

The Effect of Pre-Term Infants' Decreasing Mortality on their Future Morbidity: Preliminary Examination of Long-Term Outcomes of Stimulation Programs for Pre-Term Infants

JACQUELINE S. CHAPMAN*
Professor, Faculty of Nursing
University of Toronto

ORIENTATION TO THE PROBLEM

The percentage of neonates that will be classified as premature infants in 1978 will be approximately 8 percent of all live births. In spite of all the advances in perinatology in the past decade the rate of prematurity has remained unaltered. The definition of a premature infant, however, has received critical scrutiny in the past decade.

Any infant who, at birth, weighs 2500 grams (5½ pounds) or less, for vital statistic purposes, is classified as premature. Such a definition does not differentiate between the undersized infant who is the product of a 9 month pregnancy and the infant of comparable birth weight who is born several weeks or even months prior to his mother's expected date of confinement. 'Pre-term infant' is the term now used to connote an infant who is born at 37 or fewer weeks from conception (Hunt and Rhodes, 1977, p. 206). The term 'small-for-gestational-age infant' is used by Lubchenco (1978) for an infant of any gestational age who, at birth, is below the 10th percentile for the expected weight of an infant born that long after conception. The term 'appropriate-for-gestational-age' means that the pre-term infant's measurements, clinical features, and neurological examination are congruent with expected values for the length of time he has been in utero.

Mortality and morbidity of premature infants have been found to be influenced both by how long before term the infant is born and,

* This project is supported by NHRDP grant 606-2024-48. It could not have been accomplished without the aid of (1) members of the Faculty of Nursing competent in administration of the Rosenblith Test — Elizabeth Benson, Roslyn Goode, Judith Hendry, Ellen Hodnett and Blondina Matheson; (2) consultant from and graduates of the Institute of Child Study — Professor Betty Flint, Linda Mounts and Margaret Wilson; (3) research assistants Sharon Samland and Carol Mellor; (4) the premature nursing staff of three teaching hospitals; (5) Dr. A. Shennan, neonatologist; and (6) the public health nurses throughout the province of Ontario.

in the case of the small-for-gestational-age infant, the degree of intrauterine growth retardation experienced. The earlier in pregnancy the child is born, the lower his birth weight and the higher his risk for mortality.

In the past decade the mortality rate of the smallest group of pre-term infants who at birth weigh 1500 grams (3 lbs. 5 oz.) or less has decreased from 85% to 50% (Fitzhardinge and Campbell, 1977, p. 126). Use of neonatal intensive care units, the neonatologist, and the machinery available for ventilatory assistance are key factors in this decline of mortality in these very small infants. When all pre-term infants up to 35 gestational weeks are included — many of whose birth weights would exceed 1500 grams (3 lbs. 5 oz.) — the mortality rate encountered a decade ago was 35% (Chase, 1973, p. 25).

Today, or at least from 1977 statistics, in one hospital with 2619 live births, 209 (7.9%) were classified as premature.* Only 15 (7.2%) of these 209 infants died, and 13 of these 15 deaths occurred in infants under 1500 grams. Hence although the rate of prematurity has not changed, an increasing number of infants survive prematurity.

Statement of the problem. Fitzhardinge and Campbell (1977, p. 126) ask, "Does a reduction in mortality now lead to an increase in morbidity later on?" Morbidity as defined by Lubchenco and others (1972) encompasses learning problems as well as physical handicaps.

Justification for the study. Outcome studies of U.S. health care for pre-term infants born in the early 1960's (Lubchenco and others, 1972, p. 510) show that few survivors were devoid of some developmental handicap at 10 years of age. In France 21% of pre-term infants born before 1962 had long-term "serious and definitive neurological sequelae" (Dargassies, 1977, p. 465).

Giles (1978), a physician, in presenting an historical perspective of perinatology at the 3rd Annual March of Dimes Perinatal Nursing Conference outlined the nursery policies that existed in the early 60's as follows: 1) prevent the mother from seeing her infant particularly if it is likely to die; 2) separate the mother and the baby at birth; 3) allow no visitors into the nursery; and 4) if the infant is 10 weeks or more early allow it to die. From today's perspective it does not seem surprising that the long-term follow-up of infants housed in the 1960 nurseries which observed these policies should show high rates of morbidity. In the 1960's however, nurses such as Eileen

* According to the 1977 Neonatal Intensive Care Unit Annual Report of Hospital A where the majority of the sample was obtained.

Hasselmeyer (1961, 1963) began to challenge those policies. She provided planned tactile and vestibular stimulation for infants who could maintain their temperature outside of the isolette. By 1967 another nurse, Mary Neal, had patented a motor-driven hammock so that smaller infants, unable to be removed from an isolette, could be rocked within its warm confines. In the 1970's several nurses have placed speakers inside the isolette to present, periodically, music, a heart beat, or taped parental voices to premature infants (Barnard, 1973; Chapman, 1975; Katz, 1971; Segall, 1971). Parents are now encouraged to visit their premature infants and to participate in their care. The 'no-touch' phenomenon of the 1960's is gone and hospital nursing staffs who recognize the importance of intermittent, multi-modality, patterned incoming stimuli to the developing infant's brain provide such stimuli.

Stimulation programs both in the nursery (Chapman, 1975; Barnard, 1973; Katz, 1971; Neal, 1967; Segall, 1971) and during the first year (Williams and Scarr, 1971, p. 296) have been shown to have beneficial effects on infant development. However, recently the beneficial effects of early stimulation programs on long-term development has been challenged (Wachs and Cucinotta, 1977). Clarke (1977) states that the effects of even prolonged early intervention fade if not followed by similar intervention. In 1976 Ross and Leavitt contended that there was a clear and present need to evaluate the effectiveness of infant stimulation programs. The project "Longitudinal Assessment of Planned Hospital and Home Stimulation Programs for Pre-Term Infants" (NHRDP project 606-2024-48) was initiated to meet this need as well as to see if, since 1975, the health care system has succeeded in decreasing morbidity as well as mortality in pre-term infants.

Research questions. Two specific problems were identified and formulated into research questions:

- (1) "When if ever, does the pre-term infant catch up?" (Hunt and Rhodes, 1977).
- (2) Do planned stimulation programs influence the long-term development of pre-term infants?

LITERATURE REVIEW

Previous publications (Chapman, 1975, 1976, 1978) provide more extensive reviews of the literature on the modalities available for use in infant stimulation programs, and introduce the rationale for selecting auditory stimulation as an appropriate modality for use with pre-term infants who are confined to incubators.

The younger the premature infant, the greater the number of purposeless, uninhibited limb movements he exhibits. These gestationally younger infants concurrently have low birth weights ($r = .67$; Chapman, 1975, p. 114) and may take from 12 days to 3 weeks to regain even that low birth weight level. It is assumed that shortening of the aforementioned length of time to regain, by decreasing the extent of initial weight loss for those infants, contributes to a decrease in mortality. Brackbill (1971, p. 25) contends that the motility of the gestationally young infant poses a threat to his survival. Wolff (1966, p. 40) found that among the auditory, visual, and tactile modalities, sound was the most effective way to achieve decrement in the level of the neonate's activity.

Concurrently, as for all other modalities, auditory stimulation can be planned to meet the criterion of continually changing, patterned stimuli. The premature infant housed in an incubator does not have the same opportunity for either the variety or extent of stimuli to meet this criterion as does his/her counterpart who completes the last trimester *in utero*. Normal human development is believed to be contingent on the impact of varied stimuli on the organism (Fiske and Maddi, 1961, p. 13). Hence, prematurely born infants miss much of the multimodality patterned stimuli available to the fetus during the last trimester.

It is assumed that provision for simulation of any of the interuterine modalities in the extrauterine environment of the premature infant contributes to a decrease in the morbidity statistics referred to earlier in this report. A continually varied, patterned external stimulus is effective because it creates excitation in the reticular activating system (Morruzzi and Magoun, 1949, p. 470). A stimulus in any modality enhances the sensitivity of the cortical sensory receptors for other modalities (Sokolov, 1963, p. 13). Hence, since auditory stimulation concurrently achieves decrement in motility, a mortality-related factor, patterned auditory stimulation was chosen as the modality of choice for stimulation of pre-term infants confined to incubators.

Conceptual framework. The research questions are raised within one of nursing's theoretical frameworks. Martha Roger's interrelated concepts about the phenomenon of man's interaction with his environment through time are paramount for this study. She states: "Developmental events along life's axis express the growing complexity of pattern and organization evolving out of multiple previous man-environment interactions" (Rogers, 1970, p. 16). Recently extrauterine life for the pre-term infant has been found to actually accelerate

development for the first few months (Hunt and Rhodes, 1977, p. 207). Pre-term infants have had multiple interactions by the time they reach their mother's expected date of confinement. It would seem that if these interactions were planned to aid development, the potential of the infant would be maximized. Nursing practice both in the hospital and in the public health fields is viewed as promoting integrative interactions such that the pre-term infant's development is optimized.

Purpose. The purpose of the study is 1) to assess the intellectual, motor, and social functioning of pre-term infants at the developmental ages of 9 and 18 months, at 3 years, and yearly thereafter until age 8; and 2) to evaluate the effectiveness of planned hospital and home stimulation programs provided to some of these infants.

Research hypothesis. Pre-term infants exposed to stimulation programs will have greater developmental attainment than control subjects as demonstrated by 1) scores on The Rosenblith Scale prior to hospital discharge; and 2) after discharge by a) infant self and other trust as demonstrated on The Flint Infant Security Scale at four periods in the first year and one period in the second year; and on b) The Bayley Scales of Infant Development at 9 and 18 months from their mothers' expected dates of confinement, and on c) The Sanford-Binet and Vineland Social Maturity tests at 3 years chronological age.

For this report it is only possible to take a preliminary look at the potential answers for these hypotheses. To date almost 200 subjects have been admitted to the study. As yet, however, only 35 subjects have attained 18 months from their mother's expected date of confinement; the target sample will be 216 subjects (6 groups with 36 subjects in each).

METHOD

Subjects. Cluster sampling (Treece and Treece, 1973, p. 82) provides the initial population. Three high-risk nurseries are the source of the pre-term infants in this study. All pre-term infants without congenital anomalies or addicted mothers who are admitted to these 3 nurseries are eligible for inclusion in the sample if their anticipated hospital stay is at least 4 weeks. A three-group randomized block assignment of subjects is used. Groups are stratified by hospital and sex. Subjects are assigned to one of three groups: a control group, an alternate group, or a sequential group. The control group receives the usual care provided in the facility. In addition, the alternate group's stimulation program consists of 5 minutes of Brahms's "Lullaby" alternated with 5 minutes of a taped recording

of the infant's parent(s) voice(s) reading nursery rhymes. This alternating tape is played for 5 to 10 minutes at the midpoint of the infant's feeding schedule.

A second experimental group, designated the sequential group, has, in addition to the usual care, Brahms's "Lullaby" played at the same intervals as the alternate group during the first half of their hospitalization, then, the parental voice tape is substituted for the latter half of the infant's hospitalization.

The comparison of the effect of sequential presentation of music and voice to the alternate presentation has been derived from inductive theoretical considerations.

As pointed out in the literature review, patterned auditory stimulation would seem the independent variable of choice to decrease the mortality-related writhing of the premature infant as well as to concurrently contribute to maturation and reduce long-term morbidity.

Auditory patterns used in an earlier study on pre-term infants (Chapman, 1978) were a lullaby which had been noted to have a quieting influence when used with normal infants (Hardy and others, 1959) and speech since Rothschild (1967) had suggested that daily verbal stimulation of infants in incubators might reduce the incidence of later behavioral disturbances. The 1978 study's music group, although not significantly different in weight or gestational age at birth from the control groups, attained, on average, the weight of 4 pounds significantly earlier (a week) than the control group. This suggested that musical stimulation conserves energy and permits use of calories for weight gain. The speech group in the same study had their right arm movements, in comparison to the control group, significantly affected. That is, brain maturation as evidenced in laterality appeared (Segalowitz and Chapman, 1978).

Both music and speech alone produced benefits in the former sample. The question for the current research then was: might not a combined auditory program be beneficial and what type(s) of combination should be provided? Latest information indicates that the entire brain would be stimulated if both music and speech were used since music stimulates the right side of the brain; speech, the left (Molfese, 1977).

Since the greatest weight loss occurs in the first week or so of the premature infant's life and music has been shown to be most efficacious in promoting weight gain, a sequential program in which music would be provided for the first half of the infant's hospitalization was planned. Later, when the infant's weight gain was well-established, the music would be replaced with a parental voice (usually the

mother's) to stimulate maturation and promote bonding and emotionally stable development. Since weight gain could possibly be promoted with a pattern which allowed a shorter exposure to music but also provided exposure to the human voice from the outset, the alternate presentation was selected as a second regime for the current study. Both experimental groups receive comparable amounts of planned auditory stimulation but the pattern of presentation differs.

Procedure. During the first four days of the subject's life the investigator visits the infant's mother to explain the study and to secure her written consent for her child's inclusion.

The auditory regime is started on the 5th day of life for the two experimental groups. By this time the effects of maternal medication are diminishing in the infant. An instrument that emits a sound like a bird tweet is used to ascertain if the infant blinks in response to sound. The regime continues until a few days before the infant's discharge. Following discontinuation of the hospital stimulation program all subjects are assessed on an instrument known as the Rosenblith Scale (Rosenblith, 1961) prior to discharge. Two trained testers independently rate each subject. These testers are unaware of the hospital stimulation program to which the subject was assigned.

At discharge the subjects in each of the three hospital groups are assigned at random to either the home control or the home stimulation program. All subjects receive a monthly visit from the public health nurse until they reach 9 months from their mother's expected date of confinement. Appointment times are made at the mother's convenience and, where possible, to coincide with the infant's awake time. For the home control group, in order to control the Hawthorne Effect, the same length of visit is made, problems, if any, are identified and appropriate action is taken. In addition, for the 50% of the sample in the home stimulation program, a teaching module is used to help the infant's caretaker anticipate his development and appropriate toys are also provided each month.

Since 1970 new data about how to help parents maximize the potential of premature infants have become available. Two home programs (Scarr-Salapatek and Williams, 1972; Wittenberg, 1971) for low birth weight infants have demonstrated that monthly visits during the first year of life can bring experimental infants' developmental status towards standardized norms whereas control groups remained a standard deviation below the norms. The teaching modules for this project were devised using correspondence with and writings by Sandra Scarr-Salapatek, Institute of Child Development, University

of Minnesota; Burton White, Director Pre-School Project, Harvard University, and Ira I. Gordon, Director, Institute for Development of Human Resources, University of Florida. Toys called "Playtentials" specifically created and tested in Burton White's laboratory were used in this study. These toys are no longer available commercially.

The teaching module for each developmental stage was specified. The public health nurse utilized the prepared module for teaching the infant's caretaker; she also demonstrated the use of the appropriate age toy. This mediator-model which involves parents or other primary care givers actively and intimately in the infant's program is believed by experts to be far superior to programs where health professionals give the program directly to the baby (Ramsden 1977).

The investigator accompanies the public health nurse at the initial visit a few days after discharge and then at visits during the 3rd, 5th, and 7th chronological months in order to independently rate, along with the public health nurse, the subject on a second instrument — the Flint Infant Security Scale (Flint, 1959).

At 9 and 18 months from the infant's mother's expected date of confinement a graduate of the Institute of Child Study who is unaware of the subject's group assignment accompanies the public health nurse and investigator to the subject's home to administer a third instrument, the Bayley Scales of Infant Development (Bayley, 1969). During these visits the investigator and the public health nurse again independently rate the subject on the Flint Infant Security Scale.

Instruments. The Rosenblith Scale (Rosenblith, 1961) is used to assess the predischARGE behavioral repertoire of each subject. The scale assesses motor strength and co-ordination as well as vision and hearing function.

The Flint Infant Security Scale assesses the subject's willingness to accept dependence, that is, his trust in the adults in his environment as well as his capability of putting forth efforts to explore and learn as he develops.

The Bayley Scales of Infant Development (BSID) were designed for both clinical and research use (Bayley, 1969, p. iii). Forty-five hundred infant examinations have contributed to the standardization of the Scales (Bayley, 1969, p. iii). The 1969 edition of the BSID were standardized on 1262 children distributed comparably among 14 age groups between 2 and 30 months.

There are 3 complementary parts to the BSID: (a) The Mental Scale — “The Mental Scale is designed to assess sensory-perceptual abilities...; the early acquisition of ‘object constancy’...; vocalization...; and . . . abstract thinking. Results . . . are expressed as a standard score, the MDI, or Mental Development Index” (Bayley, 1969, p. 3); (b) The Motor Scale — “The Motor Scale is designed to . . . measure . . . the degree of control of the body, co-ordination of the larger muscles and finer manipulatory skills of the hands and fingers Results . . . are expressed as a standard score, the PDI, or Psychomotor Development Index” (Bayley, 1969, p. 3); and (c) The Infant Behavior Record (IBR) — The IBR assesses “The child’s attitudes, interests, emotions, energy, activity, and tendencies to approach or withdraw from stimulation” (Bayley, 1969, p. 4). Both specific observations and qualitative judgements by the tester are required (Bayley, 1969, p. 23).

In the standardization sample, stratification was used to control sex, ethnic group, urban-rural, and education of head of the household in each of the 14 age groups. For children between 2 to 15 months a limit of 4 days on either side of the desired age was applied (Bayley, 1969, p. 7). Between 18 and 30 months \pm 1 week was allowed. The same criteria for choice of time of test was used in this study. Bayley tested children who were ‘normal’, lived at home, and only one child per family was tested. More than one child per family will be tested in this study as twins and subsequent pre-term siblings are included.

The MDI and PDI raw scores have standard score equivalents ranging from 50 to 150 with a mean value of 100 and a standard deviation of 16 (Bayley, 1969, p. 15). The indexes derived from the MDI and PDI are stated to establish the child’s current status, not to necessarily predict later abilities (Bayley, 1969, p. 4). The Infant Behavior Record section was standardized on approximately 700 children below 15 months and on the entire BSID standardized sample above 15 months. All materials for testing are housed in a standard test kit. Average testing time is 45 minutes (Bayley, 1969, p. 24).

Validity and Reliability Data on The Three Instruments Selected to Assess Infant Development. Validity and reliability data on the Rosenblith Scale (Graham, 1956; Rosenblith, 1961), the Flint Infant Security Scale (Flint, 1974), and the Bayley Scales of Infant Development (Bayley, 1969), have been established.

EVENTUAL STATISTICAL PLAN FOR DATA ANALYSIS — DEPENDENT VARIABLES

1. *Rosenblith scales.* Since females are known to have more rapid development than males, two-way analysis of variance (sex by treatment group) will be used to assess the development of the 3 hospital groups at the time of discharge. The two components of the maturation score, motor strength and co-ordination (tactile-adaptive), will be subjected to two-way analysis of variance as well as their additive sum (designated maturation score). Similarly, the other dimensions on the Rosenblith scale, muscle tension score, auditory score, vision score, and the combined sensory score (auditory plus vision score) each will be subjected to two-way analysis of variance.

2. *Flint Infant Security Scale.* Multivariate analysis will be used, as a need for trend analysis over the 5 assessments (at 3, 5, 7, 9, 18 months of age) in both sexes among treatment groups is anticipated.

3. *The Bayley Scales of Infant Development.* A three-way analysis of variance (treatment, by date, by sex) analysis of variance will be used to assess differences among the 6 groups' mental and motor scores on The Bayley Scales which are obtained at 9 and 18 months from the infant's mother's expected date of confinement. The correlation between the 9 and 18 months scores will also be assessed. For the behavior record section of the Bayley 11 items are rated on a 5 point scale. If the obtained data are distributed across the scale they will be treated as internal level data. If the scores' distribution requires, ordinal statistics (such as the median test) will be used or, if the data indicates a nominal level statistic is required, the Chi-Square test will be used.

PRELIMINARY RESULTS

The results to be presented are tentative due to the small sample size; the unequal N in each group does not meet the assumption underlying the analysis of variance; and time constraints have permitted limited approaches to even what data is available. With such small subgroups one usually does not expect to attain statistically significant results.

The sample. The preliminary sample examined consisted of 17 boys and 18 girls. Twenty-six were Caucasian, 3 were East Indian, 3 were Black, 2 were Filipino, and 1 was Indonesian. Ten of the 26 parents in the Caucasian group were born outside of Canada — in Portugal (1), England (1), Yugoslavia (1), Italy (2), Greece (2), Russia (1), France (1), and Spain (1). The mean gestational age of the sample at birth, which did not differ among the 3 hospital groups, was 234.5 days or 33½ weeks of gestation. Two-thirds of

the sample were born between 5 and 8 weeks early. The mean weight of the sample at birth, which did not differ among the groups, was 1716 grams (3 lbs. 12½ oz.). Two-thirds of the sample weighed between 1466 grams (3 lbs. 3 oz) and 1866 grams (4 lbs. 3 oz.).

The sample took 11 to 12 days to return to their birth weight. This return to birth weight corresponds to the Dancis (1948, p. 571) curve for the average birth weight of the sample. The Rosenblith predischARGE test was performed, on the average, 4 weeks after birth. The average gestational age of the sample at this time, which did not differ among groups, was 263 days or 37½ weeks. Two-thirds of the sample were tested between 36 and 39 gestational weeks.

Results on the Rosenblith Scale. 1. Motor Score. The motor score is derived from the following items: the ability of the infant to move his head when placed face down on his crib, the strength of his hand grasp, the ability to elicit a right-left-right crawl sequence when he is prone, and the vigor of his reaction to a cotton ball or cellophane placed over his nares. The total possible score is 9. Rosenblith (1975) reported for 202 infants at 37-39 weeks a mean motor score of 4.55 ± 1.97 . The mean motor score for this sample, which did not differ among groups, was similar — 4.69.

2. Tactile-Adaptive Score. This is derived from the following items: the ability of the infant to shake his head in an attempt to avoid the cotton batten ball or cellophane sheet over his nares and the persistence he shows during 3 trials. The total possible score is 9. Rosenblith (1975) reported a mean tactile adaptative score of 6.54 ± 1.36 for 202 infants between 37 and 39 weeks. The mean score for this sample, which did not differ among the three groups, was 7.95.

The motor and tactile-adaptive scales are summed to provide a general maturation score out of 18. Rosenblith reported for 202 infants between 27 and 39 weeks a mean maturation score of 10.87 ± 2.86 . The mean score for this sample, which did not differ among groups, was 12.54.

3. Auditory score. Auditory response to and localization of sound produced by a two-seed rattle and a bicycle bell are observed and rated. The maximum score possible is 5. The average highest score for this sample, which did not differ among the groups, was 4.73.

4. Visual score. Vision is assessed by shaking a shiny bicycle bell in front of the baby's eyes, obtaining fixation and then trying to have the infant pursue it horizontally and, if possible, vertically. The maximum score the infant can achieve is 10. The average score for this sample, which did not differ among the groups, was 7.94.

Table 1. Means and Standard Deviations of Mental Development Index (MDI) Scores on The Bayley Scales of Infant Development for Chronological Age at Nine Months from Mother's Expected Date of Confinement for Subjects Exposed to Six Different Stimulation Programs.

MDI Scores					
Type of	For chronological age*			For 9 months from EDC**	
Stimulation program	n	Mean	Standard Deviation	Mean	Standard Deviation
Control-control	9	82.44	20.04	104.56	28.23
Control-Stimulation	6	81.33	12.36	109.17	16.63
Sequential-control	5	73.20	16.36	92.00	21.08
Sequential-stimulation	6	74.33	15.96	87.50	16.48
Alternate-control	5	62.20	9.18	81.00	15.73
Alternate-stimulation	4	66.75	11.53	86.00	21.09
Total	35	74.86	16.18	95.14	22.31

*F = 1.52 (5,29) ; n.s.

**F = 1.62 (5,29) ; n.s.

5. Comprehensive muscle tone. The infant is rated on a continuum from flaccid scored as 0 to marked tension scored as 9. The average score for this sample, which did not differ among the groups, was 5.17.

In summary, there were no statistical differences among the groups at discharge as assessed by the Rosenblith test. The alternate group had higher scores in the area of general maturation; the sequential group, in sensory functioning and muscle tone areas.

Results on the Flint Infant Security Scale. The Flint Infant Security Scale in the standardized sample showed the greatest number of scores in secure infants between $+.33$ and $+.42$. The full-term secure infants averaged a score of $+.40$ consistently throughout the first year (Flint, 1959). The scores of this sample of pre-term infants, which did not differ significantly among the groups at any of the 5 test times, show they are not as secure as the standardized sample of full-term infants. At 3 months chronological age this sample's mean score was $.31$, at 5 and 7 months the score did increase to $.33$ but the 9 month mean score fell to $.29$ and the 19 month score fell even lower-to $.27$.

Results on The Bayley Scales of Infant Development. 1. Mental scale. The mental scale has a standardized norm of 100 and a standard deviation of 16. The average chronological age score for mental development at 9 months from the expected date of confinement (EDC), which did not differ among the groups, was approximately 75 with 2/3 of the sample scores falling between 59 and 91 (see

Table 2. Means and Standard Deviations of Mental Development Index (MDI) Scores on the Bayley Scales of Infant Development for Chronological Age at Eighteen Months from Mother's Expected Date of Confinement for Subjects Exposed to Six Different Stimulation Programs.

Type of stimulation program	MDI Scores				
	For chronological age*			for 18 months from EDC**	
	<i>n</i>	Mean	Standard Deviation	Mean	Standard Deviation
Control-control	9	87.78	15.61	98.78	15.40
Control-stimulation	6	103.67	18.04	117.33	17.96
Sequential-control	5	86.20	8.67	97.60	8.32
Sequential-stimulation	6	98.00	15.35	107.67	17.23
Alternate-control	5	98.60	12.64	109.40	16.38
Alternate-simulation	4	88.50	21.67	101.00	23.79
Total	35	93.66	15.94	106.03	17.19

*F = 1.25 (5,29) n.s.

**F = 1.25 (5,29) n.s.

Table 1). In comparison with his chronological age peer, the average subject in this sample at a chronological age of 10½ months, falls in the bottom 1/6th of his age group. By late in their first year this sample of 35 pre-term infants had not caught up with their chronological peers. However, their adjusted scores, which did not differ among the groups, averaged 95, and 2/3 of the sample's scores fell between 73 and 117. The sample is below the standardized norm of 100 but if one uses the adjusted scores, as Lubchenco (1978) recommends as the indicator for risk, the sample mean falls only 5 points below the norm.

At 18 months from their mother's date of confinement there is a higher mean mental score for chronological age for the sample than there was at 9 months. The average mental score is now 94 — an average increase of 19 points. When corrected for prematurity the average score for the group increases to 106. Neither the adjusted nor chronological scores differed among the six groups (see Table 2).

2. Motor scale. Motor development for chronological age at 9 months from EDC was better than mental development at 9 months from EDC for this sample. The average motor score for chronological age, which did not differ among the three groups, was approximately 90 with 2/3 of the sample scoring between 70 and 108 (see Table 3). In comparison with their chronological peers this pre-term sample is within a standard deviation of the norm of 100 for motor development at 9 months from their mothers' EDC. The sample's average adjusted motor score at 9 months is 110 and 2/3

Table 3. Means and Standard Deviations of Physical Development Index (PDI) Scores on The Bayley Scales of Infant Development for Chronological Age at Nine Months from Mother's Expected Date of Confinement for Subjects Exposed to Six Different Stimulation Programs.

Type of stimulation program	PDI Scores				
		for chronological age*		for 9 months from EDC**	
	<i>n</i>	Mean	Standard Deviation	Mean	Standard Deviation
Control-control	9	97.44	22.02	117.67	23.55
Control-stimulation	6	93.50	19.31	118.83	24.58
Sequential-control	5	86.80	22.23	105.00	25.09
Sequential-stimulation	6	88.83	12.54	105.50	14.53
Alternate-control	5	74.80	8.41	95.00	11.09
Alternate-stimulation	4	88.75	22.59	111.75	21.41
Total	35	89.54	18.88	110.06	21.20

*F = 1.00 (5,29) n.s.

**F = 1.07 (5,29) n.s.

of the sample's adjusted scores fell between 89 and 131. The pre-term infants in this sample are catching up faster in motor than in mental development during their first year of life.

At 19½ months after birth, motor development for this sample, which did not differ among the groups, is at 99 — i.e., virtually at the norm of 100 (see Table 4). For gestational age the motor adjusted mean score of 107 matches the mental adjusted mean score of 106. Intellectual and motor development of this sample seems not only caught up to that of their full-term counterparts at 19½ months from birth but, at this stage, their mental and motor development now appear to parallel one another.

3. The Infant Behavior Record. Sociability of these infants was judged from three perspectives — to all persons present at the test, to the strange examiner and to the infant's own mother. No significant differences were found among the groups at either 9 or 18 months. The infant was responsive some of the time to persons present at 9 months but, in general, at 18 months had continual interest in persons present. Bayley (1969), in contrast, found a decrease in responsiveness to persons at 18 months. At 9 and 18 months the infant was rated as accepting of the examiner whereas he was, not surprisingly, rated as friendly to his mother. At 18 months the three home stimulation groups consistently evidenced a higher mean score for all dimensions of sociability; the combined hospital and home experimental groups also had a similar pattern at 9 months.

Table 4. Means and Standard Deviations of Physical Development Index Scores on The Bayley Scales of Infant Development for Chronological Age at Eighteen Months from Mother's Expected Date of Confinement for Subjects Exposed to Six Different Stimulation Programs.

Type of stimulation program	PDI Scores				
	for chronological age*			For 18 months from EDC**	
	<i>n</i>	Mean	Standard Deviation	Mean	Standard Deviation
Control-control	9	95.00	19.50	103.00	18.36
Control-stimulation	6	95.00	17.64	103.17	16.14
Sequential-control	5	83.60	19.27	91.20	17.82
Sequential-stimulation	6	115.83	18.80	123.00	18.51
Alternate-control	5	108.40	13.58	115.60	14.98
Alternate-stimulation	4	97.50	12.50	106.25	12.85
Total	35	99.14	19.28	106.94	18.56

*F = 2.29 (5,29) n.s.

**F = 2.36 (5,29) n.s.

Cooperativeness, fearfulness, and happiness of the infants were considered interpersonal behaviors. At 9 and 18 months the subjects accepted the test materials and were neither cooperative nor resistant to the tester. At 9 months subjects assigned to the home stimulation program from the two hospital experimental groups consistently were more cooperative than their control counterparts. At 9 and 18 months the majority of the sample had some slight vigilance and restrained behavior in the first few minutes. However, the alternate-control group was significantly more fearful at 9 months than the other groups. This group also had the lowest Flint score at 9 months chronological age. At both 9 and 18 months all home stimulation groups were consistently less fearful than the groups assigned to the home control program. At 9 and 18 months the subject might become upset but recovered fairly easily and appeared moderately happy and contented. Again the home stimulation assigned subjects from the experimental groups were consistently happier than their control counterparts.

No significant differences among the groups were found at either 9 or 18 months in behaviors which make demands on the subject such as goal directedness, attention span, and endurance. The first two of these behaviors developed over time. At 9 months although the infants made a few attempts at a goal and attended to a toy they could be distracted; at 18 months they were fairly persistent in their efforts and had moderate attention to each new toy, person, or situation. At 9 and 18 months the subjects had adequate tolerance for

most of the test, becoming restless only towards the end. The 18 months test takes longer as more applicable items are tried. The increased time may be reflected in the small decrement in the mean score from 5.94 at 9 months to 5.23 at 18 months for the item 'endurance'. Again the home stimulation assigned subjects had consistently higher mean scores for the three behaviors considered demanding than their control counterparts.

There were no significant differences in the bodily behaviors of body tone, body movements and reactivity to stimulation at 9 months among the groups. At 18 months the alternate-stimulation group was significantly tenser than the control-control group. However, in general, tenseness decreased from 9 to 18 months, whereas bodily movements increased so that the subject was in action much of the test period at 18 months. No subject was rated as hyperactive. Reactivity to stimuli increased between 9 and 18 months so that the child was more quickly alert to changes in the test materials and situations. The three home stimulation groups were consistently more responsive to stimuli than their counterpart groups.

In general both responsiveness to objects and manipulation of objects increased with age. At 9 months the infants lost interest in the toy or material after a brief reaction. At 18 months there was a sustained interest in each test material presented. At 9 months the alternate-stimulation group scored significantly higher than the sequential control group in responsiveness to toys and test materials. The home stimulation assigned subjects from the experimental groups at both 9 and 18 months demonstrated greater responsiveness to and manipulation of toys.

No significant differences in the sensory areas of interest occurred among the groups at 9 or 18 months. At both 9 and 18 months the highest area of sensory interest displayed was looking. In general, looking, listening, vocalizing, and banging scores all increased slightly from 9 to 18 months.

A significantly-higher energy level was present in the alternate-stimulation and sequential-stimulation groups than in the control-control group at 18 months. Energy level was also rated as higher in these two groups at 9 months but did not achieve statistical significance. For their age, energy levels and coordination of sample and control groups were well within the normal range.

DISCUSSION

At the conclusion of the hospital stimulation programs all subjects were assessed for general maturation and sensory functioning. No significant differences were found among the groups. In comparison

to Rosenblith's (1975) data on general maturation in pre-term infants of comparable gestational age, this sample's scores are higher on both the motor and tactile-adaptive items and hence total maturation score. Katz (1971) and Neal (1967) used the Rosenblith test after auditory and vestibular hospital stimulation programs, respectively, for pre-term infants. They found significant differences among their experimental and control groups. The scores on the motor item for their experimental groups were 5.38 and 5.69 respectively, slightly higher than the mean of 4.69 obtained in the current sample. Only 3 of the 35 subjects in the current sample were Black whereas Neal (1967, p. 35) reported 40% of her sample as non-white; Katz (1970, p. 48) had a 60% Black sample. Bayley (1969, p. 11) reported that Black children scored significantly higher on her motor scale until 14 months of age. The composition of the current sample may account for the differences in scores.

Tactile-adaptive scores in this sample were comparable to Katz's (1970, p. 49) and Neal's (1967, p. 37) experimental groups' scores. Malloy (1975, p. 60) did not report the component parts of the maturation score but has a total mean sample score, identical to this sample. The subjects in her sample were exposed to only music or only speech, not to a combined auditory program.

Highest hearing score mean in the current example (a mean of 4.73) was again comparable to Katz's (1970, p. 40) and Neal's (1967, p. 53) experimental groups. Malloy's (1975, p. 62) total sample mean was much lower — 2.27. A possible reason for the lower hearing scores in Malloy's sample was the fact that 45% of her sample had the ototoxic drug Kanamycin administered to them for an average of 8.36 days (Chapman, 1975, p. 198).

Vision scores in this sample (a mean of 7.94) are considerably higher than in Katz's (1970, p. 40) (a mean of 6.54) and Malloy's (1975, p. 64) (a mean of 5.23). Neal's (1967) results on vision were scored differently and cannot be compared. A possible explanation is that the current sample is the latest sample and more discriminating use of oxygen has been achieved. All the current sample were checked for Retrolental Fibroplasia (RLF) prior to discharge and not one subject had evidence of RLF.

The final score on the Rosenblith relates to muscle tension. Katz (1970, p. 43) found her experimental subjects scored significantly higher than her control group on muscle tension (a mean of 5.02). Malloy's (1975, p. 66) speech group, when conceptual age at the end of stimulation was controlled, had significantly higher muscle tension than the control group (a mean of 5.24 versus 4.92). The current

sample's experimental groups have similar scores to these previous investigators' experimental groups (5.17).

All Katz's (1970) experimental group were rated as normal tension (5). In both Malloy's and the current sample approximately 85% of the controls were rated 5 whereas only 63-67% of the experimentals were rated 5. More subjects in the experimental groups in the latter studies were rated above 5 and had increased muscle tone. Rosenblith (1968, p. 324) found that neonates rated tense on their initial exam differ from those rated as normal on only one of the criteria she evaluated at 8 months — their activity level was higher. No differences in fine or gross motor or physical or mental or socio-emotional development was found.

However, "a marked discrepancy in neonatal muscle tone between the upper and lower halves of the body (with upper hypotonic) is associated with a poor prognosis for almost all eight month criteria" (Rosenblith, 1973, p. 31). The only two subjects in the current sample who had a marked discrepancy between upper and lower halves of the body and who were rated as mixed were in the hospital control group.

The post-discharge psychosocial evaluation of the sample as demonstrated on the Flint Infant Security Scale raises concerns. Security of these infants (who have spent an average of over 4 weeks in hospital after birth) is lower than full-term infants at 3 months. At 5 and 7 months security begins to increase up to the full-term scores but after the child has gone through the period of "making strange" at 9 months his/her scores fall and are still low in the second year. The emotional dimension of these pre-term infants needs further study.

Mental and motor development at 9 and 18 months of age as assessed on The Bayley Scales of Infant Development did not differ significantly among the 6 groups. The control group had the highest mental and motor scores at 9 months from their mother's expected date of confinement. Sixty percent of the parents of the hospital control subjects were in professions, whereas only 27 and 22 percent, respectively, of the hospital sequential and alternate groups' parents were of this socioeconomic level. Previous research has shown that the social class of parents is a good predictor of subsequent I.Q. and that lower class premature infants have a greater chance of mental subnormality than upper class premature infants (Hindley, 1971, p. 475; Birch and others, 1970, pp. 140-141). Since assignment to groups is at random this problem of non-comparability of social class among groups should resolve as the sample size becomes larger.

The control-control group was the only group whose corrected age mental score decreased between 9 and 18 months. Hunt and Rhodes' (1977, p. 208) sample who had no planned program (like this study's control-control group) also had lower corrected mental scores at 24 than at 12 months. In Ryan's (1976) sample of disadvantaged toddlers both control and experimental quotients declined after 12 months of age. His experimental group had a home stimulation program but it did not commence until after 6 months of age. Perhaps 6 months of age is too late to begin home stimulation programs for infants known to be at risk either developmentally and/or socioeconomically.

Other than the control group, the corrected age mental scores for this sample are higher at 18 months than they were at 9 months. On the other hand, for 4 of the 6 groups corrected motor scores were lower at 18 months than at 9 months. The sample's average chronological age motor score did rise between 9 and 18 months so perhaps there is over-correction in the adjusted scores at 9 months.

The findings on the Infant Behavior Record at 9 and 18 months from the subjects' mothers' expected date of confinement were compared with the modal values of the standardization sample on each item at 10 and 18 chronological months (Bayley, 1969, pp. 156-7 and 162-3).

At 9 months the sample's scores in responsiveness to mother, activity level, and looking and listening were comparable to the standardization sample of full-term infants. This sample of premature infants, on average, had a higher level of tension and fear. One could postulate the observed difference is related to some long-term effect of the initial mother-infant separation. The premature sample were rated as more cooperative at both 9 and 18 months than their full-term counterparts were. Demanding behaviors were scored lower than for the full-term sample as were social responsiveness to persons, production of sounds and alertness to stimuli. One might ask whether these infants are more comfortable as passive acceptors than as initiators of interaction.

At 18 months, they were still banging, liked toys more and were both more active and more responsive to persons than their full-term counterparts.

The only statistically-significant findings to date on The Bayley Scales of Infant Development are on the Infant Behavior Record. One group, the alternate-control, was more fearful at 9 months than the other groups. However, in the standardization sample 1/5 of the eight-month-olds had similar scores and this finding may be due to the small N in this group.

Another group, the alternate group with the home stimulation program, was the most interested in toys at 9 months; at 18 months they were rated as more energetic and tenser than other subjects in the sample. One could ask whether this group of behaviours might reflect the concept of motivation.

It is interesting to note that the mean scores of the hospital experimental groups assigned to a home stimulation program are usually higher than their counterparts assigned to the home control program. Conversely, although there are a few items where the control hospital group assigned to a home stimulation program have higher mean scores than the control-control group the same consistent pattern is not seen.

Do in-hospital interventions create a potential for a pre-term infant to better utilize the opportunities offered in a home stimulation program? The home stimulation program stopped 9 months prior to the 18 month developmental assessment. Yet, subjects started on an intervention program in hospital which continued until 9 months from their mothers' expected date of confinement still had higher mean scores on many of the items on The Infant Behavior Record than the other hospital control and/or home control group subjects 9 months after discontinuation of the combined hospital and home stimulation program.

The Ypsilanti Perry Preschool Project showed that the group receiving a preschool program, after its discontinuation, had I.Q. scores again equivalent to the control group (Weikart, 1977, pp. 1-8). However, throughout the first 8 years of school their academic achievement became increasingly greater than the controls, that is, with the same level of I.Q. they succeeded better in the real world. Similarly, Skeels (1966) reported, in a group of 13 adults who had had interventions as children a quarter of a century earlier, profound improvements over their controls in life achievement in terms of employment status and lifetime earnings.

SUMMARY

In summary a preliminary look has been taken at the sample's pre-hospital discharge status, as measured by the Rosenblith Scale; the security level of the pre-term infant during the first and second year of development, as measured on The Flint Infant Security Scale; and The Bayley Scales of Infant Development have been used to assess, at both 9 and 18 months from their mother's expected date of confinement the sample's mental, motor, and behavioral development.

The first specific question this research sought to answer was "when, if ever, do pre-term infants catch up?" (Hunt and Rhodes, 1977).

At hospital discharge the general maturation of these pre-term infants is, not surprisingly, weak on the motor dimension but adequate for protective movements in response to interference with their airway. Sensory functioning is excellent with high scores in both hearing and visual modalities.

The security level of the pre-term infant as measured in this study is low throughout the first year compared to that of their full-term peers. Moreover, the one assessment of this sample's level of security during the second year shows a further decline in their self-trust and other trust.

At 9 months from their mothers' date of expected confinement these pre-term infants are not caught up to their chronological peers in mental or motor development; they are catching up faster in motor than mental development at that age. Socially these 9 months infants had a higher level of tension and fear than their full-term counterparts.

At 18 months from their mother's expected date of confinement this sample had caught up in both mental and motor development, moreover the development in both areas was now parallel, with the mental no longer behind the motor. Their behaviors at this time reflected increased sociability although in some emotional areas they still scored lower than the full-term sample.

The second question this research attempted to answer was "Do planned stimulation programs influence the long-term development of pre-term infants?"

The answer is tentative at best, but to date the indication is that the effect is on a motivational dimension of behavior; the hospital experimental groups seemed able to capitalize better on the opportunities afforded them in a home stimulation program than either those who had only the hospital program or those who had a home stimulation program without a hospital stimulation program. Moreover, the effect on behavior had not faded 9 months after discontinuation of the program for the groups who had a combined hospital and home stimulation program for the first 10 months of life. Whether or not these tentative answers will change has yet to be discovered.

REFERENCES

- Barnard, K. The effect of stimulation on the sleep behavior of the premature infant. *Communicating Nursing Research*, 1973, 6, 12-33.
- Bayley, N. *Manual for the Bayley Scales of infant development*. New York: Psychological Corporation, 1969.

- Birch, H. C., S. A. Richardson, D. Baird, G. Horobin, and R. Illsely. *Mental subnormally in the community: A clinical and epidemiology study*. Baltimore: Wilkins & Wilkins, 1970.
- Brackbill, Y. Cumulative effects of continuous stimulation on arousal levels in infants. *Child Development*, 1971, 42, 17-26.
- Chapman, J. S. The relation between auditory stimulation of short gestation infants and their gross motor limb activity (Doctoral dissertations, New York University, 1975). *Dissertation Abstracts International*, 1975, 36, 1654B-1655B (University Microfilms No. 75-21, 138.)
- . The relationship between auditory stimulation and gross motor activity of short gestation infants. *Research in Nursing and Health*, 1978, 1, 29-36.
- . Influence of varied stimuli on development of motor patterns in the premature infant. In L. Runnerstrom (Chair), *Newborn behavioral organization. Nursing research and implication*. First Annual March of Dimes Perinatal Nursing Research Round Table. Chicago, November 8-9, 1976.
- Chase, H. C. A study of risks, medical care, and infant mortality. *American Journal of Public Health*, 1973, 63, 1-56 (Supplement).
- Clarke, A. D. B. Presidential address. In P. Mittler (Ed.) *Research to practice in mental retardation: Care and intervention*. (Vol. 1) Baltimore: University Park Press, 1977, A7-A19.
- Dancis, J. A. grid for recording the weight of premature infants. *The Journal of Pediatrics*, 33, 1948, 570-72.
- Dargassies, S. Long-term neurological follow-up study of 286 truly premature infants. *Development Medicine and Child Neurology*, 19, 1977, 462-78.
- Fiske, D. W., and Maddi, S. A conceptual framework. In D. W. Fiske and S. Maddi (Eds.) *Functions of varied experience*. Homewood, Ill.: Dorsey Press 1961, pp. 11-56.
- Fitzhardinge, P. and Campbell, D. High risk infants. In Ontario Ministry of Health, *Proceedings health research Ontario*. Toronto: Ministry of Health, 1977, pp. 125-130.
- Flint, B. M. *The security of infants*. Toronto: University of Toronto Press, 1959.
- . *The Flint infant security scale manual*. Toronto: University of Toronto Press, 1974.
- Giles, H. R. Perinatology — an historical perspective. Paper presented at the 3rd Annual March of Dimes Perinatal Nursing Conference. Chicago, Illinois, 1978.
- Graham, F. K. Behavioral differences between normal and traumatized newborn. *Psychological Monographs; General and Applied*, 70, 1956, (Nos. 20, 21).
- Hardy, J. B., A. Dougherty, and W. G. Hardy. Hearing responses and audiologic screening in infants. *Journal of Pediatrics*, 1959, 55, 382-90.
- Hasselmeyer, E. C. Behavior patterns of premature infants: a study of the relationship between a specific nursing procedure and general well-being of the prematurely born infant (U.S. Department of Health, Education and Welfare Publication No. 840). Washington, D.C.: U.S. Government Printing Office, 1961.
- . Handling and premature infant behavior: an experimental study of the relationship between handling and selected physiological, pathological, and behavioral indices related to body functioning among a group of prematurely born infants who weighed between 1501 and 2000 grams at birth and were between the ages of seven and 28 days of life (Doctoral dissertation, New York University, 1963) *Dissertation Abstracts*, 1964, 24B, 2874B-2875B (University Microfilms No. 64-257).
- Hindley, C. B. Testing of infant development and prediction of 11 years I.Q. in normal children. *Proceedings of the Royal Society of Medicine*, 64, 1971, p. 475.
- Hunt, J. V., and Rhodes, L. Mental development of pre-term infants during the first year. *Child Development*, 1977, 48, 204-210.
- Katz, V. Auditory stimulation and developmental behavior of the premature infant. *Nursing Research*, 1971, 20, 196-201.

- . The relationship between auditory stimulation and the developmental behavior of the premature infant. (Doctoral dissertation, New York University, 1970). *Dissertation Abstracts International*, 1971, 31B, 4156B-4175B (University Microfilms No. 70-26463).
- Lubchenko, L. O. Long-term outcome of the SGA Infant. Paper presented at the 3rd Annual March of Dimes Perinatal Nursing Conference, Chicago, Illinois, 1978.
- , M. Delivoria-Papadopoulos, and D. Searls. Long-term follow-up studies of prematurely born infants. II. Influence of birth weight and gestational age on sequellae. *The Journal of Pediatrics*, 1972, 80, 509-12.
- Malloy, G. The relationship between maternal and musical auditory stimulation and the developmental behavior of premature infants (Doctoral dissertation, New York University, 1975) *Dissertation Abstracts International*, 1975, 36B, 1656B (University Microfilms No. 75-21, 155).
- Molfese, D. L. Infant cerebral asymmetry, pp. 22-25 in S. Segalowitz and F. Gruber, Ed., *Language, development and neurological theory*. New York: Academic Press, 1977.
- Morruzzi, C., and Magoun, H. W. Brain-stem reticular formation and activation of the EEG. *Electroencephography and Clinical Neurophysiology*, 1949, 1, 455-473.
- Neal, M. V. The relationship between regimen of vestibular stimulation and the developmental behavior of the premature infant (Doctoral dissertation, New York University, 1967). *Dissertation Abstracts International*, 1970, 30, 4151A (University Microfilms No. 70-7342).
- Ramsden, N. Professional standards in infant stimulation services: a provincial overview In *AMMD Professional Standards in the Delivery of Services to the Mentally Retarded: Proceedings of the 1st Annual Congress of the American Association on Mental Deficiency*, 1977, pp. 46-48. Toronto: Ministry of Community and Social Services.
- Rogers, M. E. *An introduction to the theoretical basis of nursing*. Philadelphia: F. A. Davis, 1970.
- Rosenblith, J. F. The modified Graham behavior test for neonates; test-retest reliability, normative data, and hypotheses for future work. *Biologia Neonatorum*, 3, 1961, 174-92.
- . Prognostic significance of discrepancies in muscle tension between upper and lower limbs. *Developmental Medicine and Child Neurology*, 1968, 10, 322-330.
- . Personal Communication, 1975.
- Ross, L. E. and L. A. Leavitt. Process research: Its use in prevention and intervention with high risk children. In T. D. Tjossem (Ed.) *Intervention strategies for high risk infants and young children*. Baltimore: University Park Press, 1976, pp. 107-177.
- Rothschild, B. F. Incubator isolation as a possible contributing factor to the high incidence of emotional disturbance among prematurely born persons. *The Journal of Genetic Psychology*, 1967, 110, 287-304.
- Ryan, T. Promoting child development through a program of home visiting. *Canadian Journal of Behavioural Science*, 1976, 8, 102-105.
- Scarr-Salapatek, S. and M. L. Williams. A stimulation program for low birth weight infants. *American Journal of Public Health*, 1972, 62, 662-667.
- Segall, M. Relationship between auditory stimulation and heart rate response of the premature infant. *Nursing Research Conference*, 1971, 7, 119-129, (ANA Publication).
- Segalowitz, S. J. and Chapman, J. S. Cerebral asymmetry for speech in neonates. *Brain and Language*, 1978 (In press).
- Skeels, H. M. Adult status of children with contrasting early life experiences: A follow-up study. *Monographs of the Society for Research in Child Development*, 32, 1966, 2.
- Sokolov, E. N. *Perception and the conditioned reflex*. New York: Macmillan, 1963.
- Treece, E. E. and J. W. Treece. *Elements of research in nursing*. St. Louis: C. V. Mosby, 1973.
- Wachs, T. D. and P. Cucinotta. The effects of enriched neonatal experiences upon later cognitive functioning. *Developmental Psychology*, 5, 1977, 542-49.

- Weikart, D. P. Research report — can preschool education make a lasting difference? Results of follow-up through eighth grade for the Ypsilanti Perry Preschool Project. *Bulletin of the High/Scope Foundation*, 4, 1977, 1-8.
- Williams, M. L. and S. Scarr. Effects of short term intervention on performance in low-birth weight, disadvantaged children. *Pediatrics*, 47, 1971, 289-98.
- Wittenberg, C. Infant stimulation as part of well baby care in a disadvantaged area. *Mental Health Program Reports* — 5, Department of Health, Education and Welfare Publications, No. HSM 72-9042 — Rockville, Maryland: National Institute of Mental Health, 1971, 257-71.
- Wolff, P. H. The causes, controls, and organization of behaviour in the neonate. *Psychological Issues*, 1966, 5, 1-93 (Monograph).

Les effets de la baisse de mortalité chez les prématurés sur leurs risques futurs de morbidité: Etude préliminaire des résultats à long terme de programmes de stimulation pour les prématurés

Le prématuré présente des risques à la fois de mortalité et de morbidité. Ses contorsions contribuent à la perte de poids et son environnement extra-utérin ne contient pas les stimuli structurés afférents, à modalités multiples, qui frappent le cerveau en développement dans l'utérus. Le son est la modalité la plus efficace en ce qui a trait à une baisse de la motilité accompagnée d'un accroissement de l'activité corticale. Nous avons prévu que des sujets exposés à des sons structurés pendant 5 à 10 minutes, au milieu de leur période d'alimentation, devraient, lorsque nés à 37 semaines, faire preuve d'un degré de développement plus élevé à la sortie de l'hôpital; si, de plus, les sujets étaient soumis à un programme de stimulation à domicile, leur développement ultérieur devrait également présenter une certaine amélioration. L'échantillon cible se compose de 216 sujets; ce rapport ne traite que des résultats préliminaires portant sur les 35 premiers sujets. Les sujets d'expérience ont été divisés en trois groupes distincts, sur la base d'une affectation stratifiée effectuée au hasard. Dans le premier groupe, les prématurés ont été soumis à un programme dit "d'audition séquentielle" au cours duquel on leur a fait entendre la Berceuse de Brahms durant la première moitié de leur hospitalisation, pour y substituer un enregistrement de la voix de leur mère pendant la seconde moitié; dans le second groupe, les prématurés ont suivi un programme dit "alternatif", lors duquel ils entendaient, successivement et durant le même nombre de minutes, la Berceuse de Brahms et la voix de leur mère, au milieu de chacune de leurs périodes d'alimentation. Le troisième groupe a servi d'échantillon témoin. Les premières constatations semblent indiquer qu'un programme combiné — stimulation à l'hôpital/stimulation à domicile — offre de meilleurs résultats qu'un seul de ces deux processus ou qu'aucun processus de stimulation.