THE RELATIONSHIP BETWEEN HEALTH HISTORY FACTORS AND ACADEMIC ACHIEVEMENT/COGNITIVE DEVELOPMENT IN NATIVE INDIAN CHILDREN

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A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES

(Educational Psychology)

We accept this thesis as conforming

to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

October, 1989

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Date Oct. 12, 1989

ABSTRACT

This study examined the relationship between health history factors and academic readiness/cognitive abilities in a sample of grade one Native Indian children. Subjects ranged in age from 5-11 to 7-08. There were 14 male and 5 female students in the sample. A battery of psychoeducational tests was administered to each child. Medical data were obtained from files at the Indian Health Office. Individual health factors as well as a composite risk score were used in analyses. Correlations were computed to determine the relationship between the health factors and the psychoeducational test scores. A series of t-tests was undertaken to examine differences in means between the high and low health risk groups. Several significant correlations were found: Respiratory illnesses, Dental problems and failed Denver Developmental Screening Tests were associated with lower scores on several psychoeducational measures. The overall risk composite was found to be a meaningful predictor of readiness for this sample. Children in the high risk group scored lower on ten of the eleven tests/subtests. The differences between the means of the high and low risk groups were significant for the K-ABC Number Recall and Metropolitan Readiness Language. This sample did manifest a wide variety of the health ailments found to be endemic in Native Indian populations. These health problems appeared to be associated with their performance on the psychoeducational battery.

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CHAPTER I

INTRODUCTION

As a group, North American Native Indian children (hereafter referred to as Native Indian or Native) continue to be at great risk for academic failure, falling farther behind their white peers with increasing years of schooling (Brooks, 1978; Bryde, 1968). Academic levels of Native students are consistently lower than national norms on standardized achievement tests (More, 1984) and verbal subtests of intelligence tests (McShane & Plas, 1984; Common & Frost, 1988). Within this group there is a high rate of reading disability with literacy levels tending to be very low for Natives when compared to national norms (Burnaby, 1982; Lankford & Riley, 1986). Approximately 70 percent of Native children in Canada do not reach grade 12 with about one third repeating a year by the time they enter grade 2 (Indian Conditions, 1980).

Various reasons have been put forth for Native Indians' chronic and consistent academic problems. Havighurst (1970) suggests that instructional methods employed by teachers of Native children are not always effective owing to the distinct needs and perceptual abilities of these children.

Several researchers have explored the theory of a "Native learning style," based on their supposed strengths in visual-spatial processing rather than auditory-sequential processing. Auditory-sequential is generally accepted as being more conducive to the typical school environment (Kaulback, 1984;

Osborne, 1985; McShane & Plas, 1984). Sabatino, Hayden and Kelling (1972) reported that Navajo children referred for special classes experienced school learning problems predominantly due to a lack of knowledge of the linguistic rules of the English language. The nonstandard English spoken by many Native students has also been associated with their lack of progress in reading and writing (Barth, 1979).

The low verbal IQ scores obtained by Native children are interpreted by Teeter, Moore and Petersen (1982) as reflecting divergent language, cultural and experiential factors rather than as a deficit in intellectual potential.

Downing, Ollila and Oliver (1975) found the children from the British Columbia Native culture they studied to have less experience of literacy behavior and less awareness of the acts of speech. They describe this phenomenon as "cognitive confusion" regarding reading and writing. Their sample had less knowledge of the purpose of literacy activities and poorer technical knowledge of units of speech and writing.

In addition to lack of preschool experiences and cultural stimulus, irrelevant curriculum may also be placing these children at a disadvantage in the provincial school system (McEachern, 1981).

Various other factors often associated with low socio-economic status, regardless of cultural affiliation also apply to this group, for example: poverty, lack of stability within the district, as well as low rates of attendance. These have

also been suggested as contributing factors to their academic failure (Vernon, 1966; Blowers, 1981; Rohner, 1965).

McShane (1983) proposed a multi faceted model to explain the unique patterns of achievement in these children. His combined Deficit-Difference-Developmental model takes into account detrimental environmental conditions, cultural disorganization (i.e. shifting between the Native and dominant cultures), language and emotional problems.

In addition to the aforementioned academic problems, Native children also continue to experience a disproportionately high incidence of health problems. The types of illnesses they are predisposed to are the same as those endemic in other low socioeconomic groups, i.e. respiratory tract infections, gastrointestinal problems, otitis media (o.m.) and skin infections (Baker, Findlay, Isbister & Peekeekoot, 1987).

In spite of progress being made they continue to represent a high risk group from disadvantaged families. (Wallace, 1974; Plaxton, Shah, Young & Bain, 1983). Among Native groups there are more adolescent pregnancies, more complications in pregnancy and childbirth, greater multiparity, higher perinatal, neonatal and infant deaths and more low and high birth weights. They also have more deaths from gastrointestinal infections and congenital anomalies. These children also exhibit higher incidence of respiratory illness and severe recurrent pulmonary disease. (Manitoba Native Indian Mother and Child, 1981).

Despite the marked decline in the incidence of diphtheria the continuous presence of cases and carriers is a persistent problem in northern Native communities. Otitis media with resultant hearing impairment is one of the most serious health problems in this population (McShane & Mitchell, 1979; Wallace, 1974) and has been for the past two decades, with prevalence estimates ranging from 20-70%. Much research has documented the relationship of o.m. and academic/learning problems, especially when the fluctuating hearing loss and distorted auditory signals occur during critical periods of language and auditory processing development (McShane, 1982; Bender, Burks, Baum, Fleshman & Vieira, 1975). Not only are Native children at extreme risk for hearing problems but they also appear to be at greater risk than other groups of children for vision difficulties. Hamilton (1976) found six times as many Native children as nonNative entering school with a vision handicap.

Gastroenteritis has consistently ranked as the second most prevalent disease followed by strep throat, scarlet fever and influenza (Evers & Rand, 1983). In children most of these diseases are preventable through better living conditions at home, more adequate housing, a safer water supply system and regular immunization (Plaxton et al., 1983).

The high rates of infant mortality and morbidity also suggest that the Native child has a suboptimal nutrition status. A Nutrition Canada survey (Department of Health and Welfare, 1975) reported that, in general Native and Eskimo

children and adolescents displayed deficiencies in iron folate and vitamin C. Lee, Reyburn & Carrow (1971) in a study of two populations of Natives in northern B.C. found caloric excess with resultant obesity rather than caloric insufficiency to be a problem.

In addition to these detrimental health factors, the use of medical services, especially by Native people living off reserve is often inadequate or inappropriate. "Developmental, vision and hearing screenings are often not done routinely and there is room for improvement in providing immunization and vaccination, especially among children over 24 months. In general preventive health care is made difficult because of lack of trained staff, high turnover and prior demands of acute care." (Plaxton et al., 1983). A considerable gap still exists between the health status of Native people in Canada and that of the general population.

Numerous researchers have examined the relationship of environmental factors such as birth complications and illnesses and later development. Results are inconsistent across studies. Some have found medical screening to be a significant predictor of psychoeducational difficulties, while others report it to be of minimal usefulness for prediction. After an extensive literature search by this researcher only one study was found that examined this relationship in Native children. This was Bender et al.'s (1975) study of over 600 Eskimo children. Their results indicated that anemia in infancy and/or the occurrence of significant illnesses or

otitis media were associated with lower IQ and achievement test scores.

Since Native groups experience both health problems and academic difficulties in proportions which greatly exceed the non-Native population it seems that an understanding of possible relationships between these conditions may provide assistance in developing programs at the health service and school level. A focus on early identification and intervention for children thought to be at risk for educational difficulties would assist in appropriately directing limited resources. The dearth of research in this specific area warrants further study.

Statement of the Problem

The relationships between health problems such as otitis media and perinatal trauma and education difficulty have been documented. However, little work has been done in this area for Native Indians. As a group they manifest both variables in higher proportions than the majority culture. English as a second dialect, poverty and different concepts of learning are all factors which influence a Native child's adaptation to the public school system. Substandard nutrition and frequent bouts of otitis media and other illnesses associated with developmental delay are also highly prevalent in this population.

Purpose of the Study

The purpose of this study is to assess the relationship of antecedent health history factors and academic achievement

and readiness skills in a sample of Native children in a small B.C. community.

Variables

In this study the independent variables will be the various health factors obtained from the medical files of each child (e.g. birth weight, perinatal trauma, otitis media and so on).

The dependent variables are academic achievement or readiness as measured by the battery of standardized tests.

Hypothesis

There will be a significant relationship between health history factors and readiness. A linear relationship is expected to exist with those children at higher risk for health problems displaying lower cognitive abilities and readiness skills than children with more stable health histories.

CHAPTER II

REVIEW OF THE LITERATURE

In this review of the literature three main themes are outlined: Native Indian education problems, the relationship between health risk factors and developmental sequelae and Native health status.

Education and the Native Indian

The subject of Native Indians' education problems has been widely researched over the past several decades. The lack of success Native students experience in the public school system is manifest in high dropout rates and grade retention and low achievement scores (Burnaby, 1982; McShane & Plas, 1988; More, 1984; Rohner, 1965). Unfortunately low levels of education often coexist with other socioeconomic and medical problems and thus can not be studied in isolation. In spite of considerable resources directed at improving the living conditions for Natives living on and off reserve these issues have been an ongoing concern.

The Hawthorn report of 1966 indicated that, at that time, 94% of Canadian Natives dropped out of school between grades one and 12. Approximately 80% repeated grade one and many again repeated grade three and if not grade three or grade four.

The present Canadian situation finds the enrollment of Native children at the elementary level to be equivalent to national elementary enrollment levels; however, while the total secondary education enrollment has more than doubled

since 1965, the proportion of Native children enrolled has been steadily declining since a peak in 1972-1973. Their rate completing high school is less than one quarter of the national school completion levels (Burnaby, 1982; Indian Conditions, 1980).

In the Vancouver school district in 1980 over 20% of Native students repeated one grade versus about 5% of nonNatives. As well they were two times more likely to repeat a second time. The number to graduate was one half those of nonNative. On average more Natives dropped out of secondary school than any other ethnic group (Hunter & Stevens, 1980). More (1984) also found 41% of Native students in B.C. to be placed at least one year below grade level for chronological age and the dropout rate to be 80%. His review of the quality of Native education found that, on every measure of achievement in every study, Native students were significantly behind their nonNative peers in achievement. About one third of the Natives were a year behind by the time they entered grade two. In many areas they were held back because of language differences or deficiencies even though English was their first language (p.34). On standardized tests such as the Gates MacGinitie, Native children were significantly below grade level on vocabulary and comprehension. Reading problems were especially prevalent among those children who did not attend kindergarten. Barth (1979) documented similar findings regarding reading problems in Native students.

Reports and studies on education have been commissioned by the Bands themselves as they have taken control from federal and provincial governments over the schools their children attend (Hamilton & Owston, 1983; More, 1984). The confirmation that generally Native children are not succeeding in the provincial school systems is consistent across these studies. "Natives still form the single most underprivileged group in British Columbia in terms of education and employment (Blunt, 1979)."

Various researchers have tried to account for these disheartening statistics. Mayfield (1985) attributed the high dropout rate to lack of mastery of the skills needed in formal education.

Lack of knowledge of basic operations in the major curricular areas, especially Language Arts and Math was established in Kirkness' (1978) sample. "Even though they appear to have the same innate potential for learning to read as any child, there exists a high rate of reading failure for Indian children (Lankford & Riley, 1986)." Spitler (1980) attributes low scores on math achievement tests to a tendency to rely on memory rather than understanding. Low Math achievement in Native children was also documented by Trent and Gilman (1985).

The concept of academic crossover developed by Bryde (1963) was based on the fact that Native children in his study began grade four at or ahead of the general achievement norms. They tended to achieve satisfactorily for a while, then fell

behind in a steady decline by the eighth grade. Other researchers have referred to this as "cumulative deficit" (Berry, 1968) or "age-grade deceleration in achievement" (Rampaul, Singh & Didyk, 1984) which places these children further behind with increasing years of school.

As much of the curriculum is cumulative, basic skills not learned well or not remediated early in the education process may develop into unsurmountable academic and emotional problems (Rampaul et al., 1984). Beiser and Attneave (1982) found Native children at all ages except 5-9 to be at higher risk for entering mental health treatment than were nonNatives. As they stated," the direction of causality is unclear, i.e. whether declining academic performance is due to emotional problems or if academic decline is in part responsible for increasing emotional problems."

Other reasons suggested as contributing to academic deficits are lack of motivation on the part of the child or the parents, chronic absenteeism (which may be associated with high incidence of certain health problems), or social problems (Lankford & Riley, 1986). Truancy, poor grades and a negative attitude may be due not to lack of concern on the part of the parents but rather to a lack of knowledge of and involvement in the education system.

Many aspects of the curriculum are seen to be irrelevant for Native learners (Blowers, 1981; Vernon, 1966). Basal readers which are Ministry of Education approved are relevant to the experiences of "mainline Canadian children." Much of

the content deals with children living in urban environments where the nuclear family predominates (McEachern, 1981). Because of the discrepancy between their home and school it is assumed that little reinforcement is given at home for the work of the school and vice versa (Sealey, 1980). In recognition of this, reading series and curriculum aimed at this population of students are being developed (Brooks, 1978).

Current staffing in Native education is characterized by high turnover, inadequate training for transcultural education and low morale. There are few experienced or native teachers employed and it is widely accepted that white teachers have difficulty relating to the cultural differences of these children, especially on reserves where white personnel are seen as transient. Several colleges and universities in Canada now offer Native teacher and training programmes, in an attempt to remedy this situation (Bigart, 1974; Brooks, 1978).

A positive relationship has been found to exist between teacher expectations regarding Native learners and academic achievement which may lead to a self fulfilling prophecy effect (Rampaul et al., 1984). Preconceived notions and stereotypes held by teachers may also lead to misconceptions; e.g. one finding of the Lillooet (Napoleon, 1988) study was that although teachers identified high rates of absenteeism among Native children as likely contributing to their lack of academic success, no significant differences were found in days absent for Native versus white students, except for grade

one, when the Native children were absent more. However, this high absenteeism rate early in their education may in fact contribute to delayed skill acquisition from the onset, in this group.

With Native teacher training programmes and focus on curriculum development the situation is slowly improving, though not in proportion to the considerable funding which has been directed toward Native education over the past several decades (Indian Conditions, 1980).

The discrepancy between "Native learning styles" and methods and materials of instruction has also been cited as a contributing factor to their lack of achievement (Havighurst, 1970; Vernon, 1966; Brooks, 1978; Kaulback, 1984; More, 1984). The concept of the Native Indian learning style has generally been based on the assumption that Native children have significantly greater spatial abilities than verbal; the latter being more conducive to school achievement (Williams, 1986). Some researchers suggest that Native pupils use spatial or simultaneous abilities to solve tasks that other groups might for example use verbal or sequential abilities to solve (Brooks, 1978; McShane & Plas, 1988; More, 1984).

The concept of an English language deficit or inherent weakness in verbal skills has also received considerable attention by researchers. Depending on where they live and the degree of integration with the majority culture, Native students come to school with varying degrees of competency in the English language. Approximately 60% of Native children

entering school across Canada do lack facility in English. Statistics from the Department of Indian and Northern affairs for the year 1978-79 showed that 35% of Native children entered the education system speaking Native and English, 23% speaking Native only and 31% speaking English only. Frequently those who do speak English show a reduced vocabulary and errors in grammar and syntax. When English is a first language it may be a distinctively Native variety that is a continuation of the Native language traditions. It may preserve phonological, syntactic and semantic discourse processes of the Native language (Ashworth, 1979; Barth, 1979; Bayles & Harris, 1982; Burnaby, 1982).

One Ontario study (Burnaby, 1982) found that "the more Native language there is in these peoples' background the lower their achievement and conversely, the more English in their background the higher their achievement." Sabatino and Hayden (1972) found similar links between language and achievement reporting that Navajo children referred for special class placement experienced school learning problems predominantly due to lack of knowledge of the linguistic rules of the English language.

A frequently cited assumption is that the Native community does not stress oral language and often functions without the benefit of full literacy (Downing et al., 1975; Hawthorn, 1966). Few of these studies mention how they have determined this different interaction style, however. Lack of verbal/auditory stimulation in early home life has been

suggested as a factor making school success progressively more difficult for Native children with age (Mickelson & Galloway, 1969).

Interference from the student's native language has been an obvious problem in English language acquisition. Interference from nonNative English learned from parents who are the first generation to be monolingual in that language, lack of vocabulary and experiential background and the often highly artificial usage of English in the classroom may be regarded as additional problems (Barth, 1979; Burnaby, 1982). Downing et al. (1975) found kindergarten pupils from two B.C. Native bands in which there were no traditions of written language to be "in a state of cognitive confusion regarding the functions and task processes of the skills of literacy." They were less able to recognize the acts of reading and writing, the letters and their names. As well, they were immature in their concepts of the communicative function of reading and writing compared to nonNative children from the same geographic area. Their study did not control for socioeconomic status, however,with the Native homes poorer economically, with fewer reading materials. In Lillooet the Native students in grades one and three were significantly below the norms on the PPVT-R, with the net effect being that they start off school at a disadvantage, unprepared for "school related vocabulary" (Napoleon, 1988).

Instead of finding improvements with age, Ashworth (1979) found that the quality of Native children's descriptive

language declined as they got older. Language development seemed to slow down as they moved from grade one to grade three. They were also less proficient in the language used in school, in terms of describing, explaining, qualifying, etc. than were nonNative urban children.

Attempts to measure Native students' achievement and aptitude are complicated by reading, writing, language and attendance problems. This leads to general problems in conducting controlled quantitative research with this population.

Although the number of studies concerned with Native performance on IQ tests is small the results are generally consistent in demonstrating that the language skills of Native children contribute to a characteristic WISC-R pattern, that is, significantly lower verbal than performance scales (McShane & Plas, 1984; Common & Frost, 1988). Cultural and social biases usually result in lower full scale IQ scores than the norms. Chrisjohn, Towson, Pace & Peters (1989) suggest that when their recommended procedures for cross cultural assessment are practiced there is no "Indian/nonIndian" distinction. Some of the procedures they employed may violate standardized administration guidelines. For example, they do not specify the amount of training given to their Native examiners nor the extent of "testing the limits" which is allowable.

Teeter et al. (1982) examined a group of Navajo children referred for a variety of special education services; the only

study located which included a handicapped Native sample. They found that their students, regardless of specific learning deficits scored lower than the standardization group on verbal subtests of the WISC-R. Consequently they interpreted the low verbal scores as reflecting divergent cultural, language and experiential factors rather than as a deficit in intellectual potential. McShane (1984) in a review of literature on WISC-R testing with Native children came to the conclusion that an 8-19 point discrepancy in favour of the Performance scale could be considered typical for Native children. This verbal performance discrepancy has also been documented in several other studies.

> This pattern has been obtained by researchers in different parts of Canada using Natives from different linguistic and indigenous peoples' groups. Without taking into account socioeconomic factors, cultural opportunities, type of schooling, etc. it is difficult to make statements regarding the underlying causes of lower verbal skills however these results have been consistently found; therefore they must be considered characteristic of the performance of Native Indians on standardized intelligence tests (Common & Frost, 1988 p.22).

Sternberg (1984) proposed that there are probably no differences across cultures in innate cognitive processes and strategies, rather it is the relative importance of various aspects of cognitive functioning which vary from culture to

culture. Several researchers suggest that Native groups tend to use nonverbal communication between parents and children, concluding that performance type skills will likely be fostered more than verbal (Common & Frost, 1988; Kaulback, 1984; Pepper & Henry, 1986).

Tests developed and normed on the white population will reflect those skills and capabilities which are adaptive to the white culture and real life situation. They will not necessarily be those which are adaptable and relevant to the Native way of life (Common & Frost 1988). Rohner (1965) however, suggests that although such scores are a biased measure of "intellectual capacity" they may provide a rough predictor of academic achievement in the dominant school system, which itself is culturally biased, to the disadvantage of the Native student.

More and Oldridge (1980) suggest that Native children were overrepresented in classes for the mentally retarded in B.C.and also propose that this is partly due to to cultural biases of current IQ tests used to make their placements. For example, another study in the Lillooet District, Native students made up 40% of the enrollment, however they made up 70% of the enrollment in "special programmes" (Napoleon, 1988). Similar findings were also found in the Okanagon Nicola study (More, 1984) and a B.C. central interior school district (Barth,1979).

Other sequalae of academic failure such as emotional problems have been documented. "Children attending a

characteristically high verbal school may find themselves in a culturally incoherent situation with an effect approximating culture shock" (Pepper & Henry, 1986). Much of the literature refers to this conflict between the white culture of the school system and the Native culture of the home (Bigart, 1974; Rohner, 1965).

Socioeconomic data also find Native Indians to be overrepresented in the percentage earning incomes below the poverty line. The relationship between low SES and IQ scores and academic achievement has been an accepted phenomenon for some time. Therefore the findings of More & Oldridge (1980), that is, higher proportions of Natives in special education, may be expected, as they represent a disadvantaged group economically and academically. Low socioeconomic status also appears to be a contributing factor to the health problems which Native children manifest well in excess of the national norms. Although the direction of causality again is uncertain, it appears that the educational situation of Native students is to be expected given the disadvantaged position they maintain in our society.

Much of the literature in this chapter includes assumptions and generalizations regarding Native learners which are accepted as fact. However, earlier research which forms the basis for these assumptions was often methodologically flawed. The overwhelming majority of research employed either survey, observational or historical methods, as well there are relatively few primary sources. Chrisjohn et

al. (1989) refer to many of the viewpoints current in Native education theory as being "latently racist." Statements have been published such as, "the motivation is excellent in the early years among Indians ... by 12 or so they fall off in keenness and tend to become introverted and suspicious (Vernon, 1966). Few comparative studies controlled for SES or language proficiency. Concepts such as verbal interaction in the homes was rarely quantified. Assessment measures were often inappropriate for this group or inadequate for the purposes of the study. Brandt (1984) in her critique specifies several other limitations which apply to much of the literature, e.g. treating all Natives as a homogeneous group regardless of degree of assimilation into the majority culture, and not taking into account handicapped as well as normal populations. In spite of these limitations, collectively these studies do justify the premise that Native children are at risk for educational failure. One group of factors which may be related to their underachievement is the health problems which Natives manifest well in excess of national norms.

Native children form a high risk group with regard to quality of prenatal care, nutrition and general health status. Higher incidence of many diseases which have been associated with developmental outcome are endemic in this population. The next section deals with the medical research which has documented the current state of the health of the Native Indian child.

Native Health Status

Extensive research has been conducted on the health status of Native Indian children. This research has been impeded by lack of norms for vital statistics, such as weight and height, for Native people who are ethnically, culturally and physically distinct and whose lifestyle more often resembles that of third world countries rather than that of the majority culture. (Indian and Inuit Health Committee 1987). Natives continue to fall significantly below national standards for various aspects of health care, despite improvements in their living conditions. Types of illnesses among Native children are the same as those among lower socioeconomic groups: respiratory tract infections, gastrointestinal problems, skin infection and trauma (Baker et al., 1987; Evers & Rand, 1983). Admissions to hospital are significantly more frequent than those of the average white child (Houston, Weiler & Harbick, 1979; Shawana & Taylor, 1988; Manitoba Native Indian Mother and Child, 1981). Life expectancy, a reflection of health standards, is still 10 years less than that of the rest of the Canadian population (Shah & Farkas, 1985).

The frequency of parasitic diseases, mental disorders, complications of pregnancy, skin disease, diabetes and poisoning is higher in Native people than among nonNatives both in rural and urban areas. This appears to indicate that these problems are not restricted to those living in isolated communities. Many of the health problems seen on reserves are

actually exacerbated by the stress of adaptation to the urban health care system which often differs dramatically from community based health care services on reserves (Shah & Farkas, 1985).

The Native population has been increasing faster than the general population. As a result of higher fertility rates and lower life expectancy the Native population is younger and more dependent than the national population.

Though alcohol and drug abuse are recognized as major health problems in Native communities, little attention has been given to problems related to it such as child abuse and fetal alcohol syndrome. A recent study sanctioned by the band of a B.C. Native community found the prevalence of fetal alcohol syndrome to be 190 out of 1000 children up to 18 years. Two thirds of these children were mentally handicapped and it was the leading cause of retardation in the community (Robinson, Conry & Conry, 1987). McShane and Plas (1984) also emphasize the importance of FAS as a possible contributor to the learning difficulties experienced by many Native children. May, Hymbaugh and Aase, (1983) draw attention to Fetal Alcohol Effects which, though less easily recognized appear to have negative consequences on development as well. Early alcohol consumption by the Native child himself is also thought to have detrimental effects on intellectual functioning (McShane & Plas, 1984).

High infant and youth mortality accounts for a lower Native life expectancy, a general indication of health status

(Shawana & Taylor, 1988). Low birth weight, inadequately utilized antenatal care services, accidents, substandard pediatric care and failure to diagnose potentially treatable conditions have been found to be common causes of perinatal death. (Evers & Rand, 1983). Perinatal deaths in a study on Manitoba reserves were significantly higher than those of the provincial population's, with infant mortality approximately 100% higher and perinatal about 60% higher. These mothers and infants continue to show as a high risk group in spite of improved quality and access to health services (Manitoba Native Indian Mother and Child, 1981). Normal labour as a percentage of total births appears to be steadily declining and the Caesarean section rate for the Pacific Coast region nearly doubled since 1974. (Medical Services Report, 1980). Generally there are more adolescent pregnancies, greater multiparity and more low and high birthweights (Mayfield, 1985; Manitoba Native Mother and Child, 1981).

Higher than average birthweights have been attributed to various factors, e.g. ethnic variations and food patterns, maternal age, parity stature, weight before pregnancy and weight gain during pregnancy (Munroe, Shah, Badgley & Bain, 1984). A Nutrition Canada survey (Department of Health and Welfare, 1975) showed that 60% of Native women between 20 and 40 years of age were at moderate risk for obesity, which greatly increases the risk of gestational diabetes (Indian and Inuit study, 1987). Studies in the U.S. have also shown the weight of Native children to be consistently greater than the

U.S. standard for age indicating that obesity is a more serious problem for them than for the rest of the U.S. population. Though caloric insufficiency does not seem to be a problem several studies have found deficiencies in iron folate and vitamin C. Anemia, a common problem in Native children has been attributed to a lack of animal protein in the diet, which again is related to low SES (Birbeck et al., 1971, Evers, Orchard & McCracken, 1985). Another manifestation of a poorly balanced diet is the large increase in dental caries (Desai & Lee, 1971). Inadequate professional care and unsatisfactory oral hygiene are also seen as contributing to this increase (Mayhall, 1975).

A large proportion of postneonatal mortality in Native populations is attributed to respiratory ailments and infectious and parasitic diseases. These often reflect poor housing, lack of sewage disposal and potable water as well as less access to medical facilities (Carlile, Olson, Gorman, McCracken, VanderWagen & Connor, 1972; Indian Health Services, 1978). Native children, particularly those who are overweight, have also been found to have a greater tendency for repeated episodes of bronchitis, pneumonia and other respiratory infections (Upadhyaay & Gerrard, 1969). The rate of 75 illnesses per 100 children per year documented by Evers & Rand (1985) far exceeded the ratio for nonNative children used as controls in their study in semi-rural southern Ontario. Severe recurrent pulmonary disease associated with diarrhea as well as otitis media have been linked to bottle feeding and dairy

products. Recent research has also documented a high incidence of lactose intolerance among Native people (Leichter & Lee, 1971). Houston et al. (1979) suggest that the high frequency with which chest infections were associated with diarrhea may indicate a higher susceptibility of both the respiratory and gastrointestinal systems to infection or to a common precipitating cause, such as milk allergy.

Although the incidence of rheumatic fever has been declining worldwide, a study in Manitoba found the incidence and severity to be unacceptably high among Native children. The researchers suggest that this is due to social and cultural factors such as poverty and overcrowding rather than a genetic predisposition (Longstaffe, Postl, Kao, Nicolle & Ferguson, 1982). Diphtheria infection also continues to persist as a public health problem in this population, even though the majority of cases and carriers have been found to be well immunized. The great majority of isolations were from the discharge associated with otitis media. Young (1984) maintains that unless otitis media is controlled eradication of diphtheria infection is unlikely to be achieved.

While many children experience episodes of acute otitis media, chronic otitis media with resultant hearing impairment has long been the most serious health problem for Native children (Indian Health Trends, 1978; McShane & Mitchell, 1979). Prevalence estimates range from 20-70%. Incidence for the general population is approximately 5%, with those for the poor increasing to 20%; thus Native children have much in

excess of what would be explained by their low socioeconomic status (McShane, 1982; McShane & Plas, 1984; Tempest, 1987). The high incidence of respiratory infections among Natives is frequently cited as a predisposing factor (Kaplan, Fleshman, Bender, Baum & Clark, 1973) although some studies claim that the reverse relationship is true. Manning (1975) suggests that the rapid change in nutritional status is a possible causative factor which best fits the epidemiology of disease. He further states that the high amounts of dental caries in children with o.m. supports the relationship between suboptimal nutrition and o.m. Viral infections, allergies, poor health care as well as eustachian dysfunction may also play a role; in short its actual cause and means of prevention are unknown.

Gastroenteritis has consistently ranked as the second most prevalent disease in Native people, followed by strep throat, scarlet fever and influenza (Indian Health Services, 1978).

Native children also appear to be at risk for vision problems. In addition to myopia, astigmatism appears to be endemic in this group. Hamilton (1976) found six times as many Native children as nonNative entering school with a vision handicap and the majority of the Native children not to be wearing their prescribed glasses. The degree of anomaly was often greater and for most not detected before fourth grade. Tempest (1987) as well found 24% of Navajo fifth graders to have Snellen readings of 20/50 or worse in at least one eye.

Many factors seem to be contributing to the continuing existence of o.m. and other largely preventable diseases. Poor living conditions foster and exacerbate Native morbidity and mortality rates (Shawana & Taylor, 1988). Native parents are often unaware of the signs and symptoms of these illnesses. Lack of knowledge in the health professions about the uniquely high prevalence of these diseases in Native children and the need for special attention, such as screening, prevail (McShane, 1982). The use of medical services by Native people, especially those living off reserve is often inadequate or inappropriate. Difficulty in maintaining longterm health services staff, particularly in remote areas, is not conducive to establishing continuity of service and positive rapport with patients (Julien, Baxter, Crago, Ilecki & Therian, 1987). As well, developmental, vision and hearing screening are often not done routinely or if done use inappropriate measures for the subjects. (Burke, Sayers, Baumgart & Wray, 1985; Evers & Rand, 1983). There is room for improvement in providing immunization and vaccination, especially among children over 24 months. All of these above mentioned factors combine to make preventive health care for Native groups difficult (Plaxton et al., 1983).

The next section deals with the relationship between various health factors and psychoeducational outcome. Most of the research in this area deals with samples of children from the dominant culture.

Developmental and Educational Risk Factors

There is no dearth of experimental evidence relating the environmental conditions within which a child is born, grows and develops, to later educational handicap (Evans, 1976). Over a century ago Little noticed an unusually high occurrence of labour complications in the histories of children with Little's Disease, later to be called cerebral palsy (Page, 1986, p.1252).

Studies which have focused on the relationship of a single obstetric neonatal risk factor to later disability have not been successful in predicting later abnormality. Short term follow-up studies often missed later outcomes such as learning disabilities, attention span disorders and abnormal visual motor integration at school age. As well, milder problems noted in infancy are not necessarily predictive of enduring disabilities and conversely normal development does not guarantee normal intellectual abilities later in childhood (Hunt at al., 1982); thus the need for longitudinal studies. Interview and open-ended questionnaire format in some research often lacks the structure necessary for research purposes and may rely too heavily on mothers' and others' memories of developmental/medical events which may have taken place several years prior to data collection (Gray, Dean & Rattan, 1987).

Medical screening has provided some important evidence about the risks associated with perinatal mortality. Though difficult to separate from each other some factors have been

generally accepted as being indicative of increased risk. Examples of these are: a very young or older (over 35) mother, gravida, specifically the first and beyond a fourth pregnancy, maternal malnutrition or substance abuse and Apgar scores less than or equal to six at one minute (Aubry & Pennington, 1973). Certain conditions such as high levels of phenylalanine, or PKU and sensory disorders have obvious implications for educational development, others such as low birth weight, perinatal trauma, etc.are less clear. "While medical screening may be efficient for certain profound handicaps its usefulness as a predictor of milder psychoeducational difficulty is debatable" (Lindsay & Wedell, 1982).

Numerous studies have examined a high risk group with a view to determining developmental outcome, however, few of these similarly examined a matched control group. Johnson, Cox and McKim's (1987) retrospective study of 143 low birth weight infants found 10% to have severe neurodevelopmental abnormalities and 11% to have minor problems such as seizures, developmental delay and behavior disorders. Though low birthweight may not yield many severe handicaps, Hunt, Tooley and Harvin (1982) in a longitudinal follow-up of 102 low birthweight infants found that many of these children later were shown to be at risk for learning disabilities as the demands of school became more complex. The most common problems were in the areas of language comprehension and visual-motor integration. Their incidence figures of 37% were almost twice that of the highest estimates for learning

problems in the general population. Neither of the above studies examined a matched control group.

One of the largest scale longitudinal studies was The British Perinatal Mortality Study and the follow up National Child Development Study (Davie, Butler & Goldstein, 1972). Researchers began with a group of 16,000 expectant mothers and concluded that certain health factors were of value in the prediction of severe physical/mental handicap and educational backwardness. Among those were low for gestation birthweight pre or postmaturity and social class. Pfeiffer, Heffernan & Pfeiffer (1985) found medical variables, gestational age and birth weight, to account for greater than 50% of the variance in McCarthy General Cognitive scores at age three years. Their sample of 100 preschoolers having high risk neonatal histories scored about one standard deviation lower than the low risk control group. Cadman, Walter, Chambers, Ferguson, Szatmari, Johnson and McNamee (1988) also found health, developmental and behavioral histories to predict later school problems and suggest that health professionals may play a useful role in screening for future school problems. In a retrospective study of 50 learning disabled children Colletti (1979) examined health history variables such as length of pregnancy, parity, blood incompatibility, infections, length of labour, complications, birth type and birth weight. When compared to national norms, significantly fewer learning disabled children were categorized as well and healthy at birth, with longer

second stage labour, more induced births, complications of labour and significantly lower Apgar scores in this group.

Colligan (1984) however, in a large sample prospective study, n = 386, found only marginal support for the concept of a continuum of reproductive casualty. That is, perinatal stress, as measured from combined obstetric, delivery and puerperium data, was not a significant factor in predicting results of later psychological tests.

Social status and concomitant environmental conditions also appeared to be significant factors in several multifactorial studies which took them into account.

Lievans (1974) found almost all of his subjects with perinatal stress (i.e. neonatal cerebral effects without neurological sequelae), from "normal homes" (not defined in the study) to display various anomalies in cognitive and affective functioning, leading to learning problems in three specific areas: inadequacy of attention, inadequacy of motor control and inadequacy of emotional inhibitions. Fifty-four percent of this sample were one or more years behind in school in the primary grades. A major retrospective study of over 13,000 births suggested that perinatal factors such as breech delivery and asphyxia at birth were not related to later developmental status. Birth weight and social factors appeared to be better predictors (Nelligan, Kolvin & Garside, 1976). Badian (1988) in a nine year follow-up study found the main characteristics differentiating poor readers from good were complications during pregnancy and labour, birth order, speech

delay and SES. Sameroff and Chandler (1975) found that social status reduced or amplified initial intellectual deficits associated with neurological insult. Deficits tended to decrease in the middle class population and increase in the lower class. SES had a strong mediating effect on cognitive outcome of low birth weight children. General cognitive abilities and language abilities were proportional to maternal education and child care. Gross perceptual and motor abilities were proportional to perinatal complications.

Siegal (1982) in recognition of the effects of multiple variables, developed a risk index based on reproductive and demographic factors to predict developmental delay. The index included such items as gravidity, birthweight and Apgar scores. A standardized rating of SES and a Home Observation Measure were also used. The combination of environmental factors in addition to biological factors yielded correlations ranging from .38 to .63, with subsequent cognitive and language development for the high risk group. The combination system of perinatal, reproductive and environmental variables allowed for the detection of infants at risk for developmental problems.

In general, although the relationship between health risk factors and various developmental outcomes has been studied extensively, the results are unclear. Robert's (1969) study in Wales came to the conclusion that many complications of birth and pregnancy may co-exist and that because of the many interdependent variables, to study the influence of one

complication on infant development would be futile. The overall pattern does seem to point to increased problems in the population at risk for health problems, however several other variables such as SES seem to contribute strongly as well, thereby making prediction more difficult. Research is further complicated by the fact that "the sequelae of neonatal complications rarely occur in an all or none fashion but instead develop along a continuum of disability necessitating the use of somewhat arbitrary endpoints of normality ... therefore it is not always possible to get a firm definition of dependent and independent variables and to keep others constant (Page, 1986, p.1253)."

Few researchers have examined this relationship in culturally distinct and/or minority groups, which adds yet another variable to the analyses.

Werner and Smith (1979) looked at longterm interaction effects of perinatal stress and the quality of family environments for a multiracial cohort in Hawaii. Their prospective study followed 660 subjects from preterm to age 18 years. By age 10 differences between children exposed to various degrees of perinatal stress and those born without perinatal stress were less pronounced than at age two. In follow-up studies they found significant interaction effects between characteristics of the family environment and perinatal stress which produced the largest deficits for the most disadvantaged children. The impact of the caretaking environment appeared more powerful than the residual effects

of perinatal complications for most of the children. A comparison of the developmental status of preterm and high risk infants in a Southeast Asian culture was carried out by Williams, Williams and Dial (1986). They found perinatal events correlated with developmental delays ($p < .001$) as measured by the Denver Developmental Screening Test standardized on the local population. Their preliminary evidence indicated that a combination of professional intervention and parenting skill training proved effective in improving outcomes.

Some researchers have examined the relationship between specific disorders such as otitis media, and educational problems and language delay in Native populations. Mild conductive hearing loss has been linked to impaired language development, serious educational difficulty, learning disabilities and specific processing problems. (McShane, 1982; McShane & Mitchell, 1979; Julien et al., 1987; Tempest, 1987). Scaldwell and Frame (1985) in a study in a Federal Native school found over 50% of Ontario Native children referred for difficulties in word recognition and spelling to have a history of chronic middle ear infection and respiratory ailments. A long term study by Kaplan et al. (1973) on a sample of 500 Inuit children found that those with the greater number of episodes of o.m. during their first two years of life scored lower on verbal scales of the WISC-R than those with fewer episodes. Furthermore the achievement gap tended to widen with age. Bender et al. (1975) in a related study of

over 600 Inuit children suggest that nutritional anemia in infancy without overt manifestations of malnutrition was related to poorer intellectual functioning in childhood. They also found the occurrence of significant illnesses before age two, such as pneumonia and meningitis, to be associated with lower IQ and achievement test scores. Otitis media, before age two, independent of any association with significant illnesses or anemia, was also associated with impairments of intellectual development at school age. The reduction in verbal skills was considered significant, especially in their combined morbidity group, i.e. those children with two or three of anemia, otitis media and significant illness. Those factors which did not appear to be significant were prematurity, protein caloric malnutrition and SES. A profile of Navajo Indian students on reserve found those students who had fewer illnesses that required hospitalization to have significantly higher achievement than their peers with more frequent illnesses. Also significantly correlated with achievement was the difference between high and low achievement and income, as well as otitis media (Tempest, 1987).

Overall, "while prediction may be possible when influences operating on the child are controlled, prediction for the majority whose deficiencies are balanced against their resources is difficult" (Lindsay & Wedell, 1982 p.215). Perinatal factors tend to be interrelated and have a contributory rather than causal effect. Depending on their resources children compensate over time for their deficiencies

(Hunt et al., 1982). In the case of the Native Indian child, quite often health complications are in combination with or caused by deprivation in terms of health care, nutrition, economic means and general cultural factors at odds with the majority culture. Regardless of the cause these children do exhibit an inordinate frequency of health problems as well as educational difficulties.

Early detection of these health problems, which appear to be related to cognitive development, should minimize subsequent distortions of development and avoid secondary problems which obscure the diagnosis and complicate treatment. This need has been identified by various researchers (Cadman et al., 1988; Parkyn, 1985; Badian, 1988.) as well as the Canadian Standing Senate Committee. (1982). Their report on the Child at Risk refers to the need for a system of identification and follow-up of children at risk for developmental delay and failure to thrive. Especially relevant to early diagnosis, according to Rogers (1981) are genetic and pregnancy history, neonatal assessments and neurological examinations, developmental histories and periodic developmental assessments in infancy and childhood.

Most of the literature on Native academic problems has focused on sociocultural factors such as language, lack of stimulation in the home, cognitive processes and learning styles. Apart from the effects of otitis media on language development and related functions, little research has dealt with the effects of other variables contained in the health

histories, which may be placing these children at risk for learning problems. Given the myriad of illnesses and health complications prevalent from the prenatal period onward it seems that the sequelae of some of these factors are worth further study. An examination in the Native context would eliminate confounding factors inherent in previous research which did not include sociocultural factors in its analyses.

This chapter has outlined many of the problems Native students encounter in the public school system, such as low achievement levels, low self esteem and high rates of grade retention. Research has also shown these children to be at risk with regard to health. Although results are not conclusive, another avenue of research has examined the relationship between health status and developmental outcome. Early identification of Native children with a history of health factors which prove relevant to academic achievement would provide educators with a means of assigning priority for support services to this subset of children who, in essence are behind before they begin.

The problem in this study therefore, is to determine if there is a relationship between health factors and academic readiness/cognitive development in a sample of Native Indian children.

CHAPTER III

METHODOLOGY

The following topics are described in this chapter: The target population, sample characteristics, design of the study, instruments used, procedures followed, the statistical hypothesis and finally, the method of analysis.

This study was conducted in conjunction with a larger research project initiated by six of the Lillooet area Indian bands, based on community concerns regarding the quality of education their children were receiving. The thesis study was presented to the bands for their approval, which they provided, as well as guidance and support.

Population

The target population was grade one Native children in the B.C. school system. It can not be assumed that all Native groups have had similar cultural or environmental experiences, therefore this study was restricted to children of one tribal group. The population used for the study was from the Lillooet nation, which is part of the Interior Salish linguistic group.

The population of the Lillooet area bands numbers approximately 1900 people. The reserve's boundaries fall within a 35 mile radius of the town of Lillooet, 160 miles northeast of Vancouver.

The history of this tribe with regard to education is similar to that of the majority of B.C. Native groups. Day schools were first set up on reserve in the 1950's. In the early 1960's an agreement between the federal Department of

Indian Affairs and the Provincial Government allowed Native students to be integrated into the public schools in town. The current Native enrollment makes up 43% of the total school enrollment (Napoleon, 1989). The Native community has expressed concern with their childrens' assimilation into the public school system. The Native language and culture are fading and few concessions are made in the schools for propagating these important aspects of their way of life. The main industries in the area are logging, ranching and fishing. However, the people from this tribe suffer from high rates of unemployment as well as related school dropout and substance addiction (Napoleon, 1989).

Sample

The sample used in this study consisted of 23 grade one and transition-one Native students in the two elementary schools in the Lillooet area. The transition-one (T-1) programme is designed for students who, after the kindergarten year still do not have the skills necessary for grade one. Six of the students in the sample were enrolled in T-1. Those students considered to be culturally Native were identified by the Education Consultant for the six local Indian bands, and community representatives on the Band's education committee. The sample therefore included status on and off reserve, as well as those whose mothers had lost their status through marriage. Most of the children lived on the three local reserves. The sample was relatively homogeneous with regard to socioeconomic status, with most of the children coming from

homes at the low end of the socioeconomic scale. The predominant language spoken in their homes was English.

Students in the grade one and transition one classes were selected, as the focus of the study was school readiness. Eighty percent of the students in the T-1 class were Native, in contrast to 29 and 21 percent in the two regular grade one classes.

The parents of all the Native children were sent letters requesting consent for psychoeducational testing as part of the larger study (see Appendix 2). All Native students in grade one and T1 whose parents consented were tested, for a total of 23 of a possible 28. Two students were absent on the day of testing. Those four whose consents were not returned were from both classes and appeared to be homogeneous with the rest of the sample in terms of age, SES, days absent, etc. Additional letters were sent requesting access to medical files of the grade one students who had been tested (Appendix 3). The Native Health workers explained in further detail the purpose of the study individually to all of the parents or guardians. One parent did not return the consent form and three children had virtually no data available on file as their families were transient. As a result, complete health files from the Indian Health Office, and testing results were available for 19 subjects, five female and fourteen male. The subjects ranged in age from 5-11 to 7-08, with the mean age being six years six months.

Research Design

The design was correlational in nature and involved two factors: health problems, consisting of 30 variables and psychoeducational measures, consisting of 11 variables.

Independent Variables

The independent variables, i.e. health history factors, were obtained from existing health records maintained by the local Indian Health Service office. The sample was fairly stable, with little movement from the area. Detailed records have been kept for the past 8-10 years; however, some subjects showed a prolonged time period between visits, when the families moved away from the reserve. In most instances this move was into town, thereby utilizing Public Health, where the record keeping system was less systematic.

As stated in the previous chapter Native children manifest certain conditions in excess of the majority culture and at times in excess of what would be expected given their low socioeconomic status. Many of these have been linked in the literature with developmental and educational delay or disability. Based on this the following specific variables were examined:

Birthweight (grams)

Gestational age (weeks)

Apgar scores (a rating of 1-10 points of the general condition of the neonate, assigned by physician at 5 and 10 minutes after birth)

Mother's age (years)

Denver Developmental Screening Test/DDST scores; a screening of infant and preschoolers' overall development, administered in this study by the public health nurse (0=pass, 1=fail)

Gravida (rank order of pregnancy).

The remaining variables were recorded on the subjects' medical files, however little information was provided in terms of frequency or severity of occurrence, etc. Because of this limitation these were dichotomized and reported as being present (0) or not(1):

Prenatal care

Perinatal complications

Obesity

Gastrointestinal problems

Frequent fevers

" colds

Respiratory infections

Pertussis-whooping cough

Otitis media

Hearing loss

Vision problems

Alcoholism in family

Poor dental care

Dental surgery required

Impetigo-skin disease caused by staph or strep bacteria

Neglect

Poor nutrition

Composite health risk score (a continuous score, from 0-6)

In a preliminary pilot survey the above variables were noted with high frequency on the files sampled. Many of the health problems have been found to be significantly more prevalent in Native groups.

Dependent Variables

The dependent variables, psychoeducational tests, were to measure academic readiness in the sample. The concept of readiness encompasses a broad range of skill areas. For the purposes of this study, academic readiness refers to the student's ability to cope with particular intellectually demanding situations, and is a function of general intellectual development. An individual child's state of readiness is reflective of his genetic inheritance, incidental experience, intellectual stimulation and educational background (Anderson & Faust, 1973). Researchers have identified the following skill areas as being related to readiness for academic achievement, particularly reading:

Verbal/Language

Visual-Motor

Auditory

Sensorimotor (Zintz & Magg, 1986)

These skills develop as a hierarchy and it is important that children develop them to progress to the requirements of the primary curriculum.

The following measures were used to determine overall academic readiness:

Metropolitan Readiness Tests, Level II, Form P

Developmental Test of Visual-Motor Integration

Peabody Picture Vocabulary Test-Revised

Kaufman Assessment Battery for Children

Metropolitan Readiness Tests, Level II, Form P - 1976 edition

The Metropolitan is a group-administered test designed to measure pre-reading skills emphasized in beginning grade one instructional programmes. It was standardized in two full-scale national testing programmes. Special normative data were also obtained for large-city school districts with a pupil enrollment of 100,000 or more. Thirty-two thousand children participated in the research programmes. The sample was randomly stratified based on sex, school system enrollment, SES and geographic region. The test is made up of subtests designed to measure the skills presumed to be needed in beginning reading and mathematics. These are Beginning Consonants, Sound-Letter Correspondence, Visual Matching, Finding Patterns, School Language, Listening, Quantitative Concepts and Quantitative Operations. Stanines and percentile ranks are generated in four skill areas: Auditory, Visual, Language and Quantitative. A PreReading composite summarizes performance on the Auditory, Visual and Language areas.

The Metropolitan was found to be the best single predictor ($r = .76$) from among the Lee Clark Reading Test, the California Test of Mental Maturity, PPVT-R and the Bender

Visual Gestalt Test, of first, as well as second grade achievement in a sample of low SES rural children (Lessler & Bridges, 1973).

Percentiles for the overall composites were converted to z scores, based on the test's norms, in this study for data analysis.

Administration took place in late October and early November using grade norms for the Fall of grade one.

Developmental Test of Visual Motor Integration (VMI)

The VMI consists of a sequence of 24 forms, ordered from simple to complex, to be copied by the child. It is designed for preschool and early grade children. The 1984 edition used in this study was normed on 3090 children. The authors report reliability correlations for two or more scorers ranging from .58 to .99. Test retest reliability has been reported from .63 to .92. The concurrent validity with readiness tests averages about .50, tending to be higher in the primary grades. The VMI was found to be particularly sensitive in identifying "high risk" boys in kindergarten who subsequently had reading difficulty. The predictive validity appears to decline in the higher grades (Satz & Friel, 1974). Beery (1982) interprets this as being because they compensated for their visual motor weaknesses with verbal language skills. Numerous studies report significant relationships between visual-motor coordination tasks and academic achievement, particularly before grade three (Book, 1974; Solan, 1987; Tempest, 1987).

Peabody Picture Vocabulary Test-Revised (PPVT-R)

The PPVT-R, an individually administered test, measures receptive vocabulary for standard "American English". It was standardized on 4200 individuals, 200 in each age group. The sample was stratified based on sex, geographic region, SES and ethnic background. Split half reliability on form L ranges from .67 to .88. Immediate retest ranges from .73 to .91 and delayed from .53 to .90.

The PPVT-R has been used successfully (r = .62) in the prediction of achievement of culturally deprived and Native children in combination with other measures (Plant & Southern, 1968; Tempest, 1987).

Kaufman Assessment Battery for Children (K-ABC)

The K-ABC is an individually administered measure of mental processing for children from 2 years 5 months to 12 years 5 months. It was normed on 2000 children across the United States. The sample was stratified by sex, age, geographic region, SES, ethnic group, community site and educational placement. The subtests are divided into sequential processing - solving problems where the emphasis is on the serial or temporal of stimuli, and simultaneous processing - using a gestalt like or holistic approach to integrate many stimuli to solve problems. Four of the subtests were used in this study: Number Recall and Hand Movements which fall into the sequential category; and Gestalt Closure and Spatial Memory, which fall into the simultaneous category. These four subtests were found to be the best indicators of

the two processing modes in a previous study of Native children of the same linguistic group (More, 1984).

Both simultaneous and sequential processing have been shown to be necessary to achievement (Kirby & Das, 1977). However different cultural groups may have differential proficiency in, or a preference for, modes of information processing and this may be genetically determined (Cummins & Das, 1977). If there is not a uniquely "Indian" learning style, there at least appear to be consistent patterns among Native students which differentiate them from non Indian. Research also suggests that the K-ABC may be a "more sensitive" measure than some other widely used instruments when testing cognition in minority children, that is they tend to score higher on the K-ABC than on the WISC-R or PPVT-R (Bing & Bing, 1985, Naglieri, 1984).

Data Collection

The data were collected between November, 1986 and May, 1986. The researcher compiled all of the health history information with the assistance of the staff at the Indian Health Service.

Examination of these data revealed considerable heterogeneity within the group with regard to the health factors. Several factors were manifested by only one or two subjects, e.g. jaundice and obesity. This yielded a varied assortment of health problems for each child with no clear pattern or continuum emerging. Because of this and because of the small sample size, an additional overall health composite

score ranging from a low of 0 to a high of 6 was calculated for each subject. It was devised by an experienced pediatrician researcher at the University of British Columbia, based on the total health history information available for each subject.

All individual tests were administered and scored by the (Caucasian) researcher according to standardized procedures outlined in each administration manual. These were administered in the same order to each child in one sitting. A teacher (Oriental) experienced in the administration of the Metropolitan Tests gave these to groups of students over a two day period. She also scored all protocols. All testing was done in English, in the students' own schools. One student was absent at the time of the Metropolitan testing, and data was missing for that student.

Hypothesis

The hypothesis for this study is that there is a positive correlation between health problems and psychoeducational sequelae. Those children having the most health problems are expected to score lower on the tests of readiness and achievement.

Method of Analysis

An appropriate analysis would be multivariate, such as Hotelling's T, but due to small sample size that analysis was not feasible. A series of univariate t-tests for correlated means had to be undertaken to examine the association between psychoeducational test scores and each health factor, as well

as between test scores and overall health risk groups (low vs high risk). A median split on the general risk index was performed for this purpose, dividing the subjects into two groups, lower risk scoring 0-3, n = 9 and higher risk scoring 4-6, n = 10. Pearson's product moment correlations were also computed between the scores on the test battery and the continuous health variables. Point biserial correlations were computed to assess the association between dichotomous health variables and continuous test scores.

The next chapter deals with the results of the data analysis.

CHAPTER IV

RESULTS

This chapter reports the results of the data analyses and the significant relationships which resulted. The first section presents a descriptive summary and the second section summarizes the results of the inferential analyses.

The hypothesis is that there will be a negative association between presence and degree of health risk factors (the independent variables) and cognitive/ developmental test results (the dependent variables). A continuum of health problems was expected to exist, with those students manifesting the greater degrees of overall health problems attaining lower scores on the cognitive/developmental tests than subjects with fewer health problems.

Summary of Descriptive Data

Sample Characteristics:

As stated in the Methodology, data analysis was performed on the test results and medical information obtained on a total of 19 subjects. Demographic data indicated that 35% were female and 65% male. The average age was six years six months. Sixty-five percent of the subjects were enrolled in regular grade one, 35% in transition one.

Psychoeducational Test Data:

The mean scores and standard deviations were calculated for the sample on the psychoeducational test battery. The results are summarized in Table 1.

Table 1

Means and Standard Deviations of Ability and Achievement Test Scores

Dependent Variable	Mean (n=19)	S.D.
PPVT-R Std. Scores	73.13	10.91
Beery Std. Scores	7.78	2.19
KABC: Simultaneous Processing		
Gestalt Closure Std. Scores	11.48	2.83
Spatial Memory Std. Scores	8.65	3.20
KABC: Sequential Processing		
Hand Movement Std. Scores	8.39	1.56
Number Recall Std. Scores	8.69	2.72
Metropolitan Composite		
Auditory Stanines	5.38	1.80
Visual Stanines	5.19	1.43
Language Stanines	4.43	1.07
Pre-Reading Composite Z Scores	-0.03	0.71
Quantitative Z Scores	-1.16	0.18

The group mean on the PPVT-R falls within the moderately low range, which is consistent with the results of other studies on language skills of Native students. These children ranged from extremely low to average on this measure of receptive vocabulary.

The VMI is at the low end of the average range indicating average visual/motor skills. The mean = 10 and standard deviation = 3 for the standardization sample. Standard scores ranged from 5 to 12 in this study's sample. That is, some children were very weak in their visual-motor skills, and the highest scoring children were still within the average range.

All of the K-ABC subtest scores were within average levels. Subtest score ranges were as follows, Hand Movements 6-12, Gestalt Closure 6-16, Number Recall 5-14 and Spatial Memory 4-15. No clear pattern emerged with regard to simultaneous versus sequential processing strengths or weaknesses, that is, both sequential subtests were within the average range as were the two simultaneous subtests. This is consistent with the findings of More (1984) on a sample of seven year olds from the same linguistic group. Gestalt Closure, with a group mean score of 11.48, at the higher end of the average range, does stand out as being somewhat higher then the other subtests, which had mean scores at the lower end of the average range. Thus, as a group this sample scored slightly higher on the Gestalt Closure, a simultaneous subtest. If a Native learning style, as proposed by some researchers such as Kaulback (1984), More (1984) and others,

was manifested by this sample, both of the simultaneous subtests would be expected to be significantly higher than the sequential subtests. Since all of the subtests were actually within the average range, it is not meaningful to consider either area as being a significant strength or weakness.

The Metropolitan subscales, Auditory, Visual and Language are reported as stanines, the scores provided in the norms tables from the manual. Both Auditory and Visual were average and Language low average. Again, this is consistent with More's (1984) findings that Native children tend to score lower on language measures than white children used as controls. The PreReading and Quantitative composites are reported as z scores, calculated by the researcher for the data analysis. The Prereading scores fell within the average range and the Quantitative in the below average range. The range of scores on the Prereading composite was quite large with subjects scoring from the 3rd to the 82nd percentile. That is, there was a large variability in the level of the Prereading skills acquired by this group, with some scoring well above average and others being notably weak. The group was more uniform with respect to Quantitative scores which ranged from the 7th to 18th percentile. Low Math achievement has been documented among Native children from other cultural groups as well (Trent & Gilman, 1985; Spitler, 1980).

As a group these children appear to have acquired low average to average readiness skills for their age and grade

placements in all areas except Quantitative, which was below average.

The frequencies of health problems found on each subject's medical file are tabulated in Appendix 1. There was a low incidence of certain disorders, some of which were manifested by only one child, for example, jaundice and Rh incompatibility. This limited the extent of the inferential analysis.

Inferential Analyses

Based on the hypothesis, a negative correlation was expected to exist between health variables and test results. That is, those students exhibiting the greater frequency and degree of health problems were expected to score lower on the aptitude and achievement tests than their healthier peers.

Pearson's product moment correlations were calculated between the continuous health variables, such as birth weight, and the continuous test scores. Point biserials were calculated for the dichotomous health variables, such as presence of perinatal complications, and the cognitive test scores. Using the SPSS^{x} programme, each of the 30 health variables was correlated with the 11 test results. These were calculated to determine the magnitude and direction of the relationship between each of the independent and dependent variables.

Table 2 shows the values of the correlations between the six continuous health variables and the psychoeducational test scores. Significant findings are boldfaced. Due to the small

Table 2

Pearson Correlation Coefficients[1] Among Health Factors and Psychoeducational Test Scores

Test Scores	Health Factors					
	Birth Weight	Gestational Age	Apgar 1 min	Apgar 5 min	Mother's Age	Gravida
PPVT-R Std. Scores	**39**	**33**	22	00	05	05
Beery Std. Scores	23	08	07	33	01	03
KABC Subtests (Std. Scores)						
Hand Movements	**-37**	-02	**39**	**64**	-14	**-41**
Gestalt Closure	13	03	06	-39	11	24
Number Recall	06	13	27	00	**-57**	**-63**
Spatial Memory	10	-19	-27	**-66**	-11	-17
Metropolitan Composites (Stanines)						
Auditory	-35	-13	06	-49	-19	-05
Visual	10	29	-21	**-96**	15	31
Language	-15	31	**36**	00	07	02
Pre-Reading Z Scores	-21	02	-04	**-64**	-01	17
Quantitative Z Scores	-01	15	24	**-55**	09	09

[1] Correlation coefficients are shown at two significant figures and decimals omitted with boldface coefficients significant at .10 level.

sample size the probability value of .10 was established to increase the likelihood of detecting patterns or trends of practical significance and in an attempt to contain the probability of a Type II error. Significant correlations were between .32 and .71. Those correlations which attained significance ($p < .10$) are as follows:

Birth weight was positively correlated with higher standard scores on the PPVT-R and negatively correlated with the Hand Movements subtest. Only two children in the sample had birthweights which would be considered to place them at risk (<2500 g. or >4000 g. in Blackburn, 1986) and the average birthweight was 3211 grams. As birthweight increased the child was more likely to score higher on the measure of receptive vocabulary. This is consistent with the findings of Johnson et al. (1987) and Hunt et al. (1982), that low birthweight is related to various types of developmental delay and learning problems, most commonly, language comprehension and visual-motor integration. There does not appear to be a reason for the negative correlation between birthweight and Hand Movements, a sequential visual memory subtest.

Gestational Age was related to receptive language development. That is, children born to full term gestation showed higher PPVT-R scores than those who were premature. Prematurity, along with other high risk variables has been documented as increasing a child's potential for later developmental delay (Blackburn, 1986).

Table 2 also shows that as Apgar scores (taken at 1 minute) increased, childrens' scores on Hand Movements and Metropolitan Language increased. Similarly, as Apgar scores taken at 5 minutes increased again Hand Movements increased. Conversely, Spatial Memory, Prereading and Quantitative scores decreased. It is important to realize that a second Apgar is often only administered if a low score, indicating an infant at risk, is obtained on the first administration. In the present sample only 8 children were administered second Apgar ratings as opposed to 19 who received scores for the one minute administration; Thus, those few who had second scores constitute a higher risk group and would be expected to obtain lower scores on the test battery. Also all of the second administrations were scored 9 or 10, which indicates adequate overall status at that time. Colletti (1979) found lower Apgar scores in combination with other variables, such as labour complications, longer second stage labour, etc. to be significantly ($p < .05$) higher in a sample of learning disabled children compared to a group of controls.

The mean age of the mothers of the children in this sample was 21 years, with a range from 16 to 38 years. Maternal age <16 and >35 is generally accepted as being high risk for pregnancy (Blackburn, 1986). As mother's age increased the childrens' scores on Number Recall significantly decreased. It is possible that this is because only one of the sample was actually at high risk on this variable. As a

result, it is not a clinically significant discriminator of risk in this group.

Childrens' scores on Hand Movements and Number Recall decreased significantly ($p < .04$ and $p < .002$ respectively) as the number of previous pregnancies, or Gravida increased. This again is consistent with the literature indicating that gravida greater than 4 is high risk (Aubry & Pennington, 1973; Blackburn, 1986). It also seems likely that mothers with several other children at home will have less time to devote to each in terms of language development and other forms of intellectual stimulation.

Table 3 shows the point biserial correlations between the discrete health factors and the psychoeducational test scores.

While children born by Caesarean section tended to score lower on Number Recall, there were only two such cases in this sample. The six children exhibiting perinatal complications tended to score higher on Spatial Memory, Auditory and Prereading, which contradicts most research indicating that such children are at risk for developmental delay in various areas of cognitive functioning. However, again it is difficult to make interpretations based on a sample of six.

The Denver Developmental Screening Test (first administration) showed several significant relationships with psychoeducational test scores, particularly the PPVT-R, Gestalt Closure, Metropolitan Language and Prereading skills. Higher scores on the second administration of the DDST were

Table 3

Point Biserial Correlations[1] Among Health Factors and Psychoeducational Test Scores

Test	Health Factors[2]																								
	CAR	CAE	PER	DS1	DS2	OBS	OTI	HEA	DEN	SUR	FEV	COL	RES	IMP	SHI	GAS	NEG	DIE	ALC	JAU	RH	VIS	IRO	PET	HEM	RISK
PPVT-R	10	10	04	**58**	47	-19	-23	-12	-19	-13	23	03	**-40**	-04	-20	17	02	-22	11	12	25	-10	-11	-09	**-48**	**-33**
Beery	06	-13	-17	-07	**71**	04	20	13	-21	-03	15	26	-06	**33**	-21	01	-12	-30	06	-17	-07	-11	21	-28	-28	00
KABC Subtests																										
Hand Movements	33	13	-15	-19	17	**-32**	-06	26	**-37**	**-39**	**33**	-01	**-39**	-13	**-39**	**-41**	**-40**	-21	-19	13	-22	-11	06	13	13	-27
Gestalt Closure	00	-03	11	**38**	07	-20	08	**32**	-10	-37	**42**	**32**	-01	07	00	17	09	-19	14	**32**	**32**	21	09	06	**-36**	20
Number Recall	22	**-35**	07	08	12	**-41**	**-32**	-14	-14	-06	-08	20	-27	18	**-33**	**-47**	-05	-18	-24	26	-22	-04	17	-13	-13	**-49**
Spatial Memory	13	-09	**40**	09	29	17	-18	11	21	**-40**	-21	-07	-24	-08	-03	05	-18	-06	**-33**	22	-06	**36**	21	-07	14	03
Metro Comps																										
Auditory	37	-05	**44**	34	43	**-46**	-03	**39**	**-45**	-26	25	00	**-44**	14	-20	00	08	-25	15	**48**	16	10	-12	—	16	-07
Visual	-28	-31	26	19	-07	13	-05	25	**-32**	00	00	-09	00	**71**	11	00	**33**	00	**40**	17	00	14	**-38**	—	00	-12
Language	-08	-24	-08	**43**	00	-29	**-36**	08	-26	-29	-02	01	**-43**	**34**	05	05	**55**	11	**36**	**47**	-06	-10	-28	—	-06	**-39**
Pre-Reading Z	18	-18	39	**40**	40	-26	-10	**37**	**-40**	-16	19	-08	**-39**	33	-11	04	23	-14	30	**40**	13	09	-22	—	11	-10
Quantitative Z	08	-16	24	05	-08	-18	10	09	**-58**	-25	17	06	-03	**56**	-15	-12	-05	22	28	05	17	-19	**-37**	—	17	04

[1]Correlation coefficients are shown at two significant figures and decimals omitted. Coefficients appearing in boldface are significant at .10 level. n varies for each health factor.

[2]ABBREVIATIONS:

CAR: Prenatal Care; CAE: Caesarean; PER: Perinatal Complications; DS1: DDST1; DS2: DDST2; OBS: Obesity; OTI: Otitis; HEA: Hearing Loss; DEN: Dental; SUR: Surgery; FEV: Fevers; COL: Colds; RES: Upper Respiratory; IMP: Impetigo; SHI: Shigella; GAS: Gastro Intestinal; NEG: Neglect; DIE: Diet; ALC: Alcohol; JAU: Jaundice; RH: Rh; VIS: Vision; IRO: Low Iron; PET: Pertussis; HEM: Hemang; RISK: Risk Composite

strongly related ($r = .71$, $p = .02$) to higher scores on the VMI.

Administration times for the DDST varied greatly for these children. First administrations ranged from 3-14 months, and second, if given at all, from 10-36 months.

It can also be seen from Table 3 that children experiencing otitis media scored lower on Number Recall, an auditory sequential subtest, and Language. Research on the effects of otitis media has consistently found lowered language and auditory type skills, particularly in those children who experience the illness before age two (Bender et al., 1975; Julien et al., 1987). Those documented as experiencing hearing loss actually scored higher on Gestalt Closure, Auditory and Prereading, a result clearly at odds with the hypothesis.

Further from Table 3, children having more dental problems scored lower on Hand Movements, Auditory and Visual subtests of the Metropolitan and lower on the Prereading and Quantitative areas.

Children with more colds scored higher on Gestalt Closure. Respiratory infections appeared to be a good predictor of developmental status, with those children having respiratory infections scoring lower on several measures, specifically the PPVT-R, Hand Movements, Auditory, Language and Prereading.

The incidence of impetigo was significantly related ($p < .05$) to higher Visual and Quantitative skills, indicating that

this contagious skin disease is not associated with lower performance on academic readiness type skills.

General gastrointestinal problems and shigella, a specific intestinal infection found in 4 members of this sample, were both related to lower scores on Hand Movements and Number Recall.

Generalized neglect was also related to lower scores on Hand Movements. While parental involvement with alcohol was related to some subtests, the recording of this variable on the health charts was considered to be too inconsistent and subjective to warrant interpretation of this result. For example file notes were often anecdotal or based on third party information.

Significant correlations associated with jaundice, obesity, Rh incompatibility, vision problems, low iron, pertussis and hemangioma are to be interpreted with caution as only one or two children manifested each of these variables (refer to Appendix 1 for specific frequencies). The low incidence of these disorders in this sample resulted in a lopsided marginal split, thereby reducing the validity of the Point biserial calculation. These variables were, however, useful in their contribution to the overall risk score calculated for each child. They will not be discussed further as far as their individual correlations with the test scores are concerned.

As a means of grouping these specific health factors into a more meaningful variable, the overall risk composite score

was calculated. It was shown to be related to lower Receptive Vocabulary, lower Number Recall and lower Language skills.

In summary, as seen from Tables 2 and 3, health variables were found to be significantly related to scores on several of the measures of cognitive and academic development, in the direction stated in the hypothesis; that is, increased health problems were associated with lower scores on the psychoeducational tests.

Those health variables which yielded the greatest number of significant correlations in the expected direction were further analyzed using t-tests. Table 4 illustrates the magnitude of mean differences on the cognitive test scores between those subjects manifesting the particular health problem, versus those without.

Examination of Table 4 shows that children in this group who experienced respiratory illness differed significantly from those without this illness, particularly on the variables related to language development. They were more likely to score lower on receptive vocabulary, auditory and general language skills, as well as on Hand Movements and Prereading. Native children have been found to display otitis media concurrently with upper respiratory infections, causing researchers to propose that the two diseases are interrelated (Kaplan et al., 1973; Manning, 1975). Direct research has linked otitis media with language delay (Julien et al., 1987, McShane, 1982).

Table 4

T-Test Comparisons of Subjects With Versus Without Health Problem for Test Scores

		Upper Respiratory Illness			
Dependent Variable	Group[1]	Mean	S.D.	t value	p[2]
PPVT-R Std. Scores	No	72.64	9.28	1.81	0.04
	Yes	64.40	6.77		
KABC Subtest					
Hand Movements Std. Scores	No	8.57	1.34	1.73	0.05
	Yes	7.40	1.14		
Metropolitan Composites					
Auditory Stanines	No	5.38	1.44	1.90	0.04
	Yes	3.75	1.71		
Language Stanines	No	4.46	0.78	1.86	0.04
	Yes	3.50	1.29		
Pre-Reading Z Scores	No	-0.02	0.54	1.66	0.06
	Yes	-0.65	1.03		

		Dental Problems			
Dependent Variable	Group[3]	Mean	S.D.	t value	p
KABC Subtest					
Hand Movements Std. Scores	No	8.78	1.39	1.62	0.06
	Yes	7.80	1.23		
Metropolitan Composites					
Auditory Stanines	No	5.75	1.75	1.95	0.03
	Yes	4.33	1.22		
Visual Stanines	No	5.50	1.69	1.33	0.10
	Yes	4.55	1.24		
Pre-Reading Z Scores	No	0.12	0.86	1.67	0.06
	Yes	-0.42	0.42		
Quantitative Z Scores	No	-1.05	0.13	2.79	0.01
	Yes	-1.27	0.18		

Table 4 continued

	Denver Screening Test: 1st Administration				
Dependent Variable	Group[4]	Mean	S.D.	t value	p
PPVT-R Std. Scores	Fail	61.00	1.73	-2.68	0.01
	Pass	73.84	8.06		
KABC Subtest					
Gestalt Closure Std. Scores	Fail	9.33	2.89	-1.56	0.07
	Pass	12.08	2.72		
Metropolitan Composites					
Language Stanines	Fail	3.33	1.53	-1.64	0.06
	Pass	4.36	0.81		
Pre-Reading Z Scores	Fail	-0.68	1.31	-1.52	0.08
	Pass	0.01	0.51		

[1]No group: n=14 Yes group: n=5
[2]One tailed t-tests with level of significance set at $p \leq .10$
[3]No group: n=9 Yes group: n=10
[4]Fail group: n=3 Pass group: n=12

Those children in the group having dental problems showed a slightly different pattern. This group tended to be lower in Hand Movements and Prereading, as well as Visual and Auditory. They differed most significantly in the area of Quantitative skills ($p < .01$) where they scored consistently lower. Researchers have found poor dental care to be an indicator of suboptimal nutrition and also to be associated with otitis media and other upper respiratory ailments; all of which have been found to be associated with lowered cognitive/ developmental status (Manning, 1975; Mayhall, 1975).

The Denver Developmental Screening Test (first administration) also yielded some significant results. Children who failed on this administration scored lower on Receptive vocabulary, Language and Prereading skills, as well as on Gestalt Closure.

As described in Chapter III a composite risk score was compiled for each child in the sample. A median split procedure yielded high risk (4-6) and low risk (0-3) groups. The differences between the means of the test battery scores for the low and high risk groups were tested for significance using t-tests. The results are summarized in Table 5. In all cases, except Gestalt Closure, the low risk group obtained higher mean scores than the high risk group, that is, children with fewer health problems scored higher on the psycho-educational test battery. Significantly lower scores were obtained by the high risk group on the K-ABC Number Recall ($p = .01$) and the Metropolitan Language ($p = .02$). Several other

Table 5

T-Test Comparisons of High and Low Health Risk Groups for Test Scores

Dependent Variable	Risk Group[1]	Mean	S.D.	t value	p[2]
PPVT-R Std. Scores	Low	72.78	8.44	1.03	0.16
	High	68.40	9.95		
Beery Std. Scores	Low	7.67	2.34	0.06	0.47
	High	7.60	2.32		
KABC Subtests (Std. Scores)					
Hand Movements	Low	8.44	1.67	0.54	0.30
	High	8.10	1.10		
Gestalt Closure	Low	11.22	2.11	-0.06	0.48
	High	11.30	3.50		
Number Recall	Low	9.67	2.65	2.56	**0.01**
	High	7.10	1.66		
Spatial Memory	Low	9.11	4.20	0.19	0.42
	High	8.80	2.74		
Metropolitan Composites (Stanines)					
Auditory	Low	5.50	1.60	1.22	0.12
	High	4.56	1.59		
Visual	Low	5.37	1.51	0.97	0.17
	High	4.67	1.50		
Language	Low	4.75	0.71	2.33	**0.02**
	High	3.78	0.97		
Pre-Reading Z Scores	Low	0.06	0.62	1.29	0.11
	High	-0.37	0.74		
Quantitative Z Scores	Low	-1.15	0.21	0.29	0.39
	High	-1.18	0.06		

[1]Low risk group: n=9 High risk group: n=10
[2]One tailed t-tests with level of significance set at $p \leq .10$

measures also approached significance; among these were the PPVT-R, Auditory and PreReading composite. Performance on these tests and, possibly the underlying abilities which they purport to measure, may therefore be more more susceptible to the effects of early health problems.

Summary

The results suggest that overall health problems experienced early in a child's development may have detrimental effects later in the attainment of certain readiness skills as well as some cognitive abilities. In addition to overall health problems, as indicated by the health composite score, some variables appeared to be consistently associated with lowered test scores, these were: Respiratory disease, Dental problems and failed DDST (1st administration).

These findings and their implications are discussed more fully in Chapter V.

CHAPTER V

DISCUSSION

This chapter includes a restatement of the purpose of the study, as well as a summary of the results. Limitations involved in generalizing these results to the Native school population and recommendations for further research in the fields of health and education are also presented.

Purpose of the Study

Despite efforts on the part of government and Native groups themselves, many aspects of daily life for Canada's Native peoples are below acceptable standards for the western world. Among these are the health problems which continue to be endemic in this group and the high dropout and failure rates of Native students in the school system. Research in the fields of education and medicine has tended to focus on these issues independently. The contributing effects and possible interactions of several conditions on developmental outcome of Native children have been suggested by researchers as alternatives to previously held stereotypes and assumptions. Recommendations have been made for further study in this area (McShane & Plas, 1988; Williams, 1986).

The purpose of the present study therefore, was to explore the relationship between health problems and cognitive development/academic readiness in a sample of grade one Native children.

Thirty health variables cited in the literature as being relevant in the prediction of developmental outcome were

obtained from subjects' medical files. A battery of psycho-educational tests found to be associated with prediction of academic aptitude was administered to the 19 children in the sample.

Summary of Results

Examination of the descriptive data revealed that many of the parasitic and infectious diseases which are associated with suboptimal living conditions, for example impetigo and shigella, occurred with some frequency in this sample. This finding is consistent with those of several researchers who found that Native children as a group manifest many health problems in greater frequency and severity than white children (Shawana & Taylor, 1988; Shah & Farkas, 1982).

Mean scores on all of the tests in the battery administered were within the moderately low to average range, with the exception of the Metropolitan Quantitative, which was below average. The mean score on the VMI, at the low end of the average range is actually lower than would be expected in this sample. Most research tends to find Native children having strong average skills in this area, a relative strength in contrast to their lower verbal abilities (Kaulback, 1984; Blowers, 1981). The average scores obtained on the other measures are consistent with the research of Bryde (1963) and others (Berry, 1968, Rampaul et al., 1984) who found that Native children actually began school on an equivalent level with their white counterparts, with achievement problems intensifying in later grades. This is in conflict with the

majority of researchers, for example, Downing et al. (1975) who found Native students lacking in reading readiness skills in kindergarten. Mickelson and Galloway (1969) also referred to an initial lack of preparedness for academic success for Natives, and suggested that a contributing factor was lack of verbal/auditory stimulation in early home life.

The results of the Pearson and Point Biserial correlations indicated several significant negative correlations between the health variables and scores on the various psychoeducational tests. Significant correlations ranged from .32 to .96 (Tables 2, 3, and 6). Due to the small sample size and variability in the health histories, there were only one or two cases of several of the illnesses. Because of the resulting imbalance in the marginal splits for the Point Biserials such cases must be interpreted with caution. Those health variables which were present in sufficient numbers and yielded significant ($p < .10$) correlations were as follows:

Denver Developmental Screening Test (first administration) was associated with lower PPVT-R, Gestalt Closure, Language and Prereading composite. Although the DDST was found in the medical files and was administered by the public health nurse it can be argued that, in fact, it is more a measure of cognitive development than a health factor, therefore the positive relationship between it and the other academic-type tests is to be expected. Cautions have been raised by researchers with regard to the Denver's use with

TABLE 6

SIGNIFICANT CORRELATIONS BETWEEN HEALTH FACTORS AND PSYCHOEDUCATIONAL TEST SCORES ($P < 0.10$)

Dependent Variables

Independent variables	PPVT-R	VMI	K-ABC Hand Move.	Gestalt Closure	Number Recall	Spatial Memory	Metro. Auditory	Visual	Language	Pre-Reading	Quant.
Birth Weight	0.39		-0.37								
Gestation	0.33										
Perinatal Comp						0.4	0.44			0.39	
Mother's Age					-0.57						
Gravida			-0.41		-0.63						
Apgar 1 min			0.39						0.36		
Apgar 5 min			0.64			-0.66		-0.96		-0.64	-0.55
DDST 1	0.58			0.38					0.43	0.4	
DDST 2		0.71									
Otitis Media					-0.32				-0.36		
Hearing Loss				0.32			0.39			0.37	
Dental Probs			-0.37				-0.45	-0.32		-0.39	-0.58
Dental Surgery			-0.39			-0.39					
Fevers			0.33	0.42							
Colds				0.32							
Resp. Illness	-0.4		-0.39				-0.44		-0.43	-0.39	
Impetigo		0.33						0.71			0.56
Shigella			-0.39		-0.33						
GI Problems			-0.41		-0.47						
General Neglect			-0.4					0.33	0.55		
Risk Composite	-0.33				-0.49				-0.39		

Native children, however as the use of English is not appropriate in some Native communities (this is likely not a factor in the present study) and many of the items are scored as "no opportunity", particularly in isolated areas (Burke, Sayers & Wray, 1981). Those same factors which are seen to bias the DDST for Native students are also factors which hamper the Native child in the provincial school system, which rarely accommodates for their different backgrounds and skill acquisition. Because of this, the DDST may in fact be a good predictor of academic aptitude, as it was in this study.

Dental Problems were associated with lower scores on Hand Movements, Auditory, Visual, PreReading composite and Quantitative. Although there is no apparent reason why dental problems themselves would affect these tests, poor dental status has been associated in the literature with a variety of other health factors, such as otitis media and suboptimal nutrition and therefore it appears to be one indicator of overall health status. The high incidence of dental problems in Native groups has been attributed to a shift to the high sugar and carbohydrate North American diet, as well as lack of utilization or availability of adequate dental care (Manning, 1975, Mayhall, 1975). The encouraging aspect of this finding is that these problems, and presumably their sequelae, are largely preventable.

Finally, respiratory illnesses were related to lower scores on the PPVT-R, Hand Movements, Auditory, Language and PreReading. Three of these four tests have a major language

component. Lowered performance in this specific area would be expected based on the literature linking respiratory illness with the inflamed eustachian tubes and fluctuating hearing loss associated with otitis media (Julien et al., 1987; Kaplan et al., 1973; McShane & Mitchell, 1979; Scaldwell & Frame, 1985). The severity and frequency of respiratory disease in Native children is often significantly greater than that documented in white children and results in higher rates of hospitalization for them (Houston et al., 1979). This increase in length of illness as well as hospital stay is likely responsible for frequent absences from school and reduced opportunity for cognitive development.

Significant correlations were also noted on several other health variables, specifically otitis media, gastrointestinal illness and shigella, though with few fewer psychoeducational measures. It is possible that more findings of significance would be obtained with more detailed health history information. For example, the frequency of occurrences of otitis media has been found to affect developmental outcome, with greater than four occurrences being associated with lower verbal skills than less than four (McShane, 1982). The same likely applies to several of the health variables which were dichotomized in this study. The method of recording health history information employed by the Indian Health Office prevented such depth of data collection.

The assignment of the health risk composite score permitted a more global examination of the data. A pattern was

found to exist, indicating more favorable outcome for the low health risk group on each of the psychoeducational tests administered. The mean differences were significant ($p < .05$) with Number Recall and Language.

These results suggest that for this sample several significant correlations existed in the direction stated in the research hypothesis. Such findings support the views of several researchers (McShane, 1983; Bender et al., 1975; Tempest, 1987) who proposed a combination rather than single variable effect on developmental outcome.

In summary, this sample did manifest a wide variety of health problems, their mean scores on the psychoeducational tests were somewhat lower than the norms, though not significantly so, and there did appear to be a relationship between their health problems and performance on the test battery.

Limitations of the Study

The findings of the present study must be interpreted in view of several limitations to its generalizability. The small sample size was a major limitation narrowing the scope of the data analysis. This, in combination with the degree of variability within the subjects' health histories made group effects difficult to determine. It had been assumed that a continuum would exist with some subjects manifesting several of the health problems and other subjects manifesting relatively few. In fact most of the subjects had an assortment

of disorders, yielding a fairly heterogeneous sample, with each child displaying varied health concerns.

The second major limitation was the collection of data for the independent variables. The medical files for several of the subjects were incomplete or yielded minimal information. For example, otitis media would be listed as a single entry with few details on the severity of the episode, if treatment was required, or the frequency of occurrences. Very sparse information was available on those subjects who had availed of Provincial Public Health rather than the Indian Health Office. As well,the onus was on the mother to arrange prenatal visits and to bring her child in for regular checkups, where the DDST screenings, etc., occurred. This may have resulted in some bias in the group which had that information available.

Results of the Lillooet Education Study (Napoleon, 1988) showed that for the grade one group only (which formed this study's sample), Native children were absent more frequently than whites. This leads one to question why they were absent, perhaps because they experienced more health problems. If so, is it the missed instructional time or illness which is causing their academic difficulties? The direction of causality is difficult to determine.

Recommendations

The results of this study raise a number of issues which appear worthy of future research. The pattern of lower test scores in the high risk group suggests that a study examining

this relationship in a larger sample may arrive at more consistent significant results. As Parkyn (1985), Siegal (1982) and others have suggested, the use of social as well as physical factors is likely a more effective means of accounting for variables related to developmental outcome, than examining single factors. Affective measures should also be incorporated as Native children tend to be at risk for emotional problems, as well as low self esteem with regard to academic pursuits (Beiser & Attneave, 1982, Rampaul et al., 1984). Such a study could employ multivariate analysis to compare the influences of health, emotional status and SES on cognitive development.

A longitudinal method which entailed keeping detailed accounts of the relevant medical status of subjects in combination with an assessment of current health status, using various physical examinations, strength measures and so forth, would likely overcome some of the problems associated with retrospective medical data collection. Administration of psychoeducational tests early and later in the academic stages would control for the possible mitigating effects of time on preschool health problems, as well as "academic crossover", "cumulative deficit" and other effects which confound research on achievement in this population.

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Appendix 1

Health History Variables – Occurrence

											Health Health Variables[1]																
Subject	BWT	GES	NAT	CAE	COM	JAU	MAG	GRA	APG	DSC	OBS	OTI	FLU	EYE	DEN	SUR	FEV	COL	RES	IRO	IMP	SHI	PER	DIA	HAE	NEG	NUT	ALC
1	3530	36	1	0	0	0	19	1	9	P	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0
2	6649	40	1	0	0	0	18	1	9,10		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
3	3815	40	1	1	0	0			9,10	F	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
4	2890		1	0	0	0	16	1	8,10	P	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
5	2790	38	0	0	0	0	17	2	8,10	P,F	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	1	1	1
6	3068		1	0	1	0			8,9	P	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
7	3770	40	0	0	0	0	38	5	8	P	1	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	1	1
8	3920	40	1	0	1	0	23	3	4,9	F,P	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0
9	2200	35	2	0	0	0	20	2	8,10	P	0	1	1	0	1	1	0	0	0	1	0	0	0	0	0	1	0	1
10	3430	40	1	0	0	0	16	1	8	P	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
11	2910	40	1	0	0	0	18	1	8	F,P	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1
12	3818	40	1	0	0	0	27	5	8	P	0	1	1	0	0	0	0	1	1	0	1	0	0	0	0	1	0	1
13	3460	40	1	0	0	0	23	4		P,F	0	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0	0	0
14	3340	38	1	1	0	0	20	2	8	P	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0
15	3100	40	1	0	0	0	18	3	7		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1
16	2690	38	1	0	0	0	31	3	9	P	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
17	3250	37	1	0	0	1	21	3	8	P	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1
18	1520	34	1	0	1	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
19	4170	40	1	0	1	0	17	2	7,9		0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0
20			2	0	1	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[1]ABBREVIATIONS:

BWT: Birth Wt (grams) GES: Gestation (weeks) NAT: Prenatal Care CAE: Caesarean COM: Complications JAU: Jaundice

MAG: Mother's Age GRA: Gravida APG: Apgar 1,5 min DSC: Denver Score OBS: Obesity OTI: Otitis Media

FLU: Flucuating Loss EYE: Vision Prob DEN: Dental Poor SUR: Requiring Surgery FEV: Frequent Fevers COL: Colds

RES: Upper Respiratory IRO: Low Iron IMP: Impetigo SHI: Shigella PER: Pertussis DIA: Chronic Diarrhea

HEM: Haemangioma NEG: Neglect NUT: Poor Nutrition ALC: Alcoholism in Family

Parent Consent Form

School District #29 (Lillooet) and the six Indian bands in the Lillooet area are participating in a study of student achievement and aptitudes in cooperation with the University of British Columbia.

Your child _____ has been selected randomly, to take part in the study if you are willing.

1. His/her participation will involve about 1 1/2 hours of testing over one to three testing sessions. The tests are a series of achievement and aptitude tests.
2. All testing will be done by fully qualified psychometrists.
3. All test results will be kept in strictest confidence.
4. Participation in this project is voluntary and may be terminated at any time by the student, parents or guardian, or teacher.
5. The results of the study will help the schools understand the achievement and aptitudes of children in the school district, as well as provide the teacher of your son or daughter with very helpful information that would not normally be available.
6. For further information please contact your school principal.

Please sign one line below

I AGREE to my child taking part in the study._____
Parent or Guardian

I DO NOT AGREE to my child taking part in the study._____
Parent or Guardian

Date _____.