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EFFECTS OF HANDLING ON THE SUBSEQUENT DEVELOPMENTS OF PREMATURE INFANTS[1]

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The immediate and subsequent effects of handling on the behavioral and physical development of 10 low birth weight infants were studied. The 5 experimental infants were stroked in their isolettes 5 minutes every hour of the day, for 10 days, while the 5 controls were provided with routine nursery care. The handled infants were more active, regained initial birth weights faster and were described as physically healthier in terms of growth and motor development than the controls. Home ratings of intensity and variety of stimulation were also higher for the handled infants at between 7 and 8 months of age.

A variety of anomolies has been found to be associated with low birth weight or prematurity. Among the sequelae enumerated have been such deficiencies as intellectual impariment, even at ages ranging into adolescence (Harper, Fischer, & Rider, 1959; Wiener, Rider, Oppel, & Harper, 1968), slow learning (Harmeling & Jones, 1968), lack of concentration (Drillien, 1961), confusion, hyperactivity and disorganization (Rogers, Lilienfeld, & Pasamanick, 1955), linguistic immaturity, especially as reflected in oral language and lack of reading readiness (DeHirsch, Jansky, & Langford, 1964), visual disorders (Dann, Levine, & New, 1958, 1964), motor retardation (DeHirsch, Jansky, & Langford, 1966; Rabinovitch, Bibace, & Caplan, 1961), and neurological abnormalities (Knobloch & Pasamanick, 1966).

Most investigators have emphasized neurological defect or minimal brain damage as explanatory hypotheses for these undesirable sequelae and have suggested numerous environmental factors presumed to underlie both the prematurity and associated neurological involvement.

One factor insufficiently considered in previous research has been the possible role of sensory deprivation in producing some of the impairments associated with low birth weight. There are considerable clinical and experimental animal data to suggest that a dearth of early environmental stimulation may deleteriously and irreversibly affect a wide range of behaviors (Denenberg, 1959; Levine, 1957; Levine & Otis, 1958; Spitz, 1945, 1946). In view of the nature of the immediate postuterine environment of the premature infant, it therefore becomes reasonable to explore the possible adverse effects of life in the well-controlled, monotonous environment of an isolette where the infant receives minimal emotional, sensory, or tactual stimulation for several weeks. Specifically, the problem posed by the present research is: What are the immediate and subsequent effects of one form of stimulation, handling, on the behavioral and physical development of premature infants?

In one of two studies on early stimulation of premature infants, Hasselmeyer (1964) found that infants who received increased sensory, tactile, and kinesthetic stimulation were made significantly more quiescent, especially before feeding; while a low-handled group exhibited more crying behavior before feedings. There were no significant differences between the groups in morbidity, weight gain, number of defecations, or in response to an interruption of the feeding process. In the second study, Freedman, Boverman, and Freedman (1966) found that

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among five co-twin control cases, the rocked twin (rocked twice daily for 30 minutes 7–10 days after an upward weight trend was established) gained weight at a greater rate per day than did the control twin in every instance, although the advantage of the rocked group was only a temporary one.

Method

Subjects

The subjects in the present study were to consist of 20 white premature infants, 10 boys and 10 girls, with birth weights between 1,190 (2 pounds 8 ounces) and 1,590 grams (3 pounds 8 ounces). However, because of a variety of personnel problems and an unexpected reduction in the number of premature births in the Buffalo area, the sample for this pilot study was reduced to a total of 10 infants, 4 boys and 1 girl in the experimental group, with the same number and sex distribution in the control group. The mean birth weight for the experimental group was 3.00 pounds and for the control group, 3.02 pounds.

Procedure

Within 12 hours after delivery, each infant was examined by a physician and those ascertained to be functioning within "normal" limits were randomly assigned to either an experimental or control group. The subjects in the control group were treated in the manner customarily employed in the care of premature infants at the nursery. Handling of these infants took place at 3-hour intervals in association with the feeding process, and was mainly confined to rubbing the infant's back until a burp had been produced. Aside from handling associated with diaper change, stimulation produced by spontaneous movements, and the usual environmental stimuli in the nursery, these infants experienced no additional stimulation for a period of 10 days.

In addition to the stimulation received by the control subjects, each infant in the experimental group was handled in his isolette 5 minutes each hour, for 24 hours, for a period of 10 days. Handling was accomplished in the following way: As close as possible to the beginning of each hour, and while awake, the infant's neck, back, and arms were gently rubbed by a nurse or aide. Although it was impossible to ensure equal handling pressures, a fair degree of similarity was achieved through training. After the 10-day experimental period, and until discharge from the nursery, the experimental infants were treated in the same manner as were the controls.

Dependent Variables

Activity. To provide continuous activity recording, each infant rested on a stabilimeter (Lipsitt & DeLucia, 1960) which was placed in his isolette. During each of the 10 experimental days, polygraph readings, from a Honeywell recorder, were taken at the following times: (*a*) every 4 hours, (*b*) 5 minutes before each feeding, (*c*) 5 minutes after each feeding, (*d*) 5 minutes after handling, and (*e*) during three crying periods.

Weight. From the time of delivery until leaving the nursery, each infant was weighed once a day, at about the same time.

Temperature. Six times each day, for the 10-day experimental period, each infant's axillary temperature was taken for 1 minute.

Startle responses. Once a day, the magnitude of the startle response to a constant, sudden noise was recorded on the stabilimeter.

Crying. Six 10-minute observations by two independent observers (Sophomore medical students) were made of the intensity of crying and vigor of accompanying bodily movements.

Frequency of urination and defecation. The infants' diapers were loosely attached so that hourly checks could be made as to whether the infant urinated or defecated.

Physical development. After a period of time varying from 6 to 9 months, each infant was examined by the same pediatrician who knew nothing of the nature of the experiment.

Results

Immediate Effects of Handling

Because of the small size of the sample no formal statistical procedures were applied to the data, and all findings must, therefore, be considered tentative.

Two measures seemed to be affected by the experimental conditions: The handled infants were more active and they regained their initial birth weights faster than did the control infants. The control group regained its birth weight in 15.4 days while for the experimental group it was 10.8 days. However, by the time the infants were 6 weeks old, the initial advantage of the experimental group was lost. There was also some indication that the experimental infants cried less than did the controls.

In relation to the finding on activity, it was interesting to note some of the nurses' observations. They seemed to feel that after several handling experiences, the infants began to act as though they anticipated additional handling. They based this conclusion on the observation that the infants gradually became more active immediately prior to each subsequent stimulation period. The possibility of temporal conditioning having oc-

curred will have to be studied under more carefully controlled conditions with an additional sample of infants.

Follow-Up Effects

Somewhere between 7 and 8 months after the infants were discharged from the premature nursery, the Bayley Test of Mental and Motor Development (Bayley, 1965) and a complete physical examination were administered to each infant by a pediatrician who was unaware of the nature of the study. In addition, a home visit to obtain a history of the child's physical and behavioral progress and to assess the home environment was made by a second-year medical student who was also in the dark as to the experimental or control status of a given infant.

Generally, the handled infants fared better than their nonhandled controls. All of the handled babies were described as active and physically healthy. Of the five nonhandled infants, three were rated as more than two standard deviations below the growth mean for their age and one was at the lower limit of normal. Two of these four children were also rated as suspicious for cerebral palsy. Thus, only one child in the nonhandled group was considered to be developing normally.

Whereas only one of the handled babies showed poor gross and fine motor development, four of the nonhandled infants were below the mean for their age in motor development.

Assessments of the home environment were made in a rather subjective fashion and consisted of interviews with the mother and observations of certain physical arrangements in the home. In general, the homes of the handled infants were found to offer the child more stimulation (e.g., more toys, greater mother-infant interaction, etc.) than was the case in the homes of the nonhandled babies. It is tantalizing to speculate whether the handling procedures may have more positively affected the infants' behavior, thereby resulting in a more positive attitude on the part of the mother toward her infant.

Discussion

In contrast to the opinions of some pediatricians and nurses, there were no deleterious effects of the handling procedures on any of the infants.

On the basis of these pilot data, suggestive differences do appear between handled and nonhandled prematures in respect to both activity level and the speed with which initial birth weight is regained.

In view of the small size of the present sample, some of the differences reported may be due entirely to chance. For example, the two infants diagnosed as suspicious for cerebral palsy may have unfavorably biased the results for the nonhandled group. It is therefore imperative that subsequent studies of this nature very carefully match control and experimental infants.

In subsequent research, the present study will be replicated, differences in conditionability as a function of handling will be studied, and the behavioral effects of other types of early stimulation, for example, visual, auditory, will be evaluated.

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Editor's note: This article by Solkoff, Yaffe, Weintraub, and Blase has been published with its small *N* and absence of conventional statistical treatment of data because of its important implications for the health and later welfare of prematurely born infants. Additionally, it is very relevant to the growing theory and literature about early organism stimulation. The authors clearly recognize and frankly state its deficiencies as a finished piece of research, but join the Editor in believing that it is useful to publish it at this time.