

PEDIATRIC HOSPITALIZATIONS FOR
AMBULATORY CARE SENSITIVE CONDITIONS:
A COMPARATIVE STUDY OF SASKATCHEWAN REGISTERED INDIANS AND
NORTHERNERS WITH RURAL AND URBAN SASKATCHEWAN CHILDREN

by

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A Thesis
Submitted to the Faculty of Graduate Studies in partial
fulfillment of the requirements for the degree of
Master of Science

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CARE SENSITIVE CONDITIONS: A COMPARATIVE STUDY OF
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BY

JAMES IRVINE

**A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University
of Manitoba in partial fulfillment of the requirements of the degree
of
MASTER OF SCIENCE**

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ABSTRACT

This study compared the 1992-93 hospitalization rates for conditions considered to be preventable or treatable through ambulatory care for children of five Saskatchewan population groups including northern and southern registered Indian children as well as non-Indian children in northern, rural and urban areas.

A Pediatric Ambulatory Care Sensitive (PACS) index, was used as an indicator of hospitalizations preventable through ambulatory care.

Results of this study revealed hospitalizations for all conditions and for PACS conditions are greater for registered Indian children compared to other population groups; greater for southern registered Indian children than for northern registered Indians; and greater for other northern children than those in southern rural and urban communities. An assessment using the proportion of hospitalizations for PACS conditions was not found to be as useful because of the difficulties in interpretation.

These comparisons provided some assessment of various models of ambulatory health services as northern Registered Indians have access to a primary health care system involving primary care nurses in on-reserve health centers

who are teamed with visiting family physicians; whereas the southern groups do not have a specific, organized primary health care system.

Hospitalization for some ambulatory care sensitive conditions could be used as an indicator for monitoring changes in access to ambulatory care during a period of health organizational change.

DEDICATION

This work is dedicated to Trudy, Jeffrey and Daniel for their patience, support and love during the evenings and weekends that this work required; and to the Aboriginal peoples of Saskatchewan.

ACKNOWLEDGMENTS

I would especially like to thank some of the many people who provided encouragement, support and guidance for the production of this thesis, including my thesis supervisor, Dr. Charlyn Black and other Thesis Supervisory Committee members, Dr. Brian Postl and Dr. Cam Mustard; as well as Dr. K.C. Carriere, Charles Burchill, Dr. Sharon MacDonald, Dr. Leonard Tan, Val Phillips, Donna Stockdale, Ruth Bond, Riaz Alvi, Drs. Pat and Joseph Kaufert, my colleagues in the Masters program especially Pat Martens, and the members of Northern Medical Services Research and Development Committee.

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1 STATEMENT OF THE PROBLEM

1.1 Introduction

There is a general movement across Canada to reform the health care system with less emphasis on institutional care coupled with more community based health services, health promotion, disease prevention and early intervention with primary medical care. Some initiatives to effect changes in institutional health care include reducing the number of tertiary care, regional, or local hospital beds, amalgamating some hospitals or hospital services, and converting of small hospitals into community health centers.

Concurrently, increased responsibility for the delivery of health services on reserves is being transferred to First Nations people across Canada through the Health Transfer Program of Health Canada. The extent of transfer varies across Canada and will change with time with more First Nations likely to have direct involvement with planning and directing the ambulatory care services for First Nations' communities. Changes in the hospital care sector such as hospital bed closures, increased use of outpatient

procedures, or early discharge programs will affect these developments.

There are many potential benefits with the refocusing of the health care system but also potential risks especially to the most vulnerable segments of our society. This includes children, especially Aboriginal children and children living in remote communities. First Nations children and children resident in northern communities have well documented health status inequities in Canada. Little information is available on the hospital utilization patterns of these children in Canada other than information showing high utilization rates.

Hospitalization accounts for a large portion of the expenditures in child health, and decreases in the rate of hospitalization can release funds and resources for other health initiatives (Connell et al., 1981). As well, hospitalization for children is not without risk. One can regard a proportion of hospitalizations as a breakdown in other aspects of health programming including the health promotion, community development, disease prevention, or ambulatory service components of the health and medical care system. The lack of hospitalization analysis makes it more difficult to assess the potential impact of various forms of ambulatory care services and to determine priorities for policy and program development having the greatest and most efficient impact on improving health status and health care

services of Indian and northern children. (Lovejoy et al, 1971; Mushlin & Appel, 1976; Twaddle & Sweet, 1970)

Small-area analysis using indicators to evaluate ambulatory care can provide information to assess the impact of various ambulatory care programs on the rate for children being hospitalized and could complement other research efforts. This could be especially helpful for those children from First Nations and northern communities because of their present health status inequities, high hospital utilization rate and the potential for change through health reform and Indian Health Transfer.

1.2 Purpose of the Study

The purpose of the study is to compare the relative extent to which hospitalization is used in various populations of Saskatchewan children for conditions that are potentially amenable to ambulatory care. The principal analysis will be to compare children from northern Saskatchewan with those from other groups in southern Saskatchewan. This will involve the comparison of hospital utilization for children from northern Saskatchewan stratified by registered Indian status with those from southern Saskatchewan children stratified by registered Indian status and, for children other than registered

Indians, by urban/rural status. In addition, further analysis will provide an understanding of the extent to which hospitalization is resorted to for these various groups for some conditions generally recognized to be sensitive to ambulatory care. It has been argued that hospitalization for these conditions serves as an indicator for potential to improve in the provision of ambulatory care services to a population.

This study would also assist in evaluating two models of primary and ambulatory care provided to registered Indians on reserves in the province; comparing that of northern Saskatchewan where there is a more integrated ambulatory care system with that of southern Saskatchewan. In northern Saskatchewan, there is generally more primary care provided in the reserve community through primary care centers with primary care nurses teamed with visiting family physicians.

This study would be done for the period from April 1, 1992 to March 30, 1993 which is prior to any major changes occurring as a result of health reform and prior to many major changes in the ambulatory care programs through the Indian Health Transfer Program. It could provide information to assist with policy and program development as well as provide a baseline for future evaluation following Indian Health Transfer of primary care nursing programs and various health reform initiatives including the conversion of many

small southern rural hospitals into community health centers.

1.3 Hypotheses

The major hypothesis for this study is that hospitalization rates for conditions which are felt to be prevented or treated through ambulatory care are different for various populations of Saskatchewan children. Further, these rates will be associated with a number of factors including: registered Indian status and north-south/rural-urban geographic areas of residence. Residential location and registered Indian status provide some population information on health status, general socio-economic conditions, ethnicity as well as access to varying programs and emphasis for ambulatory care and hospital care (including hospital bed availability). The predicted pediatric hospital utilization rate for all conditions and the rate and proportion of admissions that could potentially be prevented or treated by ambulatory care, is hypothesized to decrease according to category as follows (as rationalized in Table 1):

- 1) Indian children registered with southern bands;
- 2) Indian children registered with northern bands;
- 3) Other northern children;

- 4) Other southern children in rural communities; and
- 5) Other southern children in urban communities.

TABLE 1: HYPOTHESIS FOR ORDER OF HOSPITAL UTILIZATION AND PROPORTION OF AMBULATORY CARE SENSITIVE CONDITIONS

Subpopulation	Utilization & Proportion PACS Rank	Rationale
Southern registered Indian	1	<ul style="list-style-type: none"> ● Registered Indian population ● Less integrated primary medical care
Northern registered Indian	2	<ul style="list-style-type: none"> ● Registered Indian population ● More integrated primary medical care
Other northern children	3	<ul style="list-style-type: none"> ● Some conditions similar to registered Indians ● Mixed Aboriginal/non-Aboriginal population ● More integrated primary medical care
Other southern - rural	4	<ul style="list-style-type: none"> ● Predominately non-Aboriginal ● Access to health services
Other southern - urban	5	<ul style="list-style-type: none"> ● Predominately non-Aboriginal ● Full range of services

A second hypothesis is that children living in remote northern communities or registered with remote northern bands (i.e. greater travel burdens to the closest hospital) would have higher rates of hospitalization for ambulatory care sensitive conditions compared to those northern children living or registered with bands closer to communities with hospital services. Thus in children registered in northern Saskatchewan, registered Indians and those registered in communities further from communities with hospitals would have higher rates of hospitalizations for conditions that could be potentially prevented or treated by ambulatory care. The predicted hospitalization rate for such conditions is hypothesized to decrease according to category as follows:

- 1) Indian children registered with northern remote bands;
- 2) Indian children registered with northern central bands;
- 3) Other northern children living in remote communities;
- 4) Other northern children living in communities close to hospitals; and
- 5) Other northern children living in communities with hospitals.

A third hypothesis is that children living in communities in southern rural or northern communities further from hospitals would have a higher proportion of

their hospitalizations with conditions potentially preventable or treatable through ambulatory care than their counterparts in southern urban or northern communities closer to hospitals. The proportions of hospitalizations that could potentially be prevented or treated by ambulatory care, would be as follows in descending order:

- 1) Registered Indian children residing in southern rural Saskatchewan;
- 2) Registered Indian children residing in remote northern Saskatchewan;
- 3) Registered Indian children residing in urban areas;
- 4) Registered Indian children residing near northern hospitals;
- 5) Other northern children residing in remote communities;
- 6) Other northern children residing near northern hospitals;
- 7) Southern rural children; and
- 8) Southern urban children.

To test this hypothesis the location of residence determined by using postal codes for registered Indians rather than geographic area of band of registration would be utilized by using the postal code of residence recorded on the hospital separation record.

These hypotheses are based on several considerations. First, based on other research, it is assumed that increased hospital utilization for ambulatory care conditions occurs

more frequently in First Nations children compared to non-Aboriginal children based on other research; that rural and remote children have less access to the full range of ambulatory services than urban children though hospital beds have been readily available; that the health status of northern and southern First Nations' are fairly comparable based on infant mortality and general mortality rates; and that the more integrated system of health care services in northern Saskatchewan provides more effective ambulatory care for First Nations' children on reserve compared to those in southern Saskatchewan. It is also assumed that First Nations status is not a risk condition for hospitalization in its own right but a population indicator of a wide variety of risk factors possibly including social, educational as well as economic conditions all of which determine health status, as well as differing utilization patterns of ambulatory care services based on poverty, health beliefs, and the appropriateness or inappropriateness of the provision of health care services to them.

1.4 Specific Objectives

- 1) To determine the age- and sex-standardized hospitalization episode rates among northern Saskatchewan children less than 15 years of age stratified by Indian

status (i.e. Indians registered with northern bands and others) for the year April 1, 1992 to March 31, 1993 and to compare these rates with children from southern Saskatchewan stratified into three groups: Indian children registered with southern bands, other children from urban communities and other children from more rural areas;

2) to determine and compare the rates and proportions of hospitalizations for these five groups for ambulatory sensitive hospitalizations using a Pediatric Ambulatory Care Sensitive (PACS) hospitalization index;

3) to determine and compare the hospital episode rates and rates of hospitalization for PACS conditions for children with various degrees of access to hospitals in northern Saskatchewan (i.e. those registered Indian children and other northern children registered with bands or residing in communities within one hour travelling time with road access to those children registered with bands or residing in communities more than an hour or without road access to a community with a hospital) to determine influence of time and distance on hospitalization and to determine the influence of location of rural versus urban residence on the proportion of hospitalizations for ambulatory care conditions for southern registered Indians; and

4) to determine and compare the proportions of hospitalizations for PACS conditions for registered Indian children living in remote northern communities (one hour or more travelling time to a hospital or without road access)

and less remote northern communities (postal codes indicating residence in northern Saskatchewan plus registered with a northern band) with those living on or near reserves in southern Saskatchewan (southern band registration excluding those with urban postal codes) and with those living in urban areas.

1.5 Definition of Terms

Ambulatory care sensitive (ACS) conditions include those "diagnoses for which timely and effective outpatient care can help to reduce the risks of hospitalization by either preventing the onset of an illness or condition, controlling an acute episodic illness or condition or managing a chronic disease or condition" (Billings et al, 1993). This concept of timely and effective outpatient care is seen in this thesis to include a broad perspective in the overall aspect of outpatient health care and it involves family/parents, community-based services, various health care providers including informal care givers, community health workers, primary care and public health nurses, family physicians, and specialists/consultants in a variety of settings including the home (family/social support), local community health centers and clinics, as well as outpatient and emergency departments of hospitals/health

centers. It involves a complex interplay of access and availability of ambulatory care, appropriateness of the service system, client mobility, compliance, confidence in the provider and the system, and health beliefs. Access can be determined through geographic availability or linkage to outpatient care, as well as economic and social access (for health care, for costs of medications, for transportation costs, for costs and availability of childcare).

In this manuscript, primary medical care will be used to describe "health care that begins at the time of the first encounter between a patient and a provider of health care", which is sometimes referred to as primary health care (Last). This will help make the distinction with the WHO definition of primary health care which is a broader concept.

There are a variety of terms that are used to describe various Aboriginal groups in Canada, including "Aboriginal people", "First Nations peoples", "Natives", "Status and Non-Status Indians", "Métis" and "Inuit". Aboriginal People are defined by the Canada Constitution Act (1982), Section 35(2) as comprising three groups: Indian (Status and Non-Status), Métis, and Inuit. In this study, the term "Registered Indians" will be utilized because the Registered Indians, sometimes referred to as "Status Indians", are separately identified through Saskatchewan Health data files. Registered Indians are eligible for certain uninsured medical benefits not available to others. Other groups of

Aboriginal People are not identified separately through the health data files and so identification and description of hospital utilization for Non-Status Indians or Métis are not possible.

For this study, Northern Saskatchewan will refer to the area covered by the Northern Health Services Branch of Saskatchewan Health. It divides the province approximately in half geographically with about 2.8% of the provincial population being included in the northern half. The reason that this definition is used is three fold: most other health status or health care information in the province uses fairly similar divisions, the region has distinct geographic, socio-economic, and demographic characteristics, and there is a fairly clear distinction in the approach to providing primarily medical care in this northern region.

Children's hospitalizations will refer to hospital separations by children under the age of 15 years, excluding newborns. Separations will be the focus of analysis because hospital abstracts for inpatient care which form the basis of the hospital administrative data are based on information available at the time of separation. The separations were used to determine the number of episodes of hospital care. Episodes count the number of hospital separations that represent an initiation of use of hospital care (i.e. additional separations resulting from transfers of a patient between hospitals are not counted) (Black, Roos, Burchill). This measure adjusts for bias introduced by double, triple

or even quadruple counting separations for patients who are transferred from one hospital to another to receive care, which contributes to higher measured rates of hospital separations for residents living outside major urban centers with tertiary care facilities, and even higher for those living away from other urban centers. (e.g. two people with same severity of illness though one is from LaRonge and the other is from Saskatoon: the individual from LaRonge could be admitted to LaRonge Hospital, transferred to Prince Albert and later, on to Saskatoon with a subsequent transfer back to LaRonge for recovery or recuperation. Though both individuals would be counted as having one episode of hospital care, the individual from LaRonge would be counted as having 4 separations while the individual from Saskatoon would be counted as having one separation).

2 BACKGROUND AND LITERATURE REVIEW

2.1 The Significance of Hospitalization in Children

It has been suggested that a significant proportion of hospitalizations can be viewed as examples of the failure of the preventive, community, or ambulatory components of the health and medical care system and with better or more timely ambulatory or preventive care, the need for hospitalization could be avoided (Lovejoy et al., 1971; Mushlin & Apple, 1976; Twaddle & Sweet, 1970). Aagaard (1979) and Kemper (1988) have stated that some hospitalizations in the pediatric population are inappropriate if improved ambulatory care, preventive programs and community social support were available. As hospitalization makes up a large proportion of the costs of child health care, decreases in the rate of hospitalization may produce important reductions in the cost of that care and thus provide resources for other programs influencing health and social conditions. As well, a reduction in hospitalizations might reduce some potential risks to children including chances of iatrogenic complications, hospital acquired infections, social and emotional burdens and family disruption (Connell, 1981; Schimmel, 1964).

Vernon et al (1965) and Thompson and Vernon (1993) have suggested short-term or even long-term negative emotional or behavioral problems following childhood hospitalization.

There is some information available now which suggests that children stay in hospital or are admitted to hospital more than necessary. Gloor et al. (1993) found 24% of pediatric hospital days were inappropriate at an Ontario pediatric tertiary care hospital and Kasian et al. (1992) found 16.2% of the days at a Saskatchewan pediatric tertiary center were inappropriate. In a Saskatchewan-wide study involving all hospitals, average pediatric admission non-acute care days ranged from 36% in regional hospitals to 56% in large community hospitals (Health Services Utilization and Research Commission, 1994).

2.2 Hospital Utilization Research Methods

Increasingly epidemiological techniques are being applied to health care services and the secondary analysis of administrative data is increasingly being used in health services research. Using administrative data has been shown to be useful and relatively inexpensive in providing timely information, obtained in an unobtrusive manner, to assist government, health boards, researchers, planners and service providers (Roos L et al, 1987; Roos & Payne, 1987; Roos et

al, 1989; Roos N, 1989; Roos L & Roos N, 1989; Lohr, 1990; Wennberg, 1990; Gormley et al, 1990; Shapiro, 1991; Health Services Research Group, 1992; Fisher et al, 1992). The utility of administrative data has also been shown for studies in the pediatric age group (Connell et al, 1981; Wissow et al, 1988; Perrin et al, 1989). One investigational approach to using hospital administrative data is small-area analysis, described by Paul-Shaheen et al. (1974) as a method to document the amount of variation in health care use among different areas, to determine if there is a pattern to such use in high- versus low-use areas, and to identify elements which are associated with the variation and which may explain part of the variation.

Researchers have also attempted to determine whether variations in health care utilization were associated with characteristics of the population, whether they reflect differences in need, or whether they are associated with differences in the medical care system itself (Anderson, 1973).

Variables that have been suggested as associated with hospital utilization variation include health status; socio-demographic characteristics such as age-structure, income, education and employment levels; insurance status; the utilization of ambulatory care services; and the availability and accessibility of hospital care. Wennberg (1987) also suggested that differences in clinical judgment on the appropriateness of treatment also played a major role

when comparing patterns of variations of the population-based rate of hospitalization for specific diagnoses or surgical conditions among relatively comparable areas in the United States. Thus, Wennberg suggested it was differences in medical practice, including the physician's threshold of admission to hospital, which were reflected in variations in admission rates.

2.3 Ambulatory Medical Care Impact on Hospitalization

Connell et al. (1981) have suggested that "a large proportion of hospitalizations can be viewed as examples of the failure of the preventive, community, or ambulatory components of the medical care system and that even in some cases where hospitalization was clearly necessary at the time of admission, better or more timely ambulatory or preventive care may have eliminated the need itself."

Black et al. (1993) reported that the two regions of Manitoba that had the highest utilization rate of hospitals for all ages were those regions with the poorest health and highest socioeconomic risk. Access to hospitalization appeared adequate throughout Manitoba. In light of the relationship seen between socioeconomic risk factors, health status and use of hospital resources, they concluded that there may be other more effective approaches to improving

population health in these disadvantaged regions than providing more hospital resources in an area with already high hospital use. These other approaches could include changes in community-based or ambulatory care health promotion, disease prevention and early intervention programs as well as initiatives to influence social, environmental and economic conditions.

Roemer (1993) has suggested that though there is an expectation that primary medical care reduces use of hospitals, there is little clear evidence supporting this. He mentions three studies that have supported the role of primary medical care in reducing hospital use. One study in California revealed that the addition of a copayment charge to a Medicaid population, compared to a control group, there was a prompt reduction in ambulatory visits to a doctor and a few months later there was an increase in the rate of hospitalizations. In Cuba, with an increased emphasis on primary health care utilizing small teams of a family doctor and a nurse in polyclinics, there was a reduction in hospital admissions and a change in the principal causes of admission. Agdestein and Roemer (1991) also compared the medical care systems in Norway and Sweden and found that in Norway, with a greater emphasis on primary care through family physicians, there was a lower rate of hospital admissions and a lower rate of hospital bed occupancy.

Studies using small-area analysis have added further information on the influence of ambulatory care and

hospitalization. Brewer and Freedman (1982) suggested through small-area analysis that outpatient visits in the general population were negatively correlated with the rate of hospitalization suggesting that areas with more office-based visits tend to have lower hospitalization rates.

Parchman and Culler studied the relationship between the availability of primary care physicians and the rate of hospitalizations for certain conditions determined to be influenced by the ability of a population to access health care. They suggested that the number of family and general practice physicians per population was significantly correlated with adult and pediatric hospitalizations for these certain conditions after controlling for the effect of per capita income. Gill found no association between the availability of a regular source of care for Medicaid clients and the rate of hospitalization for all conditions or for conditions determined to be potentially avoidable through ambulatory care.

Bindman and colleagues suggested that perceived access to medical care was associated with lower hospitalizations for specific chronic medical conditions after controlling for the prevalence of the conditions, health care seeking behaviour and physician practice patterns.

In a study specifically targeting hospitalization in children, Connell et al. (1981) studied variations in admission rates among Medicaid children from various areas in the State of Washington. This study determined that for

these relatively comparable children from different areas, the differences in admission rates were not associated with medical need, demographic factors, physician and hospital bed supply, or delay in seeking medical care and they suggested that the differences may reflect either differences in the tendency of local physicians to admit children to hospital (practice style or admission threshold) or to the adequacy of community, ambulatory, and preventive care influencing reliance on hospitalization.

Wise and Eisenberg (1989) suggested that a physician's decision to hospitalize a child will depend on that physician's perception of the severity of the illness, the likelihood of its progression, and the responsiveness of the caretaker and the outpatient system. They felt that the greatest concern in the variations of hospitalization rates was the possibility that reliance on hospitalization was the only appropriate response, because community-based services were inadequate.

Goodman et al examined the relationship between the characteristics of local medical services and the likelihood of hospitalization in children. They suggested that for conditions for which outpatient alternatives were available (asthma/bronchitis and gastroenteritis), there were higher rates of hospitalizations for children from lower income areas, high per capita bed supply areas, and for children living closer to hospitals. For femur fractures, a condition for which hospital admission nearly equals disease

incidence, there was no significant association with bed supply, or distance from hospital. However, there was an association with median household income that may have influenced incidence rather than hospitalization for this condition.

Perrin et al. (1989) also suggested demographic differences including variations in socio-economic status could influence rates of hospitalization in children in several ways - frequency or severity of disease, decreasing access to ambulatory care, and lowering thresholds for admission which could reflect concerns for the adequacy of outpatient/homecare services.

To assess the quality of ambulatory care for vulnerable populations, some authors have utilized sentinel health conditions. Some of the early work on these sentinel health conditions was done by Rutstein et al. (1976). Others have used variations of Rutstein's sentinel indicators to investigate variations in the rates of preventable deaths (Woolhandler et al., 1985; Buck & Bull, 1986; Poikolainen & Eskola, 1986; Schwartz et al., 1990) or in a few instances for hospitalizations (Wissow et al., 1988; Weissmann et al., 1992; Billings et al., 1993). Only one of these specifically studied children (Wissow et al., 1988) and limited the study to children with asthma.

Weissman et al. (1992) have utilized "Avoidable Hospital Conditions" as an indicator for conditions for which hospitalization could be avoided with ambulatory care

provided in a timely and effective manner. Other studies have utilized this indicator to assess ambulatory care between groups (Parchman and Culler, Pappas et al, Casanova and Starfield).

Billings et al (1993) developed the ACS index as a sentinel indicator for ambulatory care services through a medical advisory panel of six internists and pediatricians including some with expertise on problems associated with access barriers. Billings et al suggested that examining ACS admission rates could be a useful method in monitoring need and providing useful information to establish local health priorities and to allocate scarce resources. Other studies have utilized these ambulatory care sensitive conditions as a sentinel indicator (Gill; Billings, 1996; Institute of Medicine) With minor adjustments, the Manitoba Center for Health Policy and Evaluation's Population Health Information System included these same conditions for an "Ambulatory Sensitive Hospitalizations" or ASH indicator as one of their population health status indicators. (Cohen and MacWilliam, 1994)

The ASH could be considered a subset of conditions that Rutstein et al. referred to as unnecessary or preventable diseases. Thus injuries could be considered unnecessary or preventable conditions but not necessarily sensitive to ambulatory care. Similarly, though shigellosis is preventable by other means, it is not preventable through early ambulatory care; however, dehydration could be seen as

amenable to or prevented by early ambulatory care. Whooping cough is preventable and relatively unnecessary and this prevention is based on ambulatory care immunization programs.

The ACS indicator is not an indication of the overall potential impact on the hospitalization utilization by ambulatory care but an indicator to compare ambulatory service access, availability, and utilization among various population groups. There are other conditions that may be impacted by ambulatory care and the conditions that will serve as ACS have varying degrees by which ambulatory care can prevent hospitalization. An example of this is whooping cough for which hospitalization could be greatly reduced through immunization and, as required, chemoprophylaxis but because the vaccine is not fully efficacious, especially only after one or two doses, the need for hospitalization may not be completely eliminated even with high quality ambulatory services.

There have been two methods described in the literature of calculating rates for avoidable or ambulatory care hospital conditions (Parchman & Culler). Billings et al calculated ambulatory care hospitalization rates by dividing the number of ACH admissions for a given small area by the population of that area adjusting for age and sex. Weissman et al similarly calculated a simple rate of avoidable hospitalization adjusting for age and sex and then determined the relative admission rates for avoidable

hospitalizations between the different study groups. They then attempted to adjust for other factors than access or quality of care such as differing degrees of patient demand, treatment preferences (style of practice or threshold for admissions) or physician supply which could influence variations in utilization. They calculated an adjusted rate by dividing the avoidable hospitalization rate by the rate of admissions for all other conditions (i.e., all conditions other than those identified as avoidable hospitalization conditions). An additional identified advantage of this method, which compared the relative risk of hospitalization due to an avoidable hospital condition versus that due to other or non-AHC conditions between groups, was that it was independent of estimates of denominator populations. Parchman and Culler were hesitant about the adjusted rate as used by Weissman et al as they felt the observed variations in the relative rates might be related to variations in unavoidable elective hospitalizations. Parchman and Culler used the approach by Billings et al, comparing, between different areas or populations, the different rates of admissions for a core group of diagnoses for which timely and effective ambulatory care may avoid hospitalization.

Studies have shown that hospitalization rates for ambulatory care conditions (ACS) or for avoidable hospitalizations are associated with socioeconomic factors (Billings 1993; Billings 1996; Pappas et al), race (Pappas et al) and the methods of health care coverage (Billings

1996). Billings et al (1996) found that there were less dramatic differences in ACS hospitalization rates between high- and low- income areas in the Canadian cities studies in comparison to the American cities. The system of universal health care coverage was suggested as one of the main differences between the Canadian and American cities.

Other North American researchers have used extensive chart reviews to look at the appropriateness of hospital use as a method of investigating hospital use by various populations. Studies using this approach include five in Canadian pediatric populations (Lavis & Anderson, 1993). These studies have determined the proportion of medically inappropriate pediatric hospital days utilized or the proportion on admissions requiring acute care.

The concept of determining the frequency or proportion of acute care days and acute care admissions is somewhat different than the concept of ambulatory care sensitive conditions. Even for some hospitalizations that were clearly acute and requiring admission at the time, with the use of earlier or more appropriate ambulatory care for some conditions amenable to treatment or prevention, the need for hospitalization may have been eliminated.

2.4 Health Status of Registered Indian and Northern Children

The Canadian Institute of Child Health (1994) or the CICH stated that "socially, Aboriginal peoples are among the most disadvantaged of all Canadians" and that their health problems exceed Canadian averages in most areas and these inequities have been persistent over several decades. The CICH, Young (1988 and 1994) and Postl et al. (1994) have chronicled some of these some of disparities in the Canadian Indian population including stillbirth, perinatal and infant mortality rates double the overall Canadian rate; and life expectancy remaining nearly ten years below that of the total Canadian population.

Within Saskatchewan, the children of Saskatchewan's north (Tan et al., 1992; Irvine et al., 1991) and of registered Indian descent (Canada, Health and Welfare, 1989,1992) also have well documented health status inequities in the province. Both infants in northern Saskatchewan and registered Indian infants have mortality rates almost double that of the province.

2.5 Hospital Utilization of Registered Indian and Northern Children in Canada

Morbidity statistics based on hospitalizations of the general population are published for Canada and for the provinces. Limited information is available for Registered Indian utilization. All studies that have reported on hospital utilization by Indian children in Canada have reported elevated rates. The relative rates have ranged from one and a half times to over eight times the rate of the general population depending on the age group and the study area. (Appendix B) In British Columbia, hospitalizations in Indian children were analyzed for 1966-70 through a combined selective hospital-based study, revealing 3 to 4 times higher hospitalization rates in Indian compared to non-Indian children (Robinson and Evans, 1993). Evers and Rand (1982) documented hospitalization rates in Canadian Indian infants of southern Ontario four times the rate of non-Indian infants in the same area. In Saskatchewan, separation rates were higher for Indians than for the total population in all age groups with those less than one having the greatest discrepancy (Canada, Health and Welfare, 1991). For the year 1985-86, Indian children less than 1 year of age had a separation rate over 8 times the rate for the Saskatchewan less than 1 population. Recently in Manitoba, Postl (1995) reported that Aboriginal children are

"very identifiable as being at-risk for hospitalization" with Registered Indian children being hospitalized in 1992 two to three times as frequently as non-aboriginal children. When the 30 leading causes of hospitalization in Manitoba were examined, the risk for hospitalization was higher in Registered Indian children for virtually all the diagnoses. Also in Manitoba, Gudmundson (1993) compared utilization of Winnipeg Status Indians and other Winnipeg residents and suggested that ethnicity (i.e. being a Status Indian) was a greater factor than poverty in affecting high health care service utilization. Gudmundson included an age-specific information and reported higher hospital separations for children (less than 10 and between 10 and 17 years) in Status Indian children whether they were in the city's core area or suburbs area (indicator of socio-economic status) compared to the other children in Winnipeg's core or suburban area.

Few studies have been done in rural or remote areas with small communities. American Indian Health Services (1989) studies are not generalizable because of the smaller, much more isolated Canadian Indian communities. Studies in the Northwest Territories used hospitalization data to help assess infant morbidity patterns (Spady et al., 1991). Black et al. (1993), in assessing the variability of hospitalization day rates in Manitoba which were especially high in the 0-14 year age group (with adjusted rates varying five-fold across the regions), found the rates generally

higher in the northern areas of the province. Rates ranged from 35 days to 170 days per 1000 total residents. The Health Services Utilization and Research Commission (1994) in Saskatchewan, as part of a study assessing the proportion of hospitalizations considered for acute care, determined in the northern based hospitals that 59% of the pediatric medical days were for acute care and 10% of the days having services provided which could be appropriately provided through outpatient care. This compared to 52% in large community hospitals and 74% in base hospitals for acute care.

2.6 Background to Saskatchewan Population and Health Services

Saskatchewan is divided approximately in half geographically with the northern half covered by Northern Health Services Branch (NHSB) of Saskatchewan Health (Appendix A). There are significant differences between northern and southern Saskatchewan geographically, demographically, economically and some differences in the organization of health care services. The north, covering the northern half of the province, has a small population (2.8% of the provincial population) with high levels of unemployment. Aboriginal people comprise over two-thirds of

the population of Northern Saskatchewan, whereas the province as a whole has over 12% Aboriginal people. Registered Indians make up just over 50% of northern Saskatchewan and about 8% of the province as a whole (Statistics Canada, 1987) The northern population is spread over more than 40 communities, a few of which have no road access even in winter months.

The northern and southern Registered Indian population have fairly similar demographics; each has a very high proportion of children less than 15 years of age (41.5% and 41.1%) compared to other northern, southern urban and rural populations in Saskatchewan (24.1%, 22.1%, and 22.5%) (Health and Welfare Canada, 1992; Saskatchewan Health, 1992) The Registered Indian population has significant health disparities compared to the general Saskatchewan population although the northern and southern Registered Indian populations have fairly comparable health status indicators such as general and infant mortality rates (Health and Welfare Canada; Health Canada) (Appendix C). In 1992, approximately 50% of the southern Registered Indians lived on reserve and in northern Saskatchewan somewhat over 60% lived on reserve.

There are differences in the way health care is provided for Registered Indians living in northern and southern Saskatchewan. In northern Saskatchewan, health services involves somewhat more of a team approach with primary care and public health nurses, family physicians who

visit surrounding communities and have contractual arrangements to provide site and phone consultation to the primary care nurses, itinerant consultants, and community health workers in a sparsely populated area. Most communities have some form of health care center where ambulatory care services are provided though some communities are some distance from the nearest hospital. In southern Saskatchewan hospitals are more widely distributed (73 hospitals at the time of the study period). Registered Indian children in the south are generally served by either urban-based ambulatory care with few specific services for Aboriginal people or, for the on-reserve population, a system involving nurses utilizing a public health approach, community health representatives, family physicians who have not been contracted to visit the reserve communities and may not have a direct supporting role to the public health nurse and community health worker, and more centrally based consultants/specialists. Generally, there is less access to ambulatory care on the southern reserves and it is more often provided in neighbouring communities. There are some family physician services provided on reserves in southern Saskatchewan, but the stability of these arrangements varies, and the physicians work more independently in the absence of primary care nurses and in the absence of any contractual arrangements to support the public health nurses.

In northern Saskatchewan there are 4 small community hospitals (Ile a la Crosse, Laloche, LaRonge, and Uranium City) with one Manitoba larger community hospital (Flin Flon) also serving a part of northeastern Saskatchewan. Some primary, all secondary and tertiary hospital care is provided for northern residents in southern Saskatchewan and to a lesser extent out of province (e.g. Flin Flon, Manitoba and Fort McMurray, Alberta). In southern Saskatchewan there were 73 hospitals during the study period (6 base, 7 regional, 7 large community, and 53 small community hospitals) (Health Services Utilization and Research Commission, 1994)

3 METHODOLOGY

3.1 Study design

This study is a population-based, descriptive, comparative study of hospitalization of children among different populations in Saskatchewan for the 1992/93 year (April 1, 1992 to March 31, 1993). Five mutually exclusive provincial groups are compared initially with subsequent analysis using a subset of the northern groups and then further assessment using eight mutually exclusive provincial groups.

This entails secondary analysis of data derived from the computerized claims data systems of Saskatchewan Health. This will include children 14 years of age and younger excluding newborn separations. This design will involve small-area analysis utilizing population groups rather than geographic areas or regions alone.

3.2 Population

Saskatchewan Health maintains a population registry of persons covered for health services provided under the provincial health insurance plan. All individuals registered with Saskatchewan Health are assigned a number allowing each individual to be uniquely identified in a population registry and hospitalization records. Since April 1, 1991 the Health Services Number (HSN) is used as the unique identifier for each person in the registry and this number remains with the person for a lifetime. As there is no premium payment required, most individuals resident in the province register with Saskatchewan Health after they are eligible after living in the province for 3 months. The population registry allows for data categorized by age, sex and residential code. The residence code is assigned by Saskatchewan Health to the person's city, town, village, rural municipality, or registered Indian band. Saskatchewan Health uses the Indian or First Nation band of origin as the residence code for registered Indians. This does not necessarily indicate their actual place of residence. A closer indicator of place of residence for Registered Indian children, though still an approximation, is available from the postal code of residence recorded on the hospital separation record.

The Registered Indian population was stratified in two manners in the different phases of this study: one utilizes the location of the band to which the children are registered; the other utilizes the best estimation of the place of residence identified by the postal code on the hospital separation record. The residence of the non-Indian northern and southern Saskatchewan children was stratified by residential code and by postal code in the hospital separation file in different phases of this study. If there were different postal codes for the same child over several hospitalizations, the postal code used was the most common postal code or most recent if the numbers were equal.

This study first assessed the hospitalization utilization data of all Saskatchewan registered Indian children stratified by location of Indian band of registration (i.e. not using the postal code residence information) and children resident in northern Saskatchewan (excluding registered Indians) in comparison to southern urban and rural resident children (excluding registered Indians) for the initial phase of the study. For the purpose of this part of the study the provincial population is divided into five mutually exclusive groups:

- Residents of northern Saskatchewan, grouped as:
 - A. Indian children registered in northern bands
(n = 7,088)
 - B. Other children resident in the north
(n = 5,212)
- Residents of southern Saskatchewan, grouped as:
 - C. Indian children registered in southern bands
(n = 20,479)
 - X. Other children resident in the rural south
(n = 91,771)
 - Y. Other children resident in the urban south
(n = 116,315)

(See Table 2)

TABLE 2: POPULATION GROUPS: FIVE MUTUALLY EXCLUSIVE GROUPS

Population	Registered Indian by location of band	Other	Total
North	A (n= 7,088)	B (n= 5,212)	12,300
South	C (n=20,479)	Rural X (n= 91,771)	228,565
		Urban Y (n= 116,315)	
Total	27,657	213,298	240,865

Appendix D provides a age and gender breakdown of these populations.

Northern residents (groups A and B) are persons with Saskatchewan Health residence codes in the area covered by Northern Health Services Branch (NHSB) (Appendix E). Southern residents (group C, X, and Y) are persons with residence codes in Saskatchewan communities other than those in the Northern Health Services Branch area. Southern urban non-Indian residents (group Y) are persons who live in one of the 15 Saskatchewan urban communities (Appendix F). Saskatchewan urban areas are generally defined as all towns and cities that have a population greater than 5,000 according to the Saskatchewan Health Covered Population, 1992. Although the towns of Kindersley and Nipawin and the city of Melville have less than 5,000 people, they are included in the urban group because their health services are similar to other small urban centers and their population approximates the 5,000 mark. Southern rural non-Indian residents (group X) are persons with residence codes in the remaining non-reserve communities in southern Saskatchewan.

Access to northern hospital could influence the hospitalization rates of northern registered Indian and other children differently for those living in remote communities compared to those living in relatively close proximity to a hospital. The two northern groups (registered Indian and other children) was further stratified into five subgroups for the second phase of this study:

- A(i) Indian children registered with bands situated within one hour travelling time to a hospital with road access (central registered Indian);
- A(ii) Indian children registered with bands situated greater than one hour travelling time to a hospital or without road access (remote registered Indian);
- B(i) other northern children with residences determined by postal code in the core communities of LaRonge, Air Ronge and Creighton (core other);
- B(ii) other northern children with residences determined by postal codes to be situated within one hour travelling time to a hospital with road access but not included in the core communities (central other); and
- B(iii) other northern children with residences determined by postal codes to be situated greater than one hour travelling time to a hospital or without road access (remote other).

Children residing in the core communities of LaRonge, Air Ronge and Creighton were analyzed separately because of the distinct predominant population group in these communities: predominately Caucasian with higher rates of education, employment and income than other northern communities. Though there is one registered Indian band located next to two core communities (LaRonge and Air Ronge), the reserve areas are spread over several communities some of which are

in the central category. All individuals registered with this band were classified as being central registered Indians.

For the third phase of analysis, the entire population of registered Indians was stratified into four categories by grouping of the residence postal code recorded on the hospital separation record: residing in northern Saskatchewan in communities greater than one hour travelling time by road from a hospital (remote), residing in northern Saskatchewan within one hour travelling time by road from a hospital (central), residing in southern urban areas, and residing on-reserve or rural areas in southern Saskatchewan. Northern Saskatchewan children other than registered Indians were stratified into two categories by grouping of the residence postal code: residing in northern Saskatchewan in communities greater than one hour travelling time by road from a hospital (remote), residing in northern Saskatchewan within one hour travelling time by road from a hospital (central). Southern non-registered Indian children will remain stratified into those residing in rural or urban communities. For the purpose of this part of the study the provincial population is thus divided into eight mutually exclusive groups:

- Residents of northern Saskatchewan, grouped as:
 - a) registered Indian children with postal codes indicating northern remote residence;
 - b) registered Indian children with postal codes indicating northern central residence
 - c) other children resident in remote northern communities; and
 - d) other children resident in central northern communities.

- Residents of southern Saskatchewan, grouped as:
 - e) registered Indian children with postal codes indicating southern non-urban residence;
 - f) registered Indian children with postal codes indicating southern urban residence;
 - x) other children resident in the rural south; and
 - y) other children resident in the urban south.

This stratification allowed for the assessment of southern residence (rural versus urban) for registered Indians of the proportion of hospital episodes for PACS conditions and it also accounts for children registered with northern bands who are recently residing in southern locations to be classified as southern urban or southern rural registered Indians.

Thus the analysis would involve three phases; each with differing stratification or substratification. This is depicted in Table 3. Phase 2 involves a sub-stratification of the two northern groups from Phase 1. Phase 3 involves

using different criteria for stratification for northern and registered Indian groups based on postal codes and though there is overlap with the groups in the first two phases, they are not simply a sub-stratification of those groups. For example, an individual child registered with a remote northern Indian band but living in an urban location in the south would be classified as A) northern registered Indian in Phase 1; A(i) Remote registered Indian in Phase 2; and (d) southern urban residing registered Indian in Phase 3.

TABLE 3: STRATIFICATION AND ANALYSIS FOR THE THREE PHASES OF THE STUDY

	Phase 1 (5 Provincial Groups)	Phase 2 (5 Northern Groups)	Phase 3 (8 Provincial Groups)
Stratified Groups	A) Northern Registered Indian B) Northern Other C) Southern Registered Indian X) Southern Rural Y) Southern Urban	A(i) Remote Registered Indian A(ii) Central Registered Indian B(i) Remote Other* B(ii) Central Other* B(iii) Core Other*	a) Northern Remote Residing Indian* b) Northern Central Residing Indian* c) Southern Rural Residing Indian* d) Southern Urban Residing Indian* e) Northern Remote Residing Other* f) Northern Central Residing Other* X) Southern Urban Y) Southern Rural
Analysis	Episode Rate PACS Episode Rate PACS Proportion	Episode Rate PACS Episode Rate PACS Proportion	PACS Proportion

* = postal codes from the hospital abstract used to stratify; others use residence code from registry.

Population numbers by age and sex are available through the Saskatchewan Health's Covered Population by band to which the child is registered and not by place of residence as determined by the postal code. Medical Services Branch of Health Canada has some population figures for on and off

reserve status for the different bands though one cannot determine whether off reserve children are in rural areas close to a reserve or in urban areas. As accurate population figures by age and gender are not available for Registered Indian children by location of residence without further administrative data linkages, rates will not be calculated for these groups. However, the proportions of hospital episodes with ambulatory care diagnoses compared to the total hospital episodes will be determined.

3.3 Sample

GROUPS A, B, and C: 100% of the 1992/93 hospital separations for all northern (registered Indian and other) and southern registered Indian children (i.e. 100% sampling of hospitalized children less than 15 years who have residence codes in northern Saskatchewan and for registered Indian bands). The northern sample will not include children hospitalized who are only temporarily resident in the north, i.e. whose parents' addresses are listed with Saskatchewan Health in other than northern Saskatchewan communities. The denominator population will be derived from Saskatchewan Health's published 1992 Covered Population figures for 100% of the population with residence codes in those areas. (Table 4 and Appendix G)

Groups X and Y: For the two comparison groups, the southern rural and southern urban populations, a 10% sample of children over 1 year of age and a 20% sample for those under 1 year of age will be used. Saskatchewan Health has done this sampling by ordering the health services numbers of hospitalized persons and choosing every tenth number for those over 1 year and every fifth for those less than 1 year. All of the records in this 1992/93 year for the selected hospitalized persons will be included. This method of sampling will result in more comparable denominator sizes for the particular age groups for all groups (groups A, B, C, X, and Y). (Table 4 and Appendix G)

TABLE 4: DENOMINATOR NUMBERS FOR SAMPLE GROUPS

Age group (years)	Group A	Group B	Group C	Group X	Group Y
< 1	588	377	1586	896 (X 5)	1503 (X 5)
1 - 4	2271	1666	6352	2131 (X 10)	3268 (X 10)
5- 14	4230	3169	12541	6598 (X 10)	7612 (X 10)
Total	7089	5212	20479	9625 (X 10)	12383 (X 10)

Reliable denominator figures by age and sex are not available for Registered Indians stratified by present residence (i.e., on or off reserve, living in northern or southern Saskatchewan, living in urban or rural areas) through the Saskatchewan Health population registry. A

separate analysis will be done for the proportion of ambulatory care sensitive hospitalization episodes utilizing postal codes recorded on the hospital separation recorded and included in the database to help separate out Registered Indians in northern bands residing in the south and in southern bands residing in urban areas.

3.4 Database

This study utilized the computerized data collected by Saskatchewan Health, Strategic Program Branch, for hospital claims payments. Saskatchewan Health provided the database available for this study as part of a larger study on hospitalization trends in northern Saskatchewan residents and Saskatchewan Registered Indians (Dr. Leonard Tan, University of Saskatchewan, principal investigator).

3.5 Variables

The variables extracted from the hospitalization data files of Saskatchewan Health are shown in Appendix H. The unique identifier (Health Services Number) had been changed to an encrypted number preventing identification of

individuals but still allowing for the distinction for multiple hospital separations by single individuals. Diagnoses are coded under the International Classification of Diseases - Ninth Revision (ICD-9). The Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures (CCP) is used for coding of procedures.

3.6 Instrumentation

This study utilized a Pediatric Ambulatory Care Sensitive (PACS) condition indicator which has been modified from the original work of Billings et al (1993) to provide additional specificity for a pediatric population and to suit the coding systems used in Saskatchewan. (Appendices I, J, and K) Billings' ACS was determined as the instrument used over Weissman et al's Avoidable Hospital Conditions (AHC) as Billings' had more conditions which would occur in the pediatric age group. Some of the conditions included in Weissman et al.'s (1992) AHCs that could be utilized for a pediatric group were included in the development of the PACS index. Billings' ACS and Manitoba's ASH condition indicators use the five digit ICD-9 CM coding for the diagnoses and ACS uses ICD-9 CM for the procedures. Saskatchewan Health utilizes the four digit ICD-9 coding for diagnoses and CCP coding for procedures (Statistics Canada, 1986). Conversion

between the two forms of coding was straightforward though there are slight differences for the some of the hypertension, congestive heart failure and diabetic conditions.

Alterations of the ACS conditions were made to develop a list of "Pediatric Ambulatory Care Sensitive" or PACS conditions which would be suited to the variables available through Saskatchewan Health. The criteria used to alter Billings' list of ACS conditions was that they were conditions in children for which risk of hospitalization could be reduced through timely and effective outpatient care. (Appendices K and L describe some of the differences between PACS and ACS). Once the PACS conditions were identified, two physicians (one family physician experienced in northern and Aboriginal health care and one university-based pediatrician) reviewed the list for verification.

3.7 Analysis

The analysis of the hospitalizations was based on the annual episodes of hospital care rate for all diagnoses combined and for PACS hospitalizations for each group.

The annual rate of episodes of hospital care is the number of hospital separations that represent an initiation of use of hospital per 1,000 population. Episodes of care

were utilized because this measure adjusts for bias introduced by double counting separations for patients transferred from one hospital to another, which would contribute to higher measured rates of hospital contact for those living outside urban areas (Black et al., 1993) By using the encrypted identification code provided by Saskatchewan Health, it is possible to eliminate overcounting hospital separation from patient transfers by not counting admissions to another hospital within the same or next day of separation from another hospital.

Differing patterns of hospital utilization rates can reflect differences in a number of variables that could include hospital bed availability, health status, insurance, race, socioeconomic status, physician practice patterns or threshold for admission, as well as access to, availability and utilization of ambulatory care. Differing rates of hospitalizations for ambulatory care sensitive conditions can also reflect differences in these groups of variables in addition to access to, availability and utilization of ambulatory care services. Comparing the proportion of hospital episodes from conditions with ambulatory care sensitive conditions with the overall hospital episode rate should provide a better approach as hospital bed availability, health status, race, socioeconomic status and physician practice patterns would make some adjustment for these other influences in variations and should more

accurately separate out the impact of ambulatory care from the other variables. (Weissman et al., 1992).

Hospital episode rates were calculated for groups of PACS conditions, for all PACS conditions combined and for all diagnoses combined for each of the five groups in Phase 1. The Saskatchewan Health 1992 Covered Population figures for each group by sex and age group (less than 1, 1 to 4, and 5 to 9, and 10 to 14) was used for the denominator in the calculation of rates. (Appendix D). Because there were slight differences in the configurations of the populations, the rates were age- and sex-standardized directly using the provincial population as the standard population. Comparisons were then made of the proportion of age-sex-standardized hospitalization rates that were due to all PACS conditions (i.e. relative risks of hospitalization being due to an PACS condition) for each of the five groups. T^2 and Z^2 statistical analysis were utilized to test the significance in the differences in the overall hospitalization rate and the proportions of admissions considered as PACS. This method has been described by Carriere and Roos (1994) as an appropriate method to compare standardized rates of events in small area analysis. An initial test would be done to determine an overall difference in the rates; subsequent analysis would test the hypothesis for the differences between rates as laid out in the hypothesis ($H_A = R_1 > R_2 > R_3 > R_4 > R_5$).

Statistical analysis was done using T^2 statistical testing as describe by Carriere and Roos (1994). The Populus Prime© computer program was utilized for the direct standardization as well as the T^2 calculations. A simultaneous T^2 test was first done to assess whether there was any statistically significant difference between the five groups in the directly age-standardized rates of separation. If it was determined that there was a statistically significant difference in the rates between the groups, multiple comparison testing was done to test the hypothesis. As the hypothesis was ordered, a series of Z^2 tests were done between the groups using χ^2 as the critical values to determine the level of significance:

- 1) between southern registered Indian children and northern registered Indian children;
- 2) between northern registered Indian children and northern other children;
- 3) between northern other Indian children and southern rural children; and
- 4) between southern rural and southern urban children.

If it was determined that there was a non-significant difference between two groups, the groups would be combined and tested against the subsequent group. Because multiple comparisons were done, Bonferroni correction was used in determining the critical χ^2 value.

Phase 2 included comparisons of the age-sex standardized hospital episode rates, the PACS hospital episode rates as well as the proportion of hospital episodes considered as PACS episodes for the five northern groups of remote and central registered Indian children, and remote, central and core children other than registered Indian. The same analytical technique was utilized for Phase 2 as was used in the analysis of the five provincial study groups in Phase 1; however, the main comparisons were between the remote and central northern registered Indian groups and between the northern remote, central and core other groups to assess the variability of rates and proportions with varying travel time to hospital.

Phase 3 involved comparing the proportion of hospital episodes determined as PACS for 8 groups including: Southern Registered Indian Rural (southern postal code other than in one of the urban centers); Southern Registered Indian Urban (with a southern urban postal code); Northern Registered Indian Remote and Northern Other Remote (postal code indicating residence greater than 1 hour from a community with a hospital); and Northern Registered Indian Central and Northern Other Central (postal code indicating residence less than one hour from a community with a hospital). This analysis was done without the determination of rates of hospitalization episodes or rates of PACS hospitalization episodes because data was not available on the population numbers (for the denominators) in differentiating between

southern urban and southern rural areas. This will most accurately provide a comparison for Registered Indians registered with bands in northern Saskatchewan and continuing to reside in remote and central northern Saskatchewan with Registered Indians children residing on or near their reserve and those residing in urban areas. Although population-based rates can not be determined by actual area of residence for registered Indians because of the absence of reliable population numbers, a comparison of the proportions of hospital episodes which are for ambulatory care sensitive conditions would be the equivalent to the rates by which hospitalizations are utilized for PACS conditions. The significance of differences in the rates among these groups, was be tested using the T^2 and Z^2 statistic.

For Phase 3, the Populus Prime© computer program was also utilized for the direct age-sex standardization of proportions as well as the T^2 calculations. A simultaneous T^2 test was first done to assess whether there was any statistically significant difference between the five groups in the directly age-standardized rates of separation. If it was determined that there was a statistically significant difference in the proportions between the groups, multiple comparison testing was done to test the hypothesis. As the hypothesis was ordered, a series of Z^2 tests were done between the groups using χ^2 as the critical values to

determine the level of significance. If it was determined that there was a non-significant difference between two groups, the groups would be combined and tested against the subsequent group. Because multiple comparisons were done, Bonferroni correction was used in determining the critical χ^2 value.

4 ETHICS

4.1 Patient Confidentiality

Prior to receiving the data from Saskatchewan Health, the unique personal identifier (Personal Health Number) was changed to an encrypted number preventing any identification of the individual though still allowing for the distinction for multiple hospital separations by single individuals. Only aggregate statistics have been reported in any publication to maintain patient confidentiality. Approval will be sought from Saskatchewan Health prior to public release of study results to assure confidentiality is maintained.

4.2 Organization Consent and Co-participation

The impetus for the larger hospitalization study originated with the University of Saskatchewan's Northern Medical Services Research and Development Committee which includes representatives from the two northern Saskatchewan

municipalities (Northwest and Northeast Municipalities Associations); the two northern tribal councils (Prince Albert Grand Council and Meadow Lake Tribal Council); Saskatchewan Health's Northern Health Services Branch; Health Canada's Medical Services Branch; and the University of Saskatchewan's Northern Medical Services and Department of Community Health and Epidemiology. Saskatchewan Health provided the data for the larger hospitalization study (Hospitalization Trends of Northern Saskatchewan Residents and Saskatchewan Registered Indians; Dr. Leonard Tan, University of Saskatchewan, principal investigator) with the proviso that patient confidentiality is assured and that any written or verbal release of the study results should indicate that any conclusions are those of the author(s) and not of Saskatchewan Health. Specific consent for use of this data for this project has been received. Representatives on the Research and Development Committee have participated in the development of the larger hospitalization study, setting of some of the priorities for research questions to be addressed. This same group assisted through an early review of the results. Approval was also received from the University of Manitoba's Faculty of Medicine Ethical Committee.

4.3 Computer access

Special computer access codes were utilized for the computers used to analyze this data, even if names and personal health numbers were not available. Access to the data utilized for the larger hospitalization study was specifically limited to the investigation team.

4.4 Significance of Research

Information on hospitalization rates and the comparison among groups of the degree to which children are being hospitalized for conditions that could be treated or prevented through appropriate ambulatory care programs would assist in providing direction for improvements in ambulatory medical care as well as community health and preventive programs for First Nations and northern children. This would allow for more efficient resource use and improvement in the health of these children.

At this time, when First Nations, provincial health departments, and district health boards are reassessing and reforming the health care systems in Canada, information on ambulatory care sensitive hospitalizations and their variations across various population groups would aid

decision making in ambulatory care program development. Hospitalization for some ambulatory care sensitive conditions could be used as an indicator to provide some of the needed information as well as providing ongoing information for quality improvement / quality management in ambulatory care programs from a population health perspective.

5 RESULTS

5.1 Phase One: Five Provincial Groups

5.1.1 Hospitalization Episodes: All Diagnoses Combined

Analysis of hospitalization episodes was done for all diagnosis combined for the 1992-93 year period. This analysis was completed for the five population groups for which population data were available.

5.1.1.a) Number of Hospitalization Episodes

The number of hospitalization episodes in each group is displayed in Table 5. The population included in these groups is seen in Appendix G. This appendix shows the southern urban and southern rural populations were sampled to give more similar sizes of groups. The sampling fraction for southern rural and urban children less than one year of age was 0.2 and for children between over one and less than fifteen was 0.1. A total of 11,166 separations were contained in the database obtained for this study. The largest number (6503) was in the southern registered Indian

group and the smallest number of separations was in the northern other group (864).

TABLE 5: THE NUMBER OF HOSPITALIZATION EPISODES IN EACH GROUP CONTAINED IN DATA.

Study Group	Sex	Number of Hospital Episodes in Each Age Group				
		< 1	1 - 4	5 - 9	10-14	Total
Southern Registered Indian	Male	1380	1413	558	344	3695
	Female	894	1132	427	355	2808
Northern Registered Indian	Male	441	409	122	68	1040
	Female	283	306	96	74	759
Northern Other	Male	159	197	84	53	493
	Female	125	131	65	50	371
Southern Rural	Male	156	138	107	99	500
	Female	109	119	83	98	409
Southern Urban	Male	199	199	91	82	571
	Female	203	136	93	88	520
Total		11166				

5.1.1.b) Hospital Episode Age-Sex Specific Rates: All
Diagnoses Combined

Age-sex specific rates were calculated for the four age groups. (Table 6) Generally, the highest rates were in the under one age group and the rates decreased in the older groups, though there was a slight increase in the female rate going from the 5 - 9 year age group to the 10 - 14 year age group in the southern three groups but not in the northern two groups. Generally, there appeared to be a gradient of age-specific rates with the southern registered Indian group generally having the highest rates and the southern urban having the lower rates.

TABLE 6: AGE-SEX-SPECIFIC HOSPITAL EPISODE RATE PER 1,000
FOR EACH AGE GROUP OF SASKATCHEWAN CHILDREN 1992-93.

Study Group	Sex	Age-Sex Specific Hospital Separation Rate per 1,000 for Each Age Group			
		< 1	1 - 4	5 - 9	10 - 14
Southern Registered Indian	Male	1656.7	425.7	159.9	118.2
	Female	1187.3	364.0	126.7	128.2
Northern Registered Indian	Male	1450.7	354.1	103.7	68.8
	Female	996.5	274.2	82.3	82.3
Northern Other	Male	873.6	226.7	93.8	72.8
	Female	641.0	164.4	74.9	73.9
Southern Rural	Male	343.6	126.8	65.4	55.8
	Female	246.0	114.1	53.4	59.9
Southern Urban	Male	260.5	118.2	40.1	44.0
	Female	274.7	85.8	47.8	49.3

5.1.1.c) Hospital Standardized Episodes Rates: All

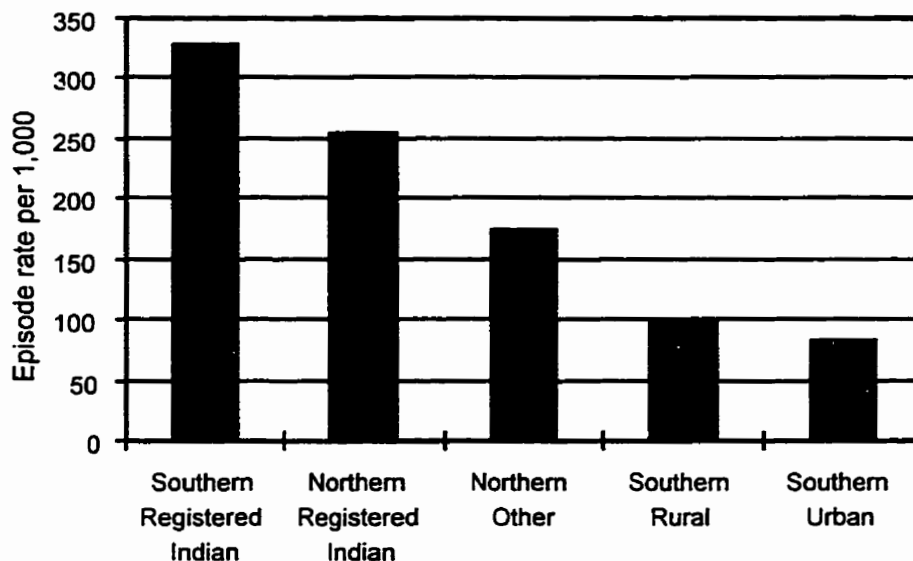
Diagnoses Combined

The direct age-standardized hospital episode rates per 1,000 revealed a gradient with the highest separation rate occurring in the southern registered Indian children and the lowest rate being in the southern urban children. (see Table 7 and Figure 1)

TABLE 7: DIRECT AGE-SEX-STANDARDIZED HOSPITAL EPISODE RATES PER 1,000 FOR SASKATCHEWAN CHILDREN 1992-93

Study Group	Population	Separation Rate	Standard Error
Southern Registered Indian	20479	327.26	1.81367
Northern Registered Indian	7089	254.18	3.20303
Northern Other	5212	174.29	4.50140
Southern Rural	9627	97.88	3.04185
Southern Urban	12383	82.47	2.37251
Total Saskatchewan	54790	203.80	1.47599

Figure 1: Standardized Hospital Episode Rate - Saskatchewan Children



The hypothesis was that the predicted pediatric hospital episode rate for all diagnoses combined would be as follows in descending order of hospital episode rate:

- 1) Indian children registered with southern bands
- 2) Indian children registered with northern bands
- 3) Other northern children
- 4) Other southern children - rural
- 5) Other southern children - urban.

A simultaneous T^2 test was first done to assess whether there was any statistically significant difference between these five groups in the directly age-standardized rates of separation. The probability that the differences in the episode rates between these five groups were due to chance was determined to be less than 0.001. ($T^2 = 9193.31$)

Following the determination that there was a statistically significant difference in the rates between

these groups, multiple comparison testing was done to test the hypothesis. As the hypothesis was ordered, a series of Z^2 tests were done between the groups using χ^2 as the critical values to determine the level of significance:

- 1) between southern registered Indian children and northern registered Indian children;
- 2) between northern registered Indian children and northern other children;
- 3) between northern other Indian children and southern rural children; and
- 4) between southern rural and southern urban children.

The Chi-square and the p values for these comparisons are seen in Table 8.

TABLE 8: CHI-SQUARE AND P VALUES FOR COMPARISON PAIRS FOR HOSPITAL EPISODES

Group	Standard Error	χ^2	p value
Southern Reg Indian	1.81367	394.18	< 0.005
Northern Reg Indian	3.20303		
Northern Reg Indian	3.20303	209.11	< 0.005
Northern Other	4.50140		
Northern Other	4.50140	197.81	< 0.005
Southern Rural	3.04185		
Southern Rural	3.040185	15.96	< 0.005
Southern Urban	2.37251		

$$\alpha = 0.05 \div 4 = 0.0125$$

$$\text{Critical } \chi^2_{d.f. = 1} = 6.63 \text{ (for } p = 0.01)$$

Thus, the hospital episode rate (ER) of southern treaty children is very significantly greater than the northern registered Indian ER ($p < 0.005$); the northern registered

Indian ER is very significantly greater than the northern other rate; the northern other ER is very significantly greater than the southern rural ER; and the southern rural ER is very significantly greater than the southern urban ER.

S. Reg. Ind. ER > N. Reg. Ind. ER > N. Other ER > S. Rural ER > S. Urban ER

Thus, the null hypothesis is rejected. There is a descending order of episode rates as predicted and differences were statistically very significant in keeping with the first hypothesis.

5.1.2 Hospitalization Episodes for Ambulatory Care Sensitive Conditions: All Conditions Combined

Analysis of hospitalizations was done for all ambulatory care sensitive (PACS) conditions combined for hospital episodes in the 1992-93 year period. This analysis was completed for the five population groups for which population data were available.

5.1.2.a) Ambulatory Care Sensitive Hospitalization

Episodes: All Conditions Combined: Number of Episodes

The number of hospitalization episodes for ambulatory care sensitive conditions in each group is displayed in

Table 9. The population included in these groups is seen in Appendix G. The sampling fraction for southern rural and urban children less than one year of age was 0.2 and for children between over one and less than fifteen was 0.1. Of the total of 11,166 hospitalization episodes contained in the database obtained for this study, 5993 were for conditions that were deemed sensitive to ambulatory care. The largest number (3298) was in the southern registered Indian group and the smallest number of separations was in the northern other group (473).

TABLE 9: THE NUMBER OF HOSPITALIZATION EPISODES FOR PACS CONDITIONS IN EACH GROUP CONTAINED IN DATA.

Study Group	Sex	Number of Hospital Episodes for PACS Conditions in Each Age Group				
		< 1	1 - 4	5 - 9	10-14	Total
Southern Registered Indian	Male	648	590	358	260	1856
	Female	407	515	257	255	1434
Northern Registered Indian	Male	215	188	82	52	537
	Female	130	144	50	59	383
Northern Other	Male	91	83	51	43	268
	Female	61	62	37	45	205
Southern Rural	Male	88	83	71	76	318
	Female	82	66	53	76	277
Southern Urban	Male	129	118	58	72	377
	Female	139	60	68	71	338
Total						5993

5.1.2.b) Ambulatory Care Sensitive Hospitalization

Episodes: All Conditions Combined: Age-Sex Specific
Rates

Age-sex specific rates were calculated for the four age groups. (Table 10; Figure 2; Figure 3) Generally, the highest rates were in the under one age group and the rates decreased in the older groups, though there was a slight increase in the rate going from the 5 - 9 year age group to the 10 - 14 year age group for females in all study groups as well as for males in the southern urban and, to a lesser extent, in the northern other groups. Generally, there appeared to be a gradient of age-specific rates with the southern registered Indian group generally having the highest rates and the southern urban having the lower rates.

TABLE 10: AGE-SEX-SPECIFIC HOSPITAL EPISODE RATE FOR
 AMBULATORY CARE SENSITIVE CONDITIONS PER 1,000 FOR EACH
 AGE GROUP OF SASKATCHEWAN CHILDREN

Study Group	Sex	Age-Sex Specific Hospital Episode Rate for PACS Conditions per 1,000 for Each Age Group			
		< 1	1 - 4	5 - 9	10 - 14
Southern Registered Indian	Male	777.9	182.0	102.6	89.3
	Female	540.5	165.6	76.2	92.1
Northern Registered Indian	Male	707.2	162.8	69.7	52.6
	Female	457.7	129.0	42.9	65.6
Northern Other	Male	500.0	95.5	56.9	59.1
	Female	312.8	77.8	42.6	66.5
Southern Rural	Male	193.8	76.3	43.4	42.8
	Female	185.1	63.3	34.1	46.5
Southern Urban	Male	168.8	70.1	28.7	38.7
	Female	188.1	37.9	35.0	39.8

Figure 2 : Male Age Specific Rates: PACS and Non-PACS Hospital Episodes for Study Groups

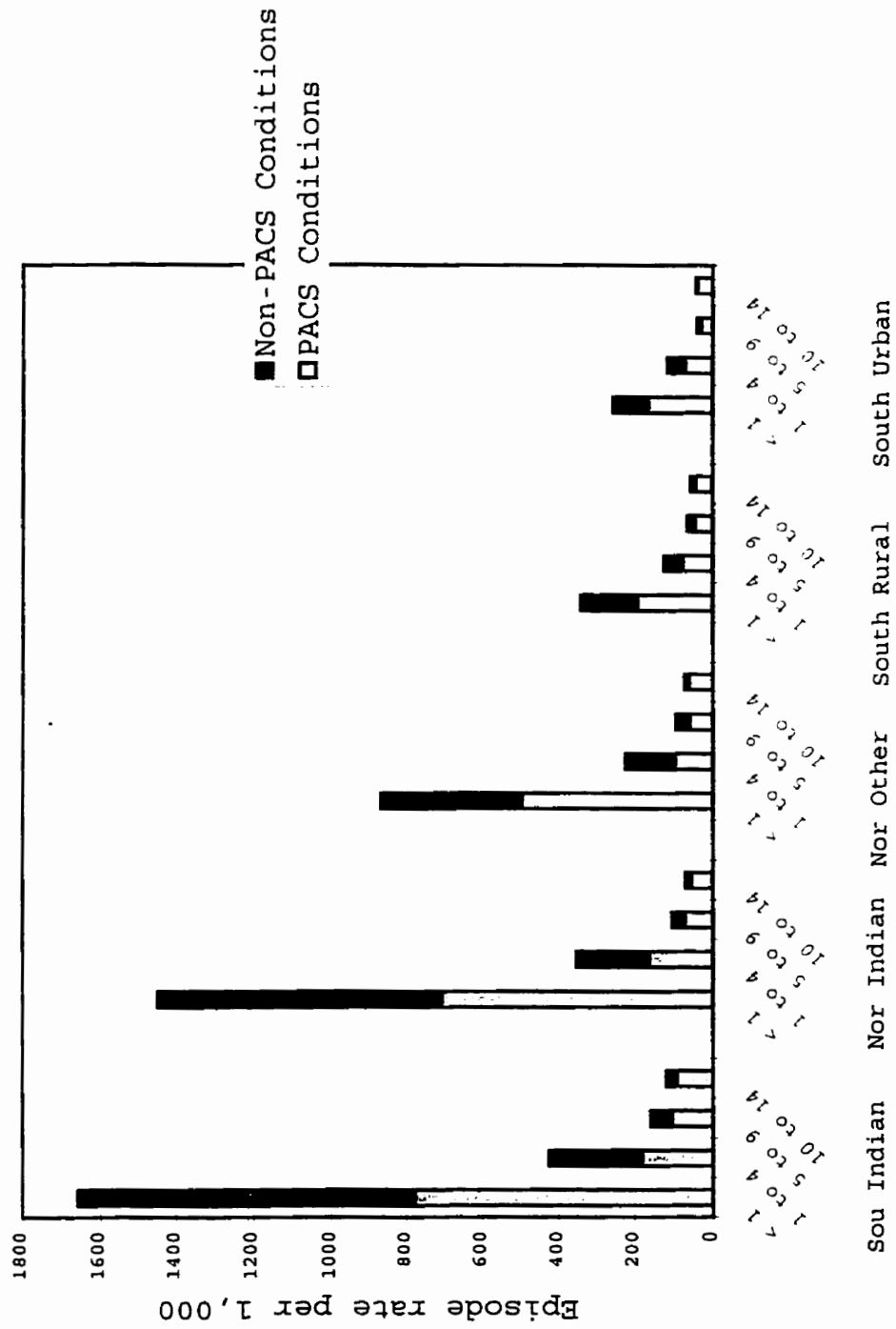
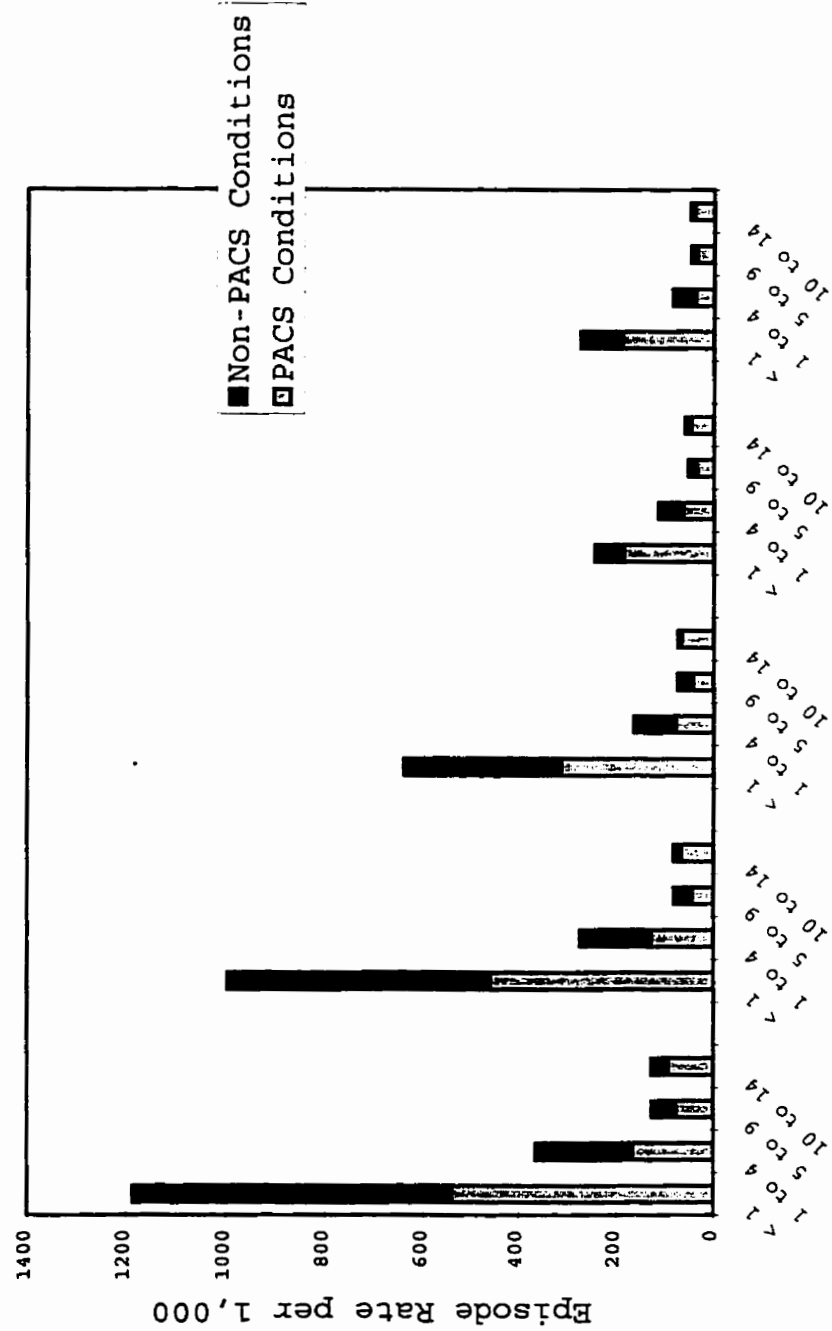


Figure 3: Female Age Specific Rates: PACS and Non-PACS Hospital Episodes by Study Group



Sou Indian Nor Indian Nor Other Sou Rural Sou Urban

5.1.2.c) Ambulatory Care Sensitive Hospitalization

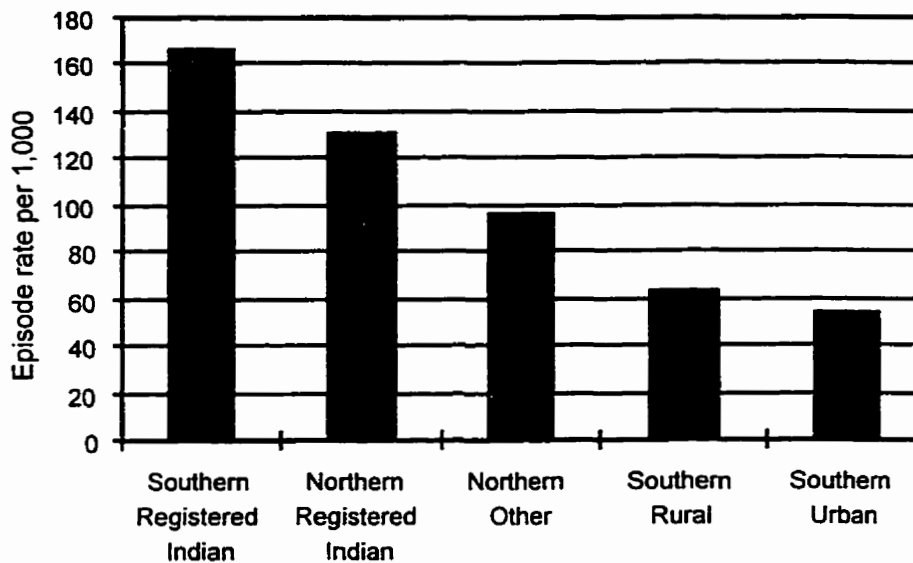
Episodes: All Conditions Combined: Age-Sex-
Standardized Rates

The direct age-standardized hospital episode rates per 1,000 for ambulatory care sensitive conditions revealed a gradient with the highest separation rate occurring in the southern registered Indian children and the lowest rate being in the southern urban children. (see Table 11 and Figure 4)

TABLE 11: DIRECT AGE-SEX-STANDARDIZED HOSPITAL EPISODE RATES PER 1,000 FOR AMBULATORY CARE SENSITIVE CONDITIONS FOR SASKATCHEWAN CHILDREN 1992-93

Study Group	Population	Separation Rate	Standard Error
Southern Registered Indian	20479	165.85	2.34151
Northern Registered Indian	7089	130.74	3.56172
Northern Other	5212	96.64	3.94151
Southern Rural	9627	63.04	2.50123
Southern Urban	12383	53.66	1.95247
Total Saskatchewan	54790	109.38	1.26607

Figure 4: Standardized Hospital Episode Rate for PACS Conditions - Saskatchewan Children 1992-93



The hypothesis was that the predicted pediatric hospital episode rate for all PACS conditions combined would be as follows in descending order of hospital episode rate:

- 1) treaty Indian children registered with southern bands
- 2) treaty Indian children registered with northern bands
- 3) Other northern children
- 4) Other southern children - rural
- 5) Other southern children - urban.

A simultaneous T^2 test was first done to assess whether there was any statistically significant difference between these five groups in the directly age-standardized rates of

separation. The probability that the differences in the episode rates between these five groups were due to chance was determined to be less than 0.001. ($T^2 = 1496.38$)

Following the determination that there was a statistically significant difference in the rates between these groups, multiple comparison testing was done to test the hypothesis. As the hypothesis was ordered, a series of Z^2 tests were done between the groups using χ^2 as the critical values to determine the level of significance (Table 12):

- 1) between southern registered Indian children and northern registered Indian children;
- 2) between northern registered Indian children and northern other children;
- 3) between northern non-treaty Indian children and southern rural children; and
- 4) between southern rural and southern urban children.

TABLE 12: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS

Group	Standard Error	χ^2	p value
Southern Indian Reg	2.34151	67.74	< 0.005
Northern Indian Reg	3.56172		
Northern Indian Reg	3.56172	41.20	< 0.005
Northern Other	3.94151		
Northern Other	3.94151	51.78	< 0.005
Southern Rural	2.50123		
Southern Rural	2.50123	8.76	< 0.025
Southern Urban	1.95247		

$$\alpha = 0.05 \div 4 = 0.0125$$

$$\text{Critical } \chi^2_{d.f. = 1} = 6.63 \text{ (for } p = 0.01)$$

Thus, the hospital episode rate (ER) for PACS conditions of southern registered Indian children is very significantly greater than the northern registered Indian ER ($p < 0.005$); the northern registered Indian ER is very significantly greater than the northern other rate; the northern other ER is very significantly greater than the southern rural ER; and the southern rural ER is significantly greater than the southern urban ER.

S. Reg. Ind. ER > N. Reg. Ind. ER > N. Other ER >
S. Rural ER > S. Urban ER

Thus, the null hypothesis is rejected. There is a descending order of episode rates for PACS conditions as predicted and differences were statistically significant.

5.1.3 Hospitalization Episodes for Various Ambulatory Care Sensitive Conditions

Analysis of hospitalizations were done for various types and groups of ambulatory care sensitive (PACS) conditions for hospital episodes in the 1992-93 year period. This analysis was completed for the five population groups for which population data was available.

5.1.3.a) Hospitalization Episodes for Types of Ambulatory Care Sensitive Conditions: Number of Episodes

The number of hospitalization episodes by type of ambulatory care sensitive conditions in each group is displayed in Table 13. A complete breakdown of PACS types and subtypes by study group is contained in Appendix L.

TABLE 13: THE NUMBER OF HOSPITALIZATION EPISODES FOR PACS CONDITIONS IN EACH GROUP CONTAINED IN DATA.

PACS Group	PACS Type	South Reg Indian	North Reg Indian	North Other	South Rural	South Urban
General Infections	Imm. related & preventable	14	3	0	1	3
	TB	10	1	1	0	0
	Cellulitis	108	24	10	11	8
	Kidney/urinary	89	25	11	17	20
ENT Infections		802	168	76	73	74
Bacterial pneumonia		885	295	135	44	54
Gastro-enteritis	Gastro-enteritis	681	91	38	79	80
	Dehydration	42	21	2	2	13
Convulsions		89	24	18	18	25
Chronic Diseases	Asthma	366	161	33	60	85
	Diabetes	1	1	1	3	2
Nutritional	Iron-def. anemia	62	13	5	2	4
	Nutritional deficiency	0	1	0	0	0
	Failure to Thrive	8	9	2	0	5
Dental Conditions		56	43	59	4	3
Non-PACS Conditions		3631	1028	551	688	781
Total		6844	1908	942	1002	1157

5.1.3.b) Hospitalization Episodes for Grouped Ambulatory
Care Sensitive Conditions: Age-Sex Specific Rates

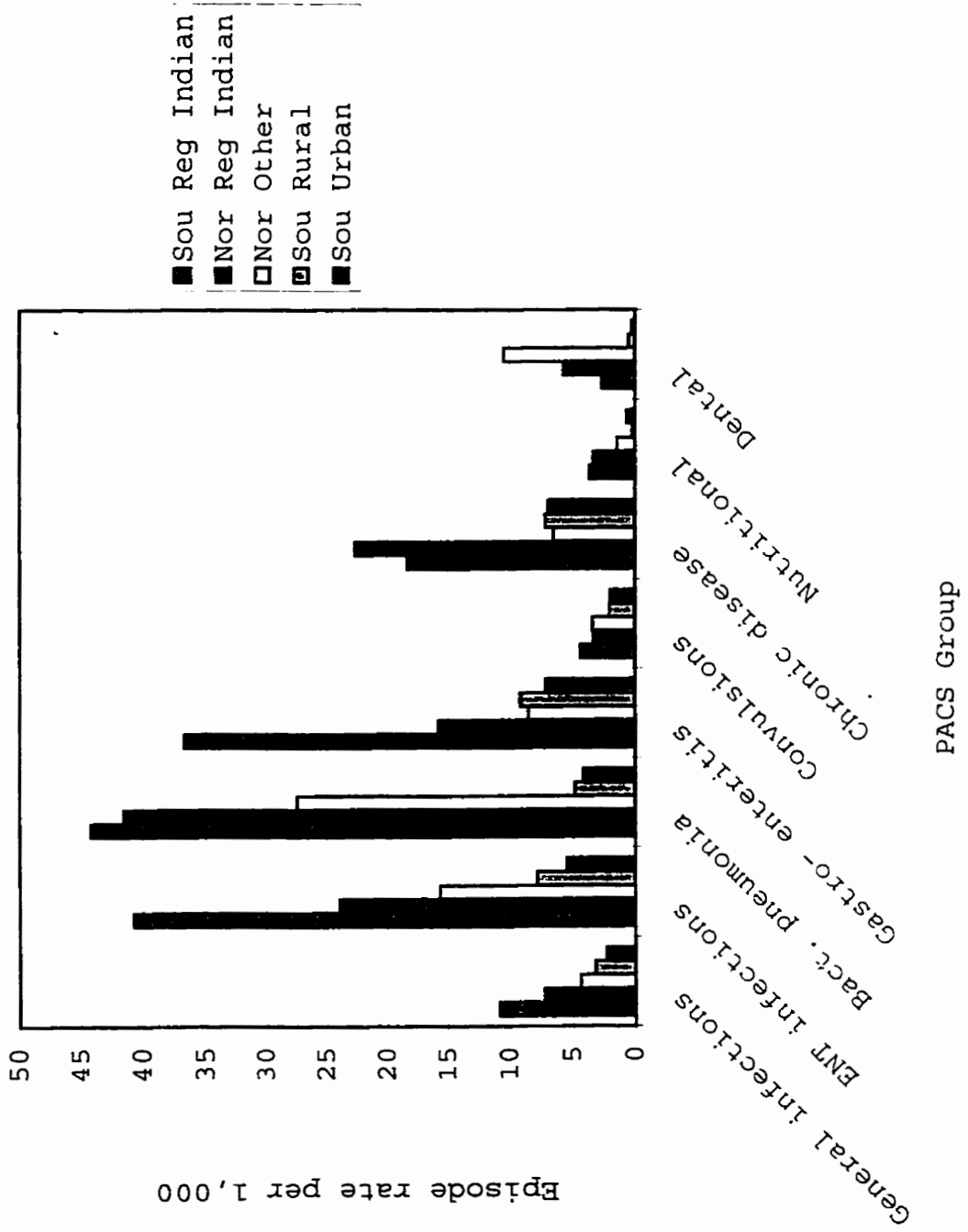
For statistical comparisons between PACS types, PACS types with small numbers of episodes were combined with other related types into groups providing a total number of episodes per group of at least 30. Age-sex standardized rates for each of these PACS groups is seen in Table 14 and depicted in Figure 5.

TABLE 14: AGE-SEX STANDARDIZED RATES FOR PACS GROUPS BY STUDY GROUP

PACS Group	South Reg. Indian	North Reg. Indian	Northern Other	Southern Rural	Southern Urban
General Infections	10.84 (0.727) *	7.24 (1.002)	4.34 (0.928)	3.21 (0.603)	2.30 (0.418)
ENT Infections	40.68 (1.351)	23.96 (1.771)	15.67 (1.773)	7.81 (0.919)	5.47 (0.642)
Bacterial pneumonia	44.17 (1.387)	41.52 (2.219)	27.41 (2.264)	4.82 (0.732)	4.13 (0.568)
Gastro-enteritis	36.78 (1.294)	15.78 (1.462)	8.53 (1.338)	9.11 (1.017)	7.13 (0.745)
Convulsions	4.35 (0.461)	3.26 (0.666)	3.37 (0.800)	2.02 (0.480)	1.97 (0.398)
Chronic Diseases	18.38 (0.936)	22.71 (1.718)	6.48 (1.117)	7.18 (0.912)	6.93 (0.746)
Nutritional	3.61 (0.430)	3.27 (0.680)	1.39 (0.533)	0.20 (0.142)	0.63 (0.212)
Dental Conditions	2.63 (0.352)	5.70 (0.867)	10.46 (1.351)	0.48 (0.240)	0.25 (0.147)

* = Standard error

Figure 5: Age-sex Standardized Episode Rate for PACS Conditions by Study Group



Generally, the highest rates were in the southern registered Indian study group for most PACS groups followed by northern registered Indians, northern other, southern rural and urban study groups. Southern registered Indian children had the highest rate in all PACS groups other than chronic diseases in which they had the second highest rate after northern registered Indian children and in dental conditions in which they had the third highest rate after northern other children and northern registered Indian children. The episode rate for northern other children was less for gastroenteritis than southern rural children and less for chronic diseases (asthma and diabetes) than southern rural and urban children.

For statistical analysis, simultaneous T^2 test was first done for each of the PACS groups to assess whether there was any statistically significant difference between these five groups in the directly age-standardized rates of separation. (Table 15) Because eight comparisons were done, Bonferroni correction was used in determining the critical value. Because multiple comparisons were done, Bonferroni correction was used in determining the critical T^2 value.

TABLE 15: T² AND SIGNIFICANCE OF DIFFERENCE IN THE PACS GROUPED CONDITIONS

PACS Group	T ²	p value
General Infections	109.483	< 0.01
ENT Infections	579.087	< 0.01
Bacterial Pneumonia	673.097	< 0.01
Gastroenteritis	508.949	< 0.01
Convulsions	18.061	< 0.05
Chronic Diseases	172.649	< 0.01
Nutritional Conditions	52.383	< 0.01
Dental Conditions	143.121	< 0.01

$$\alpha = 0.05 \div 8 = 0.00625$$

Critical T²_{d.f. = 4} value = 14.86 (for p = 0.005)

The probability that the differences in the episode rates of the various PACS groups between these five groups were due to chance was determined to be at least less than 0.5 for each comparison.

Following the determination that there was a statistically significant difference in the rates between these groups, multiple comparison testing was done to see where the differences were. If it was determined that there was a non-significant difference between two groups, the groups would be combined and tested against the subsequent

group. Again because multiple comparisons were done, Bonferroni correction was used in determining the critical χ^2 value.

a) General Infections

TABLE 16: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS GENERAL INFECTIOUS CONDITIONS

Group	χ^2	p value
Southern Reg Indian Northern Reg Indian	8.447	Not significant
Southern Reg Indian & Northern Reg Indian Northern Other	25.455	< 0.05
Northern Other Southern Rural	1.039	Not significant
Northern Other & Southern Rural Southern Urban	3.687	Not significant

$$\alpha = 0.05 \div 32 = 0.0015625$$

$$\text{Critical } \chi^2_{d.f. - 1} = 10.83 \text{ (for } p = 0.001)$$

As depicted in Table 16, the hospital episode rate (ER) for PACS conditions grouped as general infections is statistically not significantly different between the southern and northern registered Indian children. The

registered Indian children have the highest rate and have a significantly higher rate of hospital episodes for general infection PACS conditions than the northern other, the southern rural and the southern urban children. There is no significant difference in the rate of general infection episodes for the northern other, the southern rural and the southern urban children.

S. Reg Ind ER = N. Reg Ind ER > N. Other ER = S. Rural ER = S. Urban ER

There is a descending order of episode rates for PACS conditions grouped as general infections; however, most differences were not statistically significant other than the pooled rates of the southern and northern registered Indian children compared to the pooled rates of the northern other and the southern rural and urban children.

b) ENT Infections

TABLE 17: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS ENT INFECTIOUS CONDITIONS

Group	χ^2	p value
Southern Reg Indian Northern Reg Indian	56.415	< 0.05
Northern Reg Indian Northern Other	79.823	< 0.05
Northern Other Southern Rural	15.465	< 0.05
Southern Rural Southern Urban	4.361	Not significant

$$\alpha = 0.05 \div 32 = 0.0015625$$

$$\text{Critical } \chi^2_{d.f., .1} = 10.83 \text{ (for } p = 0.001)$$

As depicted in Table 17, the hospital episode rate (ER) for PACS ENT conditions of southern registered Indian children is significantly greater than the northern registered Indian ER ($p < 0.05$); the northern registered Indian ER is significantly greater than the northern other rate; and the northern other ER is significantly greater than the southern rural ER; however, the southern rural ER is not significantly greater than the southern urban ER.

S. Reg Ind ER > N. Reg Ind ER > N. Other ER > S. Rural ER = S. Urban ER

There is a descending order of episode rates for PACS ENT infectious conditions. Most differences were statistically significant other than the differences between southern rural and southern urban children.

c) Bacterial pneumonia

TABLE 18: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS BACTERIAL PNEUMONIA CONDITIONS

Group	χ^2	p value
Southern Reg Indian Northern Reg Indian	1.025	Not significant
Northern Reg Indian Northern Other	19.802	< 0.05
Northern Other Southern Rural	90.192	< 0.05
Southern Rural Southern Urban	0.556	Not significant

$$\alpha = 0.05 \div 32 = 0.0015625$$

$$\text{Critical } \chi^2_{d.f., .1} = 10.83 \text{ (for } p = 0.001)$$

As depicted in Table 18, the hospital episode rate (ER) for PACS bacterial pneumonia conditions of southern registered

Indian children is not significantly greater than the northern registered Indian ER; the northern registered Indian ER is significantly greater than the northern other rate; the northern other ER is significantly greater than the southern rural ER; and the southern rural ER is not significantly greater than the southern urban ER.

S. Reg Ind ER = N. Ind ER > N. Other ER > S. Rural ER = S. Urban ER

There is a descending order of episode rates for PACS conditions and some of the differences are statistically significant.

d) Gastroenteritis

TABLE 19: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS GASTROENTERITIS CONDITIONS

Group	χ^2	p value
Southern Reg Indian Northern Reg Indian	115.705	< 0.05
Northern Reg Indian Southern Rural	14.020	< 0.05
Southern Rural Northern Other	0.121	Not Significant
Southern Rural & Northern Other Southern Urban	1.935	Not significant

$$\alpha = 0.05 \div 32 = 0.0015625$$

$$\text{Critical } \chi^2_{d.f., .1} = 10.83 \text{ (for } p = 0.001)$$

As depicted in Table 19, the hospital episode rate (ER) for PACS conditions of southern registered Indian children is significantly greater than the northern treaty ER ($p < 0.05$); the northern registered Indian ER is significantly greater than the southern rural ER ($p < 0.05$); and there is no significant difference in the southern rural ER, the northern other ER and the southern urban ER.

S. Reg Ind ER > N. Reg Ind ER > S. Rural ER = N. Other ER = S. Urban ER

Thus there is a slight variation of the predicted descending order of the episode rates for PACS conditions grouped as gastroenteritis conditions with the southern rural being greater, though not statistically significantly, than the northern other episode rate.

e) Convulsions

TABLE 20: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS CONVULSION CONDITIONS

Group	χ^2	p value
Southern Reg Indian Northern Other	1.122	Not significant
Southern Reg Indian & Northern Other Northern Reg Indian	1.329	Not significant
Southern Reg Indian, Northern Other, & Northern Reg Indian Southern Rural	10.731	Not significant
Southern Rural Southern Urban	0.006	Not significant

$$\alpha = 0.05 \div 32 = 0.0015625$$

$$\text{Critical } \chi^2_{d.f., \alpha} = 10.83 \text{ (for } p = 0.001)$$

There was no significant difference in the hospitalization rates for convulsions between study groups (Table 20):

S. Reg Ind ER = N. Other ER = N. Reg Ind ER = S. Rural ER = S. Urban ER

f) Chronic Diseases

TABLE 21: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS CHRONIC DISEASE CONDITIONS

Group	χ^2	p value
Northern Reg Indian Southern Reg Indian	4.906	Not significant
Northern Reg Indian & Southern Reg Indian Southern Rural	100.93	< 0.05
Southern Rural Southern Urban	0.044	Not significant
Southern Rural & Southern Urban Northern Other	0.158	Not significant

$$\alpha = 0.05 \div 32 = 0.0015625$$

$$\text{Critical } \chi^2_{d.f. = 1} = 10.83 \text{ (for } p = 0.001)$$

As depicted in Table 21, the hospital episode rate (ER) for PACS chronic conditions of northern registered Indian children is not significantly greater than the southern registered Indian ER; the pooled rate for northern and southern registered Indian children is significantly greater than the southern rural rate; and the southern rural rate is not significantly greater than the northern other and southern urban ER.

N. Reg Ind ER = S. Reg Ind ER > S. Rural ER = N. Other ER = S. Urban ER

Thus there is a variation of the predicted descending order of the episode rates for PACS conditions grouped as chronic diseases with the northern registered Indian rate being insignificantly greater than the southern registered Indian rate; and the southern rural rate being insignificantly greater than the northern other rate.

g) Nutritional

TABLE 22: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS NUTRITIONAL CONDITIONS

Group	χ^2	p value
Southern Reg Indian Northern Reg Indian	0.177	Not significant
Southern Reg Indian & Northern Reg Indian Northern Other	10.844	< 0.05
Northern Other Southern Urban	1.792	Not significant
Northern Other & Southern Urban Southern Rural	6.3226	Not significant

$$\alpha = 0.05 \div 32 = 0.0015625$$

$$\text{Critical } \chi^2_{d.f. - 1} = 10.83 \text{ (for } p = 0.001)$$

As depicted in Table 22, the hospital episode rate (ER) for PACS nutritional conditions of southern registered Indian children is not significantly greater than the northern registered Indian ER; the pooled southern and northern registered Indian ER is significantly greater than the northern other rate; northern other ER is not significantly greater than the southern urban ER; and the pooled northern

other and southern urban ER is not significantly greater than the southern rural ER.

S. Reg Ind ER = N. Reg Ind ER > N. Other ER = S. Rural ER
S. Urban ER

Thus there is a variation of the predicted descending order of the episode rates for PACS nutritional conditions with the southern registered Indian rate being insignificantly greater than the northern registered Indian rate; and the southern urban rate being insignificantly greater than the northern other southern rural rate.

h) Dental conditions

TABLE 23: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS DENTAL CONDITIONS

Group	χ^2	p value
Northern Other Northern Reg Indian	8.795	Not significant
Northern Other & Northern Reg Indian Southern Reg Indian	36.903	< 0.05
Southern Reg Indian Southern Rural	25.680	< 0.05
Southern Rural Southern Urban	0.620	Not significant

$$\alpha = 0.05 \div 32 = 0.0015625$$

$$\text{Critical } \chi^2_{d.f., .1} = 10.83 \text{ (for } p = 0.001)$$

As depicted in Table 23, the hospital episode rate (ER) for PACS dental conditions of northern other children is not significantly greater than the northern registered Indian ER ($p < 0.005$); the pooled northern other and registered Indian ER is significantly greater than the southern registered Indian ER; the southern registered Indian ER is significantly greater than the southern rural ER; and the southern rural ER is not significantly greater than the southern urban ER.

N. Other ER = N. Reg Ind ER > S. Reg Ind ER > S. Rural ER = S. Urban ER

Thus there is considerable variation of the predicted descending order of the episode rates for PACS dental conditions with the northern other ER being greater than the northern registered Indian ER though not significantly; and the two northern groups having significantly higher rates than the southern registered Indian ER. The southern rural and the southern urban had the lowest rates though were not significantly different from each other.

5.1.4 The Proportion of Hospitalization Episodes Considered
for Ambulatory Care Sensitive Conditions: All PACS
Conditions Combined

Proportions of hospital episodes determined as Ambulatory Care Sensitive Conditions were calculated. Analysis of hospitalizations were done for all ambulatory care sensitive (PACS) conditions combined for hospital episodes in the 1992-93 year period. This analysis was completed for the five provincial population groups for which population (denominator) data was available.

5.1.4.a) The Proportion of Hospital Episodes for Ambulatory
Care Sensitive Conditions: All PACS Conditions
Combined: Age-Sex Specific 1992-93

Age-sex specific proportions were calculated for the four age groups. (Table 24) Generally, the proportions of hospital episodes considered as sensitive to ambulatory care were highest in the 10 to 14 year age group and the rates decreased in the younger groups, though there was an increase in the proportion for the under 1 year age group compared to the 1 to 4 year age group except for Northern Treaty females and Southern rural males. Generally, for each of the age-sex specific groups the highest proportions of episodes considered ambulatory care sensitive in the age-sex

groups were seen in either the Southern Urban or Southern Rural groups.

TABLE 24: THE PROPORTION OF HOSPITAL EPISODES CONSIDERED AS AMBULATORY CARE SENSITIVE CONDITIONS FOR EACH AGE-SEX GROUP OF SASKATCHEWAN CHILDREN 1992-93 BY STUDY GROUP.

Study Group	Sex	The Proportion of Episodes Considered as PACS Conditions for Each Age-Gender Group			
		< 1	1 - 4	5 - 9	10 - 14
Southern Treaty	Male	0.4695	0.4275	0.6417	0.7555
	Female	0.4552	0.4549	0.6014	0.7179
Northern Treaty	Male	0.4875	0.4598	0.6721	0.7645
	Female	0.4593	0.4705	0.5213	0.7971
Northern Non-Treaty	Male	0.5723	0.4213	0.6066	0.8118
	Female	0.4880	0.4732	0.5688	0.8999
Southern Rural	Male	0.5640	0.6017	0.6621	0.7670
	Female	0.7524	0.5548	0.6386	0.7763
Southern Urban	Male	0.6480	0.5931	0.7157	0.8795
	Female	0.6847	0.4417	0.7322	0.8073

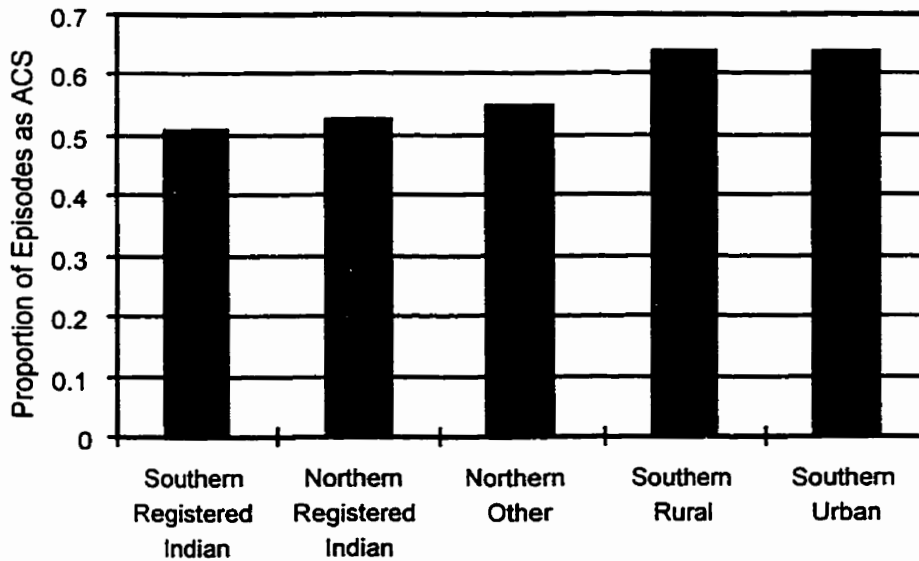
5.1.4.b) The Proportion of Hospital Episodes for Ambulatory Care Sensitive Conditions: All PACS Conditions Combined: Age-Sex Standardized

The direct age-sex-standardized proportion of hospital episodes considered for Ambulatory Care Sensitive conditions revealed, in general, a gradient with the highest proportion rate occurring in the southern rural and urban children and the lowest proportion being in the southern Indian children. (see Table 25 and Figure 6)

TABLE 25: DIRECT AGE-STANDARDIZED PROPORTION OF HOSPITAL EPISODES PER 1,000 AS AMBULATORY CARE SENSITIVE CONDITIONS FOR SASKATCHEWAN CHILDREN BY STUDY GROUP

Study Group	Hospital Episodes	Proportion of PACS Episodes	Standard Error
Southern Registered Indian	6503	0.5094	0.0060618
Northern Registered Indian	1799	0.5275	0.0116098
Northern Other	864	0.5482	0.0164933
Southern Rural	909	0.6357	0.0167465
Southern Urban	1091	0.6355	0.0146810
Total Saskatchewan	11166	0.5367	0.0046195

Figure 6: Standardized Proportion of Hospital Episodes Rate Considered as PACS Conditions



The hypothesis was that the predicted proportion of hospital episodes considered as PACS for all PACS conditions

combined would be as follows in descending order of proportion:

- 1) Indian children registered with southern bands
- 2) Indian children registered with northern bands
- 3) Other northern children
- 4) Other southern children - rural
- 5) Other southern children - urban.

A simultaneous T^2 test was first done to assess whether there was any statistically significant difference between these five groups in the directly age-standardized proportion. The probability that the differences in the proportion between these five groups were due to chance was determined to be less than 0.001. ($T^2 = 115.149$)

Following the determination that there was a statistically significant difference in the proportion between these groups, multiple comparison testing was done to test the hypothesis. As the hypothesis was ordered, a series of Z^2 tests were done between the groups using χ^2 as the critical values to determine the level of significance (Table 26):

- 1) between southern registered Indian children and northern registered Indian children;
- 2) between northern registered Indian children and northern other children;
- 3) between northern other Indian children and southern rural children; and
- 4) between southern rural and southern urban children.

If it was determined that there was a non-significant difference between two groups, the groups would be combined and tested against the subsequent group. Because multiple comparisons were done, Bonferroni correction was used in determining the critical χ^2 value.

TABLE 26: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS PROPORTION OF HOSPITAL EPISODES

Group	Proportion	χ^2	p value
Southern Reg Indian	0.509382	1.908841	Not significant
Northern Reg Indian	0.527477		
Northern Reg Indian	0.527477	1.058269	Not significant
Northern Other	0.548226		
Southern Reg Indian	0.509382	4.886598	Not significant
Northern Other	0.548226		
Northern Other	0.548226	13.86911	< 0.01
Southern Rural	0.635666		
Southern Rural	0.635666	0.0000523	Not significant
Southern Urban	0.635505		

$$\alpha = 0.05 \div 5 = 0.01$$

$$\text{Critical } \chi^2_{d.f., .1} = 6.63 \text{ (for } p = 0.01)$$

This was confirmed by pooling the standard error for the three similar groups of Southern Registered Indian, Northern Registered Indian and Northern Other together and the two

similar groups of Southern Rural and Southern Urban together (Table 27).

TABLE 27: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS

Group	Proportion	Standard Error	χ^2	p value
Southern Rural & Southern Urban	0.634322	0.0110289	94.2048	< 0.001
Southern Reg. Indian Northern Reg. Indian & Northern Other	0.516392	0.0050984		

$$\alpha = 0.05 \div 6 = 0.0083$$

$$\text{Critical } \chi^2_{d.f., .1} = 7.88 \text{ (for } p = 0.005)$$

Thus, the proportion of hospital episodes (PEA) for PACS conditions were not significantly different for of southern registered Indian, northern registered Indian, and northern other children; not significantly different between the southern urban or southern rural children; and there was a significantly greater proportion in the southern rural and urban children compared to the southern and northern registered Indian and other northern children.

$$\underline{S. \text{ Reg. Ind. PEA} = N. \text{ Reg. Ind. PEA} = N. \text{ Other PEA} < S. \text{ Rural PEA} = S. \text{ Urban PEA}}$$

Thus, the null hypothesis cannot be rejected. A descending order of the proportion of hospital episodes for PACS conditions was not found as hypothesized. In fact, it appears that the order was opposite to that hypothesized.

5.2 Phase Two: Five Northern Groups

5.2.1 Hospitalization Episode Comparisons of Northern Remote, Central and Core Areas

Further analysis was completed to assess whether differing direct access to hospital facilities was associated with differences in hospital episode rates and PACS episode rates in northern Saskatchewan. This analysis was done to see whether children living in remote communities (greater than an hour travelling time from a hospital or with no road access) had differing hospital episode or hospital PACS episode rates than those children with more immediate access to hospitals.

Analysis of hospitalizations were done for all diagnosis combined, for all PACS conditions and for PACS proportion of hospital episodes in the 1992-93 year period comparing groups in northern Saskatchewan with various degrees of direct access to hospital facilities. The

northern registered Indian and northern other population was divided into 5 groups. Northern registered Indian children with residence codes in communities within one hour travelling time by road to a hospital was compared with those Northern registered Indian children with residence codes in communities greater than one hour travelling time from a hospital or without road access. For the northern children other than registered Indian children, those with postal codes indicating residence in communities within an hours travelling time by road to a hospital was compared with those Northern other children with residence codes in communities greater than an hour travelling time from a hospital or without road access. Children residing in the core communities of LaRonge, Air Ronge and Creighton were analyzed separately because of the distinct predominate population group in these communities: predominately Caucasian with higher rates of education, employment and income than other northern communities.

Population data for children other than registered Indians would more accurately indicate living in northern Saskatchewan and more accurately indicate location of actual residence than the data on registered Indian children. Registered Indian population data is based on location of band registration rather than by actual residence. This will need to be considered in the interpretation of this data.

5.2.1.a) Age-Sex-Specific Hospitalization Episode Rates:

All Diagnosis Combined and PACS Conditions

The rates of hospitalization episodes for all diagnosis combined and for PACS conditions in each group is displayed in Table 28 and depicted graphically in Figure 7 and Figure 8.

Generally, the hospital episode rate decreases with increasing age for both males and females for each of the five northern groups except for a slight increase in the 10 to 14 year age group in females in the remote registered Indian, the remote other and the core other groups and, in males, in the core other group. (Table 28) A similar pattern is found for the hospital episode rates for PACS conditions with decreasing rates with increasing age in both males and females except that in all female groups the rates in the 10 to 14 year age group are greater than the 5 to 9 year age group. In males, PACS episode rates are higher in the 10 to 14 year age group compared to the 5 to 9 year age group in the core other and remote other groups. The impact of PACS conditions on overall hospital episode rate appears to increase with increasing age. (Figure 7 and Figure 8) The rates of both hospital episode rates for all diagnoses and for PACS conditions generally appear to be higher in males than in females in all age groups for most groups except in the 10 to 14 year age group when females generally have higher rates than males. Exceptions to this include females less than one in the Northern Core group have a higher rate

for all diagnoses combined than males; and, in the 10 to 14 year age group males from the Remote Registered group have almost an equal rate of hospitalizations for all diagnoses and, more obviously, in the Northern Core group in that age group, males have a greater rate of hospitalization for both all diagnoses combined and for all PACS conditions.

TABLE 28: AGE-SPECIFIC HOSPITAL EPISODE RATE FOR ALL
 DIAGNOSES AND FOR PACS CONDITIONS PER 1,000 FOR EACH
 AGE GROUP IN THE NORTHERN CHILDREN GROUPS.

Study Group	Sex	Age-Sex Specific Hospital Episode Rate per 1,000 for Each Age Group for All Diagnoses and (for PACS Conditions)			
		< 1	1 - 4	5 - 9	10 - 14
Remote Registered Indian	Male	1416.15 (695.65)	295.11 (133.03)	104.67 (66.48)	81.91 (64.85)
	Female	955.41 (515.92)	245.11 (120.30)	75.25 (40.51)	80.68 (69.42)
Central Registered Indian	Male	1489.51 (720.28)	431.14 (201.60)	102.35 (74.63)	49.63 (34.74)
	Female	1047.24 (385.83)	317.07 (141.91)	92.63 (46.32)	84.68 (60.11)
Remote Northern Other	Male	810.34 (396.55)	294.61 (120.33)	80.36 (62.50)	76.39 (69.44)
	Female	600.00 (377.78)	194.57 (113.12)	82.61 (47.83)	109.68 (96.77)
Central Northern Other	Male	1096.39 (626.51)	233.33 (90.48)	112.15 (58.41)	61.95 (38.35)
	Female	682.69 (259.62)	184.21 (65.79)	95.61 (51.68)	81.76 (78.62)
Northern Core Other	Male	512.20 (390.24)	134.62 (76.92)	74.07 (49.38)	85.71 (81.63)
	Female	586.69 (369.57)	91.84 (61.22)	37.34 (24.90)	33.98 (24.27)

Figure 7: Male Age-Specific Rates: PACS and Non-PACS Hospital Episodes for Northern Groups

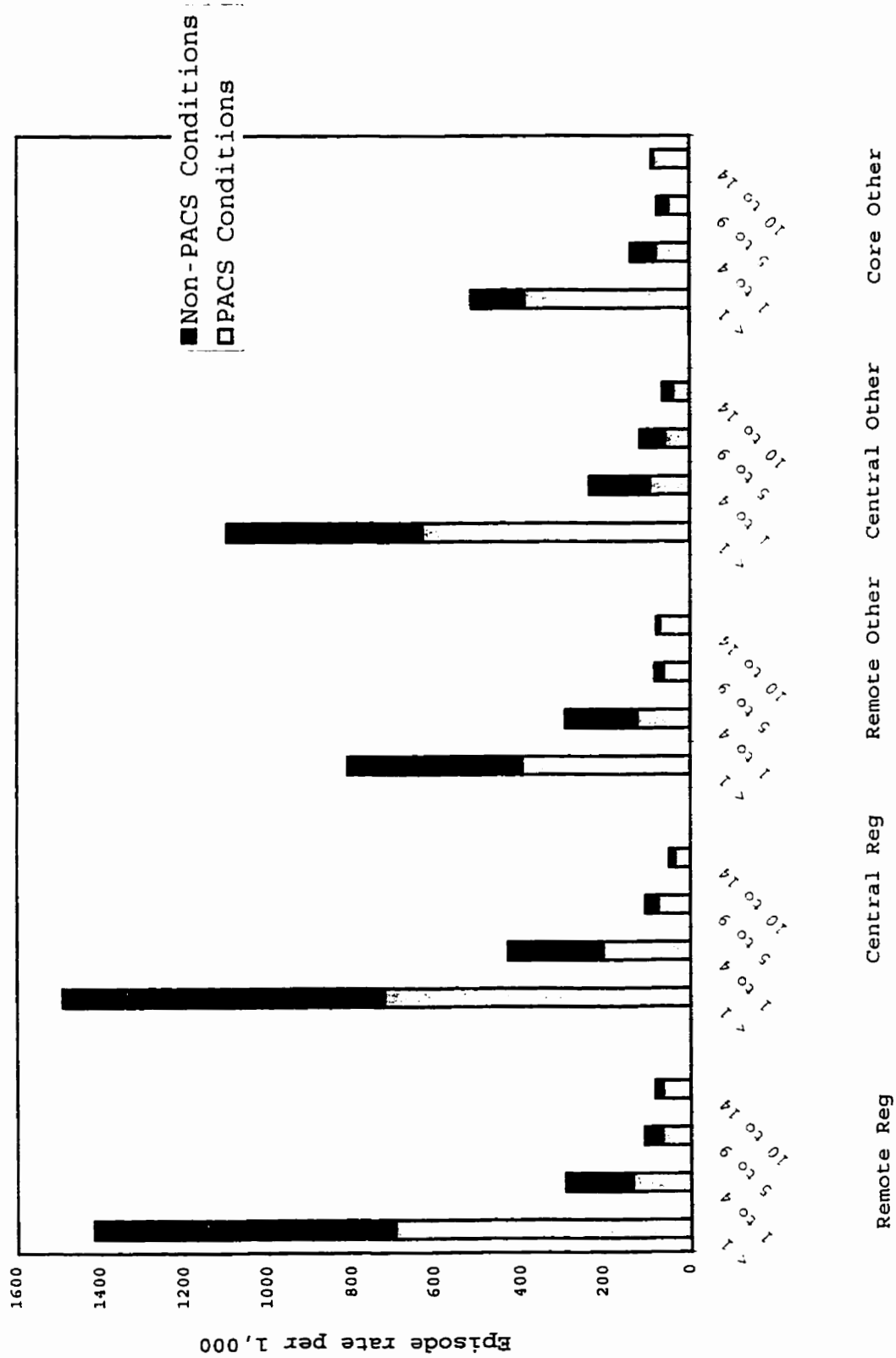
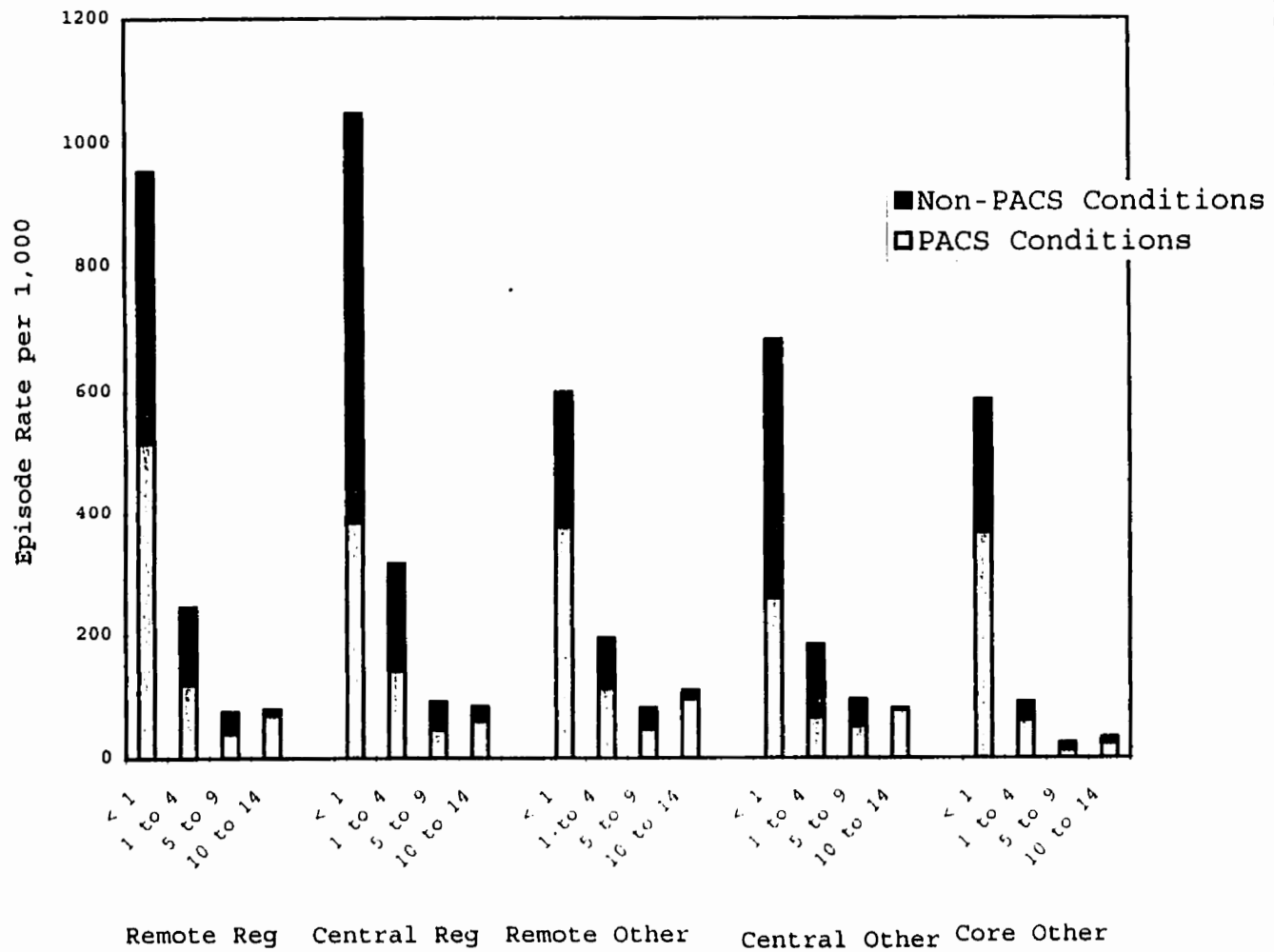


Figure 8: Female Age-Specific Rates: PACS and Non-PACS Hospital Episodes for Northern Groups



5.2.1.b) Age-Sex Standardized Hospital Episodes for PACS
Conditions and All Diagnoses Combined and the
Proportion of Hospital Episodes Considered PACS

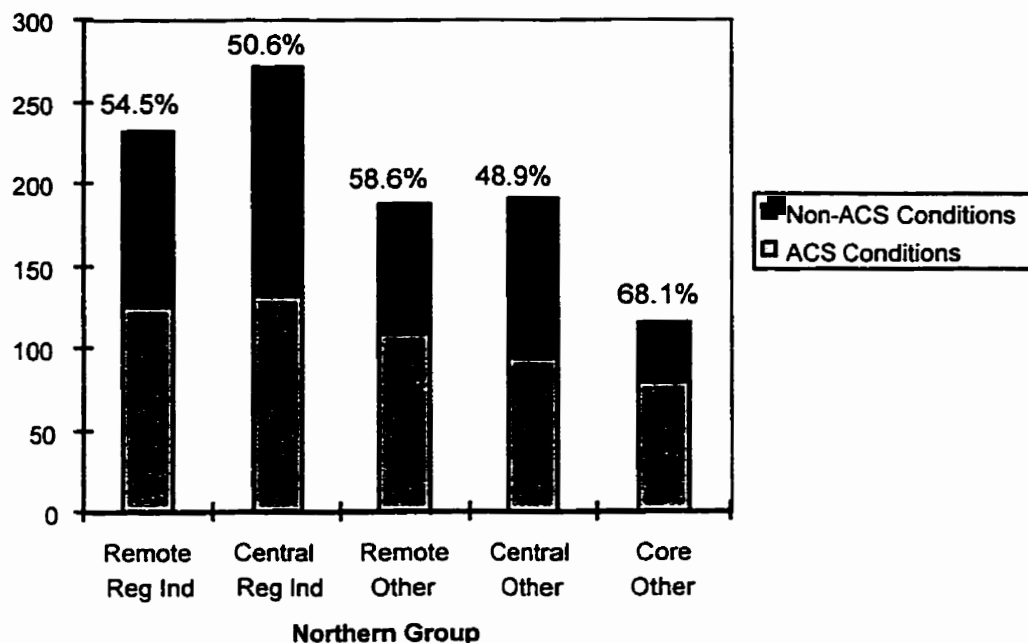
Directly age-sex standardized hospital episode rates were then determined for PACS conditions and for all diagnoses combined for each of these five northern groups. (Table 29 and Figure 9) The proportion of hospital episodes considered PACS was also determined for each of these five groups.

TABLE 29: THE AGE-SEX STANDARDIZED RATE PER 1,000 OF HOSPITALIZATION EPISODES FOR ALL DIAGNOSES COMBINED AND FOR PACS CONDITIONS IN FIVE NORTHERN GROUPS.

Northern Group	Pop'n	All Diagnoses Combined		PACS Conditions		PACS Proportion	
		Rate (#)	SE*	Rate (#)	SE	%	SE
Remote Registered Indian	4154	231.8 (951)	4.621	124.1 (510)	4.604	54.5	15.81
Central Registered Indian	2935	270.3 (848)	5.701	131.7 (410)	5.590	50.6	17.50
Remote Other	1318	186.1 (253)	9.5575	108.4 (144)	8.289	58.6	30.38
Central Other	2459	190.8 (462)	6.505	93.8 (225)	5.435	48.9	22.44
Core Other	1426	114.6 (149)	8.036	79.0 (104)	7.053	68.1	41.13

* = Standard Error

Figure 9: Age-Sex Standardized Hospital Episode Rates For PACS Conditions And All Conditions Combined In Five Northern Groups; 1992-93



The direct age-standardized hospital episode rates per 1,000 revealed a gradient with the highest separation rate occurring in the central registered Indian children and the lowest rate being in the core other children for both all diagnoses combined and for PACS conditions. The two registered Indian groups have the highest rates and the other children groups having the lowest rates.

The hypothesis was that the pediatric hospital episode rate for all diagnoses combined, for PACS conditions combined and the proportion of hospitalization considered as PACS would be comparable between registered Indian children living in remote communities and registered Indian children living in central communities; and between other northern children living in remote communities and other northern

children living in central communities; and that children living in the core communities of LaRonge, Air Ronge and Creighton would have a significantly lower rate of hospital episodes and PACS episodes and a lower proportion of hospital episodes considered as PACS.

A simultaneous T^2 test was first done to assess whether there was any statistically significant difference between these five groups in the directly age-standardized rates of separation. The probability that the differences in the episode rates between these five groups were due to chance was determined to be less than 0.001. ($T^2 = 3921.89$)

Following the determination that there was a statistically significant difference in the rates between these groups, multiple comparison testing was done to test the hypothesis. A series of Z^2 tests were done between the groups using χ^2 as the critical values to determine the level of significance:

- 1) between central registered Indian and remote registered Indian children;
- 2 between remote registered Indian and central other children;
- 2) between central other children and remote other children; and
- 3) between central and remote other and core other children.

Because multiple comparisons were done, Bonferroni correction was used in determining the critical χ^2 value.

a) Hospital Episode Rates for All Diagnoses Combined:

The results of the statistical analysis for comparing episode rates for all diagnoses combined are included in Table 30.

TABLE 30: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR ALL DIAGNOSES COMBINED

Northern Group	All Diagnoses Combined	
	χ^2	p value
Central Registered Indian Remote Registered Indian	27.59	< 0.001
Remote Registered Indian Central Other	26.35	< 0.001
Central Other Remote Other	0.167	Not significant
Remote Other Core Other	32.76	< 0.001

$$\alpha = 0.05 \div 4 = 0.0125$$

$$\text{Critical } \chi^2_{d.f., \alpha} = 6.63 \text{ (for } p = 0.01)$$

Thus, the hospital episode rate (ER) of central registered Indian children is very significantly greater than that of remote registered Indians ($p < 0.001$); the remote registered

Indian ER is very significantly greater than the central other rate; the central other ER is no significantly different than the remote other ER; and core other ER is very significantly greater than the remote other urban ER.

Central Indian ER > Remote Indian ER > Central Other ER = Remote Other > Other Core

Thus, part of the null hypothesis is rejected. There is a statistically significant difference in the rates of hospital episodes between registered Indian children in remote compared to central communities with those in central communities having higher hospital episode rates. Rates between other children living in remote versus central communities are not significantly different. However, the hospital episode rates for children living in the core communities are significantly less.

b) Episode Rates for PACS Conditions:

TABLE 31: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS CONDITIONS

Northern Group	PACS Conditions	
	χ^2	p value
Central Registered Indian Remote Registered Indian	1.07	Not significant
Remote Other Central Other	2.15	Not significant
Remote & Central Other Core Other	5.15	Not significant

$$\alpha = 0.05 \div 4 = 0.0125$$

$$\text{Critical } \chi^2_{d.f., .1} = 6.63 \text{ (for } p = 0.01)$$

Thus the null hypothesis is partially rejected (Table 31). There are no significant differences between the hospital episode rates for PACS conditions for registered Indian and other children living in remote versus central communities. There is also no significant difference in the PACS episode rates between other remote and central children compared to core children.

Central Registered Indian ER = Remote Registered Indian ER

Remote Other ER = Central Other ER > Core Other ER

c) The Proportion of Hospital Episodes Considered as
PACS Conditions:

TABLE 32: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR
THE PROPORTION OF HOSPITAL EPISODES AS PACS CONDITIONS

Northern Group	Proportion of Hospital Episodes As PACS Conditions	
	χ^2	p value
Central Registered Indian Remote Registered Indian	0.051	Not significant
Remote Other Central Other	0.034	Not significant
Remote & Central Other Core Other	12.70	< 0.01

$$\alpha = 0.05 \div 4 = 0.0125$$

$$\text{Critical } \chi^2_{d.f. = 1} = 6.63 \text{ (for } p = 0.01)$$

There were no significant differences detected in the proportion of hospital episodes considered as PACS between registered Indian children living in remote versus central communities and between other children living in remote versus central communities (Table 32). However, there was a significant difference in those children living in the core communities with a higher proportion of PACS admissions.

Central Registered Indian proportion = Remote Registered Indian proportion

Remote Other proportion = Central Other proportion > Core Other proportion

5.3 Phase Three: Eight Provincial Groups with Residence Determined by Postal Code

5.3.1 The Proportion of Hospitalization Episodes Considered for Ambulatory Care Sensitive Conditions by Area within Groups: All PACS Diagnoses Combined

Proportions of hospital episodes determined as Ambulatory Care Sensitive Conditions were calculated for 8 groups including Southern Registered Indian Rural (any registered Indian with a southern postal code other than in one of the urban centers); Southern Registered Indian Urban (any registered Indians with a southern urban postal code); Northern Registered Indian Remote and Northern Other Remote (any registered Indian or any northern other child with a postal code indicating residence greater than 1 hour from a community with a hospital); and Northern Registered Indian Central and Northern Other Central (any registered Indian or

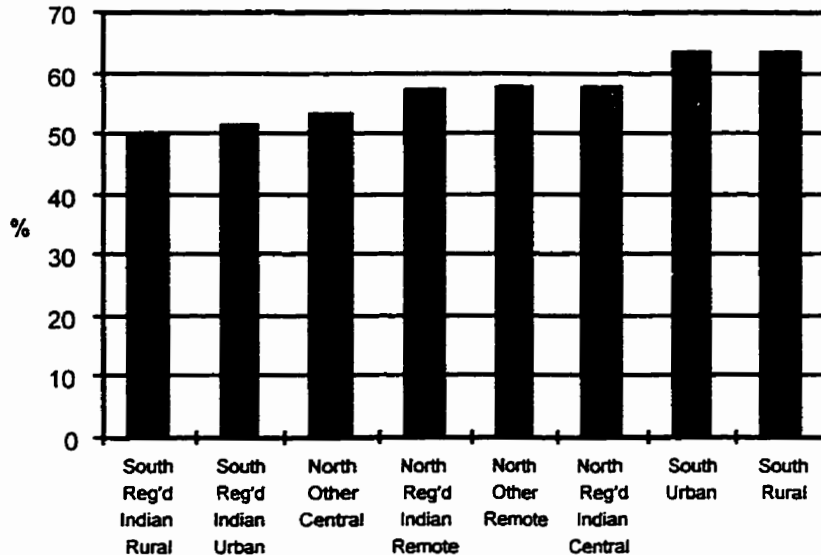
northern other child with a postal code indicating residence less than one hour from a community with a hospital). Analysis of hospitalizations were done for all ambulatory care sensitive (PACS) conditions combined for hospital episodes in the 1992-93 year period. This analysis on proportions of hospital episodes considered as PACS episodes was completed for the eight population. This analysis was done without the determination of rates of hospitalization episodes or rates of PACS hospitalization episodes because data was not available on the population numbers (denominators) for registered Indians by residence determined by postal code or community.

The direct age-sex-standardized proportion of hospital episodes considered for Pediatric Ambulatory Care Sensitive conditions revealed a gradient with the highest proportion occurring in the southern rural and urban children and the lowest proportion being in southern Indian children with the rural registered Indian children having a slightly lower proportion than the urban registered Indian children. (see Table 33 and Figure 8)

TABLE 33: DIRECT AGE-STANDARDIZED PROPORTION OF HOSPITAL
 EPISODES PER 1,000 AS AMBULATORY CARE SENSITIVE
 CONDITIONS BY POSTAL CODE DETERMINED GROUP

Study Group	Hospital Episodes	Proportion of PACS Episodes	Standard Error
Southern Registered Rural	4661	0.4981	0.007199
Southern Registered Urban	2350	0.5133	0.009974
Northern Registered Remote	836	0.5724	0.016895
Northern Registered Central	455	0.5754	0.022923
Northern Other Remote	333	0.5751	0.026482
Northern Other Central	531	0.5335	0.021213
Southern Rural	909	0.6357	0.016747
Southern Urban	1091	0.6355	0.014681
Total Saskatchewan	11166	0.5367	0.004620

Figure 10: Standardized Proportion of Hospital Episodes Rate Considered as PACS Conditions by Postal Code Determined Group



The hypothesis was that the predicted proportion of hospital episodes considered as PACS for all PACS conditions combined would be greater in locations further away from larger centers with rural areas having a higher proportion of PACS episodes than urban areas and remote areas having a higher proportion of PACS episodes than children in living close to hospital-based communities in the north. It was hypothesized that there would be a descending order of proportions:

- 1) Registered Indian children living in southern rural areas;

- 2) Registered Indian children living in southern urban areas;
- 3) Registered Indian children living in northern remote areas;
- 4) Registered Indian children living in northern central areas;
- 5) Other children living in remote northern areas;
- 6) Other children living in central northern areas;
- 7) Southern rural children; and
- 8) Southern urban children.

A simultaneous T^2 test was first done to assess whether there was any statistically significant difference between these five groups in the directly age-standardized proportion. The probability that the differences in the proportion between these five groups were due to chance was determined to be less than 0.001. ($T^2 = 136.699$)

Following the determination that there was a statistically significant difference in the proportion between these groups, multiple comparison testing was done to test the hypothesis. As the hypothesis was ordered, a series of Z^2 tests were done between the groups using χ^2 as the critical values to determine the level of significance:

- 1) between Registered Indian children living in southern rural areas and urban areas;

- 2) between Registered Indian children living in southern urban areas and other northern children in central areas;
- 3) between other northern Indian children in central areas and registered Indian children living in remote northern areas;
- 4) between registered Indian children living in remote northern areas and other northern children living in central northern areas;
- 5) other children living in central northern areas and registered Indian children living in central northern areas;
- 6) registered Indian children living in central northern areas and southern urban children; and
- 7) southern urban and rural children.

If it was determined that there was a non-significant difference between two groups, the groups would be combined and tested against the subsequent group. Because multiple comparisons were done, Bonferroni correction was used in determining the critical χ^2 value. (Table 34)

TABLE 34: CHI-SQUARE AND P-VALUES FOR COMPARISON PAIRS FOR PACS PROPORTIONS

Group	Proportion	χ^2	p value
Southern Registered Rural	0.4981		
		1.5252	Not significant
Southern Registered Urban	0.5133		
		0.7285	Not significant
Northern Other Central	0.5335		
		2.0594	Not significant
Northern Registered Remote	0.5724		
		0.0078	Not significant
Northern Other Remote	0.5751		
		0.0001	Not significant
Northern Registered Central	0.5754		
		4.8751	Not significant
Southern Urban	0.6357		
		0.0001	Not significant
Southern Rural	0.6351		

$$\alpha = 0.05 \div 7 = 0.007$$

$$\text{Critical } \chi^2_{d.f. - 1} = 6.63 \text{ (for } p = 0.01)$$

Standard errors for pooled groups were then determined. This was confirmed by pooling the standard error for the three similar groups of Southern Treaty, Northern Treaty and Northern Non-Treaty together and the two similar groups of Southern Rural and Southern Urban together. (Table 35)

TABLE 35: CHI-SQUARE AND P-VALUES FOR COMPARISON POOLED
PAIRS FOR PACS PROPORTIONS

Group	Proportion	χ^2	p value
Southern Registered Rural & Urban	0.5031	1.9056	Not significant
Northern Other Central	0.5335		
Southern Registered Rural & Urban plus Northern Other Central	0.5048	14.3891	< 0.05
Northern Registered Remote	0.5724		
Southern Registered Rural & Urban plus Northern Other Central	0.5048	24.8398	< 0.05
Northern Registered Remote & Central plus Northern Other Remote	0.5708		
Southern Urban & Rural	0.6343	15.2030	< 0.05

$$\alpha = 0.05 \div 11 = 0.0045$$

$$\text{Critical } \chi^2_{d.f. . 1} = 10.83 \text{ (for } p = 0.001)$$

Thus, the proportions of hospital episodes (PEA) for PACS conditions were not significantly different for of southern registered Indian children in urban or rural areas and these were not significantly different than that of other children living in northern central areas; the proportions for northern registered Indian children in remote and central areas and other children living in northern central areas were not significantly different from each other; and the proportions for southern urban and southern rural were not

significantly different. However, the pooled southern urban and rural children had a significantly higher proportion of PACS episodes than the pooled northern registered Indian children in remote and central areas and other children living in the remote north. The pooled northern registered Indian children in remote and central areas and other children living in the remote north had a significantly higher proportion of PACS episodes than the pooled southern registered Indian children in rural and urban areas and the other northern children living in the central areas.

Southern RI Rural = Southern RI Urban = Other Northern Central < Northern RI Remote = Other Northern Remote = Northern RI Central < Southern Urban = Southern Rural

Thus, the hypothesis is not accepted. A descending order of the proportion of hospital episodes for PACS conditions was not found as hypothesized and was almost opposite to what was hypothesized.

6 DISCUSSION

6.1 Limitations

One of the limitations of the study in Phase 1 and Phase 2 was that the northern registered Indian group was for children registered with northern Indian bands not necessarily living in northern Saskatchewan at the time of admission. Comparison of the number of hospitalizations for northern registered Indians determined as residing in either northern remote or northern central communities as determined by the postal code on the hospitalization record with those of those of Indian children registered with northern bands was done. This provides an overall idea of the impact on the northern registered Indian hospital episode rate (in Phase One) by children registered with northern bands actually living in southern Saskatchewan.

TABLE 36: NUMBER OF HOSPITAL EPISODES FOR INDIAN CHILDREN BY LOCATION OF BAND VERSUS BY LOCATION OF RESIDENCE

Phase	Group	Number of Episodes
Phase One*	Northern registered Indians	1799
Phase Three**	Northern registered remote	836
	Northern registered central	455
	Total Northern registered	1291
Difference		- 508
Phase One	Southern registered Indians	6503
Phase Three	Southern registered rural	4661
	Southern registered urban	2350
	Total Southern registered	7011
Difference		+ 508

* - From Table 5

** - From Table 33

As seen in Table 36, 508 or 28.2% of the hospitalizations attributed to the northern registered Indian group in Phase One were actually for Indian children registered with northern bands but having postal codes on their hospitalization records indicating that they were living in southern Saskatchewan. The impact was less on the southern registered Indians; their hospital episode number increased

by 7.8% with the inclusion of Indian children registered with northern bands but residing in southern Saskatchewan.

Another limitation that should be kept in mind is that there are differences in the population numbers for registered Indians between Saskatchewan's Health Information Registry and the registry used by Medical Services Branch of Health Canada. There is some discrepancy between the registries used by Medical Services Branch and Saskatchewan Health with some children who are registered Indians not being identified as such in Saskatchewan's Health Information Registry and vice versa. (See Appendix M (Saskatchewan Health 1992, Health Canada 1992) This discrepancy varies by age group: 2% for ages 0 - 4, 10% for ages 5 to 9, and 15% for ages 10 - 14. This discrepancy will influence absolute numbers in this study; however, it will likely not influence the rates as the discrepancy will be in both the population denominator number and the hospitalization number. If there is a difference in the children registered with Medical Services Branch and not with Saskatchewan Health compared to those that are registered with both, the results would be biased.

6.2 Summary of Results and Discussion

6.2.1 Phase One: Five Provincial Study Groups

This study showed that there were differing rates of hospitalization episodes for all conditions combined in children between the different study populations, with southern registered Indians having the highest rate, followed by northern registered Indian, northern others, southern rural and southern urban children. These differences were very statistically significant. Thus registered Indian children had higher rates of hospitalizations than other children; southern registered Indian children had higher rates than northern registered Indian children; and for other children, rates were highest in northern Saskatchewan, followed by those in rural areas and lowest in those from urban areas.

This study also showed that there were differing rates between study groups of hospitalization episodes for conditions felt to be amenable to ambulatory care. Southern registered Indian children had the highest rates of hospitalizations for ambulatory care sensitive conditions followed by northern registered Indian, northern other, southern rural and southern urban children. The pattern was similar to that for hospitalization episodes for all conditions with registered Indian children having higher

rates of hospitalizations than other children; southern registered Indian children having higher rates than northern registered Indian children; and for other children, rates were highest in northern Saskatchewan, followed by those in rural areas and lowest in those from urban areas. Thus, the first hypothesis was confirmed for hospital episodes for all conditions and for PACS conditions.

The differing rates of hospital episodes for all conditions combined and for PACS conditions may reflect differences in health status, differences in the practice patterns of health care providers or in the organization of health services. Differences in the practice patterns of health care providers and in the organization of health services could potentially result in differing thresholds of admission for the various study groups or, through the utilization of ambulatory care services, alternative methods of care rather than hospitalization. Other studies have indicated the health status of registered Indians in Canada and Saskatchewan, and in northerners in Saskatchewan tends to be poorer (Canadian Institute of Child Health, Young 1988, 1994, Postl, Tan et al, Irvine et al). This may be one factor that influences the hospital utilization patterns seen in this study. Crude health status indicators such as infant mortality and general mortality has been shown to be fairly equivalent between Indians registered with northern bands and those registered with southern bands. However, there may be some differences in the disease prevalence

between the northern and southern registered Indians to account for some of the differences in the hospitalization utilization. Further study utilizing a case severity index would be helpful in assessing the impact of disease prevalence versus a differing utilization of hospital care for different populations.

The differences in the hospital episode rates for all conditions and for PACS conditions between the northern groups of registered Indian and other children may reflect the differences in health status and/or differences in practice patterns resulting in a differing threshold for admission. The organization of health services between the northern registered Indian children and northern other children are fairly comparable. The differences in health status may not be homogenous within the northern other population as there are substantial differences in the socio-economic and cultural makeup of this northern other group being made up of both Métis and non-Aboriginal populations. The differences in practice patterns and threshold of admissions also may not be homogenous within the northern other population. Even though the northern other and northern registered Indian populations utilize the same northern physician groups, the socio-economic, educational and cultural differences within the northern other population may result in substantial differences within the various segments of the northern other population.

The differences in the hospital episode rate for all conditions and for PACS conditions between the northern other and southern rural and urban other populations may reflect differences in health status, differences in the availability and utilization of ambulatory care services, and the practice patterns between health care providers working in differing health care service systems. Studies indicate that the health status of northerners is poorer than that of the general Saskatchewan population (Tan et al, Irvine et al). Differences in hospital utilization can also be influenced by hospital bed availability and the availability of ambulatory care.

The differences in the hospital episode rate for all conditions and for PACS conditions between the northern registered Indian and southern registered Indians may indicate more of a difference in the availability and utilization of appropriate ambulatory care services and the practice patterns between health care providers working in differing health care services systems. The crude health status indicators are relatively comparable between these two groups; however, there may be some differences not accounted for by the crude indicators of infant and general mortality. However, it appears that the effectiveness of ambulatory care in preventing hospitalizations is less for southern registered Indians than northern registered Indians. There are multiple dimensions to ambulatory care as its effectiveness could be determined by such things as

language, culture, education of the family, the home support available, the confidence in and comfort with the health service system, the compliance with treatment programs, the availability of appropriate health care providers, the type of services available and the knowledge the provider has of the home support. The northern model of family physicians who travel to reserve communities, partnered with primary care nursing teams located on reserve in community health centers, with the availability of translation and education services through Community Health Representatives is associated with a lower rate of admissions in general and for PACS conditions. This system may provide a better mechanism of home community support through a primary care clinic located within the community. This system provides for care by readily available primary care nurses, family physicians who support and work with the nurses and support staff of a similar language and cultural groups.

In the analysis of the proportion of hospitalizations considered as PACS, southern rural and urban children had a highly significant larger proportion than southern and northern registered Indian and northern other children. The combined proportion for southern rural and southern urban children was 63.4% and that of the southern and northern registered Indian and northern other children was 51.6%. This is different than the order suggested by the hypothesis of southern Indians having the highest proportion followed by northern Indians, northern other, other southern children

in rural areas and other southern children living in northern areas. Further discussion follows the discussion of Phase Three.

6.2.2 Patterns of PACS groups for Five Provincial Study Groups

In the analysis of hospital episode rates for grouped PACS conditions, the general pattern was that registered Indians had the highest rates for most conditions, southern other having the lowest rates for most conditions and northern other being intermediate. (Table 37). For registered Indians, if there was a statistically significant difference in the rates for various PACS groups, generally the southern registered Indians had a higher rate than the northern registered Indians as seen in ENT infections and gastro-enteritis. An exception to this was for dental conditions in which northern other and northern registered Indians had the highest rates of hospitalization followed by southern registered Indians. This difference may be due to a variety of factors including health status but it may reflect the practice pattern of northern practicing dentists during this period with northern children (other and registered Indians) being referred for general anaesthesia in southern based hospitals. During this time these referrals could have resulted in more overnight stays for dental extraction under general anaesthesia than for

southern registered Indian children who either did not have the surgery because of lack of access to appropriate care, did not require the surgery because of differences in dental health status, or if they had surgery it could have been done on an out-patient basis because of the closer distance to hospital or simply different practice patterns of utilizing outpatient surgery more.

TABLE 37: HOSPITAL EPISODE RATE FOR PARTICULAR GROUPED PACS CONDITIONS IN DESCENDING ORDER (STATISTICALLY SIGNIFICANCE DIFFERENCES)

PACS Group	Sou Reg Indian	Nor Reg Indian	Northern Other	Southern Rural	Southern Urban
General Infections	1*	1	2	2	2
ENT Infections	1	2	3	4	4
Bacterial Pneumonia	1	1	2	3	3
Gastro-enteritis	1	2	3	3	3
Convulsions	1	1	1	2	2
Chronic Diseases	1	1	2	2	2
Nutritional	1	1	2	2	2
Dental Conditions	2	1	1	3	3

*1 = most frequent; 4 = least frequent

6.2.3 Phase Two: Five Northern Study Groups: The Role of Travel Burden to Hospital

In assessing the impact of travel burden to nearest hospital for northern groups, hospitalizations for all conditions and ambulatory care conditions as well as the proportion of ambulatory care conditions in the overall hospitalization episodes were looked at. The analysis of hospitalization episodes for all diagnoses combined showed that there were significantly higher rates of admissions for registered Indian children living within an hour's travel time to a hospital compared to those living further from a hospital; Indian children, registered with either remote or central northern bands, had a very significantly higher rate of hospitalization than other children living within an hour's travel time of a hospital; there was no significant difference in the hospitalization rate for other children living in communities within an hour's travel distance compared to those living further than an hour's travel distance; and children living in the core communities of LaRonge, Air Ronge and Creighton had the lowest rates. In the analysis of hospitalization rates for ambulatory care sensitive conditions, a similar pattern was found as that for all diagnoses; however, there was no statistically significant difference between groups. Thus the indicator for the efficacy of ambulatory care in preventing hospitalizations was found not to be significantly different for those children with various travel burdens to the nearest

hospital. In assessing the proportions of hospitalizations considered for ambulatory care sensitive conditions, the highest proportion of PACS conditions was found in the core other children with no statistically significant difference found between the other groups.

6.2.4 Phase Three: Eight Provincial Study Groups by Postal Code Residence

For the third phase of this study, postal codes were used as an indicator of the residence location in determining groups. This allowed for an assessment of the proportion of hospitalizations considered as PACS for registered Indian children living in southern rural or urban locations, and an assessment for children registered with northern Indian bands who are recognized through the postal code on their hospitalization record as actually living in either remote or central northern conditions. As population denominator estimates were not available for registered Indians by actual residence location as determined by postal code, only the proportion of hospitalizations considered as PACS was compared between the groups.

In this analysis, the highest proportion of hospitalizations considered as PACS was seen in the southern rural and southern urban children which were not significantly different from each other. They had a significantly higher proportion of PACS hospitalizations

compared to northern registered Indian living in remote or central communities and other children living in remote communities. There was no statistically significant difference in the proportion of hospitalizations considered as PACS for northern registered Indian children whether living in communities which were considered remote or central and other children living in areas further than an hour's travelling time to a hospital. Southern registered Indian children living in rural and urban areas and northern other children living within an hour's travelling time to a hospital had a significantly lower proportion of hospitalizations considered as PACS compared to the northern registered Indians in remote and central communities and northern other children in central communities.

This was different than, and nearly opposite to, what was hypothesized with southern other children having the highest proportion and registered Indians living in southern communities having the lowest proportion of PACS hospitalizations. There was no significant difference between southern registered Indians whether they lived in rural or urban communities. There was no significant difference between southern other children whether or not they lived in rural or urban communities. There also was no significant difference between northern registered Indian children whether or not they lived within an hour's travelling time to the nearest hospital or not. Other northern children had a lower proportion of PACS

hospitalizations if they lived within an hour's travelling time to the nearest hospital compared to those living further away.

6.2.5 The Use of the Proportion of Hospitalizations

Considered as PACS

The results of the assessment of the proportion of hospitalizations considered for PACS conditions were not what was predicted in the hypothesis despite the fact that the comparison of the rates of PACS conditions were as predicted. In the comparison of the proportion of hospitalizations considered as PACS for the five study groups in Phase One, southern urban and rural children had the higher proportion and registered Indian and northern other children had the lower proportion despite the findings that the southern urban and rural children had the lowest rates of hospitalizations for all conditions and for PACS conditions. In the comparison of the proportion of hospitalizations considered as PACS for the five northern groups (Phase Two), northern core children had the higher proportion with the other four groups (northern registered Indian remote and central and northern other remote and central) when the northern core had the most readily available and most comprehensive health service (physician, outpatient, emergency and public health clinics as well as hospital facilities) as well as the lowest rate of

hospitalization for all conditions. In the comparison of the proportions of hospitalizations considered as PACS between groups determined by postal code residence (Phase Three), the southern urban and southern rural groups had the highest proportion and the southern registered Indians living in rural and urban communities had the lowest proportion.

The findings of the proportion comparison may be the result of a number of factors. One, this may suggest that the differing rates of PACS hospitalizations between groups were more a result of other influences on PACS hospitalizations than the effectiveness of ambulatory care such as differences in the prevalence of disease and threshold of admission. This could also suggest lower effectiveness of the southern rural and urban as well as northern ambulatory care systems in reducing hospitalizations for those conditions in comparison to the systems available for the southern registered Indian children. It would also suggest that the differing rates of PACS hospitalizations between northern and southern registered Indian children were a result of a higher threshold of admission and a more effective ambulatory care system for southern registered Indians if disease prevalence was reasonably comparable.

Secondly, these results could suggest that there are difficulties in using proportions of hospitalizations for PACS conditions as a reliable indicator of ambulatory care effectiveness. Using the methods of calculating rates for

PACS hospitalizations suggested by Billings and colleagues or the non-adjusted rates such as determined for avoidable hospitalizations by Weissman and colleagues (i.e. not using the comparison with the hospitalizations for non-PACS conditions) as a sentinel health outcome or indicator of the effectiveness of ambulatory care is as predicted in the hypothesis. It is when the proportion of PACS conditions to all conditions is determined (similar concept to the adjusted rate suggested by Weissman and colleagues) that the hypothesis does not hold and is, in fact, at times contradictory to the assessment of the rates of PACS conditions as an indicator of ambulatory care effectiveness.

Parchman and Culler, in assessing primary care physicians' impact on avoidable hospitalizations, had selected Billings' approach for calculating AHC rates rather than Weissman because of the potential impact of the differences in non-AHC hospitalizations influencing the adjusted rate because of potential impact of highly discretionary conditions seen in non-AHC hospitalizations. Weissman used a similar approach to the proportional approach used in this study in arriving at an adjusted relative rate by dividing the age- and sex- standardized AHC rate by the rate of hospitalizations for all other conditions. The second approach, used by Billing and colleagues and the Institute of Medicine (Parchman and Culler), calculated the rate of admissions for AHC by dividing the number of AHC admissions for a given small area

by the population of that area after adjusting for age and sex, a similar fashion to the determination of PACS rates in this study. Parchman and Culler preferred the second approach because the AHC rate does not depend on variations in hospital utilization for unavoidable hospital conditions among the health services areas. For example, it is possible as suggested by Parchman and Culler, that any observed variation in an adjusted relative rate such as that used by Weissman and used in this study for the calculation of PACS proportions might be related to variation in admissions for non-AHC or non-PACS elective hospitalizations (i.e. for high discretionary conditions). Hospitalizations for non-PACS conditions that are highly discretionary can be influenced by the confidence a health care provider has in the ambulatory care system. From other studies, the proportion of hospitalizations for various diagnostic groups in children birth to age nine is different for northern and registered Indians than for urban or rural other children (Saskatchewan Institute on Prevention of Handicaps). For respiratory conditions, the leading cause for hospitalizations in Saskatchewan children birth to age nine, there are different proportions of hospitalizations for the various types of respiratory conditions between these groups as well. For example, for children one to four years of age, pneumonia and influenza makes up 19% and 17% of respiratory hospitalizations for urban and rural southern children but 37% for both northern and registered Indian children. Some

of these conditions would be highly discretionary conditions and not considered as part of the PACS index even though hospitalizations for these highly discretionary conditions could be influenced significantly by the confidence a physician or other health care provider would have in the care the child would receive out of hospital. A higher proportion of these conditions would decrease the proportion of hospitalizations considered PACS and may explain the findings of this aspect of the study.

The assumption of Weissman in utilizing an adjusted relative rate was that the variation or threshold of admissions would be comparable between groups for non-AHC and AHC and that there would not be differences in the prevalence in AHC conditions and high discretionary non-PACS conditions. These assumptions may not apply in the assessment of such differing populations as these study populations in Saskatchewan.

6.3 Pediatric Ambulatory Care Sensitive Conditions in Comparison to Billings' Ambulatory Care Sensitive Conditions

The rate of hospitalization for ACS conditions in this study on children were higher than those reported by Billings (Billings 1993; Billings 1996). Over all age groups

the ACS rate of hospitalization in Billings recent study (Billings 1996) ranged from 6.92 to 15.16 per 1,000. In Billings' New York City study (Billings 1993), the ACS rate for those less than 65 years of age was 180.84 per 10,000. Age-specific rates were reported in the New York City study as 398.4 per 10,000 in the 0 to 5 year age group and 92.1 per 10,000 in the 6 to 17 year age group. In this Saskatchewan study, using the PACS rate, the age-specific rates ranged from 168.1 to 777.9 per 1,000 in the less than one year group, 37.9 to 182 per 1,000 in the 1 to 4 year group, 28.7 to 102.6 per 1,000 in the 5 to 9 year group, and 38.7 to 89.3 in the 10 to 14 year group.

In the development of PACS conditions from Billings' ACS conditions, some diagnoses were added which included predominately infectious and immunization-preventable conditions. Some diagnoses were deleted including some chronic conditions such as congestive heart failure, hypertension, chronic obstructive pulmonary disease and angina. These conditions in children would likely have significant underlying and concomitant pathology and so were not included as ambulatory care sensitive in children.

Billings' ACS conditions are diagnoses for which ambulatory care can potentially reduce hospitalization either by preventing the onset of an illness or condition, controlling an acute episodic illness or condition, or managing a chronic disease or condition. In changing to the PACS, there is somewhat greater emphasis placed on

preventing the onset of the illness and controlling the acute episodic illness as compared to Billings ACS.

6.4 Conclusions

The main conclusions that can be drawn from this study include:

- there are differing rates of hospitalizations for all conditions by various population groups of children in Saskatchewan with registered Indians having higher rates than other children, southern registered Indians having higher rates than northern registered Indians and northern other children having higher rates than southern urban and rural children;
- there are differing rates of hospitalizations for ambulatory care sensitive conditions by various population groups of children in Saskatchewan with registered Indians having higher rates than other children, southern registered Indians having higher rates than northern registered Indians and northern other children having higher rates than southern urban and rural children;
- there are no significant differences in PACS hospitalizations for children living within an hour's

travel time to the closest hospital for northern registered Indian and northern other children other than those living in the communities of LaRonge, Air Ronge, and Creighton who have different socio-economic-cultural conditions as well as proximity to a hospital; and

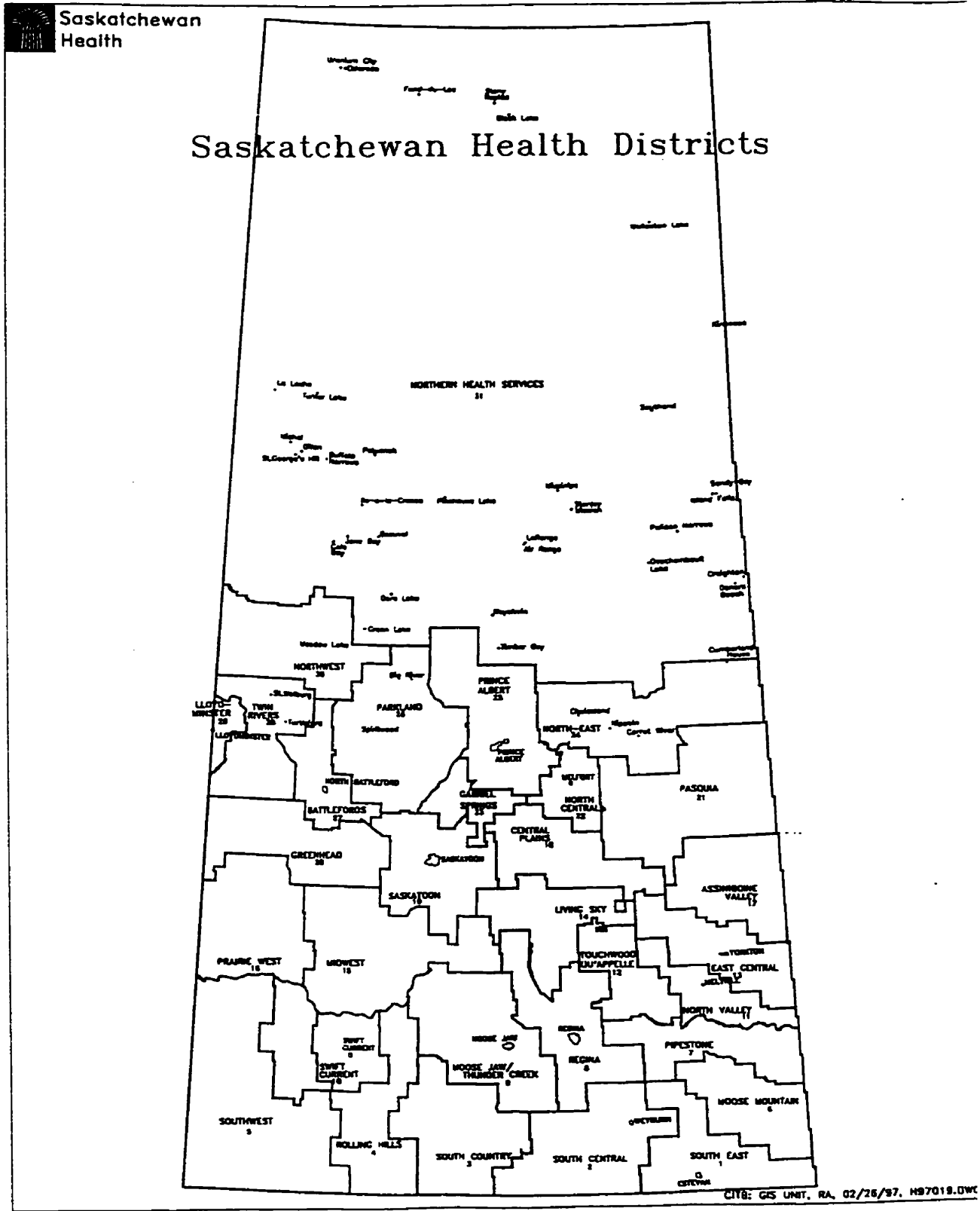
- the use of proportion of hospitalizations for PACS conditions as an indicator of ambulatory care services is limited, even though it has the advantage of not requiring population numbers for the denominator, because it is difficult to interpret and is prone to influence by other factors including differences in the prevalence of non-PACS conditions and differing practice patterns for more highly discretionary non-PACS conditions.

This study provided support for an association between an organized primary care health system on reserve and lower rates of hospitalizations for ambulatory care sensitive conditions for registered Indians. This study did not look at the association of specific aspects of ambulatory care between the various groups and hospitalizations for PACS conditions. It would seem that there is room for improvement in the frequency of hospitalizations for ambulatory care sensitive conditions for southern registered Indian children as well as northern registered Indian and northern other children. Parchman and Culler raised the issue of the importance of determining the cost of providing additional appropriate ambulatory care services to an area or

population group and the cost offset by the benefit of reducing avoidable hospitalizations. Further, what specific aspects of an ambulatory care service is most effective would need to be assessed - increased access to family physicians and primary care nurses, community health workers, family support, parent education, etc. This study suggests that the balanced, organized, team approach to primary care offered in the north may be better to reduce PACS hospitalizations in children and there may be advantages for southern registered Indians to have increased availability of primary care on reserve or more culturally appropriate, available services in urban centers.

The PACS rate could be a good indicator in the future to assess the changes to the health care system design to improve community-based, ambulatory care and prevention services through Health Reform and Indian Health Transfer.

7 APPENDIX A: SASKATCHEWAN HEALTH DISTRICT MAP - 1992/93

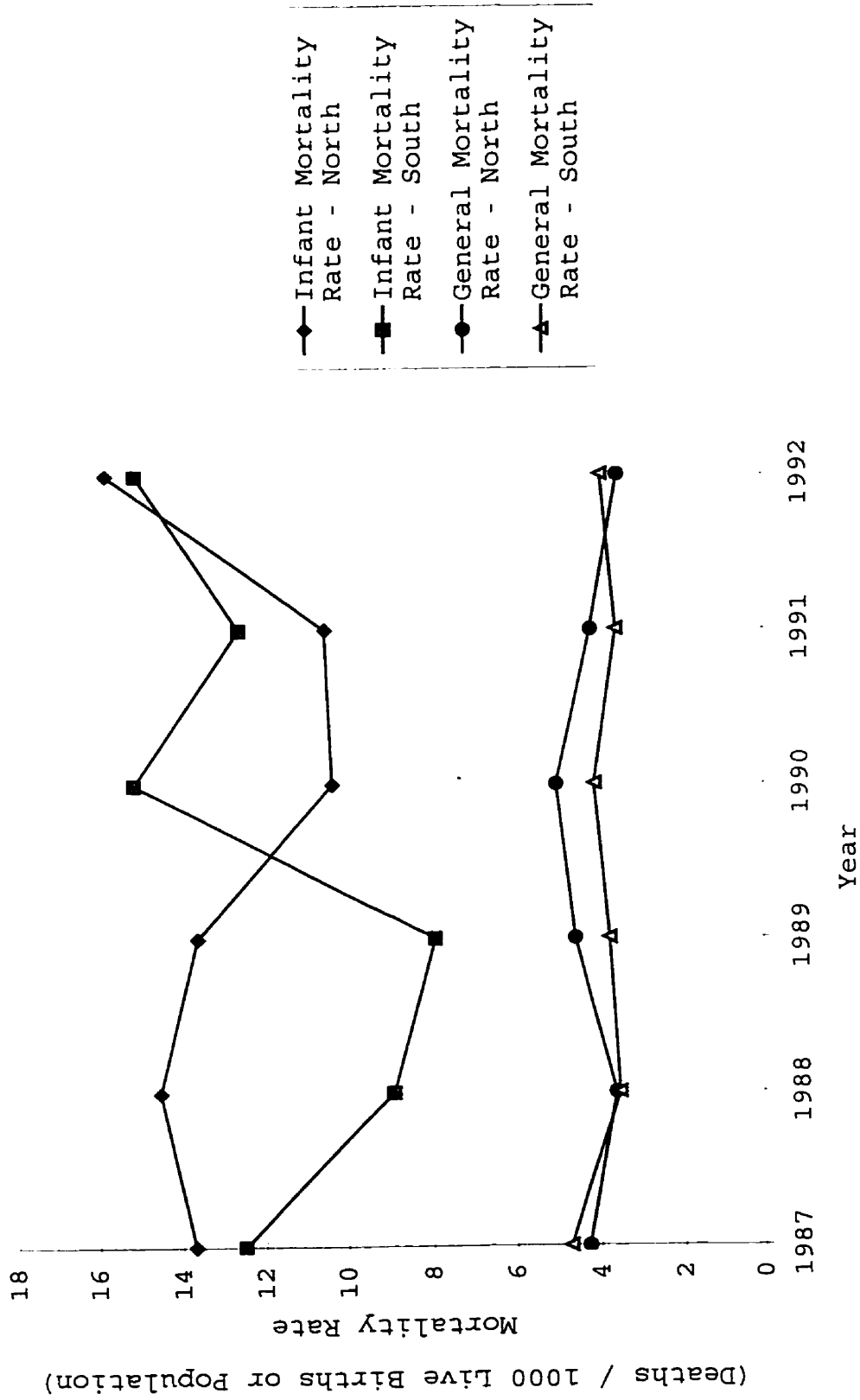


8 APPENDIX B: STUDIES OF HOSPITAL UTILIZATION IN CANADIAN INDIAN CHILDREN

Location	Date	Sex	Age (years*)	Relative Risk	Reference
British Columbia	1966-70	M&F	0 - 14	3 to 4	Robinson and Evans (1973)
Southern Ontario	1974-77	M&F	0 - 1 1 - 2	4.1 2.4	Evers and Rand (1982) Evers and Rand (1983)
Rainy River, Ontario	1975	M&F	0 - 4 5 - 14	6.9 2.4	Dixon (1976)
Blood Indians, Alberta	1984-87	M	< 1 1 - 4 5 - 14	3.59 3.53 1.78	Kashuba et al. (1994)
		F	< 1 1 - 4 5 - 14	4.5 3.83 2.15	
Saskatchewan	1985-86	M&F	< 1 1 - 4 5 - 14	8.3 3.6 2.3	Health Canada (1991)
Winnipeg, Manitoba	1990-91	M&F	< 10 10-17	1.5 - 2.6* 1.6 - 3.5*	Gudmundson (1993) ** 1st value - those living in suburbs; 2nd value - those living in core areas
Saskatchewan	1989-94	M&F	28 - 364 days 1 - 4 5 - 9	3 2.5 1.9	Saskatchewan Institute on Prevention of Handicaps (1997)

** - Gudmundson used hospital days rate; others used separation rates
* - unless specified as days

9 APPENDIX C: MORTALITY RATES - SASKATCHEWAN REGISTERED INDIANS



Source: Medical Services Branch, Health Canada. Vital Statistics

10 APPENDIX D: SASKATCHEWAN COVERED POPULATION & PROPORTIONAL DISTRIBUTION, 1992
BY REGION, GROUP, GENDER AND AGE GROUP

Region	Group	Sex	< 1 year		1 to 4 years		5 to 9 years		10 to 1 years		Total
			Number	% of Total*	Number	% of Total*	Number	% of Total*	Number	% of Total*	
North	Registered Indians	M	304	4.29	1155	16.29	1176	16.59	989	13.95	3624
		F	284	4.01	1116	15.74	1166	16.45	899	12.68	3465
		M&F	588	8.29	2271	32.03	2342	33.04	1888	26.63	7089
	Others	M	182	3.49	869	16.67	896	17.19	728	13.97	2675
		F	195	3.74	797	15.29	868	16.65	677	12.98	2537
		M&F	377	7.23	1666	31.96	1764	33.84	1405	26.96	5212
South	Registered Indians	M	833	4.07	3242	15.83	3489	17.04	2911	14.21	10475
		F	753	3.68	3110	15.19	3371	16.46	2770	13.53	10004
		M&F	1586	7.75	6352	31.02	6860	33.5	5681	27.74	20479
	Urban Others	M	3819	3.28	16830	14.47	20177	17.35	18628	16.02	59454
		F	3695	3.18	15852	13.63	19451	16.72	17863	15.36	56861
		M&F	7514	6.46	32682	28.09	39628	34.07	36491	31.37	116315
	Rural Others	M	2268	2.47	10883	11.86	16357	17.82	17735	19.33	47243
		F	2213	2.41	10426	11.36	15533	16.93	16356	17.82	44528
		M&F	4481	4.88	21309	23.22	31890	34.75	34091	37.15	91771

Total Reg. Indian	2174	8623	9202	7569	27568
Total Saskatchewan	14546	64280	82484	79556	240866

* % of Total = % of group total (male and female combined)

11 APPENDIX E: NORTHERN HEALTH SERVICES BRANCH AREA COVERED
POPULATION, 1992

1) Indian Bands In Northern Saskatchewan (Group A)

Band	Residence Code
Big C Band (Clearwater Dene First Nation)	74880
Canoe Lake Band	74680
Cumberland House Band	72582
English River Band	75180
Fond du Lac Band	75082
Hatchet Lake Band	72882
Lac La Ronge Band	72482
Montreal Lake Band	72682
Peter Ballantyne Band	72082
Buffalo River Band (Peter Pond Lake Band)	74780
Black Lake Band (Stony Rapids Band)	74982
Turnor Lake Band	74580

2) Communities in Northern Saskatchewan with Residence Codes
other than Indian Bands (Group B)

Community	Residence Code
Air Ronge	80470
Beauval	80370
Buffalo Narrows	80270
Camsell Portage	80170
Canoe Narrows	80371
Creighton	80530
Cumberland House	80570
Denare Beach	80571
Dillon	80271
Flin Flon/Creighton Unorg. area	80575
Fond du Lac	80172
Ile a la Crosse	80374
La Loche	80272
La Ronge	80430
Patuanak	80375
Pelican Narrows	80572
Pinehouse	80472
Sandy Bay	80573
Southend	80473
Stanley Mission	80474
Stony Rapids	80173
Sturgeon Landing	80574
Timber Bay	80475
Turnor Lake	80273
Uranium City	80175
Weyakwin	80471
Wollaston Lake	80174

12 APPENDIX F: SOUTHERN COVERED POPULATION, 1992

Communities Defined As Urban (Group Y)

Community	Code	Population
Estevan	005 28	10,536
Humboldt	370 30	5,177
Kindersley	290 30	4,826
Lloydminster	502 29	7,537
Melfort	428 20	6,040
Melville	214 21	4,983
Moose Jaw	161 20	34,130
Nipawin	487 30	4,571
North Battleford	437 21	13,692
Prince Albert	461 22	33,141
Regina	159 23	177,557
Saskatoon	344 24	184,255
Swift Current	137 25	15,415
Weyburn	067 26	9,897
Yorkton	244 27	15,520
Total		527,277

13 APPENDIX G: SAMPLING OF 1992 SASKATCHEWAN POPULATION

Region	Group	Sex	< 1 yr	Sampling Fraction	1-4 yr	Sampling Fraction	5-9 yr	Sampling Fraction	10-14 yr	Sampling Fraction
North	Registered Indian	Male	304	1	1155	1	1176	1	989	1
		Female	284	1	1116	1	1166	1	899	1
		Total	588	1	2271	1	2342	1	1888	1
	Others	Male	182	1	869	1	896	1	728	1
		Female	195	1	797	1	868	1	677	1
		Total	377	1	1666	1	1764	1	1405	1
South	Registered Indian	Male	833	1	3242	1	3489	1	2911	1
		Female	753	1	3110	1	3371	1	2770	1
		Total	1586	1	6352	1	6860	1	5681	1
	Urban	Male	764	0.2	1683	0.1	2018	0.1	1863	0.1
		Female	739	0.2	1585	0.1	1945	0.1	1786	0.1
		Total	1503	0.2	3268	0.1	3963	0.1	3649	0.1
Rural	Male	454	0.2	1088	0.1	1636	0.1	1774	0.1	
	Female	443	0.2	1043	0.1	1553	0.1	1636	0.1	
	Total	897	0.2	2131	0.1	3189	0.1	3410	0.1	
TOTALS			4951		15688		18118		16033	

TOTALS ALL GROUPS 54790

14 APPENDIX H:HOSPITAL SEPARATION RECORD DATA

1. Encryptic Personal Health Number
2. Study Group:
Code Description
 - 11 Status Indian registered in northern* Saskatchewan (Group A)
 - 12 Status Indian registered in southern** Saskatchewan (Group C)
 - 13 Northern* Saskatchewan resident who is not Status Indian (Group B)
 - 20 Rural southern** Saskatchewan resident who is not a Status Indian(Group X)
 - 30 Urban southern** Saskatchewan resident who is not a Status Indian(Group Y)
3. Date of Birth: YYYYmm
4. Age group at hospital separation: (under 1, 1-4, 5-9 and 10-14)
5. Sex:
 1. Male
 2. Female
6. Saskatchewan Health Code for Place of Residence
7. Postal Code for address of patient
8. Saskatchewan Health Code for Hospital
9. Saskatchewan Health Code for Location of Hospital (province/country)
10. Date of Hospital Admission: yymmdd
11. Date of Discharge, Transfer to another Hospital, or Death: yymmdd
12. Diagnosis: ICD9 code for primary, secondary and tertiary diagnosis (Nature)
13. Diagnosis: ICD9 code for primary, secondary and tertiary diagnosis (external)
14. Diagnosis: ICD-9 code for supplementary classification (v-code)
15. Diagnosis: Canadian List Number for primary, secondary and tertiary diagnosis

16. Procedural code (CCP): primary, secondary and tertiary
 1. Medical
 2. Without medical authorization
 3. Death with autopsy
 4. Death without autopsy
 5. Transferred to another hospital
 6. Transferred to a geriatric center
 7. Transferred to a nursing home
 9. Other

18. If hospitalization outcome is # 5 (Transfer to another hospital):
 1. the Saskatchewan Health code of hospital transferred from;
 2. the Saskatchewan Health code of hospital transferred to.

* The names of the northern Saskatchewan communities and their residence codes are shown in Appendix E.

** Any Saskatchewan community that is not included in the table in Appendix E is considered to belong to southern Saskatchewan. See Appendix A: Map of Health Regions in Saskatchewan

15 APPENDIX I: THE INDEX FOR PEDIATRIC AMBULATORY CARE
SENSITIVE CONDITIONS

Pediatric Ambulatory Care Sensitive (PACS) diagnoses are conditions in children for which risk of hospitalization could be reduced through timely and effective outpatient care by either preventing the onset of an illness or condition, controlling an acute episodic illness or condition or managing a chronic disease or condition. It is an indicator which has been modified from the original work of Billings et al (1993) to have more specificity for a pediatric population and to suite the coding systems used in Saskatchewan. Billings' ACS, Weissman et al.'s AHC, and Manitoba's ASH condition indicators use the five digit ICD-9 CM coding for the diagnosis and ACS uses ICD-9 CM for the procedures. Saskatchewan Health utilizes the four digit ICD-9 coding for diagnosis and CCP coding for procedures (Statistics Canada). Conversion between the two forms of coding is straightforward though there are slight differences for the some of the hypertension, congestive heart failure and diabetic conditions.

Alterations of the ACS conditions were made to develop a list of "Pediatric Ambulatory Care Sensitive" or PACS conditions which would be suited to the variables available through Saskatchewan Health. The criteria used in the altering Billings' list of ACS conditions was that they were conditions in children for which risk of hospitalization

could be reduced through timely and effective outpatient care. Some of the differences included:

- 1) greater emphasis placed on immunizable conditions with some alterations in the qualifications of these conditions. (for example, an immunizable condition was considered as a PACS condition over the age recommended by Saskatchewan Health for immunization and hospitalizations occurring as a result of adverse effects of immunizations were not included);
- 2) greater emphasis on infections and infestations of the skin (for example, impetigo and pediculosis, scabies and phthirus infestations as primary diagnoses were added);
- 3) greater emphasis on ENT (ear, nose, and throat) infections and complications (for example, infective otitis externa, mastoiditis, peritonsillar abscesses, streptococcal sore throat and scarlet fever and cholesteatoma were added); and
- 4) deleting those conditions which were recognized as ACS conditions in adults but for which outpatient care was less likely to reduce hospitalization in children (for example, congestive heart failure, hypertension, chronic obstructive pulmonary disease and angina).

16 APPENDIX J: AMBULATORY CARE SENSITIVE CONDITIONS
COMPARISON

General (Billings)	Pediatric
Congenital syphilis	Same
Immunization-related/ preventable	Some additions
Grand mal/epileptic convulsions	Same
Severe ENT infections	Some additions
Pulmonary tuberculosis	Same
Other tuberculosis	Same
COPD	Not included
Bacterial pneumonia	Same with minor change
Asthma	Same
Congestive heart failure	Not included
Hypertension	Not included
Angina	Not included
Cellulitis	Some additions
Diabetes	Same, though minor coding changes
Hypoglycemia	Same
Gastroenteritis	Same
Kidney/urinary infection	Same though one aspect not included
Rehydration/volume depletion	Same
Iron deficiency anemia	Same
Nutritional deficiencies	Same
Failure to thrive	Same
Pelvic inflammatory disease	Not included
Dental conditions	Same

17 APPENDIX K: INDICATORS FOR HOSPITALIZATIONS POTENTIALLY PREVENTABLE BY AMBULATORY CARE

Billings' "Ambulatory Care Sensitive" Conditions
Condition & ICD-9 CM Code(s)

Pediatric "Ambulatory Care Sensitive"
Conditions, ICD-9 Code(s) & CCProcedures Code
Modified from Billings

CONGENITAL SYPHILIS [090]
(secondary diagnosis for newborns only)

Same

IMMUNIZATION-RELATED & PREVENTABLE CONDITIONS
033: whooping cough

Add whooping cough > 3 months of age &
whooping cough as a principal or
secondary diagnosis¹

037: tetanus
045: polio
320.0: Haemophilus meningitis (under 5 yrs)
390: Rheumatic fever without heart involvement
391: Rheumatic fever with heart involvement

Add diphtheria [032]²

Add acute epiglottitis < 5 yrs. ³

Add measles [055], mumps [072] & rubella [056]
over 1 yr⁴
Exclude adverse effects from bacterial
vaccines [E948] & other vaccines &
biological substances [E949]⁵

GRAND MAL/EPILEPTIC CONVULSIONS
345: epilepsy
780.3: convulsions

Same

SEVERE ENT INFECTIONS
382: suppurative & unspecified otitis media
Excludes otitis media cases [382] with
myringotomy with insertion of tube [20.01]

Excludes otitis media cases [382] with
myringotomy with insertion of tube
[32.01]

Add infective otitis externa [380.1],
mastoiditis & related conditions [383]
other than complications following
mastoidectomy [383.3]

462: acute pharyngitis	Add cholesteatoma of middle ear & mastoid [385.3]
463: acute tonsillitis	Add otorrhea [388.6]
465: acute URTI of multiple or unspecified sites	Add streptococcal sore throat & scarlet fever [034]
472.1: chronic pharyngitis	Add peritonsillar abscess [475]
PULMONARY TUBERCULOSIS (TB) [011]	Same
OTHER TUBERCULOSIS	Same
012: other respiratory TB	
013: TB meninges & central nervous system	
014: TB intestines, peritoneum, & mesenteric glands	
015: TB bones & joints	
016: TB genitourinary system	
017: TB of other organs	
018: miliary TB	
CHRONIC OBSTRUCTIVE PULMONARY DISEASE	Not included
491: chronic bronchitis	
492: emphysema	
494: bronchiectasis	
496: chronic airway obstruction not elsewhere specified	
466.0: acute bronchitis (to be included only if secondary diagnosis of 491, 492, 494, 496)	
BACTERIAL PNEUMONIA (excludes cases with secondary diagnosis of sickle cell [282.6] & patients < 2 months)	Same except no exclusion of sickle cell ⁶ and add bronchopneumonia, organism unspecified [485] & pneumonia, organism unspecified [486] ⁷
481: pneumococcal	
482.2: Haemophilus influenza	
482.3: streptococcal	
482.9: bacterial unspecified	
483: other organism (Eaton's agent, mycoplasma, PPLO)	
485: bronchopneumonia unspecified	
486: pneumonia unspecified	
ASTHMA [493]	Same

CONGESTIVE HEART FAILURE (CHF)

Not included

(exclude cases with the following surgical procedures:

- 36.01, 36.02, 36.05, 36.1, 37.5, or 37.7)
- 428: heart failure
- 402.01: malignant hypertensive (HT) heart disease with CHF
- 402.11: benign HT heart disease with CHF
- 402.91: unspecified HT heart disease with CHF
- 518.4: acute edema of lung unspecified

HYPERTENSION (HT)

Not included

(exclude cases with the following procedures:

- 36.01, 36.02, 36.05, 36.1, 37.5, or 37.7)
- 401.0: malignant essential HT
- 401.9: unspecified malignant HT
- 402.00: malignant HT without CHF
- 402.10: benign HT heart disease without CHF
- 402.90: unspecified HT heart disease without CHF

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ANGINA

Not included

(exclude cases with a surgical procedure {01-86.99}

- 411.1: intermediate coronary syndrome
- 411.8: other coronary occlusion without myocardial infarction
- 413: angina pectoris

CELLULITIS

(exclude cases with a surgical procedure [01-86.99], except incision of skin & subcutaneous tissue [86.0] where it is the only listed surgical procedure)

Exclude cases with a surgical procedure [14-99] except incision with drainage of skin & subcutaneous tissue [98.03] where it is the only listed surgical procedure
Add carbuncle & furuncle [680]⁸

- 681: cellulitis & abscess of finger & toe
- 682: other cellulitis & abscess
- 683: acute lymphadenitis

Add impetigo [684] as principal diagnosis⁹

- 686: other local infections of skin & subcutaneous tissue

Add as principal diagnosis: pediculosis & phthirus infestations [132] & scabies [133.0]¹⁰

DIABETES

250.1: diabetes with ketoacidosis
 250.2: diabetes with hyperosmolarity

 250.3: diabetes with other coma
 (includes insulin, ketoacidosis, hypoglycemia)

250.1: diabetes with ketoacidosis without coma
 250.2: diabetes with coma (hyperosmolar
 ketoacidosis)

HYPOGLYCEMIA

251.2: hypoglycemia unspecified

251.0: hyperglycemic coma (includes insulin)

GASTROENTERITIS

558.9: Other & unspecified noninfectious
 gastroenteritis & colitis

Same

KIDNEY/URINARY INFECTION

590: infections of kidney
 599.0: urinary tract, site not specified
 599.9: unspecified disorder of urethra &
 urinary tract ----->

Same

Not included

DEHYDRATION/VOLUME DEPLETION

(examine principal and secondary diagnosis
 separately)
 276.5: Volume depletion

Same

IRON DEFICIENCY ANEMIA

(age 0-5 only, examining principal and secondary
 diagnosis separately)
 280.1: secondary to inadequate dietary iron intake
 blood loss)
 280.8: other specified iron deficiency anemias
 280.9: iron deficiency anemia, unspecified

280: (same as 280.1, 280.8, 280.9 plus chronic

NUTRITIONAL DEFICIENCIES

(examine principal and secondary diagnosis
 separately)
 260: kwashiorkor
 261: nutritional marasmus
 262: other severe protein-calorie malnutrition
 268.0: rickets, active
 268.1: rickets, late effect

Same

Same

FAILURE TO THRIVE
(Age <1 only)
783.4: lack of expected normal physiological
development

PELVIC INFLAMMATORY DISEASE

(Women only denominator - excludes cases with a
surgical procedure of hysterectomy [68.3-68.8])
614: inflammatory disease of ovary, fallopian tube,
pelvic cellular tissue, & peritoneum

Not included

DENTAL CONDITIONS

521: diseases of hard tissues of teeth
522: diseases of pulp & periapical tissues
523: gingival & periodontal diseases
525: other diseases & conditions of the teeth &
supporting structures

Same

- ¹ First immunization for whooping cough due at 2 months of age with lag time for effectiveness. Secondary diagnosis added to catch complications of whooping cough e.g. pneumonia.
- ² Included in Weissman et al.'s Avoidable Hospital Conditions
- ³ The major cause of acute epiglottitis in children & adults is *H. influenza* type b. (Scientific American Medicine, 7; XIX:9)
- ⁴ Measles, mumps, & rubella are immunizable diseases with immunizations scheduled at 12 months in Saskatchewan. Measles and mumps were also included for Weissman et al.'s Avoidable Hospital Conditions.
- ⁵ Excludes complications of immunizations.
- ⁶ Pneumococcal & Hemophilus vaccines are available as well as potential for chemoprophylaxis.
- ⁷ Included in Weismann's Avoidable Hospital Conditions
- ⁸ Includes boils, carbuncles, & furunculosis which can often be treated through early ambulatory care.
- ⁹ Treatable through early ambulatory care.
- ¹⁰ Treatment readily available through ambulatory care.

18 APPENDIX L: ABSOLUTE NUMBER OF EPISODES OF PACS CONDITIONS BY SUBTYPE

ACS TYPE	ACS Subtype	North Reg Indian	South Reg Indian	North Other	South Rural	South Urban
Immunization preventable		3	14	0	1	3
	Whooping cough	2	8		1	2
	Haem. meningitis	1				1
	Rheumatic fever		1			
	Measles		1			
	Mumps		3			
	Rubella		1			
Convulsions		24	89	18	18	25
	Epilepsy	4	21	2	4	3
	Convulsions	20	68	16	14	22
ENT Infections		168	802	76	73	74
	Supp otitis media.	66	260	21	20	18
	Mastoiditis		1	1		
	Cholesteatoma	4		1	2	
	Otorrhea		6			1
	Pharyng., str. throat & scarlet fever	3	78	3	8	4
	Acute tonsillitis	10	109	12	16	11
	Peritonsillar abscess	1	12	2	1	
	Acute URTI	84	336	36	26	40
	Chronic pharyngitis					
TB		1	10	1	0	0
	Pulmonary TB	1	8	1		
	Other TB		2			

Continued

Appendix L: Continued

ACS TYPE	ACS Subtype	North Reg Indian	South Reg Indian	North Other	South Rural	South Urban
Bacterial pneumonia		295	885	135	44	54
	Pneumococcal	2	26	1	1	3
	Haem. influenza	4	17	0	0	2
	Streptococcal		3	1	1	
	Bacterial unspecified		1	1		
	Other					
	Bronchopneumonia	96	477	80	14	21
	Pneumonia unspecified	192	361	52	28	28
Asthma		161	366	33	60	85
Cellulitis		24	108	10	11	8
	Cellulitis digits	1	3			
	Other cell/abscess	13	48	5	8	7
	Other infections skin		8	2	1	1
	Carbuncle/faruncle	1				
	Impetigo	9	41	1	2	
	Pediculosis/scabies		8	2		
Diabetes		1	1	1	3	2
	Diabetic ketoacidosis		1	1	1	2
	Hypoglycemia				2	
Gastroenteritis		91	681	38	79	80
Kidney & urinary infections		25	89	11	17	20
	Kidney infection	2	16	2	3	3
	Urinary infection	23	73	9	14	17
Dehydration		21	42	2	2	13
	Primary diagnosis		6	1		2
	Secondary diagnosis	21	36	1	2	11

Continued

Appendix L: Continued

ACS TYPE	ACS Subtype	North Reg Indian	South Reg Indian	North Other	South Rural	South Urban
Iron deficiency		13	62	5	2	4
anemia	Primary diagnosis	1	16	1		1
	Secondary diagnosis	12	46	4	2	3
Nutritional		1	0	0	0	0
deficiency	Primary prot/cal maln	1				
Failure thrive		9	8	2	0	5
Dental		43	56	59	4	3
conditions	Disease hard tissues	36	38	55	4	2
	Pulp/periapical	5	11	3		1
	Gingival/periodontal	2	7	1		
NON-ACS Conditions		1028	3631	551	688	781
TOTAL		1908	6844	942	1002	1157

NIL:

tetanus, polio, epiglottitis, diphtheria

infectious otitis externa

other resp TB, TB meningitis, TB intestine, TB bones, TB GU, miliary TB

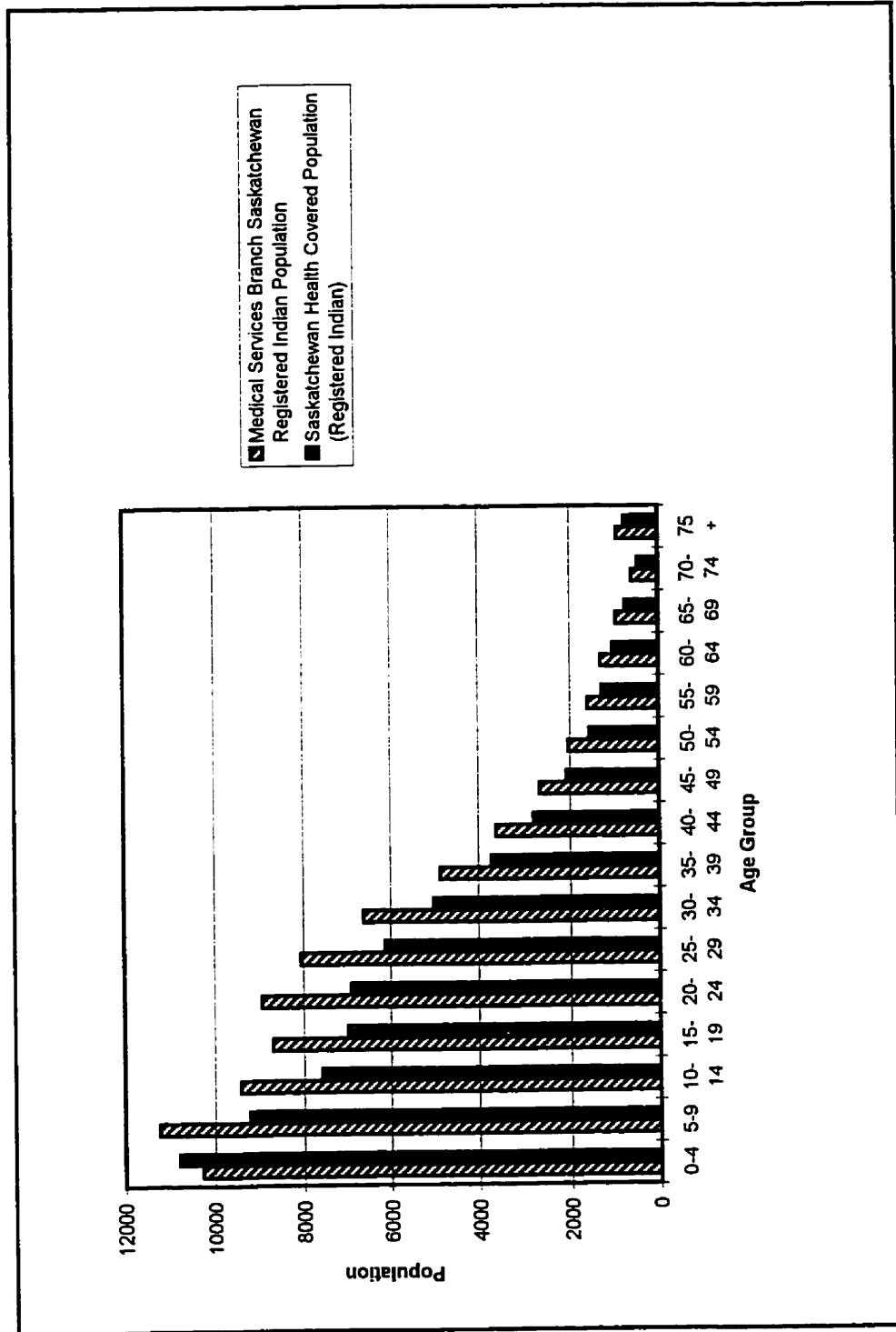
acute lymphadenitis

diabetes with coma

kwashiorkor, marasmus, rickets

Other diseases & conditions of teeth & supporting structures

19 APPENDIX M: COMPARISON OF SASKATCHEWAN HEALTH AND MEDICAL SERVICES BRANCH
 POPULATION NUMBERS FOR SASKATCHEWAN REGISTERED INDIANS - 1992



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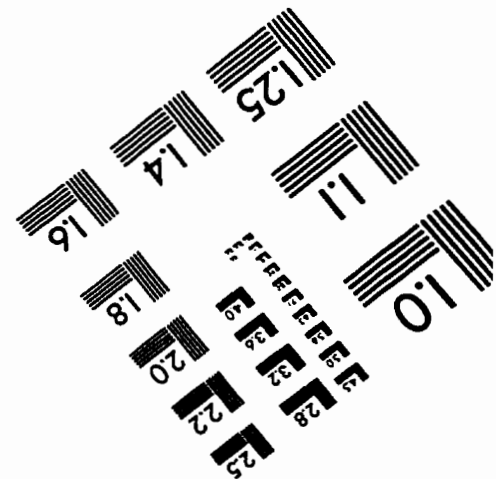
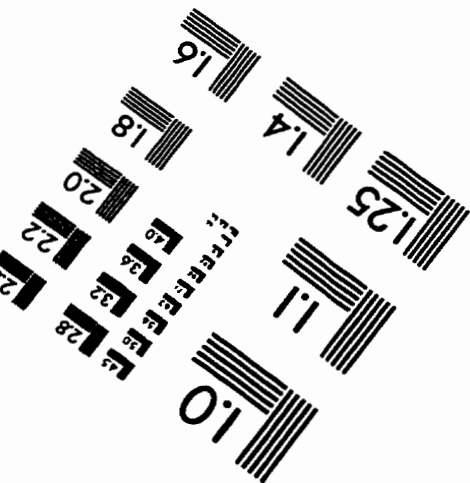
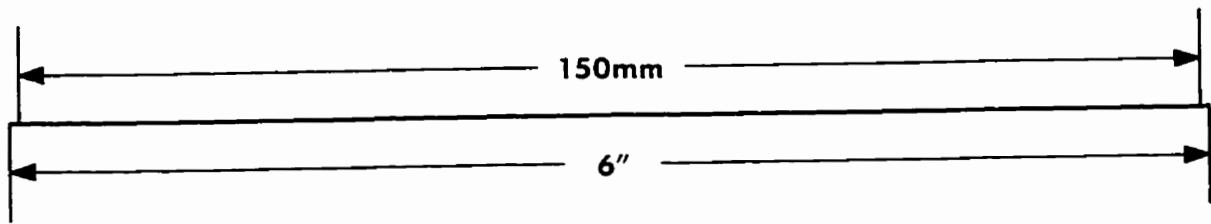
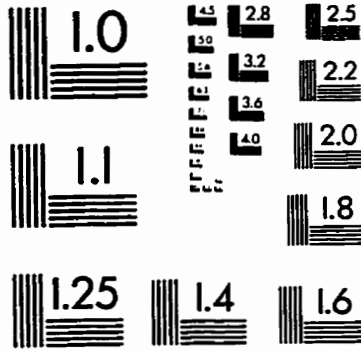
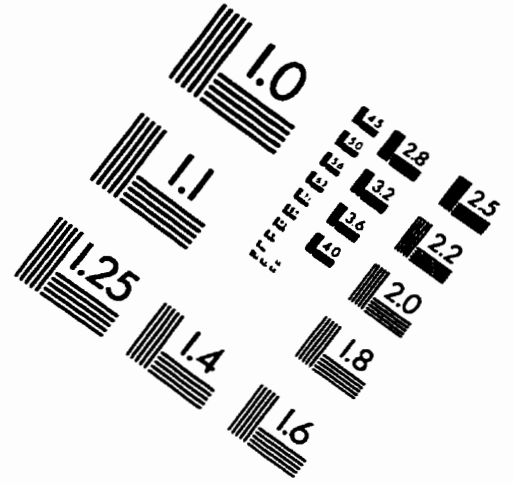
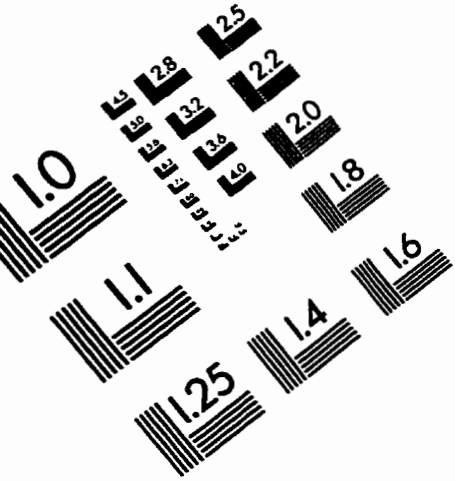
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