

# Cree Diabetes Information System (CDIS) 2009 Annual Report

Prepared by:

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# **Cree Diabetes Information System (CDIS) 2009 Annual Report**

**Public Health Department**

Public Health Report Series 3 on Diabetes  
**Cree Board of Health and Social Services of James Bay**

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The cover picture of Conrad Mianscum and Devine Loon, of Mistissini, is an example of the Maamuu Nakaahehtaa ("Together, let's prevent it") Campaign happening in Eeyou Istchee.

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# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY: CDIS 2009 ANNUAL UPDATE</b> .....	<b>1</b>
<b>FOREWORD TO THE PUBLIC HEALTH REPORT SERIES</b> .....	<b>1</b>
<b>FOREWORD TO THE ANNUAL DIABETES REPORT</b> .....	<b>2</b>
<b>INTRODUCTION</b> .....	<b>3</b>
<b>THE CREE DIABETES INFORMATION SYSTEM</b> .....	<b>4</b>
GOALS OF THE CDIS .....	4
DATA COLLECTION AND QUALITY ASSURANCE .....	4
<b>METHODS</b> .....	<b>6</b>
DATA SOURCES AND DEFINITIONS .....	6
STATISTICAL MEASURES .....	6
<b>PREVALENCE OF DIAGNOSED DIABETES</b> .....	<b>7</b>
OVERVIEW .....	7
PREVALENCE BY SEX .....	8
PREVALENCE BY AGE .....	9
PREVALENCE BY GEOGRAPHIC AREA.....	11
<b>INCIDENCE OF DIABETES</b> .....	<b>14</b>
OVERVIEW .....	14
INCIDENCE BY SEX.....	16
INCIDENCE BY AGE .....	17
INCIDENCE BY GEOGRAPHIC AREA.....	18
<b>DURATION OF DIABETES</b> .....	<b>19</b>
<b>DISCUSSION AND CONCLUSION</b> .....	<b>20</b>
<b>REFERENCES</b> .....	<b>22</b>

## INDEX OF TABLES

TABLE SUMMARY-1: NUMBER OF EYOUCH WITH DIABETES, BY COMMUNITY AND SEX, ADULTS AGE 20 AND OVER, DECEMBER 31 <sup>ST</sup> , 2009 .....	ii
TABLE 1: PREVALENCE OF DIABETES IN ADULTS 20 AND OVER: CREE POPULATION COMPARED TO QUEBEC EYYOU ISTCHEE (DECEMBER 31 <sup>ST</sup> , 2009) AND QUEBEC (2006-2007) .....	7
TABLE 2: CRUDE DIABETES PREVALENCE (%), CREE POPULATION 20 YEARS AND OVER, BY SEX, AGE GROUP AND TERRITORY, EYYOU ISTCHEE, DECEMBER 31, 2009 .....	9
TABLE 3: NUMBER OF PEOPLE WITH DIAGNOSED DIABETES BY REGION, SEX AND AGE GROUP, CREE POPULATION OF EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009.....	10
TABLE 4: NUMBER OF PEOPLE WITH DIABETES AND CRUDE PREVALENCE BY COMMUNITY AND SEX, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009.....	12
TABLE 5: CUMULATIVE INCIDENCE OF DIABETES, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, FROM 1998-2000 TO 2007-2009 .....	14
TABLE 6: TOTAL NUMBER OF NEW CASES OF DIABETES PER THREE-YEAR PERIOD, BY SEX, AGE GROUP AND REGION, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE 1998-2000 TO 2007-2009 .....	15
TABLE 7: CUMULATIVE DIABETES INCIDENCE RATE (PER 1,000) OVER TIME, BY SEX, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, 1998-2000 TO 2007-2009 .....	16
TABLE 8: CUMULATIVE DIABETES INCIDENCE RATES (PER 1,000 POPULATION) OVER TIME, BY SEX AND AGE GROUP, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, 1998-2000 TO 2007-2009 .....	17
TABLE 9: CUMULATIVE DIABETES INCIDENCE RATES (PER 1,000 POPULATION) OVER TIME, BY REGION AND SEX, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, 1998-2000 TO 2007-2009 .....	18
TABLE 10: AGE AT DIAGNOSIS OF DIABETES, CREE POPULATION, EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009 .....	19
TABLE 11: DURATION OF DIABETES, CREE POPULATION, EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009 .....	19

## INDEX OF FIGURES

FIGURE SUMMARY-1: DIABETES PREVALENCE (%) BY REGION AND COMMUNITY, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009 .....	ii
FIGURE SUMMARY-2: DIABETES RATES 1983 TO 2009 CRUDE PREVALENCE IN EYOUCH AGE 20 AND OVER (%) .....	iii
FIGURE 1: CRUDE DIABETES PREVALENCE RATE (%), CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, 1983 TO 2009 .....	8
FIGURE 2: CRUDE PREVALENCE RATES OF DIABETES, BY SEX, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009 .....	
FIGURE 3: AGE- AND SEX-SPECIFIC DIABETES PREVALENCE RATES, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009 .....	10
FIGURE 4: AGE DISTRIBUTION OF CREE ADULTS WITH DIAGNOSED DIABETES, BY REGION, DECEMBER 31, 2009.....	11
FIGURE 5: DIABETES PREVALENCE (%) BY REGION AND COMMUNITY, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009 .....	12
FIGURE 6: DIABETES PREVALENCE BY COMMUNITY AND LATITUDE, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, DECEMBER 31 <sup>ST</sup> , 2009 .....	13
FIGURE 7: CUMULATIVE INCIDENCE RATE OF DIABETES OVER TIME, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE (PER 1,000).....	14
FIGURE 8: SEX DISTRIBUTION (%) OF NEW CASES OF DIABETES, CREE POPULATION AGE 20 AND OVER, EYYOU ISTCHEE, 1998-2000 TO 2007-2009 .....	16

## EXECUTIVE SUMMARY: CDIS 2009 ANNUAL UPDATE

The 2010 Maamuu Nakaahetaau (“Together, let’s prevent it”) campaign in Eeyou Istchee seeks to bring everyone together to prevent diabetes and obesity, and to make our communities safer and healthier. It emphasizes that all groups—political leaders, teachers, restaurant owners, religious leaders, parents, healers, health care workers and individual community members—should work towards these goals. This update shows the numbers that inspired the campaign.

More than one Cree adult in five now has diabetes.

### High diabetes rates, especially in women

As of the end of 2009, a total of 1,910 Cree, 1,898 of them adults (age 20 and over) had been diagnosed with diabetes in Eeyou Istchee. More than one Cree adult in five now has diabetes (21.4%). This is almost four times the diabetes rate in the general population of Québec.

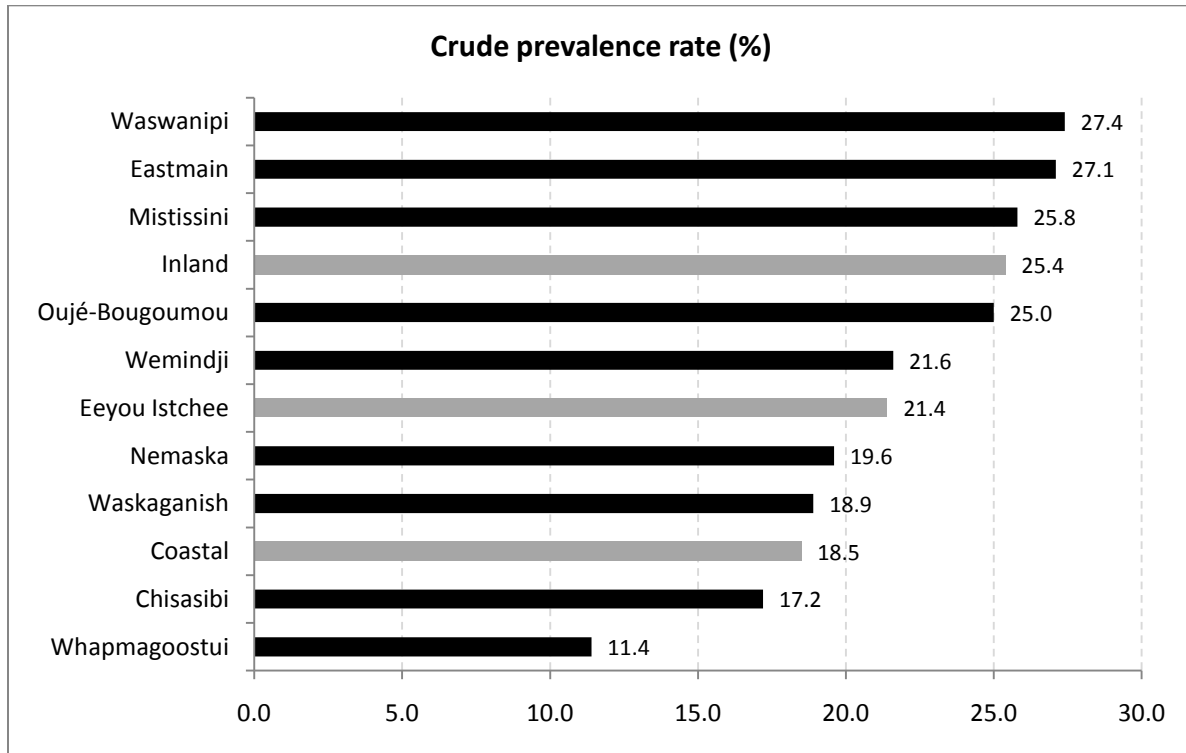
Diabetes continues to affect more Cree women than men (25.2% vs 17.5%). The higher rates in women may be due to one or a combination of several factors. As a group, Cree women are more likely than men to: be obese; become overweight at a younger age; and be less physically active. Cree women tend to gain excessive weight during pregnancy and have high rates of gestational diabetes which puts them at risk of developing Type 2 diabetes in later years. The high rate of diabetes in Cree women—especially those who are still in their childbearing years—is alarming. Babies born to women who have diabetes during pregnancy (either gestational diabetes or Type 2 diabetes) are at much higher risk of becoming obese during childhood and developing diabetes at a young age.

The high diabetes rates in women are alarming.

### Variations in diabetes rates across Eeyou Istchee

Diabetes rates vary between the communities (Figure 1 and Table 1). As in previous years, the figures for 2009 generally show higher rates for the inland communities than for the coastal ones: 25.4% vs. 18.5%.

Figure Summary-1: Diabetes prevalence (%) by region and community, Cree population age 20 and over, Eeyou Istchee, December 31<sup>st</sup>, 2009



Sources: - CDIS, September 28, 2010 extraction.  
 - MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup>, 2009.

Table Summary-1: Number of Eeyouch with diabetes, by community and sex Adults age 20 and over, December 31<sup>st</sup>, 2009

Community	Females	Males	Total
Chisasibi	246	159	405
Eastmain	62	44	106
Mistissini	287	211	498
Nemaska	45	36	81
Oujé-Bougoumou	60	40	100
Waskaganish	142	81	223
Waswanipi	143	110	253
Wemindji	108	71	179
Whapmagoostui	34	19	53
<b>Eeyou Istchee</b>	<b>1,127</b>	<b>771</b>	<b>1,898</b>

Sources: CDIS, September 28, 2010 extraction; population data from MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup>, 2009.

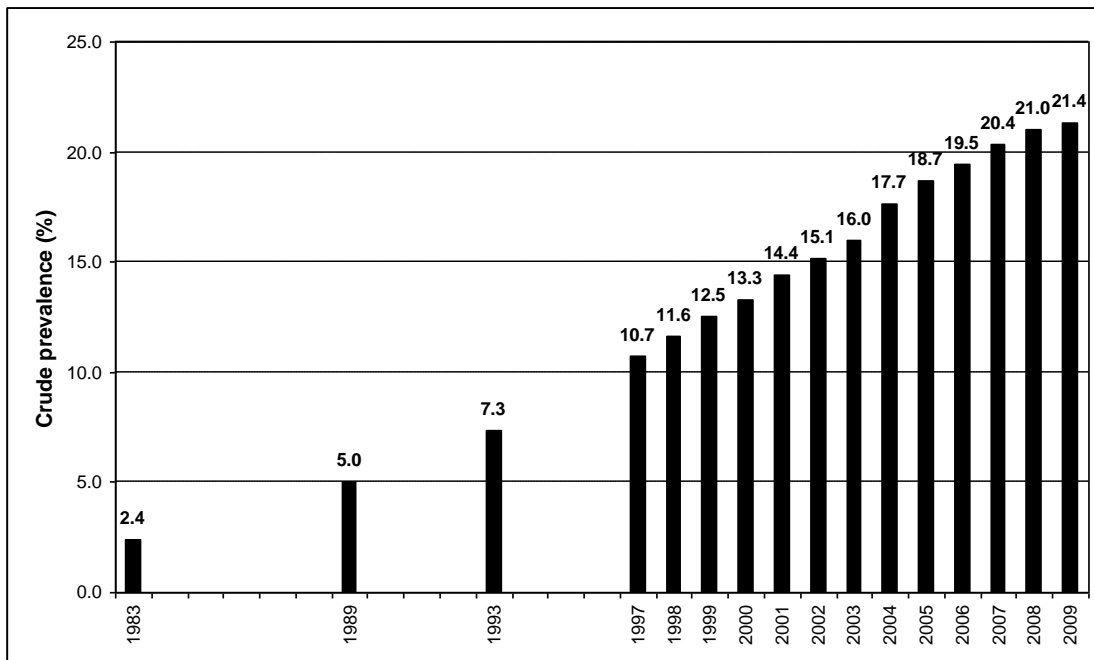
### Rising diabetes rates over time

The number of people with diabetes in Eeyou Istchee continues to rise. In 1983, 2.4% of Eeyouch had diabetes. This has increased to 21.4% in 2009 (Figure 2). In the past 3 years (2007-2009), 339 Cree adults were newly diagnosed with diabetes.

Diabetes rates continue to rise.

Figure Summary-2: Diabetes rates 1983 to 2009

Crude prevalence in Eeyouch age 20 and over (%)



### Younger ages at diagnosis

Cree people are being diagnosed with diabetes at a younger age. In 1989, the average age at diagnosis was 48 years; in 2009, it was 41 years. This is approximately 20 years younger than the age people get diagnosed with diabetes in the rest of Quebec. Almost half the Eeyouch who are now living with diabetes (46.8%) were diagnosed before they reached age 40. In the rest of Quebec it is very rare for people to be diagnosed with diabetes before the age of 40. Since diabetes is a lifelong condition, those who have it need to take care of their health to prevent complications and live a long, healthy life. If young people do not control their diabetes, they are likely to develop complications at an early age. This poses a serious threat to health in Eeyou Istchee.

A younger age of onset, and lots of new cases, mean that many more people could develop diabetic complications in the coming years.



Lastly, diabetes is a relatively new disease in the region. More than half the Eeyouch with diabetes (61.0%) have been diagnosed in the past 10 years and many of them are relatively young. Since the risk of complications increases the longer someone has diabetes, many of these people will become at higher risk as they continue living with their diabetes. This has important implications for health services in the region.

### **A call to action**

It is urgent to focus on obesity and lack of physical activity.

Taken together, these statistics show the importance of mobilizing the communities to halt or slow down the diabetes epidemic. It is urgent to focus on the things that can be changed, including obesity and lack of physical activity. It is especially important to reach children, teenagers, and women of childbearing age.

### **Mobilizing the region through the Maamuu Nakaahetaau campaign**

On August 11, 2010 the General Assembly of the Grand Council/CRA passed Resolution 13, endorsing the Maamuu Nakaahetaau\* approach. When communities are ready and request support, the Public Health Department of the Cree Health Board will help to organize summits in every community to kick-start the implementation of healthy public policies. These will be positive, action-oriented meetings that will identify things that are working well and build on them. With the leadership of Chief and Council, this campaign began in Eastmain in November, 2010. It will continue in other communities.

Health summits will kick-start development of healthy public policies.

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\* Updates on the Maamuu Nakaahetaau campaign will be posted at [www.creehealth.org](http://www.creehealth.org)

## FOREWORD TO THE PUBLIC HEALTH REPORT SERIES

The Public Health Report Series includes reports prepared by the Department of Public Health of the Cree Territory of James Bay on major activities of the Department. At the present time, the series includes the following:

- Series 1: annual reports of the Public Health Department (from 2002)
- Series 2: reports on immunizations and/or notifiable diseases (periodic)
- Series 3: annual diabetes updates (from 1996) and annual diabetes reports (from 2004 most years)
- Series 4: reports on the health status of the population (periodic)

The Series 3: Annual Diabetes Reports are dedicated to the memory of all of our late friends and colleagues who tried through their work and example to make a difference in the lives of Eeyouch living with diabetes, and especially the late Mavis Véronneau , the late Sam Awashish, the late Alan Neacappo and the late René Coon.

## FOREWORD TO THE ANNUAL DIABETES REPORT

As Director of Public Health (interim) for Eeyou Istchee, I am pleased to be presenting the 2009 report on diabetes in the territory. Monitoring and reporting on the health status of the population is a primary mandate of Public Health and, since 1997, the Public Health Department has been documenting the rise of diabetes. This information becomes important to the extent that it feeds into other actions with the potential to improve the health status of the population.

Reporting on diabetes supports the reorganization happening within health and social services in Cree Istchee. Introducing a 'primary care' model for services puts the 'patient' – who may be an individual, a family, and a community – at the centre of the services. Health care workers will work in teams organized according to the needs of the 'patient'. Specific services will integrate their work with others in order to follow the patient until the problem is resolved or the risk that justified follow-up has disappeared.

In a primary care model, services are developed and organized according to the needs of the population. The Cree Board of Health and Social Services is responsible for providing services to the population in each community according to the age profile and health status of the population. This report on the state of diabetes – which is the primary health problem in the region – provides essential information underlying that planning for local services.

According to the World Health Organization Report (2008), a dynamic primary care organization of services “forces the team to take targeted initiatives, in collaboration with other sectors, to reach the excluded and the unreached and tackle broader determinants of ill-health”.

While this emphasizes preventive practices in clinical services, it also puts a focus on prevention in the community, setting the stage for a community investment in diabetes prevention and health promotion activities, and for venturing into areas that are often overlooked, such as healthy public policies, health in schools and in the workplace. The Maamuu Nakaahetaau campaign aims at combining the efforts of all the entities in the region to prevent diabetes in children, in youth and in adults, to better support diabetic patients in the management of their disease and to prevent serious consequences or complications.

Our public health mandate from the *Public Health Act* of Québec gives us the responsibility to promote health, prevent disease, protect from illness and report on the state of health of the population. This 2009 *Annual Diabetes Report* underlines the importance of the Maamuu Nakaahetaau (“Together, let’s prevent it”) diabetes campaign to promote health-related public policies and actions throughout the region.

**Richard Lessard**

Director of Public Health (interim)

Public Health Department of the Cree Territory of James Bay

## INTRODUCTION

This report is based on data from the Cree Diabetes Information System (CDIS). The CDIS system provides clinical and demographic data, and supports two main goals: to improve management of diabetes at the clinical level, and to produce surveillance data that can be used to raise awareness of the magnitude of the problem and to stimulate action. The present report contributes to this second goal, and is intended to support the *Maamuu Nakaahettaau* campaign. Its objective is to describe the size of the diabetes problem in Eeyou Istchee, the groups at greatest risk, and the trends — both in terms of the number of new people developing diabetes, and the number of people living with it.

The presentation of data is divided into three main parts. The first looks at the prevalence of diabetes in Eeyou Istchee. It describes the magnitude of the problem, trends over time, and the demographic characteristics of the people living with diabetes: sex, age group, and community/region. The second part focuses on diabetes incidence, again looking at rates, trends, and distribution by sex, age, and community/region. The third part examines the data related to duration of diabetes, and its implications for rates of diabetic complications in future. The Discussion section at the end of the report summarizes the findings and considers some of the implications for diabetes prevention and management programs in Eeyou Istchee.

## THE CREE DIABETES INFORMATION SYSTEM

### Goals of the CDIS

The Cree Diabetes Information System (CDIS) was created in 1996, at the request of the Cree authorities, to respond to the growing problem of diabetes in Eeyou Istchee. Over the past 14 years, the system has continually evolved to address the changing needs of the communities and of health care workers.

The primary goal of the CDIS is to improve the clinical management of diabetes. It does this in part by promoting the use of standardized Diabetes Flow Sheets in medical charts. These Flow Sheets are a clinical, educational and quality assurance tool. They are particularly helpful in assisting staff to identify and manage patients at high risk of diabetes-related complications. In addition, the CDIS functions as a management tool, allowing clinic managers to obtain statistics for their particular clientele.

The secondary goal of the CDIS is to provide surveillance data to the communities and regional authorities, in order to increase awareness of the magnitude of this health problem and to stimulate action. This is part of the Public Health Department's broader mandate to monitor and report on the health of the population.

### Data collection and quality assurance

The CDIS identifies clients through their unique RAMQ healthcare number, and provides both clinical and demographic data.

*Diabetes Registration Forms* are the key first step in the CDIS data collection. These registration forms contain information about new cases of diabetes, changes in diagnosis or deaths. They are filled out in the local clinics and faxed to the Public Health Department office in Montreal. In Montreal, the information is entered into the system on a regular basis by a data-entry person. To ensure data quality, a validation process is in place: CDIS coordinators ensure ongoing training and supervision of the data-entry person, conduct regular data-quality audits, and maintain ongoing contact with the clinics in order to complete or clarify the original information where necessary.

Laboratory data are also added to the system. Beginning in 2007, an automated data-merge system has allowed lab data for the coastal communities to be updated on a regular basis. For the inland communities, periodic data merges have been carried out, most recently in December 2009.

Since the validity of the CDIS data (other than lab information) depends mainly on how well the clinics record this information on the *Diabetes Registration Forms* and *Diabetes Flow Sheets*, a regular data validation is necessary. Thus, in 2009, the CDIS Data Validation Project was conducted to validate RAMQ numbers; identify all patients with diabetes who were not registered on the CDIS (missing cases); update the list of deceased patients; and fill in missing or incomplete information on James Bay Cree band numbers and clinical measures of height, weight, and blood pressure.<sup>1</sup>

## METHODS

### Data sources and definitions

The data in this report include Cree patients (with valid James Bay Cree band numbers) age 20 and over living in Eeyou Istchee and diagnosed with type 1 or type 2 diabetes prior to December 31<sup>st</sup>, 2009.

Differentiating between type 1 and type 2 diabetes can be difficult; for the purposes of this report, all cases were considered as type 2 although a few of the individuals may have type 1 diabetes.

Incidence and prevalence rates were based on estimates of the population as of December 31<sup>st</sup> of each year, drawn from the MHSS James Bay & Northern Quebec Agreement beneficiary list. \* This differs from previous CDIS reports, which used population as of July 1<sup>st</sup> of each year. Age was also calculated using December 31<sup>st</sup> as a reference.

### Statistical measures

#### *Cumulative incidence*

This report uses cumulative incidence rates. Cumulative incidence measures risk during a specified time period in an unchanging cohort of people *as a proportion of those who were at risk throughout the entire period.*<sup>†</sup> To control for high year-to-year variability, incidence rates have been calculated for three-year periods (1998-2000, 2001-2003, 2004-2006, and 2007-2009). During each of these periods, all of the individuals aged 20+ in the population were considered at risk if they had not already been diagnosed with diabetes. The incidence rates in this document are all presented on the basis of 1,000 persons.

#### *Significance tests*

Tests for statistically significant differences were based on the 95% confidence interval around each rate. When the confidence intervals for two rates do not overlap, we can conclude with 95% confidence that the difference between the two is statistically significant.

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\* The List is the product of the registry which implements subsection 3.5: "Registration of Beneficiaries", of the James Bay & Northern Quebec Agreement (1975).

<sup>†</sup> For example, suppose 1,000 people are followed for one year. At the start of the year, 50 already have an infection; at the end, there are 50 new cases of the infection in the 900 people who were continuously at risk since the start. The one-year cumulative incidence rate is  $50/900 = 56$  per thousand. (Example from Paul-Marie Bernard and Claude Lapointe (2000), *Mesures Statistiques en Épidémiologie*. Presses de l'Université du Québec.)

## PREVALENCE OF DIAGNOSED DIABETES

### Overview

A total of 1,910 Cree, 1,898 of them adults (age 20 and over), in Eeyou Istchee had been diagnosed with diabetes as of December 31, 2009. This gives a crude prevalence rate in Cree adults of 21.4% — meaning that more than one adult in five in the region has now been diagnosed with diabetes.

Since the Cree and Quebec populations have quite different age structures, comparisons between the two must be based on age-standardized rates. Accordingly, the Cree data were age-standardized to the 2006 population of Quebec, using the direct method. As shown in Table 1, the age-standardized prevalence of diabetes in Cree adults is 29.0%. This is almost four times the comparable rate for Quebec, which was 7.6% in 2006-07<sup>2</sup> (the year to which the data were standardized).

The proportion of Cree adults (20 years and older) living with diagnosed diabetes has increased from 2.4% in 1983 to 21.4% in 2009 (Figure 1). Between 1998 and 2009, the prevalence of diabetes increased by 0.9% each year, on average.

Table 1: Prevalence of diabetes in adults 20 and over: Cree population compared to Quebec Eeyou Istchee (December 31<sup>st</sup>, 2009) and Quebec (2006-2007)

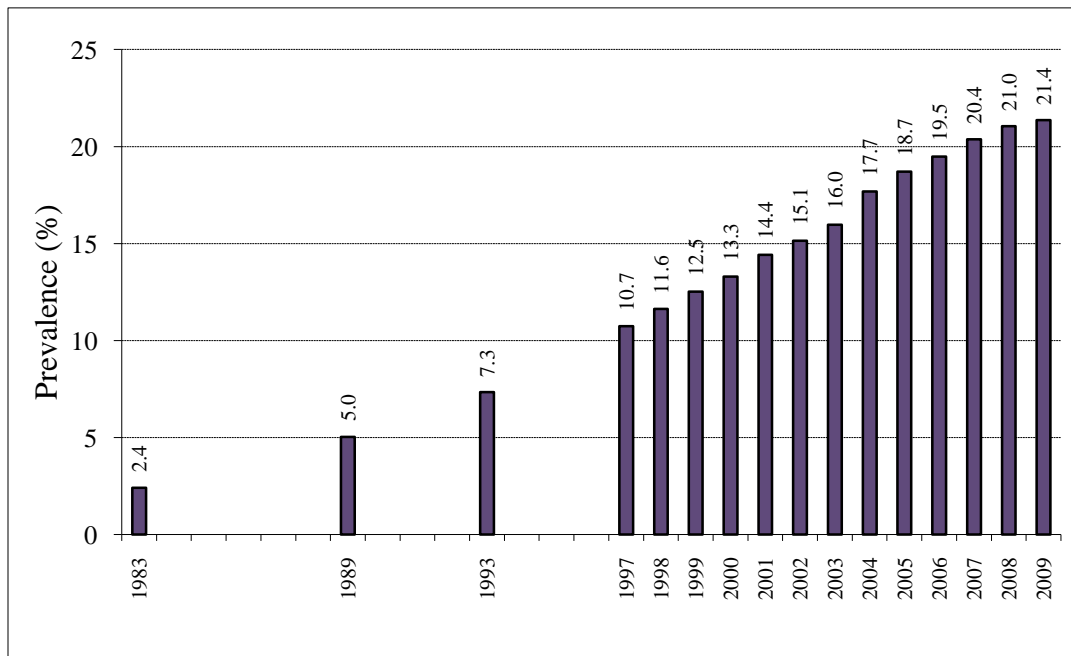
	F	M	T
Age-standardized prevalence, Eeyou Istchee 2009	33.7%	24.2%	29.0%
Crude prevalence, Quebec, 2006-2007	7.0%	8.1%	7.6%

Note: the region prevalence is adjusted using the same population used to produce Quebec's 2006-2007 crude prevalence.

Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, July 1<sup>st</sup>, 2009; MHSS, [http://www.msss.gouv.qc.ca/sujets/prob\\_sante/diabete/index.php?Etat-de-situation](http://www.msss.gouv.qc.ca/sujets/prob_sante/diabete/index.php?Etat-de-situation); Institut de la statistique du Québec, December 2009, based on Statistics Canada 2006 Census; Lejeune P, Torrie J. March, 2010. The current and projected Cree population: Public Health Department Analysis Paper. Cree Board of Health and Social Services of James Bay, Chisasibi, Québec.



Figure 1: Crude diabetes prevalence rate (%), Cree population age 20 and over, Eeyou Istchee, 1983 to 2009



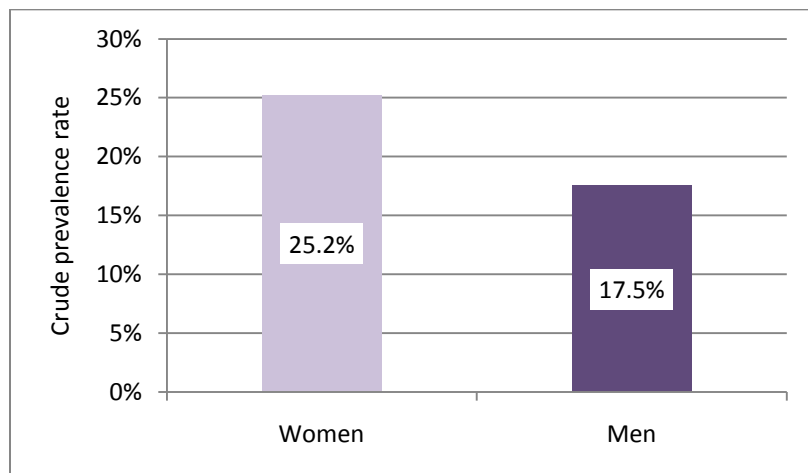
Note: The prevalence rates for the years 1983, 1989 and 1993 have been adjusted to include only those aged 20 or more. The rates for the years 1997 to 2009 are based on the data available in the CDIS database as of September 28, 2010. The rates for the years 1997-2007 were recalculated using calendar years as a reference year and 2009 CDIS validated data. Thus, the presented rates may differ from the rates reported in the previous reports.

Sources: - 1983 data from Thouez et al. (1990); 1989 data from Brassard et al. (1993); 1993 data from Véronneau and Robinson (1993); 1997 to 2009 data from the CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup> population estimates; Lejeune P, Torrie J. March, 2010. The current and projected Cree population: Public Health Department Analysis Paper. Cree Board of Health and Social Services of James Bay, Chisasibi, Québec.

### Prevalence by sex

As shown in Figure 2, diabetes continues to affect more women than men in the Cree population (25.2% vs. 17.5%, respectively, among adults 20 and over). The difference is statistically significant and corresponds to a rate ratio of 1.4, indicating that Cree women have a diabetes prevalence rate 40% higher than that of men. This sex pattern is seen in many other Aboriginal populations, but not in the general Canadian population where diabetes is more prevalent among men.<sup>3,4</sup> In Québec, the female-to-male diabetes ratio in 2006-07 was 0.9, reflecting a prevalence rate of 7.0% among adult women and 8.1% among men.<sup>2</sup>

Figure 2: Crude prevalence rates of diabetes, by sex, Cree population age 20 and over, Eeyou Istchee, December 31<sup>st</sup>, 2009



Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup>, 2009 population estimates.

### Prevalence by age

Diabetes prevalence varies greatly by age, from 3.9% in people age 20-29, up to 53.7% in those aged 60-69. For both men and women, the pattern is the same: rapid and progressive increases in prevalence with each age group, up to age 70. After age 70, the prevalence rate is lower; this may be partly due to diabetes-related mortality in this age group (Table 2 and Figure 3).

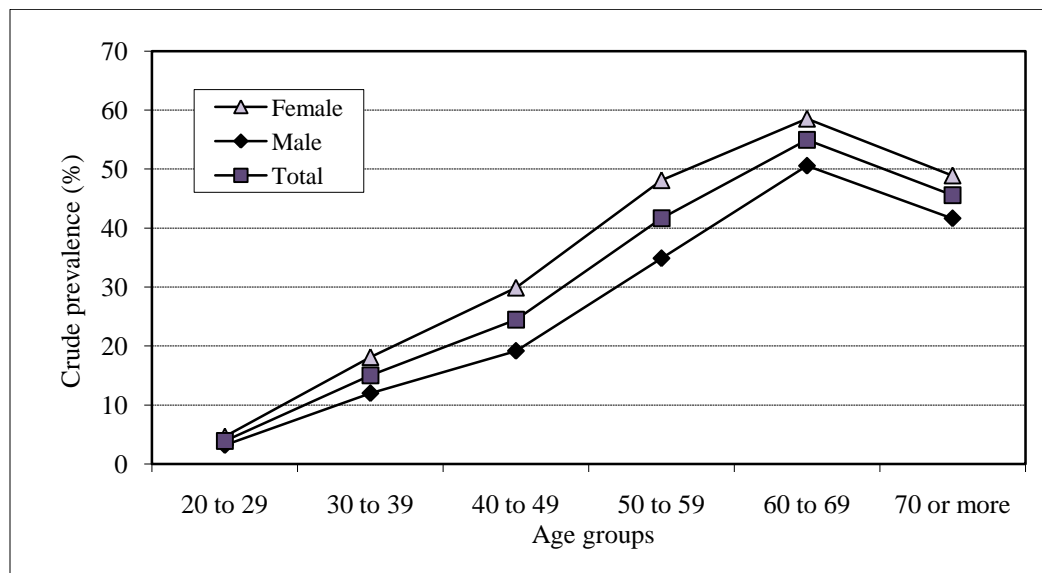
The average age of a Cree adult living with diabetes was 51.2 years. Almost one in four (24.7%) Cree persons living with diabetes was under 40 years of age (Table 3 and Figure 4).

Table 2: Crude diabetes prevalence (%), Cree population 20 years and over, by sex, age group and territory, Eeyou Istchee, December 31, 2009

Age group	Coastal			Inland			Eeyou Istchee		
	F	M	T	F	M	T	F	M	T
20-29	3.9	2.5	3.2	5.7	4.1	4.9	4.6	3.2	3.9
30-39	14.9	10.1	12.5	22.3	14.3	18.3	18.0	11.9	15.0
40-49	26.0	13.1	19.6	33.6	27.2	30.3	29.1	18.9	24.0
50-59	42.0	29.2	35.8	53.6	40.6	47.2	46.7	33.9	40.5
60-69	51.7	42.2	47.4	68.6	58.6	64.1	58.2	48.4	53.7
70+	45.0	34.0	39.7	51.0	52.5	51.7	47.6	41.0	44.6
Total	22.4	14.5	18.5	29.0	21.7	25.4	25.2	17.5	21.4

Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup>, 2009 population estimates.

Figure 3: Age- and sex-specific diabetes prevalence rates, Cree population age 20 and over, Eeyou Istchee, December 31st, 2009



Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup>, 2009 population estimates.

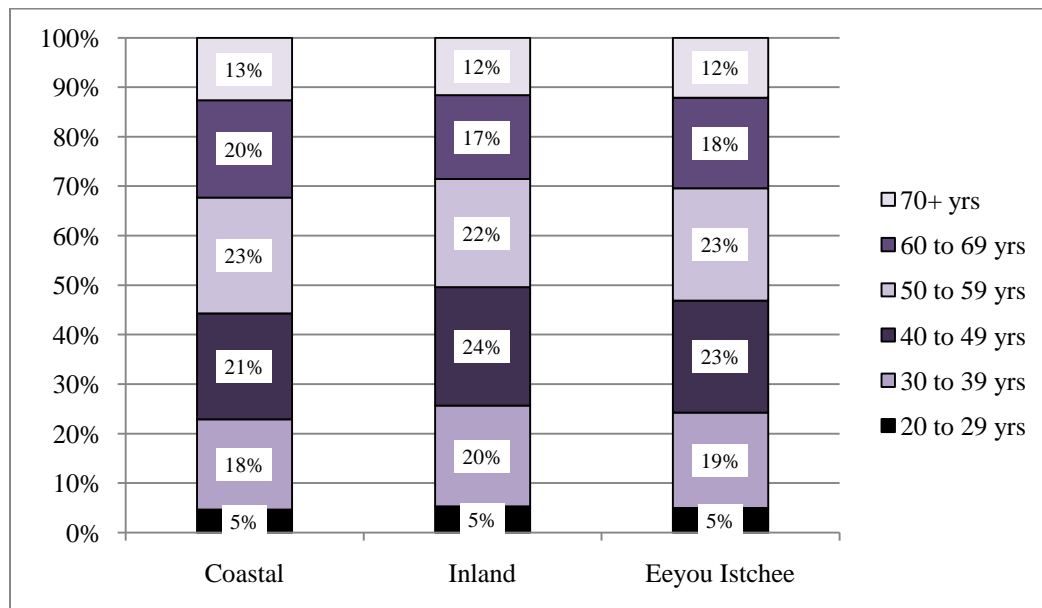
Table 3: Number of people with diagnosed diabetes by region, sex and age group, Cree population of Eeyou Istchee, December 31<sup>st</sup>, 2009

Age group	Coastal			Inland			Eeyou Istchee		
	F	M	T	F	M	T	F	M	T
20 to 29	27	18	45	28	21	49	55	39	94
30 to 39	105	71	176	114	76	190	219	147	366
40 to 49	138	69	207	121	102	223	259	171	430
50 to 59	137	89	226	118	86	204	255	175	430
60 to 69	113	77	190	93	65	158	206	142	348
70+	72	50	122	61	47	108	133	97	230
Total	592	374	966	535	397	932	1,127	771	1,898*

\* Note: There were also 12 cases of diabetes in people age 10-19; to protect confidentiality, the details for these people are not shown in the table, nor are they included in the totals.

Source: CDIS, September 28, 2010 extraction.

Figure 4: Age distribution of Cree adults with diagnosed diabetes, by region, December 31, 2009



\* To protect confidentiality, people age 10-19 have been excluded from the total, and the percentages are based only on cases age 20 and over.

Source: CDIS, September 28, 2010 extraction.

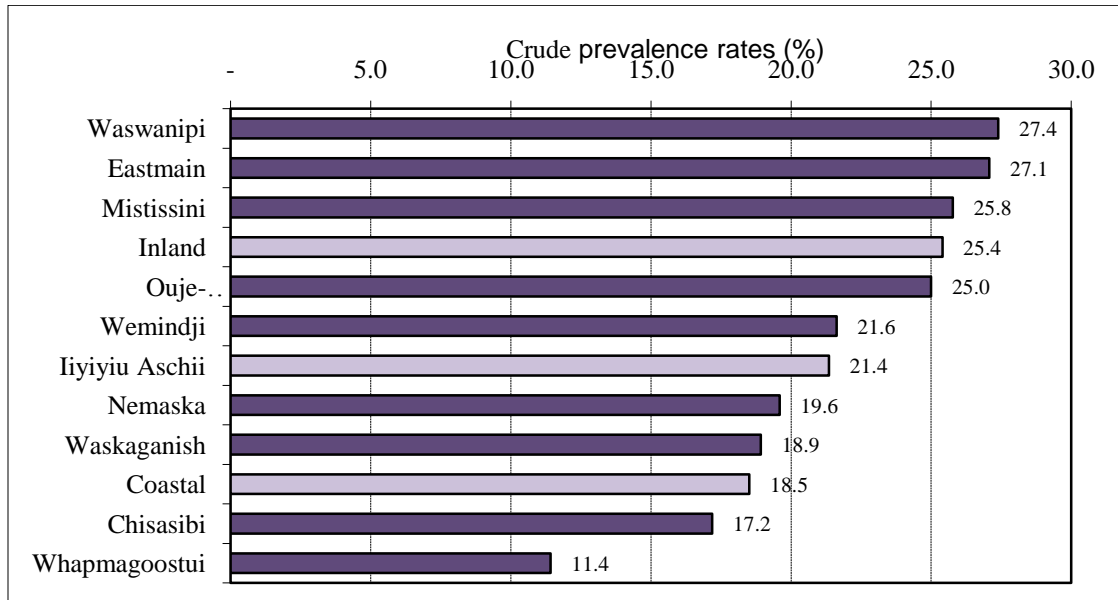
### Prevalence by geographic area

Four of Eeyou Istchee's nine communities (Nemaska, Mistissini, Oujé-Bougoumou and Waswanipi) are located inland, while the remaining five (Whapmagoostui, Chisasibi, Wemindji, Eastmain and Waskaganish) are on the coast. As shown in Figure 5 and Table 4, the prevalence of diabetes varies between the communities. The highest prevalence rates are in Waswanipi (27.4%) and Eastmain (27.1%), and the lowest in Whapmagoostui (11.4%).

As in previous years, the coastal communities have a significantly lower diabetes prevalence overall than the inland ones (18.5% vs. 25.4%, respectively). This is consistent with other studies of Aboriginal populations that have reported lower diabetes prevalence in more-isolated regions than in the less-isolated ones.<sup>5, 6</sup> Proximity to urban areas and greater access to fast-food facilities may play a role in these observed differences.

Among the Cree of Eeyou Istchee, a north-south gradient in diabetes prevalence was first reported by Brassard et al. in 1993,<sup>7</sup> and CDIS data consistently confirmed this pattern from 1998 until 2007. However, as of 2009, the coastal communities of Eastmain and Wemindji are no longer following the north-south gradient in diabetes prevalence (Figure 6).

Figure 5: Diabetes prevalence (%) by region and community, Cree population age 20 and over, Eeyou Istchee, December 31<sup>st</sup>, 2009



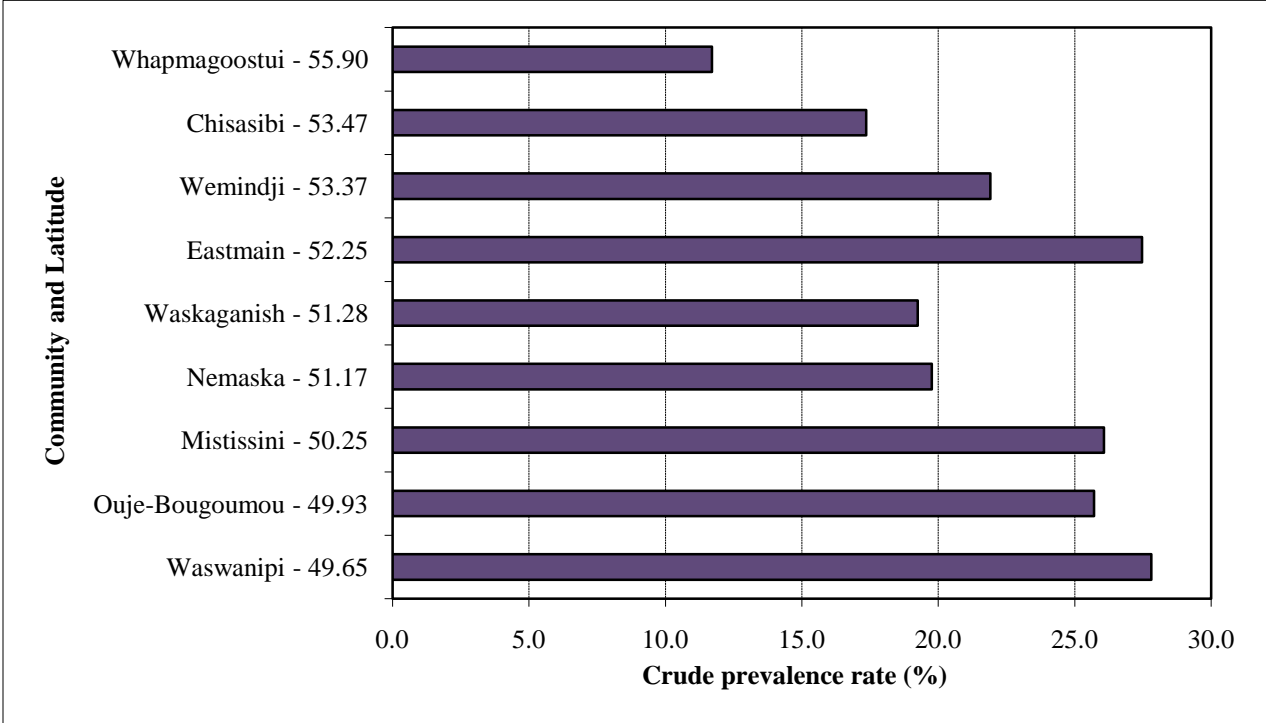
Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup>, 2009 population estimates.

Table 4: Number of people with diabetes and crude prevalence by community and sex, Cree population age 20 and over, Eeyou Istchee, December 31<sup>st</sup>, 2009

	Number of cases			Crude prevalence (%)		
	F	M	T	F	M	T
Chisasibi	246	159	405	20.7	13.6	17.2
Eastmain	62	44	106	31.1	22.9	27.1
Mistissini	287	211	498	29.1	22.3	25.8
Nemaska	45	36	81	22.3	17.0	19.6
Oujé-Bougoumou	60	40	100	29.9	20.1	25.0
Waskaganish	142	81	223	23.6	14.0	18.9
Waswanipi	143	110	253	31.5	23.4	27.4
Wemindji	108	71	179	25.8	17.3	21.6
Whapmagoostui	34	19	53	14.6	8.2	11.4
Coastal	592	374	966	22.4	14.5	18.5
Inland	535	397	932	29.0	21.7	25.4
Eeyou Istchee	1,127	771	1,898	25.2	17.5	21.4

Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup>, 2009 population estimates.

Figure 6: Diabetes prevalence by community and latitude, Cree population age 20 and over, Eeyou Istchee, December 31<sup>st</sup>, 2009



Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup>, 2009 population estimates.

## INCIDENCE OF DIABETES

### Overview

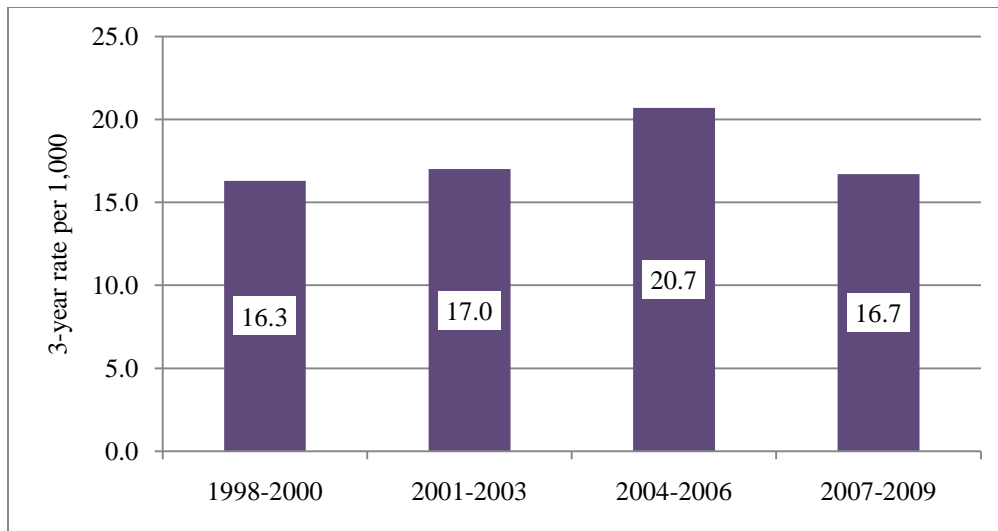
Over the 2007-2009 period, 339 Cree adults age 20 and over were newly diagnosed with diabetes. The cumulative incidence rate\* rose steadily for years, from 16.3 per 1,000 in 1998-2000 to 20.7 per 1,000 in 2004-2006. It apparently began to level off in 2007-2009, dropping to 16.7 per 1,000. However, none of these variations reach statistical significance (Table 5 and Figure 7).

Table 5: Cumulative incidence of diabetes, Cree population age 20 and over, Eeyou Istchee, from 1998-2000 to 2007-2009

Period	Number of new cases	Cumulative incidence rate (per 1,000)
1998-2000	287	16.3
2001-2003	317	17.0
2004-2006	407	20.7
2007-2009	339	16.7

Sources: CDIS, September 28, 2010 extraction; population estimates from MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, population as of December 31<sup>st</sup>.

Figure 7: Cumulative incidence rate of diabetes over time, Cree population age 20 and over, Eeyou Istchee (per 1,000)



Sources: CDIS, September 28, 2010 extraction; population estimates from MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, population as of December 31<sup>st</sup>.

\* Please see the Methods section for an explanation of cumulative incidence.

Table 6: Total number of new cases of diabetes per three-year period, by sex, age group and region, Cree population age 20 and over, Eeyou Istchee 1998-2000 to 2007-2009

Period	Age group	Coastal			Inland			Eeyou Istchee		
		F	M	T	F	M	T	F	M	T
1998-2000	20-29	14	5	19	22	12	34	36	17	53
	30-39	27	8	35	20	14	34	47	22	69
	40-49	26	15	41	19	11	30	45	26	71
	50-59	16	17	33	12	6	18	28	23	51
	60-69	9	4	13	3	9	12	12	13	25
	70+	*	*	*	*	*	*	12	6	18
	Total**	92	49	141	76	52	128	180	107	287
2001-2003	20-29	17	8	25	20	9	29	37	17	54
	30-39	33	23	56	23	14	37	56	37	93
	40-49	20	21	41	21	9	30	41	30	71
	50-59	20	19	39	8	12	20	28	31	59
	60-69	6	10	16	3	10	13	9	20	29
	70+	*	*	*	*	*	*	5	6	11
	Total**	96	81	177	75	54	129	176	141	317
2004-2006	20-29	19	10	29	21	14	35	40	24	64
	30-39	31	24	55	30	32	62	61	56	117
	40-49	27	19	46	28	28	56	55	47	102
	50-59	23	30	53	12	10	22	35	40	75
	60-69	9	11	20	8	6	14	17	17	34
	70+	*	*	*	*	*	*	9	6	15
	Total**	109	94	203	99	90	189	217	190	407
2007-2009	20-29	11	8	19	10	12	22	21	20	41
	30-39	28	27	55	26	25	51	54	52	106
	40-49	30	18	48	18	18	36	48	36	84
	50-59	21	14	35	17	13	30	38	27	65
	60-69	7	5	12	6	8	14	13	13	26
	70+	*	*	*	*	*	*	10	7	17
	Total**	97	72	169	77	76	153	184	155	339

Source: CDIS, September 28, 2010 extraction.

\* When the number of a cell is less than 5, it is not reported and related cells are also masked.

\*\* Totals show the sum of the columns, excluding any cells that are masked.



### Incidence by sex

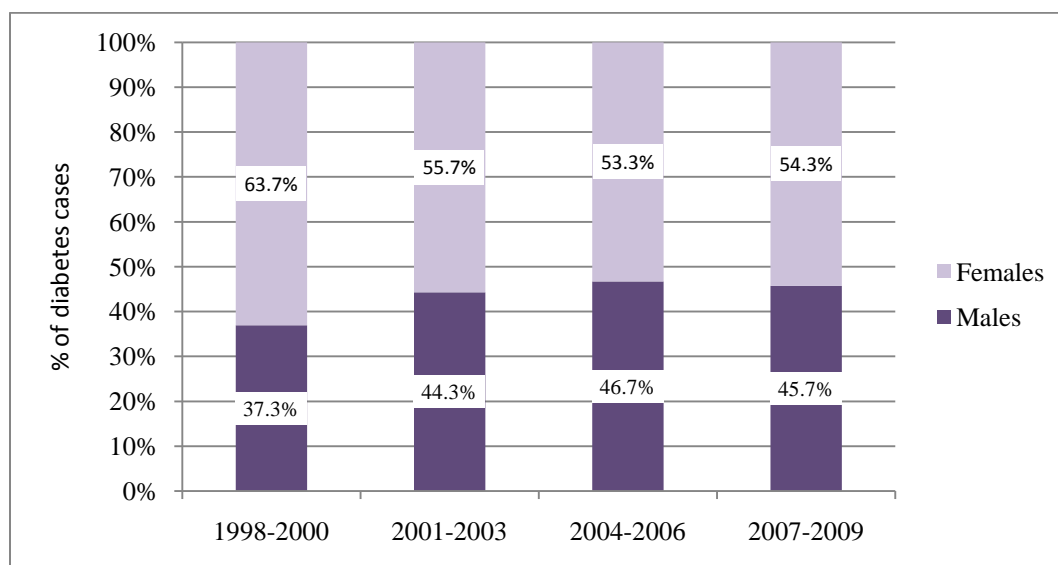
Women outnumber men in the new cases of diagnosed diabetes, although the extent to which they do so has varied over the years. Since 1998, cumulative incidence rates have been consistently higher in women than in men, but the difference is statistically significant only for the years 1998-2000 (Table 7). The proportion of men among the newly diagnosed cases climbed from 37% in 1998-2000 to 44% in 2001-2003 and 47% in 2003-2006; but fell slightly in the most recent period (2006-2009), to 46% (Figure 8).

Table 7: Cumulative diabetes incidence rate (per 1,000) over time, by sex, Cree population age 20 and over, Eeyou Istchee, 1998-2000 to 2007-2009

	1998-2000			2001-2003			2004-2006			2007-2009		
	Rate	95% CI		Rate	95% CI		Rate	95% CI		Rate	95% CI	
F	<b>21.0</b>	16.10	25.93	<b>19.6</b>	15.06	24.12	<b>22.9</b>	18.17	27.54	<b>18.8</b>	14.70	22.90
M	<b>11.8</b>	8.09	15.51	<b>14.6</b>	10.65	18.56	<b>18.7</b>	14.41	22.97	<b>14.7</b>	11.06	18.41
Both	<b>16.3</b>	13.21	19.35	<b>17.0</b>	14.01	20.02	<b>20.7</b>	17.53	23.87	<b>16.7</b>	13.95	19.44

Sources: CDIS, September 28, 2010 extraction; population estimates from MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, population as of December 31<sup>st</sup>.

Figure 8: Sex distribution (%) of new cases of diabetes, Cree population age 20 and over, Eeyou Istchee, 1998-2000 to 2007-2009



Source: CDIS, September 28, 2010 extraction.

## Incidence by age

Data since 1998 consistently show a pattern in which cumulative incidence rates increase in each age group up to age 60, but are lower after age 60 (Table 8). However, the only difference that reaches statistical significance is that between the 20-29-year group and the other age groups. No statistically significant trends over time could be detected in the incidence rates for individual age groups.

Table 8: Cumulative diabetes incidence rates (per 1,000 population) over time, by sex and age group, Cree population age 20 and over, Eeyou Istchee, 1998-2000 to 2007-2009

	1998-2000			2001-2003			2004-2006			2007-2009		
	Rate	95% CI		Rate	95% CI		Rate	95% CI		Rate	95% CI	
20-29	<b>7.5</b>	4.05	10.96	<b>7.5</b>	4.07	10.95	<b>9.2</b>	5.38	13.07	<b>6.0</b>	2.88	9.08
30-39	<b>14.2</b>	8.58	19.79	<b>17.3</b>	11.56	23.14	<b>19.7</b>	13.89	25.44	<b>17.2</b>	11.99	22.50
40-49	<b>28.0</b>	17.77	38.22	<b>23.2</b>	14.63	31.81	<b>29.6</b>	20.73	38.48	<b>21.8</b>	14.68	28.83
50-59	<b>34.7</b>	20.85	48.57	<b>37.8</b>	24.31	51.37	<b>46.0</b>	31.79	60.21	<b>37.6</b>	25.42	49.72
60-69	<b>29.5</b>	12.77	46.28	<b>36.1</b>	18.64	53.50	<b>39.3</b>	22.55	56.02	<b>29.6</b>	15.99	43.17
70+	<b>21.0</b>	6.24	35.83	<b>15.0</b>	2.73	27.31	<b>18.1</b>	5.04	31.16	<b>20.4</b>	7.43	33.45
Total	<b>16.3</b>	13.21	19.35	<b>17.0</b>	14.01	20.02	<b>20.7</b>	17.53	23.87	<b>16.7</b>	13.95	19.44

Caution: rates based on small numbers, and therefore extremely variable.

Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup> population estimates.

## Incidence by geographic area

Although the differences do not reach statistical significance, over the years cumulative incidence rates have consistently been higher in the inland region than the coastal one (Table 9).

Table 9: Cumulative diabetes incidence rates (per 1,000 population) over time, by region and sex, Cree population age 20 and over, Eeyou Istchee, 1998-2000 to 2007-2009

Region		1998-2000			2001-2003			2004-2006			2007-2009		
		Rate	95% CI		Rate	95% CI		Rate	95% CI		Rate	95% CI	
Coast	F	<b>18.0</b>	12.13	23.84	<b>16.6</b>	11.24	22.05	<b>19.5</b>	13.85	25.06	<b>17.3</b>	12.15	22.35
	M	<b>9.4</b>	5.11	13.73	<b>14.4</b>	9.26	19.49	<b>16.3</b>	11.10	21.57	<b>11.9</b>	7.58	16.21
	Both	<b>13.6</b>	9.99	17.26	<b>15.5</b>	11.77	19.21	<b>17.9</b>	14.03	21.69	<b>14.5</b>	11.16	17.83
Inland	F	<b>26.0</b>	17.37	34.70	<b>24.3</b>	16.39	32.31	<b>28.4</b>	20.15	36.55	<b>21.3</b>	14.45	28.11
	M	<b>15.5</b>	8.85	22.17	<b>15.0</b>	8.73	21.18	<b>22.3</b>	15.00	29.51	<b>19.1</b>	12.62	25.62
	Both	<b>20.5</b>	15.10	25.95	<b>19.4</b>	14.40	24.44	<b>25.1</b>	19.69	30.59	<b>20.1</b>	15.44	24.86
Eeyou Istchee	F	<b>21.0</b>	16.10	25.93	<b>19.6</b>	15.06	24.12	<b>22.9</b>	18.17	27.54	<b>18.8</b>	14.70	22.90
	M	<b>11.8</b>	8.09	15.51	<b>14.6</b>	10.65	18.56	<b>18.7</b>	14.41	22.97	<b>14.7</b>	11.06	18.41
	Both	<b>16.3</b>	13.21	19.35	<b>17.0</b>	14.01	20.02	<b>20.7</b>	17.53	23.87	<b>16.7</b>	13.95	19.44

Caution: rates based on small numbers.

Sources: CDIS, September 28, 2010 extraction; MHSS, James Bay and Northern Quebec Agreement Cree beneficiary list, December 31<sup>st</sup> population estimates.

## DURATION OF DIABETES

Diabetes is a relatively recent disease in Eeyou Istchee. As of December 31, 2009, 61% of the people living with diabetes had been diagnosed within the past ten years; 31% had been diagnosed in the previous five years. The average duration of diabetes was 8.9 years.

Concurrently, diabetes is being diagnosed at younger and younger ages. In 1989, the average age at diagnosis was 48 years;<sup>8</sup> in 2009, it was 41.4 years. As of 2009, almost half of all Eeyouch living with diabetes (46.8%) had been diagnosed before the age of 40 (Table 10).

Taken together, the large number of recent diagnoses and the younger age of onset have major implications for health services in the region. They point to the potential for rates of diabetic complications to increase dramatically as more and more people live with the disease for many years. This underscores the need for a concerted effort to help people manage their diabetes well, and thereby reduce their risk of developing complications.

Table 10: Age at diagnosis of diabetes, Cree population, Eeyou Istchee, December 31<sup>st</sup>, 2009

Age at diagnosis	Number	%
Under 40 years	893	46.8%
40-49 years	493	25.8%
50-59 years	333	17.4%
60-69 years	131	6.9%
70 years or more	60	3.1%
<b>Total all ages</b>	<b>1,910</b>	<b>100%</b>

Source: CDIS, September 28, 2010 extraction.

Table 11: Duration of diabetes, Cree population, Eeyou Istchee, December 31<sup>st</sup>, 2009

Duration (years)	Number	%
0 to 4	594	31.1%
5 to 9	571	29.9%
10 to 14	370	19.4%
15 to 19	195	10.2%
20 or more	180	9.4%
<b>Total, all durations</b>	<b>1,910</b>	<b>100%</b>

Source: CDIS, September 28, 2010 extraction.

## DISCUSSION AND CONCLUSION

Within the past twelve years, crude diabetes prevalence in Eeyouch 20 years and older has risen from 11.6% to 21.4%. Thus, as of December 31<sup>st</sup>, 2009, more than one in every five Cree adults was living with diagnosed diabetes. Diabetes rates are substantially higher in Eeyouch than in the general population of Quebec (age-adjusted prevalence of 29.0% vs. 7.6% in 2006-07<sup>2</sup>); however, they are consistent with the rates reported for other First Nations. The preponderance of female cases, and the young age of onset, are also consistent with the pattern observed in other Aboriginal groups in Canada.<sup>3</sup>

The observed increase in diabetes prevalence over the years probably results from a combination of several factors: new cases of diabetes; increased awareness and screening for diabetes, such that more of the existing cases are being detected; and decreased mortality of patients with diabetes. The contribution of new cases of diabetes to the total number of people suffering from this chronic disease varies from year to year, but remains important: cumulative incidence rates rose steadily from 1998 to 2006, although there is some indication that they may now be levelling off or decreasing. Nonetheless, in the past 3 years alone (2007-2009), 339 Cree adults were newly diagnosed with diabetes.

Although only some of the differences are statistically significant, cumulative diabetes incidence rates among Eeyouch have been consistently higher in women than in men since at least 1998. Prevalence rates are also higher in women than men (25.2% vs. 17.5%, respectively). The observed sex difference could be explained by a higher obesity rates among Cree women,<sup>9</sup> excessive weight gain by young Cree mothers during pregnancy<sup>10, 11</sup> and a high rate of gestational diabetes.<sup>12</sup> It may also reflect more aggressive screening for diabetes among women, particularly during pregnancy. Whatever the cause, the high prevalence of diabetes among Cree women, especially of reproductive age, is alarming, since women who have pre-existing type 2 diabetes or gestational diabetes are at much higher risk for maternal and neonatal complications and their children are at a significantly higher risk for obesity and diabetes at a young age.<sup>13, 14</sup>

The age at diagnosis of diabetes among Eeyouch has been dropping (41.4 years in 2009 compared to 48 years in 1989); almost half the Eeyouch currently living with diabetes (48%) were diagnosed before they reached 40 years of age. This is in sharp contrast to the trend observed in non-Aboriginal people where the majority of new cases occur among individuals aged 70 years old and older<sup>3, 4</sup>. Further, more than

half of all Cree patients with diabetes (61.0%) have been diagnosed in the past 10 years. These observations have major implications for regional health services. The 2006 diabetes clinical management audit clearly demonstrated that the risk of diabetes-related complications significantly increases with the duration of diabetes.<sup>15</sup> Therefore, a younger age at diagnosis and a longer duration of diabetes among Cree patients highlight the urgent need to implement high-quality integrated services in the region.

In conclusion, the data presented in this report underline the importance of developing and implementing effective primary prevention programs for diabetes, and reinforcing existing clinical preventive practices in the territory. In order to halt or slow the epidemic of diabetes in the Cree population, it is urgent to target the modifiable risk factors for diabetes, such as obesity and physical inactivity, especially among women of reproductive age. As well, in addition to the existing surveillance system, further surveillance projects are required to assess the magnitude of gestational diabetes among Cree women and pre-diabetic states in the general Cree population.

## REFERENCES

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- <sup>1</sup> Kuzmina E, Dannenbaum D, Torrie J. Cree Diabetes Information System (CDIS) data validation project. Internal report, Public Health Department, Cree Board of Health and Social Services of James Bay. Québec. May 2010. 12 pages.
- <sup>2</sup> Ministère de la santé et des services sociaux du Québec. Available on line at: [http://www.msss.gouv.qc.ca/sujets/prob\\_sante/diabete/index.php?Etat-de-situation&PHPSESSID=d6a42b8beb579c69abb253f62c592e40](http://www.msss.gouv.qc.ca/sujets/prob_sante/diabete/index.php?Etat-de-situation&PHPSESSID=d6a42b8beb579c69abb253f62c592e40).
- <sup>3</sup> Dyck R, Osgood N, Lin TH, Gao A, Stang MR. Epidemiology of diabetes mellitus among First Nations and non-First Nation adults. *CMAJ* 2010; 182(3):249-256.
- <sup>4</sup> The National Diabetes Surveillance System: Diabetes in Canada, 2008. Available on line at: <http://www.ndss.qc.ca>
- <sup>5</sup> Young TK, Eموke JES, Evers S, Wheatley B. Geographical distribution of diabetes among native population in Canada: A national survey". *Soc Sci Med* 1990; 31:129-39
- <sup>6</sup> Green C, Blanchard JF, Young TK et al. The epidemiology of diabetes in the Manitoba-registered First Nation population. *Diabetes Care* 2003; 26(7):1993-1998
- <sup>7</sup> Brassard P, Robinson E, Lavallée C. Prevalence of diabetes mellitus among the James Bay Cree of northern Quebec. *CMAJ* 1993; 149(3):303-307
- <sup>8</sup> Brassard P, Robinson E, Dumon C. Descriptive epidemiology of non-insulin-dependant diabetes mellitus in the James Bay Cree population of Quebec, Canada. *Arct Med Res* 1993; 52: 47-54
- <sup>9</sup> Nolin B, Blanchet C, Kuzmina E (2008) L'enquête de santé auprès des Cris 2003. Enquête sur la santé dans les collectivités canadiennes (Cycle 2.1). Iiyiyiu Aschii. Habitudes alimentaires, activité physique et poids corporel. CCSSSBJ et INSPQ. Available on line at: [www.inspq.qc.ca](http://www.inspq.qc.ca)
- <sup>10</sup> Brennand E, Dannenbaum D, Willow N. Pregnancy outcomes of first nations women in relation to pregravid weight and pregnancy weight gain. *JOGC* 2005; 936-944.
- <sup>11</sup> Chu SY, Callaghan WM, Kim SY, et al. Maternal obesity and risk of gestational diabetes mellitus. *Diabetes Care* 2007; 30(8):2070-2076
- <sup>12</sup> Rodrigues S, Robinson E, Gray-Donald K. Prevalence of gestational diabetes mellitus among James Bay Cree women in northern Quebec. *CMAJ* 1999; 160(9):1293-1297.
- <sup>13</sup> Dabelea D, Hanson RL, Lindsay RS et al. Intrauterine exposure to diabetes conveys risks for type 2 diabetes and obesity: A study of discordant sibships. *Diabetes* 2000; 49: 2208-2211.
- <sup>14</sup> Mohamed N, Dooley J. Gestational diabetes and subsequent development of NIDDM in aboriginal women of north-western Ontario. *Int J Circumpolar* 1998; 57 Suppl 1: 355-8.
- <sup>15</sup> Dannenbaum D, Kuzmina E, Gangbè M, Torrie J. Diabetes clinical management in Iiyiyiu Aschii (2006). Cree Public Health Department. Cree Board of Health and Social Services of James Bay. Québec. 2008, ISBN: 978-2-550-54041-0.14 pages.