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The Effects of Environmentally Induced Influences on the Neurologial Maturation and Weight Gain of Premature Infants

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Abstract

THE EFFECTS OF ENVIRONMENTALLY INDUCED INFLUENCES ON THE NEUROLOGICAL MATURATION AND WEIGHT GAIN OF PREMATURE INFANTS

by Valerie Eastman

Premature birth deprives the infant of the influences of maternal uterine stimulation on his physical growth and neurological development. It also deprives the newborn of the influences of the maternal sleep cycle and other aspects of maternal cyclicity. This problem has been recognized and studied for at least two decades by physiologists and neonatologists, but very few studies have been done on manipulating the premature infant's environment in order to foster cyclic patterns such as sleep.

It had been observed by this investigator that premature infants in a neonatal intensive care unit are often disturbed from quiet sleep so that the nurse may administer the required care. The purpose of this study was to determine the effect of increased quiet sleep time in the premature infant on his neurological maturation and weight gain. Quiet sleep time in this study was increased in the infants in the experimental group by planning nursing care around their quiet sleep time. The problem which was investigated was whether infants who received experimental care to promote quiet sleep would have a significant increase in neurological maturation and weight gain when compared to the control group. Stated as a directional hypothesis, the experimental group would have a significantly larger ($p=0.05$) increase in neurological maturation and weight gain than the control group.

This study used the experimental method of research. The independent variable, patterning of nursing care around the infant's quiet sleep in order to promote quiet sleep, was performed on half of the patients studied. The sample was a purposive convenience sample of 22 patients. All infants were between the gestational and conceptual ages of 31-36 weeks and were considered to be "stable" infants. Neurological examinations, consisting of segments of the Brazelton and the Amiel-Tison examinations, and weight measurements were performed on all subjects on the day of entry into the study and on the day of dismissal from the study. Infants were studied one, two, or three weeks, depending on time of discharge. Covariates that also were examined were: a history of septicemia, age of entry into the study, and initial weight of the infants.

Chi-square and t-tests were used along with measures of central tendency, such as the mean and standard deviation, to analyze the data.

The result of the neurological examination segment analysis was that there was no statistical significance (p=0.05) in the neurological maturation of the experimental infants when compared to the control infants. However, there were trends (p=0.10) in some segments of the examination and there was an overall trend of increased neurological maturation in the experimental group.

Weight demonstrated no significant (p=0.05) change between the two groups, although the weight gain of the experimental group was slightly larger than that of the control group.

In regards to the covariates, there was no statistical difference (p=0.05) between the two groups in the incidence of septicemia, conceptual age of the infant at time of entry into the study, and the initial weight.

Based on the data analysis, the directional hypothesis must be rejected. However, it is important to note that statistical trends ($p=0.10$) were evident in some segments of the neurological examination and that other segments as well as the weight gain demonstrated trends in the direction of the hypothesis.

LOMA LINDA UNIVERSITY

Graduate School

THE EFFECTS OF ENVIRONMENTALLY INDUCED INFLUENCES ON THE NEUROLOGICAL MATURATION AND WEIGHT GAIN OF PREMATURE INFANTS

by

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Each person whose signature appears below certifies that this thesis in his/her opinion is adequate, in scope and quality, as a thesis for the degree Master of Science.

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CHAPTER 1

INTRODUCTION

Premature birth deprives the infant of the influences of maternal uterine stimulation on his physical growth and neurological development. It also deprives the newborn of the influences of the maternal sleep cycle and other aspects of maternal cyclicity (Sterman and Hoppenbrouwers, 1971). This problem has been recognized and studied for at least two decades by physiologists and neonatologists but very few studies have been done on manipulating the premature infant's environment in order to foster cyclic patterns such as sleep. An attempt has been made here to explore a method of controlling environmental influences on the premature infant so that his sleep cycle may be enhanced thereby fostering optimal neurological maturation and physical growth.

BACKGROUND AND NEED FOR STUDY

It has been observed by this investigator that premature infants in a neonatal intensive care unit (NICU) are often disturbed from quiet sleep so that the nurse may administer the required care. During 24-hour observations on three consecutive days by three NICU bedside nurses, nine infants in the study population of this study were observed. It was found that the infants received an average of 17 disturbances per day during their quiet sleep. The question arises as to whether quiet sleep of the premature is important enough for the nurse to be concerned with it. If quiet sleep is significant, what action by the nurse should be taken to promote the quiet sleep of the premature? Through review of other research we hope to discover information that indicates whether further study needs to be done in this area.

The Organization of Sleep States in the Adult

Before beginning the investigation of the infant's sleep states, it is necessary to understand aspects of the adult's sleep pattern since there has been a greater amount of research done on adult sleep states than infant sleep states. In adults, normal sleep consists of cycles approximating 90 minutes. Within the cycles are various phases of sleep. With the use of an electroencephalogram (EEG) and by direct observation of the heart rate, respiratory rate, and muscular movement, researchers have been able to record five distinct stages of sleep. They are called stages I, II, III, IV, and Rapid Eye Movement (REM) sleep. The following stages have been described by Grant and Klell (1974).

Stage I. When a person is awake, his brain shows very irregular patterns on the EEG. As he relaxes, his respirations grow regular, his pulse is even, he has aimless thoughts and has the feeling of "drifting." Stage I reflects this relaxation. During this stage, a person may have myoclonic jerks and is easily awakened. Alpha waves appear on the EEG.

Stage II. The person is a little harder to awaken and he begins to have fragments of dreams. His eyes slowly roll from side to side. His EEG shows spindles.

Stage III. A person enters this stage about 20 minutes after falling asleep. In this phase he is very relaxed, his temperature starts to fall, and his blood pressure goes down. His EEG reveals large, slow waves.

Stage IV. When a person enters this stage delta waves appear on the EEG. This usually takes place about 15 to 30 minutes after falling asleep and is sometimes referred to as "quiet sleep." During the 10 to 20 minutes a person is in Stage IV he is hard to awaken.

REM sleep. When a person has completed Stage IV, he slowly starts retracing stages until he reaches Stage II again. Then instead of entering Stage I, he enters REM sleep. Suddenly the eyes begin moving rapidly from side to side, and the breathing and pulse rate become irregular. Temperature within the brain arises. The person has a wide fluctuation in blood pressure, resembling the effects of fright. This is also the stage in which most dreams occur. The EEG resembles that of a person who is awake but is in deep concentration. REM sleep is a time of autonomic excitement, hormone release, and metabolic acceleration. After the initial REM sleep, the sleeper slowly descends through all the stages to Stage IV again. These cycles of going down to Stage IV and back up to REM happen four to five times a night, about every 90 minutes. Toward the end of the night REM sleep dominates the patterns of sleep. Finally, in the morning the sleeper ascends past REM to Stage I and awakens. In the normal course of events, he should feel refreshed and ready to start the day. At this point, it is important to note that a person normally awakens from an "active" stage of sleep. This has implications as to identifying the best time to interrupt a patient from his sleep. Also, it should be noted that the premature infant only has two identifiable stages of sleep (which will be discussed in further detail later in this report). The first stage is termed "active sleep" and probably would parallel Stage I, II, and REM adult sleep. The second stage of sleep in the premature is termed "quiet sleep" and would parallel Stage III and IV of adult sleep.

Some Dynamic Aspects of Sleep in the Premature Infant

In a study done approximately thirty years ago, Gesell and Amatruda (1947) noticed that in early prematurity body mobility may be present in sleep, whereas it may be absent during wakefulness. Since that time, systematic observations have been made on the wakefulness and sleep patterns of the premature.

Parmelee and his associates (1967) have enriched our knowledge and understanding of the development of sleep. In a study done on prematures and full-term infants, Parmelee reported that it was possible to determine the state of sleep of a premature by the use of an EEG and by observation of the infant's movements, heart rate, and respiratory rate. Furthermore, active sleep was poorly characterized before 35 weeks gestational age. Hence, organization of sleep is dynamic and progressive.

Drefus-Brisac (1970) and others have concurred that sleep development is dynamic and that there are identifiable aspects of both quiet sleep and active sleep in the premature infant. One speculation drawn from Drefus-Brisac's (1970) study was that the organization of the sleep cycle and the behavior of the premature possibly was a result of environmental conditions.

The Value of Quiet Sleep and Organized Sleep Patterns

Monod and Garma (1971) studied infants in active and quiet sleep from 30 weeks gestational age. Responsivity to an auditory click was found to be higher in active sleep than in quiet sleep, whatever the gestational age. Since responsivity reflects conscious state, this study suggested that active sleep was lighter than quiet sleep. If the infant is more responsive during active sleep, then he will be more receptive at that time to interference.

This same concept was demonstrated by Anders and Roffwarg (1969) in a study done on full-term infants. They, too, found that quiet sleep seemed to be held to more tenaciously than active sleep. This was demonstrated by the use of a controlled auditory noise to waken the infant. The infant in active sleep was found to respond more quickly to the noise than did the infant in quiet sleep.

In addition, quiet sleep is the most physiologically stable sleep state. The heart rate and respiratory rate are decreased; therefore, the oxygen consumption is reduced. Also, quiet sleep is thought to be a period for increased production of the growth hormone (Shaywitz, and Others, 1971).

It has been demonstrated by Parmelee and his associates (1968) and Wantabe and his associates (1974) that the gestational age of an infant can be identified by his EEG tracings. The tracings appeared to change as the infant's neurological behavior pattern matured. The EEG pattern also seemed to be more synchronized during quiet sleep than during active sleep or when awake.

The synchronization of the EEG that occurred during quiet sleep was investigated also by Jouvet (1967), Kales (1969), and by Paul and Dittrichova (1974). All were in agreement that quiet sleep time increased with the infant's increase in neurological development and control. Whether the increase in neurological maturation affected the quiet sleep duration or vice versa was not discussed.

Drefus-Brisac (1970) stated that quiet sleep increased with the age of the infant and therefore thought it increased as the infant matured neurologically. He also noted that the ability of the infant to maintain a quiet sleep epoch should demonstrate later ability to sustain visual attention since the two processes are controlled by the same area of the brain. Since the ability to sustain visual attention is extremely important for learning to take place, the inability of the infant to maintain a quiet sleep epoch may indicate future learning problems.

The long-term effects of premature extrauterine life on the sleep pattern development of the infant have been studied by Drillien (1967). She reported that 25 per cent of the premature population she followed had sleep disturbances through two years of age. The established disorganization in the premature's sleep-wakefulness pattern again raises the issue of how this inability to organize and control behavior normally contributes to the significant incidence of learning and emotional problems manifested in the school-age population of children with a history of premature birth and low birth weight. The question was raised whether early intervention to promote a cyclic sleep pattern in the premature could reduce the long-term disturbance observed in these children.

Finally, Lacey and his associates (1975) demonstrated that during the refeeding of 10 adult patients with anorexia nervosa, slow wave sleep (quiet sleep) decreased during the final stage of restoration of weight gain back to matched population mean levels. Although Lacey's study was not done with premature infants, there may be implications for the understanding of sleep states and their relation to physical growth measured in weight gain.

Patterning of Nursing Care to Promote Quiet Sleep

In order to promote the full potential of development of quiet sleep and cyclic sleep patterns in the premature infant, a method of controlling the environment must be established. It is the nurse's responsibility to control the patient's environment to promote the full potential for restoration to wholeness (Lewis, 1970). Some methods of introducing stimulation to the premature in order to promote quiet sleep have been tried (such as a waterbed, rocker box, heartbeat recording, etc.).

Dlin and his associates (1971) observed that many nurses in the adult intensive care unit (ICU) placed higher priority on carrying out their nursing care than on the patient's need for sleep. Drefus-Brisac (1974) recognized this problem specifically in the care of the premature infant and raised the question, "When is the best time to handle the premature?" (Drefus-Brisac, 1974, p. 131) Because of the benefits of quiet sleep in the development of the premature, it seems important that the infant not be handled unnecessarily but be allowed to sleep. Patterning nursing care around this sleep state whenever possible may be seen as a way of promoting quiet sleep time. With the cooperation and participation of the NICU's nursing staff in this study, it was hoped that quiet sleep would be promoted and that increased neurological development and weight gain of the premature infant would result.

THEORETICAL APPROACH

In developing a scheme to promote neurological growth and weight gain by increasing quiet sleep time, it was necessary to understand the theoretical basis concerning their occurrence and their relationship in the premature infant. A plan could then be developed to aid the premature in his growth.

Quiet Sleep Time Related to Neurological Maturation

According to Humphrey (1970, p. 131), "the development of the ability to suppress activity (quiet sleep) is an important aspect of the development of the central nervous system (CNS). In the normally developing embryo and fetus this development can be seen perhaps in the decrease in spontaneous activity from 14 weeks on."

Furthermore, Wolff (1966) felt that while the explanation for this decrease was uncertain, it had been attributed to a combination of factors such as "increasing central nervous system control of spontaneous discharge" and the "effect of increased stimulation which the fetus experiences from more constant proprioceptive stimulation as it grows bigger." (Wolff, 1966, p. 32) In the normal neonate, the ability to handle spontaneous neural discharge and to organize periods of sleep and wakefulness can also be seen as an aspect of CNS control.

Barnard (1973), in her study on kinesthetic stimulation on the premature infant, found in those experimental infants a greater increase in quiet sleep time as well as an increase in neurological development.

Thus the development of quiet sleep seems to be correlated with an increase of CNS maturation although the reason for this remains a mystery.

Quiet Sleep Time Related to Weight Gain

The only study known to attempt to correlate the parameter of weight gain to quiet sleep was done by Barnard (1973) in which she found a greater weight gain in her experimental infants that also had an increase in the amount of quiet sleep time.

Promotion of Quiet Sleep Time

The long-range goal of promoting quiet sleep time would be to facilitate neurological maturation and weight gain in the premature infant. To do this means that the nurse would pattern her care around the quiet sleep state of the infant. Purposefully planning nursing care around the infant's sleep may enable him to receive the full benefits of uninterrupted quiet sleep. Benefits of increased quiet sleep time could then be measured by a neurological examination and weight measurement before and after this plan had been implemented.

The rationale for the conceptual framework or theoretical approach has been discussed as the basis for this study. If it is true (1) that there is a direct relationship between quiet sleep time and neurological and physical development, (2) that quiet sleep time could be differentiated from active sleep time by observing the premature, (3) that the selected neurological examination is a valid tool for measuring neurological development of the premature infant, (4) that weight gain is a suitable indicator of physical development of the premature, (5) that nurses can and will pattern nursing care to avoid disturbing the infant's quiet sleep time thus promoting the infant's quiet sleep, then it should be true that infants whose quiet sleep time is undisturbed would show greater increases in neurological and physical development than infants whose quiet sleep time may have been disturbed.

The importance of nursing intervention in dealing with the quiet sleep of a premature infant can be easily understood when examining these assumptions and concepts. The planning of patient care is an important aspect of nursing, if not the most important. Nurses are in the position of being with the patient 24 hours a day and therefore can have the most influence in controlling his environment. The optimal environment of the premature must be carefully studied and evaluated to assure the maximum benefit to the patient. This was the impetus for this study--improvement of patient care by creating an optimal environment for the premature to grow.

PURPOSE, PROBLEM, AND HYPOTHESIS

The purpose of this study was to determine the effect of planning nursing care to increase quiet sleep time in promoting weight gain and neurological development of the premature infant.

The problem which was investigated was whether the patients in the group receiving the experimental care to promote quiet sleep would have a significant increase ($p<0.05$) in neurological maturation and weight gain when compared to a control group of patients receiving routine nursing care.

A directional hypothesis could also be stated for this problem: that the experimental group would have a significantly larger ($p=0.05$) increase in neurological maturation and weight gain than the control group.

The independent variable was the patterned nursing care. Dependent variables consisted of neurological maturation and weight gain. One extraneous variable taken into account was septicemia in the infant.

DEFINITIONS

There are some terms used in this study for which meaning should be clarified.

Premature or Pre-term Infant

An infant born before 37 weeks gestational age is considered premature. All patients in this study were classified as premature infants.

Gestational Age

The age of the infant at the time of birth is his gestational age. This age is calculated by two methods:

1. From the first day of the mother's last menstrual period to the day of the infant's birth.

2. From a physical and neurological rating that may be given to the infant at time of birth as demonstrated by Lubchenco (1970) and Ameil-Tison (1968). These tests will be discussed in further detail subsequently.

Appropriate for Gestational Age (AGA)

The weight of the infant is appropriate for gestational age according to Lubchenco's intrauterine growth chart (Lubchenco, 1970).

Conceptual Age

Conceptual age refers to the gestational age of the infant plus the age from birth. The neurological examinations performed on the infants were used to establish the conceptual age at the time of the first and last neurological examination.

Sleep Pattern

The newborn infant has been known to demonstrate two behaviorally distinct sleep states, active and quiet sleep. The development of these two states and the time spent in each is known as the infant's sleep pattern (Drefus-Brisac and Monod, 1965; Parmelee, and Others, 1967).

Active Sleep

Drefus-Brisac (1970) presented the following criteria for active sleep which were used in this study.

Sleep in which there is one or more of the following activities:

1. eye movements
2. facial movements
3. frequent small body movements
4. irregular respiration
5. irregular heart rate.

Quiet Sleep

The criteria for determining quiet sleep, also presented by Drefus-Brisac (1970, p. 91) that were used in this study are listed below.

Sleep in which all of the following are observed:

1. no eye movements
2. absence of facial movements
3. no body movements except explosive body jerks
4. regular respiration
5. regular heart rate.

Weight Gain

Weight gain for the purposes of this study was calculated by subtracting the weight at the time the subject was entered into the study from the weight of the subject at the end of the study.

Neurological Maturation

Neurological maturation was the amount of increase in the conceptual age and neurological development as measured by the score of the Brazelton neurological examination (Brazelton, 1973) and the Lubchenco (1970) and Amiel-Tison (1968) conceptual age examination at the beginning and at the end of the study.

Planned Nursing Care

Routine nursing care in this study was planned around the infant's quiet sleep whenever possible so as not to interfere with the infant's sleep time. Routine nursing care for purposes of this study consisted of all care given to the infant in the NICU such as the taking of vital signs, feedings, baseline physical assessments, bathing, weighing, the taking of blood for laboratory tests, x-rays, etc. Whenever possible, all procedures except emergency procedures were carried out when the infant spontaneously was awake or in active sleep.

ORGANIZATION OF THE REMAINDER OF THE STUDY

Chapter one has given a general introduction to the study. The second chapter will consist of a review of literature and related studies. The research method and data collection procedures that were used will be included in chapter three. The analysis of the data and discussion of the findings will be presented in chapter four, followed by conclusions and recommendations in chapter five.

CHAPTER 2

LITERATURE REVIEW

Current literature was reviewed to increase understanding of the relationships between the variables in this study and aid in identifying the various factors which are involved in the solution of the problem.

ENVIRONMENTAL EFFECTS ON THE PREMATURE'S SLEEP

An infant's cyclic activities seem to be strongly affected by maternal cyclicity. A premature birth deprives the infant of the influences of maternal stimulation on his growth and neurological development and he then becomes subject to environmental influences.

Payne and Bach (1965) studied five full-term neonates. Several mothers were selected for this study and each patient was contacted two weeks prior to the expected date of delivery. They were then given the instructions as to the collection of data. For two weeks following discharge from the hospital, the mothers continued to collect data at home. Each data sheet consisted of a table marked off for each hour of the day and night with rows provided for indicating separately the activity of the baby and the mother. The mother then was asked to indicate for each hour of each day whether she was (1) awake, (2) drowsy, or (3) asleep and simultaneously (in the two-week prenatal period) whether the fetus was moving, kicking, or inactive or (during the two-week post-natal period) whether the baby was awake or asleep. A weakness of this investigation was that a limited population sample was used. Whether findings from full-term neonates are applicable to pre-term neonates is not known.

When the data sheets were returned, five mothers provided complete enough information to be included in the study. Results showed that there was a type of sleep-wake rhythm, as manifested by fetal movement, present in the fetus during the last two weeks of the third trimester of pregnancy; this rhythm corresponded to neonatal rhythms observed during the immediate post-natal period. Therefore, maternal influence on the sleep-wake rhythms of the fetus may be important in the fetus's development of his sleep-wake cycle (Payne and Bach, 1965).

In a study done on eight normal pregnant women in the last two trimesters of their pregnancy, fetal activity was recorded during three to five all-night recordings (Sterman, 1967). Recordings were obtained by placing three pressure sensitive electrodes on the mother's abdominal surface. Recordings were made at approximately 30-day intervals until term. Thirty all-night recordings of fetal activity were collected. The earliest recording was 21 weeks gestation and the last recording was at term. Maternal sleep parameters, measured by an EEG and an electro-oculargram (EOG), were recorded simultaneously with fetal activity. Comparisons of the data indicated that 65 per cent of the fetal quiet sleep occurred in direct relation to the maternal quiet sleep (non-REM) state. Sterman concluded, "it is possible that this periodicity reflects the mother's own rest-activity cycle, communicated to her fetus by some undetermined systemic factor." (Sterman, 1967, p. 224) Again in this investigation the number of subjects included in the study was limited. It was of interest that this study included the premature fetus as well as the full-term fetus.

On the other hand, the findings observed by Mann (1975) on sheep fetuses did not agree with either Sterman (1967) or Payne and Bach (1965). Mann observed 15 sheep fetuses and found that on continued 24-hour EEG tracings of both the fetus and the mother, quiet sleep did not appear to be associated with either maternal quiet sleep or wakefulness. The conclusion drawn was that the fetus had his own sleep-wake pattern that possibly was genetically determined with no direct intrauterine effect of the maternal sleep-wake cycle. This theory is also supported by Saint-Anne Dargassies (1966) who felt that all neurological behavior of the fetus and the infant has been genetically determined and cannot be environmentally influenced. It is not known whether findings from animal studies are applicable to human beings. A weakness of this study was that only an EEG was used to determine the sleep state of the fetus. According to Parmelee (1970) the EEG is the weakest indicator of sleep activity in the fetus and newborn with muscular activity being the strongest indicator.

Many environmental disturbances are imposed on the premature infant. Korones (1976) recorded the number of disturbances imposed on the premature infants in a 50-bed NICU over a 24-hour period. A random selection was made of 11 critically ill infants. The total number of disturbances for all infants during their 24-hour period of observation was 1449. The mean number of contacts per infant was 132 in 24 hours. Considered by the hour the infants were disturbed 2.8 to 7.7 times for a mean of 5.5. The primary disadvantage to this study was that the bedside nurse knew she was being observed for disturbing the infant and admitted that she had probably reduced the number of contacts she might actually have had. This study does demonstrate, however, the considerable number of disturbances an infant receives in a NICU.

The problem of sleep and rest in the adult intensive care unit was reported by Dlin and his associates (1971). All patients admitted to the six-bed ICU during the eight weeks of the project participated in the study with the exception of those patients undergoing laryngectomies and those having severe brain damage. Whenever possible, the patient was questioned on the day of his admittance to the unit as to his sleep pattern at home, his sleep during previous hospitalization, and his sleep thus far during the present hospitalization. Once a week for eight weeks, a 24-hour day was selected for continuous observation. The observers rotated in eight-hour shifts corresponding to the nurses' shifts. Each observer made notes on interruptions, with an interruption being defined as any discrete event which involved the patient directly (the taking of blood pressure, etc.). The notes consisted of: 1) the time at which an interruption occurred, 2) the nature of the interruption, 3) the duration of the interruption, 4) the patient's response to the interruption, and 5) general comments. The most significant result was that the average number of interruptions per hour ranged from a high of 12 between the hours of 7:00 a.m. and 8:00 a.m. to a low of four per hour between midnight and 1:00 a.m. Results of the observations also included: 1) that the lights were on constantly, 2) that there was little or no change in the level or type of sensory input, 3) that the activity, in spite of its decrease toward early morning, remained high (Dlin, and Others, 1971).

After questioning, it was found that the patients felt the chief deterrents to sleep, in order of their importance, were: 1) activity and noise, 2) pain and physical condition, 3) nursing procedures, 4) lights, 5) vapor tents, and 6) hypothermia (Dlin, and Others, 1971). It must be remembered that this study was done on adult patients rather than on infants and therefore the response to the environment may be different.

In their discussion of study results, Dlin and his associates felt that "sleep is too often taken for granted. It is conceded that it is important, but few treat it as a major aspect of therapy, yet a patient's sleep is vital to his welfare and cannot be substantially abused without endangering recovery." (Dlin, and Others, 1971, p. 160) They concluded, "Sleep deprivation in the ICU does exist--and can be substantially eliminated. This can only be done through a better understanding of the environment and its effects on the patient." (Dlin, and Others, 1971, p. 161).

The effects of sleep deprivation on the adult have been studied by many investigators. In general it has been found that sleep deprivation produces a number of disturbances in behavior, notably lapses in attention, irritability, feelings of fatigue, disorientation, impaired short-term memory, slower cognitive operation, and even visual and auditory hallucinations (McFadden and Giblin, 1971). A study done by Agnew and his associates (1964) examined the deprivation of Stage IV adult sleep (which is similar to quiet sleep in the infant) in 15 adult patients. The subjects were repeatedly disturbed from Stage IV sleep for one week. Through psychological testing and interviews at the beginning and end of the study, it was discovered that subjects became physically uncomfortable, withdrawn, less aggressive, and showed concern over vague physical complaints and changes in bodily feelings. Overall the impression suggested a depressive and hypochondriacal reaction. On recovery nights, a significant increase in Stage IV sleep occurred, even at the expense of other sleep stages. It must be noted that in this study subjective tools (psychological tests) were used to measure the effects of disturbed sleep and therefore are subject to various interpretations. Also a control group was not compared with the experimental group. Finally, the study was done on adult patients rather than on prematures, whose reactions to environmental stimuli may be different from the adults. Because there has been no previous investigation of the effect of sleep deprivation on the infant, the adult reaction to sleep deprivation must be used to assist in the understanding of the adverse effects of sleep deprivation on the premature infant.

ENVIRONMENTAL MANIPULATIONS TO PROMOTE QUIET SLEEP

Few maneuvers to promote quiet sleep in the premature have actually been studied. Those that have been investigated include providing an environment with neutral ambient temperature, kinesthetic stimulation, and auditory stimulation. These will be discussed in the following section.

Program to Maintain Neutral Ambient Temperature

One of the environmental influences studied was the effect of temperature on sleep. Parmelee and his associates (1962) studied eight premature infants who were placed unclothed in a specially-designed transparent incubator in which the ambient temperature could be kept constant with a difference of only 0.5° centigrade between any two points in the incubator. Twenty tests were done on eight infants in ambient neutral temperatures of 32°-34° centigrade and two tests were done on two of the eight infants in ambient temperatures of 30°-31° centigrade. Each test, or observation, lasted an average of 166 minutes. The babies' rectal temperature, heel stick blood flow, and oxygen consumption were continuously recorded. Respirations of the infant were counted for one minute approximately every five minutes by an observer and the infant's activity was recorded by an independent observer at 30-second intervals. Three infants were studied once; two, twice; one, four; one, five; and one, six times.

Results demonstrated that there was definite cycling between quiet and active sleep. The rate of oxygen consumption that occurred when the infant was awake or in active sleep was significantly higher than oxygen consumption of quiet sleep. Also noted was the significant increase in the amount of quiet sleep time of the infants placed in a neutral ambient thermal environment of 32°-34° centigrade. Six of the infants during 14 test periods had a total amount of quiet sleep of 55 per cent of the test time. Of the remaining infants, one was tested once and had a total amount of quiet sleep of 47 per cent. The other infant was tested five times and the total amount of quiet sleep was 47.3, 39.9, 45.8, 77.6, and 68.9 per cent of the test time for each test. There were two observation periods of two infants (Ber and Dor) made at environmental temperatures of 31° and 30.5°, respectively, just below the neutral temperature range. The total amount of quiet sleep during the observations was 31.3 per cent for Ber and 46 per cent for Dor, as compared with an average of 69.4 per cent for Ber and 74.7 per cent for Dor during the control periods. The author concluded, "Thus the amount of quiet sleep seemed to be significantly reduced in environmental temperatures below the neutral zone." (Parmelee, and Others, 1962, p. 325) Statistically this study cannot be considered significant since only two studies were made on infants in a decreased ambient temperature. This was unfortunate, but the study could not be accomplished with more subjects because of ethical considerations concerning the detrimental effects of a lower ambient temperature on the infant (Klaus, 1973, p. 98).

Programs to Provide Kinesthetic Stimulation

Van den Daele (1970) was the first to investigate the environmental influence of kinesthetic stimulation on the modification of infant state by treatment in a rockerbox. The subjects included 32 term infants that were divided into four equal groups aged 2-4, 10-12, 18-20, and 26-28 weeks. The infants were placed in a 32-inch-square, motor-driven, wooden platform with four-inch sides. The rockerbox oscillated 30 times per minute at slow speed or 60 times per minute at high speed.

Prior to each treatment, determination of infant state was made by two hidden independent observers that were on the other side of a one-way mirror. They rated the infant's behavior at 30-second intervals for activity level and mood quality. Four treatments in random order were administered to each infant. The treatments consisted of various combinations of high and low rocking speed with mother within or not within the infant's visual field. Each treatment was one minute in duration followed by a one-minute non-treatment period (Van den Daele, 1970).

It was discovered that the rockerbox treatment had a marked effect on infant behavior. With rocking, the infant activity level decreased and distress declined beyond the 0.0001 level ($t=9.6$; 30 df) of significance. Also significant was that the faster rocking speed was associated with less distress ($p<.01$) and somewhat reduced activity ($<.05$) (Van den Daele, 1970).

The effect of the rockerbox, this time with auditory stimulation, was again studied by Van den Daele (1971). Subjects included full-term twins, six sets of same-sex identical twins, and three sets of same-sex fraternal twins that ranged from 6 weeks to 24 weeks of age. Infants were again placed in a 32-inch-square rockerbox that was this time divided into two equal compartments and had an 80-decibel white noise source placed above it. One member of each twin set was placed on either side of the partition, then four treatments were administered in a mixed order. The treatments consisted of one-minute-combinations of slow and fast rocking under no-sound and sound conditions. The activity level of each twin was rated on a five-point scale at 30-second intervals by an observer out of the infant's visual field.

Under all conditions of stimulation, the behavior of identical twins remained similar whereas fraternal twins were significantly more divergent in behavior during the weaker, slower, no-sound condition. This finding again supports the theory of Saint-Anne Dargassies (1955), quoted earlier in this chapter, regarding the genetic control of neurological behavior. Also found was that the general effectiveness of the rockerbox treatment established in his earlier study was replicated. Results demonstrated that infants became less active and more quiescent when rocked. Furthermore, treatments accompanied by sound were more quieting than treatments not accompanied by sound (Van den Daele, 1971).

In both studies done by Van den Daele (1970, 1971), research could have been taken one step further by studying the reaction of the infants to the rockerbox at different levels of their development. However, an important implication demonstrated by these studies was that environmental intervention in the form of a rockerbox did effect a change in the state of the infant and promote quiet behavior.

In the study done by Barnard (1973), the effect of low frequency auditory and kinesthetic stimulation on sleep behavior, neurological development, and weight gain was investigated in premature infants of 33 to 35 weeks gestational age. This was accomplished by studying 15 infants who were placed on rockerbeds oscillating at 30 strokes per minute while a recording of a heartbeat offered auditory stimulation. This group was then compared to a control group which received routine nursing care with no other added stimulation. Data, consisting of observations of sleep-wakefulness, gestational age assessment, and weight gain, was then collected on all subjects during a four-week period. Quiet and active sleep were defined by the criteria of Drefus-Brisac (1970) and the gestational age assessment was accomplished by the use of the Dubowitz (1970) scoring system.

Student's t-test was calculated to determine the level of statistical significance in the difference between the two groups. The results indicated that the experimental group exceeded the control group by the end of the study period in both neurological assessment and weight gain. While neither the weight gain nor the maturational scoring denoted differences of statistical significance between the two groups, the findings did demonstrate trends in the same direction. The increased quiet sleep time found in the experimental subjects was, however, statistically significant (Barnard, 1973).

In summary, the author felt that

> . . . a program of low-frequency, redundant stimulation produced general behavior quieting and an increase of quiet sleep. . . . If the infant's maturation can be hastened to help him or her adapt to the new external existence for which he or she was ultimately programmed, this is desirable in that it potentially hastens the whole system of enzymatic initiation and production, which in turn regulates all physiological functioning. Therefore, encouraging maturation of the infant would appear to facilitate postnatal adaptation to an environment into which he or she is thrust before he or she is ready. (Barnard, 1973, p. 29)

The study by Barnard (1973) demonstrated many important qualities of a premature infant's response to stimulation but it does have several limitations which are listed below.

1. The actual means of assignment of the infants to either control or to the experimental group is not given.

2. The study population was small--seven in one group, eight in the other group.

3. Infants were assigned to the study at 32 weeks gestational age. Some of the infants were born several weeks prior to this assignment and may have had various respiratory problems requiring extensive respiratory therapy. It has been observed by Buerger, the clinical nurse specialist at the selected NICU, that infants requiring respiratory therapy longer than one week duration demonstrate different neurological behavior than the infant requiring less respiratory therapy. (Figure 1, p. 73.)

4. No control was made on inclusion of infants with high bilirubin levels or infants under bililight.

5. The investigator introduced two stimuli instead of one, thereby negating investigating whether one stimulus produced more changes in neurological behavior and weight gain than the other stimulus.

6. There were several nurses performing the neurological testing of the infants and more importantly there was no control made over their knowledge of which infant was in which study group. This may have created a bias on the part of the neurological examiner.

SUMMARY

The environmental effects on the premature infant's sleep were discussed in the review of literature. One effect, or lack of effect that is actually the basis of the problem, is the absence of maternal cyclicity for the establishment of the infant's sleep patterning. Other environmental effects discussed were additions to the infant's surroundings that might interfere with his sleep. These included activity and noise, pain, nursing procedures, lights, vapor tents, and hypothermia. The literature review concluded with various maneuvers which have been used in an effort to promote quiet sleep in the infant. Studies including environmental temperature regulation, rockerboxes, and heartbeat sounds for auditory stimulation were examined. Unfortunately, there have been no systematic studies done on the effects of planned nursing care around quiet sleep of the infant on his neurological maturation and weight gain. The research method of the present study is described in the next chapter.

CHAPTER 3

RESEARCH METHOD

This study used the experimental method of reserach. The independent variable, patterning of nursing care around the premature infant's quiet sleep, was performed on half of the patients studied. The other half of the patients were the control group and received routine nursing care with no unusual attention given to their sleep states.

SAMPLE SELECTION

Subjects included in the sample for this study were infants who had been admitted to a 40-bed NICU in a university hospital. The sample was a purposive convenience sample with patients selected in order to limit, as much as possible, some of the extraneous variables. The extraneous variables which could not be controlled were noted and analyzed as covariates. The covariates were clinically asymptomatic sepsis, differences of gestational age at birth, and difference of birth weights.

Sample Criteria

The sample was selected according to the following eight criteria:

1. Conceptual age of 31-35 weeks at the time of study.

2. Birth weight of 1100-3000 grams (appropriate for gestational age, 31-35 weeks, tenth to ninetieth percentile) (Lubchenco, 1970).

3. No diagnosis of neurological pathology as determined by the physician and/or the neonatal intensive care clinical nurse specialist.

4. Bililight not in use and the indirect bilirubin level less than 10 miligrams per cent during the course of the study.

5. No recurrent hypoglycemia after the second day of life.

6. No laboratory-confirmed sepsis unless clinically asymptomatic and on antibiotics more than three days.

7. No respiratory distress requiring oxygen therapy while on the study and no history of being on a respirator longer than one week.

8. Temperature stable in a neutral thermal environment.

Rationale for Sample Criteria

The rationale for the selection of the sample criteria is explained below. Many of the criteria were selected because they have been found to influence neurological performance or to interfere with the quiet sleep of an infant.

Conceptual age. The conceptual age of 31 weeks was chosen for the lower limit as a result of the studies done by Drefus-Brisac (1970) which demonstrate that at approximately 30-32 weeks conceptual age "different behavior patterns begin to appear which resemble wakefulness, active sleep, and quiet sleep." (Drefus-Brisac, 1970, p. 95) The upper limit of 35 weeks conceptual age was chosen due to the short amount of time the infant probably would spend in the NICU.

Appropriate-for-gestational age (AGA) birth weight. The subjects included in the sample were within the tenth to ninetieth percentile of the Lubchenco gestational age-weight chart (Lubchenco, 1970, p. 130). This demonstrated appropriateness for gestational age which was necessary in order to distinguish from small-for-gestational age (SGA) infants. It has been found that a SGA infant may show a neurological maturation and weight gain pattern different than that of an AGA infant.

No neurological pathology. An infant with a pre-existing neurological disorder would demonstrate a different type of result in a neurological examination than would a normal infant. Therefore, this infant could not be considered in a normal population of premature infants for this study.

No bililight and no high, indirect bilirubin levels. The bilirubin level in the infant was considered in two aspects. These will be discussed below.

1. If the infant was under a bilirubin light, he could not be included in the study at that time due to the eye patches he was required to wear. The eye patches might alter the sleep-wakefulness pattern of the infant and interfere with observation of his sleep-wakefulness.

2. The indirect bilirubin level was required to be lower than 10 miligrams per cent in the infant at the time of the study. When the attending physicians in the selected NICU treated hyperbilirubinemia (10 miligrams per cent) they considered both the age of the infant and his bilirubin level in prescribing a bililight and/or exchange transfusion. Also, according to Klaus (1973, p. 190), as the indirect bilirubin level increases, the central nervous system (CNS) becomes depressed and the infant becomes more irritable. These infants then would present a different neurological picture than the normal premature. Accordingly,

these infants were not included in the study until their indirect bilirubin levels were below 10 miligrams per cent.

No hypoglycemia. In the premature, hypoglycemia is defined as a blood glucose level below 20 miligrams per 100 mililiters of blood (Klaus, 1973, p. 170). Most prematures normally have a low blood sugar level the first few days of life, but, when treated appropriately, the levels quickly return to normal. Infants were not included in the study until their blood sugar returned to normal. Furthermore, infants occasionally will have recurrent hypoglycemia due to some type of pathology. These infants also were eliminated from the study since according to Klaus (1973, p. 170) hypoglycemia may present itself in the premature infant with CNS disturbances such as seizures, jitteriness, apnea, limpness, in addition to refusal to feed, etc. Since these infants may present with abnormal neurological examinations, they were excluded from the sample.

No laboratory-confirmed sepsis. Symptomatic infants with sepsis may demonstrate many CNS disturbances such as lethargy/irritability, jitteriness/hyporeflexia, tremors/seizures, coma, abnormal eye movements, etc. (Klaus, 1973, p. 212). Since this would cause the neurological examination to appear abnormal, these infants were eliminated from the study. However, if the infant did have laboratory-confirmed sepsis (other than meningitis), had been on antibiotics for longer than three days, and was asymptomatic, he was included in the sample.

No respiratory distress requiring oxygen therapy. The infant requiring oxygen therapy to meet his increased demands of oxygen consumption due to the respiratory distress could not be included in this study. This infant was not considered to be in a stable condition and as a result would have increased metabolic demands which would further increase his oxygen consumption. Because of the increased oxygen consumption the infant may not gain weight at the same rate as a premature without respiratory distress.

Also, infants requiring a respirator for assistance with ventilation for longer than one week could not be included in this study since these infants present a delayed and eratic neurological pattern when compared to a normal premature (see Appendix C).

Temperature stability. The importance of a stable temperature in a neutral thermal environment (NTE) (32-34° Centigrade) of the premature infant was carefully studied by Parmelee and his associates (1962). They found that infants not maintained in a NTE had a significantly less amount of quiet sleep than infants who were maintained in the NTE. Since less quiet sleep time might influence neurological maturation and physical growth (as our hypothesis states), these infants were not included in the sample.

Method of Sample Selection

Patients meeting the sample criteria initially were identified by their hospital record. Information obtained from this record pertained to the appropriateness for gestational age, diagnoses including any of neurological pathology, hypoglycemia, sepsis, hyperbilirubinemia, and respiratory problems. In addition to this, information regarding temperature stability of the infant was obtained from the bedside record.

The attending physician was contacted and given a verbal explanation of the study. The physician consent form appears in Appendix B. A parent was then contacted and given a verbal explanation of the study. The verbal explanation which was used appears on the parental consent form which the parent was asked to sign; the form can be found in Appendix B.

The group in which the first subject was placed was picked randomly from a box--it was the experimental group. At the time this study was initiated two subjects met all of the sample criteria so they were also entered randomly by drawing their names from a box. In order to place equal numbers of subjects in each group, the first name picked was entered into the experimental group and the second name then was placed in the control group. After this initial placement, patients were entered alternately into each study group as they were eligible to be admitted into the study. When the situation arose of two patients being eligible at the same time, the initial method of placement was used. There were never more than two patients eligible at the same time during the course of the study.

EXPERIMENTAL NURSING CARE

In preparation for this study several nurses working in the NICU were designated by the investigator to be the nurses who would administer the experimental nursing care. They were known as "experimental nurses" and were trained in observation of sleep states and in the manner the experimental nursing care was to be given. A written explanation placed on the bedside chart of each experimental infant appears in Appendix D.

The remainder of the nurses in the NICU had no knowledge of the type of observations being made except for the NICU team leaders. The team leaders were instructed as to the nature of the study (and thus considered experimental nurses). They were asked to assign experimental nurses to the care of the experimental infants and not to assign these nurses to the care of infants in the control group.

The experimental nursing care consisted of administering all types of care given to the experimental infant around his quiet sleep so as not to disturb his sleep. This routine care consisted of the taking of his vital signs, bathing, diapering, and feeding the infant. Baseline assessments, the drawing of blood samples, and urine and stool tests also were accomplished when the infant was in active sleep or awake. Whenever time was a limiting factor and the infant had to be awakened from a quiet sleep state, the nurse recorded that information on a bedside data sheet, an example of which can be found in Appendix E. The experimental nursing care was given to each infant for a minimum of one week and a maximum of three weeks depending on the time of discharge.

DATA COLLECTION

Each patient was assigned a code letter for identification. During the course of the study, a daily check was made on each infant to assure that the sleep disturbance forms at the bedside were being completed and that all of the sample criteria continued to be met. If, at any time, an infant did not fit into the sample criteria, he was dropped from the study. When he again met the criteria he was started from the beginning, but placed in the same group he had previously been assigned.

The measurement of the dependent variables, neurological maturation and weight gain, was done twice for each patient. These measurements were made once on the day of admittance into the study and then once either on the day of discharge or three weeks later, whichever came first. The measurements were accomplished by the use of a neurological examination and a weight scale. The data collection sheet appears in Appendix F.

The neurological examination performed on the infants was accomplished by one examiner, the NICU nurse clinical specialist who has a master's degree in nursing and is trained in the performance of the examinations used for this research. An example of the neurological examination can be found in Appendix G. The examiner had no knowledge of the group placement of each infant. The neurological examination consisted of two parts. The first part was developed by Amiel-Tison (1968) and indicated improvements of neurological status by indications of conceptual age. Components of Amiel-Tison's neurological examination were based on the findings of Saint-Anne Dargassies (1955). Saint-Anne Dargassies studied 100 prematures of known gestational age, and the longitudinal evolution of healthy prematures, born at 28 weeks gestational age and studied up to 40 weeks gestational age. The segments of the Amiel-Tison examination that made up "Part I" of the neurological examination used in this study were selected and used as a basis for determining the conceptual age of the subjects by the NICU clinical nurse specialist. These selected segments that made up "Part I" of the neurological examination were believed to be indicators of developmental change in the premature infant during the period of time being studied. This test consisted of observations of muscle tone and primitive reflexes. The reported error of prediction of a single score of 1.02 weeks, the 95 per cent confidence interval being plus or minus two weeks.

"Part II" of the neurological examination used in this study was developed by Brazelton (1973). This is a behavioral assessment and tests responsiveness to certain dimensions of stimulation. This is the only behavioral neurological examination known to accurately measure the differences in the premature's reactions. The observer for this again was the NICU clinical nurse specialist who was trained and certified in the performance of Brazelton examinations. Once trained, tester reliability remains high (90 per cent or more using a sample of 10 infants) (Horowitz, 1971, p. 4). Again specific sections of this examination were chosen by the clinical nurse specialist to indicate the change of behavioral responsiveness of the premature over the short period of time being studied. These sections made up "Part II" of the neurological examination used in this study. At the completion of the examination, the weight taken on the previous night was recorded on the examiner's data collection sheet.

DATA ANALYSIS

When the phase of data collection was completed, that of data analysis began. Chi-square and t-tests were used along with measures of central tendency, such as the mean to examine the changes which had occurred in the dependent variables. The findings will be discussed in Chapter four.

Chapter 4

DATA ANALYSIS

A total of 22 premature infants were studied. Eleven subjects comprised the control group, seven males and four females. The experimental group consisted of five males and six females. Both groups demonstrated some periods of apnea and bradycardia throughout the study. Infants were studied for varying lengths of time: one, two, or three weeks, depending on the time of the discharge. For purposes of data analysis, subjects from the experimental group were compared with subjects in the control group. There were equal numbers of the sub-groups in the control and experimental groups.

Two design variables were group (experimental and control) neurological maturation and weight gain. The covariates were clinically asymptomatic sepsis, differences of gestational age at time of entry into the study, differences of birth weights, and sleep disturbances in the experimental group. Measures of central tendency, Chi-square, and the t-test were used to analyze the differences between the control and the experimental groups.

NEUROLOGICAL MATURATION AND WEIGHT GAIN

The problem investigated was whether the patients in the group receiving the experimental nursing care to promote quiet sleep would have a significant increase ($p < 0.05$) in neurological maturation and weight gain when compared to a control group of patients receiving routine nursing care.

Stated as a directional hypothesis, the experimental group would have a significantly larger (p=0.05) increase in neurological maturation and weight gain than the control group.

The neurological examination was scored on the basis of a qualitative scale utilizing ordinal data. The examination consisted of two parts: "Part I" which consisted of 14 sections, and "Part II" which included 17 sections. Weight, which was scored by using a quantitative, interval scale, along with the values obtained from the neurological examination had been measured on the day of the infant's admittance into the study, and on the day of the infant's hospital discharge or in three weeks--whichever came first.

The changes in the neurological examinations and weights were compared by using measures of central tendency and the Chi-square and t-tests.

Neurological Examination

Each section of the neurological examination was analyzed separately. The mean, the differences between the initial and final means of the control and experimental groups, and the chi-square value for each section appears in Table 1.

As can be seen in Table 1, there were six segments in the neurological examination that demonstrated statistical trends. Differences in the initial and final means for both the experimental and the control groups is expressed in Figure 2, Appendix H. Trends in the direction of the hypothesis are demonstrated by the majority of segments in the neurological examination.

Table 1

Means, Differences Between the Initial and Final Means and Chi-square Level of Significance of the Neurological Examination Scores for the Control and Experimental Infants

Section	Control Subjects Means			Experimental Subjects Means			Chi-square
	Init.	Final	Diff.	Init.	Final	Diff.	p
1. Sucking	2.0	2.1	0.1	1.9	2.3	0.4	0.46
2. Rooting	1.8	2.0	0.2	1.8	2.1	0.3	0.99
3. Moro	1.9	2.1	0.2	1.9	2.2	0.3	0.99
4. Crossed Extension	1.8	2.1	0.3	1.9	2.3	0.4	0.22
5. Resting Posture	2.7	3.4	0.7	2.6	3.5	0.9	0.11*
6. Recoil--leg	2.0	2.3	0.3	1.9	2.2	0.3	0.63
7. Recoil--arm	2.1	2.4	0.3	2.1	2.6	0.5	0.06*
8. Heel to ear	2.5	2.7	0.2	2.5	3.7	1.2	0.10*
9. Scarf sign	2.4	2.8	0.4	2.4	3.2	0.8	0.56
10. Body extensors	2.4	2.6	0.2	2.1	3.0	0.9	0.09*
11. Vertical position	1.3	1.9	0.6	1.4	1.9	0.5	0.99
12. Horizontal position	1.2	1.5	0.3	1.0	1.7	0.7	0.33
13. Neck flexors	2.3	3.0	0.7	2.3	2.0	0.7	0.53
14. Neck extensors	2.3	2.7	0.4	1.5	2.5	1.0	0.39
15. Inanimate Visual (IV)	2.7	1.7	-1.0	1.9	3.3	+1.4	0.42
16. IV--response	2.4	2.1	+0.3	2.8	2.1	+0.7	0.70
17. Inanimate auditory (IA)	5.0	4.9	-0.1	3.3	4.2	+0.9	0.26
18. IA--response	1.7	1.8	-0.1	2.2	1.7	+0.5	0.62
19. Animate visual (AV)	3.8	3.8	0.0	3.0	3.6	+0.6	0.09*
20. AV--response	1.9	2.0	-0.1	2.1	1.7	+0.4	0.30
21. Animate Auditory (AA)	6.0	5.7	-0.3	5.1	5.1	0.0	0.18
22. AA--response	1.2	1.4	-0.2	1.4	1.4	0.0	0.99
23. Animate--visual and auditory (AVA)	4.1	4.2	+0.1	4.0	4.3	+0.3	0.46
24. AVA--response	1.1	1.6	-0.5	1.6	1.4	+0.2	0.88
25. Alertness	4.2	4.1	-0.1	3.1	4.1	+1.0	0.48
26. General tone	5.3	5.7	+0.4	4.8	6.7	+1.9	0.50
27. Posture--spontaneous	1.6	1.4	+0.2	2.1	1.4	+0.7	0.36
28. Posture--manipulation	1.7	1.3	+0.4	2.1	1.4	+0.7	0.23
29. Tremulousness	3.6	4.8	-1.2	4.8	3.0	+1.6	0.06*
30. Startle	2.0	2.1	-0.1	2.3	2.1	+0.2	0.80
31. Skin Color	2.6	2.8	+0.2	3.1	3.2	+0.1	0.20

* Statistical Trend

Weight

Since all of the infants in the NICU had daily volume for weight caloric requirements calculated, all infants were receiving the amount of nutrients required for a normal weight gain. Usually, the infants were not included into the study until the age of one week, so an initial weight loss had already occurred and they had begun to gain weight. Hence, weight gain was calculated by simply subtracting the initial weight taken at the beginning of the study from the final weight taken at the end of the study.

The initial and final values for weight on each subject may be found in Table 4, Appendix I. Mean weight measures, standard deviation, and t-test significance appears in Table 2.

Table 2

Mean, Standard Deviation, t-value, and t-test Level of Significance of the Initial and Final Weights

Time of Weight	Control Subjects		Experimental Subjects		t-value	p
	Mean	S.D.	Mean	S.D.		
Initial	1712	236	1701	195	.1	.9
Final	1904	256	1948	171	.5	.6

Even though the control subjects' initial mean weight was more than the experimental subjects' initial mean weight (thus possibly giving the experimental subjects more room to gain weight) the difference was not statistically significant. And, as can be seen in Table 2, the differences in the final weights of the two groups were not significant at the p=0.05 level.

COVARIATES

History of Septicemia

There have been no reported studies that have examined the effects that septicemia has on sleep. Nevertheless, this investigator deemed it necessary to report the incidence of septicemia in each group.

In analysis it was found that there were five infants in each group that had clinically asymptomatic sepsis and had been on antibiotics for more than three days (see Appendix I, Table 4). Thus, there was no statistical difference between the two groups in the history of septicemia.

Conceptual Age When Entering the Study

The infant's age when entering the study was examined to determine if one group had a mean age significantly different from that of the other group thus creating the possibility of varying sleep patterns and of having more room for neurological maturation. This information is demonstrated in Table 3.

Table 3

Mean, Standard Deviation, t-value and t-test Level of Significance for Conceptual Age at Time of Entry into the Study of the Control and Experimental Groups

	Control Subjects		Experimental Subjects			
	Mean	S.D.	Mean	S.D.	t-value	p
Conceptual Age at Entry to Study	34.25	.96	34.5	1.0	.2	.8

Both the control and experimental groups had a mean conceptual age that were very similar and were not significantly different. Therefore, neither group had a conceptual age advantage over the other.

Initial Weight When Entering the Study

This initial weight when the subject entered the study has been examined since one group may have demonstrated an initial lower weight than the other group thus giving the subjects in the lower weight group an advantage since they would have a greater space for weight gain.

As was previously discussed, the difference was not statistically significant (see Table 2). Therefore, one group did not have any advantage over the other group in their initial weight.

Sleep Disturbances of the Experimental Group

To assure the optimal lack of interruptions of quiet sleep in the experimental group infants, the bedside nurse was asked to record on a form (see Appendix E) the number and type of disturbances the infant received during the eight-hour shift.

According to these records the kinds of sleep disturbances of the experimental group, in order of their frequency, were:

1. taking of blood, manipulation of I.V.'s, and taking of x-rays
2. feeding and taking of vital signs
3. visiting of the parents
4. examinations by the physician
5. stimulation for bradycardia.

Although, at times, experimental infants were disturbed from a quiet sleep, the number of disturbances were considerably lower (1.5 per day) (see Chapter 1). In light of these data it is felt that the experimental infants did have a considerably greater amount of quiet sleep time than the infants in the control group.

DISCUSSION OF FINDINGS

Neurological Examination

Even though there was no statistically significant difference ($p=0.05$) in the neurological maturation of the experimental infants when compared to the control infants, there were significant trends. Resting posture, recoil--arm, heel to ear, body extensors, orientation response--animate visual, and tremulousness demonstrated significant trends (see Table 1, p. 38).

The fact that some neurological examination sections were significant and others were not, was not surprising. Segments of development proceed at different rates but ultimately form a certain whole behavior pattern. It is through patterns of development that a child builds a structured motor response system (Chaney and Kephart, 1968, p. 5). It is these behavior patterns that indicate certain stages of maturity (Gesell and Amatruda, 1974, p. 4). Therefore, it is expected that an infant would be more advanced in certain segments of a neurological test than in others, although a general trend of the results of the neurological examination should be toward maturity. When assessing Figure 2 in Appendix H, it can readily be observed that a definite trend of increased neurological maturity in all areas of the examination does exist for the experimental group.

Trends of increased neurological maturation with increased quiet sleep time are not thoroughly consistent with the theory of Saint-Anne Darggassies (1966) who felt that all neurological behavior of the fetus and of the infant had been genetically determined and cannot be environmentally influenced. But these trends are consistent with the findings of Barnard (1973) who found increased neurological maturation trends in infants who received kinesthetic and auditory stimulation and who had an increase in quiet sleep time when compared to infants in a control group.

Jouvet (1967), Kales (1969), Paul and Dittrichova (1974), and Drefus-Brisac (1970) felt that quiet sleep time increased with the infant's increase in neurological development. Although they did not speculate as to whether increased quiet sleep time effected neurological development or vice versa, the relationship was noted.

Finally, Humphrey (1970, p. 131) felt that the development of the ability to suppress activity (quiet sleep) is an important aspect of the development of the CNS. Since trends of increased neurological maturation might indicate the development of the CNS, it is possible that increased quiet sleep time was responsible for the change in examination scores.

Weight

The difference in weight gain of the experimental infants compared to the control infants was not statistically significant ($p=0.05$). However, it is of interest that the level of significance decreased with the final weight thus demonstrating a slightly larger weight gain by the experimental group over the control group. These findings are consistent with those of Barnard's (1973, p. 22) study which demonstrated weight gain increases with kinesthetic and auditory stimulation, and increased quiet sleep time in the pre-term infant. Lacey and his associates (1975) demonstrated similar findings when studying adult anorexia nervosa patients. It was found that quiet sleep in these patients decreased during the final stage of restoration of weight gain back to matched population mean levels, thus indicating the possible need for quiet sleep during the time when the body is not functioning under optimal conditions.

Covariates

It was found that there was no significant difference ($p=0.05$) between the experimental and control groups in the history of septicemia, conceptual age when entering the study, and initial weight when entering the study. Therefore, it is assumed that one group did not have any advantage over the other group during the course of the study.

Limitations

The non-statistical significance in neurological maturation and weight gain of infants receiving increased amounts of quiet sleep could be a result of some of the limitations of this study. The limitations, listed below, later will be discussed in detail.

1. Small study sample size and limited time that each infant could participate in the study.

2. Lack of control over extraneous variables such as vestibular, kinesthetic, and auditory stimulation; and the amount of clothing of the infant.

3. Lack of control over the infant being awakened, even when in the experimental group, because of emergency and/or other procedures.

4. Lack of firm control over the neurological examiner's knowledge of the group to which the infant was assigned.

5. Difference in neurological examiner required to finish the collection of data.

6. Lack of "Part II" of the neurological examination being standardized on healthy and/or sick premature infants.

7. Sections of the Amiel-Tison and Brazelton neurological examinations used instead of the complete examinations.

8. Lack of complete control over the experimental nurses being assigned to the care of control infants.

Sample size. Because of the time limitations and the rigid sample criteria, the sample size was small. A total of 22 patients were studied: six being studied for three weeks, eight being studied for two weeks, and eight being studied for one week. Originally it was hoped that all infants would be studied for three weeks and would be tested by the neurological examiner at the beginning of the study and at the end of each consecutive week. However, quite often by the time the infant was stable enough to be admitted into the study, he would be ready for, or close to, hospital discharge. This created the situation where infants were only able to be studied for one or two weeks before discharge. It was felt by this examiner that the lack of time each infant could participate in the study presented the most significant limitation of the study. It is quite possible that it is necessary to study an infant for at least three weeks in order to be able to observe the maximum neurological change in maturation. The size of the sample was limited because of reasons other than time limitations of this investigator. If the infant developed a requirement for respiratory therapy during the time of participation in the study, he had to be dismissed from the study--this occurred twice. Because of the unavailability of the neurological examiner, in some cases infants were discharged before the examiner was able to assess them. Also, the examiner was unable to assess the infant each week of the infant's participation in the study; thus they received a neurological examination twice during the course of the study--at the beginning and at the end.

Extraneous stimulation. No control could be made over, nor was it desired to limit, the amount of "extra" stimulation the infant received during the study. According to Barnard (1973) kinesthetic and auditory stimulation may benefit the infant's neurological maturation and weight gain. Depending on the type of warmer the infant was in, he may have received different types of stimulation. For example, if the infant was in an isolette, the noise of the monitors and general room commotion might have been decreased. Also, in this type of warmer the infant had on both a shirt and a diaper--this extra clothing might have given him a type of stimulation. In contrast, an infant in a radiant heat warmer would be able to clearly hear any noise in the room and would have only a diaper on or no diaper on at all. It is possible that some infants were rocked and held more than other infants. Waterbeds would naturally create more stimulation for the infant. There were four infants in the control group and three in the experimental group who were placed on waterbeds during the study.

Awakenings. A situation that must be considered is the possibility of some infants being disturbed more than others. Although all infants in the study were considered to be "stable," I.V. feedings had to be started, x-rays needed to be taken, etc., and some of these procedures could not be postponed until the infant was in active sleep or awake. The disturbances in the experimental group have been discussed earlier in this chapter.

Examiner's awareness of the subject's group. The group to which the infant was assigned was to be unknown to the examiner. Several times the bedside nurse inadvertently gave the examiner clues to the subject's group by asking questions regarding the infant's sleep state. To the examiner's knowledge, this situation occurred twice, although the examiner stated that she tried to remain unbiased.

Change of examiners. At the end of the study another neurological examiner was asked to complete the last four examinations because of a serious illness in the initial neurological examiner. This might have decreased the reliability of testing, but was necessary because of time limitations.

The second neurological examiner was a Pediatric Nurse Associate and an experienced NICU nurse. This examiner had experience doing "Part I" of the neurological examination but was not certified in the Brazelton examination which made up "Part II" of the examination. As a result, the "Part II" of the examination was not completed in eight examinations (four patients). There was a total of 36 complete examinations by the first neurological examiner.

Standardization of the neurological examination. The Brazelton neurological examination which made up "Part II" of the neurological examination used in this study was scored on 53 neurologically "suspect" and "abnormal" full-term neonates. Infants were labeled "suspect" if they demonstrated two minor neurological abnormalities such as tremulousness, jitteriness, clonus, facial paresis, etc. They were labeled "abnormal" if there were more than two minor or one major abnormality such as hypo- or hypertonic, abnormal moro, myocloic jerks, abnormal vestibular responses, etc., on the neurological examination. It is important to note that although the test was scored on "suspect" or "abnormal" infants, it was used to differentiate between "abnormal," "suspect," and "normal" infants. Interscorer agreement (predictor value) for this examination was at least 85 per cent (Tronick and Brazelton, 1975, p. 144).

With this frame of reference, it was felt that this examination most accurately demonstrated the ability of the neonate to organize and integrate acts that point to a higher level of central nervous system functioning and could be effectively used with "normal" premature infants to assess their neurological maturation.

Sections used instead of complete examination. The fact that only sections of the complete Amiel-Tison (1968) and Brazelton (1973) examinations were used in the neurological examination utilized in this research may have implications related to the maturation observed in the infants. It is possible that both complete neurological examinations must be used in order to demonstrate their full potential for establishing neurological maturation. Unfortunately, in order to use both examinations in their entirety, the examiner would have to spend approximately one and one-half hours with each infant in order to complete the examination. This was not feasible in this study because of the time limitations of the neurological examiner. Also, certain categories in these neurological examinations were deemed less likely to demonstrate a change in neurological maturation in the brief time the infant was studied.

Experimental nurses caring for infants in the control group. It was brought to this investigator's attention that in a few instances, because of staffing limitations in the NICU, it was necessary to assign nurses trained in the observation of sleep states to infants in the control group. This was undesirable in that experimental nurses may have subconsciously planned their nursing care around the control infant's sleep states, thus creating the same situation as that of the experimental infants. Apparently the situation was unavoidable but should be kept in mind when interpreting the data.

SUMMARY

Through the analysis of the data discussed in Chapter four, it has been established that there was no statistically significant increase ($p=0.05$) in neurological maturation and weight gain in the infants who had increased quiet sleep time when compared to infants in a control group.

However, trends were noted (some statistically significant, some not statistically significant) in all areas of the neurological examination and in weight gain. Limitations of the study were discussed to aid in the understanding of the statistically insignificant data.

It is felt that in light of the trends, quiet sleep in the premature infant is important in promoting optimal growth and neurological maturation but that further research needs to be done in this area in order to establish a firm conclusion.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

Premature birth deprives the infant of the influences of maternal uterine stimualation on his physical growth and neurological development. It also deprives the newborn of the influences of the maternal sleep cycle and other aspects of maternal cyclicity. The attempt was made here to explore a method of controlling environmental influences on the premature infant so that his sleep cycle may be enhanced, thus fostering optimal neurological maturation and physical growth.

Since it was observed by this investigator that infants are often disturbed from quiet sleep so that the nurse may administer the required care, the importance and significance of an infant's quiet sleep state was studied. It was found that an infant has two sleep states, active sleep and quiet sleep, and that they can be differentiated by observation of the infant's physical characteristics. Active sleep was believed to be a much lighter sleep state and the infant was more easily awakened from this state. Quiet sleep was discovered to be a time when EEG synchronization occurred, when the heart rate and respiratory rate were decreased and regular, and when oxygen consumption was reduced. It was noted that quiet sleep time increased in relation to weight gain and also with the age of the infant, and therefore was thought to increase as the infant matured neurologically.

When reviewing related research studies that had been done in this area, it was found that the number of studies was quite limited. The effect of neutral ambient temperature on sleep was found to increase quiet sleep time in the infant. Infants using rocker-boxes as a means of kinesthetic stimulation were found to become less active and more quiescent when rocked. Finally, infants receiving kinesthetic stimulation in the form of a rocker-box and auditory stimulation in the form of a heartbeat recording had a slight increase in weight gain and in neurological development, although it was not statistically significant ($p=0.05$).

Following the review of this research, a plan was devised to increase quiet sleep time in the premature. By planning nursing care so as not to interrupt the infant's quiet sleep time, quiet sleep would be promoted and the effect on his neurological maturation and weight gain could be studied.

The experimental method of research was used in this study. The sample was a purposive, convenience sample of 22 patients. Subjects were studied for one, two, or three weeks, depending on the time of their discharge. All subjects were within the gestational and conceptual age of 31-35 weeks. Neurological examinations and weight measurements were performed on all subjects on the day of entry into the study and on the day of dismissal from the study. Covariates that also were studied were: a history of septicemia, age of entry into the study, and initial weight of the infant.

Chi-square and t-tests were used along with measures of central tendency, such as the mean, in interpreting the data.

The results of the neurological examination segment analysis was that there was no statistical significance ($p-0.05$) in the neurological maturation of the experimental infants when compared to the control infants. However, there were significant trends in some segments of the examination and there was an overall trend of increased neurological maturation in the experimental group.

Weight demonstrated no significant difference ($p=0.05$) between the two groups, although the weight gain of the experimental group was slightly larger than that of the control group.

In regards to the covariates, there was no statistical difference ($p-0.05$) between the two groups in the incidence of septicemia, conceptual age of the infant at the time of entry into the study, and the initial weight.

CONCLUSIONS

The directional hypothesis for this study was that the experimental group would have a significantly larger ($p=0.05$) increase in neurological maturation and weight gain than the control group.

Based on data analysis, this directional hypothesis must be rejected. Subjects who received nursing care that was planned so as not to interrupt the infant's quiet sleep time did not have a statistically significant increase in their neurological maturation and weight gain when compared to a control group.

In view of these findings, it is felt by this investigator that the relatively small amount of time (one or two weeks) that the majority of the infants were able to be studied was a major influencing factor in the rejection of the hypothesis.

It is important to note that statistical trends ($p=0.10$) were evident in some segments of the neurological examination and that other segments as well as the weight gain demonstrated trends in the direction of the hypothesis. The experimental group had a mean weight gain of 55 grams greater than the control group. This is clinically significant in that it represents the average weight gained in two days of hospitalization of the premature infant.

Based on these trends, which are consistent with the findings of Barnard (1973), Drefus-Brisac (1970), Humphrey (1970), Lacey and his associates (1975), and other investigators, it seems important that the nurse recognize quiet sleep in the premature and strive to promote this sleep whenever possible. Further research on the hypothesis seems warranted.

RECOMMENDATIONS

Increased quiet sleep time has been felt to be an important aspect of the premature's development by several investigators. Although statistical significance was not demonstrated by data analysis, the appearance of trends does have important implications.

It is recommended that this research study be replicated with the exception of studying a larger number of infants and studying all of the infants for at least three weeks. As may be expected, this would require a much longer time period for the overall study--probably six months to a year--in order to observe a sufficient number of subjects.

This study also could be changed by using the entire neurological examinations, instead of certain segments; using only one examiner for the entire study; and studying small for gestational age infants instead of premature infants.

Investigation of various types of environmental influences that would increase quiet sleep time would be very beneficial. As previously discussed, it is the nurse's responsibility to provide the optimal environment for the patient's restoration to wholeness; therefore, attempts should be made to manipulate the environment for the benefit of the patient. Because of the lack of statistical significance found in related research studies, it would be of greatest benefit to study only one method of manipulating the environment at a time in order to single out the method which would create the most benefit to the patient.

Thus, this investigator is in agreement with Gesell and Amatruda (1974, p. 4) who believe:

> Behavior patterns are not whimsical or accidental by-products. The human fetus becomes the human infant; the human infant, the human child and adult. This orderly sequence represents the human genetic endowment. The behavioral end-products of the total developmental process are a consequence of continuing reciprocal interaction between the genetic endowment and the environment.

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BIBLIOGRAPHY

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APPENDIX A

LETTERS REQUESTING PERMISSION TO CONDUCT THE STUDY

May 24, 1977

Miss Gertrude Haussler, R.N., M.S.
Director of Nursing Service
Loma Linda University Medical Center
Loma Linda, California 92354

Dear Miss Haussler:

As a graduate student in nursing, I am investigating the effects of environmentally induced influences on the neurological maturation and weight gain of the pre-term infant. The study I am planning to do is to meet part of the requirements for a master's degree in nursing at Loma Linda University. I am hereby requesting permission to involve patients and their records from the neonatal intensive care unit at Loma Linda University Medical Center. My research advisor and committee chairman, Lucile Lewis, has approved this research for my thesis and I have obtained approval from the Ethics in Nursing Research Committee.

The proposed research will study pre-term infants of approximately 32 weeks gestational age. Routine nursing care will be patterned around the sleep states of the infants in the experimental group. Infants in this group will be given care when in active sleep or when awake, but they will not be disturbed when in a quiet sleep state. (Sleep states in the pre-term infants usually last no longer than ten to twenty minutes each.) In the control group no attentil will be made as to the sleep states of the infant when routine care is delivered. Weekly data will be collected regarding the weight gain and neurological maturation of all the infants in the study. This will be collected for three weeks on each infant. After I have obtained the physician's consent and approval to include each patient in the study, I will then obtain parental consent to include their infant in the study. Confidentiality of the patient's response and the right of the parents to withdraw their infant from the study without prejudice will be assured for each patient.

My committee for this project includes: Lucile Lewis, R.N., M.S.; Eddy Buerger, R.N., M.S.; and Dr. Chul Cha, Co-Director, NICU. With your permission I would like to begin data collection during the first week in September. I expect to collect data with twenty patients in a period of three to four months. I will be happy to make an appointment with you to discuss this research further if you desire and to share the findings of the study after its completion. Space has been provided on the attached letter from the graduate program for your reply. Thank you for your assistance.

Sincerely,

Valerie Eastman, R.N., B.S.
Graduate Program in Nursing
Loma Linda University
School of Nursing

September 22, 1977

Mrs. Bonnie Wesslen
Supervisor of Neonatal Intensive Care
Loma Linda University Medical Center
Loma Linda, California 92354

Dear Mrs. Wesslen:

As a graduate student in nursing, I am investigating the effects of environmentally induced influences on the neurological maturation and weight gain of the pre-term infant. The study I am planning to do is to meet part of the requirements for a master's degree in nursing at Loma Linda University. I am hereby requesting permission to involve patients and their records from the neonatal intensive care unit at Loma Linda University Medical Center. My research advisor and committee chairman, Lucile Lewis, has approved this research for my thesis. I also have obtained permission from the Ethics in Nursing Research Committee and from Miss Gertrude Haussler, Director of Nursing Service.

The proposed research will study pre-term infants of approximately 32-34 weeks gestational age. Routine nursing care will be patterned around the sleep states of the infants in the experimental group. Infants in this group will be given care when in active sleep or when awake, but they will not be disturbed when in a quiet sleep state. (Sleep states in the pre-term infants usually last no longer than ten to twenty minutes each.) In the control group no attention will be made as to the sleep states of the infant when routine care is delivered. Weekly data will be collected regarding the weight gain the neurological maturation of all the infants in the study. This will be collected for three weeks on each infant. After I have obtained the physician's consent and approval to include each patient in the study, I will then obtain parental consent to include their infant in the study. Confidentiality of the patient's response and the right of the parents to withdraw their infant from the study without prejudice will be assured for each patient.

My committee for this project includes: Lucile Lewis, R.N., M.S.; Eddy Buerger, R.N., M.S.; and Dr. Chul Cha, Co-Director, NICU. With your permission I would like to begin data collection during the fourth week of September. I expect to collect data with twenty patients in a period of three to four months. I will be happy to make an appointment with you to discuss this research further if you desire and to share the findings of the study after its completion. Thank you for your assistance.

Sincerely,

Valerie Eastman, R.N., B.S.
Graduate Program in Nursing
Loma Linda University
School of Nursing

September 22, 1977

Mrs. Marilyn Thunquest
Head Nurse of Neonatal Intensive Care
Loma Linda University Medical Center
Loma Linda, California 92354

Dear Mrs. Thunquest:

As a graduate student in nursing, I am investigating the effects of environmentally induced influences on the neurological maturation and weight gain of the pre-term infant. The study I am planning to do is to meet part of the requirements for a master's degree in nursing at Loma Linda University. I am hereby requesting permission to involve patients and their records from the neonatal intensive care unit at Loma Linda University Medical Center. My research advisor and committee chairman, Lucile Lewis, has approved this research for my thesis. I also have obtained permission from the Ethics in Nursing Research Committee and from Miss Gertrude Haussler, Director of Nursing Service.

The proposed research will study pre-term infants of approximately 32-34 weeks gestational age. Routine nursing care will be patterned around the sleep states of the infants in the experimental group. Infants in this group will be given care when in active sleep or when awake, but they will not be disturbed when in a quiet sleep state. (Sleep states in the pre-term infants usually last no longer than ten to twenty minutes each.) In the control group no attention will be made as to the sleep states of the infant when routine care is delivered. Weekly data will be collected regarding the weight gain and neurological maturation of all the infants in the study. This will be collected for three weeks on each infant. After I have obtained the physician's consent and approval to include each patient in the study, I will then obtain parental consent to include their infant in the study. Confidentiality of the patient's response and the right of the parents to withdraw their infant from the study without prejudice will be assured for each patient.

My committee for this project includes: Lucile Lewis, R.N., M.S.; Eddy Buerger, R.N., M.S.; and Dr. Chul Cha, Co-Director, NIEU. With your permission I would like to begin data collection during the fourth week of September. I expect to collect data with twenty patients in a period of three to four months. I will be happy to make an appointment with you to discuss this research further if you desire and to share the findings of the study after its completion. Thank you for your assistance.

Sincerely,

Valerie Eastman, R.N., B.S.
Graduate Program in Nursing
Loma Linda University
School of Nursing

APPENDIX B

LETTERS GRANTING PERMISSION TO CONDUCT THE STUDY

PHYSICIAN CONSENT FORM

EXPLANATION TO THE PARENTS AND CONSENT FORM ma Linda University Medical Center

te: 5-25-77

ar Valerie:

ur request for permission to collect data for your research project at ma Linda University Medical Center has been received and reviewed. The llowing action has been taken:

✓ You have my permission to conduct your study in our facility.

_ Your request has been temporarily denied pending provision of additional information.

_ Your request cannot be granted at this time.

.so, it will be necessary for you to:

✓ Obtain permission from the attending physician since your study involves patients and/or their records.

✓ Obtain additional permission from Bonnie Wissler and Marilyn Thunquest

_ Notify and/or advise the following persons of your study.

_ Make an appointment with ____________________ for additional discussion and information provision.

_ Other

: I can be of further help, please let me know.

.ncerely,

Gertrude Haussler

ertrude L. Haussler, M.S.
ssistant Administrator
ırsing

ᴍA LINDA UNIVERSITY

LOMA LINDA, CALIFORNIA 92354

Medical Center

ɜeptember 26, 1977

Dear Valerie Eastman,

Your request for permission to collect data for your research project at Loma Linda University Medical Center has been received and reviewed. You have my permission to conduct your study in this facility. If I can be of any help, please let me know.

Sincerely,

Bonnie Wesslen

Bonnie Wesslen
Director of Module 1

MA LINDA UNIVERSITY

LOMA LINDA, CALIFORNIA 92354

Medical Center

September 26, 1977

Valerie Eastman, RN,BS
Graduate Program in Nursing
Loma Linda University
School of Nursing

Dear Valerie,

I have read your research proposal and feel that your findings could have an impact on the delivery of care in the Neonatal Intensive Care Unit.

We are happy to grant you permission for data collection in the unit and will be glad to cooperate in any way we can.

Sincerely,

Marilyn

Marilyn Thunquest
Head Nurse
Neonatal Intensive Care.

LOMA LINDA UNIVERSITY
Graduate Program in Nursing

Approval Date: January 18, 1977

Dear Mrs. Eastman:

The Ethics in Nursing Research Committee has reviewed the proposal you submitted for a research study to partially fulfill the School of Nursing requirements for a Master of Science degree from Loma Linda University.

The committee has voted that your study is:

__x__ Approved as submitted. Consent of parents will be required as you have indicated in your proposal.

_____ Approved after the attached recommended changes have been made and a memo from your committee chairman to this effect has been received by the committee chairman.

_____ Not approved as submitted to the committee. See the attached comments for recommended changes. Must be resubmitted prior to any data collection.

_____ Deferred to: ___ URACHE ___ Major Advisor ___ Research Chairman

___ Other ___ Advisor

Please see attached comments regarding this action.

Please contact the Chairman of the Ethics in Nursing Research Committee if you have questions related to the decision of the Committee. If any changes are made in the hypothesis, tool, consent form, or the procedure for data collection, this proposal must be resubmitted to this Committee.

We pray that the Lord will continue to bless your endeavors.

Sincerely,

Evelyn L. Elwell, Chairman
Ethics in Nursing Research Committee

ELE:lw

cc: Research Committee Chairman - Lucile Lewis

PHYSICIAN CONSENT FORM

As a graduate student in nursing, I am investigating the effects of environmentally induced influences on the neurological maturation and weight gain of the pre-term infant. The study I am planning to do is to meet part of the requirements for a master's degree in nursing at Loma Linda University. Permission to conduct this study has been obtained from the Ethics in Nursing Research Committee; Ms. Gertrude Haussler, Director of Nursing; Mrs. Bonnie Wesslen, Director of Module I; Mrs. Marilyn Thunquest, Head Nurse, NICU; and the members of my thesis committee, Ms. Lucile Lewis, Dr. Chul Cha, and Ms. Eddy Buerger. I am hereby requesting permission to involve your patients and their records in this study, which is explained in more detail below.

CRITERIA FOR SAMPLE SELECTION

1. Conceptual age of 31-35 weeks at the time of study.
2. Birth weight of 1100-3000 grams (appropriate for gestational age, 31-35 weeks, tenth to ninetieth percentile).
3. No diagnosis of neurological pathology as determined by the physician and/or the neonatal intensive care clinical nurse specialist.
4. Bililight not in use and the indirect bilirubin level less than 10 milligrams per cent during the study.
5. No recurrent hypoglycemia after the second day of life.
6. No laboratory confirmed sepsis unless clinically asymptomatic and on antibiotics longer than three days.
7. No respiratory distress requiring oxygen therapy while on the study and no history of being on the respirator longer than one week.
8. Temperature stable in a neutral thermal environment.

DATA COLLECTION

The proposed research will study pre-term infants of approximately 32 weeks gestational age. Routine nursing care will be patterned around the sleep states of the infants in the experimental group. Infants in this group will be given care when in active sleep or when awake, but they will not be disturbed, unless necessary, when in a quiet sleep state. (Sleep states in the pre-term infants usually last no longer than 10 to 20 minutes each.) In the control group no attention will be made as to the sleep states of the infant when routine care is delivered. Weekly data will be collected regarding the weight gain and neurological maturation of all the infants in the study. This will be collected for three weeks on each infant. The neurological examinations will be done by Ms. Eddy Buerger. Parental consent will be obtained and confidentiality of the patient's response and the right of the parents to withdraw their infant from the study without prejudice will be assured for each patient.

I hereby consent to permit Valerie D. Eastman, R.N., under the supervision of Lucile Lewis of Loma Linda University to include my patients in the research study as described in the previous paragraphs. I understand that I am free to withdraw my permission at any time, and that parental consent will also be obtained.

____
Signed

____
Date

____
Witness

EXPLANATION TO THE PARENTS AND CONSENT FORM

With your permission, your baby will be included in a study conducted by an R.N. with a college degree and working on her master's degree in nursing, guided by the attending doctors on the floor (Dr. Cha and Dr. Swarner). It consists of letting your baby receive the benefits of sleep by not waking him for routine nursing procedures. This will in no way reduce the quality of nursing care your baby receives. It means that the nurse will let your baby sleep 15-20 minutes longer at times before changing his diaper or feeding him. It is anticipated that this will help your baby establish his sleeping habits while in the hospital and possibly promote his weight gain and neurological development, though this cannot be guaranteed. This study will not interfere adversely with your baby's growth and development in any way.

* * * * *

I have considered the above statements and hereby give my free and voluntary consent to have my baby participate in this study under the supervision of Valerie Eastman, R.N., Loma Linda University, and in witness thereof I have signed this consent. I understand that I am free to withdraw my baby from participation in the study at any time without resulting in any prejudice toward me or my baby.

____
Signed

____
Date

____
Witness

APPENDIX C

Figure 1

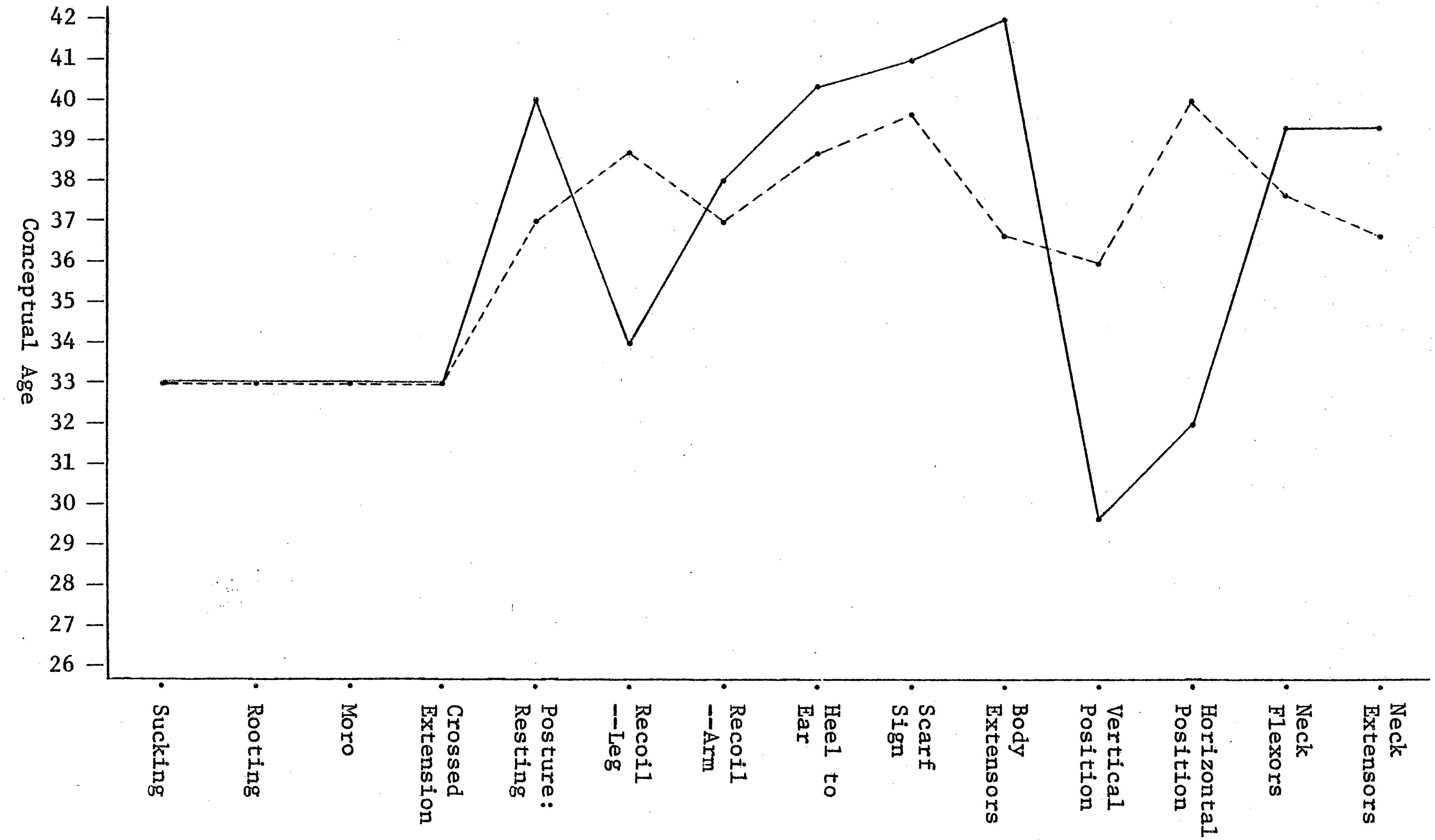

Figure 1

Neurological Examination: Comparative Results of an Infant Having a Respirator History vs. an Infant Not Having a Respirator History at Time of Hospital Discharge

APPENDIX D

RESPONSIBILITIES OF THE EXPERIMENTAL NURSE

RESPONSIBILITIES OF THE EXPERIMENTAL NURSE

The focus of this study is "quiet sleep" time of the infant. The aim is to promote this quiet sleep time by not interrupting him at this time. This means that all procedures (except emergency procedures and those procedures which cannot be delayed such as x-rays, I.V.'s, etc.) should be done while he is awake or when he is in active sleep. Sleep states in the premature infants usually last no longer than 10 to 20 minutes each.

Whenever the infant has to be awakened during quiet sleep, this should be recorded on his data sheet along with the reason for his being awakened. Please make sure the data sheet is totally filled out each shift.

Each infant will be included in the study for three weeks, and Eddy Buerger will be performing neurological assessments on all of the infants in the study. Thank you for participating!!

Valerie Eastman

Criteria to follow for sleep states:

<u>Quiet Sleep Identification</u>
Sleep in which all of the following are observed:

No eye movements

Absence of facial movements

No body movements except explosive body jerks

Regular respiration

Regular heart rate

<u>Active Sleep Identification</u>
Sleep in which any of the following are observed:

Eye movements

Facial movements

Frequent small body movements

Irregular respiration

Irregular heart rate

APPENDIX E

BEDSIDE DATA SHEET

BEDSIDE DATA SHEET

Patient____________________________

Date_______________________ Shift #_________

Quiet sleep disturbances:

Check if occurs	Reason why infant was awakened
____	____
____	____
____	____
____	____
____	____

Total number of disturbances this shift _________

Nurse's signature____________________________________

Date_______________________ Shift #_________

Quiet sleep disturbances:

Check if occurs	Reason why infant was awakened
____	____
____	____
____	____
____	____
____	____

Total number of disturbances this shift _________

Nurse's signature____________________________________

Date_______________________ Shift #_________

Quiet sleep disturbances:

Check if occurs	Reason why infant was awakened
____	____
____	____
____	____
____	____
____	____

Total number of disturbances this shift _________

Nurse's signature____________________________________

APPENDIX F

DATA COLLECTION SHEET

DATA COLLECTION SHEET

Subject ____________________ Birth Weight ____________________

Date of Birth ____________________

____________________ neurological examination

Part I:	Score		Score
Sucking	____	Tone: Heel to ear	____
Rooting	____	Scarf sign	____
Moro	____	Body extensors	____
Crossed extension	____	Vertical position	____
Posture: resting	____	Horizontal position	____
Recoil--leg	____	Neck flexors	____
Recoil--arm	____	Neck extensors	____

Part II:

Orientation Response--Inanimate Visual	____
Difficulty in eliciting responsivity	____
Orientation Response--Inanimate Auditory	____
Difficulty in eliciting responsivity	____
Orientation Response--Animate Visual	____
Difficulty in eliciting responsivity	____
Orientation Response--Animate Auditory	____
Difficulty in eliciting responsivity	____
Orientation Response--Animate Visual and Auditory	____
Difficulty in eliciting responsivity	____
Alertness	____
General tone	____
Posture--spontaneous	____
Posture--with manipulation	____
Tremulousness (all states)	____
Amount of startle during the examination	____
Lability of skin color	____

Today's weight ____________________

APPENDIX G

NEUROLOGICAL EXAMINATION

NEUROLOGICAL EXAMINATION

Description and Scoring System

PART I--Description

Sucking. The suck of the infant was elicited by the examiner inserting her fifth finger into the infant's mouth.

Rooting. The rooting reflex in the infant was elicited by gently brushing the infant's cheek from the corner of his mouth outward.

Moro. A gentle technique was used to elicit this reflex with the premature infants: the baby was lifted a few centimeters off the bed by holding both hands and then suddenly letting go.

Crossed extension. While the sole of one foot was rubbed and the same leg held in extension, the response of the opposite leg was observed.

Resting posture. The posture of the infant was observed while the infant was lying in his bed.

Recoil--leg. The rapidity of recoil of the leg was observed when holding it straight for 30 seconds then letting it go.

Recoil--arm. This reflex was elicited in the arm in the same manner as the recoil--leg.

Heel to ear. With the infant in a prone position the arms are kept straight and bent up and back, as far as possible, toward the infant's head.

Scarf sign. In this maneuver the infant's hand was put around his neck and as far posteriorly as possible over the opposite shoulder.

Body extensors. The body extensor tone was tested by holding the infant upright and observing straightening of the trunk.

Vertical positions. Tone again was tested by holding the infant upright under his arms and noting his ability to support himself.

Horizontal positions. Holding the infant horizontally over the examiner's hand, the infant's position was observed.

Neck flexors. With the infant lying on his bed, the infant's hands were grasped and he was slowly pulled to the sitting position; the position of the head in relation to the trunk was observed.

Neck extensors. With the infant sitting, and the head hanging down on the chest, the trunk was slowly moved backward and the reaction of the head was observed.

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Sucking	Weak--not synchronized with swallowing 1						stronger synchron. 2			perfect 3			perfect--hand to mouth 4				
Rooting	Long latency period slow, imperfect 1				hand-to-mouth 2					brisk, complete, durable 3							
Moro	Weak not elicited every time 1						stronger 2			arm extension and cry 3			complete--all three components 4				
Crossed Extension	Flexion, extension in a random, purposeless pattern 1						extension no adduct. 2			still incomplete 3			extension, adduction fanning of toes 4				
Resting Posture	Hypotonic 1				2		stronger 3		frog-like 4		flexion all limbs 5		hypertonic 6				
Recoil --leg	No recoil 1						Partial recoil 2						Prompt 3				
Recoil --arm	No recoil 1						Begin flexion--no recoil 2				Prompt recoil--may be inhibited 3						
Heel-to-ear	1				2		3		4		5		6				
Scarf sign	No resistance 1						More limited 2				Elbow slightly past midline 3				Almost midline 4		
Body Extensors						Brief support 1		Transitory Straighten 2			Good straightening when upright 3				4		
Vertical Positions	When held under arms, body slips through hands 1								Arms hold baby 2		Legs flexed, good support with arms 3						
Horizontal Positions	Hypotonic arm and legs straight 1										Arms and legs flex 2		Head and back even 3				
Neck Flexors (head lag)	No movement of the head 1					(face view) Head rolls 2			Head passes trunk 3				Head maintained few seconds 4			5	
Neck Extensors	Head begins to lift but falls 1					Head passes trunk 2			Good straightening --not maintained 3				Head maintained few seconds 4			More than few sec. 5	
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

Part II

The following sections that comprised "Part II" of the neurological examination have been described by Brazelton (1976) and are briefly discussed below. Both the description and the scoring system will appear together.

Orientation Responses--Inanimate Visual--With the infant in an alert state, his ability to fix on a visual object and follow it horizontally for brief excursions was observed.

Score:
1 Does not focus on or follow stimulus.
2 Stills with stimulus and brightens.
3 Stills, focuses on stimulus when presented, brief following.
4 Stills, focuses on stimulus, following for 30° arc, jerky movements.
5 Focuses and follows with eyes horizontally for at least a 30° arc. Smooth movement, loses stimulus but finds it again.
6 Follows for two 30° arcs, with eyes and head. Eye movements are smooth.
7 Follows with eyes and head at least 60° horizontally, maybe briefly vertically, continuous movement, loses stimulus occasionally, head turns to follow. Eye movements are smooth.

Difficulty in eliciting responsivity:

1- response can be obtained with ease.
2- several maneuvers needed to elicit optimal response.
3- response is achieved only with great difficulty and responsivity is very precarious and/or baby fatigues easily.

Orientation Response--Inanimate Auditory--The infant's response to a rattle or soft bell was observed when he was in an alert state.

Score:
1 No reaction.
2 Respiratory change or blink only.
3 General quieting as well as blink and respiratory changes.
4 Stills, brightens, no attempt to locate source.
5 Shifting of eyes to sound, as well as stills and brightens.
6 Alerting and shifting of eyes and head turn to source.
7 Alert, head turns to stimulus, and search with eyes.

Difficulty in eliciting responsivity:

1- response can be obtained with ease.
2- several maneuvers needed to elicit optimal response.
3- response is achieved only with great difficulty and responsivity is very precarious and/or baby fatigues easily.

Orientation Response--Animate Visual--The next three responses were elicited by the examiner giving social cues such as cuddling, holding, rocking, and/or talking to the infant. In this "visual only" item the examiner placed his face in the infant's line of vision then moved it slowly in lateral and vertical arcs until the infant stopped following.

Score: 1 Does not focus on or follow stimulus.
2 Stills with stimulus and brightens.
3 Stills, focuses on stimulus when presented, brief following.
4 Stills, focuses on stimulus, follows for 30° arc, jerky movements.
5 Focuses and follows with eyes horizontally for at least a 30° arc. Smooth movement, loses stimulus but finds it again.

Difficulty in eliciting responsivity:

1- response can be obtained with ease.
2- several maneuvers needed to elicit optimal response.
3- response is achieved only with great difficulty and responsivity is very precarious and/or baby fatigues easily.

Orientation Response--Animate Auditory--The attention of the infant was observed as the examiner removed his face from the infant's line of vision and talked to him from one side.

Score: 1 No reaction.
2 Respiratory change or blink only.
3 General quieting as well as blink and respiratory changes.
4 Stills, brightens, no attempt to locate source.
5 Shifting of eyes to sound, as well as stills and brightens.
6 Alerting and shifting of eyes and head turns to source.
7 Alerting, head turns to stimulus, and search with eyes.

Difficulty in eliciting responsibity:

1- response can be obtained with ease.
2- several maneuvers needed to elicit optimal response.
3- response is achieved only with great difficulty and responsivity is very precarious and/or baby fatigues easily.

Orientation Response--Animate Visual and Auditory--This maneuver was a combination of the previous two sections of the neurological examination.

Score: 1 Does not focus on or follow stimulus.
2 Stills with stimulus and brightens.
3 Stills, focuses on stimulus when presented, brief following.
4 Stills, focuses on stimulus, follows for 30° arc, jerky movements.
5 Focuses and follows with eyes horizontally for at least a 30° arc. Smooth movement, loses stimulus but finds it again.
6 Follows for two 30° arcs, with eyes and head. Eye movements are smooth.
7 Follows with eyes and head at least 60° horizontally, maybe briefly vertically, partly continuous movement, loses stimulus occasionally, head turns to follow.

Difficulty in eliciting responsivity:

1- response can be obtained with ease.
2- several maneuvers needed to elicit optimal response.
3- response is achieved only with great difficulty and responsivity is very precarious and/or baby fatigues easily.

Alertness--The neurological examiner assessed the frequency of the best periods of alertness as shown by his responsivity to the examiner within these best periods.

Score: 1 Inattentive--rarely or never responsive to direct stimulation.
2 When alert responsivity brief and generally quiet delayed--alerting and orientation very brief and general.
3 When alert responsivity brief and somewhat delayed--quality of alertness variable.
4 When alert responsivity somewhat brief but not generally delayed through variable.
5 When alert responsivity of moderate duration and response generally not delayed and less variable.
6 When alert responsivity moderately sustained and not delayed. May use stimulation to come to alert state.
7 When alert episodes are of generally sustained duration, etc.
8 Always has sustained periods of alertness in best periods. Alerting and orientation frequent and reliable. Stimulation brings infant to alert state and quiets infant.

General Tone--This scored the motor tone of the infant in his most characteristic state of responsiveness.

Score: 1 Flaccid, limp like a rag doll, no resistance when limbs are moved, complete head lag in pull to sit.
2 Little response felt as he is moved, but less than about 25% of the time.
3 Flaccid, limp most of the time, but is responsive about 25% of the time with some tone.

4 Some tone half the time, responds to being handled with some tone less than half the time.
5 Tone when handled, lies in fairly flaccid state in between handling.
6 Variable tone in resting, responsive with good tone as he is handled approximately 75% of the time.
7 Is on the hypertonic side approximately 50% of the time.
8 When handled he is responsive with hypertonicity about 75% of the time.
9 Hypertonic at rest (in flexion) and hypertonic all the time (abnormal).

Spontaneous Posture--The posture of the infant was observed when he was not being handled by the examiner.

Score: 1 Organized with some flexion.
2 Frog-like arm and leg posture.
3 Much hand on face and sudden arm and leg extensions.

Posture with Manipulation--The posture of the infant was observed when being handled by the examiner.

Score: 1 Organized arm and leg coordination.
2 Some discoordination between arms and legs.
3 Much separation of organization of arms and legs.

Tremulousness--The examiner observed any tremulousness demonstrated by the infant during the examination.

Score: 1 No tremors or tremulousness noted.
2 Tremors only during sleep.
3 Tremors only after the Moro or startles.
4 Tremulousness seen 1 or 2 times in states 5 or 6.
5 Tremulousness seen 3 or more times in states 5 or 6.
6 Tremulousness seen 1 or 2 times in states 3, 4, sleep and crying.
7 Tremulousness seen 3 or more times in state 4.
8 Tremulousness seen in several states.
9 Tremulousness seen consistently in all states.

Amount of Startle During the Examination--Both spontaneous startles and those which had been elicited in the course of stimulation were included in this.

Score: 1 No startles noted.
2 Startle as a response to the examiner's attempts to set off a Moro reflex only.
3 Two startles, including Moro.
4 Three startles, including Moro.
5 Four startles, including Moro.
6 Five startles, including Moro.
7 Seven startles, including Moro.
8 Ten startles, including Moro
9 Eleven or more startles, including Moro.

Lability of Skin Color--The infant's skin color was observed as he was handled during the examination.

Score: 1 Pale, cyanotic, and does not change during the exam.
2 Good color which changes only minimally during the exam.
3 Healthy skin color; no changes except change to slight blue around the mouth or extremities when uncovered, or to red when crying; recovery of original color is rapid.
4 Mild cyanosis around mouth or extremities when undressed; slight change in chest or abdomen, but rapid recovery.
5 Healthy color but changes color all over when uncovered or crying; face, lips, extremities may pale or redden; mottling may appear on face, chest, limbs; original color returns quickly.
6 Change in color during exam, but color returns with soothing or covering.
7 Healthy color at outset, changes color to very red or blue when uncovered or crying; recovers slowly if covered or soothed.
8 Good color which rapidly changes with uncovering; recovery is slow but does finally recover when dressed.
9 Marked, rapid changes to very red or blue, no recovery to good color during rest of exam.
NA Jaundice

APPENDIX H

Figure 2

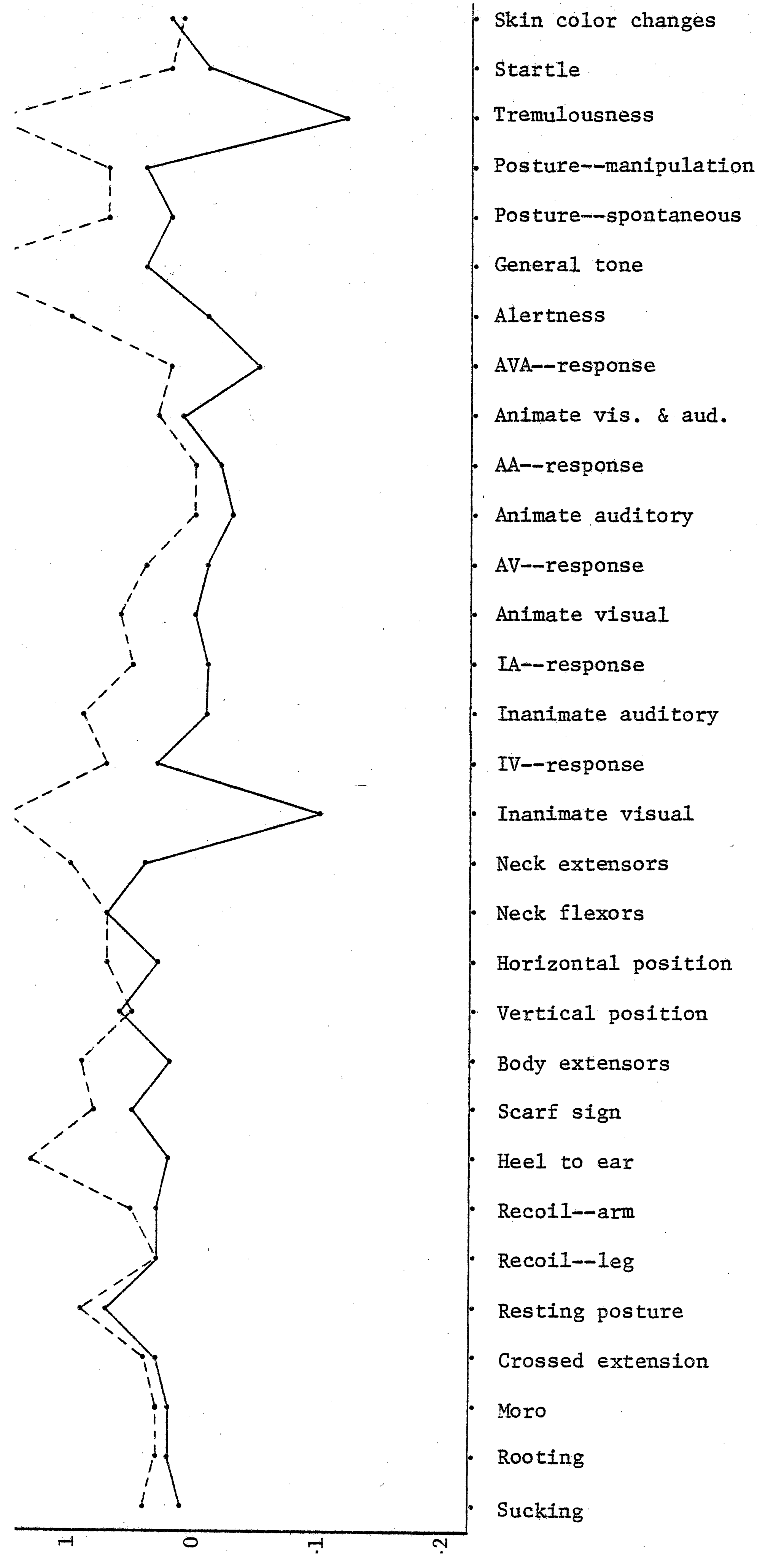

Figure 2

Differences Between the Initial and Final Means of the Neurological Examination Segments of the Experimental and Control Groups

—— Control

- - Experimental

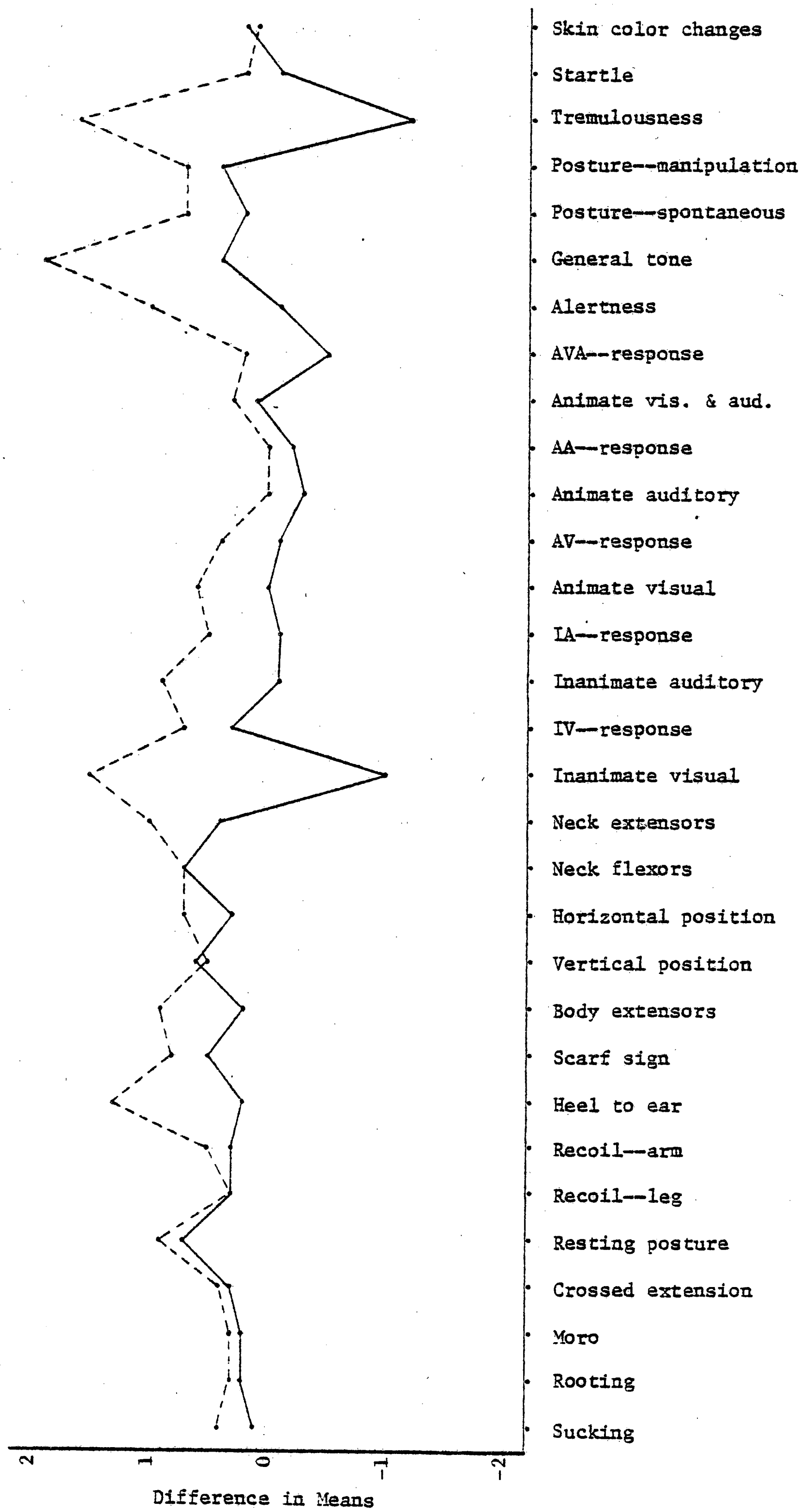

Figure 2

Differences Between the Initial and Final Means of the Neurological Examination Segments of the Experimental and Control Groups

APPENDIX I

Table 4

Table 4

Weight, Neurological Examination and Covariate Data for the Control and Experimental Groups

Subjects	Number of Weeks Studied	Gestational Age at Entry	Septicemia	Weight		Sucking		Rooting		Moro		Crossed Extension		Resting Posture		Recoil —leg		Recoil —arm		Heel-to ear		Scarf Sign		Body Extensors		Vertical Position	
				Initial	Final	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Control Subjects																											
1	3	34	No	1740	2160	2	2	2	2	2	2	2	2	2	4	2	2	2	2	2	3	2	3	2	2	2	3
2	3	33	Yes	1680	2025	2	2	2	2	2	2	2	2	3	4	2	3	3	3	3	4	3	4	4	4	2	3
3	1	33	No	1690	1720	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	1	1	1	1
4	3	34	Yes	1580	2060	2	2	2	2	2	2	2	2	3	3	2	2	2	2	3	3	3	3	3	3	1	2
5	2	35	No	2100	2211	2	2	2	2	2	2	2	2	3	3	2	2	2	2	3	3	2	3	3	3	1	1
6	1	34	No	1660	1710	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	3	2	2	1	1
7	2	32	Yes	1660	1860	2	2	1	2	2	2	2	2	4	4	1	2	1	2	1	2	2	3	2	3	1	2
8	1	35	Yes	2010	2100	2	2	2	2	2	2	2	2	3	4	2	3	2	3	3	2	3	2	3	4	1	2
9	1	35	No	1810	1870	2	3	2	2	2	2	2	2	3	4	3	3	3	3	3	3	2	2	3	3	2	2
10	2	33	Yes	1720	1910	2	3	2	2	2	3	1	3	2	4	2	2	2	2	3	3	2	3	2	2	1	2
11	2	32	No	1180	1320	2	2	1	2	1	2	1	2	4	4	2	2	2	2	3	3	2	3	1	2	1	2
Experimental Subjects																											
1	3	32	Yes	1240	1560	2	2	2	2	2	2	2	2	1	1	1	1	2	1	1	2	1	2	1	2	1	1
2	2	35	No	1900	2010	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	4	4	2	2
3	2	34	No	1720	2210	2	2	2	2	2	2	2	2	3	4	2	2	3	2	2	3	3	4	2	3	1	2
4	1	35	Yes	1890	2020	2	2	2	2	2	2	2	2	1	4	2	2	2	3	2	5	3	4	3	4	1	1
5	3	34	Yes	1510	2100	2	2	2	2	2	2	2	2	1	4	2	3	2	3	2	3	2	4	1	4	1	1
6	1	35	No	1880	2018	2	2	2	2	2	2	2	2	5	5	3	3	3	3	3	5	3	4	3	3	2	3
7	2	33	No	1710	1960	2	2	1	2	2	2	2	2	3	3	2	3	2	3	2	3	2	3	3	4	1	2
8	2	32	Yes	1640	1980	1	2	1	2	1	2	1	2	1	4	1	2	1	2	2	3	3	3	1	2	1	2
9	3	33	Yes	1700	1860	2	4	2	3	2	3	2	3	4	4	2	2	2	3	4	5	1	2	1	2	1	2
10	1	33	No	1840	1920	2	2	2	2	2	2	2	3	4	4	2	2	2	3	3	4	2	3	2	3	2	3
11	1	35	No	1680	1790	2	2	2	2	2	3	2	3	4	4	2	2	2	2	4	4	2	2	2	2	2	2

Subjects	Horizontal Position		Neck Flexors		Neck Extensors		Inanimate Visual (IV)		IV Response		Inanimate Auditory (IA)		IA Response		Animate Visual (AV)		AV Response	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Control Subjects																		
1	1	1	2	2	3	2	4	3	2	3	6	6	2	1	4	4	1	2
2	2	3	1	4	1	3	5	3	2	2	7	4	1	3	5	3	1	1
3	1	1	2	2	2	2	3	3	3	3	6	6	2	2	4	4	2	2
4	1	1	3	4	3	4	1	1	3	3	4	4	2	3	4	2	2	3
5	1	1	3	3	3	3	5	6	1	1	6	6	1	1	5	5	1	1
6	1	1	2	2	2	2	2	1	3	3	6	6	2	2	4	4	2	2
7	1	2	2	3	1	3	1	3	3	2	2	2	2	2	4	4	2	2
8	2	3	3	4	3	4	1	6	3	1	5	6	1	1	1	5	3	2
9	1	2	3	4	3	3	2	2	2	1	3	4	2	1	3	3	3	3
10	1	1	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
11	1	1	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
Experimental Subjects																		
1	1	1	1	2	1	1	1	1	3	3	3	3	2	2	3	2	2	2
2	1	2	3	4	2	3	2	5	3	1	5	5	2	1	2	3	3	1
3	1	2	2	3	1	2	2	3	3	2	3	4	2	2	3	4	3	2
4	1	1	2	2	1	2	1	1	3	3	2	1	3	3	1	1	3	3
5	1	1	1	3	1	3	2	2	3	2	3	4	2	2	5	3	1	2
6	1	2	4	4	4	4	5	6	1	1	6	6	1	1	5	5	1	1
7	1	3	4	4	1	4	1	4	3	2	4	6	3	2	4	3	1	1
8	1	2	2	3	2	3	1	4	3	3	1	4	3	1	1	7	3	2
9	1	2	2	3	1	2	2	4	3	2	3	5	2	1	3	4	2	1
10	1	2	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
11	1	1	2	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-

Subjects	Animate Auditory (AA)		AA Response		Animate Vis. & Aud. (AV/A)		AV/A Response		Alertness		General Tone		Posture Spontaneous		Posture Manipulation		Tremulousness		Startle		Skin Color	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Control Subjects																						
1	6	5	1	1	5	4	1	1	6	4	7	3	2	1	2	1	5	2	2	2	2	2
2	7	6	1	1	5	6	1	1	7	5	7	7	1	1	2	1	1	6	2	2	2	3
3	6	6	1	1	4	4	1	1	3	3	1	2	2	2	2	2	4	5	2	2	3	3
4	6	5	1	3	4	3	1	3	3	2	7	7	1	1	1	1	5	6	2	2	2	3
5	6	7	1	1	6	6	1	1	6	6	7	7	1	1	1	1	7	7	2	2	3	3
6	6	6	1	1	3	3	1	2	2	3	4	4	2	2	2	2	6	8	2	2	3	3
7	6	5	2	2	4	4	1	2	2	4	4	6	2	3	2	2	2	7	2	3	3	3
8	7	6	1	2	4	6	1	1	6	5	7	8	1	1	1	1	1	1	2	2	3	3
9	4	5	2	1	2	2	2	2	3	5	4	7	2	1	2	1	1	1	2	2	2	2
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Experimental Subjects																						
1	6	5	1	2	6	3	1	2	2	3	3	4	3	2	3	2	4	1	2	2	2	3
2	6	6	2	1	3	4	1	1	6	5	7	7	1	1	1	1	4	3	2	2	2	3
3	4	4	1	1	3	3	2	2	2	4	7	7	1	1	1	1	1	1	2	2	2	3
4	6	1	2	3	3	1	3	3	1	1	2	7	3	3	3	2	6	1	2	2	3	3
5	6	6	1	1	4	6	1	1	2	3	3	7	3	1	3	1	6	1	3	2	2	3
6	7	7	1	1	6	6	1	1	6	6	7	7	1	1	1	1	7	7	2	2	3	3
7	6	6	1	1	6	3	1	1	5	5	8	8	2	1	2	1	8	1	2	2	7	2
8	1	5	3	2	1	7	3	1	1	4	3	6	2	2	2	3	2	6	2	4	3	3
9	4	6	1	1	4	6	1	1	3	6	3	7	3	1	3	1	3	6	4	1	4	6
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-