HEALTH AND DEVELOPMENTAL STATUS OF INFANTS
AT BIRTH AND AT FOUR MONTHS AS A FUNCTION
OF MATERNAL HEALTH INDEX SCORES

by

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ABSTRACT

In the present study 28 children were evaluated at the neonatal period and at four months to determine if development could be predicted prenatally by the use of the Maternal Health Index. Fifteen of the 28 infants had abnormalities at the neonatal examination and five had remaining abnormalities at four months. Among the most frequently seen abnormalities were hip clicks and high pitched cries.

The results of the study indicated that the Maternal Health Index has not predicted the abnormalities seen in these infants.
CHAPTER I

INTRODUCTION

The status of maternal and child health is a reliable index of the caliber of overall health care in any social system, e.g., society, nation, or ethnic group (Jacobson & Reid, 1964). As an index, the status of maternal and child health in the United States indicates that the general health care in the country is comparatively low. Chase (1967) reported that in 1964 when comparing seven countries, the United States had the highest rate of infant mortality. Although Chase noted a significant downward trend in infant mortality rates since 1950, she reported that infant mortality is not declining as fast as it formerly did. She reported that an acceleration of the decline in infant mortality would require concerted effort by the medical profession, hospitals, government and community agencies, along with a rise in the personal initiative of prospective mothers.

Perinatal morbidity is not only related to general health care but, also, has a multifaceted effect on the families involved. Jacobson and Reid noted that in many situations (e.g., permanent nervous system damage to the newborn, perinatal morbidity and mortality) there is both psychological and economic impact on the family unit. Except for relief or modification of symptomology, some conditions, presently, do not appear to respond to
curative measures. Since conditions, such as mental retardation and cerebral palsy, do not appear curable, health care assets should be directed towards the prevention of such conditions. Considerable attention should be directed toward those complications of pregnancy from which many of these cases are derived, not the least of which is premature births.

Shapiro, Ross, and Levine (1965) did an extensive study of pregnancy complications in the New York City area. Out of 5,984 pregnancies recorded, about one in four ended in a loss or disability: 14 per cent in a fetal death, 0.8 per cent in a neonatal death, 4.5 per cent in a surviving child who had a significant anomaly, and another 4.0 per cent in a low birth-weight child which had no anomaly. A significant anomaly was defined as an abnormality the presence of which would probably make a difference in his life. This may be either by affecting his survival or by necessitating parental, medical, surgical, educational and/or public attention which is not required by the majority of the individuals of his age.

Shapiro et al. (1965) stated that the primary target of their research was to develop leads to some of the biological and environmental factors which are influencing fetal loss, mortality in early childhood, prematurity, congenital anomalies and other morbidity among the liveborn. Some of the conditions observed during the pregnancies were: (1) allergic diseases, (2) acute respiratory infections and inflammations, (3) urinary tract infections and inflammations, (4) acute monor localized infections and inflammations.
(excluding gynecological and respiratory), (5) accidents, (6) poisonings, (7) violence, and (8) antepartum bleeding. Also considered were the mothers' prior pregnancy complications, if any, and parity.

Goodwin, Dunne, and Thomas (1969) conducted a similar observational study of situations (prior obstetrical complications, parity, age, certain medical conditions, antepartum bleeding) which may have an influence on the outcome of the pregnancy. He went on to use these factors to assess pregnant women and to select high risk pregnancies for intensive management before, during, and after labor. High risk pregnancy was defined as a pregnancy in which some feature of the maternal environment or reproductive performance in the past represented a substantial risk to fetal well-being.

The method developed by this group divided the assessment of the antepartal fetal risk into three categories; (1) the status of the woman as the pregnancy began; (2) the complications which had developed during the pregnancy; and (3) the gestational age reached at the time of scoring. The scores ranged from 0 to 10, with 0 denoting the lowest potential risk and 10 the highest. None of the 144 perinatal deaths scored 0, and none of the 792 survivors scored higher than 6.

As a result of a study conducted in Colorado and Utah from 1963 to 1969, the Maternal Health Index (MHI) (Rubbelke & Waller, 1969) (Appendix 1) was developed as an objective nursing device useful in the identification of a high risk mother and her allocation toward high priority care. This method
of assessment included forty "predictors of outcome." Examples of the
predictors are: (1) age over 35 or under 15; (2) parity 5 or over; (3) com-
plications of previous pregnancies; (4) complications of the current preg-
nancy. Nurses used the MHI at the time of a patient's first antepartum
examination to assess her condition and to assign her to a low, moderate,
or high risk category. During the course of her pregnancy, a woman was
reclassified as her condition changed. In a group of 292 women, unfavor-
able outcomes were predicted correctly in 93 percent of the cases. Unfavor-
able outcomes for the infant included fetal deaths, neonatal deaths, newborn
morbidity, congenital anomalies, and low birth-weights. For the mother
unfavorable consequences included obstetrical complications of a pregnancy,
labor, or delivery, increased severity of medical complications, and post
partum morbidity (Rubbelke & Waller, 1969).

The fetal and early childhood period of life is a time of crucial develop-
ment. Early detection of anomalies and early institution of treatment are
essential for effective treatment as well as the acceptance of the condition by
both the child and his parents. Several studies have developed tools for
identification of the fetus at risk. The purpose of the present study is to
ascertain whether one of those methods could effectively predict the health
and developmental state of the child beyond the fetal stage. Is the probability
of delayed development or developmental anomalies greater in the child whose
mother was classified high risk by the MHI during her pregnancy? At four
months of age, will the developmental condition of infants whose mothers were classified high risk be significantly different than that of infants whose mothers were classified low or moderate risk?
CHAPTER II

METHOD

Subjects. The subjects in this study were 28 infants born at the University of Utah Medical Center, a 275 bed general and research hospital with a 19 bed obstetrical unit and a 20 crib capacity newborn nursery. The Ss were born between April 17, 1970, and May 18, 1970. During the period of their neonatal hospitalization each of these infants was included in the population of a newborn study (Chinn, 1970). Of the fifty infants from the original newborn population, 28 were available for examination at the age of four months. Approximately one-half of the 50 mothers received their prenatal care at UUMC prenatal clinic and MHI scores were derived at that time.

Examination Materials. The newborn examination utilized the Neonatal Examination and the Neonatal Neurological Examination. The purpose of these examinations, as used in the present study, was to detect and record evidences of stress, injury, congenital malformation and disease in the infant in the first few days after birth (The Collaborative study on cerebral palsy, 1966) (Appendix 2).

To determine developmental status at four months, two standardized examinations were used: (1) The Denver Developmental Screening Test,
which was developed to aid in the early detection of delayed development in young children. Administration of the test is easily learned and its use by nursing personnel enables the examiner to note whether the development of a child is within the normal range. Although it was not developed specifically for diagnostic purposes, it allows the examiner to identify areas of development which should be examined further by screening normal from abnormal (Frankenburg & Dodds, 1967) (Appendix 3).

(2) The 4-month Pediatric Examination was developed by the National Institute of Health to detect evidences of injury or disease in the infant, with particular emphasis on differentiating those conditions related to the prenatal or perinatal period from those acquired in the postnatal period (The Collaborative study on cerebral palsy, 1966) (Appendix 4).

Procedure. The newborn examination was done in the newborn nursery of the University of Utah Medical Center. Each child was examined three times during his neonatal hospitalization as a function of the newborn study (Chinn, 1970).

The four month examination was done by appointment at the child's home in Salt Lake or Davis County between August 15, 1970 and September 15, 1970. During July, each mother was contacted by a letter (Appendix 5) stating the purpose of the examination, and that she would be contacted by telephone.
At the time set, the examiner visited the home, and conducted the examination in the presence of the mother.

During the examination the mother was asked whether the child had been ill since his birth, and whether she had seen a physician regularly for well child examinations. If the child was not being seen regularly by a physician, the mother was encouraged to begin regular well child care for the child as soon as possible. During this visit, questions were answered for the mother regarding the growth and development of the child.
CHAPTER III

RESULTS

Of the 50 mothers contacted by letter, 28 were located and available to participate in the four month study.

At the newborn examination 15 of the 28 children were found to have anomalies which affected or may affect their future chance for survival. At four months, five children were found to have abnormalities which had persisted over a four month period.

To ascertain whether the Maternal Health Index could predict abnormalities at both the neonatal stage and at four months of age, two chi squares were used. The first utilized a two-by-three contingency table incorporating normal and abnormal infants and low, moderate, and high risk classifications of mothers respectively. The obtained chi square (reported in Table 1) indicated that the test had not predicted abnormalities in the neonatal stage.

The second chi square was used with a two-by-two contingency table incorporating normal versus abnormal infants, and low and moderate risk versus high risk classifications of mothers respectively. Low and moderate risk categories were combined because the small number of mothers in the low risk category precluded analysis with chi square techniques. The obtained chi square (reported in Table 2) indicated that, with this population
### TABLE 1
Summary of Chi Square Analysis of Newborn Examination Data

<table>
<thead>
<tr>
<th></th>
<th>Low Risk Mothers</th>
<th>Moderate Risk Mothers</th>
<th>High Risk Mothers</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Infants</td>
<td>1</td>
<td>6</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Normal Infants</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Totals</td>
<td>5</td>
<td>10</td>
<td>13</td>
<td>28</td>
</tr>
</tbody>
</table>

\[X^2 = 3.67, \text{ df.} = 2, \ p > .05\]

### TABLE 2
Summary of Chi Square Analysis of 4-month Examination Data

<table>
<thead>
<tr>
<th></th>
<th>Low and Moderate Risk Mothers</th>
<th>High Risk Mothers</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Infants</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Normal Infants</td>
<td>12</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Totals</td>
<td>15</td>
<td>13</td>
<td>28</td>
</tr>
</tbody>
</table>

\[X^2 = .32, \text{ df.} = 1, \ p > .05\]
at least, the test had not predicted abnormalities in the four month old infants. There was no significant difference in the occurrence of developmental abnormalities in children whose mothers had been classified either low, moderate or high risk.

The children who showed abnormalities in the neonatal examination and those who continued to be developmentally abnormal are described below. The children will be discussed in the order of ascending Maternal Health Index classifications: Children of the low risk group will be designated A, and given a number to denote placement within the group; children of the moderate risk group will be designated B, and those of the high risk group C.

Low Risk Group:

From the group of mothers classified low risk Child A-1 was found whose eyes were not in the horizontal midline, but rather approximately one half of the iris remained beneath the lower eyelid. This was noticed during an examination on the third day of life, but persisted for less than eight hours. When the child was examined at four months of age he was able to fix and follow with his eyes, and the position was normal. In all areas tested the child was found to be within the normal ranges of development.

Moderate Risk Group:

In the newborn examination, six infants from the group of mothers classified moderate risk were found to have abnormalities which were
considered significant. Three of these infants were outside of the normal range of development at the four month examination, with findings that might have persisted over the four month period. Those children are discussed below.

Child B-1 had a small anal fissure at the time of the newborn examination. There was no medical information regarding time of occurrence, precipitating factors, or even a notation of its presence. At the time of the four month examination it was seen to be healed. The anal sphincter reflex was normal, and the child's mother reported no problems concerning the child's bowel habits.

Child B-2 had a palpable liver 0.5 centimeters below the costal margin, a palpable spleen tip, and a mass in the right flank measuring two by three centimeters. His cry was an abnormal sound described as plaintive and of short duration. The medical examination at the time of his discharge from the hospital indicated a normal term infant. During the first four months of life the child was treated once for pneumonia. Further diagnosis indicated a congenital boot-shaped heart without murmur or signs of cardiac disease. The gross motor area of this child's development was outside the range of normal at four months of age. He was not able to bear weight on his legs; he did not lift his head above the plane of his body when he was prone; he did not lift his chest or support himself on his forearms when in a prone position. When he was pulled from a supine to a
sitting position there was complete head lag; he did not support his head when he was held or sitting. His movements were slightly tremulous.

This child was under continuing treatment in the University of Utah Medical Center's pediatric cardiac outpatient clinic at the time of the study.

Child B-3, examined during his neonatal hospital stay, appeared to have asymmetric facies, and small ears with thickened cartilage and pointed pinnae. His hips abducted fully but had bilateral audible clicks. When the examiner tried to elicit a plantar grasp, the child's toes flared. The four month examination revealed a child who had wide-set eyes and a flat face with slanted palpebral fissures and prominent epicanthic folds. His ears were small and had a thick, wide outer fold of cartilage. His legs were frogged from the pelvis. His head control was not consistent, and his head was often unsteady. He did not roll over nor did he sit with support; he did not turn his head to a voice, although he did respond to the sounds of the bell and rattle. The stepping response was absent, and when the examiner attempted to elicit it the child stood firmly on his feet. This child was attending the University of Utah Medical Center pediatric outpatient clinic, and at four months of age he had had no specific disorder diagnosed.

Child B-4 had moderately tremulous movements and a bilaterally absent blink reflex at the time of the neonatal examination. At the four month examination, his movements were noted to be normal and without tremor, and a bilateral blink reflex was present. The child was seen to
be within the normal ranges of development in all areas of the examination.

Child B-5 had a complete head lag when he was pulled to a sitting position. During the newborn examination all areas of muscles (extremities, trunk, neck flexor, neck extensor) appeared to be hypotonic. At four months, the examination showed an infant who did not support himself on his forearms when he was placed in a prone position and who did not lift his chest from the plane of his body when he was prone. The muscle tone in his extremities, neck and trunk appeared normal at that time. In all other areas of development tested, the child was within the normal limits.

Child B-6 had a unilateral hip click during the newborn examination. During the four month examination the child's hips abducted fully and no click was felt. This child bore weight well when standing and was within the normal ranges in all areas of development tested.

High Risk Group:

In the group of mothers which was classified high risk, eight children were found to have abnormalities at the newborn examination. Two had abnormal findings remaining at the time of the four month examination.

During the newborn examination Child C-1 was seen to have a bilateral hip click. However, the hips abducted completely. At four months of age, the child appeared to be normal. No click was felt when the hips were abducted, and the hips abducted completely at that time. The child was able to bear weight on his legs within normal limits.
Child C-2 was found to have a unilateral left hip click. His gluteal folds were not symmetrical. At the four month examination, no click was felt in his hip on movement, and the child appeared to be within the range of normal development, bearing weight on both legs.

Child C-3 had a forced, high pitched cry at the time of the neonatal examination. At four months of age a questionable swooshing sound was audible after the first heart sound at the left sternal border. The infant was under the care of a private physician, and no medical diagnosis was available to the examiner.

Child C-4 had a high pitched cry at birth, as well as shallow respirations. At four months, this child was within the normal ranges of development in all areas tested.

Child C-5, in the neonatal examination, was found to have a bilateral hip click. His gluteal folds were symmetrical at that time; however, both feet adducted markedly. When the child was seen for the examination at four months of age, he had just had the second set of bilateral casts removed after correction of a varus deformity of his feet. The alignment of his feet at that time appeared to be normal. In all other areas of development the child was within the normal ranges.

The newborn examination revealed that Child C-6's right leg was 0.5 centimeter longer than his left leg. In addition, there was an audible click in the left hip although the hips abducted fully. At the time of the four
month examination, the child appeared to be normal in all tested aspects of development, and bore weight equally on both legs. The original inequality in leg length was no longer discernible.

Child C-7 had a shrill, high pitched cry during the newborn period as well as an irregular and slow heart rate (100 beats per minute in a resting state, 110 beats per minute with activity). The four month examination revealed a large baby who was developmentally within normal ranges. His heart rate was regular and normal (120 beats per minute in a resting state).

Child C-8 had asymmetrical palmar grasps and an inward deviation of the ankles which was exaggerated with movement. At four months the child was developing within the limits of normality. His ankles appeared to be straight and he bore weight equally on both feet. His palmar grasp reflex was still present and at that time it was equal in both hands.

In all, fifteen children were seen to have abnormalities during the period of their newborn hospitalization. Five of these children had remaining abnormalities which were noted and recorded at the time of the four month examination.

Findings considered abnormal included not only gross physical or developmental deviations, but also symptoms which are frequently associated with more subtle underlying conditions, e.g., high pitched cry, hip clicks.

In summary, the results indicated that the MHI which classified mothers as low, moderate, or high risk during their pregnancies, did not,
with the present sample at least, predict abnormalities in infants. There
was no statistical difference in the occurrence of abnormalities as a function
of MHI classification.
CHAPTER IV

DISCUSSION

The examination of 28 infants during their neonatal hospital stay, and again at age four months revealed 15 children with abnormalities at age four months. A previous classification of the 28 mothers with the MHI had showed five to be at low risk, ten to be at moderate risk, and thirteen to be at high risk. The statistical analysis of the data has indicated that the MHI did not predict abnormalities at the newborn stage or at four months of age.

The present results may suggest that the MHI is not a reliable tool for prediction of abnormalities after the fetal period. The MHI was developed to predict, from the prenatal period, those pregnancies with a high risk of unfavorable outcome for either the mother or the fetus. In the subjects studied, it did not adequately predict abnormalities in the newborn or in the four month old infant. One reason for this may be the nature of the MHI. It was designed to predict high risk pregnancies and thereby to assign those women to high priority services and care. It is possible that, by this care, some abnormalities in the infants were averted.

Of the 15 abnormalities found at the neonatal examination, two-thirds had been resolved by the age of four months. The change might be expected, since several of the findings were indications of questionable abnormalities,
e.g., high pitched cries, hip clicks. The present results suggest that questionable abnormalities seen in the immediate postnatal period are not always a reliable indication of more permanent abnormalities. Abnormalities which had resolved were those which were questionable during the newborn examination, e.g., high pitched cries, hip clicks with or without asymmetry of the gluteal folds.

The most frequent abnormalities in children at the newborn examination were hip clicks and high pitched cries. Hip clicks are frequently found in children with congenital dislocations of the hip (Cooke, 1968). Since congenital dislocations, if left untreated, are a serious problem for children, it is important that the diagnosis be made and treatment begun at an early age. The small sample size in the present study precludes a definitive statement concerning the interrelatedness of hip clicks and congenitally dislocated hips. Further study in the area might yield variable information for nurses who care for and examine infants in the newborn nursery.

Abnormal cries also can be indicative of an underlying abnormality in infants. Ostwald, Fibbs and Fox (1968) concluded from their investigation of infant cries in relation to diagnosis, that excessively high pitched cries occur only among questionably impaired and abnormal infants. They found that not all, but a significant number of infants with high pitched cries, had an underlying disorder. In the present study it was noted that two of the four children with high pitched cries in the newborn period were developmentally
normal at four months of age, while two were not normal. One of the latter was grossly abnormal in motor development (Child B-2); the other had questionable heart sounds (Child C-3). Further investigation in this area might prove valuable in supplying nurses with a means of identifying potentially abnormal infants at an early age.

With each of the groups of children who had hip clicks or high pitched cries in the newborn period, there were some children with evidence of continuing abnormalities at the time of the four month examination. However, there were several in whom there was no evidence of abnormal development. This may support the position of regularly scheduled well child examinations. It indicates that findings in the newborn period are often not permanent but of a transient nature. The need for public awareness and commitment to regular examinations cannot be stressed too strongly if children are to be provided with the best possible opportunity for good health.

The small population available for the present study may also have been a limiting factor in determining whether one test can predict abnormalities. More conclusive results might be drawn from the study of a much larger population of infants.

Since this test did not predict abnormalities in infants whose mothers were classified high risk, several implications might be drawn from the study. The first is a need for periodic regularly scheduled physical examinations for all children beginning at birth and continuing throughout childhood.
The present schedule of well child care allows professional observation of the child's developmental patterns over a long period of time. The relative frequency of examinations during the period of most rapid development provides opportunities for an assessment of development as it occurs. Such visits also offer an opportunity for parents to ask about things which especially concern them. Since two-thirds of the observed abnormalities of the neonates were not observed in the four month old children, the development of these children was not predicted accurately in the prenatal or in the neonatal period. Nursing responsibility lies in the education of parents and prospective parents to the importance of well child care for their infants and children.

Parent education in the area of developmental milestones, and in the importance of accurately recording when these milestones occur in their child is another teaching responsibility of nurses. A positive outcome of such teaching might be realized in parents who recognize and question specific abnormalities in their child's development at an early age, and who make the child and themselves available for early diagnosis and treatment of the problem.

In the area of development many parents are unsure, not only of the time of occurrence for specific tasks, but also of the implications for the future held by successfully completing or omitting a task. Parents find themselves concerned primarily with the age at which a child walks, talks,
gets his teeth, and is toilet trained. Several other milestones which should be important to the parent of the young child are spontaneous smiling, reaching, grasping, rolling over, pre-speech babbling, and responding to a voice, as indications of fine and gross motor, social and speech development. One reason parents are not displaying concern with these areas may be that medical professionals do not stress the importance of these tasks, but rather try to protect parents from being overly concerned with their child's motor and speech development.

It seems obvious that the health professionals have a responsibility for teaching the public, especially parents and prospective parents, more about the development of young children. After having given the information, it appears important to answer their questions, help them deal realistically with their problems and fears, and support them in their decisions.

As a result of the present study it is recommended that present schedules of regularly spaced well child examination be continued as a means of detecting abnormalities as they may occur. Another function of well child examinations is that of providing counseling for parents. An additional need is to provide for education of parents in the area of child development. Occasions for teaching a large number of parents with the smallest amount of inconvenience for all concerned are provided in waiting rooms of clinics and private physicians' offices on days specified for well child care. It is therefore recommended that this teaching function become a part of the
practice of each nurse who worked in the area of child health care as well as a part of her job description. Teaching of parents must be a part of the attempt to provide children with their right to a healthy future.

Further examination of the present population is suggested. This might serve to evaluate the long range effects of the noted abnormalities and thereby give health professionals further information which will be useful in working with and caring for parents and children.
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APPENDIX 1

MATERNAL HEALTH INDEX

Part 1.

Patient's Name __________________________ Place of interview __________________________
Address __________________________ Interview Date / /
Patient's age ____ yrs. (at last birthday) Para ____ Race-ethnicity ______

Part II.

1. Marital Status
   __ married
   __ widowed
   __ separated
   __ divorced
   __ never married

2. Age of Patient
   __ under 20
   __ 20-24
   __ 25-29
   __ 30 and over

3. Religion
   __ catholic
   __ protestant
   __ L.D.S.
   __ other (specify)

4. Weight/Height Ratio
   __ under 1.75
   __ 1.75-1.99
   __ 2.00-2.24
   __ 2.25-over

5. Pulse
   __ under 80
   __ 80-89
   __ 90 and over

6. Systolic B.P.
   __ under 100
   __ 100-109
   __ 110-119
   __ 120 and over

7. Pulse Pressure
   __ under 40
   __ 40-49
   __ 50 and over

8. Blood Type
   __ A
   __ B
   __ O
   __ other

9. Rh of Patient
   __ positive
   __ negative

10. Hematocrit
    __ under 35
    __ 35-39
    __ 40 and over

    __ none
    __ one
    __ two and over

12. Kidney Trouble
    __ yes
    __ no

    __ yes
    __ no

RISK INDEX: (Summation of Part II)
Risk Status (Based on Part II and III)
   __ High Risk (index of 35 or more or condition in Part III present)
   __ Moderate Risk (index of 26-34)
   __ Low Risk (index of 25 or less)
Appendix 1 (continued)

Part III.
- cancer of womb
- diabetes
- German measles (during 1st trimester)
- acute urinary tract infection
- toxemia
- previous high blood pressure

Part IV.
Nurse's observations and other history
- serious accident, rape, violence
- previous multiple pregnancies
- serious cardiac disorder
- thyroid disturbance
- tuberculosis
- venereal disease
- psychiatric condition

Remarks:
- genetic problem
- x-ray radiation of abdomen
- smoking 2 or more pkgs.
- cigarettes/day
- use of harmful drugs
- contraceptive use
- less than 2 year interval since last pregnancy
- multiple socio-economic problems
- previous dystocia
- recurrent bleeding

Part V.
Current Pregnancy Outcome

Mother:
- favorable
- unfavorable

Infant:
- favorable
- unfavorable

Comments: __________________________
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### APPENDIX 2

### NEONATAL EXAMINATION

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## Appendix 2 (continued)

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<th>31. Heart</th>
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<tr>
<td>21. Size (in cms.)</td>
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<td>Anterior</td>
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<td>Posterior</td>
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<td>22. Tension</td>
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<tr>
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<td>Normal Other</td>
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<td>23. Ears</td>
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<td>24. Nose</td>
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<td>25. Mouth and Pharynx</td>
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<td>26. Neck</td>
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<td>27. Thorax</td>
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<td>28. Respirations</td>
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<td>32. Femoral Pulses</td>
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<tr>
<td>30. Heart</td>
<td>strong and equal bilaterally</td>
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<tr>
<td>31. Heart</td>
<td>weak or asymmetrical</td>
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<tr>
<td>32. Femoral Pulses</td>
<td>33. Abdomen</td>
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<td>33. Abdomen</td>
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<td>34. Genitalia</td>
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<td>35. Spine</td>
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<td>36. Extremities and joints</td>
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<td>37. Suck (evaluate with finger)</td>
<td>38. Palmar Grasp</td>
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<tr>
<td>38. Palmar Grasp</td>
<td>present</td>
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<tr>
<td>39. Plantar Grasp</td>
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### Other (Specify)

- Other (Specify)
- Other (Specify)
- Other (Specify)
- Other (Specify)
- Other (Specify)
- Other (Specify)
- Other (Specify)
40. Response
   __ obtained with ease
   __ obtained with difficulty
   __ no constant pattern (skip to 43)
   __ no response (skip to 43)

41. Response of Arms
   __ normal (extensor and flexor components symmetrically present)
   __ flexor component absent
      __ with anterior extension
      __ with lateral extension
   __ asymmetrical
   __ other (specify)

42. Response of Legs
   __ movement
   __ no movement

43. Cry
   __ normal
   __ none
   __ other (specify)

46. Motor Activity
   __ normal
   __ tremulous or jittery
   __ rapid jerky movements
   __ myoclonic movements
   __ writhing movements
   __ asymmetrical movements
   __ convulsions
   __ local
   __ generalized
   __ other (specify)

47. Tone (Use the following code which will indicate a gradation from flaccid to rigid. Describe any asymmetry in right hand column.
   1. Hypotonic
   2. Questionable hypotonicity
   3. Normal
   4. Questionable hypertonicity
   5. Hypertonic

53. Weight
   __ term infant (birth weight over 2500 gms.)
   __ premature (birth weight 2500 gms. or less)

54. Dysmaturity, Stage of
   __ 0--no sign of dysmaturity
   __ ?--equivocal signs of dysmaturity
   __ 1--stage 1 dysmaturity
   __ 2--stage 2 dysmaturity
   __ 3--stage 3 dysmaturity

55. Clinical Impression
   __ normal
   __ central nervous system defect or injury
   __ congenital malformations other than central nervous system
   __ other

56. Unsatisfactory Exam Conditions
   __ absent
   __ present
## NEONATAL NEUROLOGICAL EXAMINATION

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<td>2. Name of Examiner</td>
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<td>3. Title or Position</td>
<td>4. Date</td>
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<td>5. Time Examination started</td>
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<td>6. Time last feedings started</td>
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<td>7. Age of child (hours completed if less than 72 hours, days completed if 72 hours (3 days) or more)</td>
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<td>8. Time since last feeding (item 5 minus item 6 to nearest 15 min.)</td>
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<td>9. Eyes—position at rest (draw position of pupils)</td>
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<td>10. Right 11. Left</td>
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<td>12. Blink Reflex (light stimulus)</td>
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<td>13. Movements of Face</td>
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<td>14. Motor Activity</td>
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<td>15. Extremity Movements (intensity and range)</td>
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<td>16. Cry (quality)</td>
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<tr>
<td>17. Palmar Grasp (with head in midline. Stimulus—finger applied to ulnar side of palm)</td>
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</table>
20. Plantar Grasp (with head in midline. Stimulus—finger applied to medial side of sole)
   __ symmetrical response present
   __ absent bilaterally
   __ asymmetrical response (describe)
   __ other (describe)

21. Patellar Jerk (with head in midline)
   __ symmetrical response present
   __ absent bilaterally
   __ asymmetrical response (describe)
   __ other (describe)

22. Ankle Clonus (with knees flexed at 45°, count number of clonic movements)

23. Right
   __ none
   __ under 8
   __ 8 or more

24. Left
   __ none
   __ under 8
   __ 8 or more

25. Suck (evaluate with sterile nipple)
   __ strong
   __ weak
   __ absent

26. Rooting Response (stimulus—touch a corner of lips. Record movement toward stimulus)
   __ movement toward stimulus
   __ no movement
   __ asymmetrical response (describe)
   __ other (describe)

27. Prone Position
   __ normal (child lifts chin up or turns head to side or makes crawling movements)
   __ questionable abnormality (describe)
   __ abnormal (no chin up, no head to side, no crawl)
   __ other (describe)

28. Traction Response (elicit by lifting child from supine position by pulling arms)
   __ normal (neck flexes, head controlled and shoulder muscles assist movement)
   __ questionable (describe)
   __ abnormal (check all that apply below)
   __ no head control
   __ no neck flexion
   __ no shoulder muscle assistance

31. Withdrawal Reflex (Stimulus—pinprick to both soles)
   __ withdrawal of stimulated extremity elicited bilaterally
   __ response other than withdrawal of stimulated extremity elicited bilaterally
32. Incurvation of Trunk (child prone, stroke or tap paravertebral areas)
   ___ normal, symmetrical
   ___ questionable response (describe)
   ___ absent bilaterally
   ___ asymmetrical (describe)
   ___ other (describe)

33. Stepping (child erect, sole of foot on surface, and trunk and head inclined forward)
   ___ present bilaterally and symmetrically
   ___ questionable response (describe)
   ___ absent bilaterally
   ___ asymmetrical (describe)
   ___ other (describe)

34. Placing (child held erect and dorsum of feet drawn under lower edge of surface)
   ___ present bilaterally and symmetrically
   ___ questionable response (describe)
   ___ absent bilaterally
   ___ asymmetrical (describe)
   ___ other (describe)

35. Moro (support child under back and head--let child’s head drop back about 30° and note pattern of response on three successive attempts. If no constant pattern or no response, repeat series of three attempts once again later in the examination before completing the item.)

36. Response -- General
   ___ obtained with ease
   ___ obtained with difficulty
   ___ no constant pattern (skip to item 41)
   ___ no response (skip to item 41)

37. Response of Arms
   ___ normal (extensor and flexor components symmetrically present)
   ___ flexor component absent with anterior extension
   ___ flexor component absent with lateral extension
   ___ asymmetrical
   ___ other (specify)

38. Response of Legs
   ___ movement
   ___ no movement

41. Eye Movements (stimulus: lateral translocation of child in frontal plane, both left and right.)
   ___ normal (horizontal)
   ___ questionable abnormality
   ___ abnormal (describe)

42. Pupils--Direct Reaction to Light
   ___ present and rapid bilaterally
   ___ present but sluggish bilaterally
   ___ absent bilaterally
   ___ asymmetrical response (describe)
   ___ unable to evaluate (give reason)
### Appendix 2 (continued)

43. **Pupil--Size**
   - normal and equal bilaterally
   - questionable abnormality
     (describe)
   - abnormal bilaterally
     (describe in detail with drawing)
   - asymmetrical (describe)
   - unable to evaluate (give reason)

44. **Eyes--Structure--External Examination**
   - normal
   - hemorrhage--scleral or conjunctival
     (describe)
   - other (describe)

   **NOTE:** If ophthalmoscopic exam is done separately, complete items 45-48, otherwise skip them.

45. **Name of Examiner**

46. **Date of exam**

47. **Title or position**

48. **Time exam started**

49. **Eyes--Structure--Ophthalmoscopic Examination**
   - normal
   - hemorrhage--retinal
     (describe)
   - other (describe)
   - unable to evaluate (give reason)
   - not done

50. **Tone--Use the following code which will indicate a gradation from flaccid to rigid. Describe any asymmetry in right hand column.**
   1. Hypotonic
   2. Questionable hypotonicity
   3. Normal
   4. Questionable hypertonicity
   5. Hypertonic
   6. Unable to evaluate (give reason)

51. **Upper extremity**

52. **Lower extremity**

53. **Neck flexor**

54. **Neck extensor**

55. **Trunk**

56. **Transillumination**
   - absent (normal)
   - doubtful or questionable (describe)
   - present (describe in detail)
   - unable to evaluate (give reason)

57. **Tonic Neck Reflex (optional)**
   - obtained with ease
   - obtained with difficulty
   - no constant pattern
   - no response

Bilateral R. L.

---

58. **Upper extremity**

59. **Lower extremity**

60. **Neck flexor**

61. **Neck extensor**

62. **Trunk**

63. **Transillumination**
   - absent (normal)
   - doubtful or questionable (describe)
   - present (describe in detail)
   - unable to evaluate (give reason)

64. **Tonic Neck Reflex (optional)**
   - obtained with ease
   - obtained with difficulty
   - no constant pattern
   - no response
### Appendix 2 (continued)

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<th>63. Head Rotated to Right</th>
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<td>65. Jaw leg</td>
<td>___ ___ ___</td>
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<tr>
<td>66. Occiput arm</td>
<td>___ ___ ___</td>
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<tr>
<td>67. Occiput leg</td>
<td>___ ___ ___</td>
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<th>68. Head Rotated to Left</th>
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<td>___ ___ ___</td>
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<tr>
<td>70. Jaw leg</td>
<td>___ ___ ___</td>
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<td>71. Occiput arm</td>
<td>___ ___ ___</td>
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<tr>
<td>72. Occiput leg</td>
<td>___ ___ ___</td>
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| 73. Other Signs, Reflexes, Tests, Etc. | no ___yes (specify) |

### Impression

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<tr>
<td>neurologically suspicious but not definite abnormalities (describe reason for this statement in detail)</td>
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<td>neurologically abnormal child (describe fully and give reasons)</td>
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<table>
<thead>
<tr>
<th>75. Non-neurological Abnormalities (check all that apply)</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
</tr>
<tr>
<td>minor abnormalities or deviations (describe)</td>
</tr>
<tr>
<td>questionable abnormalities (describe)</td>
</tr>
<tr>
<td>definite abnormalities (describe)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>76. Unsatisfactory Conditions for Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>absent</td>
</tr>
<tr>
<td>present (specify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>77. Repeat Examination Scheduled for Verification of Abnormalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>no ___yes</td>
</tr>
</tbody>
</table>

APPENDIX 4

FOUR MONTH PEDIATRIC EXAMINATION

1. Patient Identification

2. Date of Exam 5. Age (wks.)

3. Weight

4. Body Length
   Total (crown-heel) ___________ cms.
   Lower segment (heel-symphysis) ___________ cms.

6. Head circumference ___________ cms.

7. Head circumference ___________ cms.

8. Respiratory Rate
   (baby in resting state) ______ per minute

9. Heart Rate
   (baby in resting state) ______ per minute

10. Systolic Blood Pressure
    (palpation) ___________

11. Skin
    normal (including Mongolian spots, stork bites, and diaper rash)
    ________ pigmented nevi
    ________ vascular nevi
    ________ other rashes
    ________ loose and wrinkled
    ________ cafe au lait spots --approximate number _______
    ________ other (specify)

(All items other than normal must be described)

12. Subcutaneous Tissue
    normal
    ________ other (specify)

13. Hair and Nails
    normal
    ________ other (specify)

14. Head
    normal
    ________ other (specify)

15. Fontanelles

16. Ant.

17. Post.

18. Open

19. Ant. AP normal ________ Lat ________ (specify)

20. Closed

21. Lat ________ (specify)

22. Facies
    normal
    ________ asymmetrical
    ________ other (specify)

23. Movements of Face
    ________ present and symmetrical
    ________ absent
    ________ asymmetrical
    ________ other (specify)
26. Eyes
27. Right
   normal
   abnormal
   _lid
   _conjunctiva
   _cornea
   _pupil
   _lens
   _extraocular muscles
   _other (specify)

28. Left
   normal
   abnormal
   _lid
   _conjunctiva
   _cornea
   _pupil
   _lens
   _extraocular muscles
   _other (specify)

29. Ears
30. Right
   normal
   abnormal
   _shape and location
   _canal
   _drum
   _other (specify)

31. Left
   normal
   abnormal
   _shape and location
   _canal
   _drum
   _other (specify)

32. Nose, Mouth and Pharynx
    normal
    _other (specify)

33. Neck
    normal
    _restricted range of motion
    _masses (other than lymph nodes)
    _other (specify)

34. Thorax
    normal
    _other (specify)

35. Respirations
    normal
    _other (specify)

36. Lungs
    normal
    _other (specify)

37. Heart
    normal
    _irregular rhythm
    _murmur (describe)
    _thrill
    _other (specify)

38. Femoral Pulses
    strong and equal bilaterally
    _other (specify)

42. Lymph Nodes
    normal
    _other (specify)
Appendix 4 (continued)

43. Liver
   ___ normal
   ___ other (specify)

44. Spleen
   ___ normal
   ___ other (specify)

45. Kidneys
   ___ not palpable
   ___ palpable (describe)

46. Genitalia
   ___ normal
   ___ other (specify)

47. Anal Sphincter Reflex
   ___ normal
   ___ other (specify)

48. Spine
   ___ normal
   ___ other

49. Musculoskeletal System
   Normal
   ___ Shoulder girdle
   ___ Arms & wrists
   ___ Hands
   ___ Pelvic girdle
   ___ Legs & ankles
   ___ Feet

50. Motor Activity
   ___ normal
   ___ tremulous or jittery movements
   ___ rapid jerky movements
   ___ myoclonic movements
   ___ writhing movements
   ___ asymmetrical movements

60. Tone--Use the following code which will indicate a gradation from flaccid to rigid. Describe any asymmetry in right hand column.

   1. Hypotonic
   2. Questionable hypotonicity
   3. Normal
   4. Questionable hypertonicity
   5. Hypertonic

61. Upper extrem.
62. Lower extrem.
63. Neck flexor
64. Neck extensor
65. Trunk

66. Palmar Grasp
   ___ present
   ___ asymmetrical
   ___ absent

67. Plantar Grasp
   ___ present
   ___ asymmetrical
   ___ absent

68. Patellar Jerk
   ___ present bilaterally
   ___ other (specify)

69. Ankle Jerk
   ___ present bilaterally
   ___ other (specify)
Appendix 4 (continued)

70. Ankle Clonus
   ____ absent bilaterally
   ____ other (specify)

71. Hearing Response
   ____ normal
   ____ other (specify)

72. Stepping (child erect, sole of foot on surface, and trunk and head inclined forward)
   ____ present bilaterally and symmetrically
   ____ questionable response (describe)
   ____ absent bilaterally
   ____ asymmetrical (describe)
   ____ scissoring
   ____ other (describe)

73. Placing (child held erect and dorsum of feet drawn under lower edge of surface)
   ____ present bilaterally and symmetrically
   ____ questionable response (describe)
   ____ absent bilaterally
   ____ asymmetrical (describe)
   ____ other (describe)

74. Response to Image in Mirror
   (check highest level of response)
   ____ smiles, vocalizes or pats mirror
   ____ shows interest in image (other than above)
   ____ response to image

77. Response to Red Ring (check level of development)
   ____ plays with ring
   ____ grasps ring
   ____ follows ring with eyes
   ____ regards red ring
   ____ none of above

78. Motor Skills
   Supports some weight on feet
   ____ Yes No known
   Prone—supports on forearms
   ____ Yes No

79. Sitting with Support (erect position of traction response)
   ____ Head erect and steady
   ____ Spine erect or slight kyphosis

80. Predominant Position of Hands
   ____ open
   ____ closed with thumb in fist
   ____ closed with thumb out of fist
   ____ asymmetrical (describe)

81. Cry
   ____ normal
   ____ absent
   ____ other (specify)

82. Vocalization (check highest level of development)
   ____ coos or laughs
   ____ other sounds only
   ____ no sounds
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>83.</td>
<td>M. C. Evaluation (see manual)</td>
</tr>
<tr>
<td>84.</td>
<td>Responsiveness to child's physical needs</td>
</tr>
<tr>
<td></td>
<td>Unresp. Rec. Abs. NE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>85.</td>
<td>Mother's focus of attention during examination</td>
</tr>
<tr>
<td></td>
<td>Child Sit. St. NE</td>
</tr>
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</table>

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<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>86.</td>
<td>Attitude toward child's test performance</td>
</tr>
<tr>
<td></td>
<td>Indif. Int. Def. NE</td>
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<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>87.</td>
<td>Child's appearance</td>
</tr>
<tr>
<td></td>
<td>P.C.F. Approp. Ovd. NE</td>
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**Impression**

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<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>90.</td>
<td>Neurological Abnormalities</td>
</tr>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>neurologically suspicious but not definite abnormalities (describe reasons for this statement in detail)</td>
</tr>
<tr>
<td></td>
<td>neurologically abnormal child (describe fully and give reasons)</td>
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</tbody>
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<thead>
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<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>91.</td>
<td>Non-neurological Abnormalities (check all that apply)</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<td>questionable abnormalities (describe)</td>
</tr>
<tr>
<td></td>
<td>definite major abnormalities (describe)</td>
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</table>

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<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<tbody>
<tr>
<td>92.</td>
<td>Unsatisfactory Conditions for Examination</td>
</tr>
<tr>
<td></td>
<td>absent</td>
</tr>
<tr>
<td></td>
<td>present (specify)</td>
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<thead>
<tr>
<th>Item</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>93.</td>
<td>Disposition</td>
</tr>
<tr>
<td></td>
<td>no indication for further evaluation at this time</td>
</tr>
<tr>
<td></td>
<td>further evaluation proposed or scheduled (specify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.</td>
<td>CP-5 Attached</td>
</tr>
<tr>
<td></td>
<td>no</td>
</tr>
<tr>
<td></td>
<td>yes</td>
</tr>
</tbody>
</table>
Dear [Name],

I saw your child during his stay in the newborn nursery in University Hospital. I am presently doing an evaluation of infants as a part of the research project for my Master's thesis, and would like to include your child in my study.

This would involve my making a visit to your home and doing a short uncomplicated physical examination of your child which would include weighing and measuring him along with several other procedures. The entire visit should take no more than half an hour, and I will be glad to answer any questions you may have about your baby which I can.

I will be phoning you soon to ask your consent and to make an appointment for my visit at about the time your child will be four months old which will be convenient for you.

I would appreciate knowing any change of address or phone number, and have enclosed a postcard for your convenience in giving me this information.

Thank you very much.

Sincerely,

Jane Erdahl, R.N.
<table>
<thead>
<tr>
<th>Name</th>
<th>Jane Herre Erdahl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthplace</td>
<td>Twin Falls, Idaho</td>
</tr>
<tr>
<td>Birthdate</td>
<td>October 29, 1945</td>
</tr>
<tr>
<td>Secondary School</td>
<td>Minidoka County High School Rupert, Idaho</td>
</tr>
<tr>
<td></td>
<td>College of Southern Idaho Twin Falls, Idaho, 1965</td>
</tr>
<tr>
<td></td>
<td>Goshen College Goshen, Indiana, 1966-1967</td>
</tr>
<tr>
<td></td>
<td>Idaho State University Pocatello, Idaho, 1967-1969</td>
</tr>
<tr>
<td></td>
<td>Weber State College Ogden, Utah, Summer 1968</td>
</tr>
<tr>
<td>Professional Experience</td>
<td>Staff Nurse</td>
</tr>
<tr>
<td></td>
<td>Magic Valley Memorial Hospital Twin Falls, Idaho, 1969</td>
</tr>
<tr>
<td>Professional Organizations</td>
<td>Utah State Nurses' Association</td>
</tr>
<tr>
<td></td>
<td>American Nurses' Association</td>
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