Differential Neonatal Mortality of Premature Infants at a Selected Hospital

Jean M. Crider

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DIFFERENTIAL NEONATAL MORTALITY OF PREMATURE INFANTS
AT A SELECTED HOSPITAL

by

Jean M. Crider

A Thesis in Partial Fulfillment
of the Requirements for the Degree
Master of Science in the Field of Nursing

Loma Linda University
Graduate School
I certify that I have read this thesis and that in my opinion it is adequate, in scope and quality, as a thesis for the degree of Master of Science.

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ACKNOWLEDGEMENT

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Jean M. Grider
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. THE PROBLEM PRESENTED</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>1</td>
</tr>
<tr>
<td>Scope of the Study</td>
<td>2</td>
</tr>
<tr>
<td>Justification for Selection of Problem</td>
<td>3</td>
</tr>
<tr>
<td>Hypothesis</td>
<td>3</td>
</tr>
<tr>
<td>Definitions</td>
<td>4</td>
</tr>
<tr>
<td>Summary</td>
<td>5</td>
</tr>
<tr>
<td>II. REVIEW OF THE LITERATURE</td>
<td>6</td>
</tr>
<tr>
<td>Early Studies</td>
<td>7</td>
</tr>
<tr>
<td>Several Large Scale Studies</td>
<td>11</td>
</tr>
<tr>
<td>Other Studies</td>
<td>20</td>
</tr>
<tr>
<td>Summary</td>
<td>29</td>
</tr>
<tr>
<td>III. METHODOLOGY AND RESEARCH DESIGN</td>
<td>31</td>
</tr>
<tr>
<td>Methodology</td>
<td>32</td>
</tr>
<tr>
<td>Techniques</td>
<td>33</td>
</tr>
<tr>
<td>Phenomena</td>
<td>33</td>
</tr>
<tr>
<td>Research Design</td>
<td>35</td>
</tr>
<tr>
<td>The population</td>
<td>35</td>
</tr>
<tr>
<td>The epidemiological approach</td>
<td>36</td>
</tr>
<tr>
<td>The design of research</td>
<td>37</td>
</tr>
<tr>
<td>Statistical Formulas Used</td>
<td>38</td>
</tr>
<tr>
<td>Testing the Hypothesis</td>
<td>39</td>
</tr>
<tr>
<td>Summary</td>
<td>40</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>PAGE</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>IV. PRESENTATION AND CLASSIFICATION OF THE DATA</td>
<td>42</td>
</tr>
<tr>
<td>The Infant</td>
<td>42</td>
</tr>
<tr>
<td>The Mothers of the Infants</td>
<td>45</td>
</tr>
<tr>
<td>The Delivery</td>
<td>48</td>
</tr>
<tr>
<td>Summary</td>
<td>51</td>
</tr>
<tr>
<td>V. ANALYSIS AND INTERPRETATION OF THE DATA</td>
<td>54</td>
</tr>
<tr>
<td>The Infant</td>
<td>55</td>
</tr>
<tr>
<td>The Mother of the Infant</td>
<td>60</td>
</tr>
<tr>
<td>The Delivery of the Infant</td>
<td>62</td>
</tr>
<tr>
<td>Summary</td>
<td>65</td>
</tr>
<tr>
<td>VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS</td>
<td>73</td>
</tr>
<tr>
<td>Summary</td>
<td>73</td>
</tr>
<tr>
<td>Conclusions</td>
<td>79</td>
</tr>
<tr>
<td>Recommendations</td>
<td>81</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>84</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Per cent of Neonatal Mortality of Premature Infants at a Selected Hospital (1952 through 1959)</td>
<td>31</td>
</tr>
</tbody>
</table>

vi
## LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Recorded Cases of Neonatal Deaths of Premature Infants at a Selected Hospital (1952 through 1959)</td>
<td>43</td>
</tr>
<tr>
<td>II. Selected Phenomena Studied of Premature Infants Who Died During the Neonatal Period at a Selected Hospital with Resulting Data (1952 through 1959)</td>
<td>46</td>
</tr>
<tr>
<td>III. Descriptive Phenomena Studied Regarding Mothers of Premature Infants Who Died During the Neonatal Period at a Selected Hospital with Resulting Data (1952 through 1959)</td>
<td>49</td>
</tr>
<tr>
<td>IV. Phenomena Studied Regarding Delivery of Premature Infants Who Died During the Neonatal Period at a Selected Hospital with Resulting Data (1952 through 1959)</td>
<td>52</td>
</tr>
<tr>
<td>V. Coefficients of Correlation Between the Trend in Number of Neonatal Deaths of Premature Infants at a Selected Hospital and that of Certain Phenomena Relative to the Infants (1952 through 1959)</td>
<td>59</td>
</tr>
<tr>
<td>VI. Coefficients of Correlation Between the Trend in Number of Neonatal Deaths of Premature Infants at a Selected Hospital and that of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vii</td>
</tr>
<tr>
<td>TABLE</td>
<td>PAGE</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Certain Phenomena Relative to the Mothers of the Infants (1952 through 1959)</td>
<td>63</td>
</tr>
<tr>
<td>VII. Coefficients of Correlation Between the Trend in Number of Neonatal Deaths of Premature Infants at a Selected Hospital and that of Certain Phenomena Relative to Deliveries of the Infants (1952 through 1959)</td>
<td>66</td>
</tr>
<tr>
<td>VIII. Phenomena in Which the Correlation Coefficient Was Not Within the .05 Level of Significance in a Study of Neonatal Deaths of Premature Infants at a Selected Hospital (1952 through 1959)</td>
<td>69</td>
</tr>
<tr>
<td>IX. Phenomena in Which the Coefficient of Correlation Was Within the .05 Level of Significance in a Study of Neonatal Deaths of Premature Infants at a Selected Hospital (1952 through 1959)</td>
<td>72</td>
</tr>
</tbody>
</table>
CHAPTER I

THE PROBLEM PRESENTED

The central task of the research project upon which this paper is based was chiefly concerned with the collection, classification and analysis of recorded data concerning the incidence of neonatal mortality of premature infants at a selected hospital during an eight-year period extending from 1952 through 1959. The basic assumption involved in this study was that the collection and classification of data concerning premature infants who died during the neonatal period at that institution might yield useful information in the form of general observable trends and commonalties which might be present in sufficient degree to be deemed significant in the total number of cases involved.

I. STATEMENT OF THE PROBLEM

What phenomena in the individual cases might have been most frequently associated with the trend in neonatal mortality of premature infants at the selected hospital? This question poses the problem upon which this investigation was based.

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1The hospital selected for this study was the White Memorial Hospital in Los Angeles, California.
II. SCOPE OF THE STUDY

The population studied in this investigation included all premature infants who died at the selected hospital, within the following limitations.

1. These infants were born in the same hospital in which they died.

2. The infants had not in any case been discharged from the hospital and readmitted. Hospitalization was continuous from birth until death.

3. The time period of the study included the eight-year period beginning January 1, 1952, and ending December 31, 1959.

4. Death occurred during the neonatal period (the first twenty-eight days). ²

5. Data used in the study were abstracted from the following medical records in each case: the admission record, the history and prenatal record, the labor and delivery-room record, and the autopsy report (when a post-mortem examination had been done).

Statements and inferences suggested in this paper must be limited to these cases in this institution during this period of time and cannot be assumed to refer to any other population.

III. JUSTIFICATION FOR SELECTION OF PROBLEM

The justification for the selection of the problem for investigation lies in the fact that generally observed or statistically authenticated trends might provide information for the medical and nursing groups in the institution where the study was undertaken about phenomena in these cases which might possibly correlate with the trend in deaths. Dunham states: "For its own enlightenment as to progress in the care of premature infants, every hospital needs to analyze its own records in successive periods." 3

The recommendation of the American Academy of Pediatrics 4 and the United States public health department for such an examination, the concern of the pediatricians at the selected hospital over the trend in the neonatal death rate of premature infants in that institution, and the challenge of premature care to nursing, these are factors that comprise a justification for this study.

IV. HYPOTHESIS

When one examines the data recorded about premature infants who were born and died at the selected hospital

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during the neonatal period, it will be discovered that a significant correlation does exist between the trend in deaths of premature infants at that hospital during the specified eight-year period and that of one or more of the thirty-six selected phenomena in the case histories studied.

V. DEFINITIONS

Differential. "Relation to, indicating, or exhibiting difference or differences."\(^5\)

Neonatal mortality. "Neonatal death is that of a live infant dying within the first twenty-eight days of life." (A lunar month.)\(^6\)

A live baby. "A live baby is a baby showing any signs of life, including heartbeat and breathing, movements of voluntary muscles...at any time whatever for no matter how brief a time, after birth."\(^7\)

Premature infant. "A premature infant is one who weighs 2,500 grams or less at birth (not at admission) regardless of the period of gestation."\(^8\)

---


\(^7\)Ibid., p. 4.

\(^8\)Ibid., p. 2.
Phenomena. (Plural of phenomenon.) "Any observable fact or event." 9

VI. SUMMARY

This introductory chapter has presented the task of the study as a collection, classification and analysis of recorded data concerning the incidence of neonatal mortality of premature infants at a selected hospital during an eight-year period extending from 1952 through 1959. The problem confronted was to ascertain if possible what phenomena might have been most frequently associated with the trend in mortality.

The scope and justification of the study, together with certain definitions, are also included. The study was based on the hypothesis that an examination would reveal the existence of a significant correlation between the trend in deaths of premature infants and the trend in the presence of certain phenomena in the cases studied.

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9Webster, op. cit., p. 632.
CHAPTER II

REVIEW OF THE LITERATURE

One discovers in reviewing the literature that an increasing number of studies are being devoted to problems and possible solutions to problems associated with premature infant mortality. An overall statement of the history and present status of the problem of infant mortality, made in a public health report of 1960, is quoted below.

For years the infant mortality rate declined at a rapid pace. During the period 1933-1949 the infant mortality rate for all races decreased in the United States about 4.3% each year. However, beginning about 1950, the rate of decrease in infant mortality dropped to 2% per annum. The rapid drop seen in former years occurred principally because of the reduction in mortality from infectious diseases. Between 1945 and 1946 there was an unusually sharp break in the death rate for the infectious diseases coincident with the availability of penicillin for civilian use. Also a possible factor was the availability of DDT, which had its impact on mortality from the diarrheal diseases. . . . No substantial progress in reducing neonatal mortality will be made until there is a break through in dealing with congenital malformations and the diseases of early infancy such as birth injuries, postnatal asphyxia, and premature delivery of infants. The hard core of the problem has been relatively untouched.10

EARLY STUDIES

The first manual establishing standards and recommending methods of hospital care for premature infants was published in 1943 by the Children's Bureau of the United States Government in cooperation with the American Academy of Pediatrics. This manual has been revised three times, in 1947, 1954, and 1957. The last edition was published by the American Academy of Pediatrics. In the introductory chapter of the latest manual, this statement is made: "The continued high rate of neonatal mortality is a major challenge which demands the universal adoption of all measures which will contribute to its reduction."11

In 1922, Hess published a book "which included the first comprehensive survey of the problems of prematurity and the methods of care."12 For twenty-five years after the initial survey, Hess and Lundeen, a nursing supervisor who collaborated with him on the second edition of the book, The Premature Infant, Medical and Nursing Care, studied and practiced improved methods to lower mortality and morbidity rates in the premature station at Michael Reese Hospital in


Chicago, which was the center of their experiments. Some of the outstanding contributions to the field of knowledge were the therapeutic use of the antibiotics and sulfonamides in treating a number of infectious diarrheas, blood dyscrasias of the newborn, diseases of the eyes and skin, congenital syphilis, as well as improved methods of feeding and nursing care. One chapter of this very comprehensive work lists statewide plans for improved care of the premature infant in each of eleven states.13

Hess and two associates reported in 1934 a study of eight hundred forty-four infants who were born prematurely. The findings regarding the mothers in this study were tabulated as follows.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple pregnancies</td>
<td>372</td>
</tr>
<tr>
<td>Toxic condition</td>
<td>131</td>
</tr>
<tr>
<td>Chronic infection</td>
<td>109</td>
</tr>
<tr>
<td>Chronic infection including syphilis</td>
<td></td>
</tr>
<tr>
<td>Chronic infection including tuberculosis</td>
<td>14</td>
</tr>
<tr>
<td>Local pelvic abnormality</td>
<td>109</td>
</tr>
<tr>
<td>Acute infection</td>
<td>3414</td>
</tr>
<tr>
<td>Other systemic disease</td>
<td></td>
</tr>
</tbody>
</table>

Hess has listed the factors influencing termination of pregnancy as (1) injuries, (2) sudden emotional disturbance, (3) premature rupture of the membranes (accidental or intentional), and (4) non-obstetrical surgical procedure.


He studied the etiology of prematurity and suggested the following factors as possible causes: (1) constitutional disease of parents, (2) chronic infections, (3) acute infectious disease, (4) local conditions—gonorrheal infection or malposition of the uterus, (5) anomalous position of the fetus, (6) multiple pregnancy, (7) faulty nutrition of the fetus due to maternal fatigue, lack of sufficient food, wasting diseases, diabetes or blood dyscrasias, (8) congenital malformation of the fetus, (9) intoxication by alcohol or heavy metals, (10) advanced age of parents, (11) frequent pregnancy, (12) habitual miscarriage or abortion, (13) seasonal influence.\(^\text{15}\)

In a paper read at a meeting of the British Association of Pediatric Surgeons in 1957, Rickham refers to the work of Hess in following prematures for several decades after their discharge from the hospital. He was able to keep in touch with three hundred and seventy of those whose birth weights had been under 1,250 grams (two pounds and eleven ounces). Five per cent had died, and eighty-five to ninety per cent were still living and possessed average or above average intelligence.\(^\text{16}\)


Dunham, director of the Division of Research in Child Development in the United States Children's Bureau and a consultant in Pediatrics in the World Health Organization in Geneva, Switzerland, has prepared two excellent manuals for physicians on the subject of the premature infant. One was printed in 1948 and the latest one in 1955.  

She has reported a number of interesting research projects in the following areas: racial and sex factors, age and parity, socio-economic factors, nutritional factors. She reports recommendations made by a committee in Canberra, Australia for the prevention of prematurity. The recommendations that were made were these:  

(1) Improved prenatal supervision  
(2) Dietary and general hygienic education of mother  
(3) Introduction of more comprehensive socio-economic measures to alleviate harmful effects of overcrowding, poor housing, and inadequate hospital and clinic facilities for pregnant women.

Dunham feels keenly that attention must be focused on the problem of prematurity and preventative measures. She states: “In the United States, although much attention has been paid to the high mortality rate from premature birth,  

reports of attempts to reduce the number of these births have been very few."

SEVERAL LARGE-SCALE STUDIES

Tyson made a fifteen-year study of prematurity in the Philadelphia Lying In Hospital. His study began in January of 1930 and was concluded with the end of 1944. The focus in this study was on incidence, mortality and survival. There were 2,960 premature infants in this sample. At the conclusion of the study, this statement is made in the report:

"In studying the occurrence of premature babies in the fifteen years of this report, only a slight annual fluctuation was noted during the entire period of time. It appears that all our efforts to bring about a reduction in premature births have been fruitless, but a number of significant facts have been uncovered that are worthy of recording, particularly the one of dietary control initiated in 1932."

In this experiment with nutrition, seven hundred and fifty expectant mothers were placed on a scientifically controlled diet, and produced no prematures. The control group was on no special diet and there were thirty-seven prematures born to this group. The diet consisted of "large amounts of proteins, minerals, vitamins with definite limitation of

18 Dunham, op. cit., p. 44.

fluids and water-embracing fruits." This study was carried out by one doctor and one nurse and a standard diet was used for all patients.

Fifty-nine per cent of the cases in this total study were prematures whose mothers were from twenty to thirty years of age. This study differs from the finding of some that the very young or above-forty age groups produce the most premature infants.

An interesting statement is made by Tyson in his report:

"The chances for survival of a premature infant depend more on what occurs before and during delivery than it does on what happens afterward."  

Bundesen, Potter, Fishbein, Bauer, and Plotske made a study based on postmortem reports of eight thousand nine hundred and five neonatal deaths in the Chicago area. This sample was not confined to the premature group, but was composed of neonatal deaths of both full-term and premature infants. In an introduction to the study the following information is given: during the previous forty years infant

20 Tyson, op. cit., p. 651


22 Tyson, op. cit., p. 560.
mortality rates had dropped eighty per cent, but there still existed a high premature death rate. It was estimated that sixty per cent of infant deaths take place during the first month; eighty-three per cent during the first week; and one-half of the eighty-three per cent die during the first twenty-four hours. This statement was made early in the report.

It soon became evident to us that the major part of these infant deaths that took place in the first days of life were directly related to conditions existing in the mother during pregnancy, to the conduct of labor and delivery, and to the immediate postnatal care of the infant.

Twenty-two objectives were set up. The total report of this research is given in a detailed form, using tables and graphs for clarity in following through their procedure and the results.

Very briefly, some of the findings were as follows:

(1) The neonatal death rate was higher for non-white than for white infants.

(2) The first days of life presented the greatest hazard.

(3) Mothers under twenty and over forty years of age were found more apt to deliver prematurely.

(4) As gravidity increased neonatal death rate increased.

\[23\text{Bundesen, op. cit., p. 1.}\]

\[24\text{Ibid., p. 3.}\]
(5) The death rate for twins was eleven times greater than for single births.

(6) The death rate was two and one-half times greater for infants of mothers who had produced previous prematures or had had abortions.

(7) Breech presentation was found much more frequently in premature or previable infants.

(8) Causes of death as listed:

(a) Forty per cent of all infants of 1000 to 2500 grams weight who died during the years 1939 to 1949 at the Chicago Lying In Hospital died as a result of congestive pulmonary failure (resorption atelectasis with hyaline-like membrane).

(b) The second cause of death was injury at birth (16.6%).

(c) The third cause was malformations (15.8%).

(d) The fourth cause was infection (13.4%). This was higher in the non-white.

(e) Blood dyscrasias accounted for 5.3 per cent of deaths.

(f) Erythroblastosis was three times as frequently found in white infants (2.8% of all deaths).

(9) The calculated mortality rate when no anesthetic was used was lower than with any type of anesthetic, except chloroform, which was employed in relatively few instances. The highest rate was with cyclopropane and opiates.25

25Bundesen, op. cit., p. 50.
It was suggested that anesthetics be used with caution and eliminated when possible.

Anderson, Brown and Lyon have collaborated on a number of studies and reports, as well as presenting a fine review of literature on the causes of prematurity in the American Journal of Diseases of Children. These studies and reports were made between the years 1939 and 1943.

In one of these projects the cases of 5,686 live-born premature infants were studied. They showed a predominance of female and negro infants born. 26

In another project, all the women admitted to the maternity ward of the Cincinnati General Hospital were interviewed. All the histories were taken by one individual, the information was tabulated on punch cards and the data assembled by mechanical sorting. This project included 2,373 infants—single live births. Antepartum bleeding seemed definitely to be associated with low birth weight. In forty per cent of the cases of premature birth the age of the mother was fifteen to nineteen years. 27

In her review of literature, Anderson presents these concepts as held by various doctors. Premature births are


the greatest in the fall among those conceived in the winter (Hess). More prematures are born in the year with the least sunshine (Bivings). Primiparas lead in premature births. More boys than girls are born prematurely (Woodbury). In some cases, the mother also had been a premature infant. Illegitimacy is a factor in prematurity (Bramler).  

Brown has reported a later study made by the same group in 1945, which involved the influence of maternal illness on the incidence of prematurity. She makes this statement: "Maternal illness appears to be associated either directly or indirectly with sixty-five per cent of single live-born premature infants."  

A considerable amount of research has been carried on at the University of Colorado Premature Center by Taylor, Lubchenco, Ott and others. A ten-year study was made of causes for and prevention of premature infant deaths. Emphasis was being placed on the importance of close cooperation between the obstetrician and the pediatrician if these infants are to be saved.  


Following are two of the recommendations that have come from these studies.

(1) It is suggested that the pediatrician be present for difficult deliveries, where toxemia is present or gross abnormality is expected, and that deep anesthesia be withheld in difficult cases to avoid anoxia in the infant.

(2) It is further suggested that one of the nursery nurses make rounds with the obstetrical staff, so that the condition of mother and infant can be correlated.

A very interesting factor is being studied by Lubchenco and Ott, the instructor in obstetrics at the University of Colorado school of nursing, and that is the premature infant's reaction to illness. This observation is being done by using a rather detailed check list of symptoms. The individuals doing the study feel that it is important to give more intensive study to the infant's emotional reaction to illness.

A series of special reports has been published by the United States Department of Health, Education and Welfare each year since 1954. Each of these reports, however, present statistics based on the data secured in 1950 on a nationwide basis matching birth and death records for infants born during


the first quarter of that year and who died within twenty-eight days of birth. The records from the State of Massachusetts were excluded since that state did not require the reporting of birth weight. Some of the findings are presented below.

**Birth weight.** Of the total born 7.4% weighed less than 2500 grams at birth. The neonatal death rate among infants weighing 2500 grams or less at birth was 173.7 per 1,000 compared with 7.8 among all the infants.\(^{32}\)

**Race.** "The over-all neonatal mortality rate among nonwhite births was about forty per cent higher than among the white."\(^{33}\)

**Plurality.** "Because of the heavy preponderance of plural births at the low weights, the neonatal mortality rate for babies born in multiple sets was five to six times the rate for single births."\(^{34}\)

**Sex.** During the neonatal period, the mortality risk for males and females differed greatly at almost every weight

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\(^{34}\) Ibid., pp. 10, 16.
level, and the over-all mortality rate among females was only three-quarters of that among males. The prognosis was considerably better for girls than for boys at most weights in both the white and nonwhite groups.\footnote{Ibid., p. 16.}

\textbf{Gestation.} "About one out of every three infants born at 28-31 weeks of gestation died in the neonatal period, as compared with one in eight at 32-35 weeks, and less than one in 100 at 37 weeks and over.\footnote{Ibid., p. 17.}

\textbf{Cause of death.} Cause of death was classified in this Government survey according to the \textit{Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, 1948} (Sixth Revision of the International Lists of Diseases and Causes of Death). There were three main categories: congenital malformations, certain diseases of infancy, and all other causes. Under the second category are listed: birth injuries (13% of deaths of infants under 2500 grams), postnatal asphyxia and atelectasis (19%), pneumonia of newborn (2.5%), neonatal disorders arising from maternal toxemia (2%), erythroblastosis (1.8%), ill defined diseases peculiar to early infancy, including nutritional maladjustment (4.8%), congenital abnormality (6.5% for infants weighing less than 2500 grams).\footnote{National Office of Vital Statistics, "Births and Neonatal Deaths by Birth Weight: Reporting Areas 1950 and 1951," \textit{Vital Statistics--Special Reports}, 38:345,387, September 9, 1955.}
Age at death. One-half of all the deaths of infants which occurred during the three-month period occurred during the first twenty-four hours of life, and four-fifths before the end of the first week. For the infants under 2500 grams, the mortality rate was 97.9 per 1,000 on the first day and 18.3 per thousand for ages 7 to 27 days.\(^{38}\)

Birth order. Birth of immature infants was found most frequently in first pregnancies and in fifth or higher.\(^{39}\)

Age of mother. Immature birth was found to be frequent among very young mothers or the older mothers. Neonatal mortality of infants was lowest in pregnancies of mothers aged twenty-five to twenty-nine years.\(^{40}\)

OTHER STUDIES

Brooks, Cass and Chinnock initiated a research project at the Los Angeles County Hospital to investigate the problem of premature infant mortality. Study was given to a population


of one thousand seven hundred and twenty-three premature infants at the hospital during the years 1949 and 1950. Studies are still in progress at the present time in the area of infant feeding—types of formulas and caloric intake.

Of approximately eight thousand live births in the Los Angeles County Hospital each year, at the time that the study was being made, about eleven per cent were premature births. Quoting from the doctors' report: "With improvement of nursing and medical care of premature infants, the combined mortality rate of both those born in the hospital and those sent in for care has been lowered from thirty-seven per cent in 1941 to nineteen and one-half per cent in 1950."\(^{41}\)

The over-all mortality rate for infants born prematurely at the county hospital in the years 1949 and 1950 was 17%. The doctors do not anticipate any significant lowering of the mortality rate for infants during the next few years. Four possible reasons were given for the high incidence of mortality of premature infants:

(1) Lower socio-economic status of mother.
(2) Poorer nutrition.
(3) Little or no prenatal care.
(4) Mothers unconcerned as to problems of a premature infant.\(^{42}\)

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\(^{42}\)Brooks, op. cit., p. 643.
Rider, Harper and Knoblock conducted a study as part of a long-term research on the relationship between the neonatal survival of premature infants and a number of selected factors in the state of Maryland. Four thousand three hundred and thirty-four premature infants were born in forty-six hospitals in Maryland in 1952. Information was collected concerning pregnancy, labor, delivery, infant's hospital course and various aspects of the care received. Some of the findings were as follows:

The survival rate was less among babies whose mothers had complications of pregnancy, labor or delivery.

"The effects of anesthesia, analgesia and other factors listed above were also studied. Some of these statewide findings were unexpected and merit careful analysis." 43

Grosse presents the statistics for the city of Birmingham for the years 1951 to 1955 on the premature baby in a book by that name. Study is given to causes of death, age of mother, birth order, socio-economic condition of the family, malnutrition, race and sex. This author states that during the first forty-eight hours the risk of dying for the premature is thirty-six times greater than for full term babies.

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She found that multiple born have a lower death rate than single of the same weight due to the greater degree of maturity. This finding differs from the usual one for multiple birth. (Bundesen places the death rate eleven times greater and the National Office for Vital Statistics five to six times greater for twins.) The difference in the Birmingham study seems to be accounted for by the fact that these figures were for infants of equal birth weight with the single born. Premature babies as a group include an excess of females. Causes of death per thousand live births of premature infants were: prematurity per se (including atelectasis) 8.5, birth injury and asphyxia 25.6, congenital malformations 19.1, infection 11. Nine of the eleven deaths due to infection were respiratory in nature.

As a result of a study conducted by Miller and several others, the following conclusion was reached: "Birth weight is not the immediate determining factor in survival but rather it is the integrity of certain vital functions."  

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44 Bundesen, op. cit., p. 44.
Possible explanations of why these vital functions are inadequate are submitted by Miller and his associates as follows:

(1) Hemorrhage of brain—interfering with vital cerebral functions.

(2) Abnormally high concentrations of indirect-reacting bilirubin in blood-depressing respiratory center.

(3) Disturbances in distribution of body water.\(^{48}\)

Zdravokhr made a study in the Soviet Union of five hundred deliveries of infants weighing less than 2500 grams. This study yielded the following information.

(1) Five per cent of the total confinements were premature.

(2) Symptoms of infantilism of the reproductive apparatus were observed in one-third of the women who were confined for the first time and gave birth to premature children.

(3) Prematurity was most often promoted by influenzal infection and by diseases of the cardio-vascular system.

(4) In cases of premature delivery, the following phenomena were observed to occur. "Premature escape of amniotic fluid, weakness of labor activity, breech presentation, placenta praevia and puerperal disease."\(^{49}\)

\(^{48}\)Ibid.

Avery and Oppenheimer compared premature infants during two time periods at John Hopkins Hospital (1944-1948 and 1954-1958). These are their conclusions regarding hyaline membrane disease.

It is clear that there was no reduction in the incidence of hyaline membrane disease with the advent of lower oxygen concentration in infant incubators. Actually the occurrence of the disease appears to be higher in the more recent period of study. For live-born premature infants over 1000 grams birth weight, in 1944-1948, 1.5 per cent of all infants had the lesion at autopsy, compared to 3.8 per cent in the more recent period.50

Another interesting observation from this study was that "birth weight and length of survival were unrelated, a somewhat unexpected finding."51

In a recent study reported in the American Journal of Nursing in January 1961 by Newman and Sutherland, several pertinent facts are presented regarding hyaline membrane disease. They state:

Of the babies who are born alive about two per cent die during the neonatal period. Around one-third of the deaths of these infants result from hyaline membrane disease. In spite of this, the disease may not always be fatal. Estimates of the fatality rate vary from 20 per cent to 60 per cent. These figures mean that from 1 to 4 per cent of all live-born infants with the capability of survival are afflicted with hyaline membrane disease or that,


51 Avery, op. cit., p. 556.
in 1958, in the United States, 200,000 to 600,000 infants suffered from the disorder.52

Predisposing conditions to hyaline membrane are stated by these authors to be: (1) Prematurity, (2) Maternal bleeding, (3) Maternal diabetes, (4) Cesarean section (perhaps).53

Beaudry and Sutherland make the following statement regarding a study carried on at the Cincinnati General Hospital.

A comparative study of the birth weights of infants of toxemic mothers and of non-toxemic control infants was conducted at the Cincinnati General Hospital. Contrary to what is generally believed, and has often been reported the birth weights of the toxemic group were not lower than those of the control group.54

Yamashita and Metcoff have been studying certain physiological factors in relation to the subject of premature mortality in Chicago. The former is associated with Michal Reese Hospital and Medical Center and the latter with Northwestern University Medical School. They report:

The mortality of premature infants weighing less than 1500 grams is very high, and frequently morphological changes are insufficient to explain death. Increased total body water and sodium and


53 Ibid., p. 74.

decreased total body potassium contents relative to mass have been noted. . . The data indicate that distortion of essential intracellular electrolyte concentration may modify pathways of terminal glycolysis and of metabolism in the citric acid cycle in muscle of premature infants. This may prove a significant factor augmenting mortality of the small premature infant in the absence of obvious complications or disease.55

Levin, director of the premature service at the Mount Sinai Hospital in Chicago, feels that the prevalence of prematurity is "the most sensitive recorder of the socio-economy of the community."56

Riordan, of the obstetrical staff of St. Joseph's and Springfield Memorial Hospitals in Springfield, feels that many premature births and deaths could be prevented.

Prevention of labor in uncomplicated pregnancies is best obtained by bed rest. Once labor has started, a limited amount of sedation is given; greater reliance is on explanation and reassurance. My own routine as regards sedation is no narcotics and barbiturates, the latter being especially depressing to the baby. I use and recommend the pudendal block as safer than the spinal block. Cesarean section should be avoided as far as prematurity is concerned because of the increased mortality rate associated with it. In a transverse presentation, of course, we do use cesarean.57


In a summary session of the ninth International Paediatric Congress in Montreal, Dr. Charles A. Smith led in a discussion of problems of the newborn. Some of the problems considered were: environmental temperatures, percentage of oxygen content in atmosphere, the etiologic effect of Cesarean section on hyaline membrane disease. From group study a new name was recommended for hyaline membrane disease. It was "idiopathic respiratory distress syndrome of the newborn."

At this meeting a very interesting finding was presented as a result of some studies being carried on in India. It was found that the high incidence of premature labor in women with X-ray evidence of small heart volumes could be lowered by reducing their workload.

The need for prevention was proved by two accounts of the long-term effects of prematurity; a moderate reduction of stature, and a much more serious reduction of coordination, sensory-motor perception, and other needs for normal learning observed in the performance at ten to twelve years of age by prematurely born children who were considered by their parents to be perfectly normal through childhood.58

The State of California has had two conferences on the prevention of prematurity in 1952. It has been recommended that study be given to the possible significance of differences in physical, emotional or social factors leading to an early termination of pregnancy. It was with this thought in

mind that this present research was undertaken. The epidemiological approach to the problem was chosen in the hope that possibly significant phenomena might emerge from the cases studied.

SUMMARY

This chapter has presented a brief chronological review of the literature regarding some of the research completed or presently being carried on in the area of neonatal mortality of premature infants—cause or prevention. Beginning with the initial quest of Hess down to the present day state programs as well as private investigation, many problems in this area have been investigated, but many unanswered questions remain.

Some of the factors considered in the literature as possibly bearing an influence on mortality of premature infants were:

I. The Infant
   1. Immature respiratory processes
   2. Undeveloped vital functions
   3. Race
   4. Low birth weight
   5. Multiple birth
   6. Malformation of fetus

II. The Mother of the Infant
   1. Age of mother
2. Prenatal care
3. High gravidity
4. History of mother having had previous premature delivery or abortion
5. Maternal illness
6. Socio-economic status of mother
7. Poor nutrition of mother

III. The Delivery of the Infant
1. Breech presentation
2. Use of anesthesia or analgesia during delivery
CHAPTER III

METODOLOGY AND RESEARCH DESIGN

It was the plan of this investigation to initiate a study of all cases of neonatal deaths of premature infants occurring at the selected hospital over an eight-year period (1952-1959). Originally it was thought to make this study over a six-year period (1953-1958). During those years the rate of mortality, with two exceptions, showed an increase. Later, in order to bring more scope into the study, the years 1952 and 1959 were added. The addition of these two years brought about some variation in the trend in the death rate. The per cent of deaths for each year is indicated by the bar graph below.

![Bar Graph]

**FIGURE 1**

PER CENT OF NEONATAL MORTALITY OF PREMATURE INFANTS AT A SELECTED HOSPITAL (1952 THROUGH 1959)
I. METHODOLOGY

The method of research employed in the project presented in this paper was of the descriptive survey type. Descriptive research is said by Brown to be "... fact-finding with adequate interpretation."59 A descriptive study is characterized by Good and Scates as including "... all of those studies that purport to present facts concerning the nature and status of anything—a group of persons, a number of objects, a set of conditions, a class of events, a system of thought, or any other kind of phenomena which one may wish to study."60

Descriptive-survey procedures have been used in many areas of investigation other than the education, psychological, and social sciences. These approaches to problem-solving are appropriate wherever the objects of any class vary among themselves and one is interested in knowing the extent to which different conditions obtain among these objects.61

A descriptive-survey study may be thought of in its relation to continuous (regular periodical) reports in any country or industry. A survey is simply one of these reports, a cross-section at a given time, but it is usually of particular importance or presents special information. . . .62

Information obtained in a descriptive survey study does not necessarily solve problems, but many times does initiate thinking which can solve problems.

61 Ibid., p. 549.
62 Ibid., p. 552.
Techniques

The procedure followed was to secure data from the medical records of all the premature infants who were born at the selected hospital and who died during the neonatal period in the same hospital. These data were obtained from three specific sections of the record: the admission record, the history and prenatal record, and the labor and delivery record. These three were present in every record. Where an autopsy report was found it was consulted in noting the cause of death. Nursery records were not found on every chart because a number of the infants expired before leaving the delivery room.

The data secured from these records were transcribed and punched into Unisort cards, one card for each infant. Cross-tabulation of all data in this paper was obtained by manipulating the cards.

Phenomena

All of the information obtained from these records was classified under three general headings, the point of reference being whether it was related to the infant, to the mother of the infant or to the delivery of the infant. Under these general headings, thirty-six phenomena presented themselves for study. The factors influencing the choosing of these phenomena were two. First, the review of the literature
suggested areas that had proved significant in previous studies. Second, these phenomena were those that emerged from the investigation of the medical records of the infants who were the subjects of this study. An outline of the phenomena is given below.

I. The Infant

A. Cause of death
   1. Anoxia due to abruptio placenta
   2. Cerebral hemorrhage
   3. Congenital abnormality
   4. Hyaline membrane
   5. Immature lungs
   6. Pneumonia
   7. Pulmonary hemorrhage

B. Length of gestation
   1. From twenty to twenty-nine weeks
   2. From thirty to forty weeks

C. Multiple birth

D. Race
   1. Caucasian
   2. Negro

E. Sex
   1. Female
   2. Male

F. Weight
   1. Under 1000 grams
   2. From 1000 grams to 1500 grams
   3. From 1501 grams to 2000 grams
   4. From 2001 grams to 2500 grams
II. The mother of the infant

A. Age of mother
   1. Up to twenty years of age
   2. From twenty-one to thirty years
   3. From thirty-one to forty
   4. Forty-one and over

B. History of previous premature birth or abortion

C. Hospital status of mother
   1. Clinic patient
   2. Private patient

D. Maternal health problem present

E. Parity
   1. First delivery
   2. Second delivery
   3. Three or more deliveries

III. The delivery of the infant

A. Analgesia used

B. Anesthesia used

C. Complications of labor and/or delivery

D. Length of labor over twelve hours

E. Type of delivery
   1. Cesarean section
   2. Forceps
   3. Spontaneous vaginal

II. RESEARCH DESIGN

The population. The population included all the premature infants born in a selected two hundred and fifty bed general hospital and the sample for the study consisted of
all of those premature infants who died during the neonatal
period in that hospital between the dates of January 1, 1952
and December 31, 1959.

The epidemiological approach. The utility of the
epidemiological approach to the etiology of any form of
mortality lies in the fact that it has provided one of the
most fruitful scientific methods of attack. A classic
element of the use of this method was that of Dr. Goldberger,
who in 1914 became interested in the case of pellagra in
certain children's hospitals and orphans' homes. Through
this type of an approach to the problem he was able to
refute the then prevalent theory that pellagra was contagious,
and to discover that it was due to a dietary deficiency. Thus
cause and treatment of pellagra was added to the general fund
of knowledge possessed by humanity. 63

More recently A. B. Hollingshead has strongly endorsed
this method for medical research, and has used it himself in
a study of schizophrenia in a large hospital population.

Epidemiology is not the study of epidemics, even
though this is a common belief. . . . The focus of
epidemiology is to relate the ways of living of a
population, or a specific sub-group in it, to the
observed distribution of a particular disease. 64

63 George Douglas Head, "A Case of Pellagra--Its Bearing
on the Etiology and Cure of the Disease," Archives of Internal
Medicine, 34:93, 94, July, 1924.

64 August B. Hollingshead, "Some Issues in the Epidemi-
ology of Schizophrenia," (The MacIver Lecture presented before
The epidemiologist tries to determine who develops the disease, when, and under what conditions.\textsuperscript{65}

The triumph of the epidemiological method has been its utility in helping researchers trace out, step by step, interdependencies between the life ways of individuals and the appearance or nonappearance of disease in a population.\textsuperscript{66}

"Premature birth is now one of the ten leading causes of death in the general population"\textsuperscript{67} and is therefore a problem that is a challenge to the medical world today.

The design of research. The design of research consisted of collecting, tabulating and analyzing data abstracted from the medical records of two hundred and one premature infants who were born and died at the selected hospital. The analysis was done by determining the coefficient of correlation between the trend in the phenomena and the trend in the number of deaths over the eight-year period. The effectiveness of this type of procedure is supported by Guilford in the following statement.

\begin{tabular}{l}
\textsuperscript{65} Ibid., citing Ernest M. Gruenberg, "The Epidemiology of Mental Disease," Scientific American, 34-42, January, 1954. \\
\textsuperscript{66} Hollingshead, op. cit., p. 6. \\
\end{tabular}
No single statistical procedure has opened up so many new avenues of discovery in psychology and education as that of correlation. This is understandable when we remember that scientific progress depends upon finding out what things are co-related and what things are not. A coefficient of correlation is a single number that tells to what extent two things are related, to what extent variations in one go with variations in the other. Without the knowledge of how one thing varies with another, we should find predictions impossible. And wherever causal relationships are involved, without knowledge of covariation, we should be unable to control one thing by manipulating another.

Statistical Formulas Used

Coefficient of correlation. The formula used in computing the coefficient of correlation (r) was from Dornbusch and Schmid.69

A Short Method for Computing r from Ungrouped Data

\[
\begin{align*}
\text{r} &= \frac{\sum XY - (\sum X) (\sum Y)}{N} \\
n &= \sqrt{\frac{\sum X^2 - (\sum X)^2}{N} \frac{\sum Y^2 - (\sum Y)^2}{N}}
\end{align*}
\]

A warning has been given by Guilford in using an analysis of this type.

Always, the coefficient of correlation is purely relative to the circumstances under which it was

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obtained and should be interpreted in the light of those circumstances, very rarely, certainly, in any absolute sense.\textsuperscript{70}

In the light of the preceding statement, it should be borne in mind that the conclusions drawn in this paper apply only to the population within the limitations of this research, and to these specific cases at this particular time.

**Standard error.** The standard error for each correlation was arrived at by the following formula:\textsuperscript{71}

\[
\sigma_r = \frac{1 - r^2}{\sqrt{N-1}}
\]

It should be said that the coefficients should be interpreted as stated only when, by comparison with the standard error of \( r \), they prove to be significant.\textsuperscript{72}

**Testing the Hypothesis**

**Operational hypothesis** (\( H_2 \)). For statistical purposes, the hypothesis was stated in the usual null form:\textsuperscript{73}

when the recorded data about premature infants who were born and died at the selected hospital during the neonatal

\textsuperscript{70} Guilford, \textit{op. cit.}, p. 147.
\textsuperscript{71} Ibid., p. 179.
\textsuperscript{72} Ibid., p. 145.
period are investigated, it will be discovered that a significant correlation between the trend in the number of deaths over the eight-year period and the trend in the occurrence of each of the phenomena selected for study does not exist.

The operational hypothesis ($H_0$) might therefore be rejected for certain categories and retained for other categories to define in detail the research hypothesis ($H_1$).

Level of significance. For this study, the level of significance was designated to be .05. A boundary value for $r$ (0.666) at the .05 level was taken. Therefore, if $r$ was greater than .666, the operational hypothesis would be rejected and thus establish significance for that particular phenomenon in the research hypothesis ($H_1$).

III. SUMMARY

This chapter has been concerned with the methodology and research design for the study. The descriptive survey method was used and the findings tabulated and classified for analysis. Each of the selected phenomena was analyzed by correlation with the number of deaths over the eight-year time period and a test for significance was employed in each instance.

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The operational hypothesis stated that when the recorded data about premature infants who were born and died at the selected hospital during the neonatal period are investigated, it will be discovered that a significant correlation between the trend in the number of deaths over the eight-year period and the trend in occurrence of each of the phenomena selected for study does not exist.

Each of the thirty-six phenomena showing a correlation with the number of deaths within the .05 level of significance would reject the operational hypothesis. The phenomena showing a lower correlation would retain the operational hypothesis.
CHAPTER IV

PRESENTATION AND CLASSIFICATION OF THE DATA

Neonatal deaths of premature infants at the selected hospital during the years 1952 through 1959 numbered two hundred and one. Of these infants, one hundred and fourteen were male and eighty-seven were female; one hundred and thirty were Caucasian and sixty-seven were Negro; thirty-four were private patients and one hundred and sixty-seven were clinic patients. Autopsies were performed in one hundred and twenty-four of the cases. One hundred and twenty-five (62 per cent) of the total deaths occurred during the first twenty-four hours of life. Details concerning data abstracted from the medical records of these cases are presented in this chapter. The phenomena are grouped according to the outline in the preceding chapter—the infant, the mother of the infant, and the delivery of the infant—and a listing of the data follows.

I. THE INFANT

Cause of death. The causes of death for the infants in this study are listed in Table I. In several instances more than one cause was ascribed to a specific infant, in which case the first cause listed was chosen.
### TABLE I

RECORDED CAUSES OF NEONATAL DEATHS OF PREMATURE INFANTS
AT A SELECTED HOSPITAL (1952 THROUGH 1959)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Anoxia due to abruptio placenta</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Cerebral hemorrhage</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Congenital abnormality</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Hyaline membrane</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>12</td>
<td>7</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Immature lungs</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>7</td>
<td>9</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Pulmonary hemorrhage</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Unspecified</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>11</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>54</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>20</td>
<td>14</td>
<td>25</td>
<td>26</td>
<td>35</td>
<td>39</td>
<td>23</td>
<td>201</td>
</tr>
</tbody>
</table>
The cause of death with the highest incidence was hyaline membrane, with deaths from this cause amounting to twenty per cent of the total. Immature lungs was listed as the cause in twelve and one-half per cent of the cases. Anoxia, cerebral hemorrhage, congenital abnormality, pneumonia, and pulmonary hemorrhage were at the five per cent level or lower.

Causes of death listed as "Other" in the table included atelectasis, adrenal insufficiency, cytomegaly of the adrenal glands, aspiration of meconium, amniotic fluid or stomach contents, kernicterus, sepsisemia, interpulmonary pathology, Hirschsprung's disease, subscapular hematoma of liver, and staphylococcus aureus.

The figures listed for each year after "Unspecified" represent the cases where no autopsy was done and death was ascribed to "prematurity" without any finer distinction of cause.

**Length of gestation.** One hundred and eleven, or fifty-five per cent of the births occurred after a twenty to twenty-nine week period of gestation. The period of gestation in the remainder of the cases was thirty to forty weeks.

**Multiple birth.** Thirty-three of the two hundred and one cases were twins. This amounted to sixteen per cent of
the total deaths. There were no triplets or higher number of multiple births in this sample.

Race. Sixty-four per cent of the infants were Caucasian, thirty-three per cent were Negro and the remaining three per cent were Oriental.

Sex. Eighty-seven of the infants, or forty-three per cent, were female and one hundred and fourteen, or fifty-seven per cent, were male.

Weight. The code used for categorization of weight is one that is employed by the medical record library of the selected hospital. The largest number of infants were in the lowest weight group. There were eighty-eight who weighed less than 1000 grams. This number is forty-four per cent of the total. Fifty of the infants weighed from 1000 to 1500 grams; thirty-two weighed 1501 to 2000 grams; and thirty-one weighed from 2001 to 2500 grams.

Table II contains the data concerning the phenomena relative to the infant.

II. THE MOTHERS OF THE INFANTS

Age of mother. Mothers of thirty-nine of the infants were under twenty-one years of age. One hundred and four came in the twenty-one to thirty age bracket. This number
TABLE II
SELECTED PHENOMENA STUDIED OF PREMATURE INFANTS WHO DIED DURING THE NEONATAL PERIOD AT A SELECTED HOSPITAL WITH RESULTING DATA (1952 THROUGH 1959)

<table>
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</thead>
<tbody>
<tr>
<td><strong>Length of gestation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 - 29 weeks</td>
<td>12</td>
<td>14</td>
<td>9</td>
<td>18</td>
<td>9</td>
<td>16</td>
<td>21</td>
<td>12</td>
<td>111</td>
</tr>
<tr>
<td>30 - 40 weeks</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>17</td>
<td>19</td>
<td>18</td>
<td>11</td>
<td>90</td>
</tr>
<tr>
<td>Multiple birth</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Caucasian</td>
<td>14</td>
<td>16</td>
<td>10</td>
<td>15</td>
<td>12</td>
<td>22</td>
<td>23</td>
<td>17</td>
<td>129</td>
</tr>
<tr>
<td>Negro</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>10</td>
<td>14</td>
<td>13</td>
<td>14</td>
<td>4</td>
<td>67</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>13</td>
<td>16</td>
<td>21</td>
<td>6</td>
<td>87</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>11</td>
<td>8</td>
<td>19</td>
<td>13</td>
<td>19</td>
<td>18</td>
<td>17</td>
<td>114</td>
</tr>
<tr>
<td><strong>Weight</strong>*</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>5</td>
<td>4</td>
<td>6</td>
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<td>11</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Code IV</td>
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<td>2</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>6</td>
<td>3</td>
<td>31</td>
</tr>
</tbody>
</table>

*The weight code used was as indicated below.*
*Code I -- Under 2 lbs. 4 oz. (1000 grams)*
*Code II -- From 2 lbs. 5 oz. to 3 lbs. 4 oz. (1000-1500 grams)*
*Code III -- From 3 lbs. 5 oz. to 4 lbs. 6 oz. (1501-2000 grams)*
*Code IV -- From 4 lbs. 7 oz. to 5 lbs. 8 oz. (2001-2500 grams)*
was 52 per cent of the total. Fifty-five were thirty-one to forty years of age. Only three were more than forty years of age.

**History of previous premature delivery or abortion.** In fifty-seven cases the mother had delivered a premature infant or had had an abortion prior to the delivery of the infant in this study. This amounted to more than one-fourth of the total number of cases.

**Hospital status of mother.** This category is divided into those who came for delivery as private patients, and those who were admitted as clinic patients. There were thirty-four in the first group, and one hundred and sixty-seven in the second. Mothers of eighty-three per cent of the total number of infants were clinic patients.

**Maternal health problems.** Mothers of forty-seven of the two hundred and one infants had a health problem of some kind. Ten of these mothers had had no prenatal care. Four of these that had had no prenatal care were in the 1958 list of cases and five were in 1959. In fact in 1959 there were only seven cases with health problems and five had no prenatal care. Although the numbers are small, this means that seventy-one per cent of these mothers with health problems that year had no prenatal care.
Maternal health problems found in the records of these cases included rheumatoid arthritis, anemia, tuberculosis, rheumatic fever, ulcerative colitis, renal disease, heart trouble and asthma.

No prenatal care. Twenty-eight per cent, or mothers of fifty-seven of the infants, had had no prenatal care, and a large number had been in for prenatal care only one month or two weeks before delivery.

Parity. For mothers of fifty-one per cent of the infants this was the third delivery or more. There were one hundred and two cases which came under this category. In forty-eight cases it was the first delivery and in forty-six, the second.

An endeavor was made to secure data on family history, but so many of the records were incomplete in this area that any report of findings in this instance would prove only partial and inadequate for statistical purposes.

The data available concerning the mothers of the premature infants who are the subject of this research are presented in Table III.

III. THE DELIVERY

Analgesia. In one hundred cases, or fifty per cent of the total number of cases, analgesia of some type was used. The analgesia used consisted of demerol, morphine, nurmorphan
<table>
<thead>
<tr>
<th>Table III</th>
</tr>
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<tbody>
<tr>
<td>DESCRIPTIVE PHENOMENA STUDIED REGARDING MOTHERS OF PREMATURE INFANTS WHO DIED DURING THE NEONATAL PERIOD AT A SELECTED HOSPITAL WITH RESULTING DATA (1952 THROUGH 1959)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<tr>
<td>Up to 20 years</td>
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<td>5</td>
<td>9</td>
<td>7</td>
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<tr>
<td>21 - 30 years</td>
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<td>6</td>
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<td>17</td>
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<td>31 - 40 years</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>8</td>
<td>55</td>
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<td>41 years and over</td>
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<td>0</td>
<td>0</td>
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<td>History of previous premature delivery or abortion</td>
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<td>10</td>
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<td>8</td>
<td>12</td>
<td>9</td>
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<td></td>
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<td></td>
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<td>24</td>
<td>21</td>
<td>27</td>
<td>29</td>
<td>19</td>
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<td>1</td>
<td>5</td>
<td>8</td>
<td>10</td>
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<td>Maternal health problem present</td>
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<td>2</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>13</td>
<td>7</td>
<td>47</td>
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<tr>
<td>No prenatal care</td>
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<td>5</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>9</td>
<td>15</td>
<td>17</td>
<td>57</td>
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<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First delivery</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>10</td>
<td>7</td>
<td>9</td>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td>Second delivery</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>5</td>
<td>7</td>
<td>46</td>
</tr>
<tr>
<td>Third or more</td>
<td>7</td>
<td>12</td>
<td>5</td>
<td>14</td>
<td>11</td>
<td>17</td>
<td>24</td>
<td>12</td>
<td>102</td>
</tr>
<tr>
<td>Unclassified</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>
or nisentil. Barbiturates were not included in this category. However, in only one case was a barbiturate used alone and not in conjunction with a narcotic of some type. In that instance nembutal was given intravenously for sedation and was considered for the purpose of this study as an anesthetic.

Anesthesia. Anesthesia was given in one hundred and twenty-six, or sixty-three per cent of the cases. Types of anesthesia used included: trilene, ether, chloroform, nitrous oxide, and cyclopropane. Saddle block, epidural block, spinal or pudendal block were also used, either with the general anesthesia or alone.

Complications of labor or delivery. In one hundred and seventeen or fifty-eight per cent of the total cases there was recorded some complication of labor or delivery. These complications were many and varied, but the one with the highest incidence was that of breech presentation of the fetus. There were fifty-seven cases of breech presentation. Twenty-eight per cent of the infants in the study were in this category. Twelve infants were born out of asepsis and twelve were born with the umbilical cord around their neck one or two times.

Some other complications were: prolapsed cord, premature rupture of the membranes, severe bleeding during labor from placenta praevia, or knotted cord, abruptio placenta, toxemia of mother, precipitate delivery, mother febrile with
amnionitis, infant aspirated meconium. In one instance the mother was comatose as a result of a subarachnoid hemorrhage and died twelve hours after delivery.

**Labor over twelve hours.** In only twenty-five cases was the length of labor over twelve hours. This was approximately twelve and one-half per cent of the total.

**Type of delivery.** All of the deliveries were listed under three headings: cesarean section, forceps delivery or spontaneous delivery. Fifteen deliveries were by cesarean section, forty-eight by forceps (in most cases low forceps) and one hundred and twenty were spontaneous deliveries. Seven and one-half per cent were by cesarean section, twenty-four per cent by forceps and sixty per cent were delivered spontaneously. The type of delivery was not recorded in eight and one-half per cent of the cases.

Data regarding the delivery of the infants under investigation appear in Table IV.

**IV. SUMMARY**

This chapter has dealt with a presentation of the accumulated and classified data concerning the two hundred and one premature infants who were born and died at the selected hospital during the period beginning in 1952 and ending with the close of 1959.
<table>
<thead>
<tr>
<th></th>
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<td>7</td>
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<td>17</td>
<td>20</td>
<td>16</td>
<td>11</td>
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<td>13</td>
<td>9</td>
<td>17</td>
<td>16</td>
<td>23</td>
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<td>6</td>
<td>11</td>
<td>11</td>
<td>16</td>
<td>19</td>
<td>8</td>
<td>96</td>
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<tr>
<td>Abruptio placenta</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
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<td>3</td>
<td>0</td>
<td>12</td>
</tr>
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<td>Breech pres.</td>
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<td>8</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>56</td>
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<td>Cord around neck</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>7</td>
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<td>12</td>
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<td>1</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td>Premature rupture of membranes</td>
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<td>2</td>
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<td>0</td>
<td>0</td>
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<td>6</td>
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<td>Premature separation placenta</td>
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<td>1</td>
<td>0</td>
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<td>Labor over twelve hours</td>
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<td>2</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Type of delivery</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cesarean section</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Forceps</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>13</td>
<td>6</td>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td>Spontaneous vaginal</td>
<td>11</td>
<td>11</td>
<td>9</td>
<td>14</td>
<td>14</td>
<td>18</td>
<td>27</td>
<td>16</td>
<td>120</td>
</tr>
</tbody>
</table>

**TABLE IV**

PHENOMENA STUDIED REGARDING DELIVERY OF PREMATURE INFANTS WHO DIED DURING THE NEONATAL PERIOD AT A SELECTED HOSPITAL WITH RESULTING DATA (1952 THROUGH 1959)
This material has been presented under three headings: the infant, the mother of the infant, and the delivery of the infant. The first category has included the recorded cause of death, length of gestation, multiple birth, race, sex and weight. The second has dealt with age of mother, history of premature delivery or abortion, hospital status of mother, the presence of a maternal health problem, no prenatal care, and parity. The third included analgesia, anesthesia, complications of labor or delivery, length of labor and type of delivery.

Chapter five follows with an analysis and interpretation of this data.
CHAPTER V

ANALYSIS AND INTERPRETATION OF THE DATA

It is the purpose of this chapter to analyze and interpret the data gathered in this study and presented in the previous chapter. The statistical test of significance used was Pearson's Rho. The correlation was computed between the number of neonatal deaths of premature infants that occurred at the selected hospital and the incidence of the appearance of the selected phenomena as recorded on the medical records of the infants who died during the eight-year period from January 1, 1952 through December 31, 1959.

An $r$ value (coefficient of correlation) of .666 was used as the lower boundary and indicates significance at the .05 level. The operational hypothesis stated: when the recorded data about premature infants who were born and died at the selected hospital during the neonatal period are investigated it will be discovered that a significant correlation between the trend in the number of deaths over the eight-year period and the trend in each of the phenomena selected for this study does not exist.

The rejection of the operational hypothesis in each case at this level is interpreted in this study to mean that
a significant relationship exists between the phenomenon in question and neonatal deaths for the eight-year period.

I. THE INFANT

Recorded cause of death. Among the seven principal recorded causes of death found in this study, hyaline membrane had the highest incidence. It occurred in twenty per cent of the cases. This rate is low in comparison with that found in other studies. It was thirty-three and one-third per cent in the study by Newman and forty per cent in that made by Bundesen. The figures for the latter were based on autopsy reports, and since autopsies were not done in every case in the present study, the condition might have been present in other cases. The coefficient of correlation for this phenomenon is .80, which would indicate that the presence of hyaline membrane was one of the phenomena which was associated with the trend in deaths.

The cause of death with the second highest incidence was immature lungs. This accounted for twelve per cent of the total deaths. The correlation in this case was .86.

The correlation for the cases of cerebral hemorrhage was .74, and for pneumonia .69. Both of these phenomena come within the .05 level of significance. Congenital

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75 Newman, op. cit., p. 72.
76 Bundesen, op. cit., pp. 2-43.
abnormality was listed as the cause of death in eleven cases. Abnormality was present in other cases, but in these other cases was apparently not serious enough or of such a nature to endanger life, and therefore in these instances death was ascribed to some other cause. The coefficient of correlation for congenital abnormality was .61, for pulmonary hemorrhage .45, and anoxia .23. In 3.5 per cent of the cases, death was attributed to anoxia per se. This corresponds with the figure given by Bundesen of 3.8 per cent of deaths being due to anoxia. The correlations indicate that from year to year the percentages of deaths from the several causes remained fairly consistent with the exception of anoxia and pulmonary hemorrhage.

**Length of gestation.** The coefficient of correlation for the twenty to twenty-nine week period of gestation was .76 and for the thirty to forty week period was .875. Both of these correlations were within the .05 level of significance. The fact that the thirty to forty week period with a higher correlation would indicate that in this instance this phenomenon is more closely associated with the trend in deaths than is the shorter period of gestation. This might be due to the fact that more infants are stillborn in the twenty to twenty-nine week period of gestation and these were not studied.

77Bundesen, op. cit., pp. 2-43.
Multiple birth. The correlation coefficient for multiple births and the number of deaths over the eight-year period was .89, which is within the level of significance. This would indicate that within this sample multiple birth was a significant phenomena. It should be stated that each infant in this category was a twin.

Race. The coefficient of correlation between the number of deaths each year and the number of infants who were Caucasian was .87 and for those who were Negro it was .837. These are both within the .05 level of significance. The statistics on race indicate that the numbers of Caucasian and Negro infants correlate closely with the trend in deaths in this study. The relative equality of the coefficients of correlation indicate that the ratio of deaths of Caucasian infants to Negro infants remained fairly constant from year to year. Other studies have found a higher mortality rate in premature Negro infants; but since the research design for this present study did not deal with the rate of mortality but with the correlation of these various phenomena with the trend in deaths for a specified time, it could not be compared with other studies with any degree of accuracy.

Sex. Deaths of infants classified by sex showed a correlation between the trend in deaths and the female

infants of .862 and the male of .7887. Both of these are within the .05 level of significance. This may have been due to the relatively small number of cases. The ratio of the sexes in the annual mortality remained fairly constant. It has been found in the same study referred to above that there was a higher mortality rate for premature male infants than for female.79

Weight. The correlation of the number of deaths with the various weight groups was as follows:

1. Those weighing less than 1000 grams — .84.
2. Those weighing between 1000 and 1500 grams — .71.
3. Those weighing between 1501 and 2000 grams — .18.
4. Those weighing between 2001 and 2500 grams — .787.

Of these groups, one, two and four correlate at a significant level; that is, the number of infants in any of these weight groups was directly related to the trend in the number of deaths which occurred during the eight years. The correlation is highest with the infants weighing less than 1000 grams, which would indicate that the incidence of this weight could have been a factor in the trend in deaths through the eight-year period.

Phenomena that are related to the infant, together with coefficients of correlation and the standard error will be found listed in Table V.

79 Ibid., p. 16.
### TABLE V

COEFFICIENTS OF CORRELATION BETWEEN THE TREND IN NUMBER OF NEONATAL DEATHS OF PREMATURE INFANTS AT A SELECTED HOSPITAL AND THAT OF CERTAIN PHENOMENA RELATIVE TO THE INFANTS (1952 THROUGH 1959)

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Coefficient of Correlation</th>
<th>Standard Error</th>
</tr>
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<tbody>
<tr>
<td><strong>Cause of Death</strong></td>
<td></td>
<td></td>
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<tr>
<td>Anoxia</td>
<td>.23</td>
<td>.36</td>
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<tr>
<td>Cerebral hemorrhage</td>
<td>.74</td>
<td>.17</td>
</tr>
<tr>
<td>Congenital abnormality</td>
<td>.61</td>
<td>.23</td>
</tr>
<tr>
<td>Hyaline membrane</td>
<td>.80</td>
<td>.13</td>
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<tr>
<td>Immature lungs</td>
<td>.86</td>
<td>.095</td>
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<tr>
<td>Pneumonia</td>
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<td>.19</td>
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<td>Pulmonary hemorrhage</td>
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<td>.30</td>
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<tr>
<td><strong>Length of Gestation</strong></td>
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<td></td>
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<tr>
<td>20 - 29 weeks</td>
<td>.76</td>
<td>.16</td>
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<tr>
<td>30 - 40 weeks</td>
<td>.875</td>
<td>.089</td>
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<tr>
<td><strong>Multiple Birth</strong></td>
<td>.89</td>
<td>.08</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>.87</td>
<td>.09</td>
</tr>
<tr>
<td>Negro</td>
<td>.837</td>
<td>.12</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>.8627</td>
<td>.0965</td>
</tr>
<tr>
<td>Male</td>
<td>.7887</td>
<td>.148</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 1000 grams</td>
<td>.84</td>
<td>.11</td>
</tr>
<tr>
<td>1000 to 1500 grams</td>
<td>.71</td>
<td>.187</td>
</tr>
<tr>
<td>1500 to 2000 grams</td>
<td>.1823</td>
<td>.36</td>
</tr>
<tr>
<td>2001 to 2500 grams</td>
<td>.7870</td>
<td>.148</td>
</tr>
</tbody>
</table>
II. THE MOTHER OF THE INFANT

Age of the mother. The coefficient of correlation between the trend in the number of deaths and the age of the mother was as follows: those twenty years of age or younger—.715, twenty-one to thirty years of age—.809, and the mothers who were between thirty-one and forty years of age—.5675. The first two age groups were within the .05 level of significance. The correlation was highest for the group that were twenty-one to thirty years of age. This could be interpreted to mean that in this study the incidence of mothers who were between twenty-one and thirty years of age was directly related to the trend in deaths. This may have been due to the fact that mothers in this group may have had previous pregnancies and developed problems associated with these former pregnancies that precipitated premature delivery.

These findings differ somewhat from those presented in the 1950 report from the Office of Vital Statistics. In that study it was found that the neonatal mortality of infants was lowest in pregnancies of mothers aged twenty-five to twenty-nine years, and highest in mothers under twenty years of age or over forty. This study included full term as well as premature infants.

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History of previous premature delivery or abortion. The coefficient of correlation between the number of deaths of infants and the incidence of previous premature delivery or abortion was .7, which places this phenomena within the level of significance and indicates that it was associated with the trend in deaths.

Hospital status of mother. The coefficient of correlation between the trend in deaths and the number of clinic patients was .84. The correlation between the number of deaths and private patients was .85. These were both within the level of statistical significance. Thus, the ratio of deaths of premature infants born to clinic patients to those born to private patients changed very little from year to year.

Maternal health problem or problems present. The incidence of mothers who had a health problem prior to pregnancy correlates with the number of deaths with a coefficient of .71. This figure is within the level of significance. This finding could be interpreted to demonstrate that the number of cases having had previous maternal health problems was directly related to the trend in deaths. Brown has shown that maternal illness is associated with sixty-five per cent of live-born premature infants. 81

No prenatal care. The coefficient of correlation between the number of mothers who had no prenatal care and the number of deaths was .59. This figure does not indicate a high correlation for these cases and is not within the .05 level of significance.

Parity. The coefficient of correlation between the number of deaths and the number of the delivery of viable infants was: first—.52, second—.453, third or more—.9281. The latter was the only phenomena to reach the level of significance, and the correlation is such that there is little opportunity for it to have been by chance. Therefore, the findings could be interpreted to indicate that the number of mothers who had three or more deliveries was directly associated with the trend in deaths.

Phenomena which are related to the mothers of the infants, together with coefficients of correlation and the standard error, will be found listed in Table VI.

III. THE DELIVERY OF THE INFANT

Analgesia. The correlation between the trend in the number of deaths and the number of cases in which analgesia was used was .82. Since this figure is within the .05 level of significance, it would indicate that in this study the use of analgesics was directly associated with the trend in the number of deaths.
<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Coefficient of Correlation</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGE OF MOTHER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 21 years of age</td>
<td>.715</td>
<td>.185</td>
</tr>
<tr>
<td>21 - 30 years of age</td>
<td>.809</td>
<td>.13</td>
</tr>
<tr>
<td>31 - 40 years of age</td>
<td>.567</td>
<td>.25</td>
</tr>
<tr>
<td><strong>HISTORY OF PREVIOUS PREMATURE DELIVERY OR ABORTION</strong></td>
<td>.679</td>
<td>.204</td>
</tr>
<tr>
<td><strong>HOSPITAL STATUS OF MOTHER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinic Patient</td>
<td>.84</td>
<td>.11</td>
</tr>
<tr>
<td>Private Patient</td>
<td>.85</td>
<td>.105</td>
</tr>
<tr>
<td><strong>MATERNAL HEALTH PROBLEM PRESENT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.71</td>
<td></td>
<td>.187</td>
</tr>
<tr>
<td><strong>NO PRENATAL CARE</strong></td>
<td></td>
<td>.246</td>
</tr>
<tr>
<td><strong>PARITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First delivery</td>
<td>.52</td>
<td>.27</td>
</tr>
<tr>
<td>Second delivery</td>
<td>.453</td>
<td>.30</td>
</tr>
<tr>
<td>Three or more deliveries</td>
<td>.9281</td>
<td>.052</td>
</tr>
</tbody>
</table>
Anesthesia. The correlation between the number of cases where anesthesia was used and the number of deaths was .92. This figure is in harmony with the findings of Riordan\textsuperscript{82} and Bundesen\textsuperscript{83} who state that the use of anesthesia may contribute toward deaths of premature infants.

Complications of labor and delivery. The coefficient of correlation of the number of deaths and the number of cases which developed complications of labor and delivery was .84. Three specific complications had a higher incidence than the others. These were infants born out of asepsis, number of infants born with the cord around the neck, and the number of infants born with a breech presentation. The coefficient of correlation would indicate that these complications were directly associated with the trend in number of deaths.

Length of labor. In these cases in only twenty-five of the two hundred and one total did the labor last over twelve hours. The coefficient of correlation was .5392 and not high enough to satisfy the level of significance that has been set for this research. Therefore, this phase of the delivery might be recognized as having no material significance.

\textsuperscript{82}Riordan, op. cit., p. 76.
\textsuperscript{83}Bundesen, op. cit., p. 50.
**Type of delivery.** The only type of delivery which showed a significant correlation with the number of deaths was the spontaneous vaginal, with a correlation coefficient of .92, which may be explained by the fact that the majority of deliveries are of this type and that precipitate delivery to which premature infants seem to be prone might be a factor in this correlation. The cases of cesarean section or where forceps were used have a low correlation, which would be interpreted to mean that there was less probability that either of these phenomena were associated with the trend in deaths.

Phenomena that are related to the delivery of the infant with the coefficients of correlation and the standard error will be found listed in Table VII.

**SUMMARY**

This chapter has dealt with an analysis and statistical interpretation of the data regarding premature infants who were born and died at the selected hospital during the neonatal period, between the beginning of 1952 and the end of 1959.

The operational hypothesis stated: when the recorded data about premature infants who were born and died at the selected hospital during the neonatal period are investigated, it will be discovered that a significant correlation between
### TABLE VII

**COEFFICIENTS OF CORRELATION BETWEEN THE TREND IN NUMBER OF NEONATAL DEATHS OF PREMATURE INFANTS AT A SELECTED HOSPITAL AND THAT OF CERTAIN PHENOMENA RELATIVE TO DELIVERIES OF THE INFANTS (1952 THROUGH 1959)**

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Coefficient of Correlation</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANALGESIA</td>
<td>.82</td>
<td>.124</td>
</tr>
<tr>
<td>ANESTHESIA</td>
<td>.96</td>
<td>.029</td>
</tr>
<tr>
<td>COMPLICATIONS OF LABOR OR DELIVERY</td>
<td>.84</td>
<td>.11</td>
</tr>
<tr>
<td>LENGTH OF LABOR OVER TWELVE HOURS</td>
<td>.5392</td>
<td>.268</td>
</tr>
<tr>
<td>METHOD OF DELIVERY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cesarean section</td>
<td>.1811</td>
<td>.25</td>
</tr>
<tr>
<td>Forceps</td>
<td>.3405</td>
<td>.33</td>
</tr>
<tr>
<td>Spontaneous vaginal</td>
<td>.92</td>
<td>.058</td>
</tr>
</tbody>
</table>
the trend in the number of deaths over the eight-year period and the trend in the occurrence of each of the selected phenomena does not exist.

The coefficient of correlation between the number of deaths and the incidence of each of the phenomena was computed. In each case where this coefficient was within the .05 level of significance, which in this case was .666, the operational hypothesis was rejected.

It was found that the correlation for eleven of the phenomena and the number of deaths did not come within the level of significance. These were as follows:

I. The infant
   A. Recorded cause of death
      1. Anoxia due to abruptio placenta
      2. Congenital abnormality
      3. Pulmonary hemorrhage
   B. Weight
      1. Between 1501 and 2000 grams

II. Mother of the infant
   A. Age of mother
      1. Thirty-one to forty years
   B. No prenatal care
   C. Parity
      1. First delivery
      2. Second delivery
III. Delivery of the infant

A. Labor over twelve hours

B. Type of delivery
   1. Cesarean section
   2. Forceps delivery

For the above, the operational hypothesis would be retained and the findings would be interpreted to mean that a significant correlation did not exist. These phenomena with their coefficients of correlation in ascending order will be found in Table VIII.

Twenty-five of the phenomena did reject the operational hypothesis because each of them came within the .05 level of significance when correlated with the trend in deaths. They are listed below:

I. The infant

A. Recorded cause of death
   1. Cerebral hemorrhage
   2. Hyaline membrane
   3. Immature lungs
   4. Pneumonia

B. Length of gestation
   1. Twenty to twenty-nine weeks
   2. Thirty to forty weeks

C. Multiple birth

D. Race
   1. Caucasian
   2. Negro
### Table VIII

Phenomena in which the correlation coefficient was not within the .05 level of significance in a study of neonatal deaths of premature infants at a selected hospital (1952 through 1959).

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Coefficient of Correlation (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cesarean section</td>
<td>.1811</td>
</tr>
<tr>
<td>Weight (1501 - 2000 grams)</td>
<td>.182</td>
</tr>
<tr>
<td>Anoxia due to abruptio placenta</td>
<td>.23</td>
</tr>
<tr>
<td>Forceps delivery</td>
<td>.34</td>
</tr>
<tr>
<td>Pulmonary hemorrhage</td>
<td>.45</td>
</tr>
<tr>
<td>Second delivery</td>
<td>.453</td>
</tr>
<tr>
<td>First delivery</td>
<td>.52</td>
</tr>
<tr>
<td>Labor over twelve hours</td>
<td>.5392</td>
</tr>
<tr>
<td>Age of mother</td>
<td>.5675</td>
</tr>
<tr>
<td>(thirty-one to forty years)</td>
<td></td>
</tr>
<tr>
<td>No prenatal care</td>
<td>.59</td>
</tr>
<tr>
<td>Congenital abnormality</td>
<td>.61</td>
</tr>
</tbody>
</table>
E. Sex
   1. Female
   2. Male
F. Weight
   1. Under 1000 grams
   2. Between 1000 and 1500 grams
   3. Between 2001 and 2500 grams

II. Mother of the infant
A. Age of mother
   1. Under twenty-one
   2. Between twenty-one and thirty
B. History of previous premature delivery or abortion
C. Maternal health problem present or in history
D. Parity
   1. Third or more deliveries
E. Hospital status of mother
   1. Clinic patient
   2. Private patient

III. Delivery of the infant
A. Analgesia
B. Anesthesia
C. Complications of labor and/or delivery
D. Type of delivery
   1. Spontaneous vaginal

In the light of the findings of this research, each one of the above was directly related to the trend in deaths.
Therefore, the hypothesis stands which stated: when one examines the data recorded about premature infants who were born and died at the selected hospital during the neonatal period, it will be discovered that a significant correlation does exist between the trend in deaths of premature infants at that hospital during the specified eight-year period and that of one or more of the thirty-six selected phenomena in the case histories studied. The phenomena which come in this category with their coefficients of correlation in ascending order will be found in Table IX.

The interpretation of these several coefficients of correlation has been covered in chapter five. The correlation of all of these phenomena with the trend in deaths is statistically significant but several were not clinically significant. They are listed as follows: male and female, Caucasian and Negro, clinic or private patient.
TABLE IX

PHENOMENA IN WHICH THE COEFFICIENT OF CORRELATION WAS
WITHIN THE .05 LEVEL OF SIGNIFICANCE IN A STUDY
OF NEONATAL DEATHS OF PREMATURE INFANTS AT A
SELECTED HOSPITAL (1952 THROUGH 1959)

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Coefficient of Correlation (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of previous premature delivery or abortion</td>
<td>.679</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>.69</td>
</tr>
<tr>
<td>Weight (1000 to 1500 grams)</td>
<td>.71</td>
</tr>
<tr>
<td>Maternal health problem or problems</td>
<td>.71</td>
</tr>
<tr>
<td>Age of mother (twenty or under)</td>
<td>.715</td>
</tr>
<tr>
<td>Cerebral hemorrhage</td>
<td>.74</td>
</tr>
<tr>
<td>Gestation (20 to 29 weeks)</td>
<td>.76</td>
</tr>
<tr>
<td>Weight (2001 to 2500 grams)</td>
<td>.78</td>
</tr>
<tr>
<td>Male</td>
<td>.7887</td>
</tr>
<tr>
<td>Hyaline membrane</td>
<td>.80</td>
</tr>
<tr>
<td>Age of mother (21 to 30 years)</td>
<td>.809</td>
</tr>
<tr>
<td>Analgesia</td>
<td>.82</td>
</tr>
<tr>
<td>Negro race</td>
<td>.837</td>
</tr>
<tr>
<td>Complications of labor or delivery (total)</td>
<td>.84</td>
</tr>
<tr>
<td>Weight (under 1000 grams)</td>
<td>.84</td>
</tr>
<tr>
<td>Clinic patient (hospital status of mother)</td>
<td>.84</td>
</tr>
<tr>
<td>Private patient (hospital status of mother)</td>
<td>.85</td>
</tr>
<tr>
<td>Immature lungs</td>
<td>.86</td>
</tr>
<tr>
<td>Female</td>
<td>.8627</td>
</tr>
<tr>
<td>Multiple birth</td>
<td>.866</td>
</tr>
<tr>
<td>Caucasian race</td>
<td>.87</td>
</tr>
<tr>
<td>Gestation (30 to 40 weeks)</td>
<td>.875</td>
</tr>
<tr>
<td>Type of delivery (spontaneous vaginal)</td>
<td>.92</td>
</tr>
<tr>
<td>Three or more deliveries</td>
<td>.9281</td>
</tr>
<tr>
<td>Anesthesia</td>
<td>.96</td>
</tr>
</tbody>
</table>
CHAPTER VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The research project upon which this paper is based consisted of classifying, analyzing and interpreting certain data taken from the medical records of all the premature infants who were born and died at a selected hospital during the neonatal period between January 1, 1952 and December 31, 1959. The problem was to discover if the incidence of occurrence of certain phenomena in the individual cases might be associated with the trend in number of deaths.

The hypothesis for the study was: when one examines the data recorded about premature infants who were born and died at the selected hospital during the neonatal period, it will be discovered that a significant correlation does exist between the trend in the number of deaths of premature infants at that hospital during the specified eight-year period and that of one or more of the thirty-six selected phenomena in the case histories studied.

A brief chronological review of the literature regarding some of the research completed or presently being carried on in the area of neonatal mortality of premature infants is
presented in chapter two. This review provided insight into the problems involved in the prevention of the mortality of premature infants and also served as a basis for the selection of the phenomena used in this particular study.

Chapter three depicts the method used as descriptive survey with the epidemiological approach. Data taken from the medical records of the two hundred and one infants were punched into Unisort cards, one for each infant. Tabulation of this data was done by manipulating the cards. Findings were summarized under the following headings:

I. The infant

A. Recorded causes of death
   1. Anoxia due to abruptio placenta
   2. Cerebral hemorrhage
   3. Congenital abnormality
   4. Immature lungs
   5. Hyaline membrane
   6. Pneumonia
   7. Pulmonary hemorrhage

B. Length of gestation
   1. Twenty to twenty-nine weeks
   2. Thirty to forty weeks

C. Multiple birth

D. Race
   1. Caucasian
   2. Negro
E. Sex
   1. Male
   2. Female

F. Weight
   1. Less than 1000 grams
   2. Between 1000 and 1500 grams
   3. Between 1501 and 2000 grams
   4. Between 2001 and 2500 grams

II. Mother of the infant

A. Age of mother
   1. Under twenty-one
   2. Between twenty-one and thirty
   3. Between thirty-one and forty
   4. Forty-one or older

B. History of previous delivery or abortion

C. Hospital status of mother
   1. Clinic patient
   2. Private patient

D. Maternal health problem present or in history

E. No prenatal care

F. Parity
   1. First delivery
   2. Second delivery
   3. Third or more deliveries
III. Delivery of the infant

A. Analgesia used
B. Anesthesia given
C. Complications of labor and/or delivery
D. Labor over twelve hours
E. Method of delivery
   1. Cesarean section
   2. Forceps delivery
   3. Spontaneous delivery

A test of correlation was done between the incidence of each of these phenomena and the number of deaths during the designated period of time. The level of significance was set at .05. The operational hypothesis stated: when the recorded data about premature infants who were born and died at the selected hospital during the neonatal period are investigated it will be discovered that a significant correlation between the trend in the number of deaths during the eight-year period and the trend in the incidence of the selected phenomena in the cases studied does not exist.

A classification of the findings is presented in chapter four and an analysis and interpretation of these findings is given in chapter five and is summarized below.

Eleven of the phenomena did not fall within the .05 level of significance, and for those the operational hypothesis would stand. That is, for each of the following phenomena a significant correlation with the number of deaths did not exist:
I. The infant
   A. Recorded cause of death
      1. Anoxia due to abruptio placenta
      2. Congenital abnormality
      3. Pulmonary hemorrhage
   B. Weight
      1. Between 1501 and 2000 grams

II. Mother of the infant
   A. Age of mother
      1. Thirty-one to forty years
   B. No prenatal care
   C. Parity
      1. First delivery
      2. Second delivery

III. Delivery of the infant
   A. Labor over twelve hours
   B. Method of delivery
      1. Cesarean section
      2. Forceps delivery

Twenty-five of the phenomena did come within the .05 level of significance, and for those the operational hypothesis was rejected. That is, for each of the following a significant correlation with the number of deaths did exist:

I. The infant
   A. Recorded cause of death
1. Cerebral hemorrhage
2. Hyaline membrane
3. Immature lungs
4. Pneumonia

B. Length of gestation
   1. Twenty to twenty-nine weeks
   2. Thirty to forty weeks

C. Multiple birth

D. Race
   1. Caucasian
   2. Negro

E. Sex
   1. Female
   2. Male

F. Weight
   1. Under 1000 grams
   2. Between 1000 and 1500 grams
   3. Between 2001 and 2500 grams

II. Mother of the infant
   A. Age of mother
      1. Under twenty-one
      2. Between twenty-one and thirty

   B. History of previous premature delivery or abortion

   C. Hospital status of mother
      1. Clinic
      2. Private
D. Maternal health problem present or in history
E. Parity
   1. Three or more deliveries

III. Delivery of the infant
   A. Analgesia
   B. Anesthesia
   C. Complications of labor and/or delivery
   D. Type of delivery
      1. Spontaneous vaginal

In those instances where a part of the deaths was correlated with the whole number of deaths, particularly where there was a limited number of parts, e.g., under sex or race, one may not assume causation as a conclusion from high correlation. If the correlation of one part is much higher than the other parts, investigation of the causes for such a relationship should be made. An interpretation of these findings was included in chapter five.

CONCLUSIONS

As a result of this study, it may be concluded that: when an examination was made of the data recorded about premature infants who were born and died during the neonatal period at the selected hospital, it was discovered that a significant correlation did exist between the trend in the number of deaths of premature infants at that hospital during
the specified eight-year period and that of twenty-five of
the thirty-six selected phenomena in the case histories
studied. Of this number all were statistically significant
although all were not clinically significant. Those which
did not indicate a clinical significance while showing a
statistical significance were: Caucasian and Negro, female
and male, clinic and private patients.

Of the twenty-five phenomena which showed a significant
correlation, some were genotypic and could not be altered, a
number were beyond the control of medical personnel to alter,
others might have been altered under certain circumstances,
and two of the phenomena were within the control of the
medical personnel.

Phenomena which were genotypic and could not be altered
were: multiple birth, race, and sex.

Phenomena which were beyond the control of medical
personnel to alter were: immature lungs, age of the mother,
history of previous premature delivery or abortion, presence
or history of maternal health problems, the number of
deliveries, the hospital status of the mother, and certain
complications of labor and/or delivery, such as placenta
praevia, premature rupture of the membranes, premature separ-
ation of the placenta, or the cord around the infant's neck.

The phenomena which under certain circumstances might
be altered were: cerebral hemorrhage, hyaline membrane,
pneumonia, low birth weight, length of gestation, certain
complications of labor and/or delivery such as being born out of asepsis, or a malposition of the fetus in the uterus, and spontaneous delivery.

The phenomena which were within the control of the medical personnel were the use of analgesia and anesthesia in labor and delivery.

Some of these findings were not consistent with those found in similar populations, but they represent the situation that was found within the boundaries of this study.

RECOMMENDATIONS

As a result of this study, the following recommendations were made:

That for comparative purposes a study be made which would include an examination of the medical records of all live-born premature infants, who survived during the same time period and at the same hospital, in relation to these same phenomena, and would include a comparison with the data on those who did not survive.

That a cross analysis in certain selected problem areas be made to give further information which might contribute to the reduction of mortality of premature infants. Selected topics for cross analysis might include: How many infants whose mothers were given anesthesia during delivery weighed less than 1000 grams? How many of the mothers with serious health problems did not have prenatal care? How
many infants who died as a result of hyaline membrane were born to mothers who had analgesia during labor? Within the lowest weight category how many were Negro infants or how many were male infants?

That the following comparative studies with similar populations be made: (1) with other general hospitals with approximately the same facilities—to lead into an investigation of environmental factors such as air pollution or emotional tensions arising out of present urban living conditions, (2) with large county hospitals, and (3) with hospitals in other geographical areas or in other countries.

That a study of nursing care of premature infants relative to survival be made in the same hospital. Suggested areas for research might include: amount, if any, of oxygen used, the amount and type of formula used, handling of the infant, and the type of personnel (registered nurse, licensed vocational nurse or aide) giving the care. Ideally a study of this kind would be done concurrently with the hospital stay of the infant.

That a further comparative study be done regarding the amount and types of anesthesia and analgesia used in these cases.

That nursing personnel at the selected hospital give study to effective nursing measures to:

1. Prevent or delay premature delivery.
2. Improve observation of distress signals in the unborn fetus.

3. Provide sufficient physical and emotional support to the mother in premature labor to minimize the necessity for the use of analgesia or anesthesia.
BIBLIOGRAPHY


LONA LINDA UNIVERSITY

GRADUATE SCHOOL

Differential Neonatal Mortality of Premature Infants at a Selected Hospital

by

Jean N. Crider

An Abstract of a Thesis in
Partial Fulfillment of the Requirements
for the Degree Master of Science
in the Field of Nursing

June, 1962
This study was directed toward an investigation of neonatal mortality of premature infants at a selected hospital. The sample included all premature infants who were born in and died at the selected hospital during the neonatal period between January 1, 1952 and December 31, 1959.

The epidemiological approach was used to study. Data concerning thirty-six selected phenomena related to the infant, the mother of the infant, and the delivery of the infant were abstracted from the medical records of each of the two hundred and one cases included in the study. These data were transferred to unisort cards, one card for each infant, and the total incidence of each of the phenomena per year was found by a manipulation of the cards. A test of correlation was used to discover the degree of relationship between the trend in incidence of each of the thirty-six selected phenomena and the trend in deaths over the eight year period. A .05 level of significance was set and twenty-five of the phenomena fell within this level, thus indicating that these specific phenomena did have a significant relationship with the trend in deaths.
Five of the phenomena which showed a significant correlation were genotypic and could not be altered, nine were beyond the control of medical personnel to alter, nine might have been altered under certain circumstances, and two were within the control of the medical personnel.

Therefore it could be concluded from the study of neonatal deaths of premature infants at the selected hospital between January 1, 1952 and December 31, 1959 that a number of the selected phenomena were found to occur in a sufficient number of instances to indicate a significant relationship to the trend in deaths.