THE STUDY OF OBSTETRIC HOSPITALIZATION RATES OF NORTHERN SASKATCHEWAN WOMEN AND SASKATCHEWAN REGISTERED INDIAN WOMEN IN 1992/93

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By

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ABSTRACT

The purpose of this study was to describe the obstetric hospitalization rates of northern and registered Indian women from April 1, 1992 to March 30, 1993 and to compare them with those of southern rural women in Saskatchewan.

Saskatchewan Health provided hospital separation data for 100% of northern and registered Indian women and for a 10% sample of southern rural and southern urban women hospitalized with obstetric diagnoses and procedures in 1992/93.

The crude, age-specific, and age-standardized hospitalization rates were based on the number of women of reproductive age or the number of deliveries or pregnancies. The average length of stay and hospital location were examined. Crude and age-adjusted odds ratios with 95% confidence intervals and chi-square tests were used to compare rates with southern rural women as the reference group. One-way analysis of variance was used to compare the average length of stay for obstetric episodes among study groups.

The rate of obstetric episodes per 100 pregnancies were only 5 to 18% higher for northern women and southern registered Indian women. Northern and registered Indian women had higher rates for deliveries per 1,000 women, for ectopic pregnancies per 1,000 pregnancies, and for antenatal episodes with diabetes or abnormal glucose or with urinary tract infections per 100 pregnancies and lower rates of deliveries with cesarean sections, instrument use and episiotomy. Northern women had higher rates for deliveries with fetal and placental problems and for vaginal birth after cesarean section per

100 deliveries, and lower rates of antenatal episodes with hyperemesis per 100 pregnancies. All registered Indian women had lower rates of labour and delivery complications per 100 pregnancies. The average length of stay for obstetric episodes was similar for all study groups. Over 35% of northern women delivered in northern hospitals.

The results support continued northern obstetric practice and provide a baseline for evaluation of health transfer and renewal for northern tribal councils and health districts. The high fertility rates among northern and registered Indian women warrant a high priority on obstetric services, hospital facilities, prenatal care and postnatal care that are age and culture sensitive.

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I would like to acknowledge and thank Saskatchewan Health for providing the data for this study. The responsibility for the results and conclusions is mine.

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I would like to acknowledge the Research and Development Committee of Northern Medical Services, a unit in the University of Saskatchewan Department of Family Medicine. The committee, which included representation from northern communities and agencies providing health care services, conceived the idea for the Study of Hospitalization Trends in Northern Saskatchewan Residents and Saskatchewan Registered Indians, from which this study originated. I also thank members of the committee who provided input early in the development of my study.

DEDICATION

This work is dedicated to Jim, Aaron, Erica and Jonathan and the rest of my family for their love and support

and to the women of northern Saskatchewan.

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1. INTRODUCTION

1.1. Nomenclature

Most Indian bands in Saskatchewan now refer to themselves and are referred to by others as "First Nations". However, the term "registered Indians" has been used in this thesis because it was the term used in 1992 to refer to people who had identified themselves to Saskatchewan Health as being registered members of an Indian band, under provisions of the federal Indian Act. Saskatchewan Health's registry of persons eligible for health services benefits distinguishes between registered Indians and other Saskatchewan residents because the federal government is responsible for funding most health services for registered Indians.

First Nations make up more than half of the population of northern Saskatchewan. All northern Saskatchewan people who are not identified as members of a First Nation in the hospitalization data, including aboriginal people without treaty status, Métis and people of other races, are referred to as "northern other than registered Indian" in this study.

1.2. The Problem

Pregnancy results in more hospitalizations for Saskatchewan women than any other condition. In 1992 there were 14,951 births in Saskatchewan, including 772 births in the northern half of the province, the region covered by Northern Health Services Branch (NHSB) of Saskatchewan Health.[1] Complications for pregnancy,

childbirth, and the puerperium accounted for 10.5% of total hospital separations for Saskatchewan residents in 1992/93. Obstetric procedures were the leading category of procedures done in the same year, accounting for over 20% of inpatient surgical procedures for Saskatchewan residents. [2]

Complications of pregnancy, childbirth and the puerperium have important consequences for pregnancy outcome, children's health, women's health, as well as contributing largely to the population burden of illness in terms of health care costs.

Since most births in Saskatchewan take place in hospital and many serious pregnancy complications result in hospitalization, analysis of hospitalization data provides useful information about pregnancy outcome, interventions in labour and delivery and the rates of pregnancy complications in the population.

Mortality statistics have shown inequities in health status in registered Indians and northern residents[3,4,5,6,7] but variations in morbidity have not been well documented. Analysis of obstetric hospitalization data by age, residence location, and treaty status will provide information about which obstetric complications are the most common and what population groups are associated with higher risks of complications.[8]

1.3. Purpose of the Study

The purpose of the study was to explore and describe the obstetric hospitalization rates of northern Saskatchewan and Saskatchewan registered Indian women from April 1, 1992 to March 30, 1993 and to compare them with those of the southern rural population. Hospitalization for obstetric diagnoses include hospitalizations for normal delivery plus hospitalizations for complications of pregnancy, childbirth and the puerperium.

1.4. Relevance and Significance

Through the process of health renewal in Saskatchewan, the responsibility for health care organization and delivery is being transferred to health district boards. The federal government is also transferring health care responsibility to tribal councils and bands. Increasing emphasis is placed on community-based care. Knowledge of obstetric hospitalization use will be important for the districts, tribal councils and bands in the planning and evaluation of both community and hospital services for pregnant women.

Knowledge of obstetric hospital use may suggest changes for more appropriate health care facilities, equipment, personnel and location of service. There are implications for access to care, road and air ambulance services, professional education, early discharge and postnatal programs, the need for coordination and strong referral mechanisms, and appropriate prenatal care and education.

The information from this one year study will provide a basis for evaluating the trends of hospital use and the impact of health reform measures in meeting women's obstetric needs.

2. REVIEW OF THE LITERATURE

2.1. Maternal Mortality

Previous studies have examined pregnancy outcome using mortality indicators. Maternal deaths are those directly or indirectly related to pregnancy or delivery. Maternal mortality declined dramatically in Canada from 56.2/10,000 live births in 1936 to 0.2/10,000 live births in 1990.[9] This reduction has been attributed to a general improvement in women's health and to better medical care, including early transfer of women at high risk to referral centres. In the past, the maternal mortality rate has been higher in registered Indian women than in the general population.[10] Medical Services reported a five-year average rate for registered Indian women of 18.0 maternal deaths per 100,000 live births (or 1.8 maternal deaths per 10,000 live births), five times the Canadian average rate of 3.6 (or 0.36 maternal deaths per 10,000 live births), during the years 1984 to 1988.[11] Among Saskatchewan women, there were ten deaths during pregnancy from 1987 through 1992. Three were considered to be maternal deaths due to pregnancy complications (postpartum hemorrhage, HELLP syndrome*, and an amniotic fluid embolism)[12,13,14,15,16,17].

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* HELLP (Hemolysis, Elevated Liver enzymes, Low Platelet count) syndrome is a variant of severe pre-eclampsia and is associated with high perinatal and maternal mortality.

The health of mothers during pregnancy is one of many factors that profoundly affect the health of their offspring from infancy to adulthood.[18] Neonatal and infant mortality rates have fallen over the last few years in all areas of the province. The rates of low birth weight and neonatal death are now similar for northern and southern Saskatchewan and for Saskatchewan registered Indian women and the total Saskatchewan population. The narrowing of the gap in low birth weight and neonatal death rates has been attributed to receiving better prenatal care and medical care during birth. Although improvements in medical care have been associated with reducing perinatal death rates, they have had less effect on lowering the rates of infant deaths; discrepancies in the stillbirth and infant death rates still remain between north and south and between registered Indians and the total population, with the largest rates occurring in registered Indians living on reserves.[3,5,7] These rates may reflect community social and environmental conditions. There have been no studies that have looked at rates in registered Indians by residence in the northern or southern part of the province.

2.2. Hospitalization Studies

Hospitalization data contain codes for diagnoses that at the time of separation contributed to the greatest length of the hospital stay. Separation diagnoses provide more accurate information about morbidity than admitting diagnoses would since they are made following diagnostic tests, procedures and other events occurring during the course of the hospital stay.

Morbidity data provide different information on health status than is reflected by mortality data. Hospital morbidity rates reflect the frequency, length and reasons for hospital care.[19] The main causes of

obstetric hospitalization are among the main causes of maternal morbidity and mortality.[8,9,10]

However, there are many factors besides health status which influence hospitalization rates, including availability of and accessibility to hospital, ambulatory, home and other forms of care. Hospitalization rates vary by age group, race, geographic area, and physician threshold for admission.[8,20,21,22] The changing intensity of hospital use over time and between rural and urban areas, as well as changing technology, cost, quality of care and case complexity affect the comparability of hospital data over time and place.[23]

Hospital data in Saskatchewan contain a limited amount of epidemiological information on age, registered Indian status, and residence but additional data would be needed to explain differences in rates or associate them with factors such as socioeconomic status, level of education, previous illness, severity of illness, lifestyle, ambulatory care, community health services or criteria for admission.[22,24]

Data analysis in large hospitalization studies is usually done by stratifying and creating cross-tabulations and determining rates and proportions. In studies with sufficient numbers, e.g., 24,500 births[25], 1,700,000 hospitalizations[8], tests of statistical significance using chi-square or relative ratios with 95% confidence intervals were performed. When dealing with small numbers, it is usually not possible to show statistically significant differences. Annual rates fluctuate greatly and small errors in diagnostic classifications or denominators can dramatically change the rates. One has to use caution then in interpreting the rates and comparing them in different populations.[26]

2.3. Maternal Hospital Morbidity

Hospitalizations for obstetric delivery and complications of pregnancy, childbirth and the puerperium account for a large proportion of hospital use, but there have been few studies that have looked at specific complications or procedural interventions.

Small studies of referral patterns, obstetric complications, and rates of intervention in labour in small rural practices or northern communities have used obstetric chart reviews [26,27] or have had problems with small numbers,[28] which makes generalization or interpretation of the results difficult.

Studies of pregnancy complications are usually based on the number of deliveries, live births, pregnancies or women of reproductive age. Reported conceptions or pregnancies have been defined as: live births, still births, legally induced abortion and ectopic pregnancies (Canada)[24]; deliveries, spontaneous abortion, legally induced abortion and ectopic pregnancies (Sweden)[29]; live births, legally induced abortion and ectopic pregnancies (USA)[30]; live births and legally induced abortions (Greenland)[31]; and live births, still births, spontaneous and legally induced abortions, and ectopic pregnancies, i.e. all pregnancies presenting to a hospital for care (Manitoba)[32]. Rates based on the number of pregnancies allow comparisons of pregnancy complications between groups that take into consideration differences in the pregnancy rates. Rates based on the number of women of all ages provide an indication of the health burden of pregnancy complications on the population in general.

Most studies of maternal hospital morbidity have examined rates of all obstetric diagnoses or procedures combined or focused on groups of diagnoses, ectopic pregnancy, or cesarean section.

The results of studies of obstetric hospitalization available to the author are reviewed in the remainder of this section.

Obstetric Hospitalization For All Causes Combined

In 1981/82 in Manitoba, the rate of hospitalization for complications of pregnancy per Manitoba resident was almost 4 times greater in registered Indian women than in the general population.[6] In 1984-87 in Alberta, Blood Indian women had an age-adjusted separation rate of 2130.52 per 100,000 women for diagnoses grouped as Other Complications Related To Pregnancy (Canadian Diagnostic List Number 148), that was 2.31 times greater than that of other Alberta women (922.14 per 100,000 women). The latter rate does not take into account varying pregnancy rates among the Blood Tribe and the rest of Alberta[33]. Similarly, Medical Services Branch of Health and Welfare Canada compared the separation rate for Complications of Pregnancy, Childbirth and the Puerperium (ICD9 chapter XI) between Saskatchewan registered Indians, 1987-88, and all Saskatchewan residents, 1984-85. The rate for registered Indians was 129.3 per 1,000 population (males and females of all ages) which was 2.5 times greater than that of all Saskatchewan residents combined (51.6 separations per 1,000 population)[11]. All of these rates reflect the higher pregnancy rate among First Nations and the overall health burden among these populations for pregnancy complications, but one cannot draw conclusions from them about the rate of complications per pregnancy.

Franks, et al, studied hospitalization for pregnancy complications in the United States, using National Hospital Discharge Survey data for a two year period, 1986-87. They found there were 22.2 nondelivery hospitalizations for pregnancy complications related to either antenatal or pregnancy loss complications for every 100 deliveries. Black women were noted to have a 40% higher ratio of hospitalizations for antenatal complications or pregnancy loss per 100 deliveries than white women and had longer stays per admission.[8] This is in contrast to the

experience of registered Indian women in Saskatchewan who had higher hospitalization rates for all causes combined but who spent fewer days in hospital with each admission than the provincial population as a whole, in the fiscal year 1985/86.[23]

In a study of the prevalence and indications for antenatal hospitalization among enlisted servicewomen in the United States who delivered live and stillborn infants in the period, 1987-90, Adams, et al, found that 26.8% of the women were hospitalized antenatally[34]. Antenatal hospitalizations included those that ended in a delivery if they lasted at least three days and excluded those with less than 20 weeks gestation and multiple pregnancies. The women were all usually healthy and received care at one of the four largest army medical centres in the United States.

Although the results from these studies cannot be compared with this study, they all show that antenatal complications contribute a substantial burden of illness despite access to and use of prenatal care.[34]

Complications of pregnancy, childbirth and the puerperium accounted for 10.5% of hospital separations for all Saskatchewan residents in 1992/93. Saskatchewan Health analyzes the annual hospitalization data for the Canadian List Diagnostic group of "Complications Of Pregnancy, Childbirth And The Puerperium" and the individual Canadian Diagnostic List Numbers 142 through 151 by the number of separations, the rate of separations per 1,000 covered*, the number of patient days in hospital, the rate of hospital patient days per 1,000 covered*, and the average days' stay for those hospitalized.[2] Analyses based on the number of women of reproductive age, treaty status, geographic location or pregnancy outcome are not reported.

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* includes all Saskatchewan residents registered with Saskatchewan Health for hospitalization insurance benefits

Analysis of obstetric procedures is based on the Canadian Classification of Procedures chapter using the same rates as for analysis of diagnostic chapters. More detailed analysis would determine if obstetric hospital use for northern residents or registered Indian women differs from the rest of the population and would give a picture of differences in specific complications experienced.

Ectopic Pregnancy

Hospitalization rates for ectopic pregnancy, for which nearly all cases are hospitalized, can be used to estimate the incidence in the population. The rates for ectopic pregnancy in Canada steadily increased over the period of 1971-1980. During that time there were 16 deaths attributed to ectopic pregnancy, which was the single most important cause of maternal death in the first trimester. The increasing trend corresponded to increasing rates of sexually transmitted disease and of hospitalization for pelvic inflammatory disease.[24]

Other studies have shown the ectopic pregnancy rates both per population and per pregnancy steadily increased during the 1970's and 1980's [29,30,31,32].

In 1980, the incidence of ectopic pregnancy in Canada was 9.3 per 1,000 reported pregnancies (live births, stillbirths, legal abortions, and ectopic pregnancies), with the highest age-specific rates being in the 35 to 44 year group (18.3 per 1,000 reported pregnancies)[24].

Nymann and Elving reported the highest age-standardized rate of ectopic pregnancy, which rose from 20.8 per 1,000 pregnancies (live births and induced abortions) in 1981 to 45.1 per 1,000 pregnancies in 1990 in Greenland[31]. In addition to geographic similarities between Greenland and northern Saskatchewan, they both have predominately indigenous populations living in isolated communities with similar social conditions, including high rates of sexually transmitted diseases.

In a study on the patterns of obstetric utilization in Manitoba, 1981-1989, Mustard, Barer, and Sheps, also showed an increase in the number of ectopic pregnancies between the two years with 9.1 ectopic pregnancies per 1,000 documented pregnancies (173/19077) in 1981 and 14.7 ectopic pregnancies per 1,000 documented pregnancies (324/22094) in 1989[32]. Native women had a higher ectopic pregnancy rate (15.5/1,000 pregnancies) compared to non-Native women (14.6/1,000 pregnancies). Documented pregnancies included all those pregnancies presenting to a hospital for care, i.e., spontaneous abortion, induced abortion, ectopic pregnancy, live births and still births.

Labour And Delivery Intervention

The rates of obstetric procedural interventions in labour and delivery are usually based on the number of deliveries or live births.

The rate of cesarean section deliveries increased significantly in Canada from 1970 to the mid-1980's, when the increase began to slow or level off in all provinces. In a study of trends in cesarean section deliveries in Canada from 1970 to 1988/89, Nair selected cesarean sections based on CCP codes 860-2, 868, 869 in any of the first three procedural fields. In Canada, the cesarean section rate had increased from 5.21 cesarean sections per 100 deliveries in 1970 to 19.56 in 1988/89, with a peak rate of 19.60 in 1987/88. In all years, the rate of cesarean sections per 100 deliveries increased with maternal age. The rate of vaginal birth after cesarean delivery also increased, from 3 per 100 previous cesarean sections in 1979-80 to 15.6 in 1988-89. In 1988/89, the latest year of the study, he found there were 2,876 cesarean sections out of 16,512 deliveries in Saskatchewan, giving a rate of 17.42 cesarean sections per 100 deliveries, the third lowest rate of all provinces in Canada. Newfoundland had the highest at 23.29 and

Manitoba had the lowest rate of 15.54 cesarean sections per 100 deliveries.[35] The rate for Native women was 2% lower than the rate for non-native women in Manitoba in 1989.[32]

Despite the growing trend for vaginal birth after cesarean section, few studies have assessed maternal and perinatal morbidity associated with this type of delivery. In a study comparing a trial of labour with an elective second cesarean section among Nova Scotian women in the period from 1986 through 1992, McMahon et al showed there was no significant difference in the overall rate of maternal complications for women who chose a trial of labour and those who elected cesarean section following a previous cesarean section[36]. However, major maternal complications were almost twice as likely to occur among women managed with a trial of labour compared to those undergoing an elective second cesarean section. Perinatal mortality, admission to neonatal intensive care units and apgar scores were similar among infants born to both groups of women.

Gormley et al studied the change in the regional profile for cesarean sections in Saskatchewan between 1977/78 and 1985/86. The procedures per capita (i.e. the total population) increased for Regina (42.0%), Saskatoon (34.6%), 7 other major cities (21.0%), rural residents (52.1%) and registered Indian women (37.1%) but decreased for other than registered Indian women in Northern Saskatchewan (-5.8%). In 1985/86 registered Indian women had the highest rate of cesarean sections (4.9 per 1,000 population); the rate for all residents was 2.7 cesarean sections per 1,000 population[23]. A major limitation of this study was that these population-based rates included persons not eligible for a cesarean section (i.e. males and non-pregnant females of all ages) and did not consider the higher fertility rate and younger population among registered Indian women compared to the rest of Saskatchewan women.

Safety of delivery in small community hospitals is a major concern in remote communities, although there have been few studies done. Black examined the referral patterns, intervention rates and perinatal loss rates in small northern Ontario communities. Women delivering in hospitals providing a higher level of care had significantly more interventions, without significant difference in perinatal loss rates. Relatively safe care was provided in smaller hospitals, many of which did not have the minimum capabilities suggested for obstetric units [25].

Spooner and Gorman conducted a hospital chart review of a rural Saskatchewan obstetric service for the period, 1980-1985. They found that with careful patient selection, safe and effective obstetric services can be provided in a small rural hospital.[26]

Lemelin reviewed the referral pattern and rate of intervention in a small rural obstetric practice in Quebec during the period, 1978 to 1984. He reported that the unit was successful in identifying and referring high-risk obstetrics. He also proposed that rates of referrals, low-birth weight, and delivery interventions be investigated as measures to use in evaluating the performance of small obstetric units, as an alternative to perinatal mortality rates which may be appropriate for larger centres or regions.[27]

2.4. Summary

Previous studies of obstetric hospital utilization have examined rates of pregnancy complications by ICD 9 chapter, Canadian List Number or selected diagnoses or procedures, based on pregnancy outcome or population of women of reproductive age.

Registered Indian women in Alberta, Saskatchewan, and Manitoba have had higher pregnancy rates than the rest of the population which contributed to higher rates of hospital separation for pregnancy complications per women of reproductive age. A study of

obstetric utilization in Manitoba showed that Native women also had higher rates of ectopic pregnancy during 1981 to 1989, but lower rates of cesarean section delivery per pregnancy.

There have been no studies that have examined obstetric hospital utilization in Saskatchewan based on the numbers of pregnancies or looked at differences in the experiences between northern and southern women.

The differences in separation rates for some diagnoses such as ectopic pregnancy may represent the incidence for that condition. However, the hospitalization rates for many diagnoses are often influenced by factors such as socioeconomic status, level of education, previous illness, severity of illness, lifestyle, availability of ambulatory care, access to hospital beds, community health services or physician threshold for admission. The influence of these factors cannot be determined in a study of hospitalization data collected for billings claims; thus, explanations for differences in hospitalization rates will need to be sought elsewhere.

3. OBJECTIVES

The objectives for this study were:

I. To study the age-adjusted and age-specific obstetric hospitalization rates among northern Saskatchewan and Saskatchewan registered Indian women for the year, April 1, 1992 to March 31, 1993:

   i. for all obstetric hospitalizations [classified under the ICD-9 codes 630.0 through 676.9 (complications of pregnancy, childbirth, and puerperium) and V22.0,22.1,23.0-24.2,27.0-28.9 (supplementary classification)];

   ii. for specific groups of conditions: pregnancy with abortive outcome, antenatal complications, complications of labour and delivery, and complications of the puerperium. Problems at different stages of pregnancy require different treatment and preventive services.

   iii. for specific conditions, identified by health professionals or community leaders as particular concerns: diabetes, infections during pregnancy, hypertension, ectopic pregnancy, hemorrhage in pregnancy, and preterm labour.

   iv. for obstetric procedures used in labour and delivery: cesarean section, instrument-assisted delivery, and episiotomy.

II. To compare the 1992/93 obstetric hospitalization rates of northern Saskatchewan and Saskatchewan registered Indian

women with those of the southern rural communities. Differences may suggest the need for further study or alternative health care strategies.

III. To study hospital use by northern residents according to location of hospital. These referral patterns were examined for specific conditions. A high rate of referrals may indicate a high rate of serious problems or a need for improved services in the local community.

IV. To establish a baseline for future evaluation of both community-based and hospital care, by both First Nations' health authorities and district health boards.

4. METHODS

4.1. Design

This was a population-based descriptive study of the obstetric hospitalization rates for northern Saskatchewan and Saskatchewan registered Indian women for the fiscal year, April 1, 1992 to March 31, 1993. The hospitalization rates for these groups were compared to the southern rural obstetric hospitalization rates for the same period. The study analyzed administrative computerized data collected by Saskatchewan Health for hospital claims payments.

4.2. Setting and Population

4.2.1. Setting

Saskatchewan is divided approximately in half geographically by the southern border of the area covered by Northern Health Services Branch (NHSB) of Saskatchewan Health (Appendix A). The northern population is spread over 40 communities, some of which have no road access. Registered Indians made up over half of the northern Saskatchewan population, but only 7% of the total provincial population in 1992/93.

There are four small hospitals in northern Saskatchewan and one larger community hospital near the Manitoba-Saskatchewan border that regularly provide inpatient services to northern residents, although one of the hospitals routinely transfers all women at the time of delivery to a southern or out of province facility. Cesarean sections are done at only one of these five hospitals serving northern Saskatchewan. Physicians from these five centers travel regularly to outlying

communities to provide prenatal care and other routine medical care. Primary care nurses (nurse practitioners) live in and provide both clinical diagnostic and treatment services as well as public health services in sixteen of the communities without resident physicians (reserves and other communities). In 1992, there were public health nurses living in an additional six northern communities, providing services to the immediate and outlying communities; since then public health nurses have been added to the complement of primary care nurses in three communities. Home care nursing services are available in a few of the larger communities.

Women who live in communities with poor or no road access or with high-risk pregnancy often leave their communities two weeks ahead of their expected date of confinement and are housed in hotels or hostels in the northern or southern communities where they plan to deliver. Others travel to the nearest hospital once labour begins. If complications occur during the labour or delivery, they may be transferred by road or air ambulance to a southern regional or base hospital, a distance of up to 800 kilometres. Each year, a few women unexpectedly deliver at home or at the health centre or enroute to hospital in the taxi or airplane, assisted by a primary care nurse. Most who deliver outside of hospital receive postpartum care in hospital.

In southern Saskatchewan, most people live within a 90 minute drive from the nearest community classified as urban in this study, where a base, regional or large community hospital is located. Health service delivery for southern registered Indians is quite different than for northern women. There are no primary care nurses providing services; physicians do not usually visit the reserve to hold clinics. Visiting public health nurses usually live outside of the community. In urban areas, there are few programs developed specifically for First Nations people.

Saskatchewan Health maintains a population registry of persons covered for health services provided under the provincial health insurance plan. Since a premium is not required, most residents register with Saskatchewan Health when they become eligible, after living in the province for 3 months. The registry organizes data by age, sex, and the residence code which is assigned by Saskatchewan Health to the person's city, town, village, rural municipality or registered Indian band. A unique identifier, the Health Services Number (HSN), is assigned at birth to each individual in the registry and remains with the person for a lifetime. The HSN allows the individual to be identified in the registry and records of health services covered for payment by Saskatchewan Health, including hospital records.

4.2.2. Population

For the purpose of the study, the population of Saskatchewan women of reproductive age (15 to 44 years) was divided into five mutually exclusive groups, outlined in the following table and described below:

Population	Treaty	Other
North	A	B
South - Rural	C	X
South - Urban		Y

- Residents of northern Saskatchewan, grouped as:
    - A. registered Indians
    - B. other than registered Indians
- Residents of southern Saskatchewan, grouped as:

C. registered Indians

X. rural, other than registered Indians

Y. urban, other than registered Indians

Northern residents (groups A and B) were persons with residence codes in the area covered by Northern Health Services Branch (NHSB). Southern residents (groups C, X, and Y) were persons with residence codes in communities not covered by NHSB. Southern urban other than registered Indian residents (group Y) were persons who live in one of 15 urban areas. Urban areas were defined as all towns and cities that had a population greater than 5000 according to the Saskatchewan Health Covered Population, 1992[37] and the communities of Kindersley, Nipawin and Melville. Although the towns of Kindersley and Nipawin and the city of Melville had slightly less than 5000 people in 1992, they were included in the urban group because their health services were similar to other small cities with regional facilities.

Southern rural other than registered Indian residents (group X) were persons with residence codes in the remaining non-reserve communities. This group is the most comparable to northern and registered Indian residents because of similarities related to rural life and type of health services available.

Saskatchewan Health uses the band of origin as the residence code for registered Indians, which does not necessarily indicate their actual place of residence. Therefore, women classified in this study as northern registered Indians may have lived on reserves or in other communities in either northern or southern Saskatchewan and would still be classified as northern registered Indian women. Similarly southern registered Indian women may have lived on or off reserve in northern or southern Saskatchewan. See **Appendix B** for more detail on the assignment of residence codes to study groups.

The population distribution by age group varied among the study groups as shown in the population pyramids (Figure 4-1 to Figure 4-5), which were determined from Saskatchewan Health's Covered Population for June 30, 1992[37] (**Appendix C**). Northern and southern registered Indian populations had a similar age distribution, with the highest proportions in the youngest age groups. Northern other than registered Indian women were a young population as well but with similar numbers in the 4 groups between 15-34 years of age. Southern rural women were the oldest population, with the fewest women in the 20-29 year age groups and the most in the 15-19 year, followed by the 30-39 year age groups. The women of reproductive age for the southern urban group were clustered around the middle groups, 25-39 years, with the fewest at the extremes of 15-19 and 40-44 years of age. Because of these differences, age-adjustment was used when feasible in determining odds ratios to compare differences among the study groups.

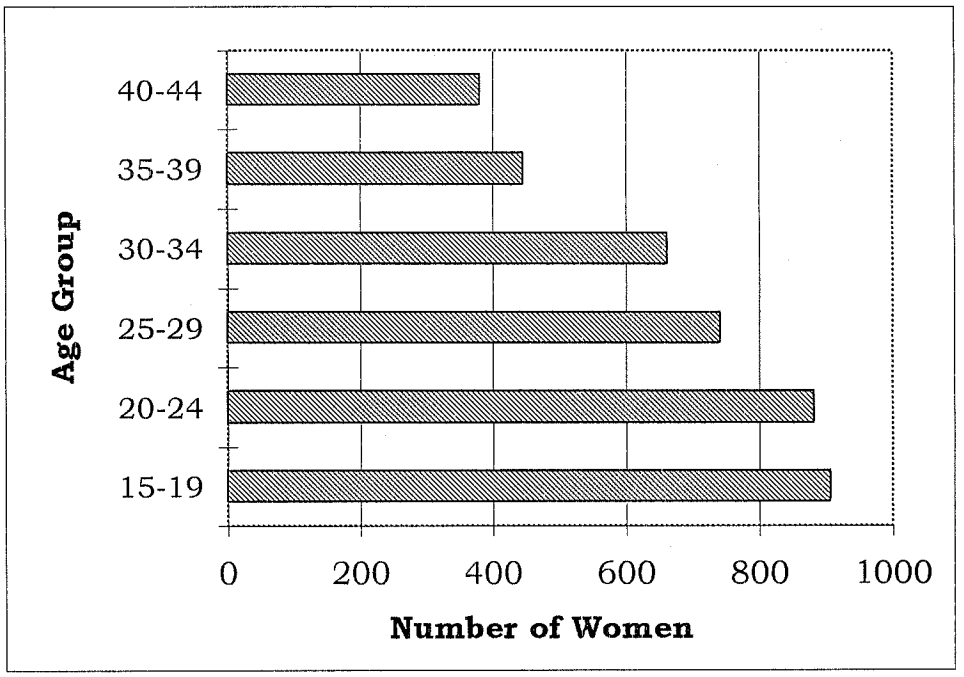

Figure 4-1 Population distribution for northern registered Indian women, 1992.

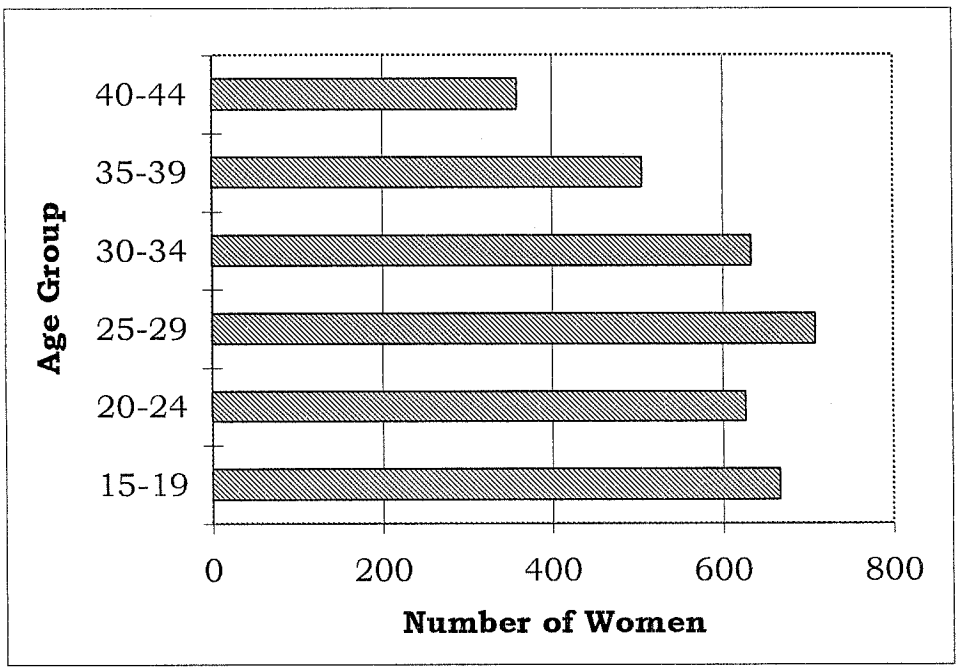

Figure 4-2 Population distribution for northern other than registered Indian women, 1992.

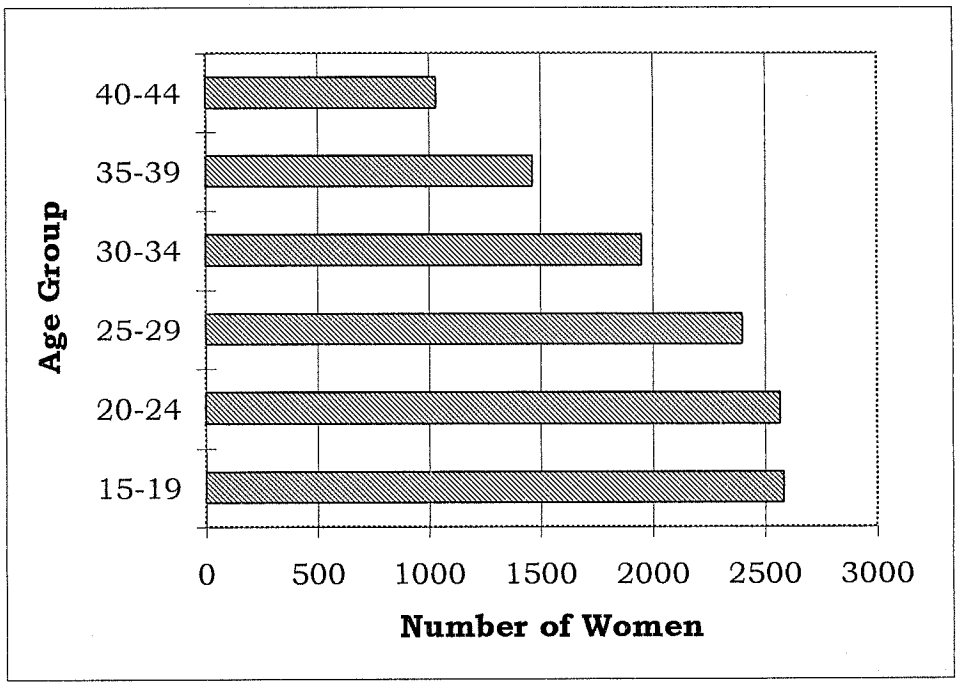

Figure 4-3 Population distribution for southern registered Indian women, 1992.

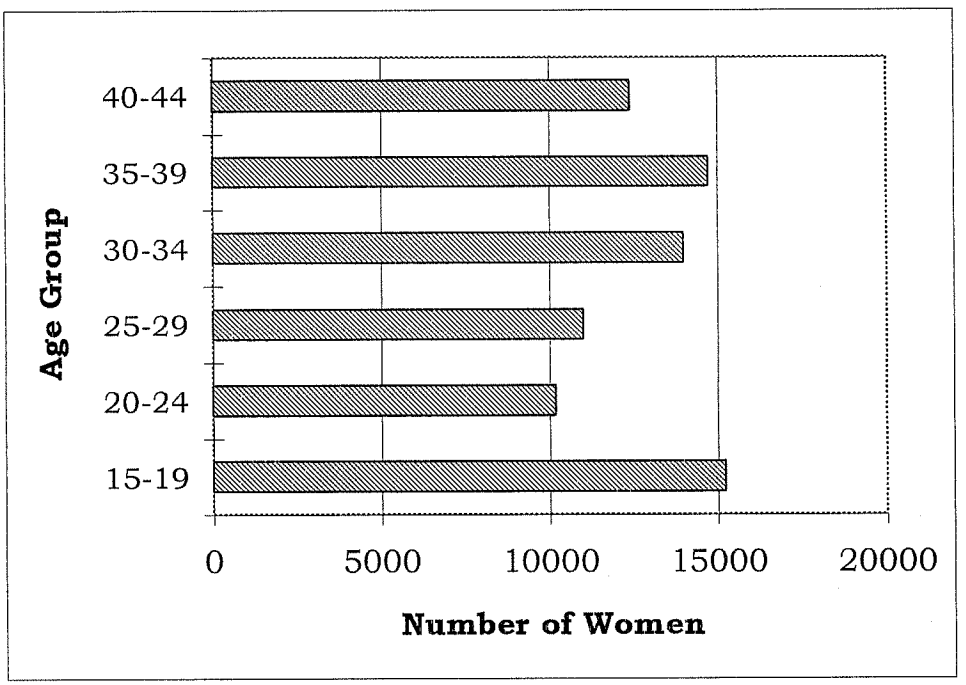

Figure 4-4 Population distribution for southern rural women, 1992.

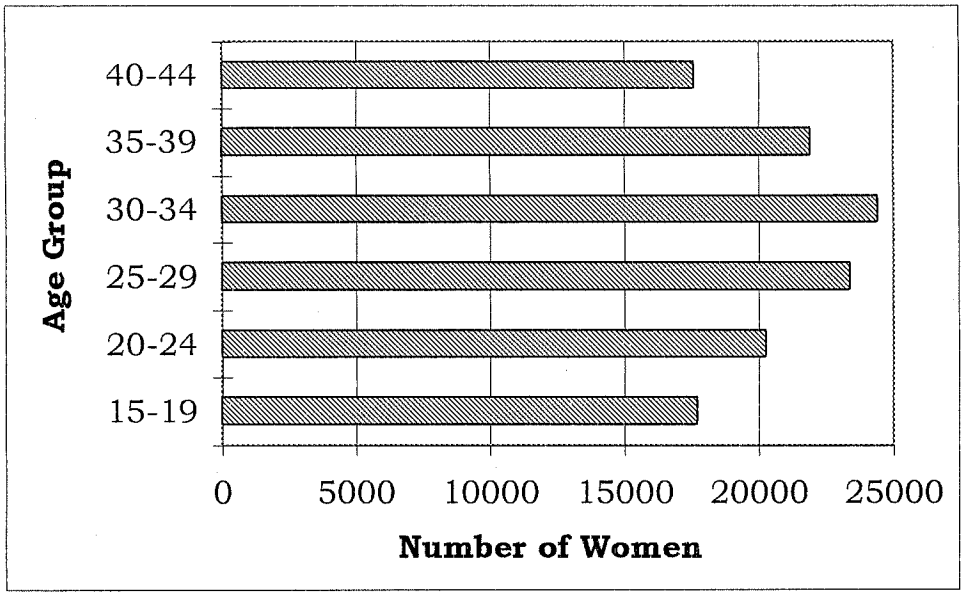

Figure 4-5 Population distribution for southern urban women, 1992.

4.3. Sample

Hospitalization data were obtained from Saskatchewan Health for the fiscal year, 1992/93, as part of the Study of Hospitalization Rates for Northern Residents and Saskatchewan Registered Indians, 1992/93. Hospitalization data were included only for persons who were registered with Saskatchewan Health for hospital insurance benefits at the time of hospitalization, which may have been within or outside of the province.

All of the hospital separation records for 1992/93 for 100% of the population with residence codes in northern Saskatchewan and for registered Indian bands were included. From the hospital data base, the health services numbers of hospitalized southern rural and urban residents older than one year of age were ordered and every 10th number chosen. All of the records in the study year for the 10% of southern urban and rural hospitalized persons were included.

This method of sampling was done to decrease detection bias that would have been present because of the differences in the study group population sizes. Using 1992 Covered Population figures, the study groups ranged in size from 3,508 Northern Other Than Registered Indian Women to 125,435 Southern Urban Women. If all of the data had been used in the study, the uncommon diagnoses would have had a greater chance of appearing in the southern rural or urban groups just because of the larger populations.

A subset of obstetric data was selected if International Classification of Diseases, Ninth Revision, (ICD-9) codes 630.0 to 679.9 (Complications Of Pregnancy, Childbirth and the Puerperium), V22.0 to V24.9 (supervision of pregnancy and postpartum care) or V27.0 to V28.9 (outcome of delivery, antenatal screening) appeared as one of the three leading diagnoses or Canadian Classification of Procedures (CCP)

codes 84.0 to 87.99 (Obstetric Procedures) appeared as one of the three leading procedures.

To determine the representativeness of the sample that was selected, the number of records for each primary diagnostic code, using the Canadian List Number (CLN), obtained in the 1992/93 obstetric study data was compared with the figures published by Saskatchewan Health for the same year[2], Table 4-1. The total number of separations for 1992/93 for each CLN was estimated from the study data by adding the number of separation records for northern and Saskatchewan registered Indian women (groups A, B, C) to ten times the number of separations for southern rural and urban women (10[X+Y]). Since Saskatchewan Health reports the number of separations for each diagnostic code only for all age groups combined in their annual report, Table 4-1 includes the numbers for all women aged 10 to 49 years.

The percent difference in the number of separations estimated from the study data and Saskatchewan Health's published figures were greatest for the three least common diagnoses, legally induced abortion, other abortion and complications of the puerperium. Since these diagnoses were not selected for detailed study, the discrepancies were not a concern. The next largest percent difference was for the diagnosis of Hemorrhage Of Pregnancy. Assuming that the sampling of southern hospitalized rural and urban women accounted for the difference, the results of analysis for this diagnosis must be interpreted accordingly.

For all obstetric diagnoses combined, the study data estimated 0.8% more separations than the number published by Saskatchewan Health, indicating the sampling method resulted in a slight over representation of records for southern rural and urban women.

Table 4-1 Comparison Of Obstetric Separations For 1992/93 Study Data With Sask Health 1992/93 Statistical Report, Age Groups 10 To 49 Years, By ICD-9 Codes for Primary Diagnoses

ICD9-1	Canadian List Number and Diagnosis		Study n (est)*	Sask Health n	difference	% difference
634	142	Spontaneous abortion	1013	1072	-59	-5.5
635	143	Legally induced abortion	28	50	-22	-44.0
636-8	144	Other abortion	83	101	-18	-17.8
630-3,639	145	Other pregnancy with abortive outcome	733	724	9	1.2
650	146	Normal delivery	2147	2199	-52	-2.4
640, 641	147	Hemorrhage of pregnancy	1043	918	125	13.6
642-648	148	Other complications related to pregnancy	4671	4637	34	0.7
651-659	149	Indications for care in pregnancy, labour, and delivery	4816	4990	-174	-3.5
660-669	150	Complications in labour and delivery	7004	6719	285	4.2
670-676	151	Complications of the puerperium	251	205	46	22.4
633-676		Chapter XI, Total Complications of Pregnancy and Childbirth	21789	21615	174	0.8

* The total n for the province is estimated from the study data by adding the number of records for northern and registered Indian women to 10 times the number of records for southern urban and rural women. (A+B+C+10[X+Y]).

4.4. Data, Reliability and Validity

From the data obtained to study hospitalization for all causes, an obstetric subset was selected based on the presence of an obstetric diagnostic code (ICD9 633.0-676.9, V22.0-24.9, V27.0-28.9) in one of the primary, secondary, and tertiary diagnosis fields or an obstetric procedural code (CCP 84.00-87.99) in one of the primary, secondary or tertiary procedure fields. Pregnancy classified as incidental to the hospital separation (V22.2) was included in the obstetric data set so that it could be examined as an entity; however, it was excluded in the analysis of antenatal separations.

The list of variables obtained from Saskatchewan Health in the data is shown in **Appendix D**. Since the maternal record was not linked to the newborn record, the birth outcome (stillbirth vs. live birth), apgar score, birth weight and gestational age were not available. Other variables that were created are defined in the following chapters.

The data were examined for obvious errors as discussed below.

4.4.1. Health Services Number, Sex, Age Group and Date of Birth

An encryptic number was used in place of the actual health services number (HSN) to maintain confidentiality and was used for analysis by individual women (for example, the number of women with an antenatal episode of care). The health services number may be inaccurate in some records because of recording errors or misidentification of individuals. However, there was no evidence found in the data to show that this was an important problem. Although the month and year of birth were not checked for consistency in all separations for each woman with multiple separations, inconsistencies were noted during the check for study group assignment. Different

years or months of birth, as well as changes in residence codes, were recorded from one separation to the next for six HSNs.

All records were coded with sex as females. The age group was recorded in the data as well as the month and year of birth for each woman. The age group was coded as "1 to 4 years" in one record and was recoded to "25 to 29 years", assuming that the woman's year of birth, 1964, and the obstetric diagnoses were correctly recorded. All of the other records had age groups consistent with birth year.

4.4.2. Study Group, Residence Code and Postal Code

The study group assignment was based on residence codes recorded for each separation. Changes in residence codes were noted for some women who were hospitalized more than once. The changes may have resulted from women actually moving from one community to another or from inaccurate information recorded at the time of separation. In some cases, the change in residence code changed the study group assignment and in other cases it did not.

There were 40 unique health service numbers, representing 26 northern and registered Indian women and 140 southern rural and urban women (after adjusting for the 10% sampling) who had more than one separation in 1992/93 and whose change in residence code resulted in a change in study group. These 166 women represent less than 1% of the approximate 17,073 women aged 10 to 49 (adjusted for sampling), who were hospitalized during pregnancy, childbirth and the puerperium at least once in the year. If the changes in recorded residence codes were entirely due to actual moves, one would expect few changes for registered Indian women since their residence codes are based on band membership, which may be transferred to other bands but is seldom lost or acquired. However, 15 of the 40 residence code changes resulted in changes in study group assignment both from

northern or southern registered Indian women (groups A and C) to northern other than registered Indian women or southern rural and urban women (groups B, X and Y) and from groups B, X and Y to groups A and C. The registered Indian status may not have been known to the person recording the residence code at the time of hospital separation.

The data was sorted first by study group and then by the unique health services number (HSN), so that a separation record for each of these 40 HSNs appears in two different study groups. The effect would have been to reduce the differences among the study groups since the multiple assignments involved all of the study groups similarly. No changes were made to the data to adjust for these inconsistencies. There was no way to check for inaccuracies in the residence code for all women contributing only one separation to the data set.

As previously mentioned, Saskatchewan Health uses the band of origin to assign the residence code for persons who identify themselves as registered Indians at the time of application for health services benefits. There were 16,046 registered Indian women aged 15 to 44 years identified in Saskatchewan Health's 1992 Covered Population registry in 1992. Medical Services Branch of Health Canada who is responsible for payment of health services provided to registered Indians reported there were 20,898 registered Indian women aged 15 to 44 years, indicating that 23.2% (4852/20,898) of registered Indian women of reproductive age were not classified in Saskatchewan Health's registry as registered Indians. The discrepancy may be due in part to women not informing Saskatchewan Health when they regained their treaty status following Bill C-31, the federal legislation which allowed persons who had previously lost their treaty status through marriage to be reinstated. To the extent that the rates of obstetric hospitalization for registered Indian women who were classified as registered Indian

women in Saskatchewan Health's data were similar to the rates for registered Indian women who were not so classified, the differences in obstetric hospitalization rates in this study between registered Indian women and the other groups will have been reduced.

The postal code was used to determine the proportion of women with northern or southern residence codes whose postal code at the time of hospital separation was for a northern or southern community. As indicated in Table 4-2, nearly 22 % of northern registered Indian women hospitalized in pregnancy gave southern postal codes as part of their address, as compared to 3 % of northern other than registered Indian women.

The Federation of Saskatchewan Indian Nations has estimated that over one-half of all registered Indian people in the province live off reserves. If this were true in the north in 1992/93, this data suggests that more than half of northern registered Indian women who live off reserve continue to live in the north. The obstetric hospitalization rates for northern women can be considered in light of this evidence that over 85% (1037 of 1214) of them were living in northern

Table 4-2 Postal Code Region By Study Group for Saskatchewan Women Hospitalized in Pregnancy, 1992/93

	South		North		Total
	n	%	n	%	
North RI	164	21.9	584	78.1	748
North Other	13	2.8	453	97.2	466
South RI	2027	99.4	13	0.6	2040
South Rural	5000	99.8	10	0.2	5010
South Urban	8750	100.0	0	0.0	8750
Sask.	15954	93.8	1060	6.2	17014

Percents are of row totals.
RI = Registered Indian women; Other = Other than registered Indian women; *adjusted for 10% sample (n=10 x sample number)

4.4.4. Discharge Codes, Transfers

The outcome of hospitalization code recorded the type of discharge such as a medical discharge (with or without medical authorization), death, or transfer to another hospital or other institution. Occasionally a transfer was recorded but another separation record was not present in the data or the next admission date was a day or more later. A variable was created that defined a transfer if an admission from one hospital occurred on the same day as a separation from another. This definition would have resulted in a conservative estimate of the actual number of transfers, since transfers that occurred over midnight would have been missed.

The discharge code was used to check the usefulness of the fields recording the code of the hospitals that transferred a patient to or received a patient from another institution. These latter fields were quite inconsistently used and were not used in the analysis.

4.4.5. Diagnoses and Procedures

The diagnostic fields record the primary, secondary and tertiary diagnoses using both the Ninth International Classifications of Diagnoses (ICD-9) and the Canadian List Number (CLN) that groups diagnoses. The procedural fields record the primary, secondary and tertiary procedures using the Canadian Classification of Procedures (CCP). The field recording the ICD-9 code for external cause of injuries was not used because of the small number of women with injuries in the data.

The primary diagnosis refers to the diagnosis coded as most responsible for the hospitalization, i.e. contributing to the longest days' stay. If a woman were admitted for antenatal complications for several days and then had a delivery, the diagnoses for the complications would appear as the primary diagnosis.

The validity of the diagnoses was not checked against the original hospital records, which were not available to the researcher. Consistency between diagnoses and procedures was not systematically checked for all separations, but some inconsistencies were noted during examination of the records for diagnoses and procedures indicating the end of pregnancy. Some diagnoses appeared to be less valid than others, such as premature rupture of membranes or early onset of delivery which occasionally occurred up to a month before the separation for delivery. A detailed study of diagnostic and procedural code validity in the Saskatchewan hospitalization data would be useful.

4.5. Method of Analysis

This section describes the methods of analysis used in general throughout the study. Details on the method of analysis specific to the group of diagnoses or procedures are discussed in the respective sections in chapter 5. The parameters in Table 4-3 were used to describe obstetric hospitalization rates for the year, 1992/93.

Hospital separation abstracts document information about inpatient diagnoses, procedures and length of stay, as well as demographic information at the time the patient leaves the hospital.

The different types of rates used show different aspects of hospital use for obstetric diagnoses and procedures. The population-based rates count the number of events by study group, which is based on area of residence, regardless of where the event occurs.

The **number of episodes of care** count the number of hospital separations that represent initial hospital care, so that further separations resulting from patient transfers between hospitals are not counted as additional separations. This measure adjusts for the potential bias introduced to separation rates when transfers between

Table 4-3 Obstetric Hospitalization Rates, ages 15-44, 1992/93

Indicator	Numerator	Denominator
1. Diagnostic Rate	- pregnancy outcomes	- women of reproductive age
	- separations or episodes of care	- deliveries or documented pregnancies
	- women with obstetric hospitalization	- women with documented pregnancy
2. Days' stay	- days in hospital	- women of reproductive age - women with documented pregnancy
3. Average length of stay	- days in hospital	- separations or episodes of care
4. Procedural rate	- procedures	- deliveries

hospitals, which are higher for non-urban residents, result in additional separations. Rates of separation and episodes of care estimate the incidence of conditions that are severe enough to result in hospitalization, such as ectopic pregnancy and eclampsia. The hospital episode of care rate varies with the number of hospitalizations for each woman and the number of women hospitalized for the same diagnosis in the year and reflects the public health burden of the condition.

The **number of persons hospitalized** counts the number of unique residents who have been hospitalized at least once in the study year. Each woman is counted only once regardless of the number of times she is hospitalized. The rate of persons separated is used as an indicator of access to hospital care which can be compared across study groups[38], assuming relative comparability of health status.

Days' stay measure the total number of hospital days experienced by the population and reflect the incidence and severity of

the illness or condition as well as the threshold of hospitalization in the area. It is a function of the number of episodes of care and the average length of stay.[38] **Average length of stay** is calculated by dividing the number of inpatient days by the number of episodes of care in the year.

Obstetric **procedural rates** were examined as the number of procedures done per 100 hospital deliveries. They reflect both physician practice and access to hospital care.

Analysis of hospitalization rates were done by stratifying on diagnosis, procedure, the five residence areas in the study, age group, and location of hospital. Hospital utilization was examined by location and type of hospital, categorized as northern, rural, regional, base and out of province. Age-specific, crude and age-standardized rates were expressed as rates per 1,000 women or per 100 pregnancies.

The population denominators were based on the female population of reproductive age who were registered with Saskatchewan Health as of June 30, 1992 while the data covered the fiscal year from April 1, 1992 to March 31, 1993.* Denominators for the numbers of pregnancies, deliveries, and pregnant women were derived from the data and are described in section 5.1, Obstetric Episodes Of Care For All Causes Combined.

The main comparison of obstetric hospitalization rates for the two main study groups, northern Saskatchewan women and Saskatchewan registered Indian women, were to those of rural southern Saskatchewan (excluding southern registered Indian women), which would be the most similar comparison group to the two study groups, based on rural/urban characteristics.

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* Although the age distribution changed (decrease of 5% in the 25-29 year age group and an increase of 5% in the other age groups combined), the total female population aged 15-44 increased by only 0.04% (n=91) between June 30, 1992 and June 30, 1993.

The data were summarized in tables, charts, and graphs, in a format that northern health professionals and community leaders would be able to use. Crude or age-adjusted odds ratios with 95% confidence intervals were determined using the BMDP LR (logistic regression) program to compare selected hospitalization rates for each study group with those of southern rural women, using estimated numbers after adjusting for the 10% sampling of southern rural and urban hospitalized women. Chi-square analysis of odds ratios was used to test the statistical significance of differences in selected diagnostic or procedural rates between study groups. One-way analysis of variance was used to test for differences in average length of stay among the study groups, using the BMDP 7D program; the Scheffe method was used for pairwise comparisons of average length of stay between individual study groups when appropriate.

4.6. Ethics

4.6.1. Patient confidentiality

Saskatchewan Health changed the actual Health Services Number to an encryptic number on each record before releasing the data. The encryptic number was unique to each individual which allowed multiple hospitalizations during the one year period to be linked to an individual. Names were not included in the data received. Results include only aggregate data.

4.6.2. Organization Consent and Co-participation

This study was part of a larger study of hospitalization rates for all causes in northern Saskatchewan residents and Saskatchewan registered Indians. The larger study was conceived by the Northern Medical Services Research and Development Committee, which has

representation from the Northwest and the Northeast Municipalities Associations in northern Saskatchewan, the Meadow Lake Tribal Council and the Prince Albert Grand Council. Approval of the larger study was formally sought from the leadership of each of these organizations. Each of these organizations and the Federation of Saskatchewan Indians had the opportunity to participate in setting some of the diagnostic categories that were examined and in a review of early results.

Saskatchewan Health gave consent to the study with a request to review publications in advance only to ensure patient confidentiality was maintained. The author assumes total responsibility for the study results.

4.6.3. Data Access

Even though names and health services numbers were not available, the data was protected by computer passwords, with access limited only to the investigation team.

5. Results

This chapter presents the results of analysis for rates of pregnancy outcome, obstetric episodes of care for all causes combined, ectopic pregnancy, antenatal hospitalization, complications of labour and delivery, cesarean section deliveries, other obstetric procedures and complications of the puerperium. Operational definitions are presented at the beginning of each section, followed by a presentation and brief discussion of the results.

5.1. Documented Pregnancy

As a basis for examining complications of pregnancy, the number of pregnancies were first derived from the hospitalization data since there were no published figures for the study groups for 1992/93. This section describes the operational definition of documented pregnancy and its validity, the numbers and rates of pregnancies and briefly discusses the results. The differences in pregnancy rates among the study groups were not tested for statistical significance since this was not an objective for this study.

5.1.1. Operational Definition

If a woman's pregnancy ended between April 1, 1992 and March 31, 1993 and she was hospitalized with a diagnosis or procedure indicating an abortive outcome (ectopic pregnancy, spontaneous or induced abortion), a stillbirth or a delivery, her pregnancy was counted as a documented pregnancy for this study (Appendix E - Operational definition of pregnancy end).

Since some obstetric diagnoses or procedures could occur with both abortive and delivery outcomes, the records with these diagnoses or procedures were first coded as deliveries and then recoded to abortive outcomes if a diagnosis for an abortive outcome was present. Since most ectopic pregnancies and most births result in hospitalization in Saskatchewan, the hospitalization data would approximate the actual number for these pregnancy outcomes occurring in 1992/93. Since spontaneous abortions may occur outside of hospital, they would have been under represented in the data.

There were 29 documented pregnancies among girls aged 10 to 14 years, representing 47 pregnancies after adjusting for sampling as shown in Table 5-1, and 3 documented pregnancies among women aged 45 to 49 in the 1992/93 data. The sample did not capture any

Table 5-1 Data Description for 10-14 Year Old Girls with Pregnancy, By Study Group, 1992/93

	North RI	North Other	South RI	South Urban	Sask
# girls aged 10-14 years†	899	677	2770	17863	22209
# pregnancies	10	5	12	*20	47
# deliveries	9	4	9	*20	42
# antenatal episodes	2	3	5	*10	20
# cesarean deliveries	0	0	1	*10	11
# deliveries with instruments	2	0	2	0	4
pregnancy rate per 1,000 girls	11.1	7.4	4.3	1.1	2.1
delivery rate per 1,000 girls	10.0	5.9	3.2	1.1	1.9
Number of obstetric episodes by initial hospital location					
Northern hospital	2	2	0	0	4
Rural hospital	1	2	5	0	8
Regional hospital	8	0	8	0	16
Base hospital	1	4	4	*30	39

RI = Registered Indian women; Other = Other than registered Indian women
† 1992 Saskatchewan Health Covered Population figures
*adjusted for 10% sample (n=10 x sample number)

obstetric records for the southern rural group. Preliminary Saskatchewan Health Vital Statistics indicate there were 34 births to mothers aged 10 to 14 in 1992 and 24 in 1993. In each year there were 3 births in total to mothers aged 45 and older, indicating the 10% sample of southern rural and urban hospitalized mothers captured most of the records for these two age groups.

Since the numbers were too small for detailed analysis, they were excluded from this study after the data checks were completed. However, the high crude rates of pregnancies per 1,000 northern and registered Indian girls aged 10-14 years compared with other Saskatchewan girls are consistent with the high pregnancy rates in all age groups for northern and registered Indian women, which are shown in Table 5-3.

The three obstetric episodes for women aged 45 to 49 in 1992/93 were for two southern registered Indian women and one southern rural woman who were hospitalized with an instrument-assisted delivery, a spontaneous abortion and a cesarean delivery.

There were 4,712 documented pregnancies among women aged 15 to 44 in the data, representing an estimated 16,513 pregnancies* in Saskatchewan in the study year, 1992/93, after accounting for differential sampling of the records for the study groups. This gives a crude rate of 16513/222684 or 74 pregnancies per 1,000 Saskatchewan women in the reproductive age groups. Of these, 14,854 pregnancies ended in delivery rather than an abortive outcome, giving a crude rate of 66.7 total births per 1,000 Saskatchewan women of reproductive age.

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* There were 17,014 women represented in the data, as shown in Table 4-2. Of these, 16, 297 had one or more documented pregnancies in 1992/93 for a total of 16,513 pregnancies. The remaining 717 women likely had an antenatal hospitalization followed by an abortive outcome outside of hospital in the study year or a delivery or abortion after March 31, 1993.

The validity of the number of documented total births estimated in the hospitalization study data can be assessed by comparing it with Saskatchewan Health Vital Statistics data, as presented in Table 5-2. The preliminary figures from Saskatchewan Health's report, Vital Events Occurring in Saskatchewan by Health Region, show that there were 15,012 total births in 1992 and 14,290 total births in 1993. Total births here include live births plus stillbirths of at least 20 weeks gestation. Adding three-quarters of the 1992 total births to one-quarter of the 1993 total gives an estimated 14,832 total births between April 1, 1992 and March 31, 1993, using the Vital Statistics data. The 1992/93 hospitalization study data show that there were an estimated 14,854 hospitalizations for delivery among women aged 15 to 44. Thus the number of deliveries documented in the hospitalization study data for all age groups combined is within close range of the number of total births estimated by averaging the vital statistics data for 1992 and 1993.

The discrepancy between the study data and the vital statistics data was greatest for the youngest and the two eldest age groups, all with the smallest numbers. Variation in sampling the southern rural and urban hospitalized persons could have been one source of these differences. Another source of discrepancy could have been in the averaging of data to arrive at the vital statistics estimate, since births do not occur at an exactly constant rate. Since the data contained the records for all northern and registered Indian women with hospital separations in 1992/93, any over or under estimation of deliveries would have affected the age-specific rates for only southern rural and urban women. Comparison of rates with southern rural and urban women should consider this data limitation, particularly when the differences are small.

Table 5-2 Comparison of Number of Births Estimated in 1992/93 Hospitalization Data With Vital Statistics for 1992 and 1993

age group	Hospitalization study data 1992/93 births (estimated)[0]	Vital Statistics - Births 1992 [1]	1993 [2]	1992/93 (estimated)[3]	difference between hosp study & vital stats
15-19	1729	1590	1567	1584	+9.1%
20-24	3428	3593	3464	3561	-3.7%
25-29	5032	5184	4723	5069	-0.7%
30-34	3453	3477	3298	3432	+0.6%
35-39	1105	951	1023	969	+14.0%
40-44	107	119	129	122	-11.9%
Live births	n/a[4]	14914	14204	14737	n/a
Stillbirths[5]	n/a[4]	98	86	95	n/a
Total births	14854	15012	14290	14832	+0.2%

[0] The column figures are the live births plus stillbirths estimated in the 1992/93 study data, adjusted for sampling: total births in groups A,B,C + 10 times total births in groups X+Y

[1] From Vital Events Occurring in Saskatchewan in 1992 by Health Region (preliminary figures)

[2] From Vital Events Occurring in Saskatchewan in 1993 by Health Region (preliminary figures)

[3] column totals equal 3/4 live births in 1992 + 1/4 live births in 1993, (preliminary vital statistics)

[4] Live and still births could not be distinguished in the data.

[5] There were 98 stillbirths of 20+ wks. gestation in 1992 and 86 in 1993. There were 59 stillbirths of 28+ weeks gestation in 1992 and 54 in 1993. (Sask Health Vital Statistics, Interim Annual Reports, 1992 and 1993). Using the stillbirths at 28+ weeks of gestation would have given a 0.4% overestimation of total births.

In addition, some separation records may have been misclassified as a delivery rather than an abortive outcome or an antenatal separation in two circumstances. First of all, the diagnosis may have been inaccurately recorded in the separation abstract. Secondly the diagnoses selected as defining a delivery may not have been accurate all of the time. For example, obstetric trauma (ICD-9 664.0 to 665.1) may

have occurred with an abortive outcome but would have been classified as a delivery-defining diagnosis if a diagnostic code for abortive outcome (ICD-9 630-637) did not also appear as one of the first three diagnoses. Although a manual review of 100% of the 513 episodes with abortive outcomes and 1,000 of the 5,871 episodes with delivery or other outcomes did not reveal any obvious misclassifications, there may have been some records coded as deliveries that actually were abortive outcomes.

There were 1,659 abortive outcomes estimated in the 1992/93 study data. In addition to misclassification of abortive outcomes as deliveries, there were three other sources of underestimating abortive outcomes.

First of all, the 10% sampling of hospitalized southern rural and urban women resulted in 4.6% (see Table 4-1) fewer separation records with the primary diagnosis coded as a pregnancy with abortive outcome (ICD9-1 630-639) than reported in Saskatchewan Health's Annual Statistical Report[2].

Secondly, many therapeutic abortions would have been done as day surgery and not required inpatient care and therefore would not appear in the study data. Others would have been done in clinics outside of Saskatchewan. In the Annual Statistical Report for 1992/93, Saskatchewan Health reported there were 1,748 day surgery separations for obstetric procedures[2]. Although the specific procedures were not given, therapeutic abortions likely accounted for many of the obstetric day surgeries. Statistics Canada reported 1605 therapeutic abortions performed for Saskatchewan residents in 1992 (1434 performed in hospitals and 171 in clinics) and 1797 therapeutic abortions performed for Saskatchewan residents in 1993 (1621 in hospitals and 176 in clinics). All clinic abortions were performed in other provinces or in the United States; 35 of the therapeutic abortions

in 1992 (2.4 %) and 32 therapeutic abortions in 1993 (2.0 %) for Saskatchewan residents were performed in out-of-province hospitals. Of the 1,621 Saskatchewan women who had therapeutic abortions in Canadian hospitals in 1993, 1,590 had 0 days stay as inpatients and 31 stayed for 1 to 10 days in hospital [39].

Finally, spontaneous abortions occurring without inpatient hospital care were not included in the denominator.

As a result of underestimating the number of abortions, the "true" pregnancy rates were underestimated and the rates of pregnancy complications were overestimated in this study. This would have affected the intergroup comparability of rates to the extent that the rate of undocumented abortion was different among the study groups.

The denominator of 16,513 documented pregnancies used in this study then included the total live births, still births plus the number of abortive outcomes occurring in hospital. The use of pregnancies as a denominator removed the influence of fertility rates in population-based obstetric hospitalization rates. This is important in examining the health risks to those who become pregnant.

5.1.2. Rates of Pregnancy Outcome

The numbers and age-specific and age-standardized rates per 1,000 women of reproductive age (ages 15-44) for abortive outcome, delivery, and pregnancy documented in the 1992/93 hospitalization data are presented by study group and age group in Table 5-3 and Table 5-4.

Table 5-3 Population and Number of Pregnancies, Deliveries and Abortive Outcomes, By Study Group and Age Group, 1992/93

Number of Women Aged 15-44						
age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	908	883	743	663	828	4025
North Other	668	628	710	635	867	3508
South RI	2585	2572	2403	1956	2505	12021
South Rural	15239	10226	11033	14016	27181	77695
South Urban	17736	20294	23396	24441	39568	125435
Sask	37136	34603	38285	41711	70949	222684
Number of Pregnancies						
	15-19	20-24	25-29	30-34	35-44	Total
North RI	178	262	175	90	35	740
North Other	85	151	136	57	25	454
South RI	508	721	425	212	83	1949
South Rural*	380	930	1870	1170	480	4830
South Urban*	730	1820	2950	2280	760	8540
Sask	1881	3884	5556	3809	1383	16513
Number of Deliveries						
age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	162	232	149	74	26	643
North Other	79	133	119	51	18	400
South RI	458	643	374	178	68	1721
South Rural*	370	830	1690	1070	410	4370
South Urban*	660	1590	2700	2080	690	7720
Sask	1729	3428	5032	3453	1212	14854
Number of Abortive Outcomes						
age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	16	30	26	16	9	97
North Other	6	18	17	6	7	54
South RI	50	78	51	34	15	228
South Rural*	10	100	180	100	70	460
South Urban*	70	230	250	200	70	820
Sask	152	456	524	356	171	1659

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

Table 5-4 Age-Specific, Crude and Age-Standardized Rates of Pregnancy, Delivery and Abortive Outcome per 1,000 Women, By Study Group and Age Group, 1992/93

Rate of Abortive Outcomes per 1,000 women							
age group	15-19	20-24	25-29	30-34	35-44	Crude	Age-std.*
North RI	17.6	34.0	35.0	24.1	10.9	24.1	22.2
North Other	9.0	28.7	23.9	9.4	8.1	15.4	14.4
South RI	19.3	30.3	21.2	17.4	6.0	19.0	16.8
South Rural	0.7	9.8	16.3	7.1	2.6	5.9	6.6
South Urban	3.9	11.3	10.7	8.2	1.8	6.5	6.4
Sask	4.1	13.2	13.7	8.5	2.4	7.5	7.5
Rate of Delivery per 1,000 Women							
age group	15-19	20-24	25-29	30-34	35-44	Crude	Age-std.*
North RI	178.4	262.7	200.5	111.6	31.4	159.8	136.0
North Other	118.3	211.8	167.6	80.3	20.8	114.0	103.1
South RI	177.2	250.0	155.6	91.0	27.1	143.2	120.8
South Rural	24.3	81.2	153.2	76.3	15.1	56.2	62.1
South Urban	37.2	78.3	115.4	85.1	17.4	61.5	59.7
Sask	46.6	99.1	131.4	82.8	17.1	66.7	66.7
Rate of Pregnancy per 1,000 Women							
	15-19	20-24	25-29	30-34	35-44	Crude	Age-std.*
North RI	196.0	296.7	235.5	135.7	42.3	183.9	158.2
North Other	127.2	240.4	191.5	89.8	28.8	129.4	117.5
South RI	196.5	280.3	176.9	108.4	33.1	162.1	137.6
South Rural	24.9	90.9	169.5	83.5	17.7	62.2	68.7
South Urban	41.2	89.7	126.1	93.3	19.2	68.1	66.1
Sask	50.7	112.2	145.1	91.3	19.5	74.2	74.2

RI = registered Indian women; Other = Other than registered Indian women
* Standardized to 1992 Saskatchewan women, aged 15-44

Abortive Outcome

Northern and registered Indian women experienced higher hospitalization rates for abortive outcome in all age groups than southern rural and urban women in 1992/93, with the greatest differences in the two youngest age groups. The rates were more than 25 and 27 times higher for adolescent northern and southern registered Indian women, respectively, and more than 12 times higher for adolescent northern other than registered Indian women compared with the rates for adolescent southern rural women. The rates were approximately three times higher for northern and registered Indian women in their early adult years (20-24) than for southern rural women of the same age (Figure 5-1).

The age-standardized hospitalization rate for abortive outcome per 1,000 northern registered Indian women was 22.2 abortions per 1,000 women which was more than 3 times the rates for southern rural and urban women (Figure 5-2), which were 6.6 and 6.4 abortions per 1,000 women respectively. The rates for northern other than registered Indian women and southern registered Indian women (14.4 and 16.8 abortive outcomes per 1,000 women, respectively) were more than double those of southern rural and urban women.

Many factors would have contributed to the differences in rates of hospitalization for abortive outcome per 1,000 women, including: 1) the different frequency of pregnancy complications, 2) the different pregnancy rates among the study groups, and 3) different physician practice patterns for hospitalization of registered Indian women in remote and rural areas.

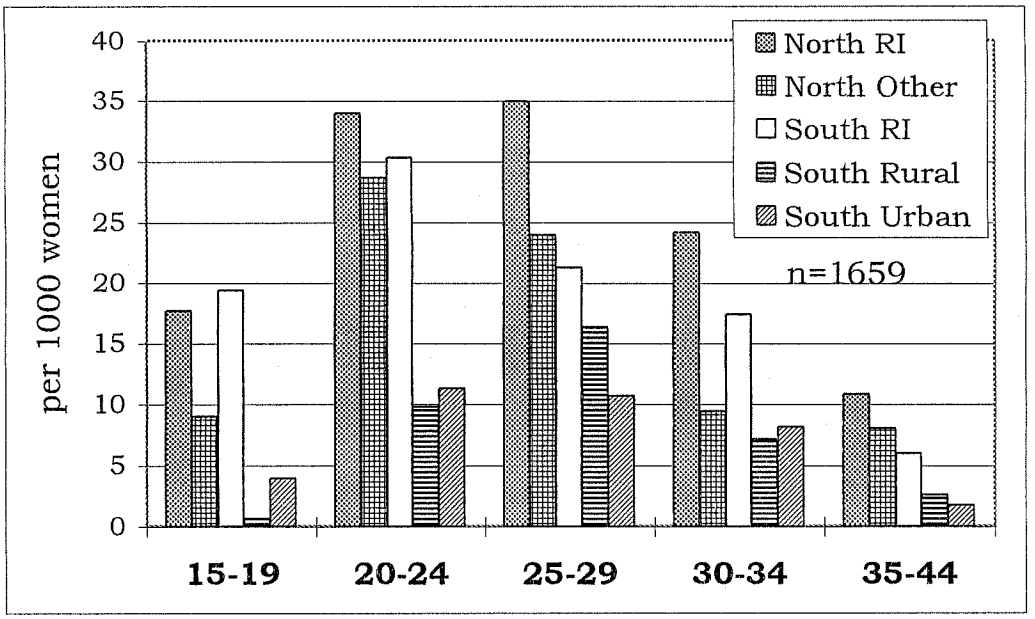

Figure 5-1 Age-specific hospitalization rates for abortion, 1992.

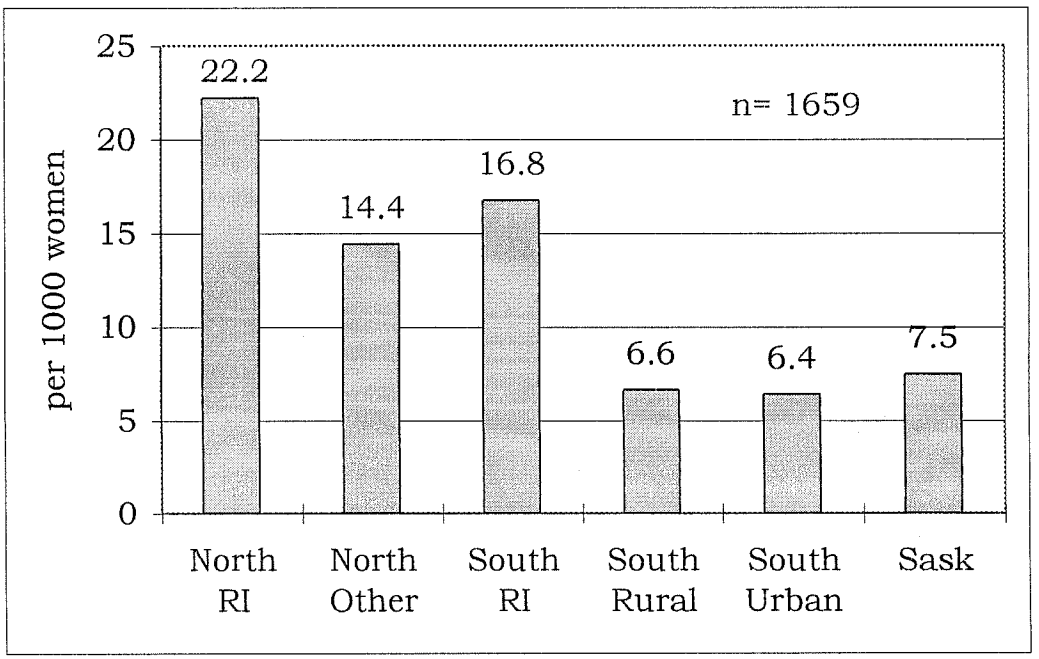

Figure 5-2 Age-standardized rates for abortion, 1992/93.

To remove the effect of differing pregnancy rates, the hospitalization rates for abortion were examined based on the number of pregnancies (Table 5-5).

For northern and registered Indian women, the proportion of documented pregnancies ending with abortion increased with age and were higher than those of southern rural women in all but the 20-24

Table 5-5 Age-Specific, Crude and Age-Adjusted Rates of Hospitalization for Abortive Outcome per 100 Pregnancies, 1992/93

Number of Abortive Outcomes							
	15-19	20-24	25-29	30-34	35-44	Total	
North RI	16	30	26	16	9	97	
North Other	6	18	17	6	7	54	
South RI	50	78	51	34	15	228	
South Rural*	10	100	180	100	70	460	
South Urban*	70	230	250	200	70	820	
Sask.	152	456	524	356	171	1659	
Number of Documented Pregnancies							
	15-19	20-24	25-29	30-34	35-44	Total	
North RI	178	262	175	90	35	740	
North Other	85	151	136	57	25	454	
South RI	508	721	425	212	83	1949	
South Rural*	380	930	1870	1170	480	4830	
South Urban*	730	1820	2950	2280	760	8540	
Sask.	1881	3884	5556	3809	1383	16513	
Rates of Abortive Outcome per 100 Pregnancies							
	15-19	20-24	25-29	30-34	35-44	Crude	Age-std†
North RI	9.0	11.5	14.9	17.8	25.7	13.1	15.0
North Other	7.1	11.9	12.5	10.5	28.0	11.9	12.6
South RI	9.8	10.8	12.0	16.0	18.1	11.7	12.9
South Rural	2.6	10.8	9.6	8.5	14.6	9.5	9.5
South Urban	9.6	12.6	8.5	8.8	9.2	9.6	9.7
Sask.	8.1	11.7	9.4	9.3	12.4	10.0	

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to Sask. women with pregnancy, aged 15-44, 1992/93

year age group where the rates were quite similar for all study groups. Northern registered Indian women had the highest age-standardized rate of abortive outcome (15 per 100 pregnancies), which was 1.5 times that of southern rural women (9.5 per 100 pregnancies).

Differing thresholds for admission may partially explain the higher hospitalization rates for abortion for northern women and southern registered Indian women. For example, northern women may be hospitalized after a miscarriage at home whereas women in areas with closer access to hospital care in the event of complications may be sent home and monitored as outpatients.

Delivery

The age-specific hospitalization rates for delivery per 1,000 women were highest for northern registered Indian women for all age groups in 1992/93 (Table 5-3 and Figure 5-3), with the highest age-specific rate at 263 deliveries per 1,000 northern registered Indian women aged 20-24. The rates in the 15-19 and 20-24 year age groups were remarkably higher (3-7 times higher) for northern and registered Indian women in comparison to those of southern rural and urban women. The difference in the rates between northern and registered Indian women and southern rural and urban women in the remaining age groups was much less. The age-standardized rates for delivery for northern registered Indian women (136 deliveries per 1,000 women) and for southern registered Indian women (120.8 per 1,000 women) were more than twice those of southern rural and urban women (62.1 and 59.7 deliveries per 1,000 women respectively). The age-standardized rate for northern other than registered Indian women (103.1 deliveries per 1,000 women) was 1.7 times greater than that of their southern rural counterparts (Figure 5-4).

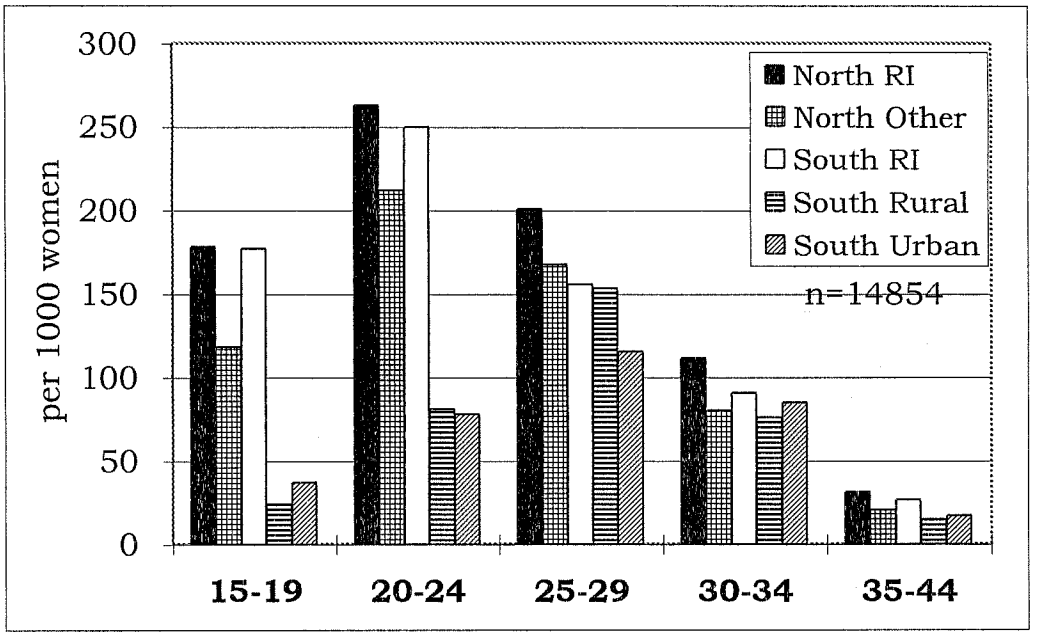

Figure 5-3 Age-specific hospitalization rates for delivery, 1992/93.

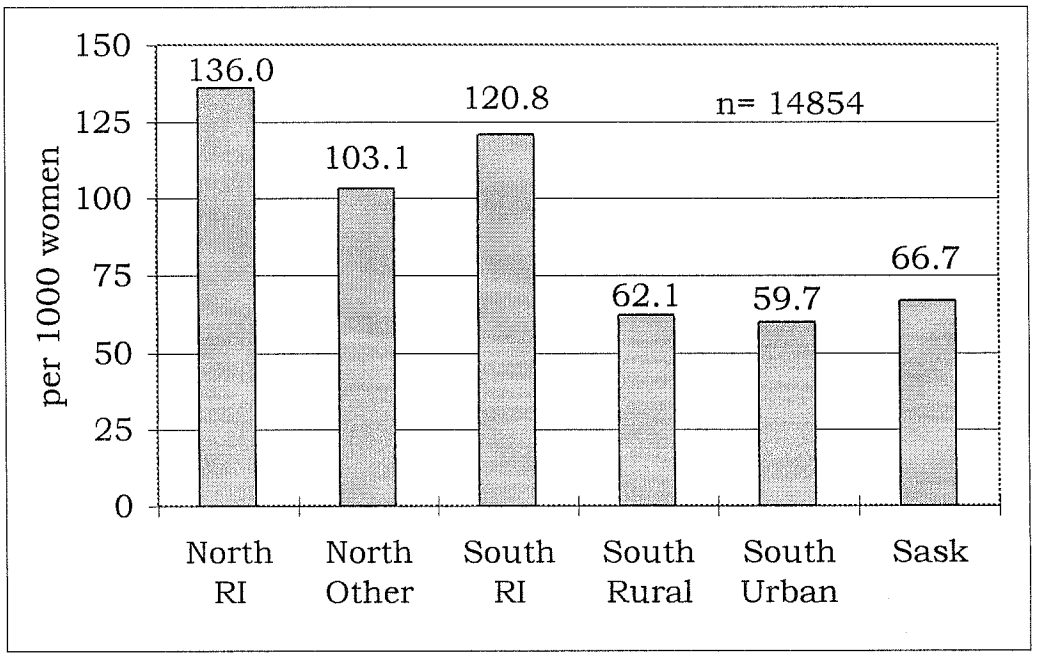

Figure 5-4 Age-standardized hospitalization rates for delivery, 1992/93.

The rates of delivery among northern and registered Indian women were highest among adolescent and young adult women, who also formed the largest population age groups of women. Between 25.2 and 26.6% of registered Indian women and 19.8% of northern other than registered Indian women giving birth in 1992/93 were 15 to 19 years of age in comparison with 8.5% of southern rural and urban women of the same age, as shown in Table 5-6 and Figure 5-5. Deliveries for southern and rural women were distributed in higher proportions among the 25 to 34 year age groups. In comparison, during the years 1978-9, the maternal age was under 20 years for 31.0% of births to registered Indian women in Ontario, Manitoba and Saskatchewan and Alberta and 35 years and older for 5.2% of births. For all other women in these provinces, the maternal age was under 20 years for 10.2% of births and 35 years and older for 4.5% of births [40].

Table 5-6 Distribution of Deliveries, By Mother's Age Group and Study Group, 1992/93

Number of Deliveries						
age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	162	232	149	74	26	643
North Other	79	133	119	51	18	400
South RI	458	643	374	178	68	1721
South Rural*	370	830	1690	1070	410	4370
South Urban*	660	1590	2700	2080	690	7720
Sask	1729	3428	5032	3453	1212	14854
Proportion of Deliveries in Each Age Group						
age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	25.2	36.1	23.2	11.5	4.0	100.0
North Other	19.8	33.3	29.8	12.8	4.5	100.0
South RI	26.6	37.4	21.7	10.3	4.0	100.0
South Rural	8.5	19.0	38.7	24.5	9.4	100.0
South Urban	8.5	20.6	35.0	26.9	8.9	100.0
Sask	11.6	23.1	33.9	23.2	8.2	100.0

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

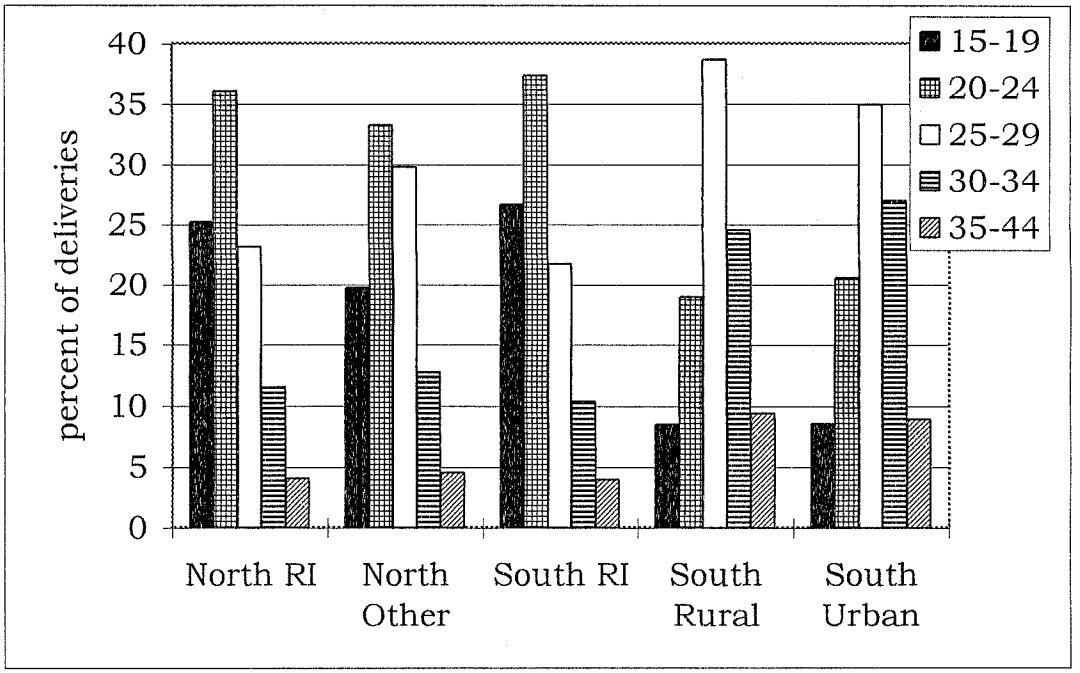

Figure 5-5 Distribution of deliveries by mother's age-group, 1992/93.

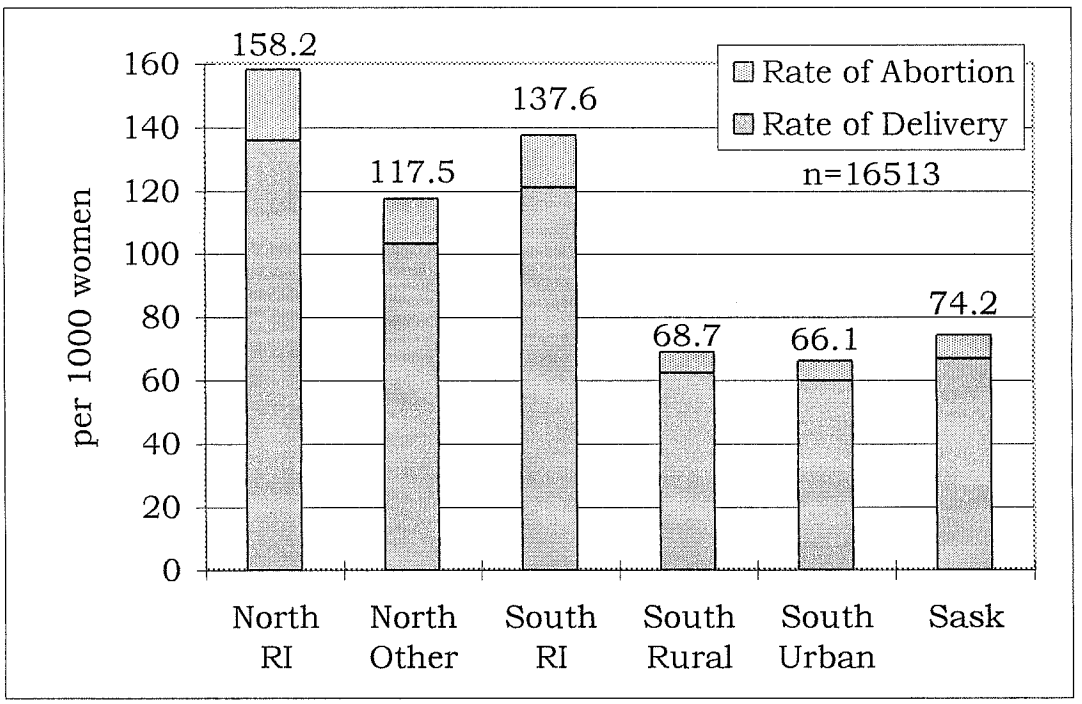

Figure 5-6 Age-standardized rates of documented pregnancy, 1992/93.

Pregnancies

The age-standardized rates of pregnancy documented in the hospitalization study data per 1,000 women of reproductive age combine the hospitalization rates for abortive outcomes and delivery (Table 5-3 and Figure 5-6). The rates for registered Indian women were more than twice those for southern rural women; the rates for northern other than registered Indian women were 1.7 times those for southern rural women.

5.1.3. Discussion

The difficulties in using hospitalization data alone to determine the number of pregnancies were presented earlier in this section and in Chapter 4. A more accurate picture would be obtained by linking obstetric hospital records to newborn records and including data from out patient visits and day surgeries. Improvements planned for Saskatchewan Health's data network over the next few years will facilitate access to this information by Health Districts and First Nations agencies.

The high rates of pregnancy among northern and registered Indian women are not news. The extremely high rate among northern and registered Indian adolescents is particularly concerning. At a time when many other 15-19 year old teen-aged girls were finishing high school or preparing for employment or further education in 1992/93, almost 18% of registered Indian teen-aged girls and 12% of northern other than registered Indian teen-aged girls were carrying a pregnancy through to delivery and preparing to become parents either for the first time or again. Teen pregnancy is often associated with interrupted education and single parenting which add to the stresses existing with poverty and other social issues. In a review of infant mortality on Canadian Indian reserves during the period 1976 to 1983, Morrison, et

al, found that single marital status and multipara status (5 or more previous births) were risk factors for postneonatal mortality (infant deaths between 28 days and 1 year of age per 1,000 live births) on reserves [40]. However, maternal age was not associated with increased postneonatal mortality on reserves. This was in contrast to the risk for Canadians as a whole, where maternal age of less than 20 years was associated with 3.75 times greater risk for postneonatal mortality among infants [40]. There is more cultural acceptance and there are often more family support systems in northern and aboriginal communities for adolescents who become pregnant which would be helpful to young mothers in raising their babies.

Since pregnancy rates are higher among northern and registered Indian women, particularly among young women, there needs to be a greater priority given to prenatal and postnatal care in these communities than in the rest of the province. Prenatal and postnatal programs need to be sensitive to the age group and cultural and social environment of those for whom they are designed.

Given the high pregnancy rates among northern and registered Indian adolescents and young adult women who also make up a larger proportion of the population than other women of reproductive age, there will continue to be major increases in the numbers of young children in these communities. This has implications for the educational system and longer term health care planning, in addition to other concerns regarding employment, housing, and other community services.

5.2. Obstetric Episodes of Care For All Causes Combined

5.2.1. Episodes of Care

Episodes of care were created to combine separations into one record if a woman was admitted to hospital on the same day she had been discharged from the same or a different hospital with an obstetric diagnosis. Episodes of care adjust for the portion of separations resulting from transfers which are higher for non-urban residents. This definition of an episode of care would have missed combining separations when the transfer occurred over midnight, but would have also avoided combining separations that were truly separate hospitalization events.

The age-specific and age-standardized hospitalization rates were determined for the number of episodes of care per 1,000 women of reproductive age and per 100 pregnancies in women of reproductive age. Age-adjusted odds ratios, 95% confidence intervals, chi-square statistics and p-values were determined using the rates per 1,000 southern rural women as the reference.

Table 5-7 shows that the age-specific rates per 1,000 female population for obstetric episodes of care were highest in the 25-44 year age groups for northern registered Indian women, followed by southern registered Indian women and then northern other than registered Indian women. For the 15-24 year age groups, southern registered Indian women had the highest rates, followed by northern registered Indian women and northern other than registered Indian women. This is not surprising, considering that the birth rate in these groups is higher than for southern rural and urban women.

Table 5-7 Age-Specific and Age-Standardized Rates of Obsterical Episodes per 1,000 Women, By Study Group, 1992/93

Female population for reproductive age groups							
age group	15-19	20-24	25-29	30-34	35-39	40-44	Total
North RI	908	883	743	663	447	381	4025
North Other	668	628	710	635	507	360	3508
South RI	2585	2572	2403	1956	1468	1037	12021
South Rural	15239	10226	11033	14016	14743	12438	77695
South Urban	17736	20294	23396	24441	21947	17621	125435
Sask	37136	34603	38285	41711	39112	31837	222684
Number of Obstetric Episodes of Care for All Causes							
age group	15-19	20-24	25-29	30-34	35-39	40-44	Total
North RI	216	350	241	114	34	9	964
North Other	138	207	177	70	34	4	630
South RI	795	1090	630	298	103	23	2939
South Rural*	500	1260	2340	1370	490	90	6050
South Urban*	1110	2660	3580	2700	770	70	10890
Sask	2759	5567	6968	4552	1431	196	21473
Obstetric Episodes of Care per 1,000 Female Population							
age group	15-19	20-24	25-29	30-34	35-39	40-44	Age-std. Rate†
North RI	238	396	324	172	76	24	206
North Other	207	330	249	110	67	11	163
South RI	308	424	262	152	70	22	206
South Rural	33	123	212	98	33	7	86
South Urban	63	131	153	110	35	4	85
Sask	74	161	182	109	37	6	96

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to 1992 Saskatchewan women, aged 15-44

The age-standardized rate ratios for episodes of care for all obstetric diagnoses combined, using the rate per 1,000 southern rural women as the reference, were quite similar to the age-adjusted odds ratios, using the same reference. The odds ratios with 95% confidence intervals, chi-square with 1 degree of freedom and p-values in Table 5-8 show there was a statistically significant difference in the risk of hospitalization for all obstetric causes combined for northern and registered Indian women in comparison with southern rural women. Northern and southern registered Indian women had more than twice the obstetric hospitalization rate in comparison with southern rural women, whose rate was very similar to that of southern urban women. The age-standardized obstetric hospitalization rate for northern other than registered Indian women was 1.9 times that of southern rural women.

Table 5-8 Age-Standardized Rate Ratios and Age-Adjusted Odds Ratios, For All Obstetric Episodes, 1992/93

	Age-std.* Rate Ratio	Age-adj. ψ	β	SE(β)	95% CI lower	95% CI upper	χ^2_1	p
North RI	2.39	3.32	1.199	0.048	3.060	3.60	715.9	<0.0001
North Other	1.88	2.23	0.803	0.048	2.030	2.45	243.9	<0.0001
South RI	2.39	3.25	1.177	0.026	3.080	3.42	1847.9	<0.0001
South Rural	1.00	1.00						
South Urban	0.98	0.99	0.012	0.017	0.956	1.02	0.46	0.4972

RI = registered Indian women; Other = Other than registered Indian women
* Standardized to 1992 Saskatchewan women, ages 15-44
ψ = Odds Ratio; β=coefficient; SE(β)=standard error of coefficient
χ^2_1=chi-square with 1 degree of freedom

Because of the small numbers of pregnancies in the 40 to 45 year age group, this group was combined with the 35 to 39 year age group

for the remainder of the analysis. The age-specific and age-standardized rates of obstetric hospitalization for all causes combined based on 100 pregnancies in the year (Table 5-9) were much closer for all study groups than were the rates expressed per 1,000 women. The age-specific rates of obstetric episodes of care for all study groups combined per 100 pregnancies were highest for the youngest age group, dropping gradually with age. This pattern was followed by southern urban women, and with the exception of a slight rise for women aged 35-44 years, by northern other than registered Indian women, southern registered Indian women and southern rural women. For northern registered Indian women the rate of obstetric episodes of care were lowest among the 15-19 year age group, rising to 25-29 years and then dropping again.

The age-standardized rates of obstetric episodes of care were highest for southern registered Indian women (148 episodes per 100 pregnancies), which were 18% higher than those for southern rural women (125 episodes per 100 pregnancies). There was only a 5 to 9% difference in the age-standardized rates between northern women and southern rural women. These rates are influenced by the number of women who have complications during pregnancy and the postpartum period and the number of times they are treated in hospital throughout their pregnancies.

Table 5-9 Age-Specific and Age-Standardized Rates of Episodes of Care for All Obstetric Diagnoses Combined, per 100 Pregnancies, 1992/93

Number of Pregnancies							
age group	15-19	20-24	25-29	30-34	35-44	Total	
North RI	178	262	175	90	35	740	
North Other	85	151	136	57	25	454	
South RI	508	721	425	212	83	1949	
South Rural*	380	930	1870	1170	480	4830	
South Urban*	730	1820	2950	2280	760	8540	
Sask.	1881	3884	5556	3809	1383	16513	
Number of Obstetric Episodes of Care for All Causes							
age group	15-19	20-24	25-29	30-34	35-44	Total	
North RI	216	350	241	114	43	964	
North Other	138	207	177	70	38	630	
South RI	795	1090	630	298	126	2939	
South Rural*	500	1260	2340	1370	580	6050	
South Urban*	1110	2660	3580	2700	840	10890	
Sask.	2759	5567	6968	4552	1627	21473	
Obstetric Episodes of Care per 100 Pregnancies							
age group	15-19	20-24	25-29	30-34	35-44	Age-std. Rate†	Relative Rate
North RI	121	134	138	127	123	131	1.05
North Other	162	137	130	123	152	136	1.09
South RI	156	151	148	141	152	148	1.18
South Rural	132	135	125	117	121	125	1.00
South Urban	152	146	121	118	111	129	1.03
Sask.	147	143	125	120	118	130	1.04

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to 1992/93 Saskatchewan deliveries

5.2.2. Days' Stay

The age-specific and age-standardized rates of days' stay per 1,000 women of reproductive age are a function of the average length of stay per episode, the average number of episodes of care with each pregnancy, and the fertility rate for each study group. The age-specific and age-standardized rates of days' stay for obstetric episodes of care for all causes combined per 100 pregnancies is a function of the average length of stay per episode and the number of episodes of care with each pregnancy.

The age-specific rates of days' stay per 1,000 women followed the same pattern as the pregnancy rates in 1992/93, with the greatest rate of days for all obstetric diagnoses combined in the 20 to 24 year age group for northern and registered Indian women and in the 25 to 29 year age group for southern rural and urban women (Table 5-10). Northern registered Indian women had the highest age-standardized rate of days' stay for all obstetric episodes of care per 1,000 women, followed in order by southern registered Indian women, northern other than registered Indian women, southern rural and then southern urban women.

The age-specific rates of days' stay per 100 pregnancies in 1992/93 for all study groups combined were highest in the 15 to 19 year age group, declined with age and then rose for women aged 35 to 44 years, a pattern followed by northern other than registered Indian women and southern urban women, although the rate for southern urban women continued to decline in the oldest age group (Table 5-10). In contrast, the age-specific rates of days' stay per 100 pregnancies for northern registered Indian women rose from the youngest to the eldest age groups. Northern registered Indian women had the highest age-standardized rate of days' stay for all obstetric episodes of care per 100

pregnancies, followed in order by southern registered Indian women, northern other than registered Indian women, southern rural and then southern urban women.

Table 5-10 Age-Specific and Age-Standardized Rates For Days' Stay for Obstetric Episodes per 1,000 Women, By Study Group, 1992/93

Female population for reproductive age groups							
age group	15-19	20-24	25-29	30-34	35-39	40-44	Total
North RI	908	883	743	663	447	381	4025
North Other	668	628	710	635	507	360	3508
South RI	2585	2572	2403	1956	1468	1037	12021
South Rural	15239	10226	11033	14016	14743	12438	77695
South Urban	17736	20294	23396	24441	21947	17621	125435
Sask	37136	34603	38285	41711	39112	31837	222684
Number of Days' Stay for Obstetric Episodes of Care							
age group	15-19	20-24	25-29	30-34	35-39	40-44	Total
North RI	883	1321	896	551	196	58	3905
North Other	569	743	654	256	136	8	2366
South RI	2825	3632	2254	1058	475	104	10348
South Rural*	1920	4840	9000	5470	2420	350	24000
South Urban*	3920	9010	13490	9860	2960	270	39510
Sask	10117	19546	26294	17195	6187	790	80129
Days' Stay for Obstetric Episodes of Care per 1,000 Female Population							
age group	15-19	20-24	25-29	30-34	35-39	40-44	Age-std. Rate†
North RI	972	1496	1206	831	438	152	856
North Other	852	1183	921	403	268	22	610
South RI	1093	1412	938	541	324	100	735
South Rural	126	473	816	390	164	28	341
South Urban	221	444	577	403	135	15	306
Sask	272	565	687	412	158	25	360

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to 1992 Saskatchewan women, aged 15-44

Table 5-11 Age-Specific and Age-Standardized Rates For Days' Stay for Obstetric Episodes per 100 Pregnancies, By Study Group, 1992/93

Number of Pregnancies age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	178	262	175	90	35	740
North Other	85	151	136	57	25	454
South RI	508	721	425	212	83	1949
South Rural*	380	930	1870	1170	480	4830
South Urban*	730	1820	2950	2280	760	8540
Sask	1881	3884	5556	3809	1383	16513

Number of Days' Stay for Obstetric Episodes age group	15-19	20-24	25-29	30-34	35-39	Total
North RI	883	1321	896	551	254	3905
North Other	569	743	654	256	144	2366
South RI	2825	3632	2254	1058	579	10348
South Rural*	1920	4840	9000	5470	2770	24000
South Urban*	3920	9010	13490	9860	3230	39510
Sask	10117	19546	26294	17195	6977	80129

Days' Stay for Obstetric Episodes per 100 Pregnancies age group	15-19	20-24	25-29	30-34	35-44	Crude Rate	Age-std. Rate†
North RI	496	504	512	612	726	528	549
North Other	669	492	481	449	576	521	506
South RI	556	504	530	499	698	531	534
South Rural	505	520	481	468	577	497	497
South Urban	537	495	457	432	425	463	467
Sask	538	503	473	451	504	485	485

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to Saskatchewan pregnancies, aged 15-44, 1992/93

5.2.3. Average Length of Stay

Southern registered Indian women on average stayed the fewest days in hospital with each obstetric episode of care for all causes combined in 1992/93 (Table 5-12) but had the highest rate of obstetric episodes of care per 100 pregnancies and second highest rate of days' stay in hospital per 100 pregnancies in 1992/93. Northern registered Indian women had the highest average days' stay per episode for all obstetric diagnoses combined as well as the most days per 1,000 women and per 100 pregnancies. The specific diagnoses and groups of diagnoses contributing to the higher rates are examined in following sections of this chapter. Other factors contributing to these differences may include distances and modes of travel from communities to hospitals, physician practice patterns, and availability of ambulatory care services and support at home (which may influence physician practice patterns).

Table 5-12 Average Length of Stay, Days per 1,000 women, Days per 100 pregnancies, For Obstetric Episodes,1992/93

	number of episodes	Ave. days/ episode	Std. Dev. of Mean	Total Days	Days†/ 1,000 women	Days§/100 pregnancies
North RI	964	4.05	3.36	3905	856	549
North Other	630	3.76	3.12	2366	610	506
South RI	2939	3.52	2.79	10348	735	534
South Rural	605	3.97	3.16	*24000	341	497
South Urban	1089	3.63	2.53	*39510	306	467
Sask.	21473	3.73		80129	360	485

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to 1992 Saskatchewan women, aged 15-44
§Standardized to 1992/93 Saskatchewan pregnancies, ages 15-44

The one-way analysis of variance showed that the differences in the mean days' stay for obstetric episodes among the groups were statistically significant (F-value=7.75, degrees of freedom = 4, $p<0.0001$). The pairwise tests using the Scheffe Method showed the difference in the mean days' stay between northern and southern registered Indian women was statistically significant at the 1% confidence level, between northern registered Indian women and southern urban women at the 5% confidence level and between southern registered Indian women and southern rural women at the 1% confidence level.

5.2.4. Location of Hospital

Northern and rural hospitals are located in communities with northern and rural residence codes respectively. Regional hospitals are located in eleven communities with urban residence codes other than Regina and Saskatoon. They include "large community hospitals", as classified by Saskatchewan Health [2]. The six tertiary care centres in Saskatoon and Regina in 1992/93 are classified as base hospitals. Hospitals classified as "Other" are located outside of the province. The distribution of initial separations of episodes of care occurring at each type of hospital were examined for each study group, as shown in Table 5-13 and Figure 5-7.

Northern other than registered Indian women and northern registered Indian women had only 40.2 and 42.4 percent of their obstetric admissions initiated in northern hospitals, and 26 and 45.6 percent respectively in urban (regional or base) hospitals in 1992/93. Since not all women with northern residence codes live in the north, as shown in Table 5-2, the proportion of obstetric admissions initiated in northern hospitals for women actually living in the north would be slightly higher than these figures indicate.

Although there are some northern communities within 90 miles of a southern centre where women receive their routine medical and hospital care, there would still be a large proportion of northern women traveling long distances to receive obstetric care in southern rural, regional or base hospitals on a referral basis. Except for the larger community out-of-province hospital that provides routine service to northern people, northern hospitals provide only routine obstetric care. This has implications for families left behind, and suggests a need for improved or alternate service in the north as well as a closer look at the conditions that contribute to admissions to hospitals. One could also examine the differences in hospital location as indicating differences in accessibility to care that regional and base hospitals provide.

Seven and one-half percent (119) of the 1594 obstetric episodes of care for northern women in 1992/93 involved inpatient transfers between hospitals; 108 episodes involved one transfer and 11 had two transfers (130 transfers in total). Of the 130 transfers, 90 occurred to or from a northern hospital. The remaining 40 transfers were among other than northern hospitals.

The study data did not contain consistent information about transfers from outpatient departments to other hospitals; however, this type of transfer is likely as common as inpatient transfers. Further investigation in this area would provide useful information to health districts and First Nations health services.

Table 5-13 Proportion of Episodes of Care with Initial Separation at Each Hospital Location For Each Study Group, 1992/93

Number of Episodes of Care by Initial Hospital Location						
Hospital	North RI	North Other	South RI	South Rural*	South Urban*	Sask.
North	409	253	8	0	0	670
Rural	94	160	694	1160	50	2158
Regional	269	73	920	2560	3220	7042
Base	171	91	1243	2050	7520	11075
Other	21	53	74	280	100	528
	964	630	2939	6050	10890	21473
Percent of Episodes of Care by Initial Hospital Location						
Hospital	North RI	North Other	South RI	South Rural	South Urban	Sask.
North	42.4	40.2	0.3	0.0	0.0	3.1
Rural	9.8	25.4	23.6	19.2	0.5	10.0
Regional	27.9	11.6	31.3	42.3	29.6	32.8
Base	17.7	14.4	42.3	33.9	69.1	51.6
Other	2.2	8.4	2.5	4.6	0.9	2.5
	100.0	100.0	100.0	100.0	100.0	100.0

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

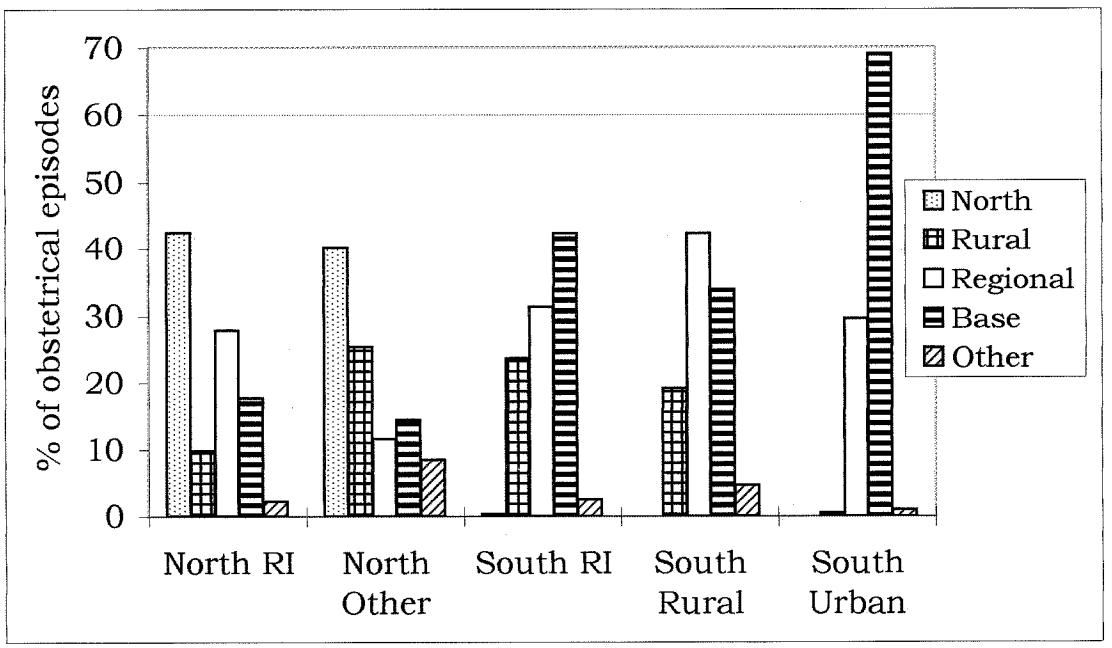

Figure 5-7 Percent of obstetrical episodes of care for hospital location of initial separation, 1992/93.

5.3. Ectopic Pregnancy

The study of ectopic pregnancy is presented in five parts. Firstly, ectopic pregnancy, which forms the numerator for the calculation of most rates, is operationally defined. The next three parts present the method and results of analysis of ectopic pregnancy rates, the length of stay and the initial hospital location. Finally, the results are compared with findings from other studies on ectopic pregnancy.

5.3.1. Operational Definition

Ectopic pregnancy was operationally defined as an episode of care with at least one of the separations containing a primary, secondary or tertiary diagnostic code, ICD-9 633.0 to 633.9. Miscoding of the diagnosis for ectopic pregnancy occurs in Canadian data but has been considered minor[24]. The effect of sampling on the representativeness of the data is not known specifically for ectopic pregnancy. However, Table 4-1 showed that the number of separations for all of Canadian List Number 145 (ICD-9 630-633,639) was very similar for both the 1992/93 study data and the data published by Saskatchewan Health for the same year[2].

To avoid double counting abortive outcomes, separation records were linked into one outcome if there were two weeks or less from the first separation to the next admission for one person with abortive outcome. For example, a woman could be discharged from one hospital with a diagnosis of unspecified ectopic pregnancy and admitted to another hospital a few days later for removal of a tubal pregnancy. Both separations would be counted as part of one ectopic pregnancy.

There were 90 episodes in the data for ectopic pregnancy for women within the ages of 15 and 44, representing an estimated 288 ectopic pregnancies for all of Saskatchewan after accounting for the

differential sampling in the study groups. There were three women each with 2 ectopic pregnancies, separated by six weeks to more than 5 months apart during the year. It may have been that two of these women actually had one ectopic pregnancy and were readmitted for complications.

5.3.2. Rate of Ectopic Pregnancy

The rate of ectopic pregnancy was based on the number of ectopic pregnancies per 100 documented pregnancies, which included spontaneous and induced abortions, ectopic pregnancies, and deliveries. Because of the small numbers of ectopic pregnancy, the five-year age groups were collapsed into two 15-year age groups to calculate age-specific and age-standardized rates per 1,000 pregnancies. Age-standardized rates were also expressed per 10,000 women of reproductive age (15-44 years).

Odds ratios with 95% confidence intervals were calculated to compare age-adjusted rates for each study group to those for southern rural women. The odds ratio is close in value to the rate ratio when the outcome of interest is infrequent, as in the case of ectopic pregnancy, and lends itself more readily to multivariate analysis.[41] Because of the small numbers of ectopic pregnancy, further statistical testing of ectopic pregnancy rates was not done.

The age-specific and age-standardized ectopic pregnancy rates are presented in Table 5-14 along with the odds ratios and 95% confidence intervals. The age-standardized ectopic pregnancy rates are shown in Figure 5-8. There were fewer than five ectopic pregnancies for northern other than registered Indian women ages 30-44 so comparisons for this group may not be reliable.

The rate of ectopic pregnancy increased with age for all groups. The increase from the 15-29 year to the 30-44 year groups was 3.5 to

over 4 times for registered Indian and southern rural women, but only 1.4 times for southern urban women. If larger numbers were available to allow for five-year age groupings, such as from several years data, an

Table 5-14 Age-Specific Rates and Age-Adjusted Odds Ratios per 1,000 Pregnancies, For Ectopic Pregnancy, ICD-9 633.0-633.9, By Study Group, 1992/93

Number of Ectopic and All Pregnancies

	Age 15-29		Age 30-44		All ages	
	# ectopic pregs.	# all pregs	# ectopic pregs.	# all pregs	# ectopic pregs.	# all pregs
North RI	10	615	7	125	17	740
North Other	9	372	‡2	82	11	454
South RI	23	1654	17	295	40	1949
South Rural	20	3180	40	1650	60	4830
South Urban	90	5500	70	3040	160	8540
Sask.	152	11321	136	5192	288	16513

Rates of ectopic pregnancy per 1,000 pregnancies

	age-specific rates		Age-std.		95% C.I.			
	15-29	30-44	rate†	OR *	lower	upper	χ^2_1	p
North RI	16.3	56.0	28.8	2.50	1.43	4.38	8.85	0.0029
North Other	24.2	24.4‡	24.3	2.50	1.29	4.84	6.06	0.0138
South RI	13.9	57.6	27.7	2.35	1.54	3.57	14.8	0.0001
South Rural¶	6.3	24.2	11.9	1.00				
South Urban¶	16.4	23.0	18.5	1.50	1.12	2.03	7.57	0.0059
Sask.	13.4	26.2	17.4					

RI = Registered Indian women; Other = Other than registered Indian women
† age-standardized to Saskatchewan pregnancies, ages 15-44, 1992/93
*age-adjusted odds ratios for each group compared to southern rural women
‡ the small numbers may make comparisons with this group unreliable
¶ adjusted for 10% sample (n=10 x sample number)
ψ = Odds Ratio; χ^2_1=chi-square with 1 degree of freedom

even larger difference would likely be evident between the youngest and oldest age groups. The rates of ectopic pregnancy for women 15-29 and 30-44 years for northern and registered Indian women were more than twice that for southern rural women in 1992/93. The age-adjusted odds ratios and 95% confidence limits show the difference in ectopic pregnancy rates per 100 pregnancies between southern rural women and each of the other groups was statistically significant.

The age-standardized rate of ectopic pregnancy per 10,000 women aged 15-44 reflects the rate of pregnancy as well as the rate of ectopic pregnancy per 1,000 pregnancies, and is an indicator of the burden of illness for women of reproductive age in each study group. As indicated in Table 5-15 and shown in Figure 5-9, northern and registered Indian women experienced ectopic pregnancy at more than two and three times the rate of all of Saskatchewan women in 1992/93 (28.9 to 43.3 ectopic pregnancies per 10,000 women as compared to 12.9 ectopic pregnancies per 10,000 women).

Because of the small numbers of ectopic pregnancy in each of the groups, these results should be interpreted with caution.

Table 5-15 Age-Standardized Rates of Ectopic Pregnancy per 10,000 Women Aged 15 to 44 Years, 1992/93

	# women		Age-std. rate†
	15-29	30-44	
North RI	2534	1491	43.3
North Other	2006	1502	28.9
South RI	7560	4461	34.3
South Rural	36498	41197	7.6
South Urban	61426	64009	12.8
Sask.	110024	112660	12.9

RI=Registered Indian women; Other=Other than registered Indian women
†Standardized to 1992 Saskatchewan women, aged 15-44. The number of ectopic pregnancies for each group are shown in Table 5-14.

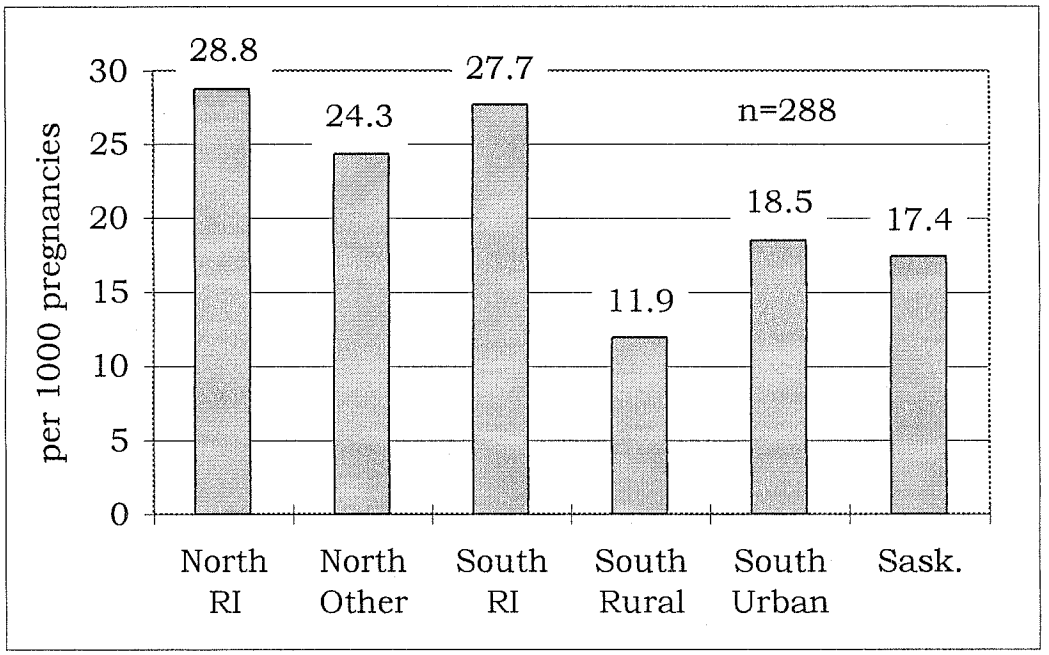

Figure 5-8 Age-standardized rate of ecopic pregnancy per 1,000 pregnancies, 1992/93.

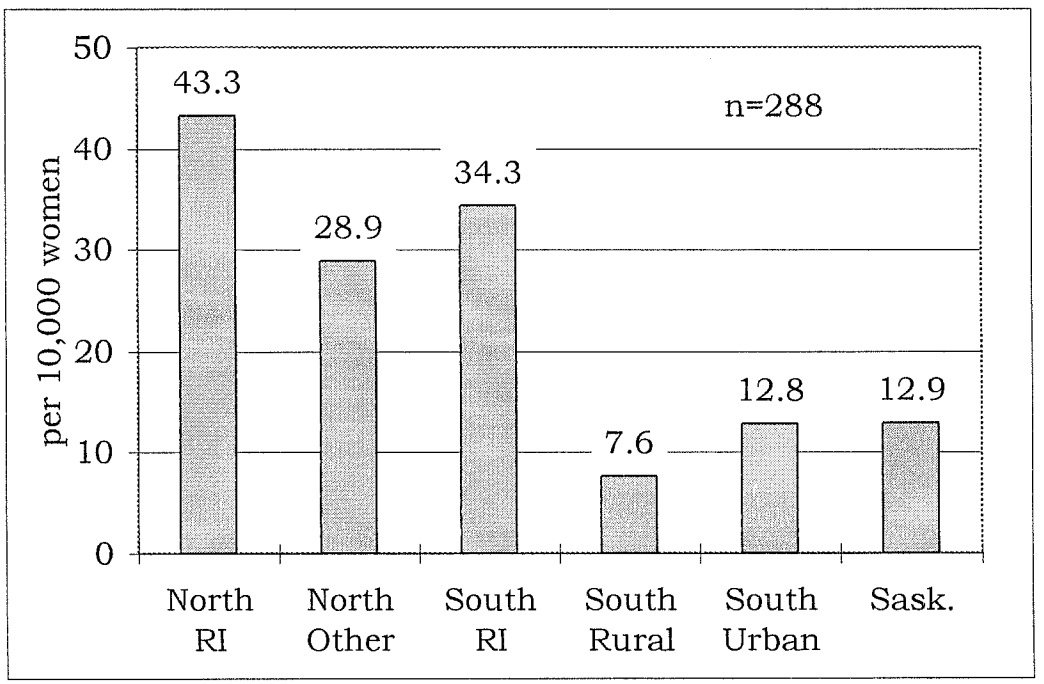

Figure 5-9 Age-standardized rate of ectopic pregnancy per 10,000 women aged 15-44, 1992/93.

5.3.3. Length of Stay

The mean length of stay for each study group, presented in Table 5-16, was based on the total number of hospital days for each ectopic pregnancy. If a woman was separated from hospital more than once within a two week period for ectopic pregnancy, the number of days summed over all of the separations were included in the length of stay. The mean number of days is based on the actual number of ectopic pregnancies in the data for each group and was derived using one-way analysis of variance. The total days' stay for ectopic pregnancy have been adjusted for the 10% sampling for southern rural and urban groups. The rate of days per 1,000 women is a function of the fertility of each study group as well as the number of ectopic pregnancies and the average length of stay and is an indicator of resources used.

Although the mean length of stay ranged from 3.44 days per ectopic pregnancy for southern rural women to 4.36 days for northern other than registered Indian women, the difference in the mean length

Table 5-16 Length of Stay for Ectopic Pregnancy, 1992/93

	n†	Mean	Std. Dev.	Total Days	Days*/1,000 women
North RI	17	4.18	1.63	71	17.6
North Other	11	4.36	2.01	48	13.7
South RI	40	4.05	2.45	162	13.5
South Rural	6	3.50	2.43	**210	2.7
South Urban	16	3.44	2.10	**550	4.4
**Total	288	3.61		**1041	4.7

RI=Registered Indian women; Other=Other than registered Indian women
† actual number in the data, unadjusted for sampling
* crude rates for women ages 15-44
**adjusted for 10 % sampling in south rural and urban groups

of stay was not statistically significant between any of the groups, based on the results from the one-way analysis of variance (F-value=0.44, degrees of freedom=4, p=0.779). The Levene's test from the BMDP 7D program showed there was no significant difference in the variances among the groups (F-value=0.71, p=0.5898).

The high rates of pregnancy, particularly ectopic pregnancy, are reflected in the rates of days' stay for ectopic pregnancy per 1,000 northern and registered Indian women which are 5 to 6½ times the rate for southern rural women.

5.3.4. Initial Hospital Location

Because of the small number of ectopic pregnancies, the study groups were combined into three groups as shown in Figure 5-10 to examine the location of hospital in which the initial diagnosis of ectopic pregnancy was made.

Over 36% (10/28) of northern women with ectopic pregnancy were diagnosed in a northern or rural hospital, compared to 4.5 to 5% for southern rural and urban and southern registered Indian women. Two of the 10 northern women were subsequently cared for in a base hospital. The other 8 women had only one separation for the ectopic pregnancy and were treated either at the Flin Flon, Manitoba hospital or the Meadow Lake hospital, which are similar in size and some services to some of the regional hospitals. It is unlikely that women would be treated at other northern or rural hospitals for ectopic pregnancy without subsequent referral to a larger centre.

5.3.5. Discussion

This study used the same denominator as that used by Mustard, Barer, and Sheps in Manitoba. Since not all women with spontaneous

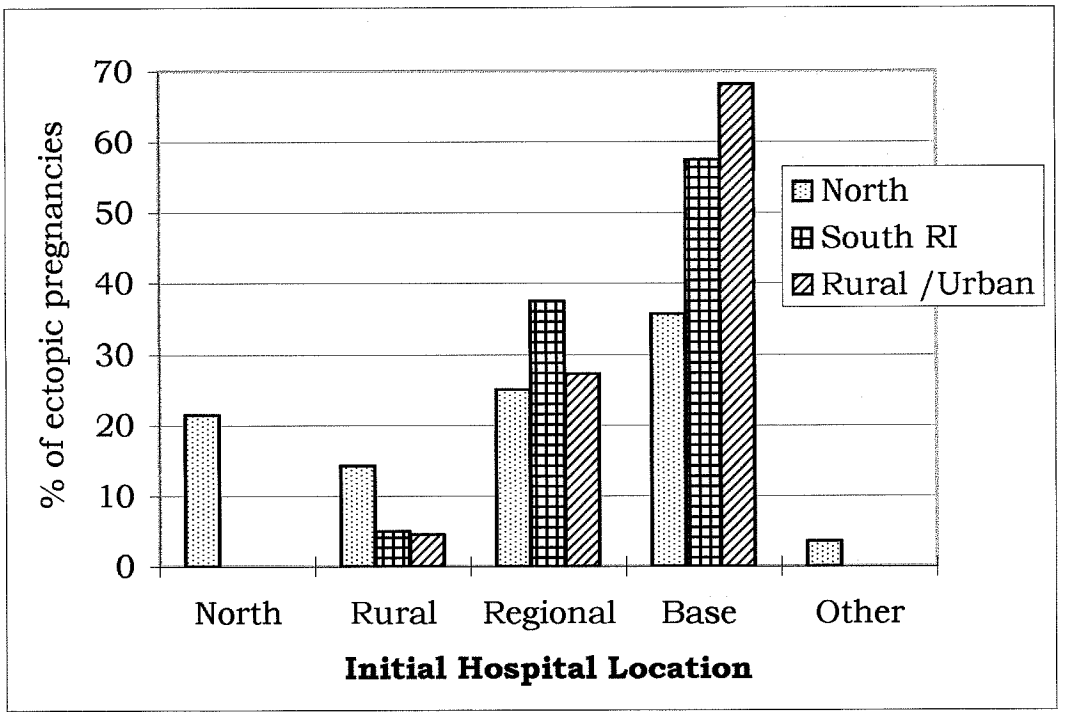

Figure 5-10 Percent of ectopic pregnancies by study group and initial hospital location, 1992/93.

or legally induced abortion would be hospitalized, these outcomes would be under-represented in the denominator, contributing to an over-estimation of the rate of ectopic pregnancy.

To determine the variation in the ectopic pregnancy rate introduced by variation in documented spontaneous abortion, the crude rate of ectopic pregnancy was examined separately, with spontaneous abortion included and then excluded. The ectopic pregnancy rate increased by 0.08 to 0.18 percent for each study group when spontaneous abortion was removed from the denominator (n=1013), but the rates remained in the same rank order. Study group was also shown to not be a significant predictor for age-adjusted rates of women

hospitalized with spontaneous abortion in 1992/93 ($\chi^2_{\text{degrees of freedom}=4}$ =8.56, ρ=0.0785); therefore including documented spontaneous abortions in the pregnancy denominator would not have introduced significant bias in rates based on the number of pregnancies for each study group. Physician practice patterns, the availability of outpatient care, the women's likelihood of seeking medical care for spontaneous abortion, and the rate of associated complications, would all influence the hospitalization rates for spontaneous abortion.

In this study, the age-standardized rate of ectopic pregnancy for all of Saskatchewan in 1992/93 was 17.4 per 1,000 documented pregnancies, which was higher than in Manitoba in 1989 (14.7 ectopic pregnancies per 1,000 documented pregnancies)[32]. The age-specific rates were higher in the older age group. The age-standardized ectopic pregnancy rates were highest in both groups of registered Indian women (27.7-28.8/1,000 pregnancies), followed by northern other than registered Indian women (24.3/1,000 pregnancies). In comparison, Manitoba registered Indian women had 15.5 ectopic pregnancies per 1,000 pregnancies in 1989 [32].

There were no women diagnosed with ectopic pregnancy treated solely in a northern hospital, indicating that appropriate referrals are being made.

The mean length of stay was not statistically significantly different between any of the study groups. If a larger number of ectopic pregnancies were to be studied, such as for a period of several years, differences may become evident. One would expect that northern and rural women would have longer days' stay per ectopic pregnancy because of transfers needed to obtain access to diagnostic and surgical services. However, northern other than registered Indian women had the longest mean length of stay but, next to urban women, had the

second fewest number of admissions per ectopic pregnancy. Further study would reveal if these differences are real or due to small numbers.

Possible factors that have been discussed by other authors as contributing to the rising incidence of ectopic pregnancy include: 1) better diagnostic methods such as ultrasound and laparoscopy; 2) higher rates of salpingitis and pelvic inflammatory disease following sexually transmitted infection (STI); 3) the occurrence of STI with an intrauterine device (IUD) in place. Better diagnostic methods could not account for the higher rates of ectopic pregnancy in northern and registered Indian women, since a lower proportion of women in these study groups are hospitalized in tertiary care facilities in comparison with southern rural and urban women. The contribution of an STI with an IUD in place to the differences in rates cannot be examined using hospitalization data alone. An association cannot be shown in this study between ectopic pregnancy and pelvic inflammatory disease. However, the age-specific separation rates for pelvic inflammatory disease as one of a primary, secondary or tertiary diagnosis were two to three times higher for northern and registered Indian women than for southern rural and urban women for most age groups in 1992/93 (Appendix F - Pelvic Inflammatory Disease).

To reduce the morbidity and potential mortality from ectopic pregnancy, early detection is important. Access to informed health care providers and appropriate diagnostic services is essential, particularly for those in northern and rural areas with long distances to tertiary care. Clearly, any efforts to reduce rates of ectopic pregnancy will have to address the incidence of sexually transmitted infection with the attendant issues of social and sexual inequities.

5.4. Antenatal Hospitalization

The goal of this analysis was to examine the antenatal episodes of care for Saskatchewan women aged 15-44. In the first subsection, antenatal hospitalization is defined. Subsections two and three present the rates of antenatal hospitalization for women for all causes combined and for selected antenatal diagnoses, respectively. The length of stay and location of hospitalization are presented. Finally, the results are discussed and compared with findings from other antenatal hospitalization studies.

5.4.1. Operational definition

An antenatal hospitalization was operationally defined as an episode of care with at least one of the separations containing a pregnancy-related primary, secondary or tertiary diagnosis but in which the woman was discharged still pregnant.

A subset of antenatal records were selected from the obstetric data by excluding episodes of care with diagnoses (ICD-9) or procedures (CCP) identifying an abortive outcome, delivery, complications of labour, delivery, and the puerperium, or supplementary diagnoses for incidental pregnancy and routine postpartum care. This process of exclusion rather than one of inclusion was used to avoid selecting separations that also included an abortive outcome or delivery, since the intent was to examine only antenatal episodes in this section. A limitation of this method was that antenatal complications were not counted if they occurred during the same episode as a delivery or abortive outcome. Since a woman may go into hospital with antenatal complications that lead to the end of her pregnancy before she is discharged, the antenatal data in this study undercount the actual number of antenatal complications and the mean length of stay for

antenatal episodes. A more accurate description of antenatal complications would require linkage to the neonatal record for the date of delivery and gestational age and access to the maternal hospital record for the date of abortive outcomes.

The outcome of delivery and the complete antenatal hospitalization history was not known for every woman who was hospitalized for pregnancy-related diagnoses or procedures within the study period, since the data included separation records only for those discharged from hospital April 1, 1992 through March 31, 1993. Therefore, the analysis of antenatal hospitalization could not be stratified by the type of pregnancy outcome (i.e. abortion or delivery) since the outcome could not be determined for every woman with an antenatal hospitalization.

The total number of antenatal episodes was estimated by adjusting for the ten per cent sampling for the hospital records of southern rural and urban women.

Analysis was based on both the number of antenatal episodes of care and the number of women who were hospitalized antenatally. There were an estimated 4449 antenatal episodes of care for the estimated 3365 women hospitalized antenatally in 1992/93, giving an average of 1.3 episodes per woman hospitalized antenatally.

5.4.2. Rates Of Antenatal Hospitalization For All Causes Combined

Age-specific and age-standardized rates and age-adjusted odds ratios of antenatal hospitalization for all causes combined were calculated as the number of antenatal episodes of care per 100 documented pregnancies (Table 5-17).

Table 5-17 Rate of Antenatal Episodes of Care Per 100 Documented Pregnancies, By Study Group and Age Group, 1992/93

Number of Pregnancies	15-19	20-24	25-29	30-34	35-44	Total
North RI	178	262	175	90	35	740
North Other	85	151	136	57	25	454
South RI	508	721	425	212	83	1949
South Rural*	380	930	1870	1170	480	4830
South Urban*	730	1820	2950	2280	760	8540
Sask.	1881	3884	5556	3809	1383	16513

Number of Antenatal Episodes of Care	15-19	20-24	25-29	30-34	35-44	Total
North RI	30	81	65	21	5	202
North Other	48	51	36	12	12	159
South RI	270	334	191	76	37	908
South Rural*	100	300	400	160	100	1060
South Urban*	350	730	570	390	80	2120
Sask.	798	1496	1262	659	234	4449

Rate of Antenatal Episodes of Care per 100 Pregnancies	15-19	20-24	25-29	30-34	35-44	Crude rate	Age-std†
North RI	16.9	30.9	37.1	23.3	14.3	27.3	28.3
North Other	56.5	33.8	26.5	21.1	48.0	35.0	32.2
South RI	53.1	46.3	44.9	35.8	44.6	46.6	44.1
South Rural	26.3	32.3	21.4	13.7	20.8	21.9	21.9
South Urban	47.9	40.1	19.3	17.1	10.5	24.8	26.2
Sask.	42.4	38.5	22.7	17.3	16.9	26.9	

RI = Registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to Saskatchewan pregnancies, ages 15-44, 1992/93

For all study groups combined, the rates of antenatal episodes per pregnancy declined with age, a pattern followed by southern urban women, northern other than registered Indian women, and southern registered Indian women, with the exception of a rise in the rates for

women aged 35-44 for the latter two groups, as shown in Table 5-17 and Figure 5-11. For northern registered Indian women, the rates for the 15-19 year age group were the second lowest, rising to age 25-29 and then falling to the lowest rate for the 35-44 year age group.

Southern registered Indian women had the highest age-standardized rate of 44.1 antenatal episodes of care per 100 pregnancies in comparison with southern rural women who had the lowest rate of 21.9 antenatal episodes per 100 pregnancies. The age-standardized rates of antenatal episodes per 100 pregnancies for northern registered Indian women were similar to those of southern urban women; the differing age-specific rates between the two groups were offset by the greater similarities in the age distribution of pregnancies between southern urban women and the rest of the province.

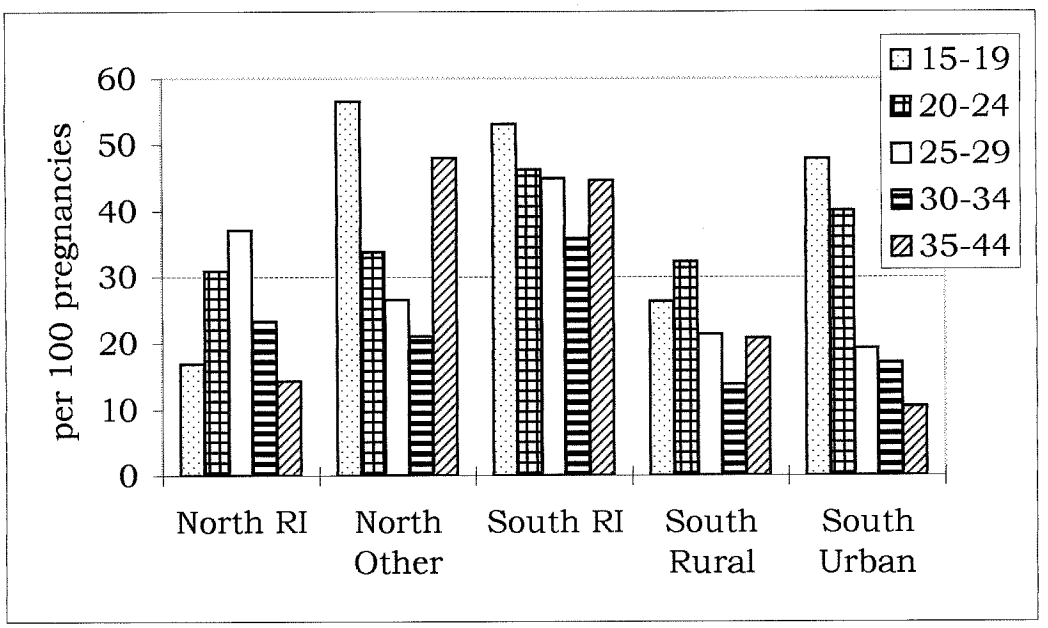

Figure 5-11 Rate of antenatal episodes by age group, 1992/93.

The differences in the rates of antenatal hospitalization for each study group in relation to those of southern rural women were tested for statistical significance by calculating age-adjusted odds ratios and 95 % confidence intervals, which are presented in Table 5-18. The age-adjusted odds ratios showed the difference in the risk for antenatal hospitalization with each pregnancy was statistically significant between southern rural women and the other study groups, except for the comparison with northern registered Indian women which had borderline significance (p=0.1089).

Table 5-18 Age-Adjusted Odds Ratios For Antenatal Episodes of Care per Pregnancy, 1992/93

				95 % C.I. of ψ			
	ψ	β	SE(β)	lower	upper	χ^2_1	ρ
North RI	1.16	0.151	0.093	0.97	1.40	2.57	0.1089
North Other	1.63	0.486	0.107	1.32	2.01	19.82	<0.0001
South RI	2.60	0.956	0.061	2.31	2.93	245.04	<0.0001
South Rural	1.00						
South Urban	1.15	0.143	0.044	1.06	1.26	10.69	0.0011

RI = Registered Indian women; Other = Other than registered Indian women
ψ = Odds Ratio; β=coefficient; SE(β)=standard error of coefficient
χ^2_1=chi-square with 1 degree of freedom

To examine whether the higher rates of antenatal episodes per pregnancy was due to a few women having many antenatal episodes or to many women on average having more antenatal episodes, the number of antenatal episodes for each woman with at least one pregnancy was determined. The number of women with no antenatal episodes was estimated by subtracting the number of women with at least one antenatal episode from the number of women with at least one pregnancy end in the study year.

Among the women with one or more documented pregnancies, 20.6% (3365/16297) had one or more antenatal episodes of care, as

shown in Table 5-19. Southern registered Indian women with documented pregnancy had the highest proportion with one or more antenatal episodes of care (32.4%) compared with 18.2% and 18.9% of southern rural and urban women respectively with one or more episodes of antenatal care. The total number of antenatal episodes of care would be influenced by the number of pregnancies the woman had

Table 5-19 Number Of Women With Documented Pregnancy By Number Of Antenatal Episodes And Study Group, 1992/93

	Number of antenatal episodes of care					
	0	1	2	3-5	1-5	Total women
North RI	559	127	30	4	161	720
North Other	322	88	24	7	119	441
South RI	1281	414	130	71	615	1896
South Rural*	3910	720	110	40	870	4780
South Urban*	6860	1200	320	80	1600	8460
Total	12932	2549	614	202	3365	16297

Percent Of Women With Documented Pregnancy By Number Of Antenatal Episodes And Study Group, 1992/93

	Number of antenatal episodes of care				
	0	1	2	3-5	1-5
North RI	77.6	17.6	4.2	0.6	22.4
North Other	73.0	20.0	5.4	1.6	27.0
South RI	67.6	21.8	6.9	3.7	32.4
South Rural	81.8	15.1	2.3	0.8	18.2
South Urban	81.1	14.2	3.8	0.9	18.9
Total	79.4	15.6	3.8	1.2	20.6

n = number of pregnant women
RI = Registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

during the year. The role of other factors which may contribute to antenatal hospitalization, such as physician practice patterns, the availability of ambulatory care and hospital beds, the severity of illness exacerbated by not using ambulatory services, the incidence of underlying illness, access to social and family support, parity, gestational age, and other demographic factors cannot be determined using this hospitalization data. The differences in the proportion of women with multiple antenatal episodes of care will contribute to differences in the rate of antenatal episodes of care per pregnancy.

The rate of antenatal episodes per pregnancy are influenced by the number of women with antenatal hospitalization as well as the number of episodes each woman has. To examine the proportion of women with antenatal episodes, age-specific and age-standardized rates were calculated and are presented in Table 5-20. Age-adjusted odds ratios with 95% confidence intervals were determined to test the statistical significance of the difference remaining when the effect of multiple episodes had been removed. These are presented in Table 5-21.

The proportion of women with antenatal episodes for all groups combined and for southern urban women declined with age (31.7% for ages 15-19 to 12.9% for ages 35-44). Northern other than registered Indian women, southern registered Indian women, and southern rural women also followed this pattern, except for an increase in the proportion of 35-44 year old women with antenatal episodes. For northern registered Indian women, the proportion of women with antenatal episodes increased with age to the middle years and then decreased in the final ten-year period.

Table 5-20 Percent of Women with Documented Pregnancy With One Or More Antenatal Episodes of Care, By Age Group and Study Group, 1992/93

Number of Women with Documented Pregnancies						
	15-19	20-24	25-29	30-34	35-44	All ages
North RI	177	249	171	88	35	720
North Other	85	145	130	56	25	441
South RI	495	703	412	207	79	1896
South Rural*	380	910	1860	1160	470	4780
South Urban*	730	1800	2940	2230	760	8460
Sask.	1867	3807	5513	3741	1369	16297

Number of Women with One Or More Antenatal Episodes of Care						
	15-19	20-24	25-29	30-34	35-44	All ages
North RI	24	67	48	19	3	161
North Other	35	40	28	9	7	119
South RI	182	220	132	55	26	615
South Rural*	100	230	320	150	70	870
South Urban*	250	460	510	310	70	1600
Total	591	1017	1038	543	176	3365

Percent of Women With One Or More Antenatal Episodes of Care, By Age Group and Study Group, 1992/93						
	15-19	20-24	25-29	30-34	35-44	Age-std†
North RI	13.6	26.9	28.1	21.6	8.6	23.0
North Other	41.2	27.6	21.5	16.1	28.0	24.5
South RI	36.8	31.3	32.0	26.6	32.9	31.2
South Rural	26.3	25.3	17.2	12.9	14.9	18.2
South Urban	34.2	25.6	17.3	13.9	9.2	19.7
Total	31.7	26.7	18.8	14.5	12.9	20.6

RI=Registered Indian women; Other=Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to Sask. women with pregnancy, aged 15-44, 1992/93

The higher proportions of northern and registered Indian women with one or more antenatal episodes of care in pregnancy in comparison

to southern rural and urban women were also seen earlier in Table 5-19. Table 5-21 shows that the differences are statistically significant only in the comparisons of northern other than registered Indian women and southern registered Indian women with southern rural women. More study is needed to determine why the rates are so much higher for these two groups compared to southern rural women and not for northern registered Indian women. Are there real differences in maternal morbidity? What role do physician practice and access to needed service play?

Table 5-21 Age-adjusted Odds Ratios For Women with Antenatal Hospitalization, 1992/93

				95 % C.I. of ψ			
	ψ	β	SE(β)	lower	upper	χ^2_1	ρ
North RI	1.11	0.102	0.101	0.91	1.35	1.00	0.3162
North Other	1.40	0.335	0.116	1.11	1.76	7.97	0.0048
South RI	1.82	0.597	0.066	1.60	2.07	80.1	<0.0001
South Rural	1.00						
South Urban	1.03	0.312	0.047	0.94	1.13	0.44	0.5079

RI = Registered Indian women; Other = Other than registered Indian women
ψ = Odds Ratio; β=coefficient; SE(β)=standard error of coefficient
χ^2_1=chi-square with 1 degree of freedom

5.4.3. Specific Antenatal Complications

To get a glimpse into the antenatal complications that are diagnosed on separation from hospital, the leading primary diagnoses were examined for each study group.

As previously discussed, the separations for a woman who was discharged and readmitted to hospital the same day were considered as part of the same episode of care in this study. In effect then, the women who were transferred once or twice during the episode of care potentially contributed six or nine diagnoses to the data. To balance the

number of diagnoses analyzed for each episode of care, the records for each diagnosis were selected on the presence of a primary, secondary or tertiary diagnosis in the first separation of an episode of care for the analysis of these selected diagnoses. Analysis of nonobstetric diagnoses was based on the primary diagnosis made for the first separation of the episode. Overall, 97.1% of antenatal episodes included only one hospital separation (Table 5-22). The range of 6.3% episodes with more than one separation per episode for northern other than registered Indian women to 1.9% for southern urban women reflects the better access that urban women have to tertiary care.

Table 5-22 Number and Percent of Antenatal Episodes, By Number Of Separations Per Episode and By Study Group, 1992/93

	1 separation		2 separations		3 separations	
	n	%	n	%	n	%
North RI	194	96.0	8	4.0	0	0.0
North Other	149	93.7	7	4.4	3	1.9
South RI	879	96.8	29	3.2	0	0.0
South Rural*	1020	96.2	30	2.8	10	0.9
South Urban*	2080	98.1	40	1.9	0	0.0
Sask.	4322	97.1	114	2.6	13	0.3

RI = Registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

The percent for each of the leading diagnoses of all antenatal diagnoses for each study group is shown in Figure 5-12. The antenatal episodes, which included hospitalizations in which the primary diagnosis was not pregnancy-related but at least one of the secondary or tertiary diagnoses were pregnancy-related, are classified in this initial analysis as non-obstetric. Pregnancy complications which are not singled out for this analysis are grouped under Other.

Of the estimated 4449 antenatal episodes, 33.6% of the primary diagnoses were related to false or early labour, 21.1% to other antenatal diagnoses, 17.7% to hemorrhage of pregnancy, 8.3% to genitourinary tract infection (UTI), 8.6% to hyperemesis, 4.7% to hypertension (including pre-eclampsia), and 6.0% to nonobstetric diagnoses. The proportion for each diagnosis is relative to the prevalence of other diagnoses in each group and makes comparisons across groups difficult. False or early labour, other obstetric conditions and hemorrhage were the top three diagnostic categories for all study groups, followed by hyperemesis for southern rural and urban women and by genitourinary tract infections for northern women and southern registered Indian women. Nonobstetric diagnoses accounted for over 10% of the primary diagnoses of the initial separation of antenatal episodes for southern registered Indian women, suggesting that other illnesses compounding antenatal complications are an important consideration for health care providers. Although the nonobstetric diagnoses were not examined closely, some were diagnoses that possibly should have been coded as an obstetric diagnosis, "classifiable elsewhere but complicating pregnancy, childbirth and the puerperium", for example, pyelonephritis.

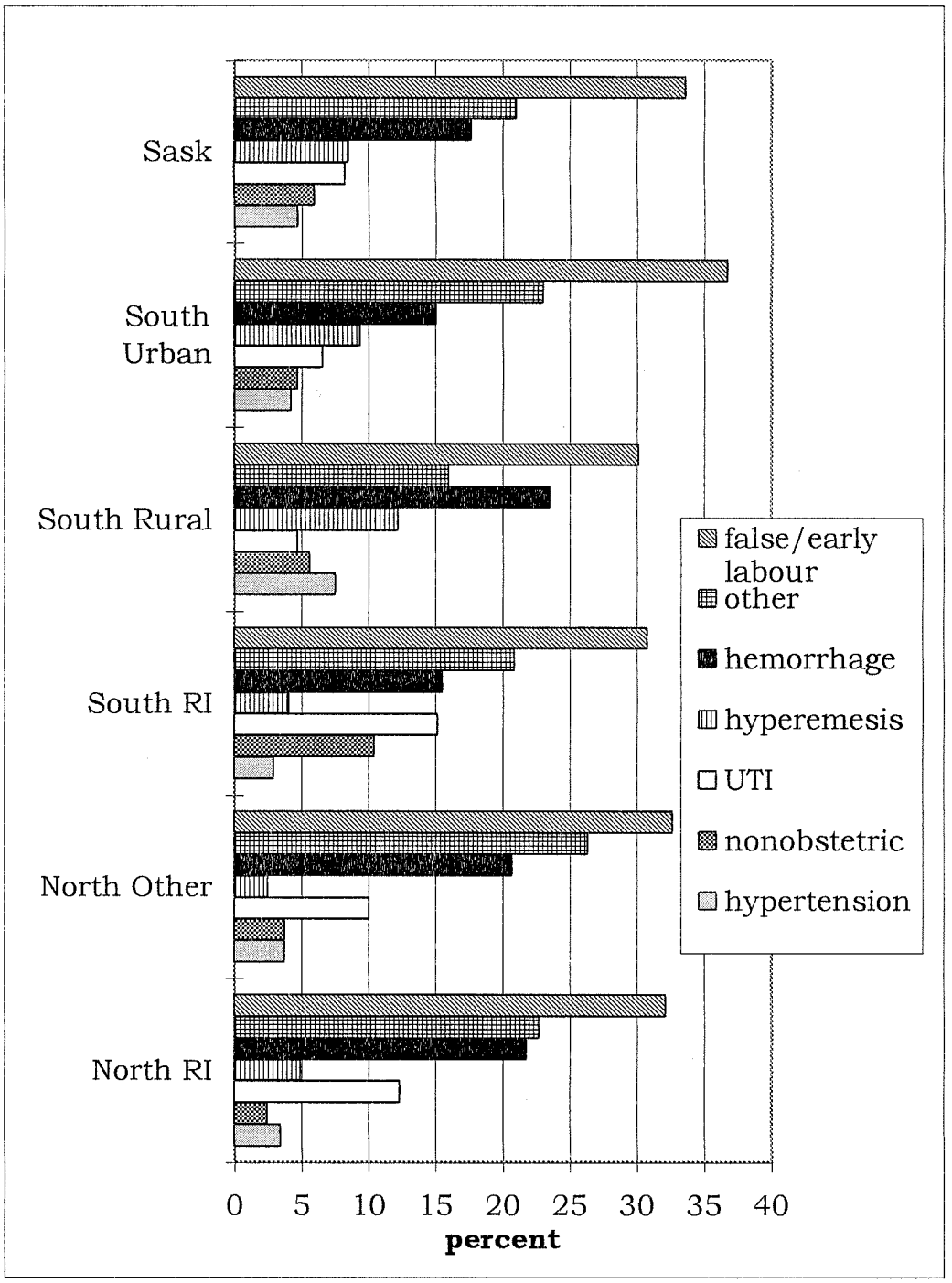

Figure 5-12 Leading diagnoses: percent of all antenatal diagnoses, 1992/93.

To compare the diagnoses for antenatal episodes, crude rates of antenatal episodes per 100 documented pregnancies (Table 5-23) and odds ratios with 95% confidence limits (Table 5-24) were calculated for the antenatal diagnoses that were among the most common or of interest to northern communities and health care providers: diabetes or abnormal glucose tolerance, genitourinary tract infection, hemorrhage, hypertension (including pre-eclampsia and eclampsia), hyperemesis, false or early labour, other antenatal diagnoses, and nonobstetric primary diagnoses. Since the diagnoses were not mutually exclusive, the sum of all the episodes with the selected diagnoses for all groups is greater than the number of antenatal episodes for all diagnoses combined.

Because of the small numbers, adjustment for age was not done for any diagnosis. Because of the small numbers of diagnoses for diabetes, episodes of care for diabetes were combined with those for abnormal glucose tolerance. Also of interest but not shown in Table 5-23, diagnoses for infective and parasitic conditions (ICD-9 647) occurred in 17 antenatal episodes of care, all for northern or registered Indian women, giving a separation rate of 5.5 episodes of care per 1,000 pregnancies. While these numbers are too small for reliable comparisons, they are consistent with previous studies showing that these people continue to suffer infectious disease at rates higher than for the rest of the province.

Southern registered Indian women had the highest crude rates of antenatal episodes for urinary tract infection, false or early labour, other antenatal diagnoses and nonobstetric diagnoses, and the second highest rate for episodes with diabetes or abnormal glucose and hemorrhage, all of which were significantly different from those of southern rural women. Hospitalization for many of these diagnoses may be considered potentially preventable.

Table 5-23 Crude Rate of Antenatal Hospitalization By Selected Diagnoses and Study Group, 1992/93

ICD-9 code	no. of pregs.	diabetes, abnormal glucose 648.0, 648.8		urinary tract infection 646.6		hemorr-hage 640.9-641.9		hyper-tension 642.0-.9	
		n	per 100	n	per 100	n	per 100	n	per 100
North RI	740	8	1.1	39	5.3	45	6.1	10	1.4
North Other	454	16	3.5	22	4.8	35	7.7	7	1.5
South RI	1949	42	2.2	171	8.8	143	7.3	32	1.6
South Rural*	4830	10	0.2	80	1.7	250	5.2	80	1.7
South Urban*	8540	20	0.2	180	2.1	330	3.9	120	1.4
Sask.	16513	96	0.6	492	3.0	803	4.9	249	1.5

ICD-9 code	no. of pregs.	hyper-emesis 643.0-643.9		false or early labour 644.0, 644.1		other antenatal diagnoses		nonobstetric primary diagnoses	
		n	per 100	n	per 100	n	per 100	n	per 100
North RI	740	10	1.4	69	9.3	50	6.8	5	0.7
North Other	454	5	1.1	55	12.1	47	10.4	6	1.3
South RI	1949	44	2.3	296	15.2	283	14.5	95	4.9
South Rural*	4830	150	3.1	350	7.2	230	4.8	60	1.2
South Urban*	8540	200	2.3	820	9.6	590	6.9	100	1.2
Sask.	16513	409	2.5	1590	9.6	1200	7.3	266	1.6

RI = Registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

Table 5-24 Odds Ratios for Antenatal Hospitalization By Selected Diagnoses and Study Group, 1992/93

	diabetes or abnormal glucose			urinary tract infection			hemorrhage			hypertension		
ICD-9 code	648.0,648.8			646.6			640.9-641.9			642.0-.9		
	Crude OR	95% C.I. lower	upper	Crude OR	95% C.I. lower	upper	Crude OR	95% C.I. lower	upper	Crude OR	95% C.I. lower	upper
North RI	5.27	2.07	13.4	3.30	2.23	4.88	1.19	0.86	1.65	0.81	0.42	1.58
North Other	17.60	7.94	39.0	3.02	1.87	4.90	1.53	1.06	2.21	0.93	0.43	2.03
South RI	10.60	5.32	21.2	5.71	4.35	7.49	1.45	1.17	1.79	0.99	0.66	1.50
South Rural	1.00			1.00			1.00			1.00		
South Urban	1.13	0.53	2.42	1.28	0.98	1.67	0.74	0.62	0.87	0.85	0.64	1.13
	hyperemesis			false or early labour			other antenatal diagnoses			nonobstetric primary diagnoses		
ICD-9 code	643.0-643.9			644.0,644.1								
	Crude OR	95% C.I. lower	upper	Crude OR	95% C.I. lower	upper	Crude OR	95% C.I. lower	upper	Crude OR	95% C.I. lower	upper
North RI	0.43	0.224	0.815	1.32	1.00	1.73	1.45	1.06	1.99	0.54	0.216	1.35
North Other	0.35	0.142	0.851	1.76	1.30	2.39	2.31	1.66	3.21	1.06	0.457	2.48
South RI	0.72	0.513	1.010	2.29	1.94	2.70	3.40	2.83	4.08	4.07	2.940	5.65
South Rural	1.00			1.00			1.00			1.00		
South Urban	0.75	0.604	0.927	1.36	1.19	1.55	1.48	1.27	1.74	0.94	0.683	1.30

RI = Registered Indian women; Other = Other than reg. Indian women; OR=Odds Ratio in reference to S. rural women

Northern other than registered Indian women had significantly higher rates of antenatal episodes for diabetes or abnormal glucose per 100 pregnancies compared to southern rural women. This may be related to a combination of higher rates of diabetes, physician practice and lack of access to out patient services for monitoring abnormal glucose. They also had significantly higher rates for urinary tract infection, hemorrhage of pregnancy, false or early labour, and other antenatal diagnoses than southern rural women.

Northern registered Indian women had significantly higher rates of diabetes or abnormal glucose, urinary tract infection, and other antenatal diagnoses than southern rural women. The reason why women of this group have lower antenatal hospitalization rates overall in comparison to other northern women and southern registered Indian women is unclear. Small numbers of events may play a role. They may also have healthier pregnancies. A higher proportion of northern registered Indian women live in remote communities without road access to physicians and hospitals than do northern other than registered Indian women; whether or not they are benefiting or losing out on needed care because of the less convenient access cannot be determined in this study.

All study groups had significantly lower rates of antenatal episodes per 100 pregnancies for hyperemesis in comparison to southern rural women.

5.4.4. Length of Stay

The length of stay, as shown in Table 5-25, was examined as the mean number of days per episode of care and the average number of days per pregnancy in 1992/93. The mean length of stay per episode of care was the shortest for southern urban women (2.4 days) and highest for southern rural women (3.1 days). Although southern registered

Indian women had a shorter average stay per episode than southern rural women, they had 1.6 times greater number of days per 100 pregnancies due to their higher rate of antenatal episodes per pregnancy, which was seen earlier.

Table 5-25 Mean Length of Stay Per Antenatal Episode of Care, 1992/93

	n	Mean	Std. Dev.	Min.	Max.	Total Days	Antenatal Days/100 Pregnancies
North RI	202	2.92	3.56	1	30	590	79.7
North Other	159	2.93	3.90	1	39	466	102.6
South RI	908	2.42	2.81	1	46	2195	112.6
South Rural*	106	3.13	3.95	1	21	*3320	68.7
South Urban*	212	2.40	2.41	1	18	*5090	59.6
Sask.	*4449	*2.62		1	46	*11661	70.6

RI = Registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample

The differences in the mean length of stay, tested using one-way analysis of variance, were of borderline statistical significance (F=2.81, p=0.0244). The Levene's test obtained from the BMDP 7D program showed the variances were significantly different (F=4.60, p=0.0011). The Welch equality of means test that does not assume equal variances showed there was not a statistically significant difference in the mean length of stay among the study groups (F=2.14, p=0.0758).

5.4.5. Hospital Location

Antenatal hospitalization was examined according to the location of the initial hospital admission as well as the location to which women were transferred as inpatients. Hospitals were grouped according to their location in the province and the level or service provided. Northern hospitals include the four northern Saskatchewan hospitals and the Flin Flon, Manitoba hospital which is the primary centre for the eastern

communities of northern Saskatchewan. Rural hospitals are located in rural Saskatchewan. Regional hospitals are located in eleven of the thirteen communities defined as urban in this study (generally, with a population of 5000). Base hospitals are the tertiary care centres in Regina and Saskatoon. "Other" hospitals refer to those out of the province, except for the Flin Flon hospital.

Table 5-26 presents the number and proportion of antenatal episodes for each study group at the initial hospital location. Since they are based on antenatal hospitalization events, more than one episode for an individual woman could have been included. Approximately 82% of all initial antenatal episodes occurred at a regional or base hospital. In comparison, 46.5% (168/361) of initial antenatal episodes for northern women occurred in a northern hospital, which is reasonable, considering that nearly half of the primary antenatal diagnoses included false or early labour, urinary tract infection, hyperemesis and nonobstetric diagnoses (Figure 5-12). However, these figures do not include women who were examined in northern hospitals as out patients before traveling south for antenatal hospital care. From the perspective of northern women hospitalized during pregnancy, 53.5% of initial antenatal episodes of care meant travel away from family and community in addition to the stress of illness and hospitalization during pregnancy.

For all study groups combined, inpatient transfers occurred during 2.5% (113/4449) of antenatal episodes of care. Northern women were transferred to other hospitals during 18 of the 361 (5%) antenatal episodes of care: eight from a northern hospital to a base hospital, three from a northern to a rural hospital, one from a northern to another northern hospital, three from a regional hospital to a base hospital, one from a base to a rural hospital, and two from a rural to a northern hospital. Only two antenatal episodes contained two transfers and both

were for northern women: one from a rural to a northern hospital and one from a northern hospital to a facility out of the province.

Table 5-26 Initial Hospital Location For Antenatal Episodes, By Study Group, 1992/93

Number of Antenatal Episodes Per Initial Hospital Location						
	North	Rural	Regional	Base	Other	Total
North RI	95	19	49	35	4	202
North Other	73	39	17	24	6	159
South RI	4	304	280	306	14	908
South Rural*	0	190	530	310	30	1060
South Urban*	0	20	810	1270	20	2120
Sask.	172	572	1686	1945	74	4449
Proportion† of Antenatal Episodes Per Initial Hospital Location						
	North	Rural	Regional	Base	Other	Total
North RI	47.0	9.4	24.3	17.3	2.0	100.0
North Other	45.9	24.5	10.7	15.1	3.8	100.0
South RI	0.4	33.5	30.8	33.7	1.5	100.0
South Rural	0.0	17.9	50.0	29.2	2.8	100.0
South Urban	0.0	0.9	38.2	59.9	0.9	100.0
Sask.	3.9	12.9	37.9	43.7	1.7	100.0

RI = Registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
† percents are based on row totals

In comparison, southern registered Indian women were transferred to other hospitals during 25 of 908 (2.8%) antenatal episodes: six between rural or regional hospitals, 14 from a rural or regional hospital to a base hospital, and five between base hospitals. Southern rural and urban women were transferred between hospitals in 70 of 3180 (2.2%) antenatal episodes: 40 from a rural or regional hospital to a base hospital, 10 between base hospitals and twenty to out of province hospitals.

5.4.6. Discussion

There have been very few studies of antenatal hospitalization in North America and none designed comparably to this.

The rates of antenatal episodes per 100 pregnancies declined with maternal age or followed a J-shaped curve, rising again with the oldest age group, for all study groups except northern registered Indian women. Edouard, Gillis, and Habbick also demonstrated a J-shaped curve for the association of the still birth rate and incidence of low birth weight to maternal age among the total population of Saskatchewan women during the years, 1984 to 1986, with teenagers and older mothers experiencing worse outcomes[3]. Among Saskatchewan registered Indian women, the still birth rate and incidence of low birth weight were lowest among teenagers, which the authors suggested may have been due to the traditional lifestyle and social support from the extended family [3]. In this study, the age-specific rates of antenatal episodes per 100 pregnancies for northern registered Indian women followed an inverted-U pattern, with teenagers and older women experiencing the lowest rates. The pattern of antenatal hospitalization rates for southern registered Indian women was more similar to those of other Saskatchewan women than to northern registered Indian women, perhaps indicating a greater move from traditional life and social support from extended families than their northern counterparts in the last decade.

The contribution of differences in physician practice patterns, hospital bed availability, alternative health care services, and socioenvironmental factors to the differences in hospitalization rates can not be determined in this study. However, the differences in antenatal hospitalization rates translate into more illness, more time away from home and work, more family and community disruption, more worry about the pregnancy outcome, and more real threat to the

development of a healthy baby for northern other than registered Indian women and southern registered Indian women. All maternal morbidity contributes to high societal costs, both in terms of finances and diminished human potential.

This information will be useful to community leaders and health care workers in planning for health promotion and prevention and treatment services in the community and service areas. A portion of acute-care funding may be better directed to primary prevention or improved outpatient management. For example, the prevalence of diabetes is increasing in northern Saskatchewan; without additional intervention, there will be a corresponding rise in antenatal episodes for diabetes management. There is a major role for health promotion and education in primary, secondary and tertiary prevention services for diabetes.

This study will also provide a baseline for future studies as community-based services are potentially strengthened through Indian Health services transfer to First Nations and through health renewal and the creation of northern district health boards.

5.5. Complications of Labour and Delivery

The main goal of this section was to examine the hospitalization rates for the diagnostic group of Complications Of Labour And Delivery (ICD-9 660.0- 669.9, Canadian List Number 150). Secondary analysis was done for selected diagnoses occurring during a delivery separation, hospital location of all deliveries, and length of stay for all delivery episodes of care.

5.5.1. Operational definition

Separations with complications in labour and delivery were operationally defined as those with a primary, secondary or tertiary diagnosis coded as ICD-9 codes 660.0 through 669.9 (also grouped as Canadian List Number 150). Saskatchewan hospitalization statistics indicate that there were 6719 separations in 1992/93 with the primary diagnosis coded as a complication in labour and delivery, compared with 7004 separations estimated from the study data for the same year, after adjusting for the 10% sampling of southern rural and urban women hospitalized. This four percent "overestimation" of separations with labour and delivery complications may have been due to sampling variation of southern rural and urban women, which should be considered in the comparison of rates.

For this analysis, separations with complications in labour and delivery were included only if the delivery was estimated to have also occurred during that separation of the episode of care. Episodes of care containing a diagnosis or procedure indicating the end of pregnancy were selected from the larger obstetric hospitalization data set for the 1992/93 fiscal year. Each episode of care consisted of one, two or three separations. At the time of delivery a woman could have delivered in the first hospital to which she was admitted or delivered after transfer to a

second hospital. Occasionally, she was transferred a second time back to the first or to a third hospital for postnatal care. As seen previously, urban women had fewer transfers than other women in the province and therefore had fewer diagnoses per episode of care captured in the data than other women. Therefore, only the separation of each episode of care that contained a delivery-related procedure or diagnosis was retained for analysis in the delivery data set. If the first and second separations both contained a delivery-related diagnosis or procedure (e.g. obstructed labour), the second separation was used, assuming that a later diagnosis would be more valid than an earlier one.

The rates of complications in labour and delivery were based on the number of deliveries in 1992/93, which was derived from the data since published figures were not available for the groups used in this study. The outcome of the delivery could not be determined according to live births or stillbirths using the maternal diagnostic and procedural codes that were available.

The 1992/93 hospitalization data estimated that there were 14,854 deliveries (total births), after adjusting for the 10% sampling of the southern rural and urban women who were hospitalized in the year, a figure which is within the range of published data. Saskatchewan Health preliminary vital statistics indicate there were 15,012 total births (14,914 live births and 98 stillbirths) in 1992 and 14,290 total births (14,204 live births and 86 stillbirths) in 1993.

5.5.2. Rates of complications in labour and delivery for all causes

The age-specific and age-standardized rates of complications specific to labour and delivery complications are presented in Table 5-27 and shown in Figures 5-13 and 5-14. They include deliveries with difficult labour, umbilical cord complications, obstetric trauma,

postpartum hemorrhage, retained placenta or membranes, and complications of the administration of anesthetic or other sedation. Deliveries that include other complications are examined in the next subsection.

The age-specific rate of labour and delivery complications decreased with age for all study groups combined and particularly for southern registered Indian women and for southern rural women

Table 5-27 Age-Specific and Age-Standardized Rates of Labour and Delivery Complications per 100 Deliveries, ICD9 660-669, 1992/93

Number of Deliveries						
	15-19	20-24	25-29	30-34	35-44	Total
North RI	162	232	149	74	26	643
North Other	79	133	119	51	18	400
South RI	458	643	374	178	68	1721
South Rural*	370	830	1690	1070	410	4370
South Urban*	660	1590	2700	2080	690	7720
Sask.	1729	3428	5032	3453	1212	14854
Number of complications in labour and delivery						
	15-19	20-24	25-29	30-34	35-44	Total
North RI	90	131	85	44	13	363
North Other	51	79	74	33	11	248
South RI	265	349	181	85	30	910
South Rural*	290	580	1070	560	220	2720
South Urban*	450	1080	1850	1480	440	5300
Sask.	1146	2219	3260	2202	714	9541
Rate of complications in labour and delivery per 100 deliveries						
	15-19	20-24	25-29	30-34	35-44	Age-std. rate†
North RI	55.6	56.5	57.0	59.5	50.0	56.7
North Other	64.6	59.4	62.2	64.7	61.1	62.3
South RI	57.9	54.3	48.4	47.8	44.1	50.4
South Rural	78.4	69.9	63.3	52.3	53.7	62.2
South Urban	68.2	67.9	68.5	71.2	63.8	68.6
Sask.	66.3	64.7	64.8	63.8	58.9	64.2

RI=registered Indian women; Other=other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to Saskatchewan deliveries, ages 15-44, 1992/93

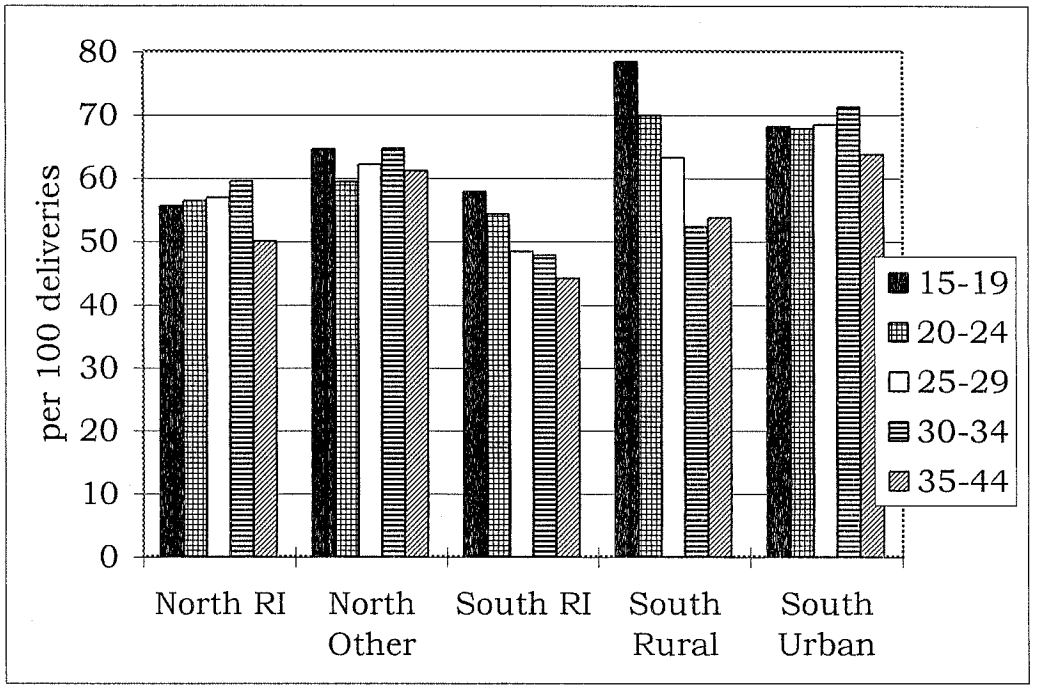

Figure 5-13 Age-specific rates of complications in labour and delivery, 1992/93.

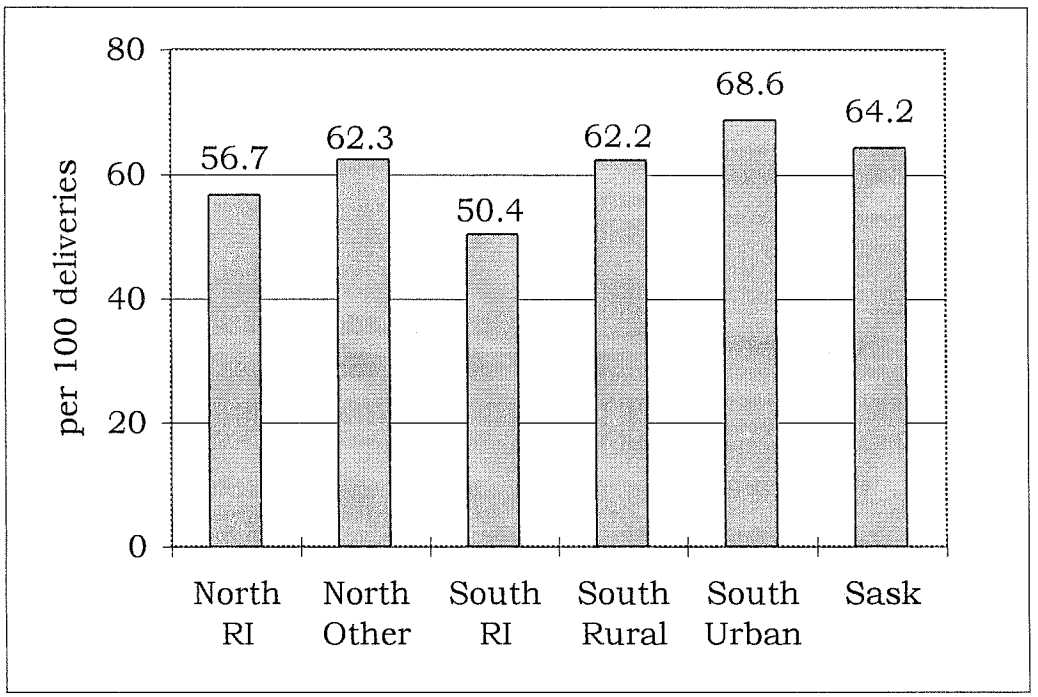

Figure 5-14 Age-standardized rates of complications in labour and delivery, 1992/93.

(whose rates leveled off at age 30). The age-specific rate for labour and delivery complications rose slightly with age, peaking at ages 30 to 34 for northern registered Indian women and southern urban women, and then dropping for ages 35-44. The small numbers of labour and delivery complications for northern other than registered Indian women are reflected in the fluctuating rates across the age groups. Southern urban women had the greatest age-standardized rate of delivery separations with labour and delivery complications per 100 deliveries (68.6 per 100 deliveries), followed by southern rural and northern other than registered Indian women (62.2 and 62.3 per 100 deliveries respectively). Northern and southern registered Indian women had the lowest age-standardized rates (56.7 and 50.4 per 100 deliveries respectively).

The rates of delivery separations with labour and delivery complications per 100 deliveries among the study groups were compared to those of southern rural women using odds ratios and 95% confidence intervals (Table 5-28). The differences in the rates of delivery separations with labour and delivery complications per 100 deliveries were significantly lower for both groups of registered Indian women and significantly higher for southern urban women in comparison to southern rural women at the 5% confidence level ($p<0.0001$).

Table 5-28 Age-Adjusted Odds Ratios Of Delivery Separations With Labour and Delivery Complications, ICD9 660-669, 1992/93

	Age-adj.			95% CI			
	ψ	β	SE(β)	lower	upper	χ^2_1	p
North RI	0.64	-0.444	0.089	0.539	0.764	24.6	<0.0001
North Other	0.84	-0.178	0.110	0.675	1.04	2.57	0.1090
South RI	0.55	-0.603	0.062	0.484	0.62	95.6	<0.0001
South Rural	1.00						
South Urban	1.33	0.285	0.040	1.230	1.44	51.1	<0.0001

RI = registered Indian women; Other = other than registered Indian women
ψ = Odds Ratio; β=coefficient; SE(β)=standard error of coefficient
χ^2_1=chi-square with 1 degree of freedom

Rates for selected diagnoses occurring as a primary, secondary or tertiary diagnosis during a delivery separation were calculated for each study group, as presented in Table 5-29. Since there were up to three diagnoses for each separation, the total number of diagnoses add up to more than the number of deliveries.

Diagnostic rates of obstruction, abnormal forces of labour and long labour per delivery were significantly lower for northern and southern registered Indian women in comparison to southern rural women ($p<0.05$). However, rates of umbilical cord problems, obstetric trauma and the group of postpartum hemorrhage, retained placenta, anesthetic and other complications per pregnancy were similar for northern and registered Indian women compared with southern rural women.

Northern women had significantly lower rates for premature rupture of membranes per delivery compared to southern rural women. Northern other than registered Indian women also had a significantly lower rate of onset of delivery before 37 weeks gestation per delivery which is good news considering the potential difficulties associated with emergency medical evacuations from northern communities.

Northern women had significantly higher rates of fetal and placental problems per delivery than southern rural women. Fetal and placental problems include known or suspected fetal abnormality, fetal distress, intrauterine death, both small for dates and large for dates fetuses, and ABO blood group or Rh incompatibility. Further analyses would be needed to determine which of these diagnoses contributed the most to the higher rates.

The rates for other diagnoses during delivery separations for northern and registered Indian women were not significantly different from those of southern rural women.

Table 5-29 Number and Crude Rate of Selected Diagnoses Occurring During a Delivery Separation as a Primary, Secondary or Tertiary Diagnosis, Per 100 Deliveries, By Study Group, 1992/93

Diagnosis	# deliveries ICD-9	North RI 643		N. Other 400		South RI 1721		S. Rural† 4370†		S. Urban† 7720†		Sask. 14854	
		n	per 100	n	per 100	n	per 100	n†	per 100	n†	per 100	n	per 100
Comps in labour & delivery	660.0-669.9	363	56.5*	248	62.0	910	52.9*	2720	62.2	5300	68.7*	9541	64.2
Obstruction, Abn. Forces of Labour, Long Labour	660.0-662.3	122	19.0*	104	26.0	306	17.8*	1120	25.6	1890	24.5	3542	23.8
Umbilical cord problems	663.0-663.9	59	9.2	26	6.5	171	9.9	410	9.4	1170	15.2*	1836	12.4
Obstetric Trauma	664.0-665.9	206	32.0	129	32.3	504	29.3	1320	30.2	2750	35.6*	4909	33.0
PP Hemorr., Ret. placenta, Anesthetic & Other Comps	666.0-669.9	45	7.0	33	8.3	118	6.9	330	7.6	680	8.8*	1206	8.1
Normal delivery	650	122	19.0	92	23.0*	366	21.3*	730	16.7	830	10.8*	2140	14.4
Other Common Diagnoses													
Fetal/placental problems	655.0-656.9	114	17.7*	69	17.3*	229	13.3	540	12.4	1060	13.7*	2012	13.5
Malposition, disproportion	652.0-653.9	60	9.3	28	7.0	128	7.4*	410	9.4	890	11.5*	1516	10.2
Prem. rupt. of membranes	658.1	22	3.4*	6	1.5*	77	4.5	240	5.5	470	6.1	815	5.5
Early Onset of Delivery	644.1	26	4.0	8	2.0*	90	5.2	190	4.3	290	3.8	604	4.1
Pre-eclampsia, eclampsia	642.4-642.7	11	1.7	14	3.5	37	2.1	120	2.7	250	3.2	432	2.9
Puerperium complications	670.0-676.9	16	2.5	10	2.5	34	2.0	110	2.5	220	2.8	390	2.6
Diabetes, abn. glucose	648.0, 648.8	18	2.8	12	3.0	56	3.3	120	2.7	150	1.9*	356	2.4
Post-term delivery	645	14	2.2	8	2.0	37	2.1	100	2.3	170	2.2	329	2.2
Hemorrhage, placenta previa, abruptio placenta	640.0-641.9	18	2.8	4	1.0	45	2.6	100	2.3	120	1.6*	287	1.9

RI = registered Indian women; Other = other than reg. Indian women †adjusted for 10% sample (n=10 x sample no.)
*p<0.05, for 95% confidence intervals for Odds Ratios in comparison with southern rural women

5.5.3. Hospital Location

Deliveries were examined according to the proportion of all deliveries occurring at each hospital location and according to the proportion at each location that had a diagnosis of Complication Occurring In Labour Delivery (ICD-9 660-669). Northern hospitals include the four hospitals in northern Saskatchewan and the Flin Flon hospital, located on the Manitoba-Saskatchewan border near Creighton. Base hospitals are located in Saskatoon and Regina. Regional hospitals are those located in the eleven Saskatchewan urban communities, other than Saskatoon and Regina. Rural hospitals are those located in the remainder of southern Saskatchewan in 1992/93. Other hospitals are those located outside of Saskatchewan.

Over 35% (372/1043) of deliveries for northern women occurred in northern hospitals in 1992/93 (Table 5-30); approximately two-thirds occurred in southern or out of province hospitals, including those for northern bands who actually were living in the south. There are one large rural and two regional hospitals routinely assisting northern women from several northern communities with deliveries. Between

Table 5-30 Percent of Deliveries At Each Hospital Location, By Study Group, 1992/93

	Hospital Location										
	North		Rural		Regional		Base		Other		
	n	%	n	%	n	%	n	%	n	%	Total
North RI	241	37.5	60	9.3	181	28.1	147	22.9	14	2.2	643
North Other	131	32.8	109	27.3	45	11.3	72	18.0	43	10.8	400
South RI	4	0.2	288	16.7	556	32.3	821	47.7	52	3.0	1721
South Rural†	0	0.0	700	16.0	1780	40.7	1680	38.4	210	4.8	4370
South Urban†	0	0.0	20	0.3	2130	27.6	5500	71.2	70	0.9	7720
Sask.	376	2.5	1177	7.9	4692	31.6	8220	55.3	389	2.6	14854

RI = registered Indian women; Other = other than registered Indian women
†adjusted for 10% sample (n=10 x sample number)

80% (1377/1721 for southern registered Indian women) and 98.8% (7630/7720 for southern urban women) of deliveries for southern women occurred in regional or base hospitals.

The proportion of deliveries with Labour and Delivery Complications for all groups combined ranged from 53.2% of those occurring in rural hospitals, 56.1% in northern hospitals, and 70.0% of all deliveries in base hospitals, as indicated in Table 5-31. The numbers of the most serious diagnoses within this category are too small to analyze by hospital location.

Table 5-31 Number and Rate of Deliveries with a Complication in Labour and Delivery Diagnosis per 100 Deliveries, At Each Hospital Location, By Study Group, 1992/93

	North		Rural		Regional		Base		Other		All locations	
	n	%	n	%	n	%	n	%	n	%	n	%
North RI	125	51.9	43	71.7	112	61.9	82	55.8	1	7.1	363	56.5
North Other	84	64.1	79	72.5	26	57.8	56	77.8	3	7.0	248	62.0
South RI	2	50.0	114	39.6	294	52.9	489	59.6	11	21.2	910	52.9
South Rural*	0	0.0	380	54.3	1090	61.2	1160	69.0	90	42.9	2720	62.2
South Urban*	0	0.0	10	50.0	1300	61.0	3970	72.2	20	28.6	5300	68.7
Sask.	211	56.1	626	53.2	2822	60.1	5757	70.0	125	32.1	9541	64.2

RI = registered Indian women; Other = other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

Most deliveries occurred in the hospital to which the woman was first admitted (Table 5-32). Six to seven percent of northern women were transferred once before delivery in comparison to 3.9 percent of southern rural women and one percent of southern urban women.

However, inpatient transfers represent an incomplete picture of emergency transfers at the time of delivery, since admissions to outpatient departments are not counted as separations in the hospitalization data. The proportion of northern women, and possibly for southern registered Indian women and southern rural women, who travel to southern or out of province hospitals during labour would be higher than estimated in this study.

Table 5-32 Separation Of The Episode Of Care In Which Delivery Occurred

	FIRST		SECOND		
	n	%	n	%	Total
North RI	603	93.8	40	6.2	643
North Other	373	93.3	27	6.8	400
South RI	1655	96.2	66	3.8	1721
South Rural*	4200	96.1	170	3.9	4370
South Urban*	7640	99.0	80	1.0	7720
Sask.	14471	97.4	383	2.6	14854

RI = registered Indian women; Other = other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

5.5.4. Length of Stay

The mean length of stay was examined for episodes with all types of delivery combined and with vaginal delivery (Table 5-33), including all separations of each delivery episode. Differences in length of stay were examined using a one way analysis of variance (ANOVA). Since the date of delivery was not available, the antepartum stay of the delivery episode could not be distinguished from the postpartum stay.

The differences in the mean length of stay were significantly different among the study groups for episodes with all types of delivery combined (F-value=3.76, p=0.0046) and for vaginal deliveries (F-value=5.71, p=0.0001). The Scheffe method of pairwise comparisons showed there were statistically significant differences in the mean

Table 5-33 Average Length Of Stay For Episodes with All Types of Delivery, and With Vaginal Delivery, By Study Group, 1992/93

Average Length Of Stay For Episodes with All Types of Delivery

	n	Mean	Std. Dev.	Total Days	MIN.	MAX.
North RI	643	4.689	3.279	3015	1	42
North Other	400	4.200	2.377	1680	1	22
South RI	1721	4.356	2.625	7497	1	44
South Rural	437	4.453	2.952	** 19460	1	49
South Urban	772	4.171	2.403	** 32200	1	38
Sask.	** 14854	4.299		** 63851		

Average Length Of Stay For Episodes with Vaginal Delivery

	n	Mean	Std. Dev.	Total Days	MIN.	MAX.
North RI	566	4.336	2.795	2454	1	35
North Other	354	3.870	2.013	1370	1	15
South RI	1472	3.992	2.155	5876	1	31
South Rural	347	3.882	1.480	** 13470	1	11
South Urban	643	3.757	2.165	** 24158	1	38
Sask.	** 12292	3.850		** 47328		

RI = registered Indian women; Other = other than registered Indian women
** adjusted for 10% sampling of southern rural and urban groups

length of stay for episodes with all types of delivery comparing northern registered Indian women with southern urban women ($p<0.05$) and with northern other than registered Indian women ($p<0.10$), but not with southern rural women. Similarly, the mean length of stay for vaginal delivery was significantly higher for northern registered Indian women in comparison with northern other than registered Indian women ($p<0.05$), southern registered Indian women ($p<0.01$), southern rural women ($p<0.05$) and southern urban women ($p<0.01$). Although the differences are statistically significant, the difference was only slightly

more than a half day between the longest and shortest means for both all types of delivery combined and for vaginal delivery alone.

Since southern rural and urban women had the highest rate of cesarean deliveries in 1992/93, as will be shown in a following section, it is not surprising they had the greatest decrease in mean length of stay once cesarean sections were excluded from the analysis.

Although northern registered Indian women had a higher mean length of stay for delivery episodes in comparison to northern other than registered Indian women, they had a lower proportion of inpatient transfers per delivery episode (Table 5-34). Thus, the rate of transfers alone cannot account for the longer stay.

Greater morbidity for northern registered Indian women is not likely the main contributor to the longer stay, since both northern and southern registered Indian women had significantly lower rates of complications in labour and delivery than other Saskatchewan women.

Other factors contributing to a longer stay at the time of delivery would include physician practice patterns, longer distances from hospital to the home community, distances to family physicians, and

Table 5-34 Percent Of Delivery Episodes With 0, 1, Or 2 Transfers, 1992/93

	0		1		2		
	n	%	n	%	n	%	Total
North RI	591	91.9	48	7.5	4	0.6	643
North Other	356	89.0	39	9.8	5	1.3	400
South RI	1624	94.4	84	4.9	13	0.8	1721
South Rural*	4030	92.2	270	6.2	70	1.6	4370
South Urban*	7580	98.2	130	1.7	10	0.1	7720
Sask.	14181	95.5	571	3.8	102	0.7	14854

RI = registered Indian women; Other = other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

other support in the home community. The majority of women living in northern communities without road access to medical care are registered Indian women. Women may be hospitalized for extra time while they await the next available flight home, or to ensure they do not have complications requiring a higher level of monitoring than is available in their home communities.

5.5.5. Discussion

There were no other Canadian studies available for comparison that examined complications of labour and delivery per 100 deliveries. Kashuba, et al, reported a rate of 1293.69 separations with a primary Canadian Diagnostic List code for Complications Occurring in Labour and Delivery (CDL - 150) per 100,000 females of the Alberta Blood Tribe during the years, 1984-87. This rate was 1.23 times higher than that for all Alberta females, who had 1048.20 separations with the same diagnosis per 100,000 females. These rates reflect higher birth rates among the Blood Tribe in comparison with the rest of Alberta.[33]

The lower rates of labour and delivery complications per delivery for both northern and southern registered Indian women in this study were consistent with the generally-held belief that aboriginal women have easier births than nonaboriginal women. This was particularly true for diagnoses of obstruction, abnormal forces of labour, and long labour (Table 5-29).

Northern women had the highest rates of fetal and placental problems per delivery, the meaning of which is unclear since this category included a wide range of diagnoses. The differences for most other diagnoses were less remarkable and there was no consistent pattern in differences, perhaps because of small numbers for these diagnoses.

The higher rates of delivery episodes with labour and delivery complications at regional and base hospitals (60.1 to 70.0 per 100 deliveries) may reflect the fact that they assist a higher proportion of high risk deliveries. Although an "acceptable" rate of labour and delivery complications per delivery or transfers at the time of delivery has not been established, the lower rates of these complications at rural and northern hospitals (53.2 to 56.1 per 100 deliveries) may reflect their success in referring high-risk deliveries to larger centres. Over 35% (372/1043) of deliveries for northern women occurred in northern hospitals and over 93% of northern women delivered at the hospital to which they were first admitted, also suggesting that northern hospitals are appropriately screening and selecting women for deliveries ahead of time. This is consistent with the few other studies that have been done regarding the safety of obstetric practice in rural or remote areas.[25,26,27]

5.6. Cesarean Section Deliveries

This section examined the 1992/93 rates of cesarean section deliveries, repeat and primary cesarean section, vaginal birth after cesarean section, hospital location, and length of stay for cesarean section, all for women of reproductive age (ages 15-44). The statistical significance of differences in cesarean delivery rates between southern rural women and each of the other study groups was determined, based on age-adjusted odds ratios and the chi-square test. The one-way analysis of variance and the Kruskal-Wallis test were both used to test for differences among the study groups in the mean length of stay for cesarean section delivery.

5.6.1. Operational Definitions

Cesarean section delivery was operationally defined as a primary procedure coded as 86.0, 86.1, 86.8, or 86.9 (Canadian Classification of Procedures). Non-delivery cesarean sections to terminate pregnancy or remove an intraperitoneal embryo (CCP 86.3, 86.41-9) were not included. All cesarean sections were coded in the 1992/93 hospitalization data as primary procedures. All but 12 records with cesarean section had cervical cesarean sections (CCP 86.1). There were no records with a diagnosis of "Cesarean section, without mention of indication" (ICD9 667.9).

There were 591 records in the 1992/93 hospitalization data with cesarean sections, representing 2,562 cesarean section deliveries in 1992/93 for the whole province. In comparison, Saskatchewan Health reported 2,510 cesarean sections as primary procedures to Statistics Canada for the fiscal year, 1992/93[35]. Assuming that the data represent 100% of the cesarean section deliveries for northern and registered Indian women (n=373), the difference shows that the 10% sampling of the persons hospitalized in southern rural and urban areas resulted in an "excess" of approximately 52 cesarean section deliveries for southern rural and urban women (n=2,189). The "excess" 52 cesarean sections are 2.4% of the southern rural and urban portion of Statistics Canada's total (52/2137). Any differences in cesarean section delivery rates that are found between study groups must be interpreted accordingly but would not likely be significantly influenced by this small over representation.

5.6.2. Rates of Cesarean Section Delivery

The age-specific and age-standardized rates of cesarean section deliveries for women aged 15-44 years were calculated per 100 deliveries documented in the 1992/93 hospitalization data. There were

an estimated 14,854 episodes of care for delivery or for postpartum care (if the delivery did not occur in hospital) in 1992/93.

As indicated in Table 5-35, the crude rate for delivery by cesarean section for all study groups combined in 1992/93 was 17.2 cesarean sections per 100 deliveries, very similar to the 1988/89 rate (17.42%) reported by Nair [35]. Southern rural women had the highest cesarean delivery rate (20.6%), followed by southern urban (16.7%), then southern registered Indian women (14.5%) and then the two northern groups (12.0% and 11.5%).

The age-specific rate was highest for women of 35 to 44 years for all groups, except for northern other than registered Indian women, as shown in Figure 5-15. Since there was only one woman aged 35 to 44 years with a cesarean section delivery in the year, the data for that age-specific group aren't reliable for comparisons. Southern rural women had the highest rate for all women aged 35 to 44 years, (39%); southern registered Indian women had the next highest rate (25%). The lowest rate of delivery by cesarean section per 100 deliveries was in the 20-24 year age group for both northern groups and in the 15-19 year age group for all three southern groups and for all groups combined.

The crude rates of cesarean section delivery were very similar to the age-standardized rates which are presented in Table 5-36 and shown in Figure 5-16.

Table 5-35 Rate of Cesarean Sections By Age Group and Study Group, 1992/93

Number of Deliveries By Age and Study Group, 1992/93						
age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	162	232	149	74	26	643
North Other	79	133	119	51	18	400
South RI	458	643	374	178	68	1721
South Rural*	370	830	1690	1070	410	4370
South Urban*	660	1590	2700	2080	690	7720
Sask.	1729	3428	5032	3453	1212	14854
Number of Cesarean Section Deliveries						
	15-19	20-24	25-29	30-34	35-44	Total
North RI	21	23	19	9	5	77
North Other	10	12	16	7	1	46
South RI	51	98	52	31	17	249
South Rural*	40	160	310	230	160	900
South Urban*	90	280	410	350	160	1290
Sask.	212	573	807	627	343	2562
Rate of Cesarean Deliveries Per 100 Deliveries, 1992/93						
Age group	15-19	20-24	25-29	30-34	35-44	Crude rate
North RI	13.0	9.9	12.8	12.2	19.2	12.0
North Other	12.7	9.0	13.4	13.7	5.6	11.5
South RI	11.1	15.2	13.9	17.4	25.0	14.5
South Rural	10.8	19.3	18.3	21.5	39.0	20.6
South Urban	13.6	17.6	15.2	16.8	23.2	16.7
Sask.	12.3	16.7	16.0	18.2	28.3	17.2

RI=registered Indian women; Other=Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

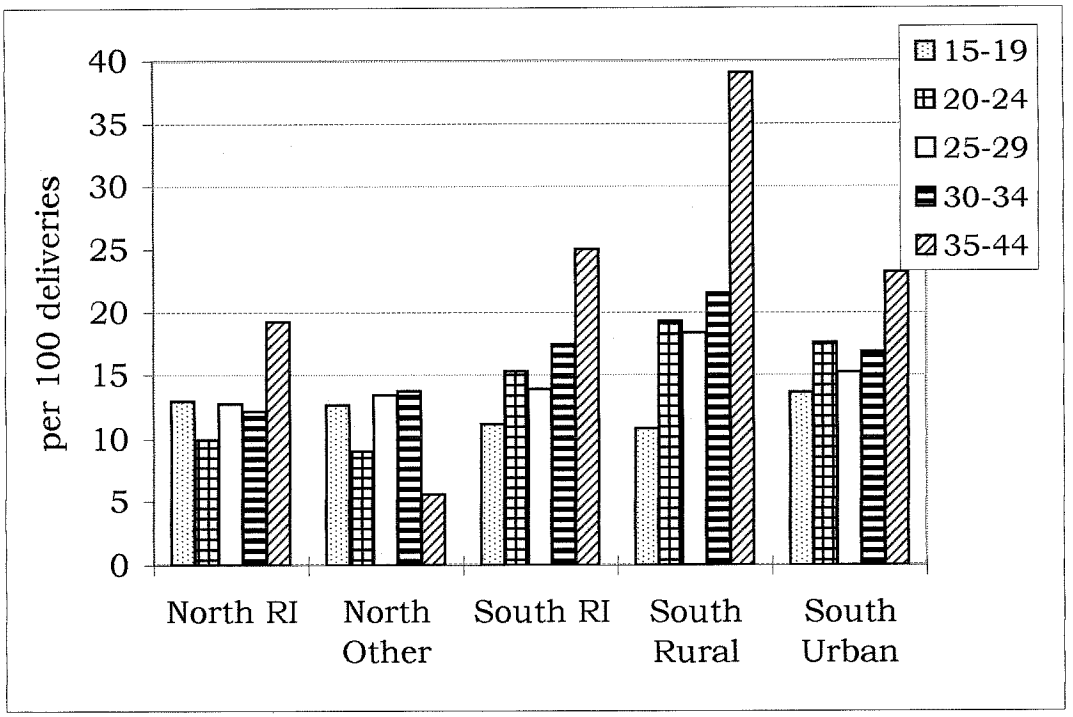

Figure 5-15 Age-specific rates of cesarean section, 1992/93.

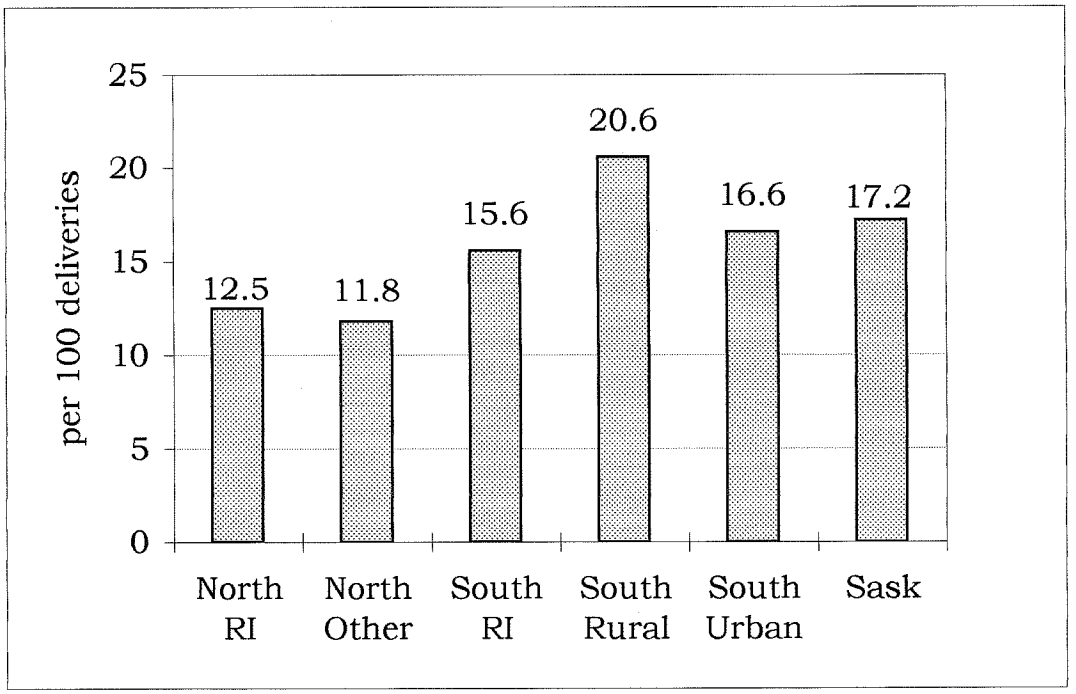

Figure 5-16 Age-standardized rates of cesarean section, 1992/93.

For statistical comparison between groups, logistic regression was done to determine age-adjusted odds ratios and confidence intervals, with southern rural women as the reference group.

All other groups had a significantly lower risk for cesarean section during delivery than southern rural women in 1992/93, with northern women having the lowest risk (Table 5-36).

Table 5-36 Comparison of Cesarean Section Deliveries, 1992/93: Age-Standardized Rates, Age-Adjusted Odds Ratios, 95% Confidence Intervals

	Age-std. Rate†	Age-adj. ψ	β	SE(β)	95% CI lower	95% CI upper	χ^2_1	p
North RI	12.5	0.605	-0.503	0.131	0.468	0.781	16.18	0.0001
North Other	11.8	0.564	-0.573	0.164	0.409	0.777	13.86	0.0002
South RI	15.6	0.756	-0.279	0.083	0.643	0.890	11.57	0.0007
South Rural	20.6	1.00						
South Urban	16.6	0.77	-0.261	0.049	0.700	0.847	28.62	<0.0001

RI = registered Indian women; Other = Other than reg. Indian women
†Standardized to Saskatchewan deliveries, ages 15-44, 1992/93
ψ = Odds Ratio; β=coefficient; SE(β)=standard error of coefficient
χ^2_1=chi-square with 1 degree of freedom

5.6.3. Hospital Location Of Cesarean Section Delivery

The hospitals contributing data to this study were classified as rural, regional, base, north or out of Saskatchewan. Base hospitals were defined as any of the 6 tertiary hospitals in Regina and Saskatoon. Regional hospitals included the remaining hospitals in the other 11 cities and towns classified as urban in this study. Rural hospitals included the remaining hospitals in southern Saskatchewan. Northern hospitals included the four hospitals in northern Saskatchewan and the hospital in Flin Flon, Manitoba, which serves the Saskatchewan communities of Sandy Bay, Deschambault, Pelican Narrows, Creighton

and Denare Beach, in addition to Flin Flon and the surrounding area in Manitoba.

The rate of cesarean section delivery at each hospital location for each study group is shown in Table 5-37. Since the numbers of cesarean sections at each hospital location for northern women are fairly small, the rates should be interpreted with caution. Northern women had a rate of 8.2 to 12.2 cesarean sections per 100 deliveries in a northern or rural hospital in 1992/93. Most if not all of the cesarean

Table 5-37 Rate of Cesarean Section Deliveries per 100 Deliveries at Each Hospital Location, By Study Group, 1992/93

Number of Deliveries By Hospital Location, 1992/93

	North	Rural	Regional	Base	Other	All Hosps
North RI	241	60	181	147	14	643
North Other	131	109	45	72	43	400
South RI	4	288	556	821	52	1721
South Rural*	0	700	1780	1680	210	4370
South Urban*	0	20	2130	5500	70	7720
Sask.	376	1177	4692	8220	389	14854

Number of Cesarean Section Deliveries

	North	Rural	Regional	Base	Other	All Hosps
North RI	20	6	24	27	0	77
North Other	16	10	3	17	0	46
South RI	0	4	100	143	2	249
South Rural*	0	20	480	390	10	900
South Urban*	0	0	330	960	0	1290
Sask.	36	40	937	1537	12	2562

Rate of Cesarean Section Deliveries per 100 Deliveries

	North	Rural	Regional	Base	Other	All Hosps
North RI	8.3	10.0	13.3	18.4	0.0	12.0
North Other	12.2	9.2	6.7	23.6	0.0	11.5
South RI	0.0	1.4	18.0	17.4	3.8	14.5
South Rural	0.0	2.9	27.0	23.2	4.8	20.6
South Urban	0.0	0.0	15.5	17.5	0.0	16.7
Sask.	9.6	3.4	20.0	18.7	3.1	17.2

RI=registered Indian women; Other=Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

sections performed at a northern hospital would have been done at the Flin Flon hospital. Northern other than registered Indian women had a rate of 23.6 cesarean section deliveries per 100 deliveries occurring at a base hospital, which was similar to the rate for southern rural women (23.2 per 100 deliveries at a base hospital). This high rate may reflect referral patterns for this group, since they had a rate of only 6.7 cesarean section deliveries per 100 deliveries at regional hospitals, which was about one quarter of the rate for southern rural women (27.7 cesarean section deliveries per 100 deliveries at regional hospitals).

Although the rates of cesarean section deliveries were lower in northern and rural hospitals for northern women, 33.8% (26/77) of cesarean sections for northern registered Indian women and 56.5% (26/46) of cesarean section deliveries for northern other than registered Indian women took place in northern or rural hospitals.

5.6.4. Length of Stay

Several scenarios may occur when a woman undergoes a cesarean section delivery. She may be admitted with an antenatal complication, undergo a cesarean section delivery, and receive postpartum care all in the same hospital during the one hospitalization event. She could also be transferred once or twice during the delivery episode and receive care in two or three different hospitals.

Episodes of care were created, linking all of the separation records for women who were separated from one hospital and admitted to another on the same day. Ninety four percent (2419/2562) of the women with cesarean section deliveries had only one separation at the time of delivery. The remaining women had one or two transfers during their hospital care. Northern registered Indian women experienced the highest proportion (13%) of cesarean section deliveries with transfers,

followed by northern other than registered Indian women, southern registered Indian women and southern rural women (7 to 8%), and then southern urban women (3%).

Length of stay was calculated by adding the days for all separations in each episode of care, i.e. by subtracting the admission date of the first hospital stay from the separation date from the last hospital stay.

The range of days' stay for each study group is shown in Table 5-38. Northern women and southern registered Indian women with cesarean section deliveries had a higher proportion (14.3 to 28.3%) of hospital stays of 8-14 days in 1992/93 than southern rural and urban women (8.9 to 9.3%). Southern registered Indian women also had the highest proportion (22.5%) of cesarean section deliveries with 1 to 4 days stay compared to the rest of Saskatchewan women (7.8-14.4%).

Table 5-38 Range of Days' Stay for Cesarean Section Delivery, 1992/93

	Number of Days								
	1-4		5-7		8-14		15-49		1-49
	n	%	n	%	n	%	n	%	Total
North RI	6	7.8	56	72.7	11	14.3	4	5.2	77
North Other	6	13.0	26	56.5	13	28.3	1	2.2	46
South RI	56	22.5	142	57.0	44	17.7	7	2.8	249
South Rural*	130	14.4	650	72.2	80	8.9	40	4.4	900
South Urban*	170	13.2	970	75.2	120	9.3	30	2.3	1290
Total	368	14.4	1844	72.0	268	10.5	82	3.2	2562

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

The average length of stay for each study group was calculated using the one-way ANOVA (Table 5-39). The mean days' stay for all women aged 15-44 with cesarean delivery was 6.449 days, after adjustments were made for the differential sampling.

The one-way ANOVA tests the hypothesis:

H_o: $\mu_A = \mu_B = \mu_C = \mu_X = \mu_Y$; the mean length of stay for cesarean section delivery for all groups are identical. The alternative hypothesis is that the mean length of stay for at least one of the groups is different from the others. The differences between the study groups for mean length of stay for cesarean section deliveries were not statistically significant (F-value=0.89, degrees of freedom=4, p=0.4687). The Levene's test for equal variances showed that the variances of the length of stay among the 5 study groups are not significantly different (F-value-1.89, p=0.11).

Table 5-39 Mean Length of Stay for Cesarean Section Delivery By Study Group, 1992/93

	n	Mean	Std. Dev.	Total days	Min.	Max.
North RI	77	7.286	5.000	561	3	42
North Other	46	6.739	3.296	310	2	22
South RI	249	6.510	3.845	1621	1	44
South Rural*	*90	6.656	5.290	*5990	2	49
South Urban*	*129	6.233	2.473	*8041	2	23
Sask.	2562	6.449		16523	1	49

RI = registered Indian women; Other = Other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

The one-way ANOVA test is based on the assumption of a normal distribution. Since the distribution of days stay for cesarean section delivery is skewed to the left, the Kruskal-Wallis test, which is a nonparametric test based on the assumptions of independent random samples and at least ordinal measurements, was also performed to test the hypothesis that the population distributions of days' stay are identical among the study groups. The results of the Kruskal-Wallis test confirm that the null hypothesis, i.e. the distribution of days' stay among the five study groups are identical, cannot be rejected (Kruskal-

Wallis test statistic = 4.45. p-value = 0.3485, using chi-square distribution with 4 degrees of freedom).

Length of stay may be related to physician's practice patterns, access to alternative services in the community, other support at home, as well as to maternal and neonatal complications.

5.6.5. Repeat Cesarean and Vaginal Birth After Cesarean Section

Previous cesarean section was identified by one of the first three diagnoses (ICD-9) coded as 654.2 in a delivery separation. Women with a previous cesarean section diagnosis in the same separation record as a cesarean section delivery in 1992/93 were then assumed to be having a repeat cesarean section. The proportion of cesarean sections that were repeats may have been underestimated if other diagnoses took precedence when the separation records were coded.

Vaginal birth after cesarean delivery (VBAC) was operationally defined by the absence of a procedural code for a cesarean section during the current delivery episode combined with the presence of a diagnosis of previous cesarean section. Thus the definition of repeat cesarean and VBAC complement each other.

The rates for repeat cesarean and vaginal births after cesarean sections were based on all deliveries with previous cesarean sections. The crude rates for repeat cesareans and vaginal births after cesarean sections for each study group are shown in Table 5-40.

For all study groups combined, the crude rate of repeat cesarean sections was 71.9 per 100 previous cesarean section deliveries in 1992/93. Southern rural women had the highest rate (82.5%) of repeat cesareans per 100 deliveries with previous cesareans, followed by southern registered Indian women (79.1%). The repeat cesarean delivery

Table 5-40 Rates of Repeat Cesarean and Vaginal Birth After Cesarean Section Delivery (VBAC), Hospital Location of VBAC, By Study Group, 1992/93

Rates of Repeat Cesarean and VBAC per 100 Previous Cesareans					
		Repeat CS		VBAC	
	No. Deliveries with Previous Cesarean Section	n	per 100 dels with Prev CS	n	per 100 dels with Prev CS
North RI	49	23	46.9*	26	53.1*
North Other	24	15	62.5*	9	37.5*
South RI	153	121	79.1[ns]	32	20.9[ns]
South Rural†	400	330	82.5	70	17.5
South Urban†	610	400	65.6*	210	34.4*
Sask	1236	889	71.9	347	28.1

Proportion of VBACs Occurring at each Hospital Location					
	Regional		Base		All Hosps
	n	%	n	%	
North RI	10	38.5	16	61.5	26
North Other¶	2	22.2	6	66.7	9
South RI	9	28.1	23	71.9	32
South Rural†	50	71.4	20	28.6	70
South Urban†	40	19.0	170	81.0	210
Sask.	111	32.0	235	67.7	347

RI = registered Indian women; Other = Other than registered Indian women
¶ 1 VBAC occurred at a rural hospital
†adjusted for 10% sample (n=10 x sample number)
* $p<0.05$ for 95% confidence intervals for Odds Ratios (relative to S. Rural)

rates for northern women and southern urban women (46.9 to 65.6%) were significantly lower than for southern rural women.

In 1992/93, the VBAC rate in Saskatchewan was 28.1 VBAC per 100 previous cesarean sections. This rate was consistent with the trend of rising VBAC rates across Canada which were documented by Nair for the period from 1970 to 1988/89. During 1988/89, Manitoba had the highest rate at 26.9 per 100 previous cesarean deliveries, followed by Alberta with 22.5 and Saskatchewan with 20.6 [35]. In the United States, the 1993 rate was 25.4 VBACs per 100 deliveries with previous

cesarean sections compared with 6.6 VBACs per 100 deliveries in 1985[42].

Southern rural women and southern registered Indian women had the lowest rates of VBAC (17.5 and 20.9 VBAC per 100 previous cesarean sections). Northern registered Indian women had the highest rate (53.1 VBAC per 100 previous cesarean sections), which was nearly twice that of the rate for all Saskatchewan women aged 15-44.

The higher proportion of VBAC for all Saskatchewan women in base hospitals is consistent with Nair's finding that the higher than expected rate of VBAC in Manitoba was from the Winnipeg area, where the teaching hospitals are located[35]. The higher proportion of VBAC for southern rural women occurring at regional hospitals is unclear since only a slightly higher proportion of all types of deliveries for this group occur there.

5.6.6. Primary Cesarean Section

Primary cesarean sections were operationally defined as all cesarean section deliveries that did not have a repeat cesarean section diagnosis coded. The rates for primary cesarean sections were calculated as a proportion of all deliveries without history of previous cesareans Table 5-41.

The rates for primary cesarean section deliveries per 100 deliveries with no history of a previous cesarean ranged from a low of 8.2 for southern registered Indian women and northern other than registered Indian women to 14.4 for southern rural women. The rates for northern and registered Indian women and for southern urban women were significantly lower in comparison to southern rural women. For all study groups combined, the primary cesarean section rate was 12.3 per 100 deliveries with no previous cesarean; the corresponding

rate for all of Canada in 1988/89 (13.3%), calculated from Statistics Canada data[35]. Further study would explain if the higher primary cesarean section rate for northern registered Indian women was associated with physician practice patterns or increased fetal or maternal complications.

Table 5-41 Crude Rates for Primary Cesarean Section Deliveries per 100 Deliveries Without Previous Cesarean, By Study Group, 1992/93

	Deliveries without previous CS	Primary CS n	per 100 dels without previous CS	Crude OR	95 % C.I. lower	upper
North RI	594	54	9.1	0.596	0.80	0.45
North Other	376	31	8.2	0.536	0.78	0.37
South RI	1568	128	8.2	0.530	0.65	0.43
South Rural†	3970	570	14.4	1.00		
South Urban†	7110	890	12.5	0.854	0.96	0.76
Sask.	13618	1673	12.3			

RI = registered Indian women; Other = Other than registered Indian women
†adjusted for 10% sample (n=10 x sample number); ns=not significant

5.6.7. Discussion

Although there have been efforts in Canada and the U.S. in the past two decades to lower the rates of cesarean deliveries[35,35], there has not been an "optimum" rate of cesarean delivery established. The results from this study can not show whether the cesarean sections were always or only performed for appropriate indications.

The Saskatchewan rate of cesarean section delivery was the same in 1992/93 (17.2 cesareans per 100 deliveries) as five years previously in 1988/89 (17.42 cesareans per 100 deliveries). Southern rural women had statistically significant higher rates than each of the other study groups. Several factors have been shown in the past to influence cesarean section rates, such as access to services, physician practice

patterns, socioeconomic factors and maternal morbidity. The influence of each factor needs to be studied further.

Several studies have shown age-specific rates of cesarean delivery to be highest in women of 35-44 years and lowest in teenage women. This was also the case in this study for all groups with the exception of northern teenagers having higher cesarean rates than the 20-24 year age group. The reason for this is unclear and should be studied further.

The rate of cesarean section deliveries per 100 deliveries were highest in regional and base hospitals for all study groups combined (20.0 and 18.7 cesareans per 100 deliveries respectively) and for all study groups separately, with the exception of northern other than registered Indian women whose rates of cesarean section deliveries were lowest in regional hospitals. The higher rates for cesarean section deliveries in base and regional hospitals than in other hospital locations for northern women reflect the referral patterns for higher risk deliveries but this study was not able to determine if the access to cesarean section was "sufficient" for their needs. Between 33.8% to 56.5% of cesarean sections for northern women were performed in a northern or rural hospital which were closer to home than other hospitals. This study did not examine the indications for cesarean sections. However, given the distances to base and regional hospitals and the uncertainty of travel conditions, the access to emergency cesarean section continues to be a concern for northern women and needs consideration by those planning for health care facilities, air and road ambulance services and training of nurses and physicians.

All but one vaginal births after a previous cesarean were performed in a regional or base hospital, an indication that the routine referral systems from northern and rural physicians to more specialized obstetrical services are working well when needed.

There was no statistically significant difference among the study groups in the length of stay for cesarean section, which was unexpected considering the distances that many of all but urban women travel for this surgery. Northern registered Indian women had the longest average stay (7.2 days); southern urban women had the shortest (6.2 days).

5.7. Other Obstetric Procedures

This goal of this section was to describe the age-specific and age-standardized rates of instrument-assisted delivery and of episiotomy to assist delivery. Age-adjusted odds ratios with 95% confidence intervals were determined to compare the risk for these procedures during a delivery for all study groups in reference to southern rural women.

5.7.1. Operational Definitions

An instrument-assisted delivery was operationally defined as a delivery separation in which a procedure from the Canadian Classification of Procedures (CCP) group, 84.0-84.9 (Forceps Extraction And Other Instrumental Delivery), appeared as one of the primary, secondary or tertiary procedural codes. This procedural group includes forceps deliveries, breech extractions and vacuum extractions.

An episiotomy-assisted delivery was defined as a delivery separation in which a CCP code for episiotomy, 85.7, appeared as one of the primary, secondary or tertiary procedural codes. This code excludes episiotomy occurring with a low forceps or outlet forceps delivery (84.1), a mid forceps delivery (84.21), a high forceps delivery (84.31), or a vacuum extraction (84.71).

5.7.2. Instrument-Assisted Delivery

There were 2278 of 14854 deliveries (15.3%) in 1992/93 with an instrument-assisted delivery. The age-specific rates for all groups

combined in 1992/93 were highest for the 15-19 year age group (22.4%), then declined and rose again for the 35-44 year age group, as presented in Table 5-42 and shown in Figure 5-17. All of the study groups followed this pattern with some variations: the rate for southern rural women did not rise with the later years. Southern rural women had the highest rates in the 15-19, 20-24 and 25-29 year age groups

Table 5-42 Age-Specific And Age-Standardized Rates Of Instrument-Assisted Deliveries, 1992/93

Number of Deliveries						
age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	162	232	149	74	26	643
North Other	79	133	119	51	18	400
South RI	458	643	374	178	68	1721
South Rural*	370	830	1690	1070	410	4370
South Urban*	660	1590	2700	2080	690	7720
Sask.	1729	3428	5032	3453	1212	14854

Number Of Instrument-Assisted Deliveries						
	15-19	20-24	25-29	30-34	35-44	Total
North RI	32	22	12	5	5	76
North Other	19	12	14	9	2	56
South RI	66	51	20	9	10	156
South Rural*	120	170	270	130	50	740
South Urban*	150	290	350	320	140	1250
Sask.	387	545	666	473	207	2278

Rate Of Instrument-Assisted Deliveries Per 100 Deliveries							
	15-19	20-24	25-29	30-34	35-44	Crude Rate	Age-std. Rate†
North RI	19.8	9.5	8.1	6.8	19.2	11.8	12.5
North Other	24.1	9.0	11.8	17.6	11.1	14.0	13.9
South RI	14.4	7.9	5.3	5.1	14.7	9.1	7.7
South Rural	32.4	20.5	16.0	12.1	12.2	16.9	16.9
South Urban	22.7	18.2	13.0	15.4	20.3	16.2	16.5
Sask.	22.4	15.9	13.2	13.7	17.1	15.3	

RI = registered Indian women; Other = other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to Saskatchewan deliveries, ages 15-44, 1992/93

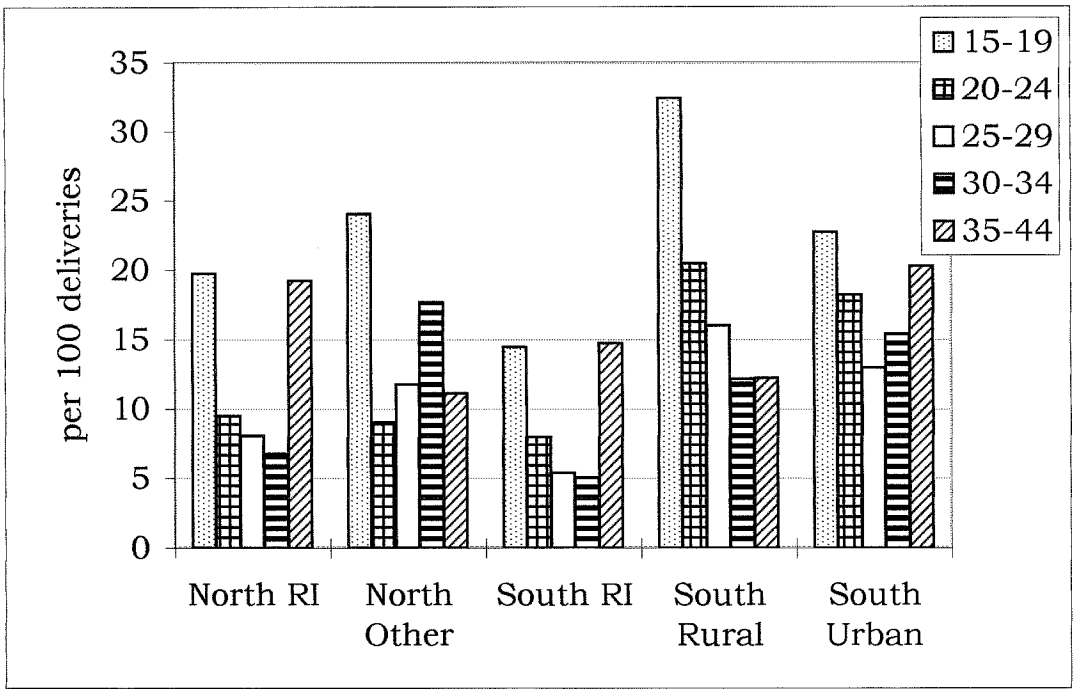

Figure 5-17 Age-specific rates of instrument-assisted deliveries, 1992/93.

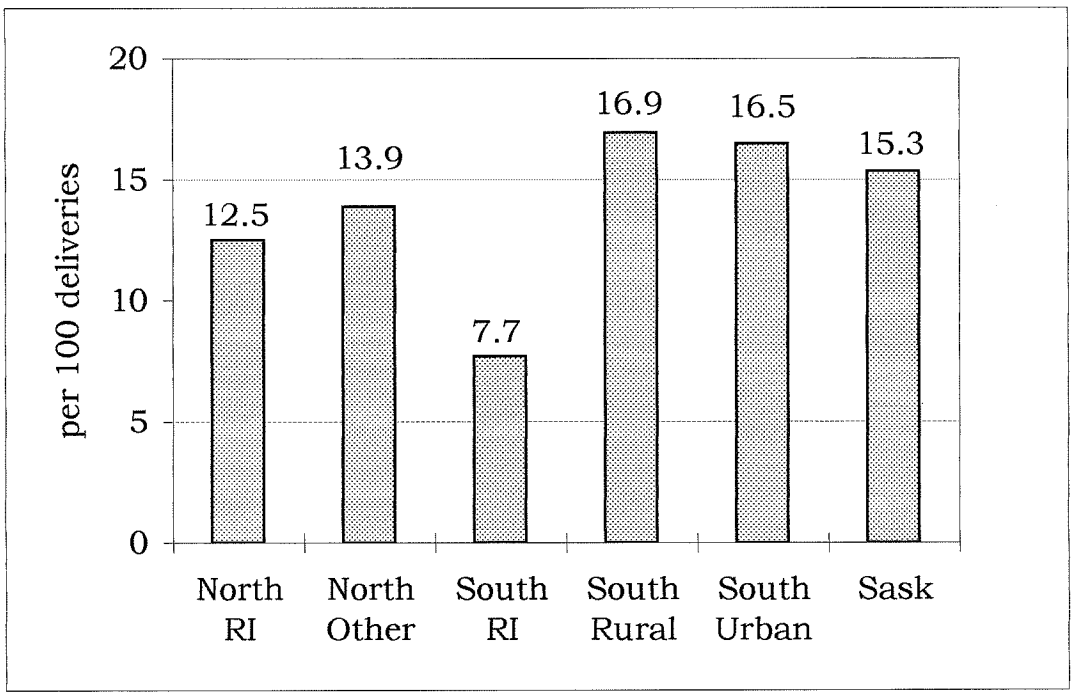

Figure 5-18 Age-standardized rates of instrument-assisted deliveries, 1992/93.

and the lowest rate in the 35-44 year age group, next to northern other than registered Indian women whose numbers of instrument-assisted deliveries for ages 35-44 were too small to make reliable comparisons. Southern registered Indian women had the lowest rates for the age groups between 15-34 years.

Southern rural women had the highest age-standardized rate of instrument-assisted delivery (16.9 per 100 deliveries), which was more than twice that of southern registered Indian women who had the lowest rate (7.7 per 100 deliveries), as shown in Figure 5-18.

The age-adjusted odds ratios and 95% confidence intervals in Table 5-43 show that the risk for an instrument-assisted delivery was significantly lower for northern and registered Indian women in comparison with that for southern rural women. The risks for southern rural and urban women were not significantly different.

Table 5-43 Age-Adjusted Odds Ratios for Instrument-Assisted Deliveries, with 95% Confidence Intervals, 1992/93

	Age-adj.			95% CI			
	ψ	β	SE(β)	lower	upper	χ^2_1	p
North RI	0.511	-0.671	0.133	0.394	0.663	28.89	<0.0001
North Other	0.659	-0.417	0.152	0.489	0.888	8.11	0.0044
South RI	0.374	-0.983	0.098	0.309	0.454	114.2	<0.0001
South Rural	1.000						
South Urban	0.947	-0.054	0.051	0.857	1.050	1.14	0.2853

RI=registered Indian women; Other=other than registered Indian women
ψ = Odds Ratio; β=coefficient; SE(β)=standard error of coefficient
χ^2_1=chi-square with 1 degree of freedom

5.7.3. Episiotomy

There were 2904 of 14854 deliveries (19.6%) in 1992/93 with episiotomies, not including those done at the time of a procedure

classified as Forceps Extraction And Other Instrumental Delivery. The age-specific rates (presented in Table-44 and shown in Figure 5-19) for all groups combined in 1992/93 were highest for the 15-19 year age group (25.0%), then declined for the 20-24 year age group, rose again for the 25-29 year age group, and then declined to the lowest rate for the 35-44 year age group. The southern rural and urban study groups followed this pattern. The rates for registered Indian women were highest among women aged 15-19 years and declined over the next three age groups. The numbers of episiotomies in the 35-44 year age group for northern and registered Indian women were too small to make reliable comparisons.

Southern rural and urban women had the highest age-standardized rates of delivery with episiotomy (20.8 and 21.0 per 100 deliveries respectively), which were twice that of northern registered Indian women who had the lowest rate (10.4 per 100 deliveries), as shown in Figure 5-20. The age-standardized rates of delivery with episiotomy for northern other than registered Indian women and southern registered Indian women were similar to those of northern registered Indian women.

Table 5-44 Age-Specific and Age-Standardized Rates of Deliveries With Episiotomy, 1992/93

Number of Deliveries age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	162	232	149	74	26	643
North Other	79	133	119	51	18	400
South RI	458	643	374	178	68	1721
South Rural*	370	830	1690	1070	410	4370
South Urban*	660	1590	2700	2080	690	7720
Sask.	1729	3428	5032	3453	1212	14854

Number of Deliveries With Episiotomy	15-19	20-24	25-29	30-34	35-44	Total
North RI	39	28	9	2	3	81
North Other	10	15	11	5	4	45
South RI	133	92	39	11	3	278
South Rural*	80	150	400	240	40	910
South Urban*	170	340	660	340	80	1590
Sask.	432	625	1119	598	130	2904

Rate of Deliveries With Episiotomy per 100 Deliveries	15-19	20-24	25-29	30-34	35-44	Crude	Age-std.† Rate
North RI	24.1	12.1	6.0	2.7	11.5	12.6	10.4
North Other	12.7	11.3	9.2	9.8	22.2	11.3	11.3
South RI	29.0	14.3	10.4	6.2	4.4	16.2	12.0
South Rural	21.6	18.1	23.7	22.4	9.8	20.8	20.8
South Urban	25.8	21.4	24.4	16.3	11.6	20.6	21.0
Sask.	25.0	18.2	22.2	17.3	10.7	19.6	

RI = registered Indian women; Other = other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)
†Standardized to Saskatchewan deliveries, ages 15-44, 1992/93

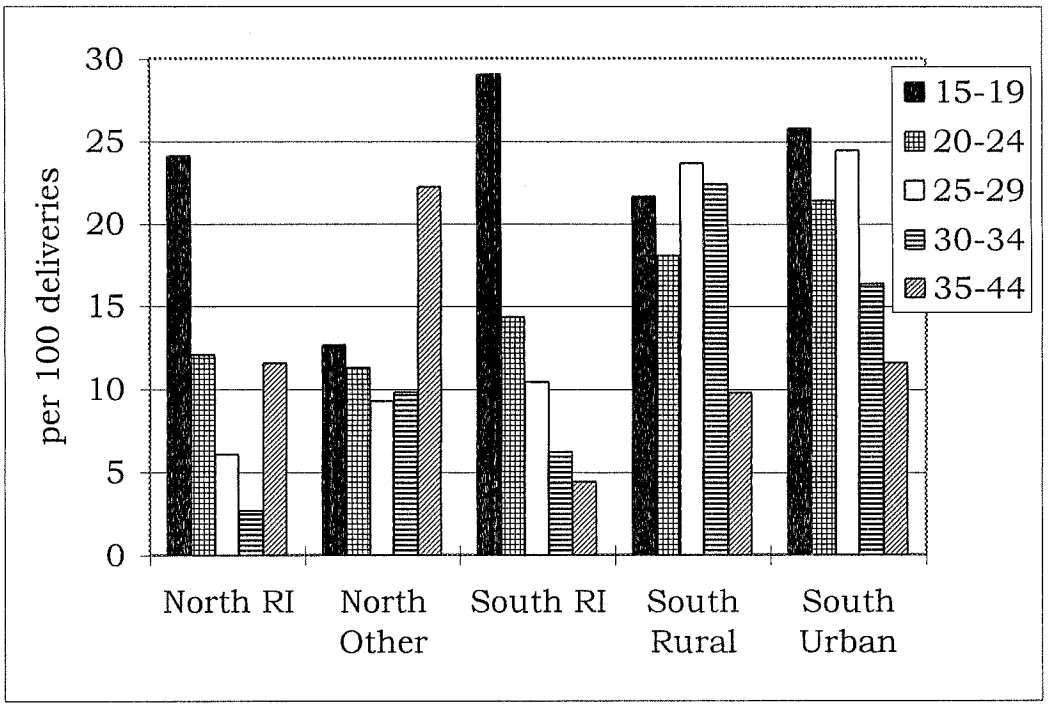

Figure 5-19 Age-specific rates of deliveries with episiotomy, 1992/93.

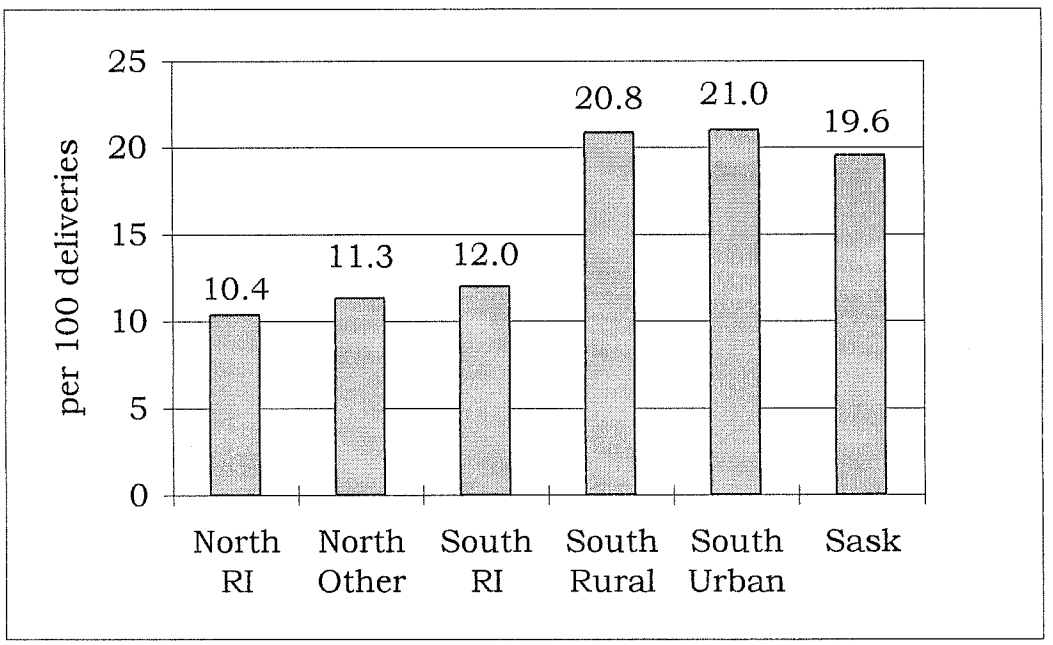

Figure 5-20 Age-standardized rates of deliveries with episiotomy, 1992/93.

The age-adjusted odds ratios and 95% confidence intervals in Table 5-43 show that the risk for an episiotomy during delivery was significantly lower for northern and registered Indian women in comparison with that for southern rural women. The risks for southern rural and urban women were not significantly different.

Table 5-45 Age-Adjusted Odds Ratios for Deliveries with Episiotomy, with 95% Confidence Intervals, 1992/93

	Age-adj.			95% CI			
	ψ	β	SE(β)	lower	upper	χ^2_1	p
North RI	0.504	-0.685	0.127	0.393	0.647	32.82	<0.0001
North Other	0.464	-0.767	0.164	0.337	0.640	25.92	<0.0001
South RI	0.633	-0.457	0.080	0.541	0.740	34.53	<0.0001
South Rural	1.000						
South Urban	0.986	-0.014	0.047	0.899	1.080	0.10	0.7570

RI=registered Indian women; Other=other than registered Indian women
ψ = Odds Ratio; β=coefficient; SE(β)=standard error of coefficient
χ^2_1=chi-square with 1 degree of freedom

5.7.4. Hospital Location

The hospitals contributing data to this study were classified as rural, regional, base, north or out of Saskatchewan, as described in section 5.6.3.

For all study groups combined, the rate of instrument-assisted deliveries ranged from 3.7% of deliveries in northern hospitals to 18.9% of deliveries occurring in base hospitals, as indicated in Table 5-46.

Table 5-46 Rate of Instrument-Assisted Deliveries per 100 Deliveries at Each Hospital Location, By Study Group, 1992/93

Number of Deliveries By Hospital Location, 1992/93

	North	Rural	Regional	Base	Other	All Hosps
North RI	241	60	181	147	14	643
North Other	131	109	45	72	43	400
South RI	4	288	556	821	52	1721
South Rural*	0	700	1780	1680	210	4370
South Urban*	0	20	2130	5500	70	7720
Sask.	376	1177	4692	8220	389	14854

Number of Instrument-Assisted Deliveries

	North	Rural	Regional	Base	Other	All Hosps
North RI	9	18	19	30	0	76
North Other	5	21	8	22	0	56
South RI	0	19	43	92	2	156
South Rural*	0	110	230	380	20	740
South Urban*	0	0	220	1030	0	1250
Sask.	14	168	520	1554	22	2278

Rate of Instrument-Assisted Deliveries per 100 Deliveries

	North	Rural	Regional	Base	Other	All Hosps
North RI	3.7	30.0	10.5	20.4	0.0	11.8
North Other	3.8	19.3	17.8	30.6	0.0	14.0
South RI	0.0	6.6	7.7	11.2	3.8	9.1
South Rural	0.0	15.7	12.9	22.6	9.5	16.9
South Urban	0.0	0.0	10.3	18.7	0.0	16.2
Sask.	3.7	14.3	11.1	18.9	5.7	15.3

RI=registered Indian women; Other=other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

For all study groups combined, the rate of deliveries with episiotomy in Saskatchewan hospitals ranged from 14.3% of deliveries in base hospitals to 29.5% of deliveries occurring in regional hospitals, as indicated in Table 5-47. The number of deliveries forming the denominators for these rates were presented in Table 5-46.

Table 5-47 Rate of Deliveries with Episiotomy per 100 Deliveries at Each Hospital Location, By Study Group, 1992/93

Number of Deliveries with Episiotomy						
	North	Rural	Regional	Base	Other	All Hosps
North RI	39	6	29	7	0	81
North Other	21	11	12	1	0	45
South RI	1	51	122	104	0	278
South Rural*	0	190	480	220	20	910
South Urban*	0	10	740	840	0	1590
Sask.	61	268	1383	1172	20	2904
Rate of Deliveries with Episiotomy per 100 Deliveries						
	North	Rural	Regional	Base	Other	All Hosps
North RI	16.2	10.0	16.0	4.8	0.0	12.6
North Other	16.0	10.1	26.7	1.4	0.0	11.3
South RI	25.0	17.7	21.9	12.7	0.0	16.2
South Rural*	0.0	27.1	27.0	13.1	9.5	20.8
South Urban*	0.0	50.0	34.7	15.3	0.0	20.6
Sask.	16.2	22.8	29.5	14.3	5.1	19.6

RI = registered Indian women
Other = other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

5.7.5. Discussion

Although appropriate rates of episiotomy or instrument-assisted delivery have not been established, there has been a move to decrease these interventions in delivery [25,26,27]. The lower rates of instrument-assisted deliveries and deliveries with episiotomy per 100 deliveries for northern and registered Indian women in comparison with those for

southern rural women were consistent with the corresponding separation rates for diagnoses of Complications in Labour and Delivery, as seen in section 5.5.

The higher rate of instrument-assisted delivery in base hospitals (18.9 per 100 deliveries) compared to northern hospitals (3.7 per 100 deliveries) may be due in part to an increased need because of the higher proportion of high risk deliveries performed there. The medicalization of birth in larger centres with advanced technology, as reported by Black[25], may also contribute to the increased use of forceps and other instruments during delivery.

The rate of deliveries with episiotomy per 100 deliveries for deliveries occurring in northern hospitals was similar to the episiotomy rate for base hospitals, indicating that for a procedure subject to physician discretion, northern physician practice is comparable to that in teaching hospitals and other tertiary care centres. The lower rates of complications in labour and delivery for northern women may also have contributed to lower episiotomy rates; however, southern registered Indian women, who had the lowest age-standardized rate of complications in labour and delivery, had episiotomy rates that were midway between those of northern and other southern women.

5.8. Complications Of The Puerperium

Episodes of care with complications of the puerperium were defined as episodes of care in which one of the three leading diagnoses in at least one separation had an ICD-9 code, 670-676, within the group of Complications of the Puerperium. This diagnostic group includes major puerperal infection, venous complications, pyrexia, obstetric pulmonary embolism, breast infections, lactation disorders, and other complications. Even though some of these conditions may occur in pregnancy or childbirth, they are still classified as Complications of the Puerperium.

Complications of the Puerperium were examined as a proportion of the number of deliveries. Since the numbers were so small, further analysis and tests of statistical significance were not done.

As shown in Table 5-48 and Figure 5-21, all of the study groups had similar rates of episodes of care with complications of the puerperium per 100 deliveries (3.3 to 3.9 episodes per 100 deliveries). The analysis of several years' data may enable analysis of individual pospartum complications, such as puerperal infection, or readmission rates for postpartum complications.

Table 5-48 Rate of Episodes of Care With Complications of the Puerperium Per 100 Deliveries, ICD-9 670-676, 1992/93

	n	# deliveries	per 100 deliveries
North RI	25	643	3.9
North Other	13	400	3.3
South RI	67	1721	3.9
South Rural*	170	4370	3.9
South Urban*	290	7720	3.8
Sask.	565	14854	3.8

RI=registered Indian women; Other=other than registered Indian women
*adjusted for 10% sample (n=10 x sample number)

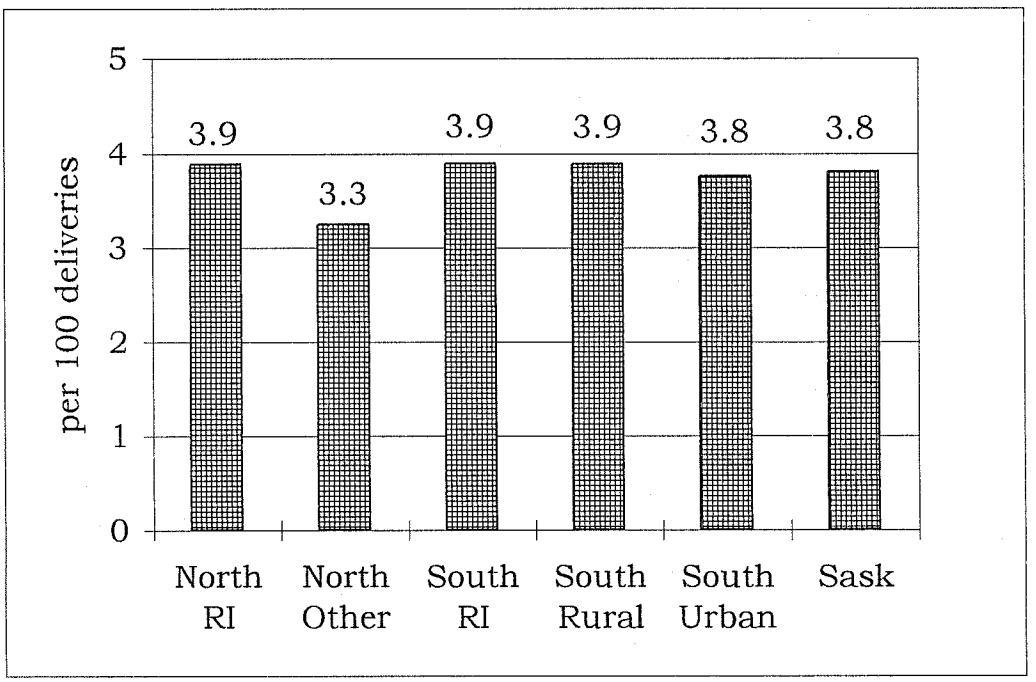

Figure 5-21 Crude rates of episodes of care with postnatal complications, 1992/93.

6. CONCLUSIONS

This chapter presents the highlights of this study first in terms of the study limitations and then the obstetric hospitalization rates for Saskatchewan women in 1992/93.

6.1. Limitations

A. This was a descriptive study of obstetric hospitalization rates for northern women and southern registered Indian women in comparison with southern rural women. Since the study was based on the obstetric hospitalization records for women discharged from hospital between April 1, 1992 to March 31, 1993, it is limited to the information contained in the maternal hospitalization data. Information was not available on birth outcome (for example, stillbirth, multiple births), the date of birth, parity, apgar score, birth weight or gestational age. For future studies, this information could be obtained by linking the maternal hospitalization record with the newborn record or vital statistics data, which would enable analysis of pregnancy complications by birth outcome.

B. Since hospitalization is influenced by many factors other than morbidity, such as physician practice patterns, access to hospital beds and alternative ambulatory care, family and community support, and other socioenvironmental factors, caution must be used in the interpretation of obstetric hospitalization rates.

C. The number of deliveries and pregnancies used as denominators in the calculation of rates were derived from the data after selection of procedures and diagnoses most likely to indicate a delivery or pregnancy. The number of deliveries estimated by the study was within the expected range of the total births estimated from Vital Statistics data for the same period. The number of pregnancies included all deliveries, ectopic pregnancies and other abortive outcomes. Including records of therapeutic abortions from day surgeries would have created a more complete count of pregnancies. However, only a portion of spontaneous abortions would have been documented in the hospitalization data and at differing rates for each study group, depending on thresholds for admission and access to alternate ambulatory care. Although rates based on the number of documented pregnancies overestimated the "true" rates, the comparison between groups would not have been greatly affected since all of the study groups have the same problem.

D. The analysis of obstetric hospitalization rates based on the number of women of reproductive age was useful to demonstrate the burden of suffering in each study group for complications of pregnancy, childbirth and the puerperium. It also indicated the amount of resources used, such as hospital days, human resources, and ambulance services. However, the analysis of obstetric hospitalization rates based on the number of pregnancies or deliveries provided a more accurate picture of the risks to individual women because it removed the influence of fertility rates that differed significantly across study groups. Even with all the difficulties in estimating the number of pregnancies and in interpretation, hospitalization rates are still one of the few indicators available that are useful for estimating morbidity during pregnancy.

E. The data contained the obstetric hospitalization records for 100% of northern women and southern registered Indian women and for 10% of southern rural and urban women who were hospitalized during the study year. The sampled records were most representative of the original hospitalization data for larger diagnostic groups. Combining data for several years or increasing the sample size would improve the representativeness of the sample for less common diagnoses. Several years data would also allow more detailed study for less common diagnoses such as diabetes, eclampsia, and postpartum complications and allow the demonstration of trends.

F. In this study, hospitals were categorized by the level of services provided and by location in the northern or southern part of the province. Additional analysis by hospital catchment area would provide a better picture of access to hospital care.

G. Individual women were assigned to study groups on the basis of the residence codes used by Saskatchewan Health to indicate the rural municipality, village, town or city where she lives. However, the residence codes for registered Indian women refer to the First Nation she belongs to rather than her actual residence. Since half of all Saskatchewan First Nations people live off reserves, the study results should be interpreted with this in mind. Further analysis of obstetric hospitalization rates would be useful on the basis of actual residence (e.g. reserve or rural area versus urban areas).

6.2. Summary Of Obstetric Hospitalization Rates

The major results of the study of obstetric hospitalization rates for northern women and registered Indian women in comparison with southern rural women in Saskatchewan in 1992/93 are highlighted in Table 6-1, followed by a summary of the implications of the study.

Where statistical analysis was used to compare rates between southern rural women and each of the other study groups, the significance of differences is noted in the table. The absence of a notation regarding statistical significance means that testing was not done.

Table 6-1, page 1 Summary Table of Selected Obstetric Hospitalization Rates for All Study Groups Compared with Southern Rural Women, Saskatchewan 1992/93

Hospitalization Rate Indicator	Study Groups Higher than South Rural	Study Groups Same As South Rural	Study Groups Lower than South Rural
Deliveries per 1,000 women†	1. North RI 2. South RI 3. North Other	South Urban	
Proportion of study group giving birth who are aged 15-24	1. North RI 2. South RI 3. North Other	South Urban	
All obstetric episodes combined per 1,000 women†	1. North RI †*** 2. South RI †*** 3. North Other †***	South Urban ns	
All obstetric episodes combined per 100 pregnancies §	South RI	1. North Other 2. North RI 3. South Urban	
Ectopic pregnancies per 1,000 pregnancies§	1. North RI ** 2. South RI * 3. North Other *** 4. South Urban **		

RI = registered Indian women; Other = other than registered Indian women

† Age-standardized to Sask. women ages 15-44, 1992; § Age-standardized to Sask. pregnancies ages 15-44, 1992/93

* Statistically sig. $p<0.05$; ** statistically sig. $p<0.01$; *** statistically sig. $p<0.001$; ns not statistically significant

Table 6-1, page 2 Summary Table of Obstetric Hospitalization Rates for All Study Groups Compared with Southern Rural Women, Saskatchewan 1992/93 - **Antenatal Episodes**

Hospitalization Rate Indicator	Study Groups Higher than South Rural	Study Groups Same As South Rural	Study Groups Lower than South Rural
Antenatal episodes per 100 pregnancies§	1. South RI *** 2. North Other *** 3. South Urban *	1. North RI ns	
Antenatal episodes with diabetes or abnormal glucose per 100 pregnancies §	1. North Other * 2. South RI * 3. North RI *	1. South Urban ns	
Antenatal episodes with urinary tract infection per 100 pregnancies§	1. South RI * 2. North RI * 3. North Other *	1. South Urban ns	
Antenatal episodes with hemorrhage per 100 pregnancies §	1. North Other * 2. South RI *	North RI ns	South Urban *
Antenatal episodes with false or early labour per 100 pregnancies §	1. South RI * 2. North Other * 3. South Urban *	North RI ns	
Antenatal episodes with hypertension per 100 pregnancies §		1. South RI ns 2. North Other ns 3. South Urban ns 4. North RI ns	
Antenatal episodes with hyperemesis per 100 pregnancies §		South RI ns	1. South Urban * 2. North RI * 3. North Other *

RI = registered Indian women; Other = other than registered Indian women

† Age-standardized to Sask. women ages 15-44, 1992; § Age-standardized to Sask. pregnancies ages 15-44, 1992/93

* Statistically sig. $p<0.05$; ** statistically sig. $p<0.01$; *** statistically sig. $p<0.001$; ns not statistically significant

Table 6-1, page 3 Summary Table of Obstetric Hospitalization Rates for All Study Groups Compared with Southern Rural Women, Saskatchewan 1992/93 - **Complications Of Labour And Delivery**

Hospitalization Rate Indicator	Study Groups Higher than South Rural	Study Groups Same As South Rural	Study Groups Lower than South Rural
Complications Of Labour And Delivery per 100 deliveries§£	South Urban ***	North Other ns	1. South RI *** 2. North RI ***
1. Obstructed or long labour, abn. forces of labour per 100 deliveries§		1. North Other ns 2. South Urban ns	1. South RI * 2. North RI *
2. Umbilical cord complications per 100 deliveries§	South Urban *	1. South RI ns 2. North RI ns 3. North Other ns	
3. Obstetric trauma per 100 deliveries§	South Urban *	1. North Other ns 2. North RI ns 3. South RI ns	
4. Delivery separations with postpartum hemorrhage, retained placenta, anesthetic complications per 100 deliveries§	South Urban *	1. North Other ns 2. North RI ns 3. South RI ns	
‡ Delivery separations with fetal and placental problems per 100 deliveries§	1. North RI * 2. North Other * 3. South Urban *	South RI ns	
‡ Malposition and malpresentation of fetus, disproportion per 100 deliveries§	South Urban *	1. North RI ns 2. North Other ns	South RI *

* Statistically sig. difference, $p<0.05$; RI = registered Indian women; Other = other than registered Indian women

§ Age-standardized to Sask. deliveries for ages 15-44, 1992/93

* Statistically sig. $p<0.05$; ** statistically sig. $p<0.001$; *** statistically sig. $p<0.001$; ns not statistically significant

£ Numbers 1-4 are included under this category; ‡ Diagnosis separate from the first category

Table 6-1, page 4 Summary Table of Obstetric Hospitalization Rates for All Study Groups Compared with Southern Rural Women, Saskatchewan 1992/93 - **Days' Stay and Length Of Stay**

Hospitalization Rate Indicator	Study Groups Higher than South Rural	Study Groups Same As South Rural	Study Groups Lower than South Rural
Days' stay for all obstetric episodes per 100 pregnancies §	1. North RI 2. South RI	North Other	South Urban
Average length of stay per obstetric episode		1. North RI ns 2. North Other ns 3. South Urban ns	South RI *
Average length of stay per ectopic pregnancy		1. North Other ns 2. North RI ns 3. South RI ns 4. South Urban ns	
Days' stay for antenatal episodes per 100 pregnancies §	1. South RI 2. North Other 3. North RI		South Urban
Average length of stay per antenatal episode		1. North Other ns 2. North RI ns 3. South RI ns 4. South Urban ns	
Average length of stay per delivery episode		1. North RI ns 2. South RI ns 3. North Other ns 4. South Urban ns	
Average length of stay per vaginal delivery episode	North RI *	1. North Other ns 2. South RI ns 3. South Urban ns	

RI = registered Indian women; Other = other than registered Indian women

§ Age-standardized to Sask. pregs for ages 15-44, 1992/93; * Statistically sig. $p<0.05$; ns not statistically significant

Table 6-1, page 5 Summary Table of Obstetric Hospitalization Rates for All Study Groups Compared with Southern Rural Women, Saskatchewan 1992/93 - **Procedures In Delivery**

Hospitalization Rate Indicator	Study Groups Higher than South Rural	Study Groups Same As South Rural	Study Groups Lower than South Rural
Average length of stay per delivery episode with cesarean section		1. North RI ns 2. North Other ns 3. South RI ns 4. South Urban ns	
Cesarean sections per 100 deliveries §			1. South Urban *** 2. South RI *** 3. North RI *** 4. North Other ***
Repeat cesarean sections per 100 deliveries with previous cesareans		South RI ns	1. South Urban * 2. North Other * 3. North RI *
Primary cesarean sections per 100 deliveries without previous cesareans			1.South Urban * 2.North RI* 3.N.Other* & SouthRI*
Vaginal births per 100 deliveries with previous cesareans (VBAC)	1. North RI * 2. North Other * 3. South Urban *	South RI ns	
Instrument-assisted deliveries per 100 deliveries§		South Urban ns	1. North Other ** 2. North RI *** 3. South RI ***
Deliveries with episiotomy per 100 deliveries §		South Urban ns	1. South RI *** 2. North RI *** 3. North Other ***

RI=reg. Indian women; Other=other than reg. Indian women; § Age-stand. to Sask. deliveries for ages 15-44, 1992/93
* Statistically sig. $p<0.05$; ** statistically sig. $p<0.001$; *** statistically sig. $p<0.001$; ns not statistically significant

A. Northern women and southern registered Indian women had higher rates of delivery per 1,000 women for all age groups than southern rural women in 1992/93, with the greatest differences in the 15-19 year and the 20-24 year age groups (Table 6-1, page 1).

The significantly higher fertility rates have implications for needs based funding and planning for education and other community resources. Formulas developed for funding services and infrastructure in northern communities need to consider both the higher fertility rates in each age group together with the younger population structure of the north. For example, the hospitals serving these communities need to have sufficient labour and delivery beds for the present and plans for expansion in the near future. Prenatal and parenting education programs need to consider the high proportion of births to adolescent and young adult mothers, be sensitive to cultural differences, and build on and enhance social supports that exist in traditional communities. Schools need to be built to accommodate an expanding young population, with consideration for day care for children of teen-aged parents.

B. The higher rates of obstetric episodes of care per 1,000 women among northern women and southern registered Indian women in comparison with southern rural women reflect the higher fertility rates among these groups in 1992/93 (Table 6-1, page 1). The rate of obstetric episodes per 100 pregnancies for southern registered Indian women was 18 percent higher than for southern rural women, but there was very little difference in the obstetric episode rates per 100 pregnancies between the other groups and southern rural women, indicating that for all diagnoses combined, the risk for complications during a pregnancy was similar for northern women and southern rural women. Further study would help explain the

differing rates of obstetric episodes per 100 pregnancies between northern and southern registered Indian women. Are thresholds of admission lower or is morbidity during pregnancy higher for southern registered Indian women? Are there health status differences, such as for rates of gestational diabetes? Do northern registered Indian women have less access to hospital care or does the ambulatory care provided by resident primary care nurses and physicians visiting northern reserves reduce the need for hospital care?

C. Northern women and southern registered Indian women had significantly higher rates for ectopic pregnancy per 1,000 pregnancies in comparison to southern rural women in 1992/93 (Table 6-1, page 1).

Programs to prevent ectopic pregnancy need to address the higher rates of sexually transmitted infections (STIs) among this population with education, appropriate screening, early diagnosis, treatment and contact tracing.

Since ectopic pregnancy can be a life-threatening condition, early diagnosis is very important. Currently ultrasound is available to northern women only if they travel south or if they are seen at a traveling ultrasound clinic at one of the northern medical clinics. The need to differentiate between diagnoses of pelvic inflammatory disease and ectopic pregnancy may support establishing resident ultrasound services in northern communities.

Since ectopic pregnancy usually requires surgical treatment, there needs to be strong referral systems in place. With newer surgical techniques such as laparoscopy and salpingostomy, the definitive management of ectopic pregnancy is usually limited to a

regional or tertiary care centre. In 1992/93 there were no ectopic pregnancies treated solely in any of the 4 small northern hospitals.

D. The rates of antenatal episodes per 100 pregnancies were significantly higher for southern registered Indian women and northern other than registered Indian women in comparison with southern rural women for all antenatal diagnoses combined, a large portion of which may have been preventable conditions (Table 6-1, page 2). The significantly higher rates of episodes for hemorrhage and for false or early labour for both study groups may reflect lower admission thresholds because of distances to hospitals and concern for a greater potential for serious complications. Why the episode rates for these diagnoses are not also higher among northern registered Indian women is not clear and should be studied further.

Northern women and registered Indian women experienced higher rates for antenatal episodes with diabetes or abnormal glucose and for genitourinary tract infections, which are potentially preventable conditions.

The rates for diabetes have been increasing among aboriginal people and are reflected in the significantly higher antenatal episode rates for gestational diabetes and abnormal glucose tolerance. Unless primary diabetes prevention efforts in the general population, including education regarding nutrition and physical activity, are increased or improved, the rates of gestational diabetes may continue to increase along with associated perinatal mortality and morbidity. The efficacy of gestational diabetes screening on outcome improvement is still in question for the general population. However, among northern and registered Indian women, screening for gestational diabetes early in pregnancy perhaps should follow recommendations for those at high risk for diabetes. At the tertiary

prevention level, women who develop gestational diabetes will need diabetic education regarding diet and activity as well as high risk pregnancy management. Since diabetes in pregnancy is associated with larger babies, there may be increasing risks to pregnant women as diabetes rates rise.

Higher rates of antenatal episodes per pregnancy for genitourinary tract infections among northern women and registered Indian women suggest that prenatal screening for asymptomatic bacteruria should be more frequent than routinely recommended for the general prenatal population. Identification and treatment of asymptomatic bacteruria with a single screening test by urine culture early in pregnancy has been shown to lead to a 10-fold decrease in pyelonephritis later in pregnancy and to a decrease in pre-term delivery and low birth weight[43].

All study groups had similar antenatal episode rates for hypertension which is consistent with their similar rates of delivery separations with pre-eclampsia or eclampsia, shown in the section on complications in labour and delivery.

The significantly lower rates of antenatal episodes for hyperemesis per delivery reflect a lower incidence or lower severity of this condition for northern women in comparison with southern women.

E. The lower rate of labour and delivery complications for registered Indian women after adjusting for age, particularly for obstructed, abnormal or long labour (Table 6-1, page 3), may support the common belief that aboriginal women have easier births than do nonaboriginal women.

Northern women and registered Indian women had similar rates to southern rural women for other complications, including umbilical cord complications, obstetric trauma, postpartum hemorrhage,

retained placenta and anesthetic complications. Considering that one-third of northern women delivered in northern hospitals, these rates again reflect well on the quality of care they received and support continued obstetric practice in northern hospitals with referral of high risk women to larger centres. In contrast, southern urban women, who delivered most of their babies in urban hospitals, had significantly more complications in labour and delivery, suggesting that ready access to advanced technology is not without risk.

Northern women had significantly higher rates of deliveries with fetal and placental problems per 100 deliveries in comparison with southern rural women. Further study would be needed to clarify which of the diagnoses in this category (including fetal abnormality, fetal distress, poor or excessive fetal growth, ABO and Rh incompatibilities) contributed to the higher rates. Previous studies have shown northern Saskatchewan children to be at higher risk for infant death associated with congenital abnormalities[7]. Southern urban women also experienced higher rates of deliveries with fetal and placental problems than southern rural women, perhaps because of detection bias with the greater use of intrapartum electronic fetal monitoring in urban hospitals.

F. The rate of total days' stay for obstetric episodes per 100 pregnancies was higher for registered Indian women than southern rural women (Table 6-1, page 4). The rate of total days' stay for antenatal episodes per 100 pregnancies was also higher for all northern women and registered Indian women than southern rural women. These higher rates of days' stay would have been most influenced by the higher incidence of obstetric episodes per 100 pregnancies rather than longer stays, since the average length of

stay per obstetric episode for northern women was the same and for southern registered Indian women was lower than the average length of stay for southern rural women.

Similarly, the average lengths of stay for ectopic pregnancy, antenatal episodes, all delivery episodes and delivery episodes specifically with cesarean section were similar for all study groups, despite the higher rate of episodes that included transfers for northern women. Although northern registered Indian women had a higher average length of stay for vaginal deliveries than southern rural women, the actual difference was only a half day more on average. The longer stay was probably influenced by waiting time for transportation home and by caution in discharging women home to communities the farthest away from hospitals, several which are accessible only by air travel. The similar length of stay for all study groups indicates that northern and rural hospital beds were not used excessively for obstetric care compared to larger centres.

The current length of stay for delivery episodes should be examined in light of the trend for shorter stays. Early discharge programs are appropriate only if there are well-developed, accessible community services for follow-up, screening and client education, as well as strong communication links between hospital and community care agencies. Considering that the majority of northern women deliver in the south, often requiring long journeys home on public transportation to communities without convenient access to hospital care* in the event of complications, there is a higher potential for problems if they are discharged too soon.

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* For example, the way home may mean a 6½ hour bus trip from Saskatoon to La Ronge followed by an hour taxi ride to Stanley Mission or a three hour scheduled flight in a small plane from Prince Albert to Fond du Lac.

G. Northern women and southern registered Indian women had significantly lower rates of deliveries with cesarean section, instrument use and episiotomy per 100 deliveries than southern rural women in 1992/93 (Table 6-1, page 5), which was consistent with their lower rates of labour and delivery complications. The higher use of epidural anesthesia in southern hospitals may contribute to higher rates of instrument-assisted deliveries and episiotomy for southern women. Physician practice styles may also influence episiotomy rates.

Southern registered Indian women with previous cesarean section deliveries had the same risk for repeat cesareans and for vaginal birth as southern rural women, which may be related to having similar proportions of deliveries in rural or regional hospitals. In contrast, northern and urban women had significantly lower rates of repeat cesareans and significantly higher rates of vaginal births after cesarean sections per 100 deliveries with a previous cesarean section compared with southern rural women, which may be related to physician practice and referral patterns for women wishing to undergo a trial of labour after a previous cesarean. None of the VBACs for northern women occurred at the four northern Saskatchewan hospitals, and all but one occurred at a regional or base hospital.

Northern and registered Indian women and southern urban women had significantly lower rates of primary cesarean section deliveries per 100 deliveries with no history of a previous cesarean in comparison to southern rural women. The primary cesarean section rate for all Saskatchewan women combined (12.3) was slightly lower than the corresponding rate for all of Canada (13.1) in 1988/89.

The lower rates of delivery with cesarean section, instruments and episiotomies as well as VBAC for northern women delivering in

northern hospitals suggest that physicians are appropriately referring women at high risk for delivery complications to southern facilities and using fewer interventions for those who deliver in the north. Northern health planners should support and enhance northern obstetric practice so that women with low risk deliveries can continue to deliver in northern hospitals and avoid unnecessary travel during labour and delivery, time away from family and other social supports, as well as delivery in a less familiar and more interventionist environment.

H. This study achieved its objective of providing a baseline of obstetric hospitalization rates for northern women and registered Indian women in Saskatchewan. Future studies will be useful for First Nations and health districts in evaluating health transfer and health renewal efforts, which includes the construction of new facilities integrating acute care, community care and community health services in the north and hospital closures with the establishment of health centres in the south.

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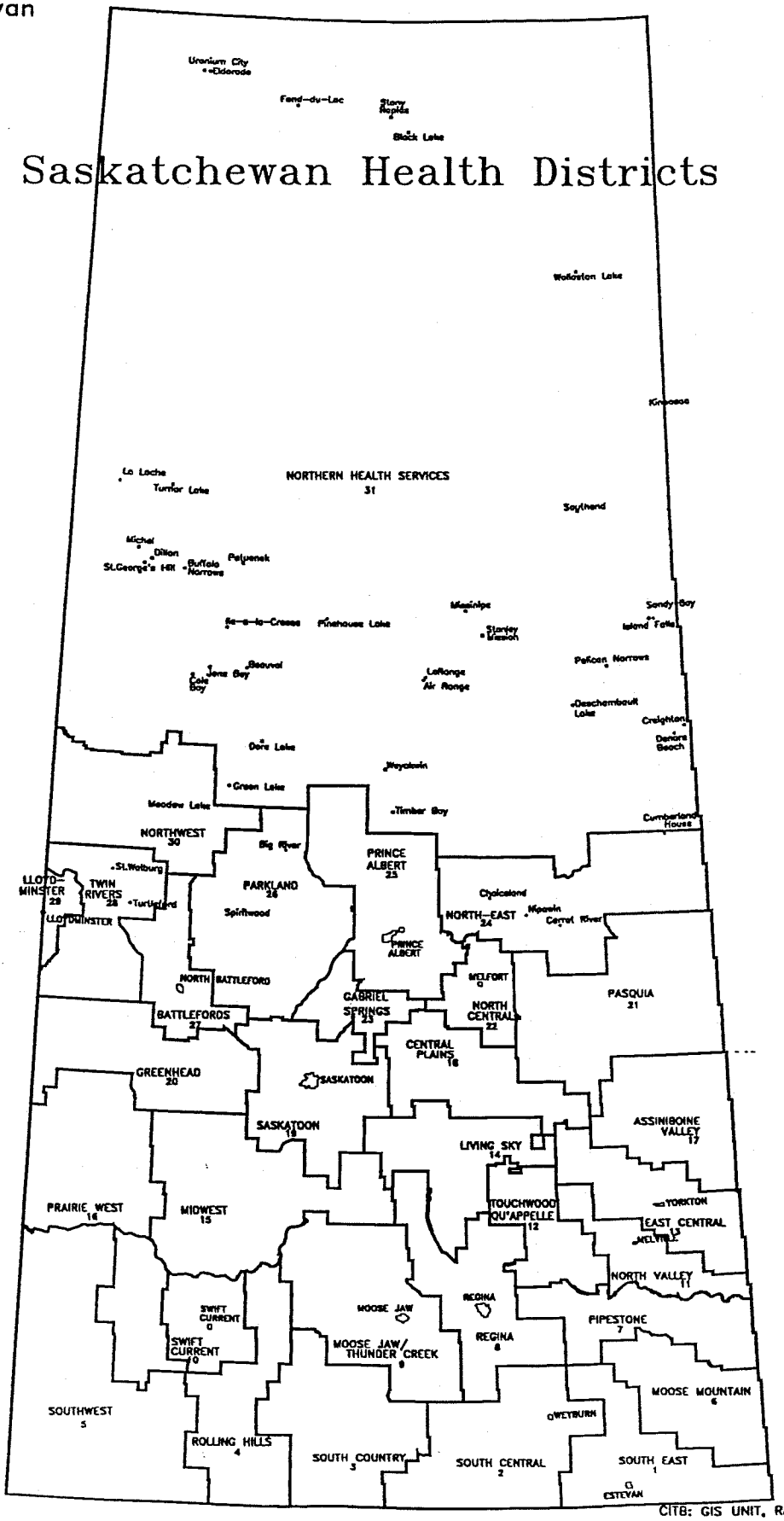
Appendix A - Map of Saskatchewan

Saskatchewan Health



Appendix B - Assignment of Residence Codes to Study Groups

Table B-1 Residence Codes For Northern Saskatchewan Registered Indian Bands (Group A)

Registered Indian Band	**Residence Code**
Buffalo River Band	74780
Canoe Lake Band	74680
Clearwater River Dene Nation	74880
Cumberland House Band	72582
English River Band	75180
Fond Du Lac Band	75082
Hatchet Lake Band	72882
Lac La Ronge Band	72482
Peter Ballantyne Band	72082
Stony Rapids Band	74982
Turnor Lake Band	74580
William Charles Band	72682

Appendix B (continued)

Table B-2 Residence Codes for Northern Saskatchewan Towns, Villages and Municipalities (Group B)

Northern Communities	**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	80530
Fond du Lac	80172
Ile a la Crosse	80374
La Loche	80272
Garson Lake	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

Appendix B (continued)

Southern Saskatchewan Registered Indian Bands (Group C)

The residence codes for southern Saskatchewan Registered Indian Bands were all the remaining residence codes for Saskatchewan Registered Indian Bands after the northern Bands had been selected. Registered Indian Bands are identified in the data by a number in the 70,000's.

Southern Rural Other Than Registered Indian Residents (Group X)

The residence codes for southern rural other than registered Indian residents were all the remaining residence codes after all of the other groups had been selected. [South rural = Total - (A+B+C+Y).]

Table B-3 Residence Codes for Southern Urban Communities (Group Y)

Southern Urban Communities	**Residence Code**
Estevan	00528
Humboldt	37030
Kindersley	29030
Lloydminster	50229
Melfort	42820
Melville	21421
Moose Jaw	16120
Nipawin	48730
North Battleford	43721
Prince Albert	46122
Regina	15923
Saskatoon	34424
Swift Current	13725
Weyburn	06726
Yorkton	24427

Appendix C - Women of Reproductive Age

Table C-1 Number and Percent of Women of Reproductive Age, By Study Group and 5-Year Age Group, June 30, 1992

Study Group		Age Group 15-19	20-24	25-29	30-34	35-39	40-44	TOTAL
Northern RI	n	908	883	743	663	447	381	4025
	%	22.6	21.9	18.5	16.5	11.1	9.5	100.0
North Other	n	668	628	710	635	507	360	3508
	%	19.0	17.9	20.2	18.1	14.5	10.3	100.0
Southern RI	n	2585	2572	2403	1956	1468	1037	12021
	%	21.5	21.4	20.0	16.3	12.2	8.6	100.0
South Rural	n	15239	10226	11033	14016	14743	12438	77695
	%	19.6	13.2	14.2	18.0	19.0	16.0	100.0
South Urban	n	17736	20294	23396	24441	21947	17621	125435
	%	14.1	16.2	18.7	19.5	17.5	14.0	100.0
Province	n	37136	34603	38285	41711	39112	31837	222684
	%	16.7	15.5	17.2	18.7	17.6	14.3	100.0

Percents are of row totals.
RI = Registered Indian women; Other = Other than registered Indian women

Appendix D- Hospital Separation Record Data

1. Encryptic Health Services Number:
2. Study Group:

Code	Description*
11	Registered Indian living in northern Saskatchewan (Group A)
12	Registered Indian living in southern Saskatchewan(Group C)
13	Northern Saskatchewan resident who is not a Registered Indian (Group B)
20	Rural southern Saskatchewan resident who is not a registered Indian (Group X)
30	Urban southern Saskatchewan resident who is not a registered Indian (Group Y)

3. Date of Birth: YYYYmm
4. Age group at hospital separation: (21 categories)
   - under 1, 1-4, 5-9, 10-14,... 90-94, 95+
5. Sex: 1. Male 2. Female
6. Sask Health Code for Place of Residence:
7. Postal Code for address of patient:
8. Sask Health Code for Hospital:
9. Sask Health Code for Location of Hospital (prov/country)
10. Date of Hospital Admission: yymmdd
11. Date of Discharge, Transfer, or Death: yymmdd
12. Number of Days in Hospital:
13. Diagnosis: ICD-9 code for primary, secondary and tertiary diagnosis (Nature)
14. Diagnosis: ICD-9 code for external cause
15. Diagnosis: ICD-9 code for supplementary classification (V-code)

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* The southern boundary of the area covered by Northern Health Services Branch forms the "border" between northern and southern Saskatchewan in this study.

16. Diagnosis: Canadian List Number for primary, secondary and tertiary diagnoses.

17. Procedural code (CCP): primary, secondary, and tertiary

18. Hospitalization Outcome:
    1. Medical
    2. Without medical authorization
    3. Death with autopsy
    4. Death without autopsy
    5. Transferred to another hospital
    6. Transferred to a geriatric centre
    7. Transferred to a nursing home
    9. Other

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

Appendix E - Operational definition of pregnancy end

Table E-1 ICD-9 Codes and CCP Codes Used to Select Episodes of Care With a Pregnancy End, 1992/93

ICD-9 Code	Delivery Outcome
650	Delivery in a completely normal case
656.4	Intrauterine death
658.2-.3	delayed delivery after art/spont rupture of membranes
660.1-.9	obstructed labour
661.3	Precipitate labour
663-.9	Umbilical cord complications
664.0-.9	Trauma to perineum and vulva during delivery
665.0-.1	Other obstetric trauma
666.0,666.1	Third stage & other immediate pp hemorrhage
669.5,669.7	forceps delivery, C/S; no mention of indication
V24.0	Postpartum care, immed. after delivery, uncomplic cases
V24.2	Routine postpartum follow-up
V27.0	single live birth
V27.1	single still birth
CCP	**Delivery Outcome**
84.0-84.99	Instrument-assisted delivery
85.01,85.09	Artificial rupture of membranes at delivery
85.61-85.69	Manually assisted delivery
85.7	Episiotomy
85.91-85.99	Other operations assisting delivery
86.0,86.1	Classical, cervical Cesarean section
86.8,86.9	vaginal and unspecified cesarean section
87.6	Removal of retained placenta
87.71-87.73	Repair of obstetric laceration of uterus, cervix, corpus uteri
87.81-87.89	Repair of other obstetric lacerations
87.91-87.99	Other obstetric operations
87.98	Delivery NEC, NOS, unassisted spontaneous delivery
ICD-9	**Abortive Outcome**
630	Hydatidiform mole
631	Other abnormal product of conception
632	Missed abortion
633.0-633.9	Ectopic pregnancy
634	Spontaneous abortion
635	Legally induced abortion
637	Unspecified abortion

Appendix F - Pelvic Inflammatory Disease

Table F-1 Rate of pelvic inflammatory disease (ICD91-3 = 614.0-614.9) per 1,000 women, By study group and age group, 1992/93

Female population for reproductive age groups

age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	908	883	743	663	828	4025
North Other	668	628	710	635	867	3508
South RI	2585	2572	2403	1956	2505	12021
South Rural	15239	10226	11033	14016	27181	77695
South Urban	17736	20294	23396	24441	39568	125435
Total	37136	34603	38285	41711	70949	222684

Number of Separations with PID†

age group	15-19	20-24	25-29	30-34	35-44	Total
North RI	8	9	7	7	11	42
North Other	6	7	9	12	5	39
South RI	31	38	33	28	36	166
South Rural *	30	50	40	70	120	310
South Urban *	50	140	130	130	140	590
Total	125	244	219	247	312	1147

Rate of PID per 1,000 women, By study group and age group, 1992/93

age group	15-19	20-24	25-29	30-34	35-44	Age-std. rate
North RI	8.8	10.2	9.4	10.6	13.3	10.9
North Other	9.0	11.1	12.7	18.9	5.8	10.8
South RI	12.0	14.8	13.7	14.3	14.4	13.9
South Rural	2.0	4.9	3.6	5.0	4.4	4.1
South Urban	2.8	6.9	5.6	5.3	3.5	4.6
Total	3.4	7.1	5.7	5.9	4.4	5.2

RI = Registered Indian women
Other = Other than registered Indian women
†Figures were obtained from 1992/93 Saskatchewan hospitalization data.
* Numbers have been multiplied by 10 to adjust for sampling.