EARLY IDENTIFICATION OF DEVELOPMENTAL IMPAIRMENTS IN INFANTS FROM BIRTH TO NINE MONTHS OF AGE

by

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ABSTRACT

EARLY IDENTIFICATION OF DEVELOPMENTAL IMPAIRMENTS IN INFANTS BIRTH TO NINE MONTHS OF AGE

Early recognition of real or potential developmental impairments in infants is an important public health role. Community health nurses have initial access to the infant population by the mandated newborn visit and the necessary skills and tools to assess infants for developmental impairments.

This experimental study was undertaken to determine the effectiveness of scheduled nursing assessments of growth, development, vision, hearing and nutrition from birth to nine months of age. A secondary purpose was to determine the predictive validity of currently used pregnancy and infant profiles for subsequent developmental impairment.

The null hypotheses tested were:

I. That the scheduled community health nursing assessments between birth and nine months of age will not detect any developmental impairments which have not already been detected by existing health services.

II. That there is no significant difference in the number of developmental impairments detected at nine months of age, between a group of infants screened by the proposed schedule of assessments and a group not so screened.

III. That there is no significant difference in the number of children exhibiting developmental impairments by nine months of age, between a group of "at risk" and a group of not "at risk" infants, using the criteria from the Vancouver Health Department's Pregnancy Profile and Infant Profile At Risk Criteria.

One hundred infants from one health unit area were studied, alternately assigned to an experimental and a control group. The experimental group received three visits in addition to the newborn visit, at 1 month, 3 months, and 6 months, for various combinations of five types of assessments. The control group received only the usual newborn visit, but no control was used to prevent access to any other health services during the study period. Pregnancy and infant profiles were completed for the subjects in both groups at the initial visit. 9 month assessments of growth, development, vision, hearing and nutrition were completed for both groups.

The data were subjected to descriptive analysis and statistical analysis by Fisher's exact test of probability, using 2 x 2 contingency tables.

The findings supported scheduled community health nursing assessments of infants from birth to nine months of age. The pregnancy and infant profiles were found to be sensitive but not specific tools for prediction of subsequent developmental impairment. The three null hypotheses were rejected.

Implications for nursing practise are discussed and recommendations for further research suggested.

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CHAPTER I

INTRODUCTION TO THE STUDY

INTRODUCTION

> It is now universally accepted that the earliest possible diagnosis and treatment are essential to prevent, or at least to minimize the handicapping effects of a disability and to make the most of the assets a child possesses. It is also generally agreed that it should be the responsibility of the local health authority to seek out young children with handicaps or potential handicaps, and it is important that this task is performed as efficiently as possible.[1]

The present day interest in infant risk can be traced back to Lilienfeld and Pasamanick and their introduction of the phrase "a continuum of reproductive casualty"[2] as a departure from the interest in perinatal death only, prevalent in the 1940s and early 1950s.[3] As infant mortality rates have decreased, the thrust of obstetric and pediatric care has been increasingly toward improvement of the quality of life for surviving infants by the prevention or early recognition and treatment of disability. This interest is shared by the public as well as private sectors of health care services. As community health nurses provide the bulk of the former, the matter of serving this infant population

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[1] J. Meier, Screening and Assessment of Young Children at Developmental Risk (Washington: DHEW Publications, 1973), 17.

[2] A.M. Lilienfield and B. Pasamanick, "Association of Maternal and Fetal Factors with Cerebral Palsy and Epilepsy," American Journal of Obstetrics and Gynecology, LXX (January, 1955), 93.

[3] R.G. Mitchell, "Changing Concepts of Risk," Develop. Med. Child Neurol., XVII (1975), 277.

most efficiently is a continuing nursing concern.

THE PROBLEM

Statement of the Problem

The problem identified was the possible lack of early detection of developmental impairments in the first several months of life, of Vancouver infants, despite the accessibility to health care facilities and the availability of prepaid medical care plans.

The community health nursing contact for many infants was limited to a single mandated newborn visit following hospital discharge. Routine examination and weighing of infants on these visits and at Child Health Centres has been deemphasized in recent years with a focus rather on maternal counselling and anticipatory guidance. The existing medical care plans do provide the alternative of having immunization given by the family's physician, but do not offer routine preventive physical examinations for healthy infants beyond the six week post-delivery check, included in obstetrical care.

Interest in expanding their nurses' assessment skills has resulted in the Vancouver Health Department providing inservice programs in physical and developmental appraisal of children. A growing number of community health nurses have, over the past two years, started examining and assessing infants on initial and repeat visits, as well as at Child Health Centres. As yet, no evaluation has been undertaken to determine the effectiveness of this investment of nursing

time, but interest has been expressed by nursing staff in development of a departmental program.

Specific Questions Posed for the Study

The questions asked for this study were:

1. Would scheduled physical and developmental assessments by a community health nurse detect any real or potential disabilities in infants, or would this be a duplication of present physician surveillance?
2. Is increased community health nurse surveillance of all infants indicated, or selective follow-up of those infants deemed to be at greater risk of subsequent disability only?
3. If the latter, are criteria on the presently used Vancouver Health Department Pregnancy Profile and Infant Profile At Risk Criteria forms[4] predictive of subsequent disability?
4. If an assessment program were implemented, would those infants examined regularly by a community health nurse for several months demonstrate a better health and developmental status than a group not so examined?

Significance of the Problem

Concerns expressed by orthoptists, speech pathologists and teachers of preschool and school age children over the past several years indicated to the researcher that diagnoses

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[4] See Appendix A

of developmental impairments were not being made until late preschool or early school years - of conditions which should have been assessable in the first year of life (congenital hearing impairment, musculoskeletal defects, obesity, squint). Hard data were not readily available as to how prevalent these late referrals were.

In the proposed study, scheduled community health nursing assessments could be evaluated as to their effectiveness in detecting developmental impairments in infancy.

Evaluation of the currently used pregnancy and infant profiles as predictive tools could also be made, in terms of their identification of infants at greater risk of subsequent disability. If shown to be predictive, they could assist in more efficient allocation of nursing resources, by limiting the number of infants requiring ongoing health surveillance.[5] If not, the concept of regular health surveillance of all infants could be strengthened.

Responsiveness of families could be assessed, with regard to overlap with existing health services and perceived benefit from increased community health nursing contact.

For the individual infant and family, earlier recognition of an existing or potential developmental impairment could be very significant. Earlier referral and treatment

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[5]K.S. Holt, "Infancy and Childhood," Lancet, II (Nov., 1974), 7888.

or even prevention of disability could be effected.[6]

In an ostensibly preventive public health service, one of the major areas where primary and secondary prevention are essential is that of assuring the optimal health of our children.[7]

ASSUMPTIONS OF THE STUDY

1. Despite individual differences, growth is a continuous and orderly process in children. "The regularity of developmental patterns... applies to more than physical growth and is referred to by some as the normative sequence, recognizing that there are identifiable stages in all aspects of growth and development."[8]

2. Within a given population, a certain percentage are vulnerable to a variety of physically and developmentally handicapping conditions, many of which are amenable to early treatment.[9]

3. Early detection and treatment/prevention allows the affected child to achieve a measurably higher level of wellness.[10]

4. Valid, reliable tools are available, and the techniques of assessment are within the capabilities of community health nurses.[11]

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[6]M. Sheridan, Children's Developmental Progress (London: Nat. Foundation of Educational Research, 1973), 1.

[7]Meier, op.cit.

[8]G.D. Sutterly and A.W. Donnelly, Perspectives of Human Development (Toronto: Lippincott, 1973), 28.

[9]U. Haynes, A Developmental Approach to Casefinding (Washington, D.C.: Dept. H.E.W., 1969), 4.

[10]Sheridan, op.cit.

[11]See Chapter III - Design and Methodology.

5. Health status can be measured in terms of normal physical and developmental assessment results.

DEFINITIONS OF TERMS USED

Infant. A child from birth to nine months of age.

At risk. "...considered to be at increased risk of subsequent handicap because of genetic endowment or adverse environmental influences during fetal, perinatal, neonatal or postnatal development."[12]

Impairment. "A deviation from normal, which may include disease, dysfunction or anomalies."[13]

Developmental impairment. "... any condition(s) which is likely to prevent a child from achieving optimal growth and development in any of the social, emotional, intellectual, linguistic or physical realms considered singly or in combination...includes those children who will predictably function at a less than normal developmental level due to various inborn and/or environmental deficiencies of such things as adequate nutrition, intellectual stimulation, language models, or emotional and social experiences."[14]

Detection. Identification by a nurse of an impairment, either through a screening procedure or examination based on parental suspicion.

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[12]M.G.H. Rogers, "The Early Recognition of Handicapping Disorders in Childhood," Develop. Med. Child, Neurol., XIII (1971), 92.

[13]Haynes, op.cit., 4.

[14]Meier, op.cit., 5.

Diagnosis. Medical confirmation of an identified impairment.

Screening procedure. A simple, reliable procedure to identify apparently well infants who have or are likely to develop impairments.

Primary prevention. Prevention of a developmental impairment by measures taken or instituted when the potential for such impairment is seen to exist.

Secondary prevention. "Identification of impairments at the earliest possible age to enable remedial action to be taken, in the knowledge that many disabilities can be treated much more effectively in very young children and that the limitations of treatment often become progressively more severe as children become older."[15]

Optimum health. "...free from disease, bodily ailment or defect or a state of the system peculiarly susceptible or liable to disease or bodily ailment...whole, right, nothing the matter with it."[16]

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[15] M. Wynn and A. Wynn, The Right of Every Child to Health Care (London: Council for Occasional Papers on Child Welfare, 1974), 5.

[16] S.B. Goldsmithe, "The Status of Health Status Indicators," Health Service Reports, LXXXVII (March, 1972), 212.

LIMITATIONS OF THE STUDY

The study was subject to the following limitations:

1. The study was limited to a time-sequential sample of one hundred infants in one geographical area of one city born in June or July of one year.

2. The infants were assigned alternately, not randomly, to the experimental and control groups.

3. The researcher completed the actual assessments except for the final ones of the experimental group.

4. The tools chosen for the assessments were limited to those within the present capabilities of community health nurses, and currently in use by the Vancouver Health Department.

5. No method was used to control or influence access to other public or private health services.

6. Completion of the pregnancy profile and 24 hour nutritional intake of the infant were dependent upon the mother's recall.

HYPOTHESES TESTED IN THE STUDY

The null hypotheses tested in the study were:

I That the scheduled community health nursing assessments between birth and nine months of age will not detect any developmental impairments which have not already been detected by existing health services.

II That there is no significant difference in the number of developmental impairments detected at nine months of age,

between a group of infants screened by the proposed schedule of assessments and a group not so screened.

III That there is no significant difference in the number of children exhibiting developmental impairments by nine months of age, between a group of "at risk" infants and a group not "at risk", using the criteria from the Vancouver Health Department's pregnancy and infant profiles.

OVERVIEW OF THE REMAINDER OF THE STUDY

Chapter II is a review of the literature focusing on the controversy surrounding selected follow-up of infants versus mass screening programs; the predictability of subsequent infant disability from prenatal and birth criteria; three programs of infant screening; and the choice of assessment tools.

Chapter III is a description of the design and methodology of the study.

Chapter IV is an analysis of the data obtained from the study.

Chapter V is a summary of the findings of the study; the conclusions arrived at; implications; and recommendations for further research.

CHAPTER II

REVIEW OF THE LITERATURE

The literature review is discussed under the following headings: at risk versus mass screening; two European infant protection programs; the Edmonton program; criteria proposed for indentifying infants "at risk" and choice of measurement procedures.

AT RISK VERSUS MASS SCREENING

Early identification and treatment of handicapping conditions in children was a recurrent theme in the literature, focusing not only on those who will predictably function at a below-normal level, but those whose handicap(s) may be hidden at birth, and the prediction be less readily made. Infant "at risk" registers were developed in an attempt to more effectively apply existing health resources. On the basis of epidemiological surveys and screening programs in existence, vulnerable sectors of the infant population were identified as being at relatively greater risk than others.

Sheridan was the earliest reference point alluded to in the literature reviewed urging the surveillance of "at risk" infants until physical and mental development progresses normally.[1] She gave specific criteria and recommended screening procedures. Following her recommendations, a number

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[1]M.D. Sheridan, "Infants at Risk of Handicapping Conditions," Monthly Bulletin Min. Health Lab. Services, XXII (1962), 238.

of risk registers were developed using variations of her criteria, such as Kettering's.[2]

Controversy followed close on the heels of popularization of the register concept, on three fronts: ethical, economic and scientific. Meier[3] summed up the ethical problem as limiting a screening and follow-up program to a number of children who, based on arbitrary criteria, were felt to be at risk, with the possibility of missing others who developed an abnormality later or possessed a latent one not detected on early examination.

Economic arguments centred around the lack of cost-benefit analysis. A highly sensitive register could be expensive and lack specificity (some included up to 60% of all births)[4] yet a less sensitive one with high specificity, allocating the bulk of health resources to a small group of children, could have missed children whose subsequent care was expensive to society at large.[5,6,7]

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[2]R. Wigglesworth, Department of Pediatrics and Child Health, Kettering General Hospital Classified List of Babies at Risk: High, Medium and Low Groups (London: unpublished, 1970)

[3]J. Meier, Screening and Assessment of Young Children at Developmental Risk, (Washington, D.C.: DHEW Publications, 1973), 17.

[4]T.E. Oppe, "Risk Registers for Babies," Develop. Med. Child. Neurol., IX (1967), 13.

[5]I.D.G. Richards and C.J. Roberts, "The at risk Infant," Lancet., II (1967) 714.

[6]J. Sackett, "W.H.O. Symposium 1971," Lancet., II (1974), 7890.

[7]A. Smith, "Identification of High-Risk Persons and Population Groups," WHO Chronicle, XXVII (February, 1973), 72.

Scientific criticisms of the at risk registers focused on the soundness of the premises on which they were based;8/9 or on misapplication of the concept, but defence of the concept itself for the limited purposes for which it was meant.[10/11/12] Walker supported the use of risk registers in Scotland, where studies showed that, for specific conditions such as hearing and vision defects, cerebral palsy and retardation, three times as many children considered "at risk" by a risk register at birth developed subsequent impairments.[13] Pringle, Butler and Davie, in a longitudinal study were able to correlate birth data to subsequent development, health and educational achievement in 14,862 cases still in the study at age seven[14] and

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[8]R.S. Illingworth, The Development of the Infant and Young Child Normal and Abnormal (London: Churchill Livingstone, 1972), 21.

[9]M.G.H. Rogers, "The Early Recognition of Handicapping Disorders in Childhood," Develop. Med. Child. Neurol., XIII (1971), 101.

[10]M. Downs, "A Critical Approach to Newborn Hearing Screening and High Risk Register," Biregional Institute on Earlier Detection and Treatment of Handicapping Conditions in Children (California: Berkeley Univ. Press, 1970), 14.

[11]L. Fisch, "The at risk Infant", Lancet, II (1967), 940.

[12]K. Howorth, "At Risk Infants," Lancet, II (1958), 886.

[13]R.G. Walker, "An Assessment of the Current Status of the At Risk Register," Lancet, II (1967), 889.

[14]M. Pringle et. al., 11,000 Seven-Year-Olds (London: Longmans, 1966), 2.

suggested development of a weighted factor list to focus on factors which may have a great effect on development in combination, but not singly. This would increase the yield of early screening assessments along the infancy continuum.

Mitchell suggested that the emphasis be moved from reproductive casualty to environmental factors in the at risk concept. These factors included infant nutrition, parental stimulation and socioeconomic status.[15] Werner, et. al. reinforced this need in a Hawaiian study of ten years duration, in which they studied the short and long term effects of perinatal stress and environmental factors in early childhood. They found the latter to be significant in ten times as many cases of handicapping conditions as the former. A significant number of physical and mental handicaps diagnosed before the age of two correlated with those present at age ten.[16]

A number of articles showed a trend away from the "infant at risk" register concept toward a concept of the high risk infant, who could be identified from conception through infancy. Regular health surveillance was recommended with more intensive supervision of the small number of high

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[15] R.G. Mitchell, "Changing Concepts of Risk," Develop. Med. Child. Neurol., XVII (1975), 278.

[16] Werner, et. al., The Children of Kauai (Honolulu: Univ. of Hawaii Press, 1971), 1.

risk babies. Risk registers, then, would complement rather than replace regular screening regimes for all infants.[17,18,19,20]

TWO EUROPEAN INFANT PROTECTION PROGRAMS

Some European countries, notably France and Sweden, have demonstrated the effectiveness of rigorous maternal-child protective services by public health authorities.

Wynn and Wynn described how France had lowered its perinatal mortality rates drastically over the past ten years.[21] Concern had arisen over the official estimate of 2.5% of the country's gross national product being spent on the costs of permanent disability originating in early life, as well as the costs to society as a whole in terms of productivity, and the immeasureable costs to the individual and family.[22] Legisla-

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[17] J.O. Forfar, "At Risk Registers," Develop. Med. Child. Neurol., X (1968) 384.

[18] T.T. Ingram "The New Approach to Early Diagnosis of Handicaps in Childhood," Develop. Med. Child. Neurol., XI (1968) 290.

[19] Oppe, op.cit., 12.

[20] WHO Symposium on Child Health, WHO Chronicle, XXV (July, 1971), 319.

[21] M. Wynn and A. Wynn, The Right of Every Child to Health Care (London: Council for Occasional Papers on Child Welfare, 1974), 4.

[22] Ibid., 6.

tion was passed in 1970 requiring that every child be seen by the local health authority for certain health checks, including developmental assessments.[23] Health visitors played an active role in pre and post natal home and clinic contacts. Although more intensive surveillance was accorded the child considered at risk, the emphasis, as the title suggests, was on the right of every child to ongoing assessment and preventive health care. France's health budget was large but justified by the government by the long term savings in treatment costs, and the improved quality of life which early intervention and prevention brought about.[24]

The Wynns described Sweden's comprehensive prenatal and postnatal program, in which the health visitor also played a major role:

> For the majority of mothers with well babies, the main value of the visits and examinations probably lay in their contribution to her health education and education in health care, apart from the usual immunizations. There was, however, a substantial minority of infants needing referral to a doctor or pediatrician at some stage.[25]

Reading the two works of the Wynns following their visit to Vancouver in 1974 motivated the researcher to investigate the local need for, and the feasibility of such a program. Little

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[23] Ibid.

[24] Ibid., 7.

[25] M. Wynn and A. Wynn, The Protection of Maternity and Infancy (London: Council for Children's Welfare, 1974), 22.

reference was found in the literature to Canadian programs of the same nature, except for one in Edmonton.

EDMONTON'S "AT RISK" PEDIATRIC PROGRAM

Edmonton has operated an "at risk" pediatric program since 1969.[26] The criteria for the At Risk Register was obtained from the Physician's Notice of Live Birth and the initial newborn visit to the home by a community health nurse. At the first contact and then between six and twelve months of age, at clinic or home visit, all babies were given a complete physical examination including head circumference measurement; length and weight; Denver Developmental Test; Hearing test of response to speech and gross hearing; and vision test for absence of squint and equal pupillary light reflexes. Depending upon findings and assessment of the family as to likelihood of seeking good medical supervision, rechecks were scheduled at one year of age and eighteen months. If all was then normal, the child's name was removed from the At Risk Supervision File and recalled for a preschool examination. The assessments were done by the community health nurses. Referrals of any impairments detected were made to the traditional medical services. Part of the success of this program was attributed to the

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[26]Edmonton, Board of Health, Suggested Follow-Up of "At Risk" Babies, unpublished guide for Community Health Nurses, 1969.

90-95% attendance of infants at the city immunization clinics, where health counselling and examinations were included as part of the service.[27]

AT RISK CRITERIA PROPOSED

For this study criteria for identification of those infants at risk of subsequent developmental impairment were chosen from a review of pertinent literature in conjunction with examination of the currently used tools in the Vancouver Health Department: the Pregnancy Profile and the Infant Profile At Risk Criteria.[28]

The Pregnancy Profile was developed in 1974, designed primarily to assist community health nurses teaching prenatal classes in identifying teaching needs of class participants as a group; and possible risk factors in individual cases. The criteria used to assess risk to the fetus and subsequent child were consistent with those of Goodwin[29] and Nesbitt,[30] and those incorporated more recently into the Perinatal Programme of British Columbia's new prenatal record.[31]

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[27] Ibid.

[28] See Appendix A

[29] W.G. Goodwin, "The Strategy of Fetal Risk Management," Canadian Family Physician, reprint, April, 1973.

[30] R.E.L. Nesbitt and R.H. Aubry, "Nesbitt Scoring System - the Maternal-Child Health Care Index," Amer.J.Obstetrics and Gynecology, CIII (1967), 13.

[31] Perinatal Programme of B.C., "B.C.'s New Prenatal Record," B.C. Medical Journal, XVII (May, 1975), 24.

A nutritional assessment and a question about smoking habits were added to the usual questions about previous pregnancies, medical history and the course of the present pregnancy. Both prenatal nutrition and smoking during pregnancy were receiving increased attention in the literature as to their effects on the unborn child. Higgins of the Montreal Diet Dispensary has presented evidence over the past thirty years supporting the significance of nutrition (and nutrition intervention) during pregnancy on the growth and development of the resulting infant.[32]

Stovel, in a comprehensive review of the literature concerning nutrition in pregnancy summarized current thoughts on its effect on infancy:

> "...the literature strongly supports the importance of good nutrition and an adequate weight gain during pregnancy to avoid the following pattern:
>
> Underweight Mother and/or Low Weight Gain During Pregnancy
> ⟶ Low Birth Weight Infant
> ⟶ higher mortality rate
> ⟶ greater chance of physical and mental retardation." [33]

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[32] A. Higgins, "Nutrition and the Outcome of Pregnancy" text of the address given by Mrs Higgins at the IV International Congress of Endocrinology Symposium, June 23rd, 1972, 1.

[33] S. Stovel, Nutrition in Pregnancy, (Vancouver: Pacific Health Education Association), 1975, i.

Both also spoke to the definite relationship of smoking to lower birth weight infants, although the exact relationship was not known.[34]

The Infant Profile At Risk Criteria was developed in 1975, as a checklist format for the information provided on the Physician's Notification of Live Birth. It alerted the community health nurse to birth information which may have put the infant at risk of subsequent complications, and served as a worksheet for recording notes of the initial newborn visit.

CHOICE OF MEASUREMENT PROCEDURES

The measurement procedures chosen for use in the study were selected from those currently used by community health nurses and known to graduates of baccalaureate nursing programs. This was a limitation of the study, as stated, but also a strength should implementation of such a program be indicated following the study. A review of the literature was pursued to confirm the appropriateness of the assessment tools chosen and to determine the assessment schedule.

SUMMARY

The literature review included an investigation of existing pediatric programs with emphasis on two European programs and one Canadian program.

The issue of selective versus mass screening was seen

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[34]Ibid., 24.

to be controversial, but it appeared that the trend was away from at risk registers toward regular surveillance of all infants with increased attention directed toward the infant at risk.

Choice of at risk criteria varied in the articles reviewed, but the data comprising the Vancouver Health Department's Pregnancy and Infant Profiles were consistent with the currently accepted at risk criteria as outlined by Goodwin and British Columbia's New Prenatal Record.

The literature search was directed lastly toward confirmation of the appropriateness of the proposed assessment tools and determination of a screening schedule for the study. Further discussion of this last area will be continued in Chapter III, Design and Methodology.

CHAPTER III

DESIGN AND METHODOLOGY

This chapter will focus on three major areas: the preliminary study; the design of the study, including setting and sample; and the methodology of the study. The methodology section comprises discussions of staff instruction, measurement procedures, data collection and data analysis.

THE PRELIMINARY STUDY

Following an in-service program in infant assessment in 1973, the researcher had completed a number of appraisals on newborns in her assignment as a community health nurse. Eighteen of these infants, then twelve to eighteen months old, were revisited between February and March 1975 to determine health status. Included in this determination were a physical examination; Denver Developmental Screening Test; vision and hearing test; and a health history obtained from the parents.

Within the limitations of the sample size and non random selection, the findings indicated a usefulness of infant assessments. Only three of the infants had had a physical examination since six weeks of age, yet six were referred to their family physicians for existing problems: obesity, squint, delayed fine motor coordination, skin conditions of long duration; as a result of the study. All of the conditions save one (delayed speech) could have been identified earlier, and treated or their impact lessened at the time. Of interest

was that all of the children had their immunity status up to date, often used as a health status indicator, and all of the parents saw their children as healthy. Altogether, ten of the eighteen were referred to at least one health professional for follow-up of identified problems. Parental response was positive and advised follow-up was pursued.

Although no correlations were made between individual birth and initial assessment data and subsequent health status, of those seven children with some risk factors identified at birth, five had exhibited some developmental impairments, as compared with five of eleven not considered at risk initially. The sample was too small and the study too informal to determine whether this might indicate a need for follow-up of the "at risk" infant only, or regular assessment of all infants.

Only six of the infants had attended child health centres. On review of the Vancouver Health Department's 1974 annual report, this was consistent with city-wide statistics. Only 30.8% of infants were enrolled in a child health centre before twelve months of age.[1] It was concluded that a child health centre-based assessment program such as Edmonton's would not be as effective in this setting as one based on home visits.

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[1]Vancouver Health Department, Health 1974 (Vancouver: City of Vancouver, 1975), 6.

DESIGN OF THE STUDY

Experimental Design

The three purposes of the study were: to determine whether any developmental impairments could be detected solely by community health nurse assessments; whether at nine months of age that group of infants assessed by the proposed schedule of assessments would differ from a group not so assessed in the number of developmental impairments present; and whether the Vancouver Health Department's Pregnancy and Infant Profiles had predictive validity for those infants who would develop subsequent impairments.

The design employed for Hypothesis I was quasi-experimental time series design:[2] 0 0 0 X 0 0 where X was the detection and referral of developmental impairments; and 0 the scheduled assessments proposed. Only the experimental group were assessed and the X could be applied between any or all of the 0s.

Causal relationships between variables were being tested in Hypotheses II and III but a true experimental design was ruled out as "...there was no formal means of certifying that the groups would have been equivalent had it not been for the X."[3] A static group comparison was chosen: $\frac{X}{} - \frac{0}{0}$.

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[2]D.T. Campbell and J.C. Stanley, Experimental and Quasi-Experimental Designs for Research, (Chicago: Rand McNally and and Co., 1966), 40.

[3]Ibid, 12.

For Hypothesis II, X was the proposed schedule of assessments and O was the nine month assessments applied to both the experimental and control groups.

For Hypothesis III, X was the "at risk" categorization by the pregnancy and infant profiles, and O the subsequent detection of developmental impairments.

The Design also included an interview component with a semistandardized format to allow for the usual service needs of visits to be met: discussion of feeding and sleep habits, family relationships, normal growth and development, and anticipatory guidance for the parents. Information regarding the health of the infant between visits and use of private and public health services was also noted.

The Setting

The setting was one health unit area in a large city, comprising a geographical area of seventeen square miles, and a population of 127, 165.[4] The socioeconomic range was broad, and a wide representation of ethnic groups included.[5]

The Subjects

A time-sequential sample of one hundred infants was chosen, composed of all those infants born in the setting from mid-May to mid-July, 1975. Infants were alternately

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[4]Vancouver City Planning Department, Vancouver Local Areas, (Vancouver: City of Vancouver, April, 1975), based on 1971 Census Data.

[5]Ibid.

assigned to the experimental and control groups by the clerical staff until fifty were included in each group. No attempt was made to match infants in the two groups as the profiles contained demographical data which was being tested for predictive validity, such as parity of the mother, socio-economic status of the family or birth weight.

METHODOLOGY OF THE STUDY

Staff Instruction

Nursing and clerical staff were given instruction sheets[6] and meetings were held prior to the start of the study to clarify their involvement.

The clerical staff, on receiving the Physician's Notice of Live Birth from the Provincial Department of Vital Statistics, completed an Infant Profile from the information given on the birth notice, attached a blank Pregnancy Profile, and alternately assigned the infants to the experimental and control groups. The experimental group's forms were given to the researcher for the initial newborn visit and the control group's to the district community health nurses as usual, for their initial newborn visits.

The community health nurses were instructed to explain to the mothers, during those visits, that a research study was

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[6] See Appendix C

being done about infant developmental assessments, and that when their infants were nine months of age the researcher would be contacting them to request their participation. They were also instructed to ask the mothers to complete a Pregnancy Profile from recall. Notes of the visit were to be made on the Infant Profile and two profiles filed together in the health unit office, as normally done. It was explained that the study was not to hamper the normal follow-up that would routinely be initiated, such as repeated home contacts where concerns had been identified.

Measurement Procedures

Five assessment tools[7] were chosen for use in various combinations for five scheduled infant visits.[8]

The physical examination was based on observation, palpation, percussion and auscultation (McLean)[9] and included reflexes (Haynes)[10] and completion of standardized growth grids (Stuart).[11] Vision testing was done according to the guide-

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[7] See Appendix B

[8] See Table I

[9] H.E. McLean, Physical Health and its Evaluation: A Manual For Nurses (Vancouver: City of Vancouver, 1971).

[10] U. Haynes, A Developmental Approach to Casefinding (Washington, D.C.: Dept. HEW, 1969).

[11] H C. Stuart, Anthropometric Chart (Boston: Harvard School of Public Health, undated).

lines for infants in a vision test (Barker, et al.)[12] standardized in Denver in 1972, and found to be accurate when used by a variety of professional and paraprofessional persons.[13]

An assessment guide was used for the testing of hearing at three and nine months (Vancouver Health Department)[14] based on the observation of behaviour as the most effective way to identify abnormal hearing in infants.[15]

Physical examinations were completed on each visit, including weighing and measuring; the vision test was completed at six months when amblyopia could be detected;[16] and the hearing test at three months. Earlier hearing behaviours were included in Haynes' reflex testing.

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[12] J. Barker, A. Goldstein and W.K. Frankenburg, Denver Eye Screening Test (Denver: University of Colorado Medical Centre, 1972).

[13] Ibid., 1.

[14] Vancouver Health Department, "Identification of Abnormal Hearing in Infants and Young Children", Public Health Nurse's Handbook (Vancouver: City of Vancouver, 1970), 91.

[15] L. Fisch, "The At Risk Infant," Lancet, 2 (1967), 1255.

[16] J. Barker et al., ibid., 2.

For development, the Denver Developmental Screening Test was used at six months.[17] It was standardized in Denver, Colorado, where intensive validity and reliability tests were conducted in 1969.[18]

Thorpe and Werner, in a critical review of five developmental inventories including the Denver, discussed the limitations of each.[19] Although cautioning against the use of any one as a predictor of future potential of gross motor abilities, communication skills, fine motor co-ordination or personal-social behaviour, they suggested that administered by a trained person, the DDST could be used as effectively as any other to provide a narrative description or profile of the child in the four psychomotor areas.[20]

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[17]W.K. Frankenburg, J.W. Dodds and A.W. Fandal, Denver Developmental Screening Test (Denver: University of Colorado Press, 1970).

[18]Frankenburg, Dodds and Fandal, ibid., Appendix A.

[19]H.S. Thorpe and E.E. Werner, "Developmental Screening of Pre-school Children: A Critical Review of Inventories Used in Health Educational Programs," Pediatrics, L (March, 1974), 362-369.

[20]Ibid., 369.

Roberts and Khosla, in a study of 193 infants 11 to 13 months of age found a strong correlation between gross motor abnormality as measured on the DDST and the following: delayed language, auditory impairment and visual defects. Little correlation was found between the language component and speech or hearing problems.[21] This was consistent with Bryant's findings, suggesting that the test should be used in conjunction with an independent hearing and vision test, then a detailed examination be carried out if any abnormality is found.[22]

In 1974, however, a study by the South Okanagan Health Unit confirmed the standardization by Frankenburg et.al. on 1,000 children in Denver including the language sector of the test.[23] The differences in setting (rural, Canadian) appeared not to affect the expected range of results.

As physical examination, vision and hearing tests were to be done concurrently with the developmental testing, it was

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[21]C.J. Roberts and T. Khosla, "An Evaluation of Developmental Examinations as a Method of Detecting Neurological, Visual and Auditory Handicaps in Infancy," Brit. J. Prev. Med. XXVI (February, 1972), 94.

[22]Ibid.

[23]G.M. Bryant and K.J. Davies, "A Preliminary Study of the Use of the Denver Developmental Screening Test in a Health Department, "Develop.Med.Child.Neurol., XV (January, 1973), 33-40

decided that the limitations possibly inherent in this tool would not present a problem.

The nutrition assessment was based on a 24-hour intake completed by a parent at the visit, by recall. Caloric computation of the intake and breakdown of the nutrients as to fat, protein and carbohydrate content was done according to a currently used guide,[24] and adequacy of the infant's diet evaluated. One month of age was chosen for the first nutritional assessment. In a study of 300 normal infants, Shulka et.al., found that 50 were suffering from infantile obesity, and 83 were overweight.[25] This correlated highly with the early introduction of solid foods to a full milk intake. In 39.7% of the cases studied, solid-foods were introduced before 4 weeks of age; in 93.3%, before 13 weeks of age. Bottle-feeding mothers tended to introduce solid foods earlier.[26]

The choice of nine months as a termination of the study was based on a quotation of Dargassies, an expert on early developmental testing:

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[24]Vancouver Health Department, Infant Nutrition Guide (Vancouver: City of Vancouver, 1974), 42.

[25]Shulka, et.al., "Infantile Overnutrition in the First Year of Life: A Field Study in Dudley, Worcestershire," British Medical Journal, II , (December, 1972), 507.

[26]Ibid.

> "The infant at 7 to 9 months. This is an important age for the child who has had or still has abnormal signs. Close observation has to be maintained at this age since he may lose his neurological abnormalities, even severe ones, or he may become worse. Only toward the end of this period can a reliable prognosis be made for the future. This is a key age because presumptive signs observed earlier may or may not be confirmed."[27]

The choice of five visits was made keeping in mind the limitations on the visiting time of a community health nurse in a generalized program, but also the ideal of the French program's nine visits in the first nine months of life.[28] Five visits spaced over this time were decided upon, meeting the suggested ages for the various tools and screening procedures chosen, and the recommended times for the earliest intervention/prevention in the developmental impairments being sought.

Data Collection

For the experimental group as well as the control, the initial visit included completion of the Pregnancy Profile by recall. A more complete explanation of the study was given[29] and verbal consent was obtained from the parent(s) for inclusion in the study. Verbal consent was considered adequate as each subsequent entry to the home was voluntary on the part of

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[27] M. Wynn and A. Wynn, The Right of Every Child to Health Care, 22.

[28] Ibid.

[29] See Appendix C.

the parent. As the researcher was a community health nurse, employed in the health unit area of the study, no difficulty was anticipated regarding repeated entry to the home. Reassurance was given that the parent(s) could withdraw the infant from the study at any time without affecting any other services by the health department.

The initial visits extended over a one and one-half month period, from early June through July 1975, and the study was completed at the end of April 1976, when the last infant reached nine months of age.

The schedule of assessments proposed for each infant in the experimental group is shown in Table I.

TABLE I

THE PROPOSED ASSESSMENT SCHEDULE FOR INFANTS IN THE EXPERIMENTAL GROUP

Age of Infant	Proposed Assessments
On receipt of birth notice (within 2 weeks of birth)	Physical Appraisal, Interview - semistandardized, including observations of general health and behaviour, use of other health services
One Month	Physical Appraisal 24 hr. Nutritional Intake Interview - as above
Three Months	Physical Appraisal Hearing Assessment Interview - as above
Six Months	Physical Appraisal Vision Test Denver Developmental Screening Test Interview - as above
Nine Months	Physical Appraisal Hearing Test Vision Test 24 hr. Nutritional Intake Denver Developmental Screening Test Interview - as above + Immunizations

The nine month assessments of the control group infants were the same as for the experimental ones, except for the addition of nutritional and health histories. This information would have been recorded over the nine month period for the experimental group.

Four community health nurses expressing interest in infant assessment were involved in the final visits to the experimental group, while the researcher completed all of the nine month visits to the control group. It was felt that greater objectivity would be lent to the study results if reliable others completed the final assessments on the experimental group infants. Prior to their involvement, inter-rater reliability was measured for each of the assessments to be given, using eight non-study infants. Other than differences of one half to one centimeter in measuring head circumference and length, and differences of less than one tenth of a kilogram in weight, no discrepancies were found in techniques or results.

Data Analysis

Analysis of the data included both descriptive analysis and statistical tests.

Data in relation to Hypothesis I were tabulated and described according to measurement procedures used, type of impairment detected and age at which the impairment was assessed.

Data in relation to Hypotheses II and III were subjected

to Fisher's exact test of probability[30] using 2 x 2 contingency tables. This non-parametric test was chosen as it was based on exact probabilities and therefore not ruled out by the low frequencies obtained in some of the cells in the contingency tables.[31] Each hypothesis was tested by determining not only the probability of occurence by chance of the particular frequency observed, but that of all other possible randomizations of that sample in the table. Assumption of an underlying normal was not required.[32] A level of significance of .05 was used for all tests.

SUMMARY

This chapter focussed on the design and methodology of the study, including a preliminary study; the design of the study; and the methodology including staff orientation, measurement procedures, data collection and the methods of data analysis.

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[30] W.L. Hays, Statistics (New York: Holt, Rinehart and Winston, 1963), 599.

[31] Ibid., 598.

[32] Ibid.

CHAPTER IV

ANALYSIS OF THE DATA

Analysis of the data will be discussed under the acceptance or rejection of each hypothesis, with a discussion of additional data following.

ANALYSIS RELATED TO THE HYPOTHESES

Data Analysis Related to Hypothesis I

Hypothesis I stated that scheduled community health nursing assessments between birth and nine months of age will not detect any developmental impairments which have not already been detected by existing health services.

Table II shows the numbers of developmental impairments detected in the experimental group infants, by type of impairment and age at which assessed. Those impairments detected by the researcher and subsequently diagnosed as normal by a physician are noted, indicating the appropriateness of the referrals. A total of thirty-six impairments were identified in the study and referred to traditional medical services for diagnosis and treatment. In three cases the medical findings were normal but the referrals said to be appropriate by the physician. Either further testing of the infant had been carried out, or consultation and examination by a specialist had been carried out before normalcy was confirmed. In one case an infant was referred for a possible vision defect which was diagnosed as being normal and the referral inappropriate. Based on the findings, the null hypothesis was rejected.

TABLE II

INFANT DEVELOPMENTAL IMPAIRMENTS DETECTED BY SCHEDULED ASSESSMENTS WHICH HAD NOT ALREADY BEEN DETECTED BY EXISTING HEALTH SERVICES[1]

Assessment Used to Detect Impairment	Assessment Ages					Total Impairments by Assessment Tool Used
	2 weeks N = 50	1 month N = 49	3 months N = 48	6 months N = 44	9 months N = 42	
PHYSICAL EXAMINATION						
General Appearance	1*	0	0	0	0	1
Skin	2	2	2	1	0	7
Ears	1	1	1	1	0	4
Eyes	2	2	0	0	0	4
Mouth & Throat	1	0	1	0	0	2
Chest-Respiratory cardiovascular	0	0	0	0	0	0
Abdomen	0	0	1	0	0	1
Genitalia	1	0	0	0	1	2
Musculaskeletal	3	2	1 + 1*	2 + 1*	0	10
Nervous System	0	0	0	0	0	0
Weight	0	2	0	1	0	3
DEVELOPMENTAL TEST	0	0	0	0	0	0
VISION TEST				1**	1	2
HEARING TEST			(1)		0	(1)
24 HR NUTRITION		(2)			0	(2)
Total Impairments Detected by Age:	11	9	7	7	2	36

* Subsequently diagnosed normal, referral appropriate
** Subsequently diagnosed normal, referral inappropriate
() Not included in total of impairments as also detected in physical examination

[1]See Appendix D, Table XI for descriptions of the impairments detected.

Data Analysis Related to Hypothesis II

Hypothesis II stated that there is no significant difference in the number of developmental impairments detected at nine months of age between a group of infants screened by the proposed schedule of assessments and a group not so screened.

Analysis of the data showed that of eighteen impairments detected, sixteen were in the control group. The Fisher's exact test of probability showed that this was significant. Table III shows a comparison of the two groups. The null hypothesis was rejected.

TABLE III

COMPARISON OF TWO GROUPS OF INFANTS BY NUMBER OF DEVELOPMENTAL IMPAIRMENTS DETECTED AT NINE MONTHS OF AGE[2]

N = 82

Group	Developmental Impairment Detected	No Developmental Impairment Detected
Experimental N = 42	2	40
Control N = 40	16	24
Total	18	64

$$\text{prob.} = \frac{114293 \times 10^{113}}{589677 \times 10^{151}} \quad \text{(significant)}$$

[2]See Appendix D, Table XII for descriptions of the impairments detected.

Data Analysis Related to Hypothesis III

Hypothesis III stated that there is no significant difference in thenumber of children exhibiting developmental impairments by nine months of age, between a group of "at risk" infants and a group of "not at risk", using the criteria from the Vancouver Health Department's Pregnancy and Infant Profiles.

Table IV shows a comparison between those infants considered at risk or not at risk by the pregnancy profile; and those considered at risk or not at risk by the infant profile. Those criteria common to both, such as maternal age and parity, were not included in the tabulation.

TABLE IV

COMPARISON OF INFANTS CONSIDERED AT RISK OR NOT AT RISK BY THE PREGNANCY PROFILE WITH THOSE CONSIDERED AT RISK OR NOT AT RISK BY THE INFANT PROFILE[3]

N = 100

Group	At Risk By The Infant Profile	Not At Risk By The Infant Profile
At Risk By The Pregnancy Profile N = 48	35	13
Not At Risk By The Pregnancy Profile N = 52	21	31
Total	56	44

$$\text{prob.} = \frac{785866 \times 10^{274}}{660548 \times 10^{253}} \quad \text{(not significant)}$$

[3]See Appendix D, Table XIII and XIV for tabulations by criteria.

Tables V, VI, and VII show comparisons of infants considered at risk or not at risk by either or both profiles with subsequent developmental impairments identified at or before nine months of age.

Fisher exact tests of probability were applied to 2 x 2 contingency tables based on the four sets of data. The results are shown on the respective tables, hypothesis III was rejected on the basis of significance established in Tables V, VI, and VII.

TABLE V

COMPARISON OF INFANTS CONSIDERED AT RISK OR NOT AT RISK BY THE COMBINED PREGNANCY AND INFANT PROFILES BY PRESENCE OR LACK OF SUBSEQUENT DEVELOPMENTAL IMPAIRMENT

N = 82

Group	Subsequent Impairment Identified	No Subsequent Impairment Identified
At Risk By The Combined Profiles N = 73	28	45
Not At Risk By The Combined Profiles N = 9	1	8
Total	29	53

$$\text{Prob.} = \frac{929692 \times 10^{115}_{122}}{475364} \quad \text{(significant)}$$

TABLE VI

COMPARISON OF INFANTS CONSIDERED AT RISK OR NOT AT RISK BY THE PREGNANCY PROFILE BY PRESENCE OR LACK OF SUBSEQUENT DEVELOPMENTAL IMPAIRMENT

N = 82

Group	Subsequent Impairment Identified	No Subsequent Impairment Identified
At Risk By The Pregnancy Profile N = 63	26	37
Not At Risk By The Pregnancy Profile N = 19	5	14
Total	31	51

$$\text{prob.} = \frac{722637 \times 10^{171}}{785137 \times 10^{174}} \qquad \text{(significant)}$$

TABLE VII

COMPARISON OF INFANTS CONSIDERED AT RISK OR NOT AT RISK BY THE INFANT PROFILE BY PRESENCE OR LACK OF SUBSEQUENT DEVELOPMENTAL IMPAIRMENT

N = 82

Group	Subsequent Impairment Identified	No Subsequent Impairment Identified
At Risk By The Infant Profile N = 57	24	33
Not At Risk By The Infant Profile N = 25	7	18
Total	31	51

$$\text{prob.} = \frac{200428 \times 10^{145}}{996305 \times 10^{147}} \qquad \text{(significant)}$$

ADDITIONAL DATA

For those infants remaining in the study at nine months of age, additional data were obtained from the parent interviews. It will be presented under four headings: child health centre attendance for immunization; physical examination by physician; infant nutrition; and parent initiation of community health nurse contacts.

Child Health Centre Attendance For Immunization

All of the infants, except one in the experimental group, had up to date immunization status. Table VIII shows a comparison of attendance at child health centres for this service with attendance at physicians' offices.

TABLE VIII

COMPARISON BETWEEN TWO GROUPS OF INFANTS BY ATTENDANCE AT CHILD HEALTH CENTRES OR PHYSICIANS' OFFICES FOR IMMUNIZATION

N = 81

Group	Attended Child Health Centre		Attended Physician's Office	
	Number	Percentage	Number	Percentage
Experimental N = 41	6	14	35	86
Control N = 40	10	25	30	75
Combined Total N = 81	16	20	65	80

Physical Examination By Physician

Forty-four of the eighty-two infants remaining in the study at nine months of age had been given a physical examination since six weeks of age, eleven of these because of illness. This number does not include those examinations following referral by the researcher.

Nutritional Data

Table IX shows a comparison of the two groups of infants by introduction of solid foods before the recommended age of three to four months, also those infants who were overweight at nine months.

TABLE IX

COMPARISON BETWEEN TWO GROUPS OF INFANTS BY EARLY INTRODUCTION OF SOLID FOODS AND BY NINE MONTH ASSESSMENT AS BEING OVERWEIGHT

N = 82

Group	Solid Foods Introduced Before Recommended Age	Solid Foods Introduced At Recommended Age
Experimental N = 42	1 *(0)	41 *(0)
Control N = 40	5 *(3)	35 *(0)
Total	6 (3)	76 (0)

*() Overweight at nine months of age

Table X shows a comparison between the two groups of infants by age of weaning from the breast. Fifty mothers breastfed their infants initially.

TABLE X

COMPARISON BETWEEN TWO GROUPS OF BREASTFED INFANTS BY AGE OF WEANING FROM THE BREAST

N = 55

Group	Age To Which Breastfeeding Continued					
	1 month		3 months		6 months or more	
	No.	%	No.	%	No.	%
Experimental N = 23	23	100	22	96	10	43
Control N = 32	22	69	15	47	9	28
Combined Total N = 55	45	81	37	67	19	35

Parent Initiation of Community Health Nurse Contact

Parental response to the study was positive in both the experimental and control groups. No infants were excluded from the study at any stage due to parental refusal to participate. Community health nurse contacts over and above those contacts involving home visit arrangements and follow up of detected impairments were documented over the nine month period. Thirty-one such contacts by telephone and additional home visits were initiated by parents of infants in the experimental group. By parent report, only thirteen such contacts were initiated in the control group with the district community health nurses.

SUMMARY

The analysis of the data and additional findings were presented in this chapter.

Analysis of the data relating to Hypothesis I revealed that developmental impairments not already detected by existing health services could be detected by a schedule of community health nursing assessments. The null hypothesis was accordingly rejected.

Analysis of the data relating to Hypothesis II revealed a significant difference between the number of developmental impairments detected in the experimental and control groups of infants. This null hypothesis was consequently rejected also.

Analysis of the data in relation to Hypothesis III indicated a significant difference between the number of infants considered at risk by the pregnancy and/or infant profiles, and the number not considered at risk, in the number exhibiting subsequent developmental impairments. The null hypothesis was accordingly rejected. The data analysis showed a correlation between at risk categorization on the pregnancy and the infant profiles beyond that which would be obtained by chance alone.

The data in Hypotheses II and III were analysed by application of Fisher's exact test of probability based on 2 x 2 contingency tables, at a .05 level of significance. Implications of these findings and those discussed under the heading of additional data will be explored in Chapter V.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS FOR FURTHER RESEARCH

SUMMARY

The problem identified for this study was the possible lack of detection of developmental impairments in infants in the first several months of life, despite the accessibility to health services and the availability of prepaid medical plans.

The specific questions posed for the study were:

I. Would scheduled physical and developmental assessments by a community health nurse detect any real or potential impairments in infants, or would this be a duplication of present physician surveillance?

II. Is increased community health nurse surveillance of all infants indicated, or selective follow-up of those infants deemed to be at greater risk of impairment only?

III. If the latter, are criteria on the presently used Vancouver Health Department Pregnancy Profile and Infant At Risk Criteria forms predictive of subsequent impairment?

IV. If an assessment program were implemented, would those infants examined regularly by a community health nurse for several months demonstrate a better health and developmental status than a group not so examined?

The following hypotheses were tested in the study:

I. That the scheduled community health nursing assessments between birth and nine months of age will not detect any developmental impairments which have not already been detected by

existing health services.

II. That there is no significant difference in the number of developmental impairments detected at nine months of age, between a group of infants screened by the proposed schedules of assessments and a group not so screened.

III. That there is no significant difference in the number of children exhibiting developmental impairments by nine months of age between a group of "at risk" and a group of not "at risk" infants, using the criteria from the Vancouver Health Department's pregnancy and infant profiles.

The literature reviewed included an investigation of three existing pediatric programs; an exploration of the issue of mass versus selective screening of infants; and a confirmation of the appropriateness of the measuring procedures chosen.

The study was conducted in one health unit area of a large city. Subjects included one hundred infants assigned alternately to an experimental and a control group as the birth notifications were received at the health unit. The experimental group received scheduled assessments over a nine month period in addition to the one mandated newborn visit. The control group received only the one visit as usual and a nine month assessment, although no control was applied to prevent access to further public health services.

Pregnancy and infant profiles were completed for infants in both groups at the initial newborn visit.

The data were collected by the researcher using the proposed assessment tools. Four community health nurses assisted in the assessments of the experimental group infants at nine months. The data were collected over a period of ten months.

The data were analysed as follows:

1. Data relating to Hypothesis I were tabulated and described by type, assessment tool used for detections and age at which assessed.

2. Data relating to Hypotheses II and III were subjected to analysis by Fisher's exact test of probability, using 2 x 2 contingency tables and a .05 level of significance.

FINDINGS

A total of 233 home visits were made to the experimental group infants and 40 to the control group for the purpose of assessment. Each visit was of one-half to three-quarters of an hour duration and incorporated service needs of the family. Of the one hundred infants enrolled in the study initially, eighty-two remained at nine months of age, forty-two in the experimental group and forty in the control group. Families moving house accounted for the attrition in both groups. Parental response was positive and no infants were excluded from the study at any stage due to parental refusal to participate.

The findings will be discussed related to the three hypotheses.

Findings Related to Hypothesis I

In the experimental group a total of forty[1] developmental impairments were detected which had not already been detected by existing health services. These were detected approximately equally amongst the first four visits, only two impairments being identified at nine months of age.

The predominant impairments were: skin conditions of long duration or showing signs of infection (seven); vision and hearing defects (four and five respectively); and musculoskeletal defects such as in-turned feet and hernias (ten). Of those impairments detected, one was subsequently deemed an inappropriate referral by the infant's physician; three were deemed appropriate although normalcy was confirmed by further examination of the infants involved. No respiratory, cardiovascular or nervous system impairments were detected, and no impairments were detected by the Denver Developmental Screening Test. One impairment was detected by the hearing test; two each by the vision test and the 24 hour nutrition intake guides. All of the impairments confirmed by medical diagnosis were resolved or under medical treatment or surveillance by the termination of the study.

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[1]See Appendix D for a description of the impairments detected.

Findings Related to Hypothesis II

During the nine month assessments of both groups of infants, eighteen developmental impairments were detected,[2] sixteen in the control group. Two each were detected by the vision and hearing tests and three by the 24 hour nutrition guide, in conjunction with the physical examinations relating to eyes, ears and weight, respectively. Seven impairments were detected by the physical examination. All impairments detected were under treatment or surveillance within a month of the termination of the study; thirteen by the infant's physician or specialist, three by modification of diet for overweight.

The two impairments detected in the experimental group were: one undescended testes and one vision defect. The former is being watched by the physician, the latter by a pediatric eye specialist.

Findings Related to Hypothesis III

Pregnancy and infant profiles were compared for the one hundred infants enrolled in the study. The probability of the cell frequencies occuring by chance was such that the relationship between the two profiles was not found to be significant. However the relationship between the two profiles (individually and in combination) and detection of subse-

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[2]See Appendix D for a description of the impairments detected.

quent developmental impairment was found to be significant. Both profiles also considered large numbers of infants at risk of subsequent impairment who did not, at least by nine months of age, exhibit impairments. The numbers of infants not considered at risk who did develop subsequent impairments were as follows: one from the combined profiles; five from the pregnancy profile alone; and seven from the infant profile alone.

Findings Related To The Additional Data

These findings are summarized in Chapter IV, and will be discussed further in relation to the implications for nursing practice and recommendations for further research.

CONCLUSIONS

I. Five community health nursing assessments between birth and nine months of age were useful in detecting developmental impairments in infants.

II. The currently used Vancouver Health Department Pregnancy Profile and Infant At Risk Criteria were predictive singly and in combination for those infants who exhibited developmental impairments in the first nine months of life. However, as they also identified as at risk a large number of infants who did not develop subsequent impairments in this period, their use as selective tools for infant screening was questionable. It was concluded that they were useful adjuncts to the regular health surveillance of all infants as sensitive but not specific predictive tools.

III. The low enrolment of infants at child health centres within the area studied ruled out this setting for widespread infant assessments at the present time.

IV. A home visiting program was well received by the parents and resulted in more community health nurse contacts initiated by the parents than was the case for the control group, for discussion of other health matters.

V. Duplication of physician services was not a concern in a program of community health nursing assessments for developmental impairments in infants.

VI. The increased community health nursing contact for infant assessment may have more far-reaching effects than purely detection of impairment. For example, there may have been a relationship between the increased contact and the longer continuance of breastfeeding.

IMPLICATIONS FOR NURSING PRACTICE

Earlier recognition of an existing or potential developmental impairment could be very significant to an individual infant and family, in terms of earlier referral and treatment or even prevention of that impairment.[3] Community health nurses are an integral part of primary and secondary preventive services to young children, and have initial access to

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[3]M. Sheridan, Children's Developmental Progress (London: Nat. Foundation of Educational Research, 1973), 1.

almost the total infant population by virtue of the mandated newborn visit.

The present study indicated that there is a usefulness to a schedule of five infant assessments over a period of birth to nine months of age by community health nurses using their present skills and the measurement procedures available to them.

The findings of this study have the following implications for practice:

I. Sufficient priority should be accorded the infant population to permit the consistent offering of the five assessment combinations to all infants.

Assessments of infants should be completed at the initial newborn visit and repeated in the first nine months of life. The schedule chosen may vary with the caseload of the community health nurse and the regime of assessment of the individual infant's physician, but neither of these factors should preclude assessments of the infant when contacts are made in the home or at the child health centre.

II. The Pregnancy Profile and the Infant At Risk Criteria are useful as gross predictive tools for risk of subsequent impairment, but should not be used for selective follow-up of infants. Their current use as a mechanism to alert the community health nurse of areas of concern is appropriate and enhances regular health surveillance of all infants.

III. The assessment program could be extended to the child health centre setting on a more widespread basis making more effective use of community health nursing time. Telephone contacts when infants are three months of age to invite the mothers to the nearest centre for these assessments may improve the enrolment.

RECOMMENDATIONS FOR FURTHER RESEARCH

Based on the findings of the present study, the following recommendations for further research are suggested:

I. Further study of the pregnancy and infant profiles to determine whether or not certain criteria singly or in combination, are more specific indicators of subsequent developmental impairment. Extension of the study to observe the development of impairments in older children may indicate a greater usefulness of the tools.

II. Further research as to the effects of increased community health nursing contact in relation to infant nutrition.

III. Extension of the study to include the preschool child to determine the need for a similar assessment program.

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APPENDIX A

PREGNANCY PROFILE

INFANT PROFILE AT RISK CRITERIA

(Both forms copied with permission, Vancouver Health Department)

3-1-2/75

PREGNANCY PROFILE Date: _____

PLEASE FILL IN THIS QUESTIONNAIRE TO HELP YOUR PUBLIC HEALTH NURSE AND NUTRITIONIST PROVIDE COUNSELLING TO MEET YOUR INDIVIDUAL INTERESTS AND NEEDS.

A. Your Name _____
Address _____ Telephone _____

B. Your Doctor's Name _____
Address _____ Telephone _____

C. AGE: (Check ✓)
18 Years or Less _____ 19 to 34 _____ 35 and over _____

D. WEIGHT BEFORE BECOMING PREGNANT:
(1 pound = 0.45 kilograms; 1 inch - 2.54 centimetres; 1 foot = 0.3048 metre)

(1) _____ lbs. X 0.45 kg./lb. = _____ kg.
(2) YOUR PRESENT WEIGHT: _____ lbs. X 0.45 kg./lb. = _____ kg.
(3) YOUR WEIGHT GAIN: ((2) minus (1) =) _____ kg.
(4) HEIGHT: _____ in. X 2.54 cm./in. = _____ cm.

E. Estimated due date _____. Number of weeks pregnant (on this date) _____

F. PREVIOUS OBSTETRICAL HISTORY:

(1) List Previous children: please give their birthdates & birthweights

Sex	Birthdate (month, day, year)	Birthweights

(If necessary continue on reverse side)

Check here (✓) if you have had no children _____.

(2) Did you have any problems during your previous pregnancies or deliveries? (Such as toxemia, bleeding, Caesarian section, induced delivery, early delivery, abortion, stillbirth, early death, etc.) Explain _____

_____

Were you hospitalized or confined to bed at home at any time during any of your previous pregnancies? YES ☐ NO ☐. If "yes", why? _____

_____

(3) Did your baby(ies) have any problems? (Such as jaundice, breathing difficulty, physical defects, low birth weight, prematurity, etc.) Explain.

_____

F. (4) How did you feed your previous babies? Breast ☐ Bottle ☐
How do you plan to initially feed this baby? Breast ☐ Bottle ☐

G. PRESENT PREGNANCY HISTORY:
If you have any questions or problems you would like assistance with, please note them _____

_____

H. MEDICAL HISTORY:
Do any of the following apply to you? Please check (✓) if applicable.

1. Allergy	_____	11. Infectious Disease during this pregnancy	_____
2. Cancer	_____	12. Kidney Condition	_____
3. Depression	_____	13. Recurrent Bleeding	_____
4. Diabetes	_____	14. Surgery in Past Year	_____
5. Epilepsy	_____	15. Toxemia	_____
6. Genetic Problem	_____	16. Varicose Veins	_____
7. Hemorrhoids	_____	17. Underweight	_____
8. Headaches	_____	18. Overweight	_____
9. Heart Condition	_____	19. Other (specify)	_____
10. High Blood Pressure	_____		

I. Do you smoke? _____ How much? _____
Do you plan to stop smoking now that you are pregnant? YES ☐ NO ☐

J. Are you on any medication? YES ☐ NO ☐. Please specify, (include all non-prescription drugs such as aspirin, antacids, laxatives, sleeping pills, tranquilizers, etc.) and state what quantity of each you take and how often.

_____

_____

K. What do you do for exercise? _____

_____

How often? _____

L. What subjects are you or your husband particularly interested in having discussed at prenatal class? _____

_____

* * *

PLEASE COMPLETE THE ONE-DAY FOOD RECORD ATTACHED (H283-3-2/75)

* * *

NURSE'S COMMENTS: _____

_____

_____

_____

_____

_____

_____

ACTION TAKEN: _____

_____

_____

DATE: _____ NURSE'S SIGNATURE _____

PREGNANCY PROFILE

ONE DAY FOOD RECORD

DAY OF WEEK _____

Please list all the foods that you eat or drink within a one day period: It is important to give the TIME you eat, and to state the KIND of food as well as the AMOUNT. Don't forget things like gum or candy, sugar and cream in coffee, jam on toast, in-between meal snacks and drinks:

FOODS EATEN IN ONE DAY		
TIME	TYPE OF FOOD: eg. whole wheat bread, hamburger	QUANTITY

Are you taking any Vitamin or Mineral Supplements? YES ☐ NO ☐

IF "YES"; Name of Product _____ Dosage _____ No. of Tabs./day

Contents of each tablet (Check the nutrient value on the Product Label.)

_____

_____

_____

INFANT PROFILE AT RISK CRITERIA

Name	Birthdate
Address	Telephone
Sex of Infant M ☐ F ☐ Birthweight	Grams

MARK [X] IF THE ANSWERS TO ANY OF THE ITEMS BELOW ARE "YES."

Marital Status - Single and/or living alone		
Age of Mother - 35 yrs. & over		
- 18 yrs. or under		
Native Indian		
Birth at Home		
Specified Measures Necessary to Promote Respiration		
Multiple Birth		
Infant Considered - Immature		
- Post Mature		
Birthweight - 2500 gms. & under		
Gestation Period - Premature (under 38 weeks)		
- Post Mature (over 41 weeks)		
Total Pregnancies - 5 & over		
Miscarriages; How Many? ☐ Total Pregnancies		
Stillbirths; How Many? ☐ Total Livebirths		
Mother's Blood - RH negative		
Operative Procedures - other than Low Forceps or Episiotomy		
Caesarian Section ☐ 1st ☐ 2nd ☐ more		
Birth Injury to Child (Describe)		
Congenital Anomoly (Describe)		
Complications of Pregnancy, Labour or Delivery (Describe)		
Low Socioeconomic		
Family File in Unit		

Nurses Remarks:

Date _____ Signed _____
(Month/Day/Year)

METROPOLITAN HEALTH SERVICE OF GREATER VANCOUVER

APPENDIX B

ASSESSMENT TOOLS

* Growth Appraisal Record

* Growth Grids - Infant Girls
  - Infant Boys

* Hearing Test Guide

  Denver Eye Screening Test

  Denver Development Screening Test

* 24 Hr. Nutrition Intake Guide
  - Traditional Method of Introducing Solids
  - Average Caloric Concentrations of Common Baby Foods
  - Recommended Caloric Intake
  - Recommended Caloric Intake Tables

(* Copied with permission, Vancouver Health Department)

CH44-6/73

GROWTH APPRAISAL RECORD

NAME _____ ADDRESS _____ TELEPHONE _____
Surname First

BIRTH DATE _____ HEAD OF HOUSEHOLD _____
Month Day Year

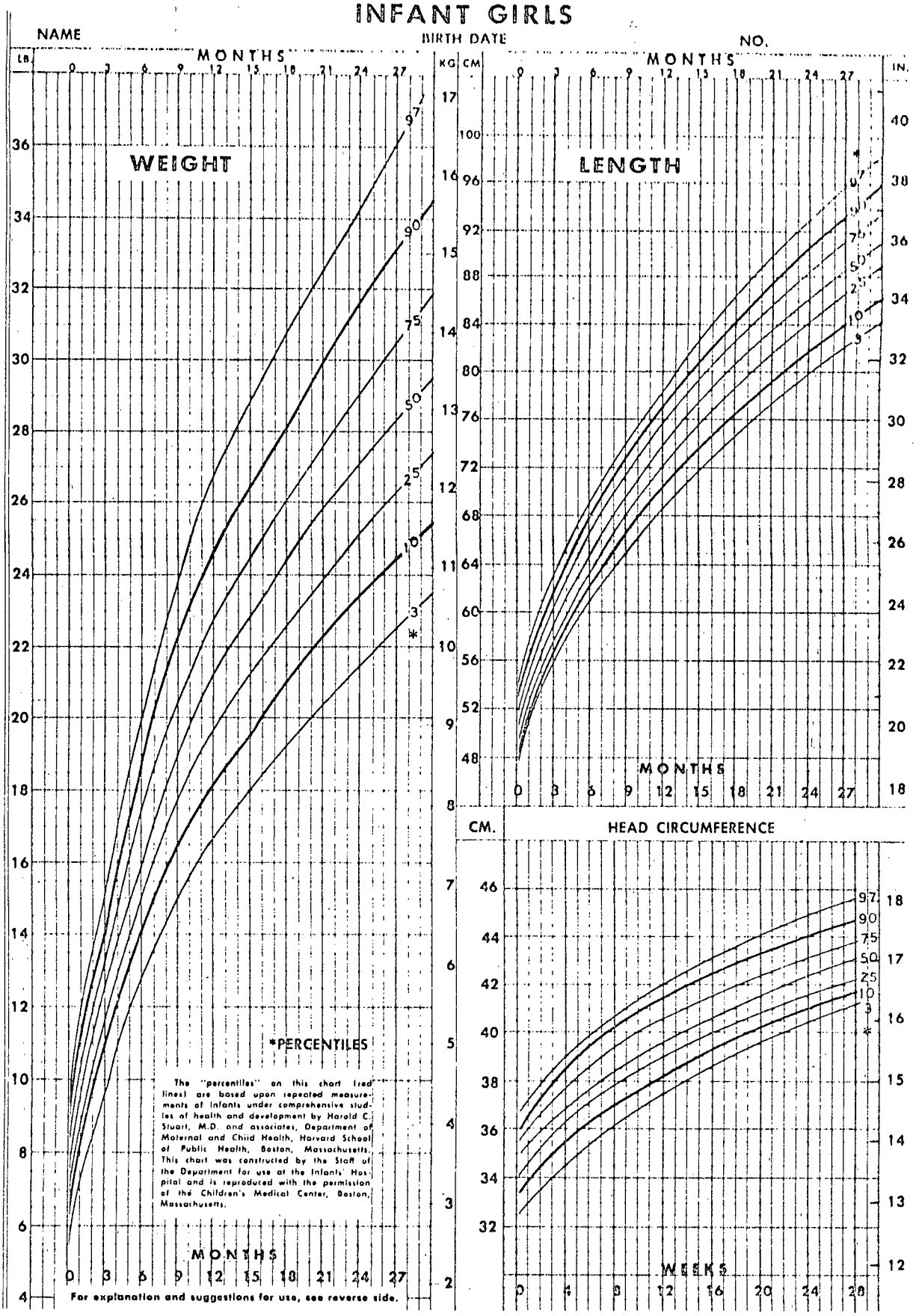
CODE:
N - No abnormality noted
O - Observe
R - Refer
T - Under Treatment
EXPLAIN

	DATES				COMMENTS - DATE AND SIGN (For More Detail Use CHC Record)
Age					
General Appearance					
Skin					
Head - Cranium					
Ears					
Eyes					
Nose					
Mouth - Throat					
Neck -					
Chest - Respiratory					
Cardiovascular					
Abdomen					
Genitalia					
Musculoskeletal					
Nervous System					
Measurements					
Height					
Weight					
Head Circumference					
Heart Rate					
Respiratory Rate					
Examiner					

METROPOLITAN HEALTH SERVICE OF GREATER VANCOUVER

INFANT GIRLS

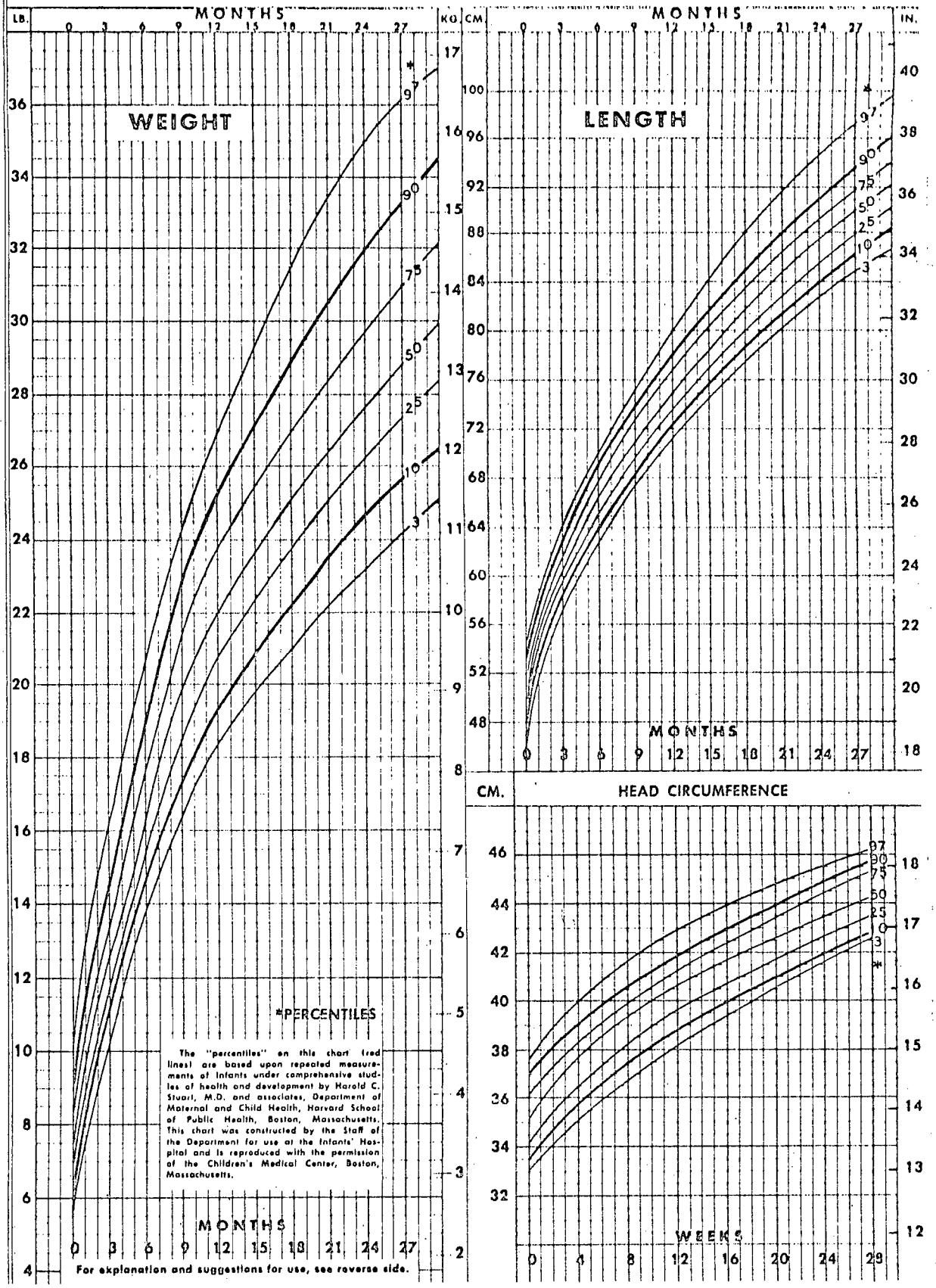
NAME BIRTH DATE NO.



THE CHILDREN'S MEDICAL CENTER, BOSTON - ANTHROPOMETRIC CHART

INFANT BOYS

NAME BIRTH DATE NO.



THE CHILDREN'S MEDICAL CENTER, BOSTON - ANTHROPOMETRIC CHART

For explanation and suggestions for use, see reverse side.

HEARING TEST GUIDE

AGE	EXPECTED HEARING/ LISTENING BEHAVIOUR	SUGGESTED QUESTIONS TO USE WITH THE MOTHER
Birth to 3 mos	<u>0 to 1 month</u> -Startle response to sudden, loud noise. -Arrests activity (crying, moving) when approached by sound. -Quietened by familiar voice. <u>1 to 2 months</u> -Searches for sound with eyes. -Often attends to speaker. <u>2 to 3 months</u> -May respond to mother's talking by vocalization. -May laugh and vocalise when played with.	1. Does your baby stop crying/moving if you speak to him as you approach him (unseen)? 2. Does a loud noise startle him? 3. When spoken to directly, does he look at your face? 4. Does he laugh and make noises when you talk to him?
3 to 6 mos.	<u>3 to 4 months</u> -Turns head to source of sound. Looks about for speaker. -Babbles (repeats sounds) to himself. <u>4 to 5 months</u> -Beginning to recognise and respond to his/her name. -Regularly locates source of sounds. <u>5 to 6 months</u> -Appears to recognise general meaning of a) warning b) angry and c) friendly tones. -Often recognises words like "Mama", "Dada", "Bye-bye". -Withdraws in response to "NO".	1. Does your baby look around when an unusual noise occurs, or to see who is talking to him? 2. Does he repeat sounds to himself? 3. Does he sometimes respond to his name? 4. Does he appear to look for someone when you say "Where's Mama/Dada?" 5. Does he appear to recognise the tone when you are: a) warning him not to do something b) angry c) friendly

DENVER EYE SCREENING TEST

Name
Hospital No.
Ward
Address

Vision Tests	1ST SCREENING:DATE						RESCREENING:DATE					
	Right Eye			Left Eye			Right Eye			Left Eye		
	Normal	Abnormal	Untestable	Normal	Abnormal	Untestable	Normal	Abnormal	Untestable	Normal	Abnormal	Untestable
1. "E" (3 years and above-3 to 5 trials)	3P	3F	U	3P	3F	U	3P	3F	U	3P	3F	U
2. Picture Card (2 1/2 - 2 11/12 yrs.-3 to 5 trials)	3P	3F	U	3P	3F	U	3P	3F	U	3P	3F	U
3. Fixation (6 months - 2 5/12 years)	P	F	U	P	F	U	P	F	U	P	F	U
4. Squinting		yes			yes			yes			yes	

Tests for Non-Straight Eyes	Normal	Abnormal	Untestable	Normal	Abnormal	Untestable
1. Do your child's eyes turn in or out, or are they ever not straight?	NO	YES	U	NO	YES	U
2. Cover Test	P	F	U	P	F	U
3. Pupillary Light Reflex	P	F	U	P	F	U

Total Test Rating (Both Eyes)		
Normal (passed vision test plus no squint, plus passed 2/3 tests for non-straight eyes)	Normal	Normal
Abnormal (abnormal on any vision test, squinting or 2 of 3 procedures for non-straight eyes)	Abnormal	Abnormal
Untestable (untestable on any vision test or untestable on 2/3 tests for non-straight eyes)	Untestable	Untestable
Future Rescreening Appointment for Total Test Rating (Abnormal or Untestable)	Date:	Date:

DENVER DEVELOPMENTAL SCREENING TEST

STO. = STOMACH
SIT = SITTING

PERCENT OF CHILDREN PASSING
25 50 75 90

May pass by report —— Footnote No. - see back of form

Test Item

Date
Name
Birthdate
Hosp. No.

MONTHS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

YEARS
2½ 3 3½ 4 4½ 5 5½ 6

PERSONAL-SOCIAL

REGARDS FACE
SMILES RESPONSIVELY
SMILES SPONTANEOUSLY
INITIALLY SHY WITH STRANGERS
PLAYS PAT-A-CAKE
FEEDS SELF CRACKERS
RESISTS TOY PULL
50%
PLAYS PEEK-A-BOO
WORKS FOR TOY OUT OF REACH
★ 100% pass at birth
PLAYS BALL WITH EXAMINER
INDICATES WANTS (NOT CRY)
DRINKS FROM CUP
IMITATES HOUSEWORK
USES SPOON, SPILLING LITTLE
HELPS IN HOUSE – SIMPLE TASKS
REMOVES GARMENT
PUTS ON CLOTHING
BUTTONS UP
WASHES & DRIES HANDS
DRESSES WITH SUPERVISION
SEPARATES FROM MOTHER EASILY
PLAYS INTERACTIVE GAMES e.g., TAG
DRESSES WITHOUT SUPERVISION

FINE MOTOR-ADAPTIVE

FOLLOWS TO MIDLINE
EQUAL MOVEMENTS
GRASPS RATTLE
REGARDS RAISIN
REACHES FOR OBJECT
FOLLOWS PAST MIDLINE
FOLLOWS 180°
HANDS TOGETHER
PASSES CUBE HAND TO HAND
SIT, LOOKS FOR YARN
SIT, TAKES 2 CUBES
BANGS 2 CUBES HELD IN HANDS
RAKES RAISIN ATTAINS
THUMB-FINGER GRASP
NEAT PINCER GRASP OF RAISIN
SCRIBBLES SPONTANEOUSLY
TOWER OF 2 CUBES
TOWER OF 4 CUBES
TOWER OF 8 CUBES
DUMPS RAISIN FROM BOTTLE-SPONT.
DUMPS RAISIN FROM BOTTLE-DEMONSTR
IMITATES VERTICAL LINE WITHIN 30°
COPIES +
COPIES O
IMITATES BRIDGE
COPIES □
IMITATES □ DEMONSTR.
DRAWS MAN 3 PARTS
DRAWS MAN 6 PARTS
PICKS LONGER LINE 3 OF 3

LANGUAGE

RESPONDS TO BELL
VOCALIZES - NOT CRYING
LAUGHS
SQUEALS
DADA OR MAMA, NONSPECIFIC
TURNS TO VOICE
DADA OR MAMA, SPECIFIC
IMITATES SPEECH SOUNDS
3 WORDS OTHER THAN MAMA, DADA
COMBINES 2 DIFFERENT WORDS
POINTS TO 1 NAMED BODY PART
NAMES 1 PICTURE
FOLLOWS DIRECTIONS/2 of 3
USES PLURALS
GIVES 1ST & LAST NAME
COMPREHENDS COLD, TIRED, HUNGRY/2 of 3
COMPREHENDS PREPOSITIONS/3 of 4
RECOGNIZES COLORS/3 of 4
OPPOSITE ANALOGIES 2 of 3
87%
DEFINES WORDS/6 of 9
87%
COMPOSITION OF/3 of 3

GROSS MOTOR

R STO LIFTS HEAD
STO HEAD UP 45°
STO HEAD UP 90°
STO CHEST UP ARM SUPPORT
SIT - HEAD STEADY
ROLLS OVER
BEAR SOME WEIGHT ON LEGS
PULL TO SIT NO HEAD LAG
SITS WITHOUT SUPPORT
STANDS HOLDING ON
PULLS SELF TO STAND
GETS TO SITTING
STANDS MOMENTARILY
WALKS HOLDING ON FURNITURE
STANDS ALONE WELL
STOOPS & RECOVERS
WALKS WELL
WALKS BACKWARDS
WALKS UP STEPS
KICKS BALL FORWARD
THROWS BALL OVERHAND
BALANCE ON 1 FOOT 1 SECOND
JUMPS IN PLACE
PEDALS TRICYCLE
BROAD JUMP
BALANCE ON 1 FOOT 10 SECONDS/2 of 3
HOPS ON 1 FOOT
CATCHES BOUNCED BALL/2 of 3
HEEL TO TOE WALK/2 of 3
BACKWARD HEEL-TOE/2 of 3
BALANCE ON 1 FOOT 5 SECONDS/2 of 3

MONTHS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
YEARS
2½ 3 3½ 4 4½ 5 5½ 6

TRADITIONAL METHOD OF INTRODUCING SOLIDS

Age (in months)

3 4 5 6 7 8 9 10 11 12

CEREALS (iron-enriched)
1tbsp-------4tbsp----------
VEGETABLES
1tbsp---4tbsp----------
FRUITS
1tbsp---4tbsp----------
MEAT, POULTRY, AND FISH
1tsp----------4tbsp
FINGER FOODS
Start----------
WHOLE COW'S MILK
500 ml. can replace formula or breast milk----------
EGG YOLK
1/4tsp--1yolk
DAIRY PRODUCTS
1tsp----------4tbsp
EGG WHITE
1/4--1
tsp--white
WHOLE EGG
Start

N.B. - This traditional method of introducing solids is provided as one example. There are other acceptable methods.

The order in which cereals, meats, fruits, and vegetables are introduced is of less importance than the age at which strained solids are given (not before 3-4 months).

AVERAGE CALORIC CONCENTRATIONS OF COMMON BABY FOODS

Food Item	kcal/ 100g	kcal/ tbsp	Percentage of Calories		
			Protein	Fat	CHO
Dry Cereal (Rice)	370	18	8	5	75
Cereal (Strained Oatmeal)	81	9	7	3	90
STRAINED					
Juices	65	10	2	2	96
Fruits	85	11	2	2	96
Vegetables: Plain	45	6	14	6	80
Meats	106	18	53	46	1
Egg Yolks	192	29	21	76	3
Meat with Vegetables Dinners	84	11	29	47	29
Soups and Vegetables with Meat Dinners	58	8	16	28	56
Desserts	96	14	4	7	89
JUNIOR					
Fruits	85	11	2	2	96
Vegetables: Plain	46	6	12	7	81
Meats	103	15	56	43	1
Meat with Vegetables Dinners	85	11	30	42	28
Soups and Vegetables with Meat Dinners	61	9	15	27	58
Desserts	93	13	4	6	90

(adapted from Fomon, 1974)

Food values of Portions Commonly used Bowes and Church, 1970.

RECOMMENDED CALORIC INTAKE

Notes

1. Weight. Weights given are for the infant of the 50th percentile of the growth chart.

2. Distribution of Calories. An infant's total caloric intake should be divided approximately as follows:

Protein:	7-16%
Fat:	30-55%
Carbohydrate:	35-65%

(See p.10.)

This chart has been calculated on the following percentages:

Protein:	11%
Fat:	41%
Carbohydrate:	48%

3. Total Caloric Intake. The recommended total caloric intake for infants is 110-120 kcal/kg/day. (Canadian Dietary Standard).

   This chart has been calculated at 115 kcal/kg/day.

4. Joules. Since 1 joule = 4.18 kcal, the recommended intake is in the range of 26.3-28.7 joules/kg/day.

   This chart is calculated at 28 joules/kg/day.

5. Formula. If the infant's formula is 20 kcal/oz, then the infant in its first month needs 391/20 = 18 oz/day or 9 oz/day of undiluted formula.

RECOMMENDED CALORIC INTAKE

Females

Age (months)	Weight lb	Weight kg	TOTAL joules/ day	kcal/day from PROTEIN	kcal/day from FAT	kcal/day from CHO	TOTAL kcal/ day
0	7.5	3.4	95	43	160	188	391
1	9.5	4.3	120	55	203	237	495
2	11.2	5.1	143	65	240	282	587
3	12.5	5.7	160	72	269	315	656
4	13.7	6.2	174	78	292	392	713
5	14.8	6.7	188	85	316	370	771
6	16.0	7.3	204	92	345	405	840
7	17.0	7.7	216	97	363	426	886
8	18.0	8.2	230	104	386	453	943
9	19.0	8.6	241	109	405	475	989
10	20.0	9.1	255	115	429	503	1047
11	20.5	9.5	260	118	438	514	1070
12	21.2	9.6	269	121	453	530	1104

Males

Age (months)	Weight lb	Weight kg	TOTAL joules/ day	kcal/day from PROTEIN	kcal/day from FAT	kcal/day from CHO	TOTAL kcal/ day
0	7.5	3.4	95	43	160	188	391
1	9.5	4.3	120	55	203	237	495
2	11.8	5.4	151	68	255	298	621
3	12.5	5.7	160	72	269	315	656
4	13.8	6.3	176	80	297	348	725
5	14.5	6.6	185	83	312	364	759
6	16.5	7.5	210	95	354	414	863
7	18.0	8.2	230	104	386	453	943
8	19.0	8.6	241	109	405	475	989
9	19.8	9.0	252	114	424	497	1035
10	20.5	9.3	260	118	438	514	1070
11	21.5	9.8	274	124	462	541	1127
12	22.0	10.0	280	127	471	552	1150

APPENDIX C

INSTRUCTIONS TO STAFF

EXPLANATION TO PARENTS

Infant Study - Instructions to Staff

The study will start in early June and finish in April or May 1976. Enrolment of infants in the study will continue from the start of the study until 100 infants are obtained.

The clerical staff will:

a) Complete an infant profile as usual and attach a blank pregnancy profile.

b) Give alternate infants to the district community health nurses for visits for newborn visits as usual, keeping a list of these infants' names for G. Doherty.

c) Keep every other infant for G. Doherty to visit.

d) File the completed profile as usual.

The community health nurses will:

a) Request the infant's mother to participate in research project by completing a pregnancy profile.

b) Add nursing notes to the infant profile as usual.

c) Advise the parents that G. Doherty will be making a contact in 9 months regarding assessments of growth, development, vision, hearing and nutrition. (G. Doherty will obtain consent then.)

G. Doherty will:

a) Visit the infants assigned and (with consent of the parents) revisit at 1 month, 2 months, 3 months and 6 months of age.

b) Request the infant's mother to complete a pregnancy profile.

c) Add nursing notes and assessment forms to the infant profile.

d) Advise the district nurses as to who she is visiting on an ongoing basis.

e) Maintain a separate file of these infants' records to which staff have the same access as the health unit files.

EXPLANATION TO PARENTS OF THE EXPERIMENTAL GROUP

"I am doing research for the Vancouver Health Department and in connection with my studies at UBC involving assessments of babies' growth, development, vision, hearing and nutrition. This will involve return visits when _____ (baby's name) is one month, three months, six months and nine months old. I will be starting this record of notes and a growth chart to compare _____'s (baby's name) changes in development and to record each visit. As with the other records in the department this is confidential and any material used for research will not have your name on it. I will explain each assessment as I do it including any findings. The assessments in no way replace the services of your doctor but hopefully will add to your baby's health care. The findings of the study will help us decide if certain nursing assessments at certain ages help to prevent, or pick up earlier, any problems in these areas. If you are interested in the results of the study I will provide you with a copy when it is completed. Please feel free to call me if you have any questions - or any concerns about your baby between visits."

APPENDIX D

STATISTICAL TABLES

TABLES OF DESCRIPTIVE ANALYSIS

TABLE XI

DESCRIPTIONS OF THE IMPAIRMENTS DETECTED IN THE EXPERIMENTAL GROUP INFANTS FROM BIRTH TO NINE MONTHS OF AGE

N = 40

Area of Impairment		Number Detected	Age Detected	Total By Area
Head	(low ears) (large tongue)	1*	2 weeks	1
Skin	scaly, generalized rash	1	2 weeks	
	infected facial rash	1	2 weeks	
	infected generalized rash	2	1 month	
	generalized allergic rach	1	3 months	
	infected diaper rash	1	3 months	
	infected diaper rash	1	6 months	7
Ears	infected outer ear canal	1	2 weeks	
	ear canal occluded by wax	1	1 month	
	both ear canals occluded by wax	1	3 months	
	abnormal ear drum (infection)	1	6 months	4
Eyes	blocked tear duct	1	2 weeks	
	infected eyes	1	1 month	
	infected eye	2	1 month	
	strabismus	1**	6 months	
	strabismus	1	9 months	6
Mouth & throat	high, narrow palate, difficulty sucking	1	2 weeks	
	thrush infection	1	3 months	2
Abdomen	impacted stool in bowel	1	3 months	1
Genitalia	skin tag on foreskin	1	2 weeks	
	undescended testicles	1	1 month	2
Musculo-skeletal struc-ture	umbilical hernia	1	2 weeks	
	in-turned foot, bowed leg	2	2 weeks	
	in-turned feet	1	1 month	
	inguinal hernia	1	1 month	
	in-turned foot	1	3 months	
	assymetrical hips, leg lengths	1*	3 months	
	in-turned feet	1*	6 months	
	in-turned foot	1	6 months	
	out-turned feet	1	6 months	10

TABLE XI continued

Area of Impairment		Number Detected	Age Detected	Total By Area
Weight	overweight	2	1 month	
	underweight	1	6 months	3
Total				36

* Subsequently diagnosed as normal after further examination, diagnostic procedures, referral appropriate

** Subsequently diagnosed normal, referral innappropriate

TABLE XII

DESCRIPTIONS OF THE IMPAIRMENTS DETECTED IN THE CONTROL GROUP INFANTS AT NINE MONTHS OF AGE

N = 40

Area of Impairment		Number Detected	Total By Area
Hearing, Ears	wax occluding both ear canals	1	
	abnormal eardum (middle ear infection)	1	2
Vision, Eyes	strabismus	4	4
Respiratory	wheezy respirations (diagnosed as asthma)	1	1
Genital	phimosis	1	
	undescended testes	1	
	large skin tag on foreskin	1	3
Abdomen	umbilical hernia	1	
Musculoskeletal structure	in-turned food	1	
	out-turned feet	1	3
Weight	obesity	3	3
Total			16

TABLE XIII

A COMPARISON BETWEEN MOTHERS OF TWO GROUPS OF INFANTS BY NUMBERS CONSIDERED AT RISK BY INDIVIDUAL CRITERIA ON THE PREGNANCY PROFILE

At Risk Criteria on the Pregnancy Profile	Numbers of mothers considered at risk	
	Experimental Group N = 50	Control Group N = 50
18 years and under	0	2
35 years and older	6	1
Prepregnant wt. over 20% ideal	2	5
" " under 20% "	4	0
Weight gain 24 lbs. not achieved	7	5
Height under 5 ft.	0	2
Over 5 children	0	3
No previous children	22	29
Toxema	0	4
Bleeding	2	1
C-section	4	0
Induced Delivery	0	0
Early delivery	0	0
Abortion	3	2
Stillbirth	1	0
Early death of previous infant(s)	1	0
Pernicious vomiting	1	0
Jaundice of previous infant(s)	1	0
Breathing difficulties of previous inf(s)	1	1
Physical defect of previous infant(s)	2	1
Low birth wt., prematurity of previous infant(s)	2	4
Allergy	5	4
Cancer	0	0
Depression	2	3
Diabetes	0	0
Epilepsy	0	0
Genetic problem	0	0
Hemorrhoids	3	3
Headaches	6	6
Heart condition	0	0
High b.p.	0	5
Infectious disease during this pregnancy	1	0
Kidney condition	1	0
Recurrent bleeding	0	1
Surgery in past year	2	0
Toxemia	0	5
Varicose veins	1	4
Underweight	4	0
Overweight	2	5
Other medical problems	0	0
Smoker	5	8
Medications taken	0	2
Food record	10	9

TABLE XIV

A COMPARISON BETWEEN MOTHERS OF TWO GROUPS OF INFANTS BY NUMBERS CONSIDERED AT RISK BY INDIVIDUAL CRITERIA ON THE INFANT PROFILE

At Risk Criteria on the Infant Profile	Number of mothers considered at risk	
	Experimental Group N = 50	Control Group N = 50
Marital status - single and/or living alone	2	3
Age of mother - 35 yrs and over	7	1
- 18 yrs and under	0	2
Native Indian	2	1
Birth at home	0	0
Measures necessary to promote respiration	1	2
Multiple birth	2	0
Infant considered - immature	4	5
- postmature	3	1
Birthweight - 2500 gms and under	4	6
Gestation period - premature (under 38 weeks)	5	4
- postmature (over 41 weeks)	2	3
Total pregnancies - 5 or over	2	3
- first	23	29
Miscarriages	3	3
Stillbirths	1	0
Mother's blood - RH negative	1	7
Operative procedures other than episiotomy, low forceps	0	2
Caesarian section	8	6
Birth injury to child	1	3
Congenital anomaly	6	4
Complications of pregnancy, labour or delivery	10	11
Low socioeconomic level	20	16