly assigned preterm and term infants. Preterm infants were assigned to 1 of 3 groups: 1) a developmental intervention group in which parents were taught to assess their child's developmental level, 2) a parent-infant intervention group in which parents were taught to be better observers and interactors with their infants, and 3) a control, no intervention group. A group of matched fullterm controls was also used. Preterm and fullterm infants were matched on corrected age, sex, type of delivery and socioeconomic status. The schedule of intervention consisted of weekly visits for 4 months, bi-weekly visits for 5 months, and monthly visits for 3 months. Preterm and fullterm control infants did not receive these home visits but were assessed in the home at 4, 8, 12 and 16 months corrected age. Using the Bayley Mental and Motor Scales, the HOME, Carey Temperament ratings and a parent-infant interaction sequence, these researches found small changes (mostly related to age) in the cognitive scores of the intervention groups. More significant changes were found in mothers' interactive behavior and home environment. Mothers in the parent-infant intervention group (group 2) were found to be more responsive than those in the preterm control or developmental groups. HOME results revealed that the

improvement shown by both treatment groups, particularly the parent-infant intervention group, was as great as that in the fullterm control group, suggesting that intervention "normalized" the home environment by teaching the parents of the preterm infants to provide appropriate challenges and opportunities for exploration and manipulation. The results of this study clearly indicate that short-term intervention can change mothering and dyadic interaction in mothers of premature infants.

Similar positive results have been obtained in other such studies. For example, Poley (1978) demonstrated the use of the Brazelton to a group of low SES, black mothers of term infants. The intervention took place 1 to 5 days after discharge in the mother's home. She found that upon follow-up at 2 weeks there was improved mother-infant synchrony as measured by the Maternal-Infant Adaptation scale. Myers (1981) also taught parents of term infants to administer the Brazelton. However, the parents in this case were middle class. Nonetheless, at the 1 month follow-up, these middle class parents were also found to be more confident and satisfied with the infant, in addition to actually showing an increase in knowledge about the infant. The results of these studies in conjunction with the work of Widmayer and Field seem to suggest that short, easily demonstrated intervention programs, employing the

parents as interveners, are effective in positively influencing the development of preterm infants.

From the studies just cited, it appears reasonable to conclude that home based intervention programs are effective in facilitating, albeit indirectly, the cognitive development of the infant and the behavior of the parents. Home based intervention programs, in addition to indirectly facilitating the cognitive development of the infant and the behavior of the parents, also have overcome many of the difficulties inherent in the early stimulation programs. In particular the issue of the mode of stimulation is no longer relevant because it is assumed that the infant is receiving multi-modal stimulation the effects of which may be indirect. A further problem that has been resolved is one of measuring outcome. Since the home based interventions focus on older infants, more standardized assessment instruments (i.e., Bayley Scales of Infant Development) are employed. There are, however, some concerns regarding the cost and implementation of home based programs. Haegert and Serbin (1983) have stated that home programs prescribed for infants are often very time consuming and complicated, and they demand lifestyle changes of the parents, all factors which can result in a low percentage of the treatment sessions being implemented. There is also some evidence which suggests that the longer

the time span of the intervention, the lower the compliance rate (Finnerty, Shaw, and Himmelsback, 1973). In addition to the concern that home-based programs (i.e., Bromwich and Parmelee, 1979; and Field et al. 1980), may be too time consuming and invasive, there is also the issue of cost. Data have been assembled (Trohanis, Cox, and Meyer, 1982) regarding the cost of home visitation programs which, though not specifically focused on the premature infant, do include in their population a number of preterm infants and employ intervention techniques similar to those used in programs serving only prematurely born infants. These data indicate that the cost per child during the first year of such programs ranges from $1,400 to $2,350. Program costs included salaries for home visitors, equipment, travel time and travel expenses. This average cost per child makes such programs difficult for most funding agencies to maintain.

An attractive option to these costly and time consuming interventions was offered by Widmayer and Field (1981). As previously described, these authors utilized a short term, easily implemented, low cost intervention program, and were able to demonstrate a significant effect upon the cognitive development of the preterm infant. Other studies using various samples but a similar approach, likewise report positive effects. Thus, it appears that early intervention

can be effective without involving long costly procedures.

The findings of Widmayer and Field, point out the fact that early intervention need not be extremely costly and time consuming to be effective. Accepting this premise, then, the present research will attempt to establish such a program to facilitate the cognitive development of a sample of preterm infants. The present approach, though similar to that of Widmayer and Field, expands on their work in several areas. One major difference between the present study and that of others is that this research will utilize a hospital based program where follow-up visits are coordinated with regularly scheduled pediatric exams. It is hypothesized that this change should result in a lower cost program due to the fact the fewer personnel are required and travel to the home is eliminated. In addition, this change should also result in higher treatment implementation since participation requires little additional effort on the part of the parents. A second major difference between the present study and the Widmayer and Field study deals with treatment administration. In the Widmayer and Field study, all treatment was administered at the same point in time for both experimental groups, namely just prior to discharge. There is some evidence that suggests that the earlier interventionis introduced, the more optimal the results

(Field, Widmayer, Stringer, & Ignatoff, 1980). However, this belief is not well documented. In the present study the intervention consists of information given to parents about the performance of their infant of the Bayley Scales of Development, and methods that they can use to facilitate their infants' development. This intervention will be initiated at different points in time for the different experimental groups, thereby providing more specific information on the benefits of early versus later intervention. This particular type of intervention was chosen because it is believed that by making the parents the "interventionists"the cost of the program can be kept at a minimum while maintaining a high level of treatment implementation. It is felt that by increasing the parent's investment in the program the are more likely to carry through with the program. A third difference is the inclusion of a parent perception variable. Other work has demonstrated significant change in parental behavior; however, of equal interest is the question of whether, as a result of intervention, the parent's perception of their infant changes.

Questions to be studied

The present study has four specific hypotheses:

1. Infants receiving this intervention will

demonstrate better cognitive development than will control infants.

In order to assess the cognitive development of the infants, the Bayley Scales of Infant Development (Bayley, 1969) will be employed. Bayley scores of infants receiving the intervention will be compared to those of control infants. It is expected that intervention infants will have significantly higher Bayley scores than will control infants.

2. Infants who receive intervention earlier versus those who receive it later will show greater developmental progress.

A comparison will be made between the Bayley scores of the early intervention group (receiving intervention at 2 months) and the later intervention group (receiving intervention at 4 months). It is believed that infants who receive the intervention earlier will perform significantly better than will the late intervention group. Though the difference in time of onset of intervention for the two groups is only 2 months, there is reason to believe this difference will be important. Specifically, since the rate of development in the early period is so rapid, the effect of early delays can become much

more pronounced. It would seem important then, that intervention initiated as soon as possible would allow the child the maximum opportunity to overcome this delay.

3. Infants who receive intervention will be viewed as more competent by their parents.

   A comparison will be made between the parents' rating of the two intervention group's infants and the control group's infants on a modified Broussard and Hartner Parent Perception Scale. It is believed that infants who receive intervention will be viewed as more competent than the control infants.

4. A short-term, easily implemented, hospital based program will maximize treatment implementation while minimizing cost.

   Treatment implementation will be assessed by measuring the percentage of treatment sessions actualized. Meanwhile, costs will be determined by computing the number of personnel hours required to assess the infant and implement the treatment program and then adding associated overhead. It is believed that the cost of such a program will be significantly less that the $1,500 - $3,500/per child required to implement the home based

programs. In addition, because of the structure of the program, it is believed that less effort will be required to participate, thus increasing the likelihood for participation.

CHAPTER III

METHOD

Subjects

The sample consisted of 43 premature infants in the Infant Special Care Unit at Polyclinic Medical Center. Included were infants born at Polyclinic Medical Center and those transported to the Neonatal Intensive Care Unit from Level I and II nurseries in a 5 county area. This sample was recruited from October 1, 1985 to July 30, 1986. As described in Table I, the infants ranged in age from 30 to 36 weeks gestational age ($\bar{X}$ gestational age = 34.64 weeks, S.D.= 1.12), as determined by the Dubowitz Assessment (Dubowitz, Dubowitz and Goldberg, 1970). They were all of birthweights appropriate for their gestational age, had a 5 minute Apgar of 7 or greater, had no known central nervous system damage, did not require surgery (except for circumcision) ,did not suffer from any syndrome (e.g. Down's Syndrome), and had no intra-cranial hemorrhage. Further, all of the infants' mothers received prenatal care, were between the ages of 20-36 years, had no history of drug or alcohol abuse and were part of a supportive and motivated family. Family status was determined by a social worker's rating. This

rating was based on an initial interview of the family conducted 2-3 days after the delivery of theinfant. The interview included questions regarding the mother's support system, mother's and father's feelings about the infant, financial concerns and concerns related to care of the infant. At the conclusion of this interview, the social worker rated each mother's support system and her motivational level on a 1 to 5 scale. A rating of 1 indicated a high level of social support while a rating of 5 represented a low level of social support. Likewise, a rating of 1 represented a high level of motivation while a rating of 5 indicated a low motivational level. Ninety four percent of the mothers were married; 86 percent were middle-class (as determined by the Hollingshead Two Factor Index of Social Position (Hollingshead, 1957); and none had a parity greater than 2. There were no significant group differences in any of the variables presented in Table I.

Procedures

Approximately one week prior to the infant's discharge from the hospital, families meeting the above criteria were asked by this experimenter or the NICU Social Worker to participate in this project. As part of the decision process to determine whether an infant and his/her family met the criteria for this study, a social

TABLE 1 : Demographic Data for Sample

VARIABLE	Group 1 (Early Intervention) (N = 11)	Group 2 (Control) (N = 11)	Group 3 (Late Intervention) (N = 11)
SEX			
Male	6	7	6
Female	5	4	5
GESTATIONAL AGE			
$\bar{X}$	34.64	33.82	33.09
S.D.	1.12	0.87	2.43
BIRTH WEIGHT			
$\bar{X}$	2198.18	2487.27	1941.82
S.D.	401.54	455.66	561.03
BIRTH LENGTH			
$\bar{X}$	44.70	46.41	42.08
S.D.	2.35	2.52	3.92
BIRTH HEAD CIRCUMFERENCE			
$\bar{X}$	31.59	32.03	30.23
S.D.	1.53	1.47	2.64
5 MINUTE APGAR			
$\bar{X}$	8.18	8.09	8.36
S.D.	0.87	0.54	0.92
MATERNAL AGE			
$\bar{X}$	28.82	23.73	25.55
S.D.	4.96	3.77	4.57
SOCIAL SUPPORT			
$\bar{X}$	1.55	1.64	1.55
S.D.	.52	.67	.51
MOTIVATION LEVEL			
$\bar{X}$	1.27	1.45	2.00
S.D.	.47	.69	0.63

history sheet (Figure 1) was developed for this program. The information to complete this sheet was obtained from the admission note in each child's medical chart and was completed the first 2-4 days after birth.

Of those families who were offered participation, 43 accepted; 5 refused. Of the 43 families originally agreeing to participate, 8 were lost to follow-up for the following reasons: 2 families no longer wanted to participate; 5 families moved and were unable to be contacted; and 1 family's infant required major surgery after entry to the study. Two other infants were excluded due to incomplete data.

The intervention in this study consisted of providing parents of premature infants suggestions to facilitate their infant's developmental progress. Each infant's development was assessed on the Bayley Scales of Infant Development. After the infant was assessed, families of infants in the experimental groups were provided information regarding their child's performance on this assessment. Specifically, information was aimed at describing the child's strengths and weaknesses as determined by the Bayley Scales. For example, if a child demonstrated a relative strength on the Mental Development Index (MDI) (e.g. 15 or more Developmental Quotient points higher than the Psychomotor Development Scale (PDI) suggestions were given to the parents

FIGURE 1: SOCIAL HISTORY

Date_____ Code #_____
Group #_____

Child's Full Name_____
Parent's Names_____ Marital status: M S D Sep
Address_____ Mother's occupation:
_____
Phone _____ Father's occupation:
_____

Estimated SES_____

Infant Information:

Sex: M F
Gestational Age:_____
D.O.B.:_____
Birthweight:_____ (SGA, AGA, LGA)
Birth length:_____
Birth head circumfrence:_____
5 minute Apgar:_____
Intercranial Hemmorrhage Y N Grade:_____
Ventilation Required Y N # days:_____
Surgery Y N
CNS Damage Y N
Apparent Syndromes Y N

Mother's Information:

Mother's age_____
Appropriate pre-natal care: Y N
History of Drug or Alcolhol Abuse: Y N
Number of Children at Home: 0 1 1

To be completed by Social Worker

	high			low	
Social Support Network for mother	1	2	3	4	5
Mother's Motivation Level	1	2	3	4	5

---

to facilitate the child's motor development. In cases where both the PDI and MDI were in the age appropriate range, if there was a relative strength in one area, suggestions were provided to integrate development. In the instance where there appeared to be no significant strengths or weaknesses, the suggestions provided to the parents were aimed at facilitating the infant's attainment of age appropriate developmental milestones. The suggestions provided to parents were obtained from a variety of sources (i.e. Early Learning Assistance Program, Learning Through Play, etc.). Also given to these parents were global milestones appropriate to their infant's chronological age. In addition to varying whether a family received intervention, the timing of the intervention was also varied. Some families began to receive intervention when their infants were 2 months of age (corrected for prematurity). Other families did not begin to receive intervention until their infants were 4 months of age (corrected for prematurity). A correction for prematurity was used in this study to standardize the timing of the administration of the intervention. To correct for prematurity, this study calculated follow-up appointments from the infant's due date, rather than from the infant's date of birth. The "correction for prematurity" is an attempt to present the intervention to

the infants at approximately the same point in development rather than at a variety of different points.

Experimental Design

Those families and their infants who agreed to participate in this study were randomly assigned to three groups identified as: Group 1- Early Intervention Group; Group 2- Control; Group 3- Late Intervention group (Figure 2).

A comparison of groups 1 and 3 versus group 2 provides information regarding the effectiveness of the intervention. A comparison of groups 1 versus 3 yields information regarding the importance of early versus late initiation of intervention.

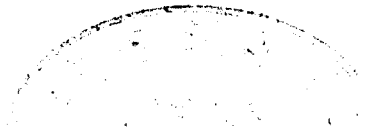
Follow-up Visits

All follow-up visits for all infants were scheduled to coincide with the infant's scheduled medical follow-up by the neonatologists. These visits were conducted in a suite of examination rooms on an outpatient pediatric floor or in a testing room arranged to accommodate developmental assessments. Both settings contained an examination table and an adequate number of chairs for the parents to observe the evaluation. The room's light and temperature levels were maintained at a comfortable level.

FIGURE 2: SCHEDULE OF INTERVENTION

	2 Months (corrected)		4 Months (corrected)		6 Months (corrected)	
	Bayley	Dev. Info	Bayley	Dev. Info	Bayley	Dev. Info
Group 1 (n = 11)	X	X	X	X	X	X
Group 2 (n = 11)	X		X		X	X
Group 3 (n = 13)			X	X	X	X

Infants assigned to the Early Intervention Group were administered the Bayley Scales of Infant Development at 2 months of age (corrected for prematurity). This administration was carried out with mother and/or father present in the room. After the administration of the Bayley, the examiner left the room to score the exam. The Bayley was scored to determine in which area or areas the infant was weak or could use some improvement. Once this determination was made, the experimenter selected appropriate developmental activities from several curricula (i.e, Early Learning Assistance Program, Learning Through Play, etc.) to give to the parents. For example,if an infant was determined to be weaker in the psychomotor area, suggestions which might be selected include activities such as playing with the baby in a variety of positions, sitting the baby with support for 10- 15 minutes at a time, and allowing the baby to spend as much time as possible on its stomach on the floor. The experimenter then reentered the evaluation room. At this time, the results (described in terms of the range of performance, i.e., age appropriate, borderline, etc., and the infant's strengths and weaknesses) were provided to the parents. In addition, the parents of these infants received the selected activities to work on until the next visit and the global milestones appropriate to their infant's chronological age. This same procedure was



followed at 4 and 6 months.

Infants assigned to the control group were also administered the Bayley Scales of Infant Development at 2, 4 and 6 months of age (corrected for prematurity). The protocol just described for the Early Intervention infants was used with the Control infants, with one major exception. After the examination was completed and scored, the examiner provided the parents with only the infant's performance levels (i.e, age appropriate, borderline, etc.). No information was given regarding areas of strengths or weaknesses; nor were any developmental activities suggested. Any parental questions relating to the infant's performance were addressed, but no activities were provided. Very few questions were asked by parents of control infants, and these dealt primarily with a task the infant was already performing (i.e. "My baby rolls over and gets stuck, is that normal ?"). At the 6 month visit, unlike the 2 and 4 month visit, parents of the control group infants were given additional information regarding their babies' strengths and weaknesses and appropriate developmental activities. This information was given as part of their debriefing as participants in the study.

Finally, those infants assigned to the Delayed Intervention Group were not assessed with the Bayley Scales of Infant Development until 4 months of age

(corrected for prematurity). After receiving the assessment, these infants and their families, like the Early Intervention Group, were provided with details of the infant's strengths and weaknesses. Similarly, appropriate developmental activities were provided to the families. Again, at the 6 month visit, the infants were assessed and the parents were provided with a detailed description of their performance and appropriate activities.

In addition to the assessments described above, several other measures were also obtained at the follow-up visits. The measures selected were chosen for two reasons. First, it was felt that measures other than the traditional indices of mental development (i.e., Bayley scores) may point out effects of the intervention (e.g., changes in the parents' perception of the infant) that the traditional measures are not sensitive to. A second reason for the choice of these measures was that earlier studies have found differences to intervention in some physical parameters (i.e., weight). The differences were thought to be due to receiving intervention.

In order to obtain some measure of the parents' perceptions of their infant throughout their participation in the research, at 2, 4, and 6 month visits, all parents completed a modified version (Figure 3) of the Broussard and Hartner (1970) Parent Perception

Figure 3 : Revised Parent Perception Questionnaire

Date _____

Infant's DOB _____ Code # _____
CA _____ Group# _____
Corr Age _____

Below is a set of words that describe infant behavior. Please circle the number closest to the word in each pair that best describes your child, and then using the same set of words, rate the average child.

YOUR CHILD

Curious	1	2	3	4	5	6	7	Disinterested
Alert	1	2	3	4	5	6	7	Dull
Active	1	2	3	4	5	6	7	Inactive
Vocal	1	2	3	4	5	6	7	Quiet
Aware	1	2	3	4	5	6	7	Unaware
Social	1	2	3	4	5	6	7	Withdrawn
Coordinated	1	2	3	4	5	6	7	Uncoordinated

AVERAGE CHILD

Curious	1	2	3	4	5	6	7	Disinterested
Alert	1	2	3	4	5	6	7	Dull
Active	1	2	3	4	5	6	7	Inactive
Vocal	1	2	3	4	5	6	7	Quiet
Aware	1	2	3	4	5	6	7	Unaware
Social	1	2	3	4	5	6	7	Withdrawn
Coordinated	1	2	3	4	5	6	7	Uncoordinated

Scale. This scale consisted of 6 single scale behavioral items. There were two forms of this scale "Your child" and "Average child" which were to be used in together. The modified version of this scale was designed to reflect the dimensions of development (i.e. vocalizations, interest, coordination, etc.) being measured by the Bayley Scales of Infant Development. Parents were asked to complete the scale during the time the examiner was out of the room to score the results of the Bayley Scales.

Also obtained at the 4 and 6 month visit for the Early Intervention Group infants, and at the 6 month visit for the Delayed Intervention Group Infants, was an estimate of the amount of intervention that had actually been provided. This was obtained by asking the parent(s) the question, "Approximately how many times each week would you estimate you worked on the prescribed activities with your infant?". Parents were instructed to count any time they actively engaged their infant in a prescribed activity. This included those times when, though not specifically intending to work on an activity, they ended up doing so in a play, feeding, bathing, etc. situation. Though a rough estimate, this did provide a means of quantifying the amount of intervention each infant received. In addition, the parents were asked two

other questions: 1) "Do you think these activities were helpful for your baby's development?"; and 2) "Were you satisfied with your participation in this program?" The first question was aimed at assessing the parents' feelings about the effectiveness of the activities they were being given, while the second question attempted to assess their overall satisfaction with their program participation. Finally, since these follow-up visits were conducted in conjunction with the regularly scheduled pediatric follow-up of these infants, several physical indicators were also collected. Namely, height, weight , head circumference, infant medications, infant hospitalizations and illness were obtained from the physician's notes and recorded on a health/developmental follow-up form (Figure 4).

Implementation and Cost Data

One of the questions of interest for this study was the effectiveness of this type of approach to increase parents participation while minimizing cost. Participation was calculated on two different levels. On a general level participation was assessed as the percentage of appointments that were kept as originally scheduled. This was calculated from the number of visits completed as scheduled and then divided by the total number visits scheduled (including those scheduled for

Figure 4: FOLLOW-UP VISIT FORM

Code #: _____
Group #: _____
Visit #: _____

Date: _____
D.O.B.: _____
Corrected Age
Of Infant: _____

Physical Information:

Height: _____
Weight: _____
Head circumference: _____

Any Illnesses Between Visits: Y N

Explain: _____

Hospitalizations Between Visits: Y N

Explain: _____

Is the Infant Presently on Medication: Y N

Explain: _____

Developmental Information:

D.Q. Scores

MDI: _____ RANGE: _____

PDI: _____ RANGE: _____

IBR: _____ RANGE: _____

Recommendations: _____

_____

_____

_____

_____

subjects who failed to complete the protocol). In addition, thepercentage of visits completed, including those completed after a rescheduling, was also computed. The second means of assessing particiaption was tied more closely to the amount of intervention each infant received. As noted earlier the parents of infants in the experimental groups reported the number of times they worked on the prescribed activities with their infant. This information, used in conjunction with the visits completed, provides a comprehensive picture of the amount of intervention received per dollar.

Cost data incorporated both direct and indirect costs. Included in the total cost figures were the following: 1) Amount of professional time (i.e. psychologist, nurse, physician); 2) Amount of secretarial time; 3) Materials (i.e. Bayley Score Sheets, telephone costs, xeroxing, etc.); 4) Indirect costs (traditionally 10% of total direct costs). Total cost for the program was obtained by adding items 1 through 4 . Average cost per child was obtained by dividing items 1-4 by the number of children who were enrolled in the program.

CHAPTER IV

RESULTS

The primary hypothesis of this research is that infants who receive intervention will have better cognitive development than control group infants. To determine if intervention improved cognitive development, a series of one-way ANOVA's was completed. These ANOVA's utilized group (Early Intervention, Control or Delayed Intervention) as their independent variable and Bayley Scale scores (Mental Development Index or Psychomotor Development Index) as the dependent variable. A summary of means and standard deviations for Mental Development Index scores and Psychomotor Development Index scores by group at each age can be found in Table II (also see figures 5 and 6).

An ANOVA on Mental Development Index (MDI) and Psychomotor Development Index (PDI) scores at 2 months of age was conducted to determine if the Early Intervention and Control Groups differed prior to the start of the intervention. No significant differences in either MDI (Early Intervention $\bar{X}$ = 104.27 vs. Control $\bar{X}$ = 99.72) or PDI (Early Intervention $\bar{X}$ = 105.82 vs. Control $\bar{X}$ = 107.81) scores were found between the two groups at this age. This

Table 2: Mean MDI and PDI scores by Group at 2, 4, and 6 months

	MDI 2	PDI 2	MDI 4	PDI 4	MDI 6	PDI 6
Early Intervention Group (Group 1)						
$\bar{X}$	104.27	105.82	109.91	112.36	111.55	109.27
S.D.	11.54	11.11	6.02	15.44	14.14	10.97
Control Group (Group 2)						
$\bar{X}$	99.72	107.81	109.80	117.90	104.30	115.30
S.D.	12.58	11.70	8.36	23.65	8.59	7.45
Delayed Intervention Group (Group 3)						
$\bar{X}$			101.64	106.09	99.20	106.20
S.D.			14.36	9.91	15.55	11.73

Figure 5 : Mean Mental Development Index Scores for each group at 2, 4, and 6 months of age.

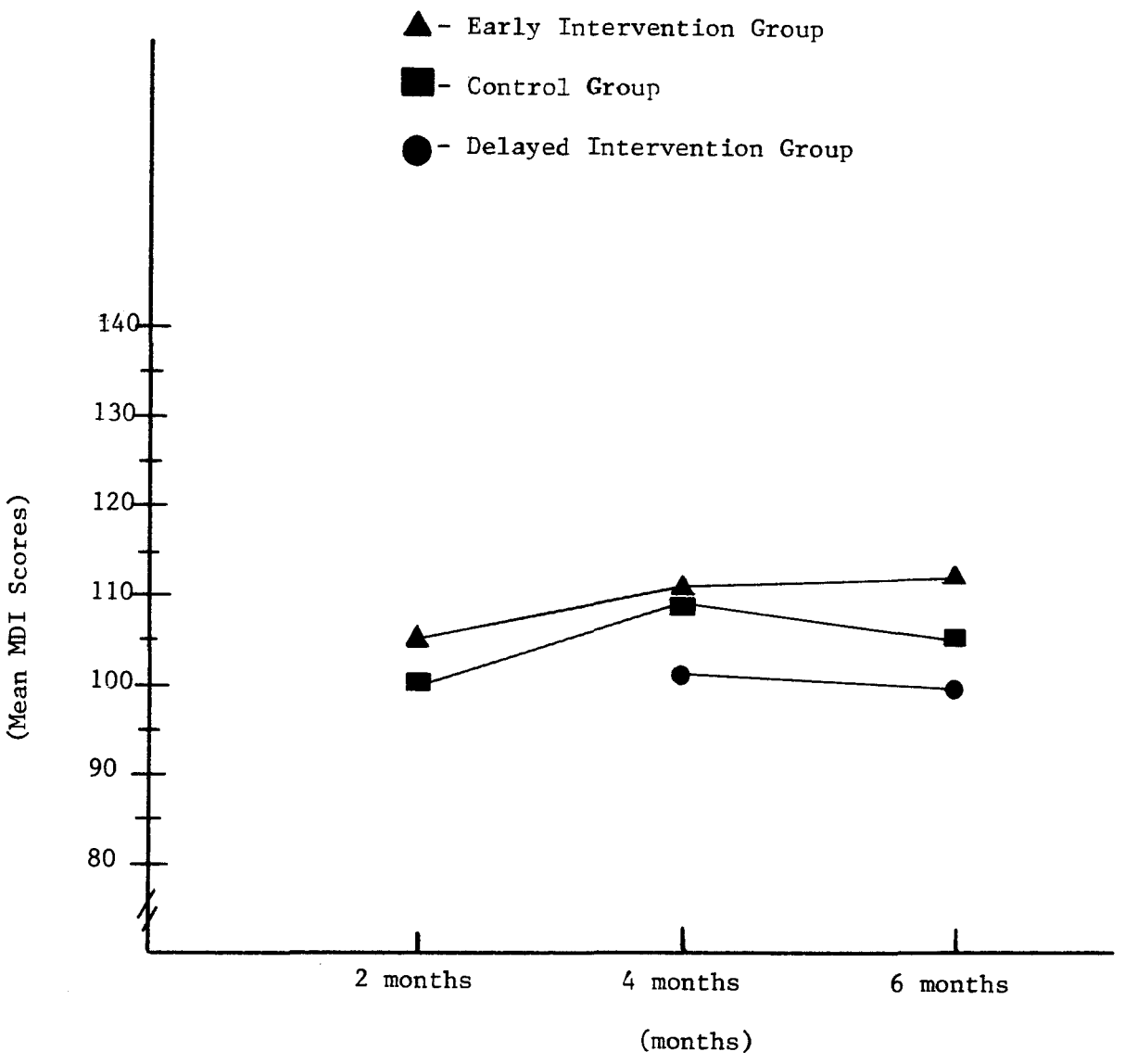
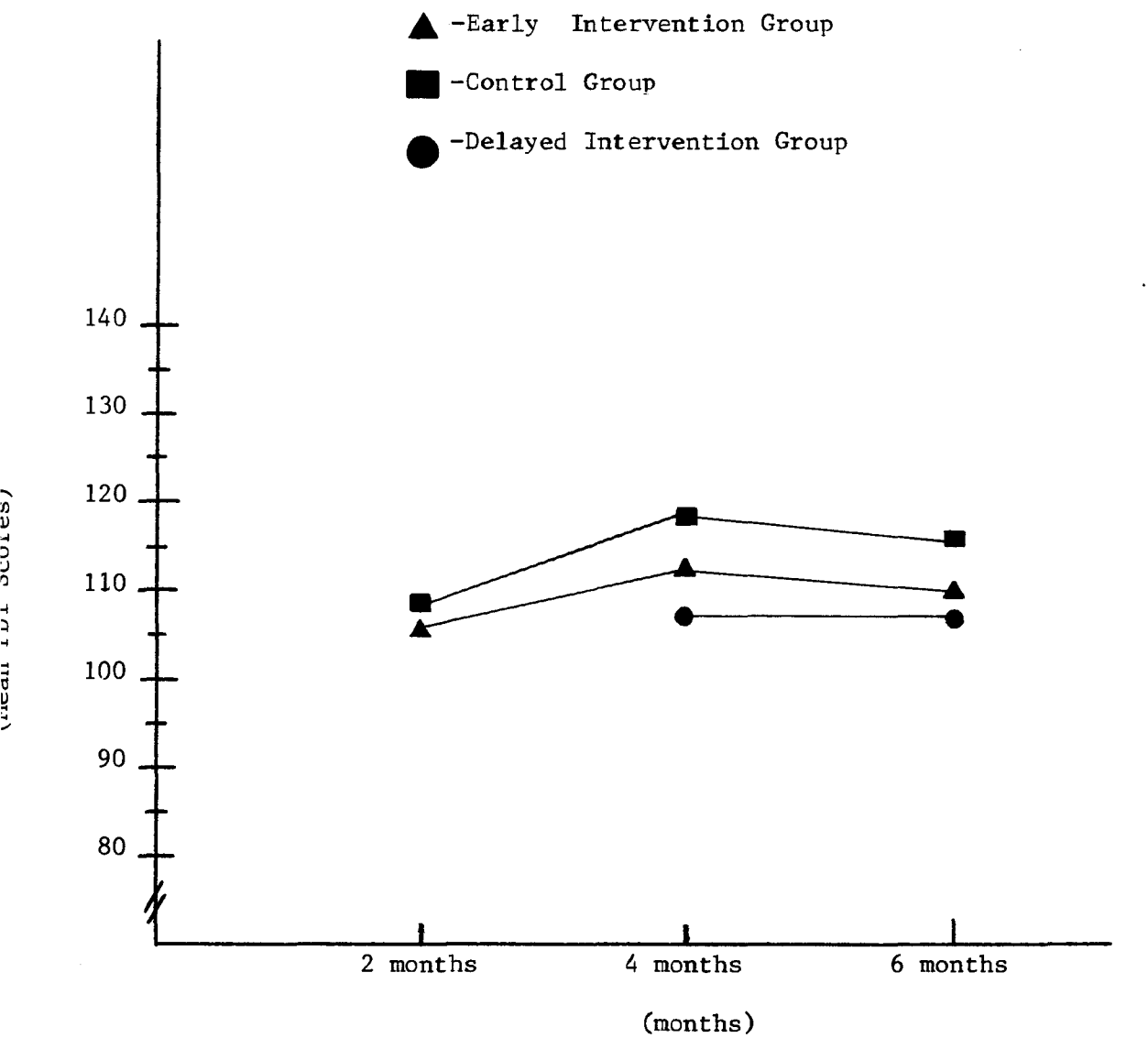


Figure 6 : Mean Psychomotor Development Index Scores for each group at 2, 4, and 6 months of age.



suggests that these groups were similar in developmental level prior to the initiation of intervention.

Two ANOVA's, comparing the MDI and PDI scores of the Early Intervention, Control and Delayed Intervention Groups at 4 months of age were also completed. These ANOVA's failed to yield significant group differences on either of these two variables. In fact, a comparison of the MDI means (Early Intervention $\bar{X}$ = 109.91; Control $\bar{X}$ = 109.80; Delayed Intervention $\bar{X}$ = 101.64) and PDI means (Early Intervention $\bar{X}$ = 112.36; Control $\bar{X}$ = 117.90; Delayed Intervention $\bar{X}$ = 106.09) suggests that the three groups are quite similar despite their varying treatment conditions.

Two more ANOVA's, comparing the MDI and PDI scores of the three groups at 6 months of age, also failed to yield significant group differences. Again, a comparison of the mean MDI scores (Early Intervention $\bar{X}$ = 111.55; Control $\bar{X}$ = 104.30; Delayed Intervention = 99.20) and PDI scores (Early Intervention $\bar{X}$ = 109.27; Control $\bar{X}$ = 115.30; Delayed Intervention $\bar{X}$ = 106.20) points to the similarity of the three groups.

To determine if the amount of intervention received (the number of times the parents reported working with their infant on the prescribed activities) affected cognitive development, four multiple regression analyses were performed. These analyses utilized MDI scores and PDI

scores as the dependent variable and the amount of intervention received as the independent variable. Regression analyses were conducted on Early Intervention Group data at 4 months and on Early Intervention and Delayed Intervention data at 4 and 6 months. These analyses failed to establish a significant relationship between the amount of intervention received and the infants' performance on the Bayley Scales of Development.

A second hypothesis of this study was that infants who receive intervention earlier (at 2 months of age) versus those who receive intervention later (at 4 months of age) would show greater developmental progress. To address this hypothesis, two Student's T-tests, comparing the MDI and PDI scores of the Early Intervention Group and the Delayed Intervention Group were performed. The results of these analyses suggest that these two groups do not significantly differ on these two variables at 6 months of age, despite the fact that the Early Intervention Group received treatment for a full two months prior to the Delayed Intervention Group's receiving treatment.

The third hypothesis of this study was that infants who received intervention would be rated by their parents as more competent than those infants in the control group. To test this hypothesis, several one way ANOVA's were completed (Table 3). These ANOVA's utilized group (Early

Table 3 : F (2,28) Values for One Way ANOVA'S Dimension by Group

Dimension	2 Months	4 Months	6 Months
Curiosity			
Your Child	.025	.818	.962
Avg. Child	.098	.925	.310
Alertness			
Your Child	.040	1.434	1.900
Avg. Child	1.757	1.172	.672
Activity			
Your Child	.068	.639	1.800
Avg. Child	.101	.377	2.975*
Vocalization			
Your Child	.491	.407	.362
Avg. Child	.001	1.788	3.063*
Awareness			
Your Child	.124	1.738	2.840*
Avg. Child	2.185	.934	3.850**
Sociability			
Your Child	.432	.293	.786
Avg. Child	.935	.603	3.942**
Coordination			
Your Child	1.346	.121	.882
Avg. Child	.215	1.561	1.975

* $p < .10$

** $p < .05$

Intervention, Control and Delayed Intervention) as the independent variable and dimensions of development from the Parent Perception Scale (i.e., vocalization, activity, coordination, etc.) as the dependent variable. Of the 42 one-way ANOVA's completed, two reached significance at the .05 level. A significant difference between groups was found on the parents' ratings of the average infant's awareness ($F(2,29) = 3.8496$, $p < .05$) and sociability ($F(2,29) = 3.9422$, $p < .05$) at 6 months of age. Simple effects analyses to uncover the source of these group differences revealed that parents of Control Group infants rated the average infant as significantly more aware than did parents of the Early Intervention and Delayed Intervention Group infants ($t(2,29) = 2.53$, $p < .05$). Also, parents of Delayed Intervention Group infants rated the average infant as significantly more aware than did the parents of Early Intervention Group infants ($t(2,29) = 2.53$, $p < .05$). Simple effects analyses on the significant group differences in parents'ratings of the sociability of the average child at 6 months of age indicates that Delayed Intervention Group parents rated the average child as significantly more social than did the Early Intervention Group parents ($t(2,29) = 2.68$, $p < .05$).

In addition to these significant group differences two trends were also indicated by the one-way ANOVA's. Trends

were noted on the parents' ratings of the average infant's vocalizations and activity at 6 months. Simple effects analyses on these trends reveal that parents in the Delayed Intervention Group rated the Average infant at 6 months as more social than did the parents in the Early Intervention Group ($t(2,29) = 2.69$, $p < .05$), and that parents in the Control Group rated the Average infant at 6 months as more active than did the parents of the Early Intervention Group infants ($t(2,29) = 2.28$, $p < .05$).

A second set of analyses was conducted on the Parent Perception Scale data to determine if parents rated their child significantly differently than they rated the average child on the behavioral dimensions of the Parent Perception Scale. Fifty-six T-tests, comparing the parents' rating of their infant and their rating of the average infant on each of the dimensions of behavior of the Parent Perception Scale at 2, 4 and 6 months of age, yielded only one significant difference. Parents of Early Intervention Group infants rated their infant as significantly more social than they rated the average infant $t(10) = 2.55$, $p < .05$. Given the large number of analyses conducted, obtaining only one significant difference is likely to have been a chance occurrence rather than a truly significant phenomenon.

The final hypothesis of this study was that a

short-term, easily implemented, hospital based program will maximize treatment implementation while minimizing costs. The issue of treatment implementation in this study was conceptualized in two ways. The first way addressed the issue of parents coming to their scheduled appointments. The number of total appointments scheduled for this study was 99. This included scheduled appointments for participants who failed to complete the protocol. The total number of appointments completed was 83, which is an 84 percent completion rate. When appointments that were completed after being rescheduled once are added to the total number, the completion total rises to 89 percent.

The second means for determining program participation was to calculate the average number of times per week the parents worked with their infant on the prescribed activities. This number was obtained from parent report. At the 4 month visit, the reported mean number of activity sessions per week for the Early Intervention Group parents was 12.09. At the 6 month visit, the Early intervention Group parents reported an average of 13.45 activity sessions per week as compared to 9.80 activity sessions per week reported by the Delayed Intervention Group parents. These numbers suggest that parents in both groups worked on the prescribed activities with their infant an average of one to two times a day.

Cost data from this program was calculated from the costs associated with several areas. Table 4 identifies the personnel involved in the follow-up visits, the time they spent with the infant and the cost of this time. As indicated, the total cost per visit, per child is $20.24. Additional costs associated with this program were for the following: 1) support personnel (i.e., secretary), 2) supplies, and 3) indirect costs. Table 5 gives both the total cost associated with each source and the average cost per child, per six month period for each source. As can be seen from this table, the associated costs for a program of this nature are approximately $1,200.00. The average cost per child per six months in associated cost is approximately $36.46. To obtain the total cost of this program for 6 months, the total cost per visit (Table 4) was multiplied by 99 (number of scheduled visits) which yielded a cost of $2,003.76 for the follow-up visits. The total associated costs were then added to the total cost for the program (Table 6) of $3,207.12. To obtain the average cost of this program per child, the total cost of the program ($3,207.12) was divided by 33 (total number of children which completed the program). This produced an average cost per child of $97.18 to receive this program. This figure favorably compares with the average cost of most home based programs which have an average cost of

TABLE 4 : Average Cost per Visit per Child

Personnel	Average time spent with infant	Cost Per Hour	Cost Per Visit
1) Psychologist	30 minutes	$ 13.56	$ 6.78
2) Nurse	10 minutes	$ 10.57	$ 1.77
3) Physician	15 minutes	$ 40.00	$ 10.00
4) Dietician	10 minutes	$ 10.10	$ 1.69
			Total=$20.24

TABLE 5 : Associated Costs per Child per 6 month Period

Source of Cost	Total Costs	Cost per child/per *6 month period
Supplies	$ 662.00	$ 20.06
Secretarial time	$ 241.56	$ 7.32
Indirect cost	$ 299.80	$ 9.08
Total =	$ 1,203.36	$ 36.40

* To determine the average cost per child/per 6 month period year, the total cost was divided by 33. Thirty-three was used because this is the number of children that completed the project. Dividing total cost by this number yields a higher, cost per child than if the total cost was divided by the total number of children enrolled. This higher total cost per child is felt to be a realistic estimate of the cost of this program.

TABLE 6 : Total Program Cost for 6 Month Period

Total Follow-up Costs:

99 visits X $ 20.24 (cost per visit)	=	$ 2,003.76

Total Associated Costs:

Cost of supplies and Secreatrial Cost and Indirect Cost	=	$ 1,203.36
Total Cost	=	$ 3,207.12

$1,400 to $2,350 per child per year. The $97.18 cost to serve a child in this program, even if doubled or tripled to prorate for an entire year of service still represents an economical approach to follow-up for mildly to moderately at-risk premature infants.

In addition to testing the four primary hypotheses of this research, additional analyses were conducted on the supplemental physical data (i.e., height, weight, head circumference) collected during the follow-up visits (Table 2). One-Way ANOVA'S were conducted on height, weight, and head circumference data for each group at each age assessed. Significant group differences were found in head circumference at 4 months ($F(2,29) = 6.16$, $p < .01$) and in height at 6 months ($F(2,29) = 4.54$, $p < .05$). Simple effects analyses revealed that, at 4 months, Control Group infants had a significantly larger head circumference than did Delayed Intervention Group infants ($t(29) = 3.506$, $p < .01$); and at 6 months of age, Control Group infants were significantly taller than both Early Intervention Group infants ($t(28) = 2.355$, $p < .05$) and Delayed Intervention Group infants. Additional ANOVA'S were run on data regarding the infant's health status (i.e., hospitalizations between visits, illnesses between visits, medications taken). These ANOVA'S failed to yield any significant group differences in health status between

visits.

A final piece of information collected at the final follow-up visit involved the parents' satisfaction with the intervention program. Parents of both Early Intervention and Delayed Intervention Group infants were asked two questions: 1) Do you think these activities were helpful for your infant's development?"; and, 2) "Were you satisfied with your participation in this program?" Eighty-five percent of the parents reported that the activities helped their infants development. Those parents who did not feel the activities were helpful stated that they were uncertain if the activities helped their child, however, they did not feel that the activites harmed their child. In response to the question regarding their satisfaction, all the parents questioned responded that they were satisfied with the intervention program.

CHAPTER V

DISCUSSION

The results of this study suggest that a short-term, easily implemented, hospital based intervention program, while not significantly affecting the cognitive development of the premature infant as measured by the Bayley, does increase a parent's awareness of an infant's capabilities. Further, an intervention program of this nature appears to promote the parent's utilization of developmental services while providing these services in a cost efficient manner.

Analyses on the parent perception data suggest that the intervention utilized in this research significantly affected the parents' perceptions of their infant and the average infant .Though parents in the intervention groups did not rate their infants as significantly more competent than did parents of Control Group infants, there were significant group differences in the parents' perceptions of the competence of the average infant at 6 months only. Parents of Control Group infants rated the average child as significantly more vocal and aware than did the parents of Early Intervention Group Infants. Likewise, parents of the Delayed Intervention Group rated the average infant as more active, social and aware than did the Early Intervention

Group parents. There were no significant differences between the perceptions of the parents of infants in the Control and Delayed Intervention groups. These results suggest that the parents who were provided the most information about development in general may be more realistic in their ratings of the capabilities of the average infant. This more realistic rating of the average infant is reflected by their mean rating of the average infant's awareness, sociability, vocalizations and activity, as significantly closer to the midpoint of the rating scale. It is assumed that a midpoint rating is reflective of the average infant's level of proficiency. Thus, providing more developmental information possibly gives the parents more objective criteria on which to rate the average infant. The fact that Delayed Intervention parents did not rate the average infant at 6 months significantly differently from the Control Group parents may be accounted for by the fact that not enough time elapsed between the time that the developmental information was provided to the Delayed Intervention parents and their final rating of the average infant. It may take several months for the developmental information to affect the parents knowledge of development. This would be supported by the fact that the only group differences that occurred were found at the 6 month follow-up.

A second finding regarding the parent perception data is that, despite differences in the amount and timing of intervention, there were no significant differences in parents perceptions of their own infant's behavior. Parents in all three groups rated their infant's behavior at every age as higher than the midpoint. In part, this can be attributed to the information about their infant's performance they were receiving during the follow-up visits. Since a large majority of the infants were assessed to be performing age appropriately, parents were informed that their infant's performance was appropriate for his/her age. This information most likely led parents to rate their infant positively. Even though parents of the Early Intervention and Delayed Intervention Group infants were provided with information regarding their infants area/areas of weakness, this did not appear to affect their perception of their infant negatively.

The findings that parents provided with developmental information have a more realistic perspective on the skills of an average infant (and hence a more realistic framework in which to view their own infant), and that developmental information specific to their infant's strengths and weaknesses positively affects parents perceptions of their infant is very encouraging. The fact that parents' perceptions of the skills of an average infant and their

own infant were influenced by this type of approach to intervention suggests that this approach may be effective in the short-run by reducing the stress associated with parenting a high risk infant. It is widely accepted that parents of prematurely born infants experience stresses and require special support (Boger, Richter, Kurnetz and Haas, 1986). If by providing these parents with information about their infant's development can reduce some of the stresses, then this further establishes the importance of having parents of infants born prematurely participate in follow-up clinics. Though not measured in the present research, there may be significant long-term effects of influencing these parents' perceptions of their infant and the average infant. In an early study on the maternal perceptions of the neonate as related to later development, Broussard & Hartner (1971) found that a significant number of those infants rated by their mothers to be "at risk", when followed up at 4 1/2 years of age, were more likely to need psychiatric intervention than thise infants not rated by their mothers to be at risk. This study suggests the powerful long-term effects a parents expectations can have on the infant's subsequent development The findings of the Broussard & Hartner study have significant implications for the present work. It is very probable that by positively influencing a parent's perceptions of their

infant and giving them a realistic view of the average infant, the present study offers a means to facilitate the subsequent outcome of the high-risk infant. Specifically, by aiding the parents to develop a positive perception of their infant, this type of intervention, may significantly impact on the parents' interaction with their infant, and over time, yield a more optimal developmental path for both the parent and the infant.

Though suggesting that parents' perceptions of their infant and the average infant may be changed by this type of intervention, the present study did not establish this intervention's effect on the cognitive development of those infants in the treatment groups regardless of when treatment was introduced. The failure of this research to demonstrate improved cognitive development in infants in the two treatment groups can be accounted for in several ways. One possible explanation is that the measure of cognitive development employed in this study, the Bayley Scales of Infant Development, was not sensitive enough to reflect changes due to intervention. It is the belief of many researchers (i.e., Parmelee, Kopp, and Sigman, 1976; Nelson, 1979) that while the Bayley Scales of Infant Development provide an adequate assessment of the general developmental competency of an infant, it may be an inadequate instrument to assess the development of the

high-risk infant.

A second possible explanation for the lack of significant group differences in cognitive development as a result of receiving intervention involves the issue of correcting for gestational age (Kramer, Korner and Hurwitz, 1985). The performance levels of the infants in each of the three groups were based on the infant's corrected age rather than on their conceptional age. By "correcting" for prematurity it is thought that a true picture of an infant's performance is obtained because it is uncertain what the experiences of the premature infant are in those early weeks of life. However, a look at the performance of the infants in the present study suggests that correcting for prematurity may be problematic. Specifically, the MDI and PDI scores of infants in all three groups, whether or not they received intervention, were primarily above 100 (the mean of this instrument) resulting in higher mean scores than expected at each age for an at risk group. Given these unexpectedly high mean scores, the possibility is raised that correcting for prematurity artificially inflates the scores of premature infants. Inflating the scores of these infants creates a ceiling effect which significantly reduces the usefulness of the Bayley Scales in detecting differences in functioning.

The failure of this study to find differences

between the Early intervention Group and the Delayed Intervention Group can, in part, be attributed to those factors previously noted as possible explanations for this study's failure to demonstrate the effects of receiving intervention. In addition, one further point must be considered. It is a well accepted fact that development in the first months of life is extremely rapid (Brazelton, 1969; Honzik, 1983). Accepting this fact, it follows that one should intervene in an at-risk situation as early as possible to ameliorate any possible lasting effects of early risk factors. In a sense, this raises the issue of a sensitive period in infancy when intervention should be introduced to have a maximum effect. Numerous studies have demonstrated parent-centered early intervention programs to have a positive effect on the subsequent development of the mildly/moderately at-risk preterm infant (Widmayer & Field, 1981; Rauh, et.al, 1984; Crittenden & Snell, 1979). However, the initiation point of the intervention in these studies has varied markedly. Intervention has been initiated from as early as a few days prior to discharge from the hospital (Rauh, et. al. 1984) to when the infant is several months of age (Field, Widmayer, et al, 1980). However, when intervention was delayed as much as 10 months (Bromwich and Parmelee, 1979) no effect on cognitive development was established.

These studies suggest that the sensitive period may be in the first half year of life for the mildly/moderately at risk preterm infant. This study in attempting to provide further information about the effects of delaying intervention, compared the performance of a group of infants who received intervention from 2 months of age (corrected) versus a group of infants where intervention was delayed until 4 months of age (corrected). Since there were no apparent effects of delaying intervention until 4 months of age it can be postulated that mildly/moderately at-risk infants who for whatever reason fail to receive intervention early in life, may receive the full benefits of intervention even when it is introduced late in the first half year of life. However, a great deal more work needs to be done to address the issue of the timing of intervention. Also further investigations should concentrate on better defining the parameters of the sensitive period for the mildly/moderately at risk infants.

The final hypothesis of this research was that a short-term easily implemented, hospital based intervention program would maximize treatment implementation while minimizing cost. This appears to be the case as implementation data collected from this study indicate a higher than expected implementation rate. As previously noted implementation was conceptualized in two ways: 1)

parents keeping scheduled appointments, and ; 2) the number of times parents worked with their infants on the prescribed activities. Parents were found to keep an unusually high percentage of 84% of their originally scheduled appointments. The completion rate increased to 89% when those appointments that were rescheduled once were included. A comparison of this completion rate versus the typical 50-65% completion rate of pediatric follow-up clinics indicates that this approach is appealing and accessible to parents.

The second measure of participation that of how frequently the parents performed the prescribed activities with their infant also points to a high level of participation. It is recognized that amount of times parents performed the activities may be slightly inflated by report bias. However, because the parents knew that the infant would be evaluated to monitor progress, it is likely that this overreporting bias was not significant. Parents in both the Early Intervention Group and the Delayed Intervention Group reportedly worked on the activities at the very least daily, and some, nearly twice a day. This indicates that the infants received more intervention, on an average, than could be provided in most home based programs. It is believed that an approach such as the one employed in this study offers several benefits not present

in most interventions.

First, it is believed that access to numerous professionals (i.e., psychologist, neonatologist, social worker, etc.) is very appealing because several opinions, encompassing a variety of aspects of their infant's development can be obtained by parents on one visit. This conclusion is supported by a recent study conducted on parent attitudes about participating in an infant follow-up program. Katz (1986) surveyed a sample of parents whose infants were in a follow-up evaluation program for at-risk infants. Results of this questionnaire suggest that parents felt extremely positively about a program where they could see several professionals in one visit.

A second benefit is that very little effort was required on the parents' part to participate in the intervention. Parents were only required to bring their infant to the hospital on two or three occasions over a 6 month period, which is not a large inconvenience for most new parents. Further, because there were no hospital personnel coming into these families' homes, they were free to work on the activities with their infant at their own convenience. In previous studies (i.e., Haegert and Serbin, 1983) it has been shown that the less time and the fewer lifestyle changes required of participants in a treatment program, the higher percentage of implementation.

Finally, this approach to intervention provides parents the opportunity to play an active role in their child's development. Providing parents with the role of interventionist enables them to feel more positive about their infant's progress (Field, 1981). As parents work with the infant and see the progress, they feel more positive about their own parenting skills which leads to increased involvement with their infant over time. This "transactional approach" to intervention is felt to result in long-term improvements in the parent-infant dyad family's, which hopefully outlast the families participation in an intervention program.

In addition to demonstrating increased participation as a result of a short-term, hospital based approach to intervention, the present research also demonstrated its cost effectiveness. This approach to intervention significantly reduced the cost of serving a mildly/moderately at-risk infant. Based on the cost data for this project, a savings of several hundred dollars a year per child can be realized with this approach. The cost-effectiveness of this project can be attributed to the fact that there was a limited amount of professional time utilized to implement the intervention. By involving the parents of the infant as primary intervener, there was no need for home visitors, extended usage of professional time

in the hospital or developmental toys that add to the costs of most intervention programs. The economic advantages of this approach to intervention is readily apparent; however, this is not without its limitations. It is felt that the short-term, hospital based approach to intervention is most useful for those infants who are not severely at risk. Specifically, those infants with extreme handicapping conditions (i.e., cerebral palsy, severe asphyxia, extreme prematurity, etc.) may be better served by a home based program. These infants require a level of intervention which may be beyond what could realistically be expected from a parent. However, this is not to say that parents of these infants should be excluded from intervening with their infant. In fact, it is widely accepted that a critical factor in the success of intervention with a severely at-risk infant may be the involvement of the parents of that infant (Barera, Rosenbaum & Cunningham 1986; Brofenbenner, 1975; Tjossem, 1976). For the mildly/moderately at-risk infant, parental involvement offers an economically feasible and practical alternative to the traditional approaches to intervention.

In addition to this approach to intervention increasing participation while minimizing costs, subjective data collected at the exit evaluation indicate that a large majority of parents of both intervention groups (Early

Intervention and Delayed Intervention) felt that the activities provided to them were helpful for their infant. Comments such as "My baby has really improved since working on the activities;" and, "I would never have thought to do that with my child" suggested that the activities are perceived as beneficial to the infant. It is likely that this perception directly effected the frequency with which parents worked with their infants on the prescribed activities.

A second question assessed parents' overall satisfaction with participating in the interaction program. One hundred percent of the parents questioned responded that they were satisfied with the intervention program. Satisfaction with the program appeared to be related to the parents' feelings about the effectiveness of the activities. Because no parents felt negatively about the activities, it is likely that parents perceived the intervention more positively. Parents also commented on the fact that having several people (i.e., physician, psychologist, etc.) accessible to them at one visit was very appealing. It is very likely that this high level of parent satisfaction, in part, accounts for their willingness to complete their follow-up opportunities.

In summary, though not demonstrating a significant effect of this intervention on the cognitive development of

a sample of preterm infants, this research did find that developmental information supplied to parents helped them to develop more positive feelings and realistic expectations for their infant. Further, this intervention was able to positively influence parent perceptions through a short-term, hospital based approach that was low cost and well received by the participating parents. These results suggest that this approach to intervention is an effective means of facilitating the relationshipof parents and their mildly/moderately at risk preterm infant.

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APPROVAL SHEET

The dissertation submitted by James S. Gyurke has been read and approved by the following committee:

Dr. Jill N. Reich, Director
Associate Dean, Graduate School of Arts and Sciences, Loyola University

Dr. Deborah L. Holmes
Professor of Psychology, Loyola University

Dr. Fred B. Bryant
Associate Professor of Psychology, Loyola University

Dr. William J. Burns
Associate Professor of Psychology and Psychiatry, Northwestern University

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

04-11-87
Date

Jill N. Reich
Directors Signature