

The Health of Manitoba's Métis Population and their Utilization of Medical Services: A Pilot Study

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SUMMARY

This pilot study examined the feasibility of linking a sample of the Manitoba Métis Federation (MMF) membership list to Manitoba Health and CancerCare Manitoba databases and to use the resulting linked records to provide estimates of the health status of the Manitoba's Métis population and their utilization of medical services. Of the list of 2,491 MMF members provided, 87.4% were successfully linked to the Manitoba Health Population Registry. The Métis sample was not representative of the overall Manitoba Métis population as the majority were residents of the Interlake RHA (88.4%), which is primarily rural, and it included very few children under the age of 15 (2.0%). Although the age-standardized average number of physician visits for the Métis (males 4.8, females 8.1) and all Manitobans (males 5.1, females 7.9) over 14 years of age was comparable, their hospitalization rate (per 1000) was higher (Métis: males 293.4, females 454.2; Manitoba: males 228.6, females 301.9). Relative to all Manitobans, the Métis visited doctors more for Endocrine (Métis rate / Manitoba rate: males 1.44, females 1.96), and Circulatory (males 1.30, females 1.44) disorders. The average number of visits was also substantially higher for Métis males for Genitourinary diagnoses (1.39), while Métis females also had more visits for Respiratory diagnoses (1.30). In contrast, the Métis had fewer visits for Neoplasms (males 0.58, females 0.74), Other (males 0.63, females 0.72) and Infectious and parasitic (males 0.64, females 0.67) diagnoses. For males, the lowest Métis / Manitoba ratios occurred for Blood disorders (0.39). The prevalence (age-standardized percent) of diabetes was substantially higher among the Métis (males 9.8%, females 11.3%) than for all Manitobans (males 6.1%, females 5.7%). Among Métis aged 65-74 years the prevalence of diabetes reached epidemic proportions (males 36.6%, females 40.0%). The prevalence of cancer was lower among Métis males (Métis 2.9%, Manitoba 7.1%) but higher among Métis females (Métis 10.5%, Manitoba 8.1%). This pilot study has provided insights into Métis health that were hitherto unreported. The results suggest that their health profile is closer to that of the First Nation people, than it is to the general Manitoba population.

1. INTRODUCTION

Very little information is available on the health status of Canada's Métis population, nor on their utilization of medical services. The recent First Nations and Inuit Regional Health Survey (FNIRHS) excluded the Métis population, and although the National Population Health Survey (NPHS) did include Métis people, the sample was not large enough to provide accurate estimates of their health status (1). The only major source of information on the health status of the Métis people is the 1991 Aboriginal People Survey (APS) (2). This survey indicated that compared to the Aboriginal population who identified themselves as North American Indian, the Métis had slightly more chronic health problems and a greater proportion had seen someone about their health in the last year.

The Manitoba Métis Federation (MMF) approached CancerCare Manitoba about the possibility of providing information on the burden of cancer among Manitoba's Métis population. Although the Manitoba Cancer Registry, as well as numerous other administrative databases maintained by Manitoba Health, can be used to provide information on the health status of Manitobans and their use of medical services, they do not contain accurate or complete identifiers that allow for analyses for specific ethnic and/or racial groups. In order to use these databases for examining the health of sub-populations, an external source of information on ethnicity and/or race needs to be linked to them.

The purpose of this pilot study was to examine the feasibility of linking a sample of the MMF membership list to Manitoba Health and CancerCare Manitoba databases, and to use the resulting linked records to provide estimates of the health status of the Manitoba's Métis population and their utilization of medical services.

2. METHODS

The MMF provided CancerCare Manitoba and Manitoba Health with a listing of approximately 2,500 individuals from their membership file. These individuals lived primarily in the Interlake

Regional Health Authority. The information they provided included full name, date of birth, gender and residential address, although the latter was not complete for all individuals. Using deterministic and probabilistic record linkage techniques, these records were linked to a version of the MHPR that is maintained by Manitoba Health's Epidemiology Unit. The MHPR contains information on all people covered by Manitoba's provincial health insurance plan (over 99% of the population). This linkage provided the Personal Health Insurance Number (PHIN) of the Métis. With the PHIN it was a straightforward task to extract information on the linked individuals from the Manitoba Health's hospital discharge and physician billing files, the Manitoba Diabetes Database, and CancerCare Manitoba's cancer registry, as they all contain the PHIN.

The Métis sample only contained a small proportion of children under the age of 15. Accordingly, the analyses were restricted to those aged 15 years or more. In order to control for the differences in the age distribution between the Métis population and the overall Manitoba population, direct age-standardized rates were calculated. The standard population used was the 1996 Manitoba population 15 years of age and over and it was derived from the MHPR.

For diabetes and cancer, both the incidence and prevalence rates were calculated. **Incidence** refers to the number of new cases of a particular disease. Incidence rates were calculated based on the disease free population. **Prevalence** refers to the number of people who are living with a particular disease at a given point in time. All people who had ever been diagnosed with cancer, regardless of how long ago, and who were alive and living in Manitoba were included in the prevalence estimate. Therefore, prevalent cancer cases by this definition included people in remission or cured of cancer.

Both the physician claims and hospital discharge databases code the diagnosis and procedures according to the International Classification of Diseases 9th Revision, Clinical Modification (ICD-9-CM). For the purposes of this report the diagnoses and procedures were aggregated to the broad ICD-9-CM chapter headings (Appendix Table A.1, A.2). There is only one diagnosis code in the physician claims data. The hospital discharges contain numerous diagnoses and procedures, however, only the principal diagnosis and procedure were used. For the analysis of

the physician claims data we excluded chiropractors, optometrists, dentists, oral surgeons and periodontists, as well as radiology and pathology related claims. For neoplasms, we have included ICD-9 codes 140-239. Thus it includes benign and in situ neoplasms. We also tended to use the more common term ‘cancer’ rather than ‘neoplasm’. Technically, ‘cancer’ refers to only malignant neoplasms.

The study was approved by the Manitoba’s Métis peoples at the Annual General Meeting of the Manitoba Métis Federation, as well as by Manitoba Health’s Access and Confidentiality Committee and the University of Manitoba’s Health Research Ethics Board.

3. RESULTS

3.1 Record Linkage

The sample file provided by MMF contained 2,491 individuals. Overall 2,177 (87.4%) of these individuals were linked to the MHPR.

3.1.1 Sex

The percentage of records linked was slightly higher for males (88.4%) than for females (86.4%) (Table 1).

Table 1. Number and percent linked by sex

Age	Sample	Number linked	% linked
Males	1236	1093	88.4
Females	1255	1084	86.4
Total	2491	2177	87.4

3.1.2 Age

The percentage of records linked was fairly high for all age groups. It ranged from a low of 83.6% for Métis aged 50-54 years, to a high of 93.5% for those aged 0-14 years (Table 2).

The Métis sample was not representative of the total Manitoba Métis population, as very few children were included. Only 2.0% of the sample were children under the age of 15 while according to the 1996/97 NPHS, 41% of the total Manitoba Métis population were of that age (3). Of all Manitobans, 21.7% were under the age of 15.

Table 2. Number and percent linked by age

Age	Sample	Number linked	% linked
0-14	46	43	93.5
15-19	229	210	91.7
20-24	292	256	87.7
25-29	246	215	87.4
30-34	316	271	85.8
35-39	283	250	88.3
40-44	293	257	87.7
45-49	204	179	87.7
50-54	140	117	83.6
55-59	110	93	84.5
60-64	111	99	89.2
65-69	88	75	85.2
70-74	54	48	88.9
75+	71	64	90.1
Unknown	8	0	0.0
Total	2491	2177	87.4

Table 3. Percent distribution by age of the Métis sample, the Manitoba Métis population¹ and the total Manitoba population

Age	Sample	Manitoba Métis	Total Manitoba
15-24	21.4	24.6	17.5
25-34	23.1	33.0	18.9
35-44	23.6	12.5	20.3
45-54	14.1	18.3	15.4
55-64	9.1	5.2	10.4
65-74	5.8	3.5	9.3
75+	2.9	2.9	8.1
15-34	44.5	57.6	36.4
55+	17.8	11.6	27.8

1. Source: 1996-97 National Population Health Survey (3)

For individuals who were 15 years of age and over we compared the age distribution of the Manitoba Métis sample with that of the Métis in the 1995/96 NPHS and that of the overall 1996 Manitoba census population (Table 3). Even in this restricted age range, the Métis sample was not representative of the overall Manitoba Métis population, as it had a lower proportion of individuals aged 15-34 years of age (44.5% vs. 57.6%). It is because of the differences in the age distribution of the Métis sample population and the Manitoba population that it was necessary to age-standardize the rates.

3.1.3 Place of residence

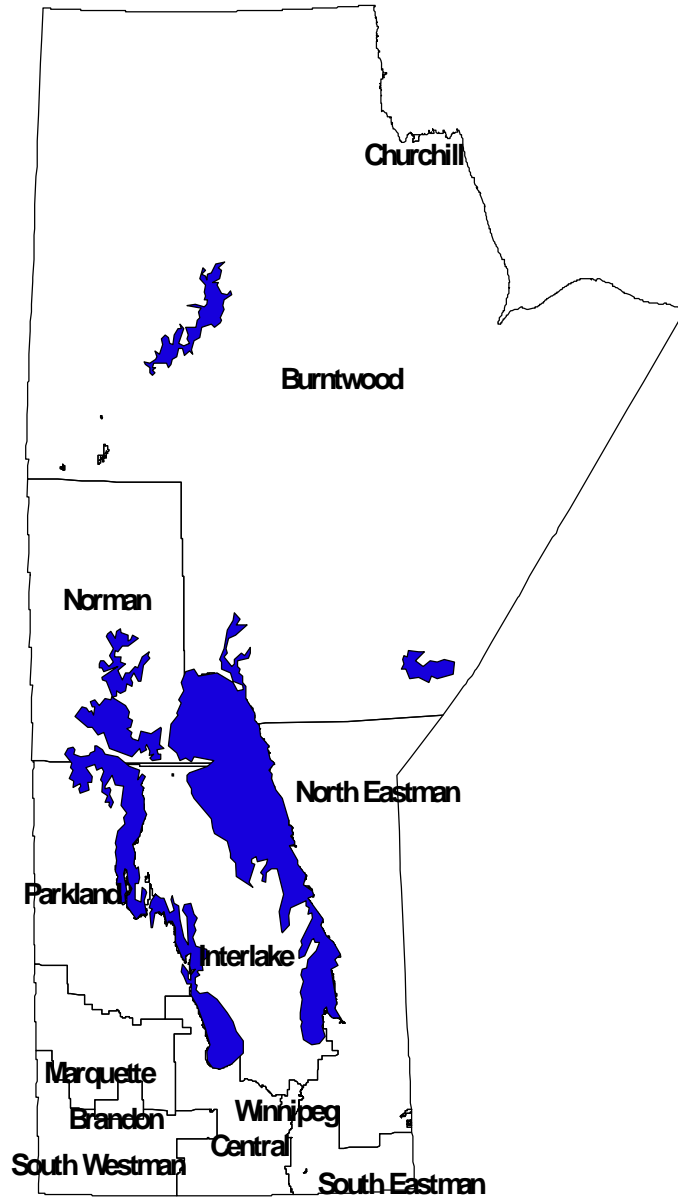
For many of the individuals in the file provided by the MMF there was no place of residence given. Table 4 compares the Regional Health Authority (RHA) of residence as on the MMF file with that in the MHPR. The majority of the linked sample (88.4%) lived in the Interlake RHA. Figure 1 shows the location of the various RHAs.

Table 4. RHA of residence in MMF file and in the linked files

RHA	MMF file	Linked file ¹
10 Winnipeg	-	166
15 Brandon	-	2
20 North Eastman	8	14
25 South Eastman	3	4
30 Interlake	2151	1924
40 Central	2	15
50 Marquette	1	6
55 South Westman	2	3
60 Parkland	4	6
70 Norman	-	2
80 Burntwood	3	13
90 Churchill	-	1
Non-Manitoba	-	21
Unknown	317	0
Total	2491	2177

1. Based on the address in the MHPR

Figure 1. Map of Manitoba Regional Health Authorities



3.2 Physician Utilization

Overall, the Métis males (5.7) had a slightly lower average annual number of physician visits per person than the total Manitoba males (5.9), but the reverse was true for females (Métis 9.3, Manitoba 8.9) (Table 5). When the average annual number of visits was standardized for the age differences between the two populations, they also were comparable for the two groups (Métis / Manitoba ratio - 0.95 for males, 1.02 for females).

3.2.1 Age-specific rates

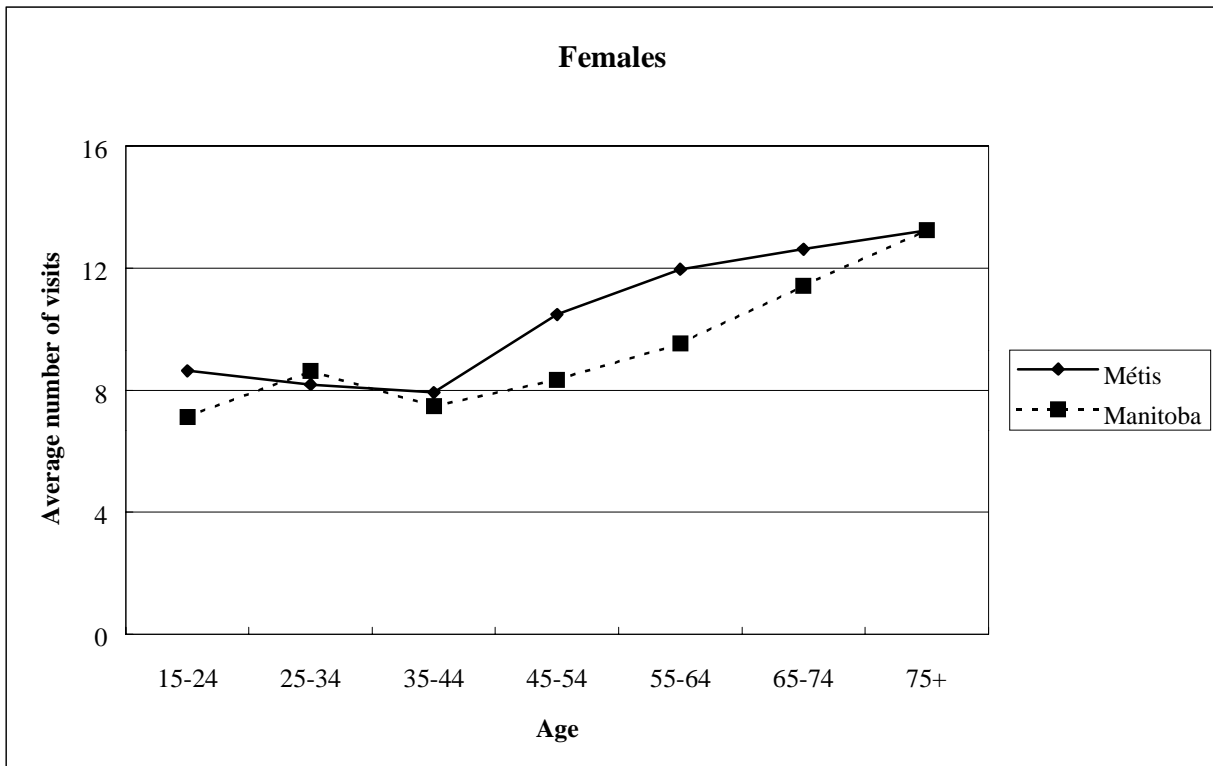
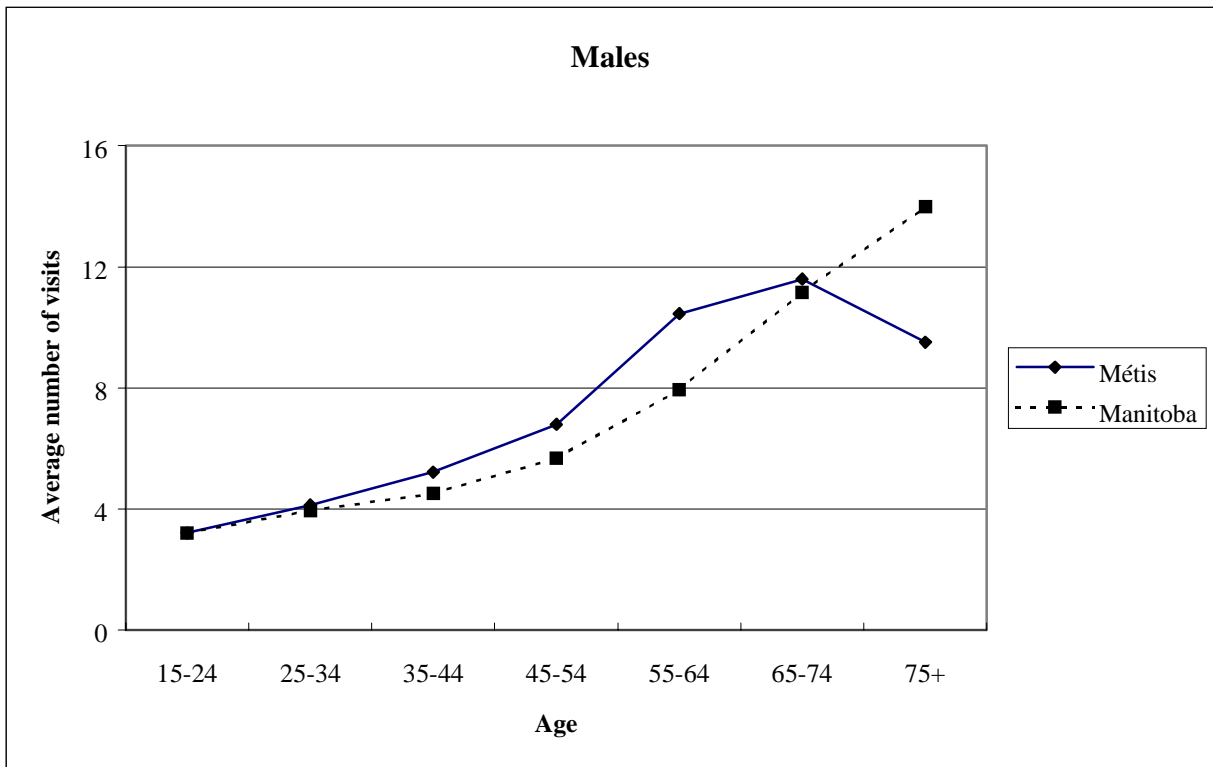
For both the Métis and all Manitoba males, the average annual number of physician visits tended to increase with advancing age (Figure 2, Table 5). The only exception was among the Métis aged 75 years and older, for whom the rate was lower than those aged 65-74 (Métis / Manitoba ratio 0.68).

Table 5. Average annual number of physician visits for the Métis sample and all Manitobans by age and sex, 1995-97

Age	Métis sample			Manitoba Average	Métis average / MB average
	Number ¹	Population	Average		
Males					
15-24	2295	238	3.2	3.2	1.01
25-34	2965	239	4.1	4.0	1.05
35-44	3995	255	5.2	4.5	1.16
45-54	2976	146	6.8	5.7	1.20
55-64	3072	98	10.4	7.9	1.32
65-74	2191	63	11.6	11.2	1.04
75+	856	30	9.5	14.0	0.68
Total	18350	1069	5.7	5.9	0.97
Standardized			4.8	5.1	0.95
Females					
15-24	5903	228	8.6	7.1	1.21
25-34	6061	247	8.2	8.6	0.95
35-44	5985	252	7.9	7.5	1.06
45-54	4717	150	10.5	8.3	1.26
55-64	3372	94	12.0	9.5	1.26
65-74	2270	60	12.6	11.4	1.11
75+	1350	34	13.2	13.2	1.00
Total	29658	1065	9.3	8.9	1.04
Standardized			8.1	7.9	1.02

1. Total number of visits 1995-97

Figure 2. Average annual number of physician visits for Métis and all Manitobans by age and sex, 1995-97



For women, the average annual number of physician visits increased with age only for those over 44 years of age. With the exception of women aged 25-34 (Métis / Manitoba ratio 0.95), the average number of visits was the same or higher for Métis women compared to all Manitoba women.

3.2.2 Diagnosis

The physician utilization rates by broad categories of diagnoses are shown in Table 6. The most frequent diagnosis was the same for both Métis and the total Manitoba population (Males - Circulatory; Females – Contact health services). Other common reasons for Métis men to see a physician included Respiratory and Musculoskeletal problems. Respiratory problems were also the second most frequent reason for all Manitoba men to see a physician, but unlike the Métis, the third most common reason was for Contact health services. For Métis women, Genitourinary and Respiratory problems were the second and third most frequent reasons for seeing a physician. These two diagnoses were also common among all Manitoba women, although the order was reversed.

For both men and women the Métis / Manitoba ratio was the highest for Endocrine and nutritional diagnoses (Males - 1.44; Females – 1.96). This no doubt reflects the high prevalence of diabetes among the Métis (see below). The physician visitation rates were also at least 25 percent higher for Métis than all Manitobans for numerous other diagnostic groups (Males – Genitourinary 1.39, Circulatory 1.30, Musculoskeletal 1.26; Females – Circulatory 1.44, Respiratory 1.30).

There were numerous disease groupings for which the Métis saw physicians substantially less frequently than did all Manitobans. The visitation rates for Blood disorders (0.39), Neoplasms (0.58) and Other and unknown (0.63) were particularly low for Métis men relative to all Manitoban men. For females, for those diagnoses for which there were more than 50 visits the Métis / Manitoba ratios were the lowest for Infectious and parasitic (0.67), Mental (0.72), Other and unknown (0.72) and Neoplasm (0.74) diagnoses.

Table 6. Number and average annual rate (per 1000) of physician visits for the Métis sample and all Manitobans (15+ years of age) by diagnosis and sex, 1995-97

Diagnosis	Métis sample		Manitoba Standard rate	Métis / Manitoba
	Number ¹	Standard rate		
Males				
Infectious, parasitic	252	77.54	121.16	0.64
Neoplasms	332	138.49	237.36	0.58
Endocrine, nutritional	1017	380.11	263.53	1.44
Blood	50	19.79	50.51	0.39
Mental	1084	344.91	393.30	0.88
Nervous, sense organs	1191	435.95	460.82	0.95
Circulatory	2032	885.65	683.45	1.30
Respiratory	2080	692.45	625.16	1.11
Digestive	909	298.66	290.97	1.03
Genitourinary	1202	385.36	277.71	1.39
Skin	778	252.28	340.25	0.74
Musculoskeletal	1950	620.92	493.98	1.26
Congenital	16	5.00	7.23	0.69
Perinatal	0	0.00	0.28	0.00
Ill Defined	1346	456.07	441.59	1.03
Injury, poisoning	1884	554.61	498.67	1.11
Contact health services	1427	549.10	531.94	1.03
Other, unknown	800	237.08	376.27	0.63
Females				
Infectious, parasitic	370	106.44	158.36	0.67
Neoplasms	529	185.29	248.98	0.74
Endocrine, nutritional	1426	586.67	299.13	1.96
Blood	223	91.72	86.31	1.06
Mental	1484	446.99	622.24	0.72
Nervous, sense organs	2053	739.07	604.98	1.22
Circulatory	1877	890.00	618.21	1.44
Respiratory	3453	1106.88	850.35	1.30
Digestive	1140	376.37	327.97	1.15
Genitourinary	3431	1003.73	955.93	1.05
Pregnancy	1003	252.18	215.60	1.17
Skin	1069	339.54	393.02	0.86
Musculoskeletal	2202	726.42	640.85	1.13
Congenital	16	4.68	8.34	0.56
Perinatal	2	0.45	0.97	0.47
Ill Defined	2227	748.86	618.39	1.21
Injury, poisoning	1445	436.19	421.44	1.04
Contact health services	4555	1439.33	1246.70	1.15
Other, unknown	1153	347.24	481.28	0.72

1. Total number of visits 1995-97

3.3 Hospitalizations

The Métis people were hospitalized more frequently than the overall Manitoba population. The Métis / Manitoba ratio of the age-standardized rates was 1.28 for males and 1.50 for females (Table 7).

3.3.1 Age-specific rates

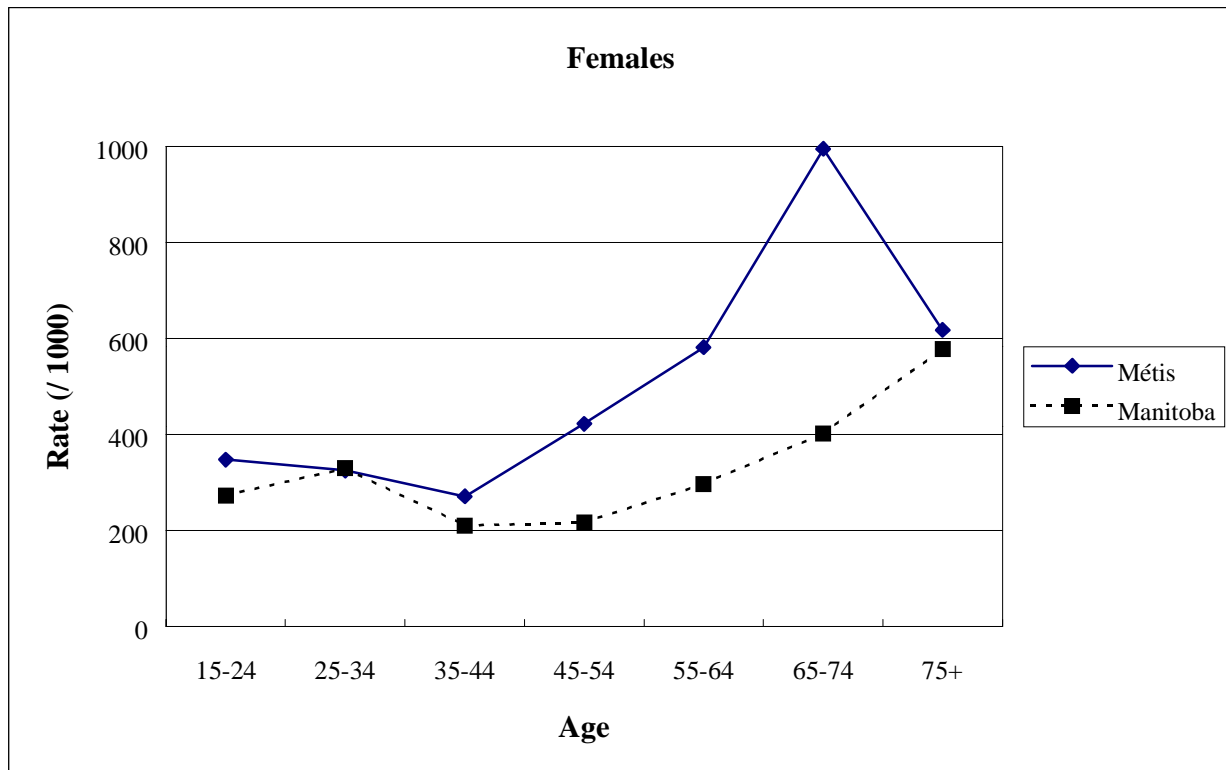
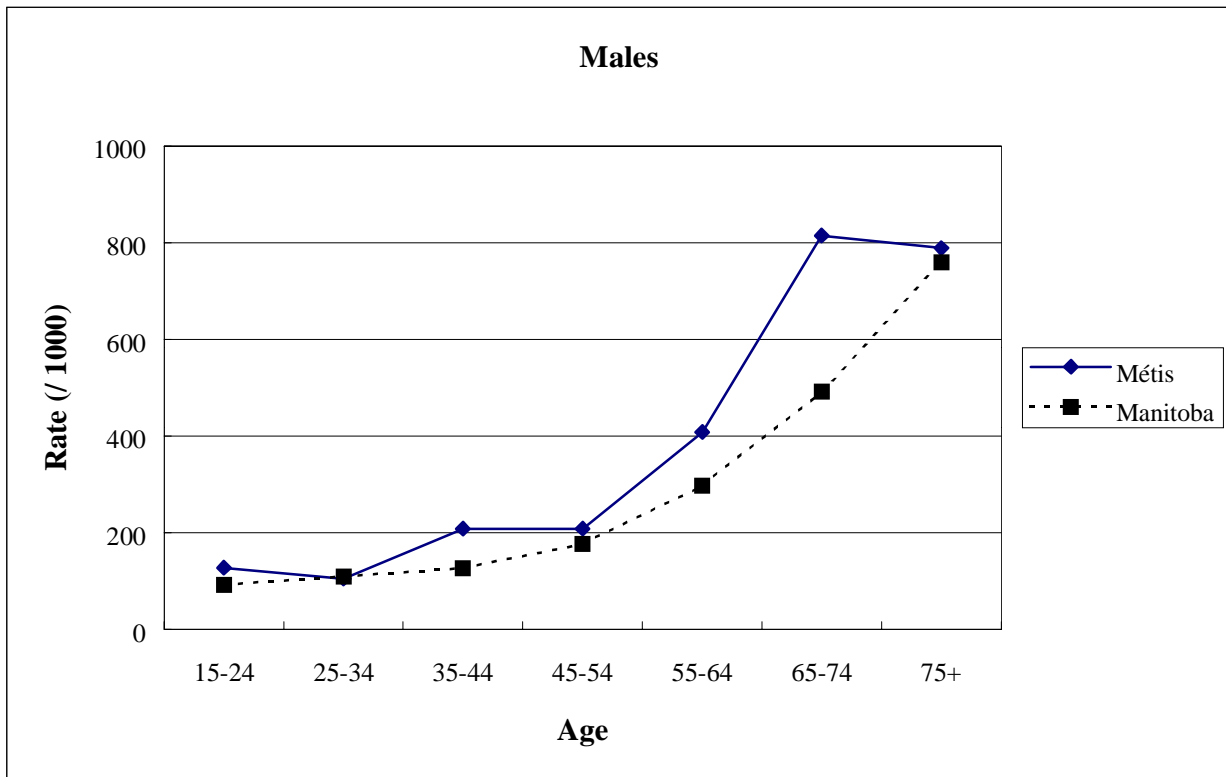
The higher hospitalization rates among the Métis tended to occur among all age groups with the exception of those aged 25-34 years (Figure 3, Table 7). The largest differences occurred among those individuals aged 65-74 years, where the Métis / Manitoba ratio was 1.66 for males and 2.47 for females.

Table 7. Number and average annual rate (per 1000) of hospitalizations for the Métis and all Manitobans by age and sex, 1995-97

Age	Métis Sample			Manitoba Rate	Métis Rate / MB Rate
	Number ¹	Population	Rate		
Males					
15-24	91	238	127.5	92.3	1.38
25-34	75	239	104.6	109.1	0.96
35-44	159	255	207.8	126.5	1.64
45-54	91	146	207.8	176.1	1.18
55-64	120	98	408.2	297.5	1.37
65-74	154	63	814.8	492.3	1.66
75+	71	30	788.9	758.9	1.04
Total	761	1069	237.3	213.9	1.11
Standardized			293.4	228.6	1.28
Females					
15-24	238	228	348.0	273.4	1.27
25-34	241	247	325.2	329.5	0.99
35-44	205	252	271.2	210.5	1.29
45-54	190	150	422.2	216.8	1.95
55-64	164	94	581.6	297.2	1.96
65-74	179	60	994.4	402.7	2.47
75+	63	34	617.6	578.3	1.07
Total	1280	1065	400.6	307.9	1.30
Standardized			454.2	301.9	1.50

1. Total number of hospitalizations 1995-97

Figure 3. Hospitalization rates (per 1000) for the Métis sample and all Manitobans by age and sex, 1995-97



3.3.2 Diagnosis

Although the number of hospitalizations has been reported by principal diagnosis, it should be noted that for several of the diagnoses the rates were based on a small number of discharges (Table 8). Relative to all Manitobans, the Métis had a much larger proportion of hospitalizations for which the diagnosis was Unknown (Métis / Manitoba ratio: males 6.36, females 6.58).

For males, the rates for the Métis were substantially higher than those for all Manitoba males for Infectious diseases (1.40) and Injury and poisonings (1.40). The Métis rates were more than 25% lower for Mental (0.50), Endocrine (0.67) and Genitourinary disorders (0.73) and Neoplasms (0.73). Compared to all Manitoba women, the hospitalization rates for Métis females were markedly higher for Nervous (1.69), Endocrine (1.58), Respiratory (1.54) and Ill-defined (1.51) conditions. Unlike males, Métis females had a low hospitalization rate for Injury and poisonings (0.66).

3.3.3 Procedures

When hospitalized, the Métis have a procedure less frequently than Manitobans generally (no procedure - Métis / Manitoba ratio: males 1.92, females 2.30) (Table 9). The most common procedures (based on the age-standardized rates) for Métis men were related to the Digestive system, Diagnostic and therapeutic, and Musculoskeletal system. The first two procedures were also the most common for all Manitoba males, although the third most common was operations on the Integumentary system. Operations on the Digestive system were also the most common procedure among Métis women and all Manitoba women, followed by operations on the Genital organs. For Métis women operations on the Integumentary system were the third most common procedure, while for Manitoba women generally, Obstetrical procedures ranked third.

Métis men had higher procedure rates than the general Manitoba male population for the Cardiovascular (1.30), Nervous (1.15), and Musculoskeletal (1.12) systems, as well as for operations on the Eyes (1.06). Relative to all Manitoba men, Métis men had particularly low rates for operations on the Urinary (0.33) and Respiratory (0.55) systems and on the Genital organs (0.55).

Table 8. Number and average annual rate (per 1000) of hospitalizations for the Métis sample and all Manitobans (15+ years of age) by diagnosis and sex, 1995-97

Diagnosis	Métis sample		Manitoba	Métis /
	Number ¹	Standard rate	Standard rate	Manitoba
Males				
Infectious, parasitic	7	4.3	3.1	1.40
Neoplasms	47	18.6	25.5	0.73
Endocrine, nutritional	7	2.6	3.9	0.67
Blood	5	2.3	2.0	1.15
Mental	11	3.9	7.7	0.50
Nervous, sense organs	27	10.7	12.7	0.84
Circulatory	75	35.0	32.5	1.08
Respiratory	37	17.6	15.6	1.12
Digestive	111	35.7	30.3	1.18
Genitourinary	27	8.7	12.0	0.73
Skin	36	12.3	11.9	1.04
Musculoskeletal	38	12.6	13.1	0.96
Congenital	0	0.0	0.4	0.00
Perinatal	0	0.0	0.0	0.00
Ill Defined	35	11.9	11.5	1.03
Injury, poisoning	71	23.5	16.7	1.40
Contact health services	48	21.0	18.2	1.15
Unknown	179	72.8	11.4	6.36
Females				
Infectious, parasitic	10	2.8	3.1	0.88
Neoplasms	89	29.9	27.1	1.11
Endocrine, nutritional	14	6.2	3.9	1.58
Blood	4	1.7	1.9	0.91
Mental	18	7.1	8.3	0.85
Nervous, sense organs	64	25.9	15.4	1.69
Circulatory	54	25.0	20.6	1.21
Respiratory	39	18.3	11.9	1.54
Digestive	110	39.6	30.3	1.31
Genitourinary	90	28.5	27.2	1.05
Pregnancy	239	60.0	60.6	0.99
Skin	39	12.8	11.1	1.16
Musculoskeletal	47	17.0	13.2	1.28
Congenital	1	0.4	0.6	0.69
Perinatal	0	0.0	0.0	0.00
Ill Defined	50	18.8	12.5	1.51
Injury, poisoning	22	8.9	13.5	0.66
Contact health services	71	23.2	21.3	1.09
Unknown	319	128.2	19.5	6.58

1. Total number of hospitalizations 1995-97

Table 9. Number and average annual rate (per 1000) of hospitalizations for the Métis sample and all Manitobans (15+ years of age) by procedure and sex, 1995-97

Diagnosis	Métis sample		Manitoba Standard rate	Métis / Manitoba
	Number ¹	Standard rate		
Males				
Nervous system	10	2.9	2.6	1.15
Endocrine system	0	0.0	0.2	0.00
Eyes	19	9.1	8.6	1.06
Ears	4	1.3	1.5	0.85
Nose, mouth, pharynx	16	5.6	5.8	0.95
Respiratory system	6	2.1	3.8	0.55
Cardiovascular system	33	14.1	10.9	1.30
Hemic, lymphatic systems	1	0.4	1.4	0.29
Digestive system	104	32.6	35.7	0.91
Urinary system	6	2.5	7.6	0.33
Genital organs	14	4.3	7.8	0.55
Musculoskeletal system	56	18.5	16.5	1.12
Integumentary system	58	17.5	19.3	0.91
Diagnostic, therapeutic	48	23.2	23.5	0.99
None	386	159.5	83.1	1.92
Females				
Nervous system	16	4.6	3.0	1.55
Endocrine system	0	0.0	0.5	0.00
Eyes	22	11.8	10.0	1.19
Ears	3	1.0	1.2	0.87
Nose, mouth, pharynx	11	3.2	4.6	0.70
Respiratory system	4	2.0	2.5	0.80
Cardiovascular system	10	4.5	6.4	0.70
Hemic, lymphatic systems	5	2.0	1.1	1.77
Digestive system	130	46.0	36.6	1.26
Urinary system	8	3.1	3.9	0.78
Genital organs	130	35.8	35.1	1.02
Obstetrical	106	26.4	28.8	0.92
Musculoskeletal system	42	14.4	14.7	0.98
Integumentary system	95	31.1	26.6	1.17
Diagnostic, therapeutic	66	25.5	20.8	1.22
None	632	242.8	105.3	2.30

1. Total number of hospitalizations 1995-97

The procedure rates for Métis women were higher than those for the general Manitoba female population for numerous system groupings. They were at least 25% higher for Hemic and lymphatic (1.77), Nervous (1.55) and Digestive (1.26) systems. Métis women had substantially

lower rates for Cardiovascular procedures (0.70), as well as for procedures on the Nose, mouth and pharynx (0.70).

3.4 Diabetes

3.4.1 Incidence

Among males, the average annual diabetes incidence rate was similar for the Métis and the general Manitoba male population (Métis / Manitoba ratio 0.97) (Table 10). In contrast, Métis women had a higher incidence rate than all Manitoba women (1.63). However, the number of incident cases among the Métis was small, and as a consequence, their rates may be subject to a great deal of variability.

Table 10. Number and average annual age-standardized diabetes incidence rate (per 100,000) for the Métis sample and all Manitobans (15+ years of age) by sex, 1995-97

Sex	Métis		Manitoba		Métis / MB
	Cases ¹	Incidence Rate	Cases ¹	Incidence Rate	Ratio
Males	14	587.1	6788	606.4	0.97
Females	18	886.5	6906	544.7	1.63

1. Total number of cases 1995-97

3.4.2 Prevalence

The age-standardized prevalence of diabetes among Métis 15 years of age and older as of December 31, 1997 was 9.8% for males and 11.3% for females (Table 11). This was substantially higher than the prevalence among the total Manitoba population (Males 6.1%, Females 5.7%).

The age-specific diabetes prevalence rates are shown in Table 11 and in Figure 4. With the exception of males aged 15-24 years, the prevalence of diabetes among the Métis was higher at every age than for the total Manitoba population. Among the Métis aged 65-74 years, diabetes was in epidemic proportions, with 36.6% of males and 40.0% of females having the disease.

Table 11. Diabetes prevalence (percent) for the Métis sample and all Manitobans by age and sex, December 31, 1997

Age	Métis			Manitoba			Métis / MB
	Cases	Population	Percent	Cases	Population	Percent	Ratio
Males							
15-24	1	189	0.5	408	74661	0.5	0.97
25-34	6	222	2.7	955	74697	1.3	2.11
35-44	8	237	3.4	2233	85487	2.6	1.29
45-54	16	149	10.7	4495	68055	6.6	1.63
55-64	15	92	16.3	5497	44874	12.2	1.33
65-74	26	71	36.6	6168	36753	16.8	2.18
75+	6	27	22.2	4660	27280	17.1	1.30
Total	78	987	7.9	24416	411807	5.9	1.33
Standardized			9.8			6.1	1.61
Females							
15-24	4	182	2.2	549	71002	0.8	2.84
25-34	11	220	5.0	1569	73790	2.1	2.35
35-44	10	256	3.9	2892	84924	3.4	1.15
45-54	18	151	11.9	4139	68195	6.1	1.96
55-64	17	97	17.5	4860	45991	10.6	1.66
65-74	22	55	40.0	6111	43003	14.2	2.81
75+	7	31	22.6	6561	45178	14.5	1.55
Total	89	992	9.0	26681	432083	6.2	1.45
Standardized			11.3			5.7	1.97

3.5 Cancer

3.5.1 Incidence

In the Métis sample only 6 males and 20 females were diagnosed with cancer in the period 1995-97 (Table 12). For Métis men the average annual age-standardized cancer incidence rate was much lower than that for all Manitoba men (Métis / Manitoba ratio 0.17), although for Métis women the incidence rate was slightly higher than for all Manitoba women (Métis / Manitoba ratio 1.07). Compared to all Manitoba women the rate for in-situ cervical cancer was substantially higher among the Métis women (Métis / Manitoba ratio 1.38).

Figure 4. Diabetes prevalence (percent) for the Métis and all Manitobans by age and sex, December 31, 1997

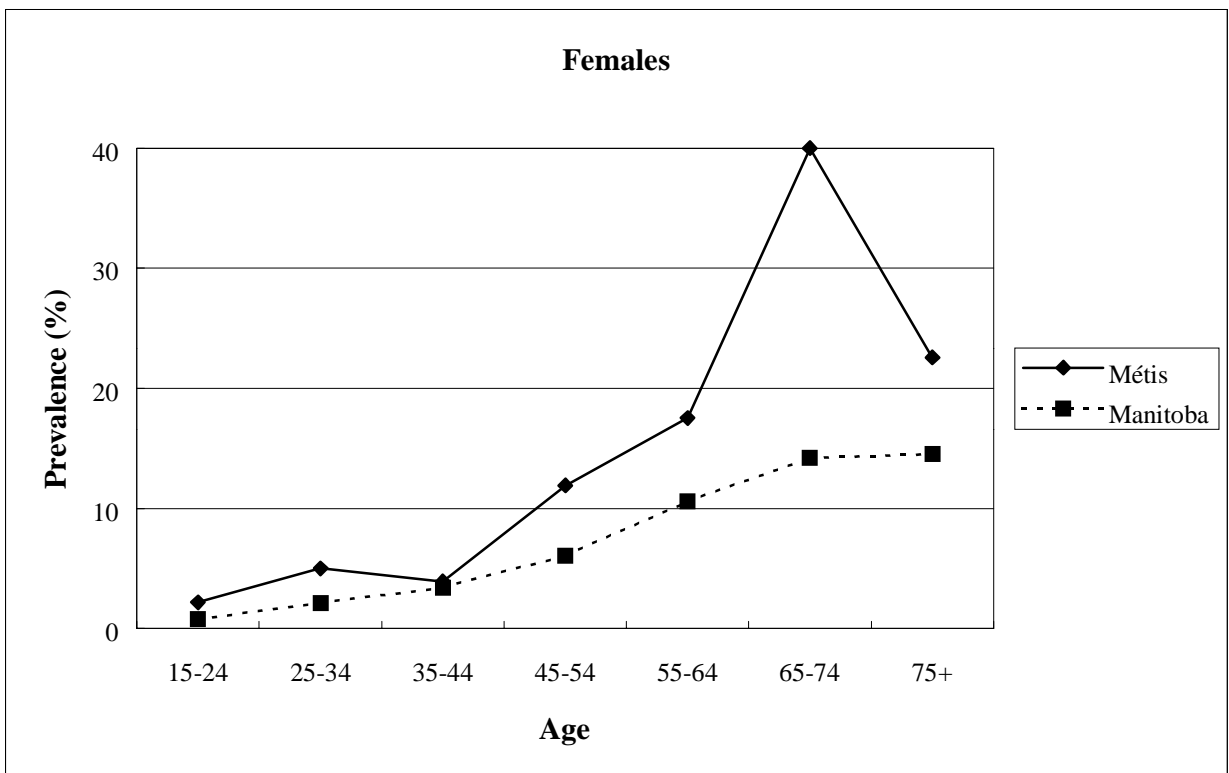


Table 12. Number and average annual age-standardized cancer incidence rate (per 100,000) for the Métis sample and all Manitobans (15+ years of age) by type/site and sex, 1995-97

Type	Métis		Manitoba		Métis / MB Ratio
	Cases ¹	Incidence Rate	Cases ¹	Incidence Rate	
Males					
Malignant	5	177.2	10743	1177.2	0.15
Other	1	39.4	1184	109.5	0.36
Total	6	219.6	11927	1319.9	0.17
Females					
Malignant	13	895.4	9791	781.3	1.15
Cervical, in-situ	5	129.0	1260	93.2	1.38
Other	2	68.9	1681	121.5	0.57
Total	20	1104.9	12732	1031.5	1.07

1. Total number of cases 1995-97

3.5.2 Prevalence

For males, the crude and age-standardized percentages of the Métis population (crude - 2.0%, standardized - 2.9%) who have at some time been diagnosed with cancer are approximately one-third that of all Manitobans (crude – 6.3%, standardized – 7.1%) (Table 13). Although the age-specific prevalence percentages are based on small numbers, at most ages they were lower for the Métis. The exception was for men who were 25-34 years of age.

The crude cancer prevalence percentage among Métis women (7.6%) was somewhat lower than that among all Manitoban women (8.7%). However, when the difference in the age structure between the two groups was taken into account, the prevalence was higher for the Métis (10.5% vs. 8.1%). With the exception of women 75 years of age and over, the age-specific prevalence rates were higher for the Métis than for all Manitoba women. The Métis / Manitoba ratio was particularly high for females aged 15-24 years (3.93).

Table 13. Cancer prevalence (percent) for the Métis sample and all Manitobans by age and sex, December 31, 1997¹

Age	Métis			Manitoba			Métis / MB
	Cases	Population	Percent	Cases	Population	Percent	Ratio
Males							
15-24	0	188	0.0	233	79115	0.3	0.00
25-34	2	225	0.9	410	81418	0.5	1.77
35-44	1	247	0.4	950	91585	1.0	0.39
45-54	1	150	0.7	2069	71269	2.9	0.23
55-64	6	93	6.5	3868	46311	8.4	0.77
65-74	6	71	8.5	7922	37652	21.0	0.40
75+	4	27	14.8	11822	27796	42.5	0.35
Total	20	1001	2.0	27274	435146	6.3	0.32
Standardized			2.9			7.1	0.39
Females							
15-24	5	187	2.7	518	76134	0.7	3.93
25-34	7	226	3.1	2032	81639	2.5	1.24
35-44	14	262	5.3	3778	91080	4.1	1.29
45-54	17	155	11.0	5228	71004	7.4	1.49
55-64	14	97	14.4	5899	47495	12.4	1.16
65-74	11	56	19.6	8551	44057	19.4	1.01
75+	9	31	29.0	13919	46040	30.2	0.96
Total	77	1014	7.6	39925	457449	8.7	0.87
Standardized			10.5			8.1	1.30

1. Includes both malignant and benign neoplasms (ICD-9 140-239)

The number of prevalent cancer cases was too small to allow for an extensive reporting by cancer site. Table 14 shows the age-standardized prevalence by cancer type and for one site, cervical in-situ. For males, the prevalence of both the Malignant (0.42) and Other (0.34) neoplasms was substantially lower in the Métis than in the total Manitoba population. For females, the prevalence of malignant neoplasms was somewhat higher among Métis women (1.29) than all Manitoba women, while for 'Other' neoplasms the prevalence was comparable in the two populations (1.06). One of the reasons the overall prevalence was higher in the Métis women was because of their high prevalence of the in-situ cervical cancers relative to all Manitoba women (1.45).

Table 14. Age-standardized prevalence (percent) of cancer for the Métis sample and all Manitobans by (15+ years of age) type/site, sex

Type	Métis		Manitoba		Métis / MB Ratio
	Cases	Prevalence (%)	Cases	Prevalence (%)	
Males					
Malignant	18	2.7	24887	6.5	0.42
Other	2	0.2	2388	0.6	0.34
Total	20	2.9	27275	7.1	0.41
Females					
Malignant	44	7.2	28519	5.6	1.29
Cervical, in-situ	26	2.3	7337	1.6	1.45
Other	7	0.9	4072	0.8	1.06
Total	77	10.5	39928	8.1	1.30

4. DISCUSSION AND CONCLUSIONS

This pilot study examined the health status of a sample of the Manitoba Métis population, as well as their use of medical services. Of the list of 2,491 members the MMF provided, 87.4% were successfully linked to the MHPR. The percentage of linked records could be increased if the MMF membership file included additional identifying information such as the current residential address of all individuals. In order to maximize the linkage, the PHIN would be required.

The Métis sample that this study was based on was not representative of the overall Manitoba Métis population. The majority of the linked sample (88.4%) were residents of the Interlake RHA, which is primarily rural. It included very few children under the age of 15 years (2.0%), and also under represented the 15-24 year age group. According to the 1991 APS, 35.4% of Manitoba's Métis population were under the age of 15 (2). Furthermore, using the APS, Bruce found that 31% of adult Métis (age 15+) in the Western Canadian provinces were aged 15-24 years (4). In the Manitoba Métis sample only 21.4% were 15-24 years old. Similarly, according to the 1996-97 NPHS 57.6% of the Manitoba Métis were 15-34 years of age, while in our sample only 44.5% were of this age. The Métis population in Manitoba was younger than the general population, as only 36.4% of the latter were aged 15-34 years.

The average annual number of physician visits for the Métis sample and all Manitobans were comparable. In contrast, Waldram et al., using the 1991 APS, found that the Métis and Indian populations in Canada visited physicians somewhat less than the total Canadian population, but they visited nurses more (5). According to the APS, 75.5% of Manitoba Métis reported seeing a medical doctor within the last year (2). Although this is higher than for those Manitobans who identified themselves as North American Indian (63.2%), it is comparable to the latter who lived off of a reserve (73.2%). Waldram found that Aboriginal and non-Aboriginal inner-city residents of Saskatoon had similar physician utilization rates, although for Saskatchewan as a whole during 1986-87, the Indian population utilized physicians somewhat more than non-Indians (6).

The two predominant reasons (based on ICD-9 chapter groupings) for men seeing a physician were the same for both Métis and the general Manitoba population (Circulatory, Respiratory), however, the third most common reason was Musculoskeletal for the Métis and Contact health services for all Manitoba men. The top three reasons for seeing a doctor were the same for both Métis and all Manitoba women (Contact health services, Genitourinary, Respiratory), although the order of the latter two was reversed for all Manitoba women. In Saskatchewan, the main reasons for registered Indians visiting a physician were acute respiratory infection, contact health services, and ill-defined conditions (7). It should be noted that the latter were based on the entire population, not just those 15 years of age and over, and the reason for the visits were broken down into finer diagnostic categories than in the current study.

Relative to all Manitobans, doctor visit rates for Endocrine and nutritional disorders were 96% higher for Métis women and 44% higher for Métis men. This no doubt reflects their higher diabetes rates. Both Métis men and women also saw physicians more frequently for Circulatory problems (Métis / Manitoba ratio - Males 1.30, Females 1.44). Visits for Genitourinary problems (1.39) were also high for Métis males relative to all Manitoba men, as were Respiratory problems for Métis females. In contrast, the Métis had fewer visits for Neoplasms (males 0.58, females 0.74), Other (males 0.63, females 0.72) and Infectious and parasitic (males 0.64, females 0.67) diagnoses. For males, the lowest Métis / Manitoba ratios occurred for Blood disorders (0.39) while Métis females also had lower rates for Mental diagnoses (0.72).

Although the physician visitation rate of the Métis was similar to that of the total Manitoba population, their hospitalization rate was higher. The higher rates among the Métis were observed in most age groups. In Saskatchewan, in 1985-86, all the age-specific hospitalization rates were higher for Registered Indians than the total population (7). The differences were substantially greater than those observed between the Métis and the general Manitoba population. The James Bay Native population also had higher hospitalization rates than the total Quebec population (8).

We have presented results on the reason for hospitalization, but it needs to be recognized that for many of the causes the results are based on small numbers and, therefore, the rates may be subject to a great deal of variability. Relative to the general Manitoba male population, Métis males had high rates of Infectious and parasitic disease and Injuries and poisonings. However, the reverse was seen among females. Métis females had substantially higher rates than all Manitoba women for diseases of the Nervous system and sense organs, Endocrine and nutritional disorders and Respiratory diseases. Although the rates were not age-standardized and included children, for men and women combined registered Indians in both Manitoba and Saskatchewan had substantially higher hospital admission rates for Infectious and parasitic diseases and Respiratory diseases (7). A similar pattern was observed among the James Bay Cree (8). Although not observed in the Manitoba Métis, nor the Manitoba registered Indian population, the Saskatchewan and James Bay Aboriginal populations had high hospitalization rates for Skin disorders compared to the general population in those regions. In contrast, the Neoplasm rates for the Aboriginal populations in Manitoba, Saskatchewan and James Bay were low, which we also observed for Métis males, but not females.

As was the case with physician visits, hospitalizations for Circulatory diseases were somewhat elevated for the Métis relative to all Manitobans (males 1.08, females 1.21). Among James Bay Cree, females but not males had higher hospitalization rates for Circulatory diseases than did the total Quebec population (8). In Manitoba in 1987-88 and in Saskatchewan in 1987-88, the registered Indian population had lower hospitalization rates for Cardiovascular diseases than did the general population (7). Early studies indicated that Aboriginal people were at lower risk of cardiovascular disease than other Canadians, however, in more recent years there have been

suggestions that the rates for the Aboriginals have been increasing relative to those of the Non-Aboriginals (9). Although heart disease is only one component of Cardiovascular diseases, results from the recent FNIHRS indicate that Aboriginal people reported higher rates of 'heart problems' than the Canadian national population and that the proportion with heart problems increased since the 1991 APS (10). The higher Cardiovascular disease rate in Manitoba Métis may be specific to them, or perhaps reflects the generally increasing risk of Cardiovascular disease among Aboriginal populations.

The Métis also tended to have somewhat elevated physician and hospitalization rates for digestive diseases. This may have arisen partly from the high rates of gall bladder and biliary tract disease that have been often reported for Native populations in Canada and the United States (9). Physician visit rates for Injuries and poisonings were only slightly higher for the Métis than the general Manitoba population. However, in terms of hospitalizations Métis males did have substantially higher rates for Injuries and poisonings than did the overall Manitoba population. Young (9) has documented the generally high rates of injury among North American Aboriginal populations.

Although based on a small number of cases, the incidence of diabetes among Métis males 15 years of age and over in 1995-97 was slightly lower than among all Manitoba males, while for females it was markedly higher. There have been no reports on the incidence of diabetes in the Métis population, although the incidence of diabetes for the Treaty Status First Nations population in Manitoba 25 years of age and over has been reported to be 2.5 times higher than that for the Manitoba population as a whole (11). Schraer et al, reported that the incidence of diabetes among Alaskan Natives for 1986-93 was 150 per 100,000 people, which is substantially lower than what we found, not only for the Metis, but also for the Manitoba population generally (12). Unlike the Métis, the 1998 incidence of diabetes in the Status Indian population in Manitoba was higher than in the non-Status population for both males and females (J. Griffith - personal communication). These results suggest that the current risk of diabetes is lower for the Métis than for the First Nations population.

The crude diabetes prevalence rates for Métis men and women in our sample were 7.9% and 9.0%, respectively. In contrast to incidence, both Métis men and women had approximately a 40% higher crude prevalence of diabetes than did the general Manitoba population. The differences among the age-standardized rates for the two populations were even greater. The higher prevalence of diabetes among the Métis would have contributed to their high rates of physician visits and hospitalizations for Endocrine disorders. The high diabetes prevalence rate for the Métis men suggests that the low observed incidence rate may have been a statistical artifact resulting from the small number of cases on which it was based.

According to the 1991 APS the prevalence of diabetes among Manitoba's Métis was 5.4%, which is substantially lower than that of the Manitoba Métis sample used in this study (8.4%) (2). Also, the prevalence of diabetes among all Manitobans in this study (6.1%) was double that found in the 1991 General Social Survey (3.0%) (4). These surveys relied on self-reported physician diagnosed diabetes, while the Manitoba diabetes database is based on physician claims and hospital discharge information (13), and this may have accounted for the differences in rates. The fact that our prevalence estimates were for the period 1995-97 and the estimates from the APS were from 1991, may also have contributed to the different results, as there have been indications that the prevalence of diabetes has been increasingly rapidly among Aboriginal people in Manitoba and elsewhere (14-17).

Using the 1991 APS, Bruce found that the prevalence of diabetes among Métis in Western Canada (Manitoba, Saskatchewan, Alberta) was 6.1%, which was approximately twice the rate of the general population in Western Canada (4). Although Bruce did not report the results for Manitoba separately for males and females, for Western Canada the Métis / general population prevalence ratios were 1.4 for males and 2.5 for females. The much lower ratio found for females in our current study (1.45) resulted primarily from the fact that the prevalence of diabetes in the general Manitoba population was substantially higher in the Manitoba diabetes database than that reported in the Statistics Canada's 1991 General Social Survey, which was what Bruce used (4). The higher diabetes prevalence rates for females than males was also found for all Western Canadian Métis (4) and for Aboriginal populations generally (9,19,20). This is in contrast to Non-Aboriginal populations where the male and females rates tend to be similar.

The higher prevalence of diabetes in the Métis population compared to the general Manitoba population was observed in virtually every age group. In some age groups it was 2-3 times higher. This is in keeping with the results reported by Bruce for Western Canada (4). The FNIRHS also showed that the prevalence of diabetes was higher at all ages for the Aboriginal people relative to the total Canadian population (1). Among the Métis in our sample aged 65-74 years, diabetes reached epidemic proportions with 36.6% of males and 40.0% of females having the disease. Blanchard et al. reported a similar prevalence rate among Manitoba Status Indians of this age group (14).

A high prevalence of diabetes has been reported for the Aboriginal population in Manitoba (2,14) and Canada generally (1,2,16). According to the APS, the prevalence of diabetes in the Manitoba Métis was lower than that for Manitobans who were North American Indians (9.0%) (2). Among the latter, those living on a reserve had a higher prevalence of diabetes (10.9%) than those who were not (7.0%). Many of those not living on reserves would have been living in urban areas. Bobet, in her analysis of the 1991 APS, found that First Nations people living in rural areas had a higher prevalence of diabetes than those living in urban areas (20). For Métis in Western Canada, Bruce found that those living in rural areas had a higher prevalence of diabetes (7.1%) than those living in urban areas (5.7%) (4). The majority of the Métis included in this study lived in rural areas. If Bruce's finding is valid for Manitoba, it may be that the diabetes prevalence estimates based on this sample may overestimate the prevalence rates for all Manitoba Métis. When a full listing of the MMF membership is available it will be possible to address this issue.

For men, the incidence and prevalence of neoplasms were markedly lower for the Métis than for Manitoba men overall. For females, the incidence rates were comparable in the Métis and the general Manitoba female population, however, the prevalence among Métis women was higher. A similar pattern was observed for hospitalizations for neoplasms, but in terms of physician visits for neoplasms, both male and female Métis had rates that were substantially lower than those for all men and women in Manitoba. The incidence and prevalence rates were substantially

higher among Métis females than males. For hospitalizations and physician visits the Métis women also had higher rates than the men, although the differences were small.

There have been no other published studies on cancer incidence among the Métis population. Studies of Manitoba's First Nations populations have reported low cancer incidence and mortality rates among both men and women relative to all Manitoba residents (21,22). The finding that Métis women appear to have cancer incidence rates comparable to that the total female population has to be treated with some caution, as the results are based on small numbers. If this finding can be confirmed among a larger sample of Métis women, it would suggest that they are at higher risk than other Aboriginal women.

For registered Indians living on reserves in Manitoba, Rosenberg and Martel found that during the period 1972-91 men had an overall higher cancer incidence rate than women, although for ages 20-49 the rates were higher for women (22). In contrast, in Saskatchewan and Ontario the cancer rates were higher for Indian females than males (23, 24).

Given the small number of incident cases it was not possible to examine site-specific rates in any detail. However, one thing that Métis women appear to have in common with other North American Aboriginal women is their high risk for cervical cancer (25-27). The incidence rates for carcinoma in situ of the cervix was 38% higher among the Métis women than among all Manitoba women. A high incidence of in situ cervical cancer has also been reported for Manitoba's Treaty Status Indians (28). A meta-analysis of studies of cancer incidence in Native populations of Canada and United States indicate that Native women are at increased risk of cervical cancer (26). These findings suggest that like other Aboriginal women, Métis women do not utilize cervical screening to the same extent as non-Aboriginal women.

In the FNIRHS the prevalence of cancer was 1.5% for males and 2.8% for females (10), which is lower than that found among the Métis, particularly for the females. This may be due to the fact that the survey relied on self-report, whereas the results for the Métis were derived from actual cancer registrations. The results for the FNIRHS were compared to those reported in the NPHS and it was found that the cancer prevalence among Aboriginal people relative to all Canadians was 2.0 times higher for males and 1.5 times higher for females (10). This is in contrast to the

results of this study, which found that Manitoba Métis men had lower cancer prevalence than Manitoba men generally.

In conclusion, this pilot study has demonstrated the utility of using Manitoba Health and CancerCare Manitoba databases to describe the health patterns of Manitoba's Métis population and their use of medical services if Métis identifiers can be linked to the databases. The detail of analyses was restricted by the relatively small size of the Métis sample. Should a complete listing of the MMF membership become available, it would be possible to provide a much more detailed description of the health status of the Métis population in Manitoba. Nonetheless, the results of this pilot study have provided insights into Métis health that were hitherto unreported. These results suggest that the health profile of the Métis people is closer to that of the First Nation people, than it is to the general Manitoba population.

Given the paucity of information available on the health status of the Métis people, the linkage of the MMF membership files to the Manitoba administrative databases results in a rich source of data that can be used in the development of health policy, programs and health services for the Métis.

Although there is some sensitivity associated with recording items such as birthplace, race and ethnicity in databases, minority populations are becoming more and more aware of the need of accurate and timely information on the health status of their people in order to facilitate the development of health policy and programs and for the planning of health services. As such, it would be extremely useful if databases, such as those maintained by Manitoba Health and CancerCare Manitoba, included such information.

5. REFERENCES

1. First Nations and Inuit Regional Health Survey National Steering Committee. First Nations and Inuit Regional Health Survey. 1999.
2. Statistics Canada. 1991 Aboriginal Peoples Survey. Language, Tradition, Health, Lifestyle and Social Issues. Ottawa: Statistics Canada, 1993. [Cat. No. 89-533].
3. Statistics Canada. National Population Health Survey 1996-97 Public Use Microdata File.

4. Bruce SG. Prevalence, Risk Factors and Impact of Diabetes among the Western Canada Métis. PhD Thesis. Winnipeg, University of Manitoba, 1999.
5. Waldram JB, Herring DA, Young TK. Aboriginal Health in Canada. Toronto: University of Toronto Press, 1995.
6. Waldram JB. Physician utilization and urban native people in Saskatoon, Canada. *Soc Sci Med* 1990;30:579-89.
7. Muir BL. Health Status of Canadian Indians and Inuit - 1990. Ottawa: Health and Welfare Canada, 1991.
8. Robinson E. The health of the James Bay Cree. *Can Fam Physician* 1988;34:1606-13.
9. Young TK. The Health of Native Americans. New York: Oxford University Press, 1994.
10. Young TK, O'Neil JD, Elias B, Leader A, Reading J. Chronic Diseases. In First Nations and Inuit Regional Health Survey National Steering Committee. First Nations and Inuit Regional Health Survey, 1999:55-86.
11. Manitoba Health. Manitoba's Regional Diabetes Profile. A Statistical Summary. Winnipeg: Manitoba Health, Public Health Branch, Epidemiology Unit and Diabetes Unit, 1997.
12. Schraer CD, Halderson KR, Adler AI, Trimble BA, Mayer AM. Diabetes complications and mortality among Alaska Native: 8 years of observation. *Diabetes Care* 1997;20:314-21.
13. Blanchard JF, Ludwig S, Wajda A, Dean H, Anderson K, Kendall O, Depew N. Incidence and prevalence of diabetes in Manitoba, 1986-1991. *Diabetes Care* 1996;19:807-11.
14. Blanchard JF. Epidemiologic Projections of Diabetes and its Complications: Forecasting the Coming Storm. Winnipeg: Manitoba Health, 1998.
15. Burrows NR, Englgau MM, Geiss LS, Acton KJ. Prevalence of diabetes among Native American and Alaska Natives: 1990-1997. An increasing burden. *Diabetes Care* 2000;24:1786-90.
16. Young TK, Reading J, Elias B, O'Neil JD. Type 2 diabetes mellitus in Canada's First Nations: status of an epidemic in progress. *Can Med Assoc J* 2000;163:561-6.
17. Mokdad AH, Bowman BA, Englgau MM, Vinicor F. Diabetes trends among American Indians and Alaska Natives: 1990-1998. *Diabetes Care* 2001;24:1508-9.
18. Piro MP, Dyck RF, Gillis DC. Diabetes prevalence rates among First Nations adults on Saskatchewan reserves in 1990: comparison by tribal groupings, geography and with Non-First Nations people. *Can J Pub Health* 1996;87:325-8.

19. Bruce SG. The impact of diabetes mellitus among the Métis of Western Canada. *Ethn Health* 2000;5:47-57.
20. Bobet E. Diabetes Among First Nations People. Ottawa: Health Canada, 1998?.
21. Young TK, Choi NW. Cancer risks among residents of Manitoba Indian reserves, 1970-79. *Can Med Assoc J* 1985;132:1269-73.
22. Rosenberg T, Martel S. 1998. Cancer trends from 1972-1991 for Registered Indians living on Manitoba reserves. *Int J Circumpolar Hlth* 1998;57(Suppl 1):391-8.
23. Gillis DC, Irvine J, Tan L, Chiu S, Liu L, Robson D. Cancer incidence and survival of Saskatchewan Northerners and Registered Indians, 1967-1986. *Arctic Med Res* 1991;Suppl:447-51.
24. Young K, Frank JW. Cancer surveillance in a remote Indian population in northwestern Ontario. *Amer J Public Health* 1983;715-20.
25. Irvine J, Gillis DC, Tan L, Chiu S, Liu L, Robson D. Lung, breast and cervical cancer incidence and survival in Saskatchewan Northerners and Registered Indians (1967-1986). *Arctic Med Res* 1991;Suppl:452-6.
26. Mahoney MC, Michalek AM. A meta-analysis of cancer incidence in United States and Canadian Native populations. *Int J Epidemiol* 1991;20:323-7.
27. Nutting PA, Freeman WL, Risser DR, Helgerson SD, Paisano R, Hisnanick J , Beaver SK, Peters I, Carney JP, Speers MA. Cancer incidence among American Indians and Alaska Natives, 1980 through 1987. *Am J Public Health* 1993;83:1589-98.
28. Young TK, Kliewer EV, Blanchard J, Mayer T. Monitoring disease burden and prevention behavior for a total population using data linkage: cervical cancer among Aboriginal people in Manitoba, Canada. *Am J Public Health* 2000;90:1466-8.

APPENDICES

Appendix 1. Aggregation of Diagnostic and Procedure Codes

Table A.1 Aggregation of diagnostic codes, International Classification of Diseases, 9th Revision

Abbreviation	ICD Chapter Heading	ICD Codes
Infectious	Infectious and parasitic diseases	001-139
Neoplasms	Neoplasms	140-239
Endocrine	Endocrine, nutritional and metabolic diseases, and immunity disorders	240-279
Blood	Diseases of blood and blood-forming organs	280-289
Mental	Mental disorders	290-319
Nervous, sens	Diseases of the nervous system and sense organs	320-389
Circulatory	Diseases of the circulatory system	390-459
Respiratory	Diseases of the respiratory system	460-519
Digestive	Diseases of the digestive system	520-579
Genitourinary	Diseases of the genitourinary system	580-629
Pregnancy	Complications of pregnancy, childbirth, and the puerperium	630-676
Skin	Diseases of the skin and subcutaneous tissue	680-709
Musculoskeletal	Diseases of the musculoskeletal system and connective tissue	710-739
Congenital	Congenital anomalies	740-759
Perinatal	Certain conditions originating in the perinatal period	760-779
Ill-defined	Symptoms, signs, and ill-defined conditions	780-799
Injuries, poison	Injury and poisoning	800-999
Contact	Influencing health status and contact with health services	V01-V82

Table A.2 Aggregation of procedure codes, International Classification of Diseases, 9th Revision

Abbreviation	Chapter Heading	Codes
Nervous	Operations on the nervous system	1-5
Endocrine	Operations on the endocrine system	6-7
Eye	Operations on the eyes	8-16
Ear	Operations on the ears	18-20
Nose, mouth, ph	Operations on the nose, mouth, and pharynx	21-29
Respiratory	Operations on the respiratory system	30-34
Cardiovascular	Operations on the cardiovascular system	35-39
Hemic, lymph	Operations on the hemic and lymphatic systems	40-41
Digestive	Operations on the digestive system	42-54
Urinary	Operations on the urinary system	55-59
Genital, male	Operations on the male genital organs	60-64
Genital, female	Operations on the female genital organs	65-71
Obstetrical	Obstetrical procedures	72-75
Musculoskeletal	Operations on the musculoskeletal system	76-84
Integumentary	Operations on the integumentary system	85-86
Diag, therapeut	Miscellaneous diagnostic and therapeutic procedures	87-99