THE ADDITIONAL COST OF CHRONIC DISEASE IN MANITOBA

April 2010

Manitoba Centre for Health Policy

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About the Manitoba Centre For Health Policy

The Manitoba Centre for Health Policy (MCHP) is located within the Department of Community Health Sciences, Faculty of Medicine, University of Manitoba. The mission of MCHP is to provide accurate and timely information to health care decision-makers, analysts and providers, so they can offer services which are effective and efficient in maintaining and improving the health of Manitobans. Our researchers rely upon the unique Population Health Research Data Repository (Repository) to describe and explain patterns of care and profiles of illness, and to explore other factors that influence health, including income, education, employment and social status. This Repository is unique in terms of its comprehensiveness, degree of integration, and orientation around an anonymized population registry.

Members of MCHP consult extensively with government officials, health care administrators, and clinicians to develop a research agenda that is topical and relevant. This strength, along with its rigorous academic standards, enables MCHP to contribute to the health policy process. MCHP undertakes several major research projects, such as this one, every year under contract to Manitoba Health (MB Health). In addition, our researchers secure external funding by competing for research grants. We are widely published and internationally recognized. Further, our researchers collaborate with a number of highly respected scientists from Canada, the United States, Europe and Australia.

We thank the University of Manitoba, Faculty of Medicine, Health Research Ethics Board for their review of this project. MCHP complies with all legislative acts and regulations governing the protection and use of sensitive information. We implement strict policies and procedures to protect the privacy and security of anonymized data used to produce this report and we keep the provincial Health Information Privacy Committee informed of all work undertaken for MB Health.

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If we have inadvertently omitted acknowledging anyone, it is not because your contribution was not valued.

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Executive Summary

Many Manitobans have a chronic disease—indeed in some age groups most Manitobans have a chronic disease. This places a burden on them and on the healthcare system. Manitoba Health asked the Manitoba Centre for Health Policy to look at the cost of chronic disease and describe how much more it costs to provide healthcare to people who have one of five chronic conditions in comparison with others who do not. In this report, we compare the costs of healthcare for people with arthritis, asthma and chronic obstructive pulmonary disease (COPD), coronary heart disease, diabetes, and stroke with those who do not have the condition. Not surprisingly we find that the costs of healthcare are greater for those with a chronic condition, but we are now able to quantify these additional costs and compare them across diseases and areas. If we can find ways to prevent chronic diseases (or at least reduce their prevalence), we can determine the impact of this on the cost of healthcare.

In this report, we have not limited our cost estimates to the cost of the chronic disease alone; for example, we do not report only the cost for diabetes drugs for people with diabetes or the cost of physician visits that are reported by the doctor as being directly related to a stroke. Rather we look at individuals who have one of these five conditions and compare all of their healthcare costs to those who do not have the condition. And we do this in two ways. First, we compare them to an age and sex matched cohort of other Manitobans—for example all 50 year old men with diabetes are matched with 50 year old men without diabetes—and we look at the differences between the group that has the condition and the age–sex matched group that does not have it. This provides us with a direct comparison of people with and without the condition. We also compare the cost of healthcare for all Manitobans who have at least one of the conditions with all Manitobans who do not have the condition. We use statistical methods to control for age, sex, and other conditions (i.e., comorbidity) that each individual has to make sure the differences between the two groups are likely associated with the presence or absence of the chronic disease of interest. In addition to looking at total costs we itemize costs for physician services, inpatient and day surgery hospital care, prescription drugs, home care, and personal care home (nursing home) residence.

Using established algorithms and the data repository housed at the Manitoba Centre for Health Policy, we found 119,193 Manitobans over the age of 19 who are being treated for asthma or COPD. On average, these individuals received $8,500 in health services within a two–year period.[1] This compares with $4,900 for a matched cohort of those who do not have asthma or COPD. Similarly, there were 48,000 people with diabetes and their average two year healthcare costs were just under $14,000 in comparison with a little under $6,400 for a matched cohort of people who do not have diabetes.

Table 1 provides a summary of the actual average total costs of healthcare during a two–year period for people who have at least one of the chronic conditions included in this study and a matched cohort of people who do not have the condition.

[1] Throughout this report we present the combined healthcare costs for two years—2005/06 and 2006/07.

Table 1: Actual Two–Year Healthcare Costs for Individuals With a Chronic Condition and a Matched Cohort of those Without the Chronic Condition, 2005/06–2006/07

	People With the Condition	People Without the Condition
Asthma and Chronic Obstructive Pulmonary Disease	$8,509	$4,910
Coronary Heart Disease	16,184	9,384
Diabetes (Definition 2)*	13,998	6,370
Stroke	22,219	10,278

*Multiple definitions for diabetes are used in this report. The one reported here is the most commonly used across Canada.

Source: Manitoba Centre for Health Policy, 2010

Because we use statistical techniques to control for other factors that are expected to affect utilization of health services, we report the majority of the results as ratios rather than dollars. "Adjusted dollars" are not meaningful to planners or others who are interested in the cost of chronic disease as they are not representative of what is actually spent for healthcare. After adjusting for age, sex, and comorbidity, the dollars become relative indicators of how much more is spent providing healthcare to individuals with and without a chronic condition. Ratios allow us to show that, for example, after controlling for age, sex, number of different health conditions, and hypertension, people who are treated for stroke have total costs that are 8.2 times more than all other people in Manitoba.

One of the most interesting–and somewhat surprising–findings of this research is that there are differences in the ratio of costs between people with and without a chronic condition, depending upon where you live in Manitoba. In some regions the ratio is higher than the provincial average and in others it is lower, even after controlling for age, sex, and comorbidity. This cannot be explained by differences in cost structures in the province as we used the same costs for care no matter where a person received their care. In other words, similar people who were treated for similar conditions would be assigned the same cost regardless of whether they were in a small rural hospital or a teaching hospital. Table 2 provides a summary of the ratios for total costs for all regions, comparing the cost of care for people living in a particular region to the provincial average cost. Possible explanations for this include differences in physician practice patterns (e.g., decisions to hospitalize individuals or to use certain prescription drugs), the availability of services (i.e., if services are readily available or are not easily accessible), and the use of community–based services such as self–management programs for people with chronic diseases. This is not an exhaustive list of possible explanations for the inter–regional differences which will require further consideration by analysts and planners in Manitoba Regional Health Authorities.

Table 2: Ratio of the Adjusted Cost of Treating People Living in Each Region With the Condition and the Provincial Average Adjusted Cost for People Without the Condition, Apr 1, 2005-March 31, 2007

After controlling for comorbidity, age, sex, and cases; population: aged 19+ years

RHA	Arthritis	Asthma/ COPD	Diabetes			CHD	Stroke
			Definition 1	Definition 2	Definition 3		
South Eastman	3.05	2.38	4.21	4.55	4.34	5.73	7.62
Central	3.32	2.36	4.02	4.42	4.19	5.83	7.45
Assiniboine	3.59	2.81	4.41	4.73	4.56	5.93	7.38
Brandon	3.80	2.87	4.64	4.90	4.81	6.93	7.88
Winnipeg	3.71	2.59	4.50	4.84	4.67	6.53	8.83
Interlake	3.14	2.23	3.84	4.23	4.03	5.00	6.73
North Eastman	3.17	2.47	3.89	4.29	4.05	5.17	6.57
Parkland	4.11	3.33	5.13	5.68	5.31	6.51	7.79
Nor-Man	3.21	2.28	3.96	4.58	4.13	5.73	6.68
Burntwood	2.56	1.98	3.07	3.55	3.22	4.56	5.85
Manitoba	3.57	2.56	4.32	4.70	4.49	6.22	8.16

* Indicates the area's rate was statistically different from the Manitoba average

Source: Manitoba Centre for Health Policy, 2010

This report includes important information that will be useful in determining the potential healthcare cost impact of programs designed to reduce the **incidence**[2] of chronic disease in Manitoba or to look at alternative ways of managing chronic disease. It provides a precise accounting of healthcare costs for individuals with a chronic condition and compares this with people who do not have the condition, both at a population level and in a matched cohort. Further, it provides details on how healthcare expenditures for treating chronic conditions differ between regions in Manitoba; a result that will require further investigation to see if there may be ways to reduce costs through alternative methods of delivering healthcare. For the first time we are able to quantify the healthcare costs associated with five chronic diseases that affect Manitobans.

[2] Throughout this report, terms in **bold** typeface are defined in the glossary at the end of this report.

Chapter 1: Introduction and Background

Research has shown that chronic disease places heavy burdens on healthcare budgets. It is estimated that across Canada $39 billion or 42% of total direct medical care expenditures are used each year for treating people with chronic health conditions (Mirolla, 2004). A study of the population of Nova Scotia estimated that as much as 60% of total medical expenditures were attributable to people with chronic diseases (Colman, 2002). Yet up to 40% of chronic illness can be prevented (Goetzel, 2001). Previous studies have described costs resulting from disease and illness (Policy Research Division-Strategic Policy Directorate-Population and Public Health Branch-Health Canada, 2002) and the potential impact on physician visits if conditions were eliminated (Rapoport, Jacobs, Bell, & Klarenbach, 2004), but none have looked specifically at the additional costs of healthcare resulting from chronic disease. Approximately 50% of premature deaths and 70% of chronic illnesses in U.S. are preventable by changing behavioral risk factors and the related social and physical systems necessary to achieve and sustain those changes (Mokdad, Marks, Stroup, & Gerberding, 2004). Indeed chronic diseases, which are reaching epidemic proportions worldwide with 80% of chronic disease deaths occurring in low– and middle–income countries, are largely preventable (Jamison et al., 2006). Globally, up to 80% of premature deaths from heart disease, stroke, and diabetes can be averted with known behavioral and pharmaceutical interventions (World Health Organization, 2005). As the costs associated with chronic disease are high and a significant proportion of chronic disease may be preventable, it is important to know the additional costs that result from chronic disease.

We also know that the highest cost users of health services are people with multiple health conditions. For example, Reid et al. (2003) found that over 80% of the heaviest users of physician services had six or more different health conditions. Similarly, Broemeling, Watson, and Black (2005) showed that nearly 30% of people with one chronic condition had six or more chronic conditions. This study found that among people with diabetes, 31% had hypertension and 12% had diabetes, hypertension, depression, ischemic heart disease, and degenerative joint conditions. In a study of the cost of major comorbidity in people with diabetes, Simpson, Corabian, Jacobs, and Johnson (2003) reported that 36% of healthcare expenditures for people with diabetes were actually associated with a **comorbidity**.

Work at the Manitoba Centre for Health Policy (MCHP) (Lix et al., 2006) has resulted in the development of **algorithms** that permit the identification of several chronic health conditions using administrative data. Using this capacity we have assessed whether or not an individual likely has **arthritis**, **asthma** or **chronic obstructive pulmonary disease (COPD[3])**, **coronary heart disease**, **diabetes**, **hypertension**, and/or **stroke**. The algorithms have been applied to the anonymized records in the Manitoba **Population Health Research Data Repository** to identify who has and who does not have one or more of these conditions. We have matched individuals who have at least one of the chronic conditions with those who do not have the condition, thereby enabling us to assess the additional healthcare costs that are attributable to **chronic conditions**. Further, we have looked at the difference in cost for health services across the population to see how much more it costs to care for individuals with chronic conditions.

[3] Although asthma and COPD are different diseases it is often not clinically possible to distinguish between the two conditions.

In this research we have addressed the following key questions:

- How much more does it cost to provide healthcare services for people with chronic conditions when compared to people without chronic conditions?
- Is there variability in the cost of providing healthcare services to people with chronic conditions among the regions in the province even after controlling for different costs of providing services?

We have adopted two approaches in making these comparisons: a case–control approach where individuals with and without a chronic condition are matched based on age and sex, and a population–based approach where we compare the cost of healthcare for the population of individuals with a chronic health condition with the population of those who do not, after controlling for age and sex.

The overall goal of this study is to estimate the additional costs incurred in providing hospital care, physician services, prescription drugs, personal care home residence, and home care to Manitobans who have arthritis, asthma/COPD, coronary heart disease, diabetes, and/or stroke.

The specific objectives were to:

1. Apply algorithms to anonymized population–based records to identify individuals who have arthritis, asthma and COPD, coronary heart disease, diabetes, and/or stroke
2. Match these individuals with others who do not have a chronic condition using matching criteria
3. Apply standard costing approaches to estimate the annual cost of healthcare for physician services, hospital care, prescription drugs, personal care home residence, and home care for the individuals with each chronic condition and those without it
4. Compare the costs of care for a two year period between those with and those without a chronic condition
5. Compare healthcare cost among people living in different Regional Health Authorities.

Costing

In preparing this work, we have used healthcare costing approaches that are well established at MCHP (Finlayson et al., 2007; Jacobs et al., 2000). **Standard** (**or average) costs** are assigned for inpatient hospital care and day surgery, home care services, and personal care home residence. **Micro–costs** (**or user–specific costs**) are assigned for physician services and prescription drugs. Further information on the costing methods is provided in Chapter 2.

Comparing Health Services Use by Manitobans With and Without a Chronic Disease

Approximately 800,000 people were potential subjects in this study of arthritis, coronary heart disease, diabetes and stroke, while approximately 700,000 were considered for asthma and COPD. In the following table, we present the count of the number of people in our study who did and did not have the chronic condition indicated. The total population included in the study varies by condition because of different lower age limits that are applied as well as the application of inclusion/exclusion criteria. See Chapter 2 for a description of the age limits and the selection criteria.

In Table 1.1, we present descriptive data regarding Manitobans who have and do not have a chronic condition, and the proportion of these individuals who received healthcare between April 1, 2005 and March 31, 2007. For each condition we indicate the number of Manitobans who had or did not have the condition and the number and percent who had costs for each of the health services. This table reflects two features of chronic disease in Manitoba. First, it shows prevalence ranging from 26,493 people being treated for stroke to 249,402 receiving treatment for arthritis. This means that nearly one–third of the persons studied have arthritis, 17% have asthma or chronic obstructive pulmonary disease, between 6% and 8% are being treated for diabetes, and 3% are receiving treatment for stroke. Second, people with these chronic conditions are heavy users of the healthcare system in all categories of service as indicated by the proportion using the different categories of service.

It should be noted that individuals with multiple chronic conditions will be included multiple times in this table. For example, a person with diabetes and CHD will be counted in both categories. In addition, the columns of people without the condition include all of those people who do not have the particular condition but may have another chronic condition. For example, the "People Without Arthritis" columns will include people who have diabetes but not those with arthritis. See Appendix 1 for counts of people with multiple chronic conditions.

Table 1.1: People With and Without Chronic Conditions in Manitoba and the Proportion with Healthcare Cost, 2005/06–2007/08

Arthritis

	People With Arthritis (n=249,402)		People Without Arthritis (n=520,826)	
	# with cost*	% with cost**	# with cost	% with cost
Physicians	245,308	98.4	463,360	89.0
Prescription Drugs	233,063	93.4	403,649	77.5
Hospital	80,585	32.3	93,963	18.0
Personal Care Home	4,153	1.7	1,961	0.4
Home Care	23,167	9.3	13,404	2.6
Any	246,160	98.7	471,196	90.5

Asthma and COPD

	People With Asthma/COPD (n=119,193)		People Without Asthma/COPD (n=580,434)	
	# with cost	% with cost	# with cost	% with cost
Physicians	117,224	98.3	530,851	91.5
Prescription Drugs	113,924	95.6	470,720	81.1
Hospital	39,027	32.7	125,078	21.5
Personal Care Home	1,681	1.4	4,472	0.8
Home Care	11,234	9.4	25,241	4.3
Any	117,757	98.8	537,478	92.6

Coronary Heart Disease

	People With CHD (n=57,170)		People Without CHD (n=746,149)	
	# with cost	% with cost	# with cost	% with cost
Physicians	56,791	99.3	684,976	91.8
Prescription Drugs	55,936	97.8	611,792	82.0
Hospital	25,537	44.7	155,099	20.8
Personal Care Home	2,299	4.0	3,920	0.5
Home Care	11,552	20.2	25,665	3.4
Any	56,897	99.5	693,555	93.0

Diabetes, Definition 1[†]

	People With Diabetes (n=63,878)		People Without Diabetes (n=731,663)	
	# with cost	% with cost	# with cost	% with cost
Physicians	63,347	99.2	670,661	91.7
Prescription Drugs	62,674	98.1	597,637	81.7
Hospital	24,237	37.9	157,406	21.5
Personal Care Home	1,344	2.1	5,034	0.7
Home Care	9,046	14.2	28,623	3.9
Any	63,610	99.6	679,060	92.8

Table 1.1: People With and Without Chronic Conditions in Manitoba and the Proportion with Healthcare Cost, 2005/06–2007/08 (continued from page 4)

Diabetes, Definition 2

	People With Diabetes (n=48,268)		People Without Diabetes (n=752,495)	
	# with cost	% with cost	# with cost	% with cost
Physicians	48,054	99.6	691,150	91.8
Prescription Drugs	47,691	98.8	617,448	82.1
Hospital	18,962	39.3	163,756	21.8
Personal Care Home	1,035	2.1	5,423	0.7
Home Care	7,652	15.9	30,136	4.0
Any	48,164	99.8	699,728	93.0

Stroke

	People With Stroke (n=26,493)		People Without Stroke (n=781,089)	
	# with cost	% with cost	# with cost	% with cost
Physicians	26,267	99.1	719,758	92.1
Prescription Drugs	25,546	96.4	646,399	82.8
Hospital	11,843	44.7	171,824	22.0
Personal Care Home	2,394	9.0	3,731	0.5
Home Care	6,782	25.6	30,175	3.9
Any	26,322	99.4	728,389	93.3

*Of all the people with the chronic condition, this is the number of people who had some cost for the healthcare service indicated.
**Of all the people with the chronic condition, this is the proportion of people who had some cost for the healthcare service indicated.
† Multiple definitions have been used for diabetes to be compatible with other studies at MCHP and in other provinces. See Chapter 2 for further information.

Source: Manitoba Centre for Health Policy, 2010

Organization of this Report

In the following pages, we discuss the methods we used to determine the cost of healthcare for Manitobans and make cost comparisons for people with and without each of the chronic conditions being studied. Then, we present the comparative costs in various ways. Finally, we discuss these findings and raise a number of questions for future study.

Chapter 2: Methods

DATA

The data used in this report come from the Population Health Research Data Repository (Repository) housed at MCHP. Data are provided to MCHP by Manitoba Health (MB Health) after identifying information (e.g., names, street addresses, and personal health information number) is removed or encrypted. Therefore, the Repository contains only anonymized information, which is linkable across the following data files:

1. Registry—this file includes anonymized information on all Manitobans eligible for healthcare services. It is used to identify individuals' region of residence, age, and sex.
2. Hospital discharge abstracts—this file contains a record of every hospitalization that was completed in the year of interest and includes both inpatient care and day surgery. It does not include information regarding care provided in the emergency department or in hospital–based outpatient clinics. This file was used to determine the cost of providing hospital care to individuals.
3. Physician services—this file contains records of most encounters a person has with a physician, including office visits and services received in hospitals. This file records the payments made to physicians for the services they provide. Some physicians are not paid on a fee–for–service basis. Many, although not all, physicians who provide services through alternative payment mechanisms submit records that report the services that they have provided. This file was used to determine the cost of physician services for individuals.
4. Pharmaceuticals—this file contains records on all prescriptions dispensed by pharmacies in Manitoba. When a prescription is dispensed, information on the drug, its dosage, and cost is entered. These data were used to determine the cost of prescription drugs for individuals. Note that this file does not contain records of over–the–counter medication use.
5. Personal Care Home (Nursing Home) Residence—this file contains records of the number of days individuals are resident of a Personal Care Home (PCH) in Manitoba. These data, along with PCH cost data, were used to determine the **per diem** cost of residing in a PCH and to assign this cost to individuals.
6. Home Care—this file contains records of the opening date and closing date of all Home Care episodes, providing the number of days of care. These data, along with home care financial data, were used to determine the per diem cost of home care and to assign this cost to individuals.

The use of data from Manitoba Health is reviewed by the Health Information Privacy Committee, and the project was approved by the University of Manitoba Health Research Ethics Board. The data analysis for this report was generated using SAS/STAT software, Version 9.1 of the SAS System for Unix.

DEFINITIONS OF CHRONIC CONDITIONS

We identified from our population–based pool of Manitoba residents those people with at least one of six chronic conditions. We used algorithms developed by Lix et al. (2006). The chronic conditions identified are: arthritis, asthma and chronic obstructive pulmonary disease (COPD), diabetes, coronary heart disease, hypertension[4], and stroke[5]. A variety of algorithms are available for each condition—investigators may select the definition that best suits the requirements of a particular research project. For this research, we selected the definition that had the highest Youden's index, that is, the definition that was found to have the highest combined sensitivity and specificity in the work done by Lix. Our rationale for selecting this approach was that for a large population–based study such as this, a definition that encompasses two measures (sensitivity and specificity) will be most likely to provide unbiased estimates. Alternative choices were definitions that had the highest **sensitivity**[6], the highest **specificity**[7], the highest **Kappa** statistic[8], the highest **positive predictive value**[9], or the lowest **negative predictive value**[10]. In cases where two definitions have the same Youden's index, of those two definitions, the one with the highest Kappa was selected.

There was one exception to this rule. For diabetes, we did use the definitions with the highest Youden's Index (Definition 1), but also two alternative definitions. The first alternative definition is frequently used in national studies and does not require the use of prescription drug data (Definition 2). This definition is commonly referred to as the National Diabetes Surveillance System (NDSS) (Health Canada, 2003). The second alternative is one that has been adopted by another study recently published by MCHP (Definition 3) (Fransoo et al., 2009). We present findings using this latter definition to be consistent with these other MCHP studies.

See Table 2.1 for the specific definitions that were used in this study.

[4] The additional cost of hypertension itself is not presented in this report. After discussion with the advisory group, it was determined that the cost of treating hypertension itself is not high; but the conditions that it contributes to (i.e., coronary heart disease, diabetes, and stroke) result in high cost. As a result, hypertension is included as a covariate in the models for these conditions.

[5] See Appendix 2 for details regarding the ICD codes and prescription drugs that were used in defining the chronic conditions.

[6] Sensitivity is a measure of the probability of correctly identifying that a person has the condition.

[7] Specificity is a measure of the probability of correctly identifying that a person does not have the condition.

[8] The Kappa statistic is a measure of the agreement between two independent observations.

[9] The positive predictive value is the proportion of people who have the condition who are correctly identified as having it.

[10] The negative predictive value is the proportion of people who do not have the condition who are correctly identified as not having it.

Table 2.1: Chronic Disease Definitions Used in This Study

Condition	Criteria for being defined as having the condition	Time period within which the criteria was applied	Minimum age as of March 31, 2005
Arthritis	1 or more hospitalizations OR 2 or more physician visits	5 years 2000/01-2004/05	19 years old
Asthma/Chronic Obstructive Pulmonary Disease	1 or more hospitalizations OR 1 or more physician visits OR 1 or more prescriptions	5 years 2000/01-2004/05	24 years old
Coronary Heart Disease	1 or more hospitalizations OR 1 or more physician visits	5 years 2000/01-2004/05	19 years old
Diabetes, Definition 1	1 or more hospitalizations OR 1 or more physician visits OR 1 or more prescriptions	2 years 2003/04-2004/05	19 years old
Diabetes, Definition 2	1 or more hospitalizations OR 2 or more physician visits	2 years 2003/04-2004/05	19 years old
Diabetes, Definition 3	1 or more hospitalizations OR 2 or more physician visits OR 1 or more prescriptions	3 years 2002/03-2004/05	19 years old
Hypertension	1 or more hospitalizations OR 1 or more physician visits OR 2 or more prescriptions	2 years 2005/06-2006/07	19 years old
Stroke	1 or more hospitalizations OR 1 or more physician visits	5 years 2000/01-2004/05	19 years old

Source: Manitoba Centre for Health Policy, 2010

COSTING METHODS

We adopted costing methods that are consistent with other work recently done at MCHP (Finlayson et al., 2007). Costs were assigned to individuals for five types of health services: physician services, hospital care, personal care home (PCH) residence, home care, and prescription drugs. Micro–costing is done for physician services and prescription drugs, while standard (or average) costing is used for hospital care, personal care home residence, and home care. We determined the cost for these services for every person in Manitoba for the period April 1, 2005 to March 31, 2007. A brief description of how the different types of costs were calculated follows.

Physician Services

The Physician Services database held at MCHP records most encounters an individual has with a physician, both in the physician's office and in other settings such as hospitals and personal care homes. Physicians submit a claim (bill) to Manitoba Health (MB Health) for each service they provide. Included with the claim is a tariff code that is used by MB Health to determine the fee that is paid to the physician. Most physicians who are not paid on a fee–for–service basis submit "**shadow claims**" to report the services they provide. To determine the cost of physician services for an individual, we sum the fees paid to all physicians during a given period of time.

Hospital Services

The Discharge Abstract Database (DAD) held at MCHP includes records for all hospital inpatient care and day surgery that occurs in the province. When a person is discharged from a hospital, a computerized record is created that reports diagnoses and procedures performed. On an annual basis, MB Health sends a file of all hospitalizations that occurred during the year to the Canadian Institute for Health Information (CIHI). CIHI applies an algorithm to each record to assign a Resource Intensity Weight (RIW) to each case. The RIW reflects the relative resources (i.e., the cost) of one type of case relative to another. For example, hospitalization for a hip replacement in an otherwise healthy adult is expected

to cost approximately 2.8 times more than a similar person who is treated for chronic bronchitis. The RIW is multiplied by a standard cost (the "cost per weighted case") which was previously calculated (Finlayson, Reimer, Dahl, Stargardter, & McGowan, 2009).[11] This results in an average cost for a particular hospitalization: an otherwise healthy adult who is treated for tuberculosis is assigned a cost of $4,553, cleft lip and palate repair in an otherwise healthy child is assigned a cost of $2,480, and angiography that is done as a day procedure is assigned a cost of $488. In determining the full cost of care, we added an "overhead" rate of 19.1% to all costs.[12] Note that the hospital costs do not include physician services, which are calculated separately, as described above.

There is one type of service provided by hospitals that is not included in these costs—visits to ambulatory clinics including the emergency department care. If an individual receives services in one of these clinics (for example physical therapy provided in a hospital to an outpatient or a visit to the emergency department), we do not have records of these services and, therefore, are unable to assign a cost. This is a limitation of the data and will result in an under–estimate of total costs of hospitalization.

Personal Care Home Residence

The Personal Care Home (PCH) database contains records reporting the number of days that a person is resident of a PCH. We calculated an average per diem for residence in a PCH by dividing the total expenditures for these facilities for a year by the total number of resident days. The cost for any individual is determined by multiplying this mean cost by the number of days the person was a PCH resident.

A limitation of this approach is that it does not take into account the level–of–care required for any given individual. Some people require greater care than others, but our data do not reliably report this information.

Home Care Services

The Home Care database contains records of the opening and closing date for all home care episodes. We calculated the average per diem for home care services by dividing total expenditures for the home care program by the total number of days individuals had an open file. The cost for any individual is determined by multiplying this mean cost by the number of days the person had an open home care file.

The data we have available to us reports neither the frequency nor intensity of home care services. For example, one person could be receiving daily nursing care for a month while another could be receiving weekly home support (e.g., light housekeeping) for a month. Both of them would be assigned the same cost, i.e., the per diem for each day they had an open file.

Prescription Drugs

When drugs are dispensed in pharmacies in Manitoba, a record is created in the **Drug Plan Information Network** (**DPIN**). For each prescription that is dispensed, the charge for the drug is recorded in the

[11] Briefly stated, the total direct cost for inpatient care in Manitoba is divided by the sum of the weights (the "total weighted cases") to produce the cost per weighted case.

[12] "Overhead" costs refer to the administrative and support services in hospitals. These services support all functions of the hospital and include hospital administration, human resources, information technology, physical plant (including heating, electricity, etc.), health records, and others.

database. An average dispensing fee is then added to this charge to provide a total expense for a dispensed prescription. The prescription drug cost for an individual is the total expenditure for all dispensed prescriptions for a given period of time.

Note that drugs dispensed as part of a hospitalization are not included in this database, but the cost of the drugs is included in hospitalization costs.

COMPARISON GROUPS

Our primary research question is "How much more does it cost to provide health services to people with a chronic condition than to people who do not have the condition and does the average cost vary among Manitoba regions?" We decided to make this comparison in two ways: by looking at a matched cohort of people and at the entire population of Manitoba. This provided two different perspectives on the difference in cost. The matched cohort compares those who have a particular chronic condition with a similar group of people who do not have this condition. The population–based comparison shows the additional cost of these chronic conditions for the entire population who does not have the condition.

In order to make a comparison between two similar groups (i.e., the matched cohort approach), it was necessary to match one or more people who have the chronic condition with one or more people with similar characteristics who do not have the condition. There are a variety of ways to do this matching including "hard" matching where people are matched exactly on selected characteristics (e.g., age, sex, location of residence, socioeconomic status [SES]) and a statistical approach called "propensity score matching." Propensity score matching allows the inclusion of many characteristics and results in identifying the closest match possible for each individual with a chronic condition. Initially, we had intended to use propensity score matching to create our two cohorts. Unfortunately given the size of our sample (e.g., 119,193 people identified as having asthma or COPD), the demands on our computing systems were too great. We therefore decided to use a hard matching approach. While it would have been desirable to have matched on a variety of characteristics, again because our sample size was so large, computing capacity precluded this; and we were only able to match on age and sex. This introduces the possibility that two people of very different characteristics (other than age and sex) could be matched—for example someone living in a wealthy urban area is matched with someone from a least affluent rural area. Had we been making comparisons between the two individuals, this would be misleading. However because we look at the costs as a group and given that the sample size is so large, it's unlikely that matching on only two characteristics introduced any systematic bias into our results.

The next step was to determine the number of people who could be matched to each person who has a chronic condition. This was dictated by the prevalence of each condition. For example arthritis is so prevalent that in some age groups, there were more people with arthritis than without. As a result, we were unable to create a matched cohort for arthritis. For the other conditions the matches were: asthma/COPD 1:2, coronary heart disease 1:1, diabetes 1:3, and stroke 1:3.

Only those people who met the criteria for having the chronic condition prior to the costing period were included as cases in the study. The matched controls did not meet the criteria in the period before April 1, 2005 or during the two–year costing period (April 1, 2005 to March 31, 2007). Similarly, in order to be considered part of the population that was compared to those with the chronic condition, an individual could not have met the criteria before or during the costing period (see Figure 2.1).

Figure 2.1: Criteria for Inclusion in the Matched Cohorts and the Population

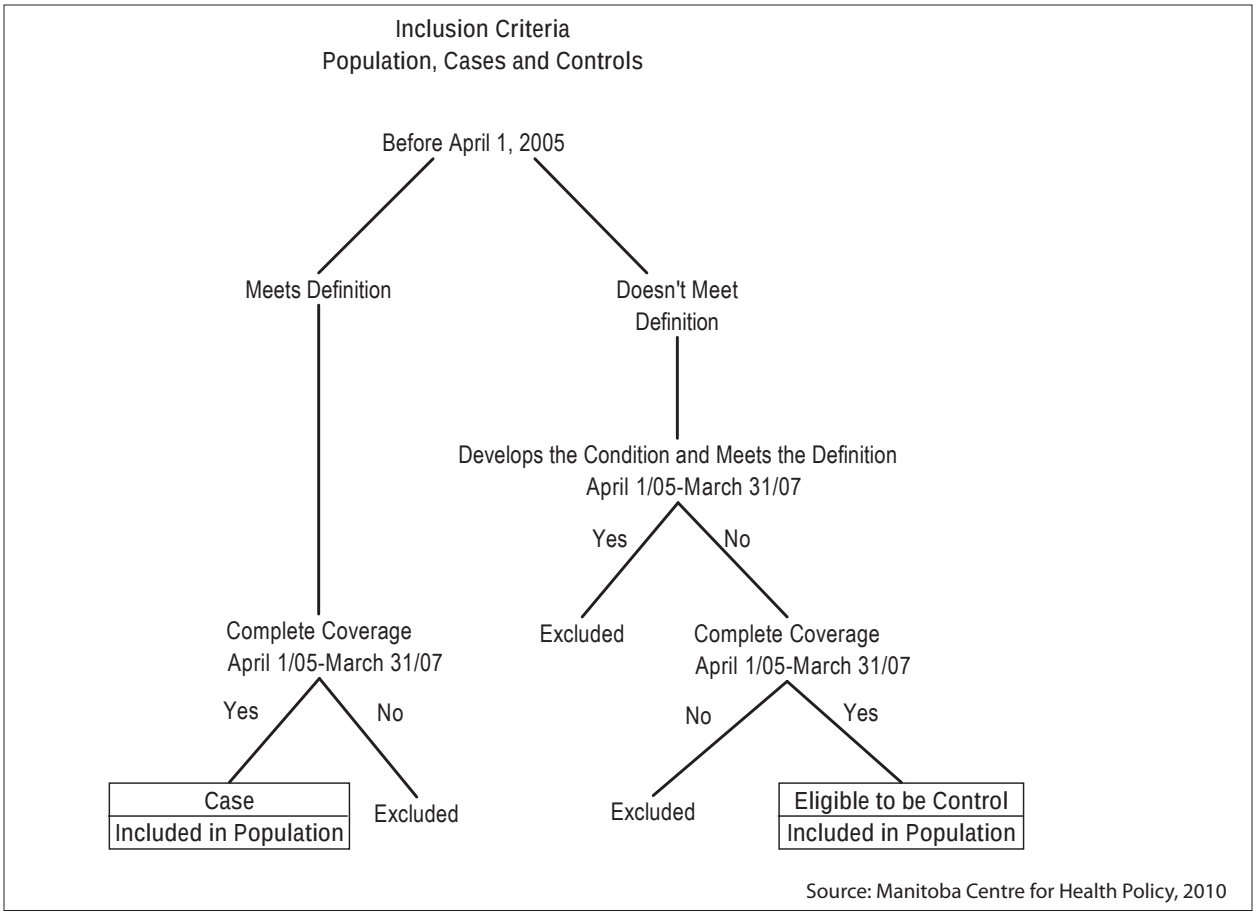


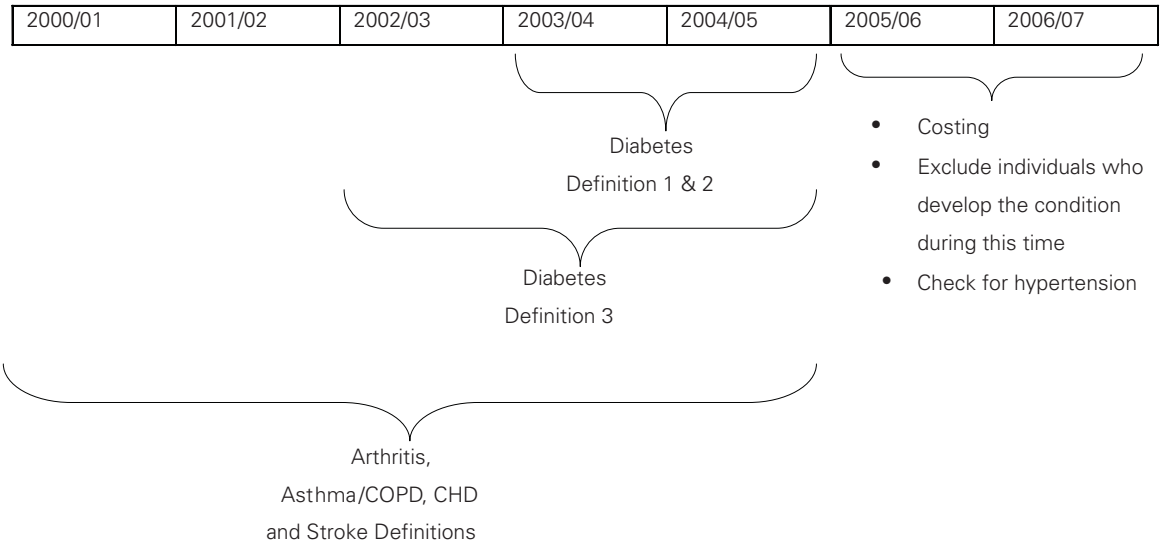
Figure 2.1 provides a graphical depiction of the inclusion/exclusion criteria for the study.

As noted in the figure, identical methods were used for the population–based analysis. The population–based approach allowed us to provide results by RHA. The cohort of those with a chronic condition remained the same; but rather than selecting a match for each individual, we simply compared those living in the region with the chronic condition with those living within the region without the condition.

TIMELINES

As was indicated earlier, we calculated healthcare costs for a two–year period, April 1, 2005 to March 31, 2007. We wanted to ensure that those defined as having the chronic condition had it throughout the period, so we needed to apply the definitions to the years prior to April 1, 2005. For arthritis, asthma/COPD, coronary heart disease, and stroke, this was for five years. For one diabetes definition (#3), this was for three years, and two years for the other two definitions (#1 and #2). We also wanted to ensure that the people who were matched to those who had the condition did not subsequently develop the condition during the costing time. We therefore tested this as well. Figure 2.2 graphically depicts how the timeline for disease definition and costing fit together.

Figure 2.2: Definition and Costing Timeline



Source: Manitoba Centre for Health Policy, 2010

MAKING COMPARISONS

When making comparisons between two groups (e.g., people who have a chronic condition and those who do not), it may be desirable to use statistical techniques to remove the effect of certain characteristics to make the groups as similar as possible except for the characteristic of interest (i.e., presence of the chronic condition). Regression **modelling** allows us to do this (although in our results we also report the crude, unadjusted results as well). This particular analysis required special modelling techniques in recognition of the fact that the data are not normally distributed—many people have very low (or zero) cost while a few have very high cost—and for some services a large number of people have $0 cost.

In creating our models, we wanted to include variables that have been shown to affect the cost of health services. Our earlier work (Finlayson, Reimer, Dahl, Stargardter, & McGowan, 2009) showed clear differences in hospital cost between the sexes and across the lifespan. We also know that having multiple health conditions (in addition to chronic disease) likely affects healthcare costs. Finally, hypertension is one comorbid condition that is often associated with three of the chronic conditions we are investigating (coronary heart disease, diabetes, and stroke). The models for arthritis and asthma/COPD included age, sex, and a measure of comorbidity as covariates. For diabetes, stroke, and CHD, the covariates were age, sex, a measure of comorbidity, and the presence of hypertension in the person during the costing period (2005/06–2006/07).

The most difficult covariate to measure is comorbidity, and there are a variety of potential ways of doing it. We considered using two measures for this research: the **Charlson Index** and **Aggregated Diagnostic Group** (**ADG**) that is calculated using the **Adjusted Clinical Group** (**ACG**) system.[13] The ADG approach has been used in previous work (Finlayson et al., 2007). The ACG system assigns individuals to one of 32 different groups based on their utilization of physician and hospital services over the previous year—these groups are called ADGs. Examples of ADGs are "Time Limited: Major–Primary Infections",

[13] The John Hopkins University Bloomberg School of Public Health, Health Services Research & Development Center. The John Hopkins ACG® Case–Mix System Version 6.0 Release Notes. Editor in Chief: Jonathan P. Weiner. The John Hopkins University. April, 2003.

"Likely to Recur: Progressive", and "Chronic Medical: Stable". ADGs may be collapsed into twelve Major ADGs (MADG), such as "Acute Minor", "Acute Major", and "Likely to Recur". Using a count of the number of different groups to which a person is assigned provides an indication of their level of comorbidity (i.e., the greater the number of groups, the greater the number of health issues). It is important to note that there is no weighting applied to these groups so that all groups are considered equal in terms of their effect on health services utilization. In smaller studies, this could introduce bias into the results; but given the number of subjects in this study, it is unlikely to affect the results. We used the count of the number of ADGs (rather than the number of MADGs) as the measure of comorbidity in our models because the greater number of ACG categories provided more variability in our measure. We also chose not to use the Charlson index. This index is specifically designed to measure comorbidity, but the index and the assigned weights are based upon predicting the cumulative one year probability of mortality given a person's diagnoses. Clearly, probability of mortality measures how sick a person is; but given this was not our outcome of interest, we chose to use the ACG approach. See Table 2.2 for a summary of variables in the models.

Table 2.2: Variables Included in Models

Dependent Variable	Covariates in models for arthritis and asthma/COPD	Covariates in models for coronary heart disease, diabetes and stroke
Two year cost for an individual for each of the health services, and for all health services combined	Age Sex Number of ADGs	Age Sex Number of ADGs Hypertension

Source: Manitoba Centre for Health Policy, 2010

In all our models, the dependent variable is the total healthcare cost for the two–year period (April 1, 2005 to March 31, 2007). The costs were modelled separately for physician services, hospital care, prescription drugs, home care, personal care home residence, and for all services combined.

When creating models, one must always be sensitive to measurement issues, i.e., the data are accurately reflecting what is intended. We are confident that all of the covariates are measuring what is intended, subject to the discussion regarding the count of ADGs above. The measure of expenditures for hospital care and prescription drugs are very precise. However, costs for hospital–based ambulatory care (including Emergency Department services) are not included here. The expenditures for physicians is good although we know that some data are missing in situations where the physician is paid on an alternative payment system and therefore is not required to submit claims to be compensated. We have some evidence that there are inter–regional differences with more data missing from the northern regions than from the south. Personal Care Home costs are reasonably well measured although, as mentioned earlier, there is no measure of intensity included in the cost (i.e., all residents are assigned the same per diem). Similarly, Home Care costs lack any sensitivity to intensity, but also do not reflect frequency of services received. For both PCH residence and home care services, we are confident that, given our large sample size, the results are not biased towards either of the groups. However, smaller, non–population–based studies should be very sensitive to this issue. Subject to the limitations indicated here we expect the total costs are an unbiased and reasonable measure of healthcare resource utilization.

Modelling

A **zero–inflated negative binomial distribution** was used in this project to model the cost of healthcare for people with a chronic disease. This distribution was chosen because of the number of individuals who were assigned a $0 cost for health services—for some of the chronic conditions nearly 80% of the people in the cohort had zero cost for certain health services. This is because this study looked at both those with and without a given chronic condition. The high proportion of people with $0 cost is primarily due to the people who do not have the given chronic condition.

Variables included in the models were age, sex, count of number of ADGs, and condition (i.e., diabetes, asthma/COPD, etc). For coronary heart disease, diabetes, and stroke, hypertension was also included as a covariate. Age and count of number of ADGs were entered in the models as continuous variables; while sex, condition, and hypertension were entered as binary variables.

SAS PROC NLMIXED was used to obtain an adjusted cost (i.e., the expected cost after adjusting for age, sex, and comorbidity) for each individual in our study cohort. For the population–based approach, the adjusted costs were summed for each person in each RHA and divided by the number of those with and without a given chronic condition to obtain the adjusted mean cost. The mean cost for those with a given chronic condition were then divided by the mean cost for those without to obtain the ratio of the means for each RHA. For the matched cohort approach, a similar method was followed except that the adjusted cost for everyone in the province with the chronic condition was summed and the adjusted cost for all of the matches was summed. These totals were divided by the number of people in each group to produce the respective mean cost. The mean cost for those with the condition was divided by the mean cost of the matched cohort to produce the ratio.

Testing for the statistical significance of the ratio of the means for each RHA against the provincial ratio was not straightforward because the statistic (ratio of the means) does not have any theoretical variance or **standard error**. Hence, we used **bootstrapping**[14] to calculate the 95 percentile confidence intervals.

[14] Bootstrapping is a statistical re–sampling approach that in this case is used to develop confidence intervals when we have a small number of observations, and these observations are ratios rather than counts. Basically, the observations are re–sampled multiple times thereby providing multiple datasets from which the confidence intervals can be calculated.

Chapter 3: Results

Introduction

Not surprisingly, our results show what we expected—on average, people who have a particular chronic condition have higher healthcare costs than people who do not have that condition. For the first time in Manitoba, we have been able to quantify these costs both in terms of the additional dollars that are involved and also as a ratio (i.e., how many times more does it cost to provide healthcare for people with a chronic condition). We not only compare the total costs incurred by those with and without each chronic condition, but also present the results by type of service (hospital care, physician services, prescription drugs, home care services, and personal care home residence).

A surprising finding is that the cost of providing care to people with chronic conditions relative to those without the conditions varies significantly depending upon where one lives in the province. This means that, for example, the cost of providing health services to a person with diabetes may be significantly higher or lower than the provincial average, depending upon where they live. In Table 3.1, we summarize the ratio of treating all people living in a region who have the condition to those living in the region who do not have it. This presentation is slightly different from Table 1 in the Executive Summary where we present ratios comparing the cost of healthcare for people in each region to the average provincial cost. Because we used standard costs across the province, this is not a result of differences in costs, it is a result of different treatments. This observation will be discussed further in the following chapter.

Table 3.1: Ratio of Costs for Individuals With and Without Chronic Diseases, Apr 1, 2005-Mar 31, 2007
After controling for number of ADGs, age, sex, and cases; population: aged 19+ years

RHA	Arthritis	Asthma/ COPD	Diabetes Definition 1	Diabetes Definition 2	Diabetes Definition 3	CHD	Stroke
South Eastman	3.32 *	2.76 *	4.82 *	5.20 *	4.97 *	6.58 *	8.56
Central	3.44 *	2.46	4.27	4.70	4.46	6.16	7.97
Assiniboine	3.20 *	2.56	4.05 *	4.35 *	4.21 *	5.41 *	6.71 *
Brandon	3.40 *	2.57	4.11	4.34 *	4.28	6.09	6.97 *
Winnipeg	3.68 *	2.51	4.38	4.70	4.54	6.43 *	8.71 *
Interlake	3.12 *	2.41 *	4.14	4.58	4.37	5.16 *	7.13 *
North Eastman	3.32 *	2.78 *	4.18	4.60	4.35	5.26 *	6.91 *
Parkland	3.51	2.81 *	4.22	4.66	4.35	5.68 *	6.20 *
Nor-Man	3.97 *	2.67	4.81 *	5.56 *	4.98 *	6.30	7.34
Burntwood	3.82 *	3.42 *	5.53 *	6.32 *	5.76 *	6.76 *	8.96
Manitoba	3.57	2.56	4.32	4.70	4.49	6.22	8.16

* Indicates the area's rate was statistically different from the Manitoba average

Source: Manitoba Centre for Health Policy, 2010

The results of the matched cohorts analysis are presented in Table 3.2. The results presented here are ratios of the cost for health services for a matched cohort of people with and without each chronic condition after adjusting for age, sex, and comorbidity and for hypertension for people with CHD, diabetes, and stroke. This table shows, for example, that people with asthma/COPD have about twice the cost for all health services compared to people who do not have asthma/COPD. Similarly, people who have diabetes have more than three times the cost for prescription drugs and over 1.5 times the cost for hospitalizations compared to people who do not.

Table 3.2: Ratio of Health Services Costs by Service and Condition for Matched Cohorts of People With and Without the Condition
Adjusted for age, sex, and comorbidity

	All Services	Physician	Hospital	Prescription Drugs	Home Care	Personal Care Home
Arthritis*	-	-	-	-	-	-
Asthma and COPD	2.1	1.7	1.7	2.3	1.9	1.3
Coronary Heart Disease	2.2	1.8	2.2	2.4	1.7	1.2
Diabetes – Definition 1	2.6	1.8	1.6	3.1	1.1	1.0
Diabetes – Definition 2	2.7	1.8	1.7	3.3	1.2	1.0
Diabetes – Definition 3	2.6	1.8	1.7	3.2	1.2	1.0
Stroke	2.6	1.7	2.3	2.1	2.0	3

* Results are not available for arthritis as it was not possible to match people with and without the condition. Because it is highly prevalent in some age groups, there were more people with the condition than without it.

Source: Manitoba Centre for Health Policy, 2010

In this chapter we present the detailed results of our analysis.

How the Results are Presented

In the following pages the results of our work are presented in several ways for each condition. First, we provide some noteworthy observations regarding our results for the condition. All of the observations relate to a table or figure that follows. Then we summarize our findings by showing the actual, unadjusted dollars that are involved for both the entire population of the province and for the matched cohorts. For this we show both the total cost and the average cost. We then compare the ratio of costs between regions. For each region, we compare the cost for all people within the region who have the condition to those living in the region who do not have the condition and control for factors that are expected to influence the cost of healthcare. Controlling for other factors allows us to be more confident that the results are reflecting cost differences that are associated with the chronic condition rather than other factors (e.g., age, sex, and comorbidity). These results tell us how many times more the healthcare costs are for people with the chronic condition. We have chosen to present all of these results as ratios rather than dollars, as "adjusted dollars" are irrelevant to policy decisions, and the ratio approach allows us to make useful comparisons between regions.[16] A table shows both the adjusted and unadjusted ratios. The adjusted ratios are then presented in the figures that follow. Actual unadjusted costs by RHA are presented in Appendix 3.

[16] It was not possible to make inter–regional comparisons using the matched approach because matches were not necessarily between people living in the same region. Comparisons between regions can only be made using the population–based approach.

The tables and figures that present results by RHA are sorted according to the premature mortality rate for regions. The premature mortality rate[17] is considered a good indicator of the overall health status of the population in a region. Regions with the healthiest population are at the top of the figures with less healthy populations at the bottom. While we would not necessarily expect ratios of costs to vary according to the health status of the population it is interesting to keep this in mind when reviewing the figures, and in fact the ratios do not show any consistent pattern that would be expected if the general health status of the population affected these ratios. Where there is a statistically significant difference from the provincial ratio this is noted with an asterisk. Due to the small population in Churchill RHA we have not reported results for this region.

ARTHRITIS

Noteworthy:

There are about one half as many people with arthritis compared to people who do not have it, yet their costs for healthcare are nearly 50% more. One of the reasons for this is that people with arthritis are often older and therefore have higher healthcare costs. While we did adjust for age, this only has the effect of making the two groups similar, not of removing the effect of age on the costs. The values presented here cannot be interpreted as the additional cost of arthritis, but rather the additional cost of services for people who have arthritis. The mean cost is highest for prescription drugs for both groups, but there are substantially more costs for people with arthritis. Overall, after controlling for age, sex, and comorbidity, the cost for healthcare services for people with arthritis is 3.6 times more than for other Manitobans.

Note the significant variation between regions—with Winnipeg, Burntwood, and Nor–Man always higher and a number of regions always lower.

Table 3.3: Actual Costs for Individuals With and Without Arthritis, Apr 1, 2005-Mar 31, 2007

	Population-Based Approach		Matched Approach*
	Manitobans With	Manitobans Without	
Number of People	249,402	520,826	
Total Expenditures			
All Services	$2,011,806,337	$1,461,314,171	
Physician Services	344,321,245	330,597,098	
Hospital	525,529,358	395,693,019	
Prescription Drugs	562,966,187	455,103,386	
Home Care	228,535,994	114,920,721	
Personal Care Home Residence	350,453,552	164,999,945	
Mean Expenditures			
All Services	$8,067	$2,806	
Physician Services	1,381	635	
Hospital	2,107	760	
Prescription Drugs	2,257	874	
Home Care	916	221	
Personal Care Home Residence	1,405	317	

* No matching was possible for arthritis because it is so prevalent in some age groups

Source: Manitoba Centre for Health Policy, 2010

[17] The premature mortality rate is the rate of death in a population before the age of 75.

Table 3.4: Ratio of Costs for Individuals With and Without Arthritis, Apr 1, 2005-Mar 31, 2007
After controling for number of ADGs, age, sex, and cases; population: aged 19+ years

Adjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	3.32	2.58	2.54	3.18	4.25	4.88
Central	3.44	2.62	2.56	3.22	4.07	4.36
Assiniboine	3.20	2.59	2.43	3.02	3.40	3.50
Brandon	3.40	2.66	2.55	3.20	3.94	4.23
Winnipeg	3.68	2.77	2.65	3.40	4.26	4.60
Interlake	3.12	2.51	2.43	3.00	3.65	3.77
North Eastman	3.32	2.68	2.44	3.11	3.53	3.56
Parkland	3.51	2.81	2.52	3.25	3.56	3.71
Nor-Man	3.97	2.96	2.71	3.61	4.51	5.63
Burntwood	3.82	2.90	2.67	3.54	4.63	5.82
Manitoba	3.57	2.73	2.60	3.33	4.11	4.42

Unadjusted Rates:

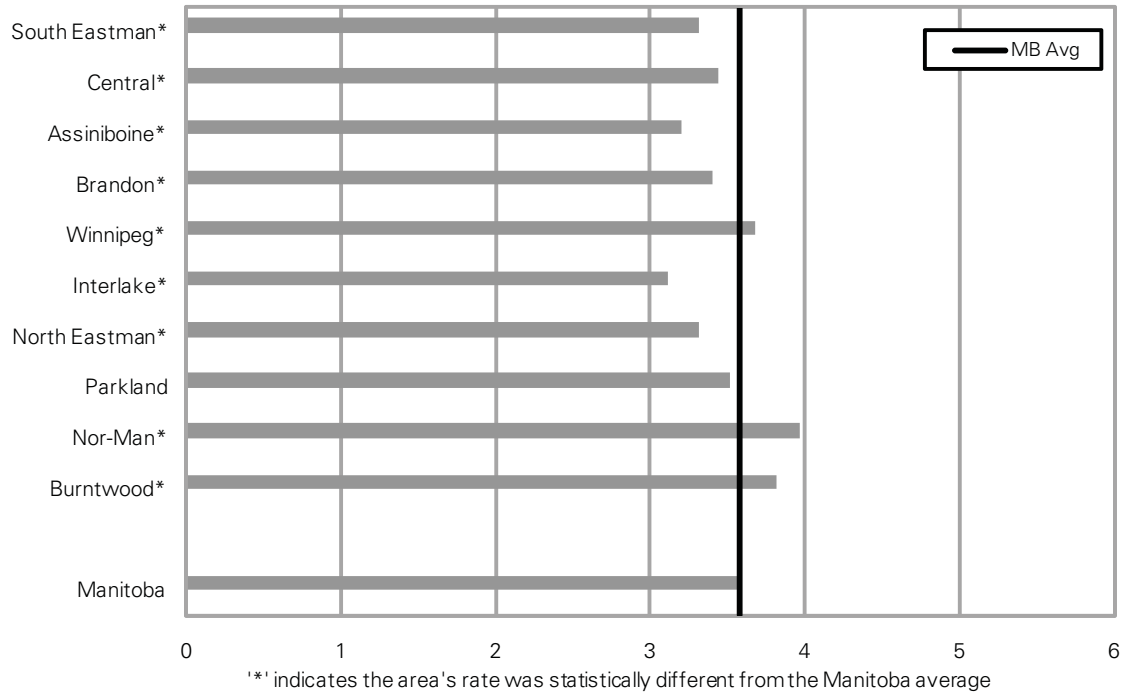
RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	2.93	2.11	2.97	2.89	4.16	3.89
Central	2.85	2.09	2.78	2.67	4.23	3.65
Assiniboine	2.60	2.16	2.74	2.30	3.26	3.00
Brandon	2.70	2.14	2.87	2.36	3.99	3.36
Winnipeg	2.95	2.18	2.78	2.53	4.25	5.57
Interlake	2.69	2.11	2.65	2.52	3.54	3.75
North Eastman	2.64	2.23	2.93	2.72	3.59	2.04
Parkland	2.77	2.25	2.91	2.71	3.86	2.63
Nor-Man	2.97	2.38	2.41	3.25	5.84	3.55
Burntwood	2.60	2.32	2.25	3.13	4.82	1.37
Manitoba	2.87	2.17	2.77	2.58	4.15	4.44

Note 1: regions ordered by PMR

Note 2: see methods section for more information on how this indicator was defined

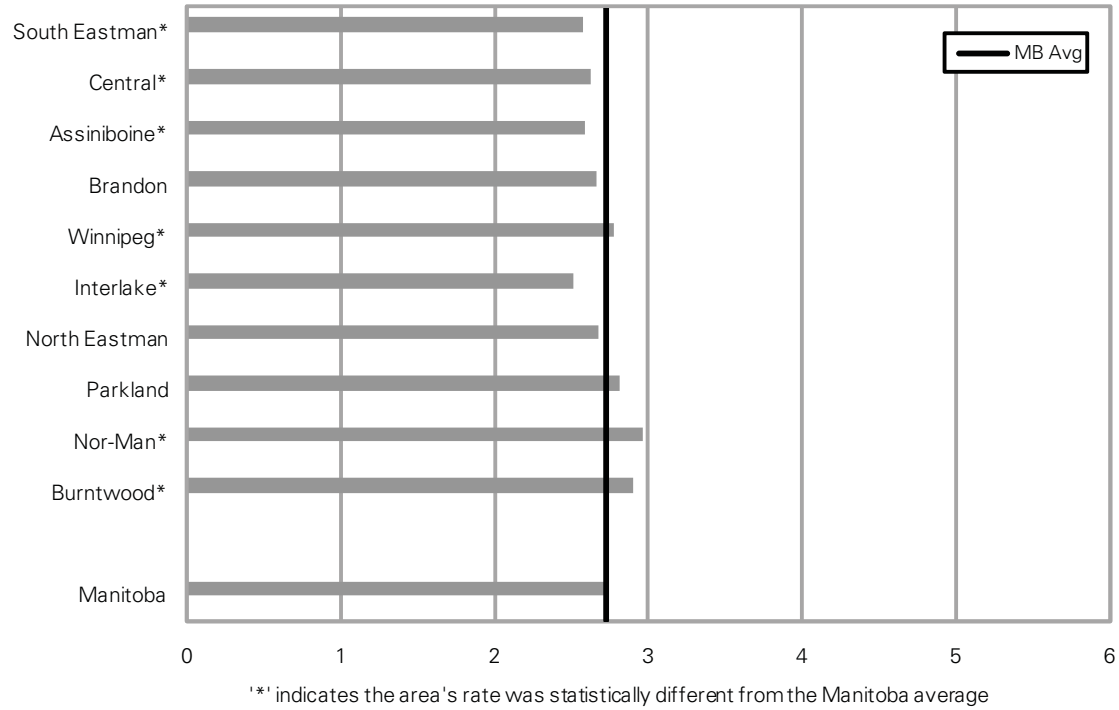
Source: Manitoba Centre for Health Policy, 2010

Figure 3.1: Ratio of Total Costs for Individuals With and Without Arthritis, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 19+ years



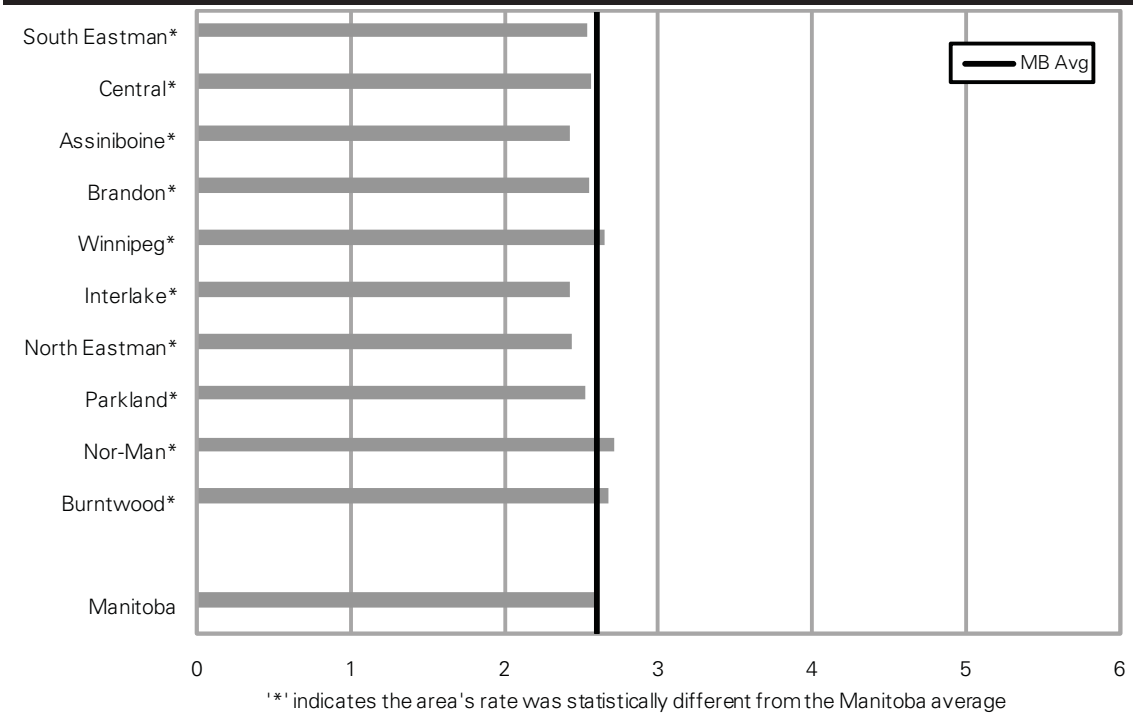
Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.2: Ratio of Physician Costs for Individuals With and Without Arthritis, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 19+ years



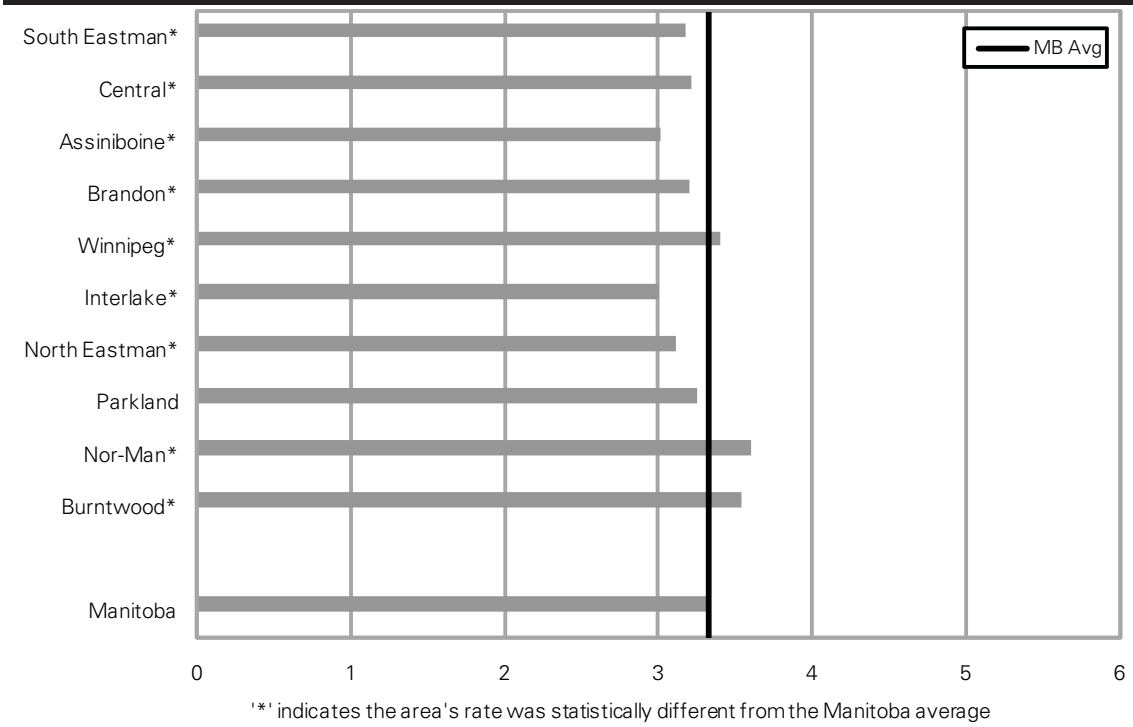
Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.3: Ratio of Hospital Costs for Individuals With and Without Arthritis, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 19+ years



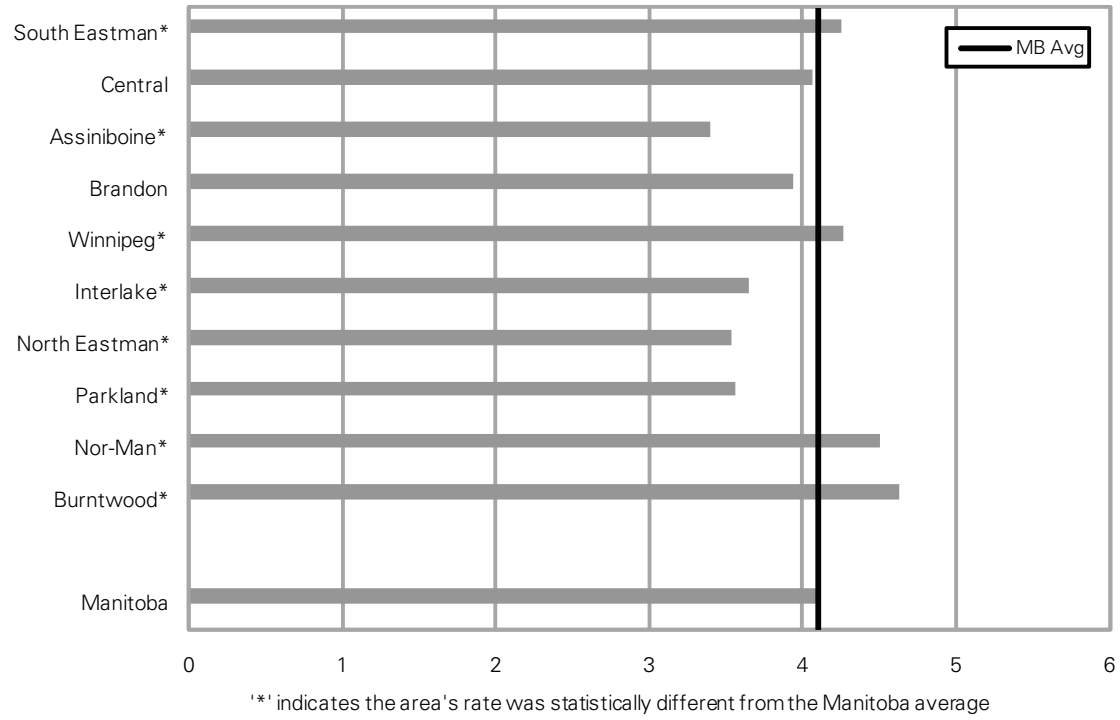
Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.4: Ratio of Prescription Drug Costs for Individuals With and Without Arthritis, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 19+ years



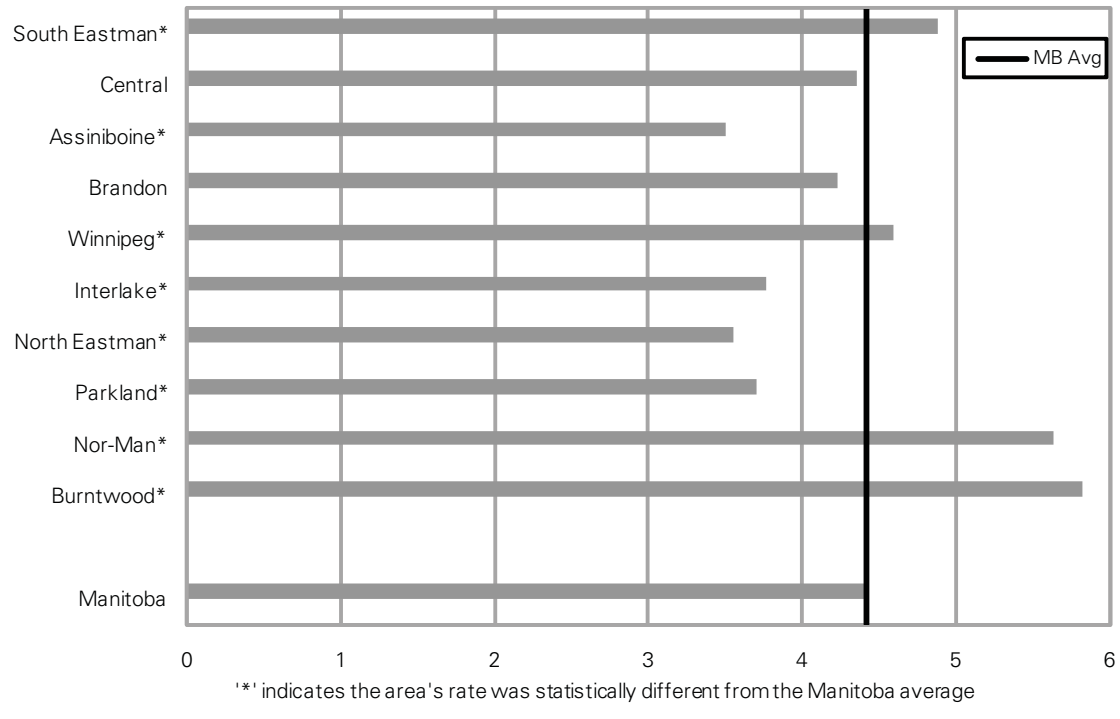
Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.5: Ratio of Home Care Costs for Individuals With and Without Arthritis, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.6: Ratio of PCH Costs for Individuals With and Without Arthritis, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

ASTHMA AND CHRONIC OBSTUCTIVE PULMONARY DISEASE

Noteworthy:

About five times as many people do not have asthma/COPD as those who do, and the total healthcare costs for people without asthma/COPD are less than half of those who do have it. When we adjust the cost for age, sex, and comorbidity, we find that overall people with asthma/COPD have 2.6 times the healthcare costs of people who do not have it. Residents of North Eastman and Burntwood have average costs that are always higher than the provincial average, while residents of Interlake often have lower costs.

Table 3.5: Actual Costs for Individuals With and Without Asthma/COPD, Apr 1, 2005-Mar 31, 2007

	Population-Based Approach		Matched Approach	
	Manitobans With	Manitobans Without	Manitobans With	Manitobans Without
Number of People	119,193	580,434	119,193	238,386
Total Expenditures				
All Services	$1,014,211,099	$2,375,593,262	$1,014,211,099	$1,170,527,153
Physician Services	166,971,670	482,360,106	166,971,670	219,616,996
Hospital	265,399,593	616,806,993	265,399,593	300,207,716
Prescription Drugs	323,989,853	675,995,128	323,989,853	308,733,100
Home Care	115,994,285	226,255,798	115,994,285	122,898,911
Personal Care Home Residence	141,855,698	374,175,236	141,855,698	219,070,430
Mean Expenditures				
All Services	$8,509	$4,093	$8,509	$4,910
Physician Services	1,401	831	1,401	921
Hospital	2,227	1,063	2,227	1,259
Prescription Drugs	2,718	1,165	2,718	1,295
Home Care	973	390	973	516
Personal Care Home Residence	1,190	645	1,190	919

Source: Manitoba Centre for Health Policy, 2010

Table 3.6: Ratio of Costs for Individuals With and Without Asthma/COPD
Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 24+ years

Adjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	2.76	2.07	2.17	3.81	3.00	2.41
Central	2.46	1.92	2.01	3.33	2.52	1.75
Assiniboine	2.56	1.97	2.06	3.51	2.56	1.78
Brandon	2.57	2.05	2.01	3.40	2.46	1.78
Winnipeg	2.51	1.98	2.00	3.35	2.48	1.80
Interlake	2.41	1.89	2.01	3.28	2.64	1.94
North Eastman	2.78	2.15	2.14	3.71	2.89	2.12
Parkland	2.81	2.16	2.14	3.78	2.60	1.79
Nor-Man	2.67	2.04	2.15	3.61	3.00	2.15
Burntwood	3.42	2.37	2.50	4.78	4.17	3.66
Manitoba	2.56	2.00	2.04	3.44	2.56	1.84

Unadjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	2.39	1.70	2.18	2.81	2.99	2.66
Central	1.92	1.64	1.99	2.25	2.55	1.37
Assiniboine	2.02	1.69	2.11	2.32	2.31	1.67
Brandon	1.90	1.62	1.86	2.00	2.49	1.96
Winnipeg	2.07	1.66	2.09	2.32	2.48	1.89
Interlake	2.05	1.66	2.07	2.21	2.30	2.07
North Eastman	2.32	1.80	2.46	2.45	2.35	2.64
Parkland	2.19	1.78	2.33	2.49	2.31	1.72
Nor-Man	2.06	1.80	2.16	2.39	3.43	0.81
Burntwood	2.32	1.99	2.12	2.61	4.09	1.33
Manitoba	2.08	1.69	2.10	2.33	2.50	1.85

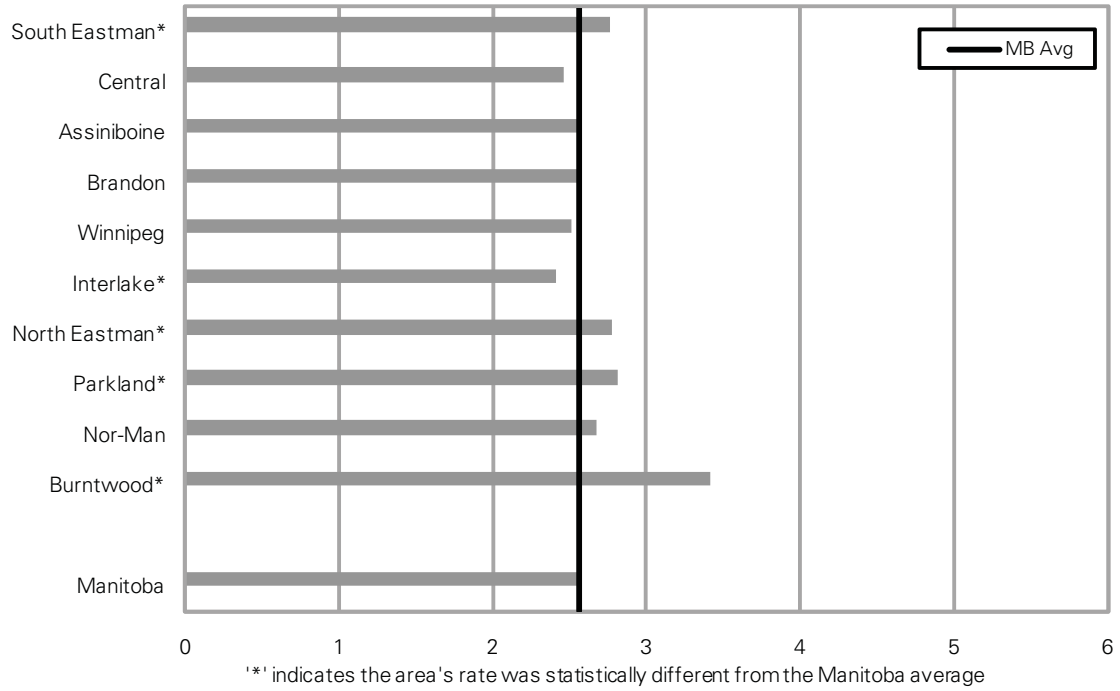
Note 1: regions ordered by PMR

Note 2: see methods section for more information on how this indicator was defined

Note 3: blank cell = suppressed data due to small numbers

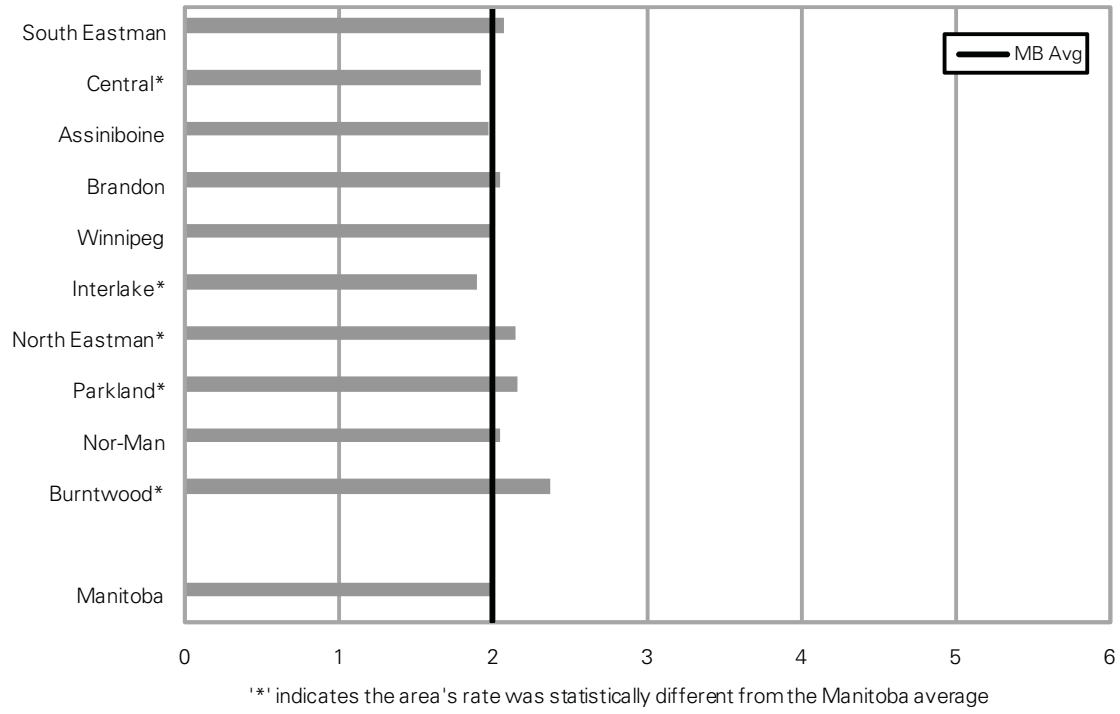
Source: Manitoba Centre for Health Policy, 2010

Figure 3.7: Ratio of Total Costs for Individuals With and Without Asthma/COPD, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 24+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

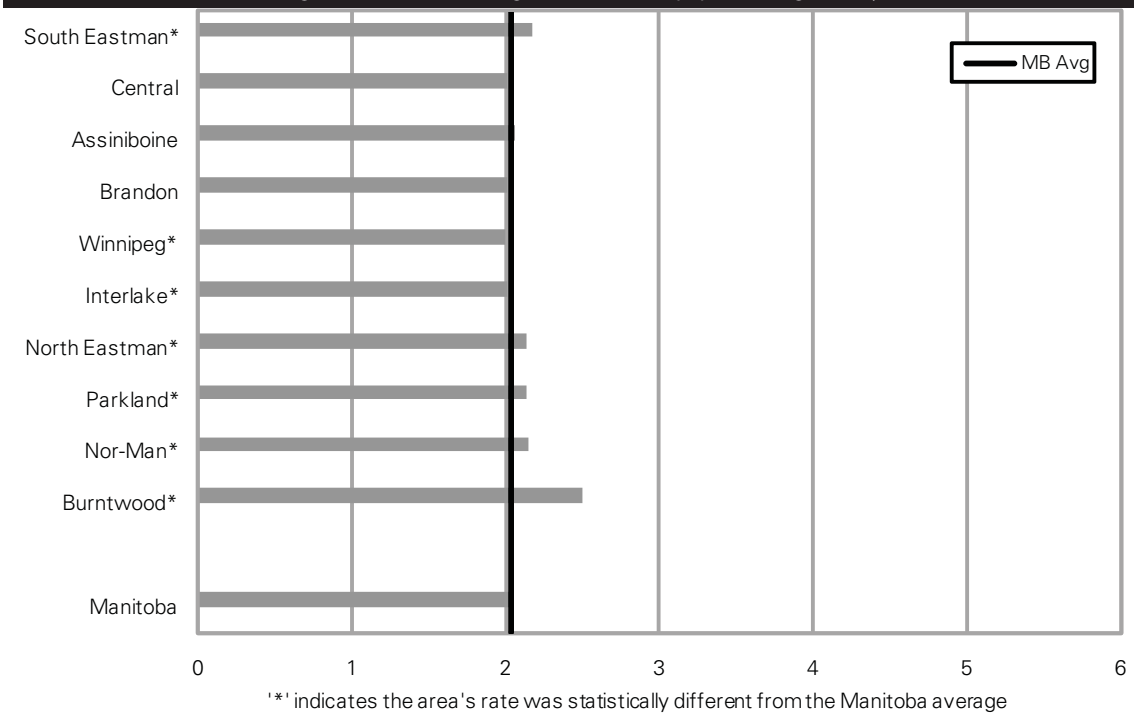
Figure 3.8: Ratio of Physician Costs for Individuals With and Without Asthma/COPD, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, and cases; population: aged 24+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.9: Ratio of Hospital Costs for Individuals With and Without Asthma/COPD, Apr 1, 2005-Mar 31, 2007

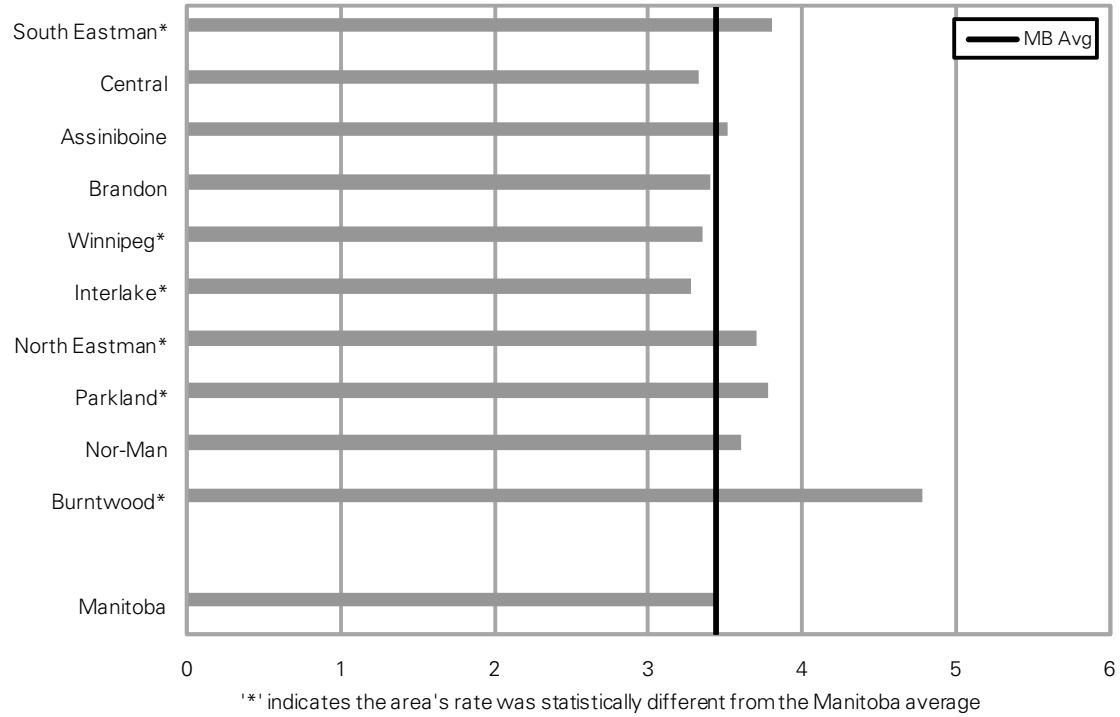
After controlling for number of ADGs, age, sex, and cases; population: aged 24+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.10: Ratio of Prescription Drug Costs for Individuals With and Without Asthma/COPD, Apr 1, 2005-Mar 31, 2007

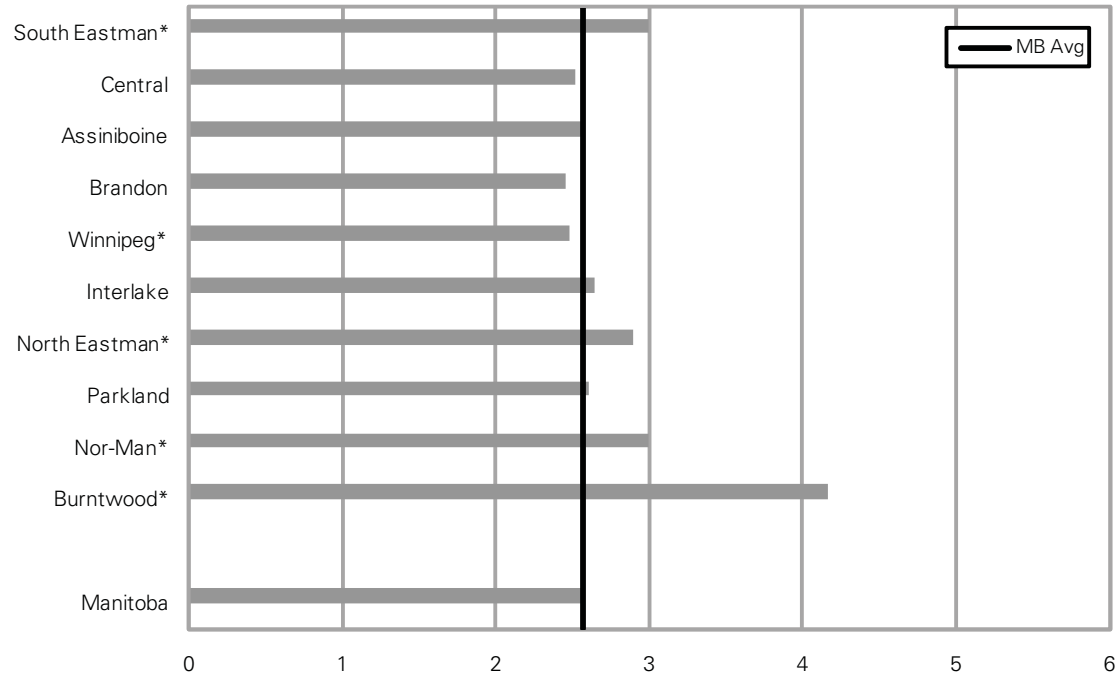
After controlling for number of ADGs, age, sex, and cases; population: aged 24+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.11: Ratio of Home Care Costs for Individuals With and Without Asthma/COPD, Apr 1, 2005-Mar 31, 2007

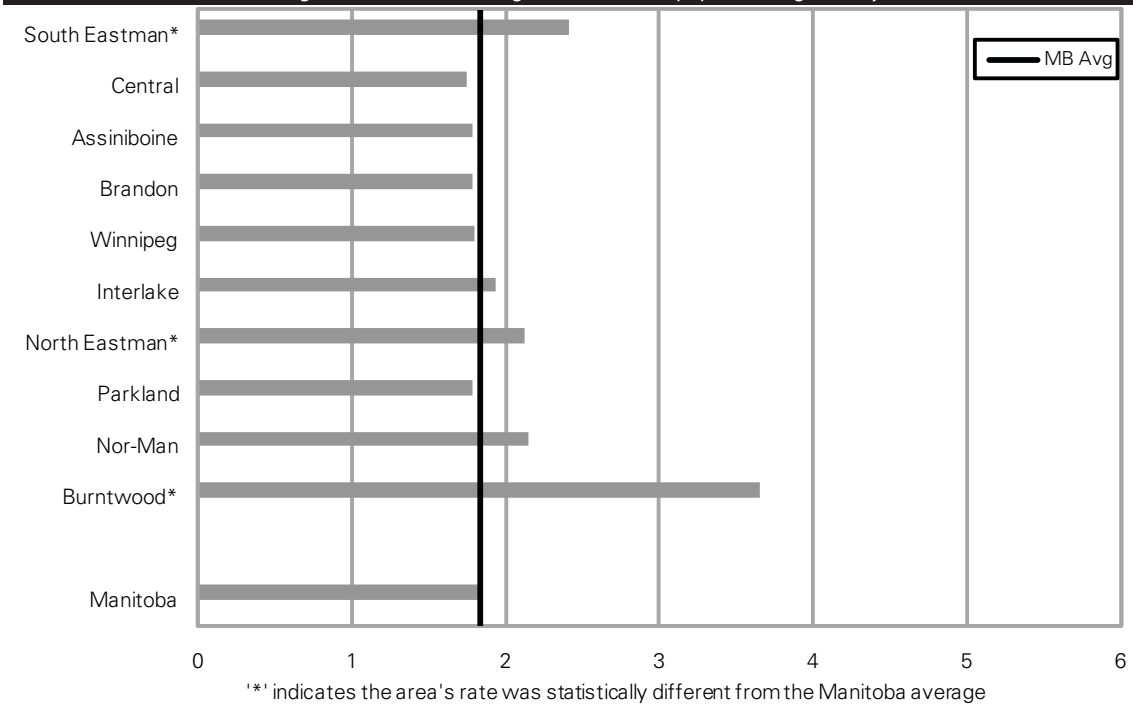
After controlling for number of ADGs, age, sex, and cases; population: aged 24+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.12: Ratio of PCH Costs for Individuals With and Without Asthma/COPD, Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, and cases; population: aged 24+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

DIABETES DEFINITION 1

(1 or more hospitalizations OR 1 or more physician visits OR 1 or more prescriptions in a two–year period)

Noteworthy:

In this report, we present three different ways of looking at the cost of diabetes, depending upon the definition that is selected. As noted earlier, the first definition is the one that was found to have the highest combined sensitivity and specificity (the Youdens Index). The second definition is the one that is most commonly used in Canada. The difference between Definition 1 and 2 is that Definition 2 does not include prescription drugs and it requires two physician visits for diabetes whereas Definition 1 only requires one visit. In Manitoba, prescription drug information is available, but this is not the case in other provinces. The third definition is one that has been used in other recent MCHP reports. Like the first definition, it includes prescription drugs (in addition to hospitalizations and physician visits) but uses three years of data rather than two years as is the case for the other two definitions; and like Definition 2, it requires two physician visits. Definition 1 is the most sensitive and includes 64,000 people. Definition 2 is the most specific and includes 48,000 people. Definition 3 is in the middle.

The results of applying the three definitions are similar. People with diabetes have healthcare costs that are more than four times greater than people without diabetes, after controlling for age, sex, hypertension, and other comorbidity. South Eastman, Nor–Man, and Burntwood have a ratio that is higher than the provincial average for many services, with South Eastman having a higher ratio for all services. Assiniboine has a lower ratio for all services for Definition 2 and for several other services using the other definitions.

Table 3.7: Actual Costs for Individuals With and Without Diabetes (Definition 1), Apr 1, 2005-Mar 31, 2007

	Population-Based Approach		Matched Approach	
	Manitobans With	Manitobans Without	Manitobans With	Manitobans Without
Number of People	63,878	731,663	63,878	191,634
Total Expenditures				
All Services	$816,269,845	$2,767,253,874	816,269,845	1,179,632,678
Physician Services	113,250,740	591,348,584	113,250,740	208,007,167
Hospital	218,459,212	735,206,311	218,459,212	315,509,519
Prescription Drugs	282,760,585	756,874,050	282,760,585	303,492,102
Home Care	90,067,954	261,544,782	90,067,954	135,686,321
Personal Care Home Residence	111,731,354	422,280,147	111,731,354	216,937,568
Mean Expenditures				
All Services	$12,779	$3,782	$12,779	$6,156
Physician Services	1,773	808	1,773	1,085
Hospital	3,420	1,005	3,420	1,646
Prescription Drugs	4,427	1,034	4,427	1,584
Home Care	1,410	357	1,410	708
Personal Care Home Residence	1,749	577	1,749	1,132

Source: Manitoba Centre for Health Policy, 2010

Table 3.8: Ratio of Costs for Individuals With and Without Diabetes (Definition 1), Apr 1, 2005 - Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years

Adjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	4.82	2.62	2.63	6.19	2.98	2.91
Central	4.27	2.44	2.40	5.50	2.38	2.07
Assiniboine	4.05	2.36	2.30	5.25	2.15	1.84
Brandon	4.11	2.33	2.44	5.43	2.48	2.09
Winnipeg	4.38	2.50	2.43	5.64	2.39	2.07
Interlake	4.14	2.40	2.30	5.33	2.19	1.81
North Eastman	4.18	2.48	2.24	5.29	2.20	2.15
Parkland	4.22	2.52	2.23	5.38	1.89	1.56
Nor-Man	4.81	2.71	2.41	5.87	2.36	1.88
Burntwood	5.53	2.92	2.62	6.61	3.08	3.08
Manitoba	4.32	2.48	2.39	5.55	2.32	2.00

Unadjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	4.14	2.23	3.72	5.21	4.95	5.62
Central	3.42	2.09	3.42	4.44	3.89	3.10
Assiniboine	3.02	2.04	3.14	3.88	3.16	2.49
Brandon	3.32	2.14	3.39	4.27	4.21	3.01
Winnipeg	3.43	2.26	3.40	4.21	4.24	3.28
Interlake	3.41	2.16	3.45	4.50	3.82	2.69
North Eastman	3.15	2.13	3.45	3.96	3.11	2.31
Parkland	3.10	2.07	3.14	4.01	3.01	2.59
Nor-Man	3.03	2.33	2.81	4.16	3.61	1.71
Burntwood	3.93	2.59	3.36	5.72	4.92	6.18
Manitoba	3.38	2.19	3.40	4.28	3.94	3.03

Note 1: regions ordered by PMR

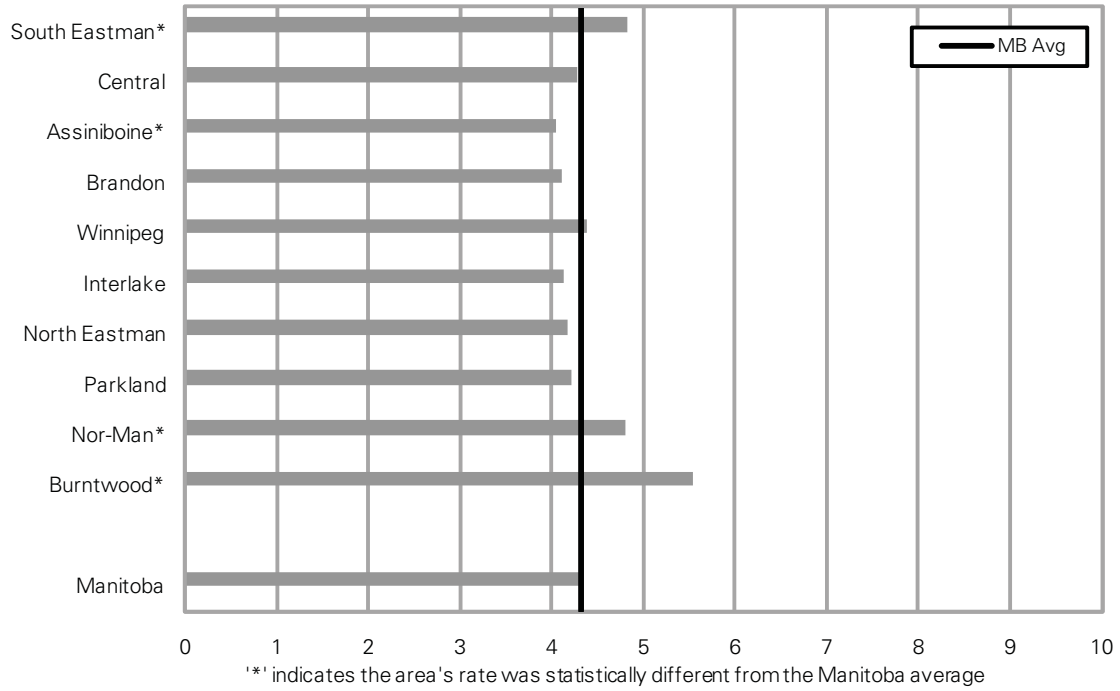
Note 2: see methods section for more information on how this indicator was defined

Note 3: blank cell = suppressed data due to small numbers

Source: Manitoba Centre for Health Policy, 2010

Figure 3.13: Ratio of Total Costs for Individuals With and Without Diabetes (Definition 1), Apr 1, 2005-Mar 31, 2007

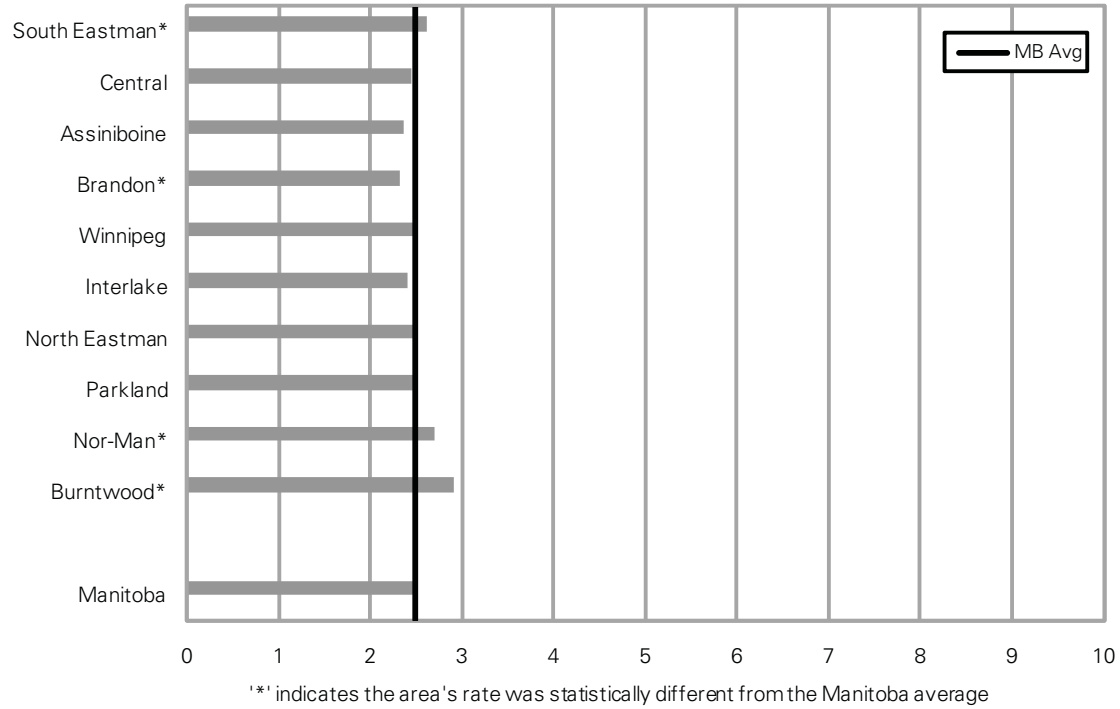
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.14: Ratio of Physician Costs for Individuals With and Without Diabetes (Definition 1), Apr 1, 2005-Mar 31, 2007

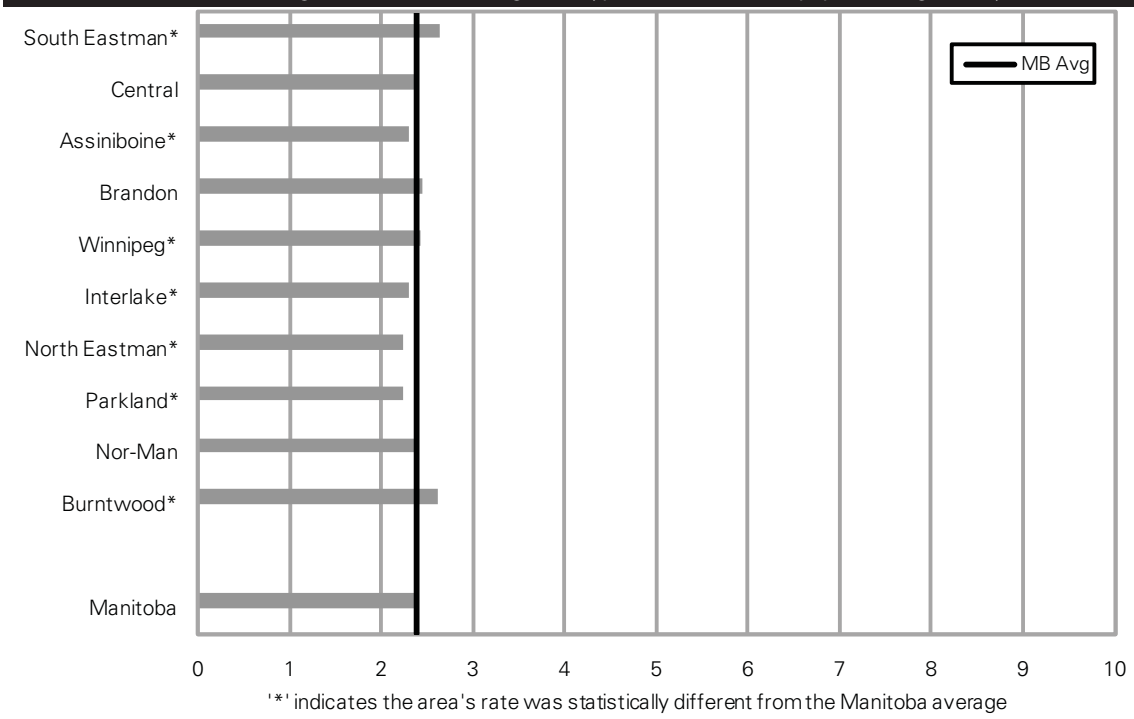
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.15: Ratio of Hospital Costs for Individuals With and Without Diabetes (Definition 1), Apr 1, 2005-Mar 31, 2007

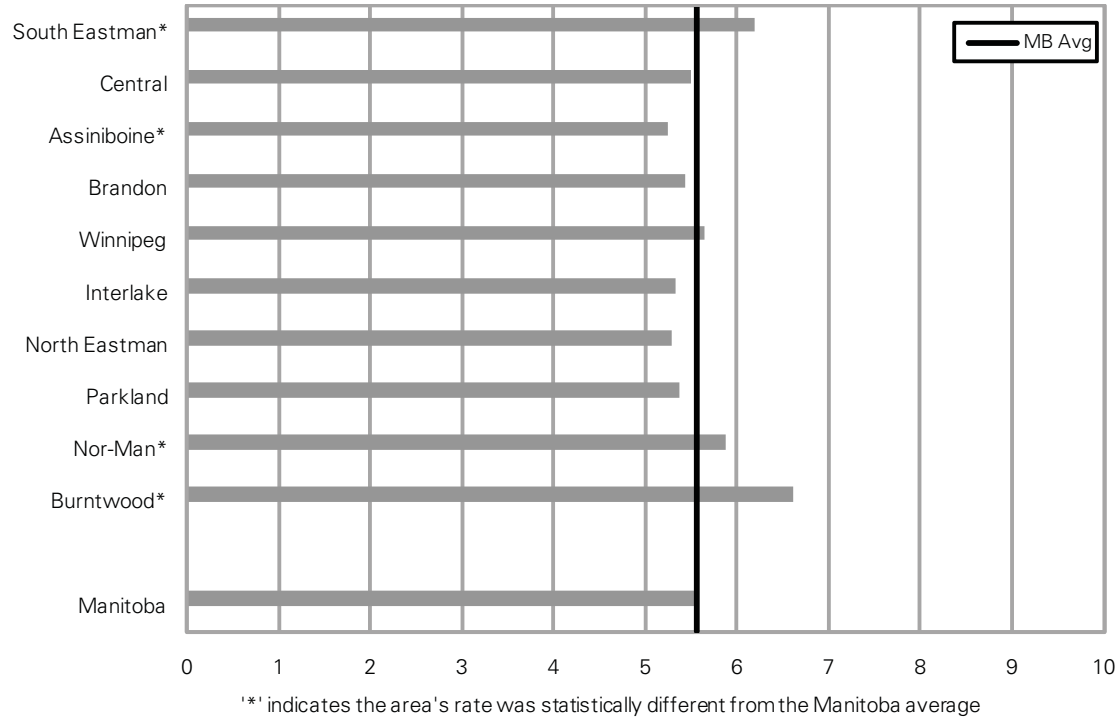
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.16: Ratio of Prescription Drug Costs for Individuals With and Without Diabetes (Definition 1), Apr 1, 2005-Mar 31, 2007

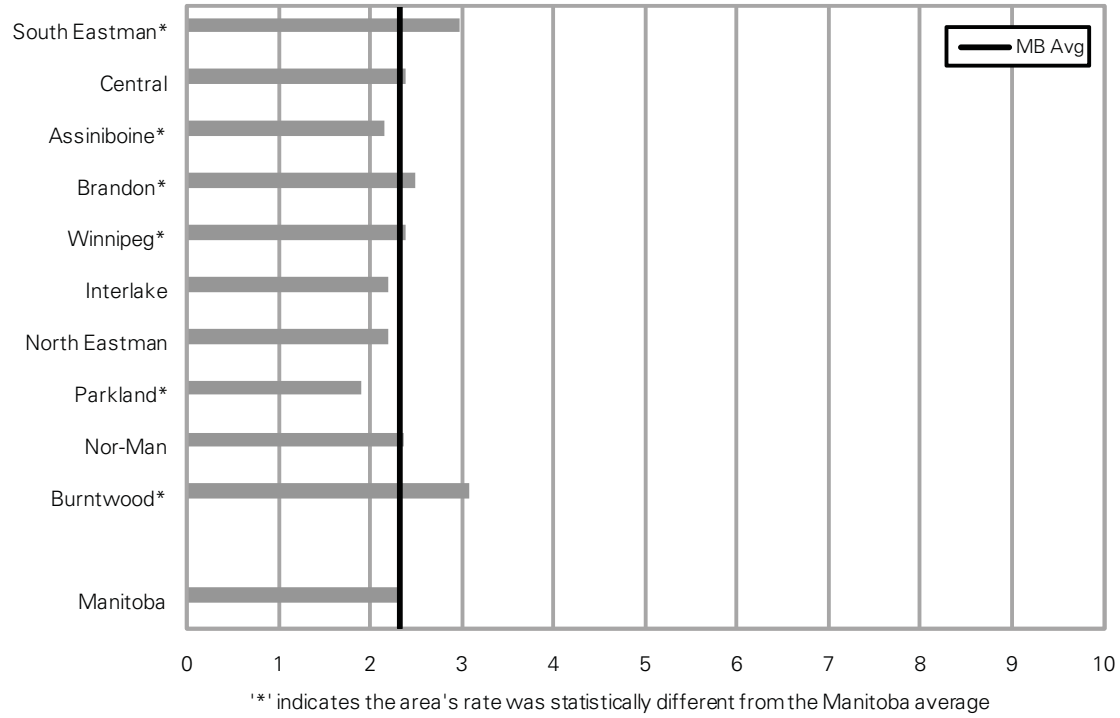
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.17: Ratio of Home Care Costs for Individuals With and Without Diabetes (Definition 1), Apr 1, 2005-Mar 31, 2007

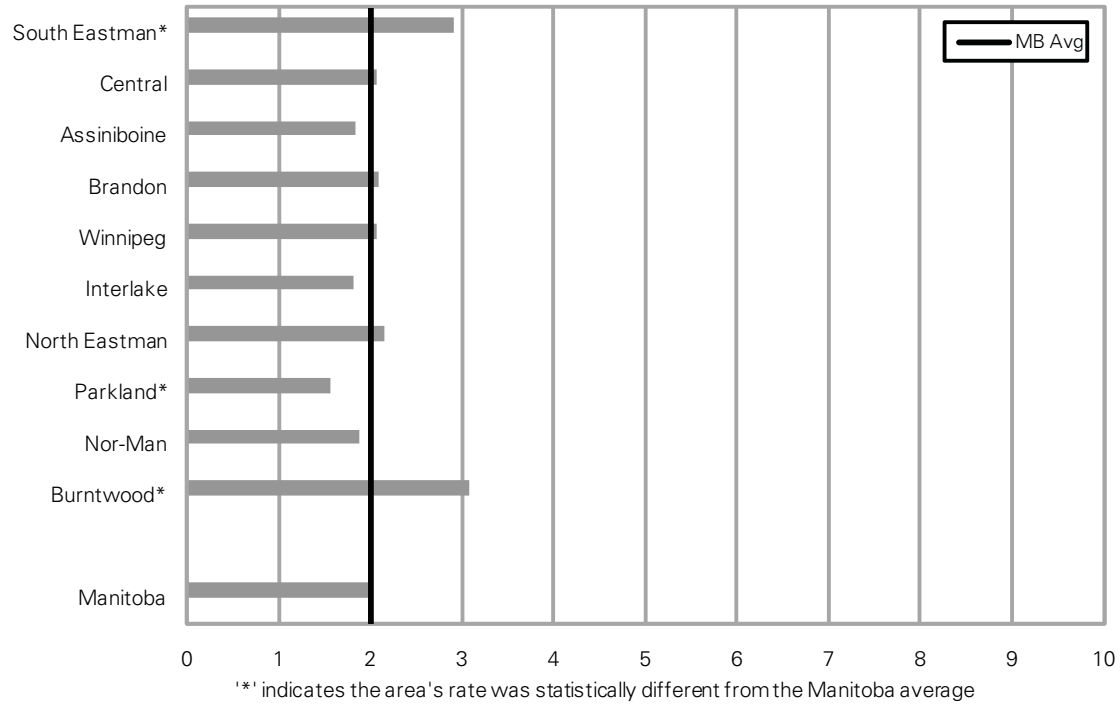
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.18: Ratio of PCH Costs for Individuals With and Without Diabetes (Definition 1), Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

DIABETES DEFINITION 2

(1 or more hospitalizations OR 2 or more physician visits in a two–year period)

Noteworthy:

See the commentary for Diabetes Definition 1.

Table 3.9: Actual Costs for Individuals With or Without Diabetes (Definition 2), April 1, 2005-March 31, 2007

	Population-Based Approach		Matched Approach	
	Manitobans With	Manitobans Without	Manitobans With	Manitobans Without
Number of People	48,268	752,495	48,268	144,804
Total Expenditures				
All Services	$675,651,902	$2,921,180,549	675,651,902	922,423,537
Physician Services	92,001,525	617,222,231	113,250,740	208,007,167
Hospital	183,072,391	769,613,383	77,841,269	58,300,378
Prescription Drugs	238,599,922	803,072,934	282,760,585	303,492,102
Home Care	77,046,523	275,495,669	90,067,954	135,686,321
Personal Care Home Residence	84,931,541	455,776,332	111,731,354	216,937,568
Mean Expenditures				
All Services	$13,998	$3,882	$13,998	$6,370
Physician Services	1,906	820	2,346	1,436
Hospital	3,793	1,023	1,613	403
Prescription Drugs	4,943	1,067	5,858	2,096
Home Care	1,596	366	1,866	937
Personal Care Home Residence	1,760	606	2,315	1,498

Source: Manitoba Centre for Health Policy, 2010

Table 3.10: Ratio of Costs for Individuals With and Without Diabetes (Definition 2), Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years

Adjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	5.20	2.77	2.81	6.79	3.03	2.71
Central	4.70	2.63	2.61	6.14	2.53	2.13
Assiniboine	4.35	2.51	2.44	5.71	2.19	1.79
Brandon	4.34	2.41	2.58	5.85	2.53	2.02
Winnipeg	4.70	2.65	2.59	6.15	2.47	2.03
Interlake	4.58	2.60	2.47	5.95	2.26	1.80
North Eastman	4.60	2.67	2.40	5.87	2.25	2.06
Parkland	4.66	2.73	2.39	5.99	1.93	1.52
Nor-Man	5.56	3.08	2.68	6.82	2.61	2.08
Burntwood	6.32	3.30	2.87	7.60	3.15	2.72
Manitoba	4.70	2.65	2.56	6.12	2.41	1.97

Unadjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	4.38	2.33	4.21	5.52	5.18	5.23
Central	3.81	2.25	3.94	4.86	4.46	3.38
Assiniboine	3.21	2.15	3.47	4.11	3.33	2.52
Brandon	3.54	2.21	3.70	4.59	4.27	3.17
Winnipeg	3.62	2.36	3.62	4.55	4.64	3.07
Interlake	3.61	2.30	3.80	4.81	4.27	2.29
North Eastman	3.37	2.27	3.78	4.36	3.33	1.93
Parkland	3.28	2.21	3.46	4.34	3.37	2.23
Nor-Man	3.37	2.53	3.20	4.55	4.16	1.77
Burntwood	4.47	2.98	3.90	6.17	5.97	9.50
Manitoba	3.61	2.32	3.71	4.63	4.36	2.91

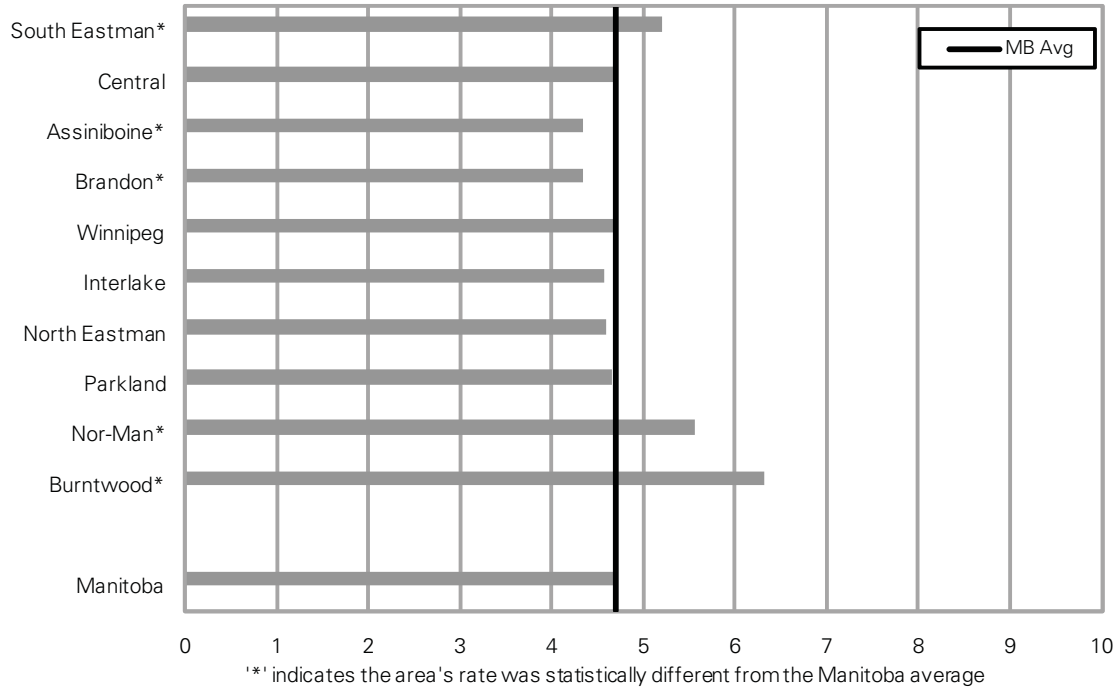
Note 1: regions ordered by PMR

Note 2: see methods section for more information on how this indicator was defined

Source: Manitoba Centre for Health Policy, 2010

Figure 3.19: Ratio of Total Costs for Individuals With and Without Diabetes (Definition 2), Apr 1, 2005-Mar 31, 2007

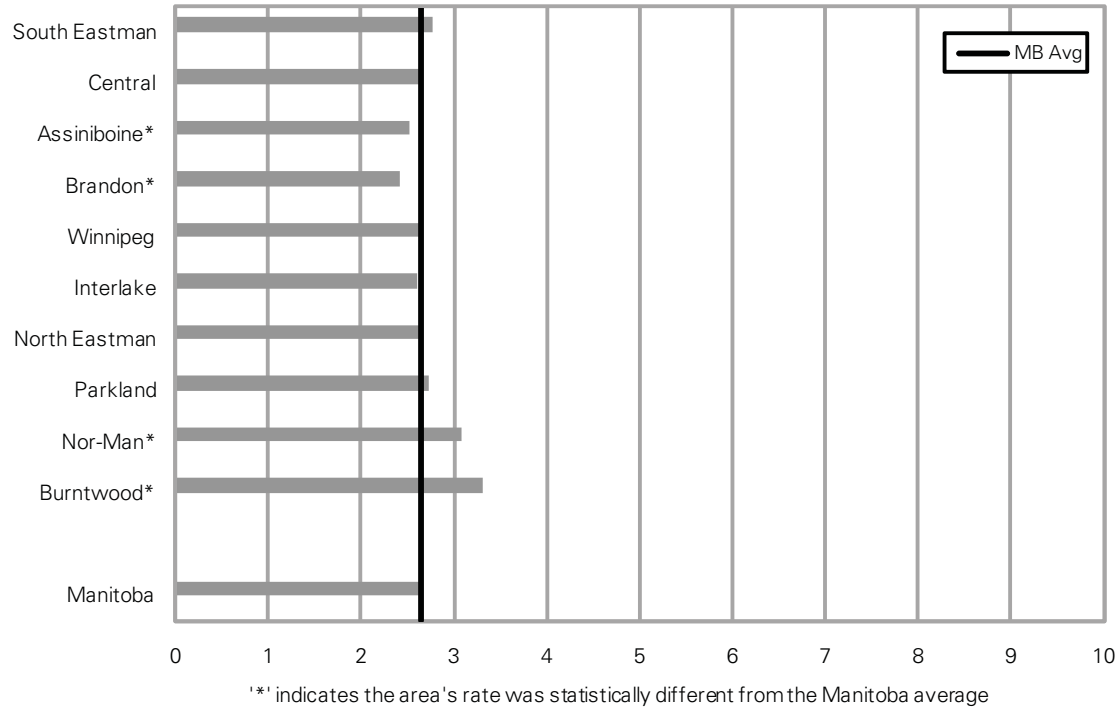
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.20: Ratio of Physician Costs for Individuals With and Without Diabetes (Definition 2), Apr 1, 2005-Mar 31, 2007

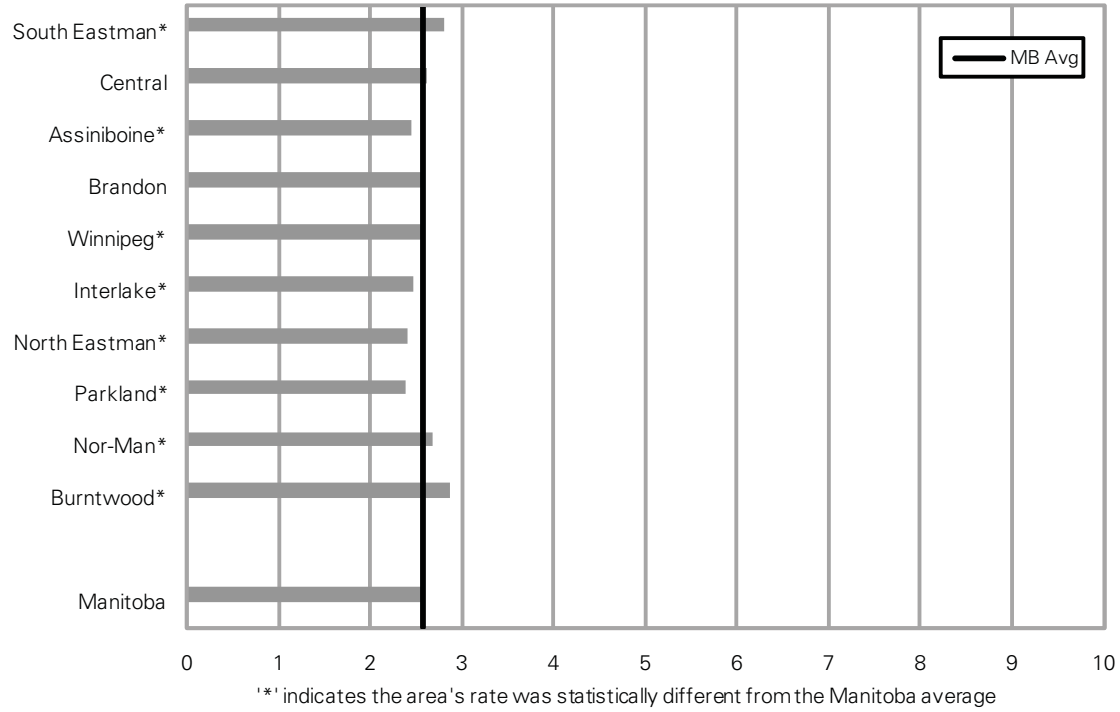
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.21: Ratio of Hospital Costs for Individuals With and Without Diabetes (Definition 2), Apr 1, 2005-Mar 31, 2007

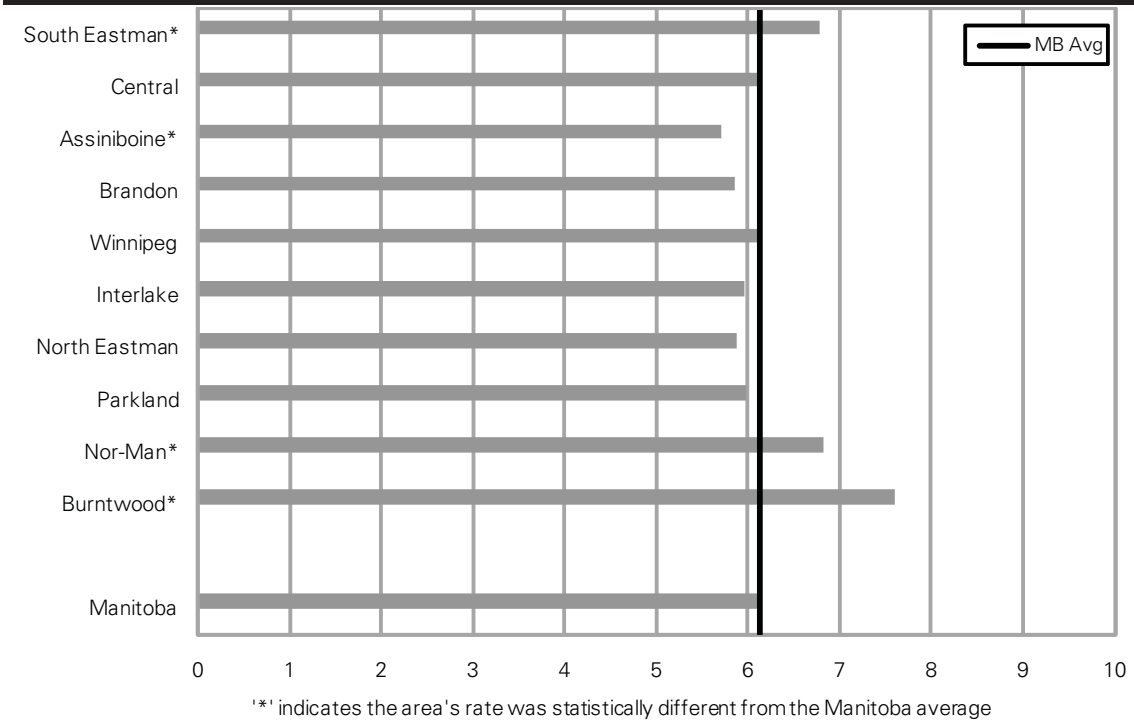
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.22: Ratio of Prescription Drug Costs for Individuals With and Without Diabetes (Definition 2), Apr 1, 2005-Mar 31, 2007

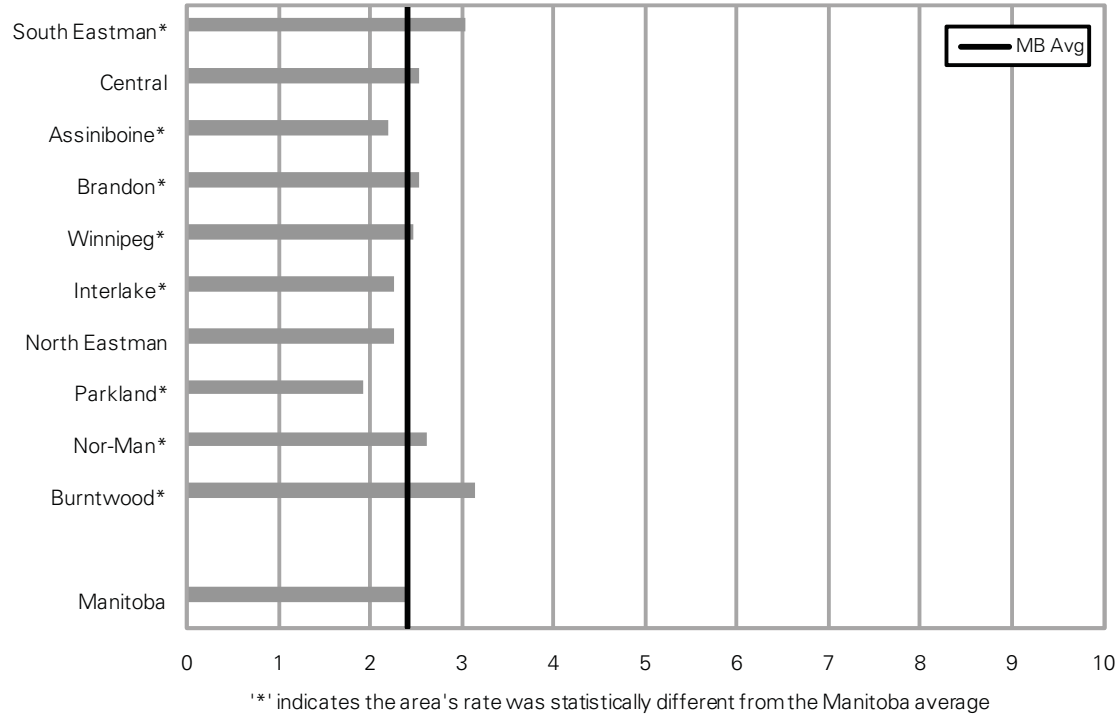
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.23: Ratio of Home Care Costs for Individuals With and Without Diabetes (Definition 2), Apr 1, 2005-Mar 31, 2007

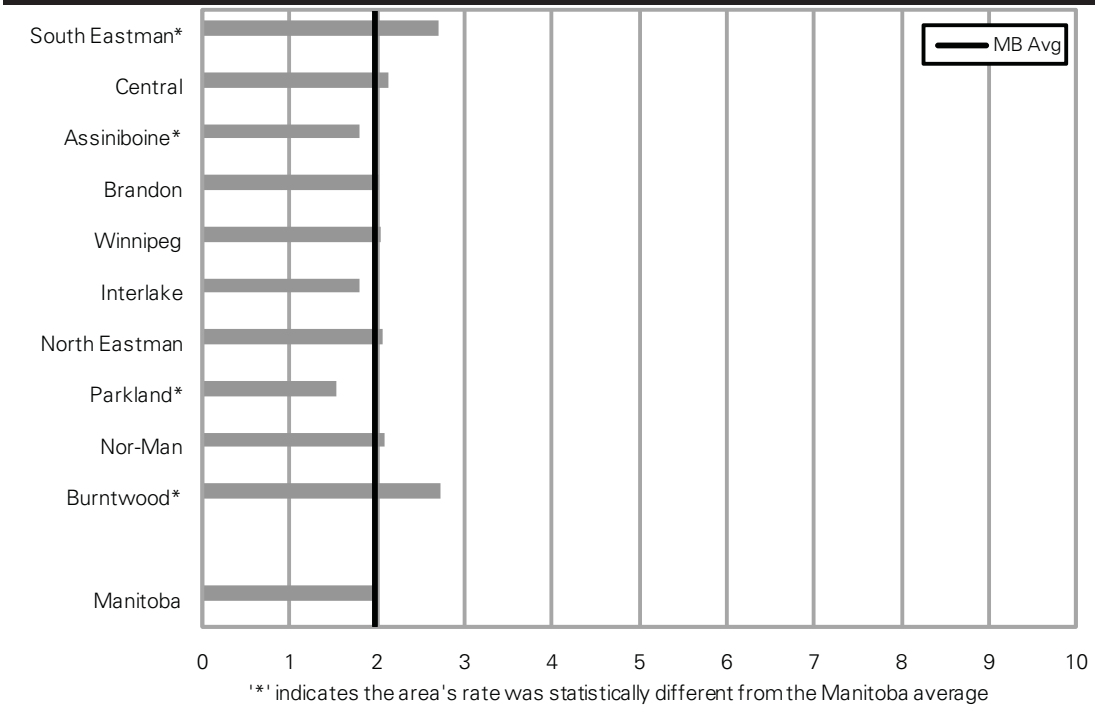
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.24: Ratio of PCH Costs for Individuals With and Without Diabetes (Definition 2), Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

DIABETES DEFINITION 3

(1 or more hospitalizations OR 2 or more physician visits OR 1 or more prescriptions over a three–year period)

Noteworthy:

See the commentary for Diabetes Definition 1.

Table 3.11: Actual Costs for Individuals With and Without Diabetes (Definition 3), Apr 1, 2005-Mar 31, 2007

	Population-Based Approach		Matched Approach	
	Manitobans With	Manitobans Without	Manitobans With	Manitobans Without
Number of People	58,153	744,243	58,153	174,459
Total Expenditures				
All Services	$774,108,939	$2,861,620,098	$774,108,939	$1,095,524,109
Physician Services	106,038,581	607,582,321	106,038,581	191,912,084
Hospital	209,432,751	757,721,740	209,432,750	291,103,916
Prescription Drugs	270,063,981	782,772,344	270,063,981	281,302,491
Home Care	86,758,046	269,753,968	86,758,046	126,993,206
Personal Care Home Residence	101,815,582	443,789,726	101,815,582	204,212,411
Mean Expenditures				
All Services	$13,312	$3,845	$13,312	$6,280
Physician Services	1,823	816	1,823	1,100
Hospital	3,601	1,018	3,601	1,669
Prescription Drugs	4,644	1,052	4,644	1,612
Home Care	1,492	362	1,492	728
Personal Care Home Residence	1,751	596	1,751	1,171

Source: Manitoba Centre for Health Policy, 2010

Table 3.12: Ratio of Costs for Individuals With and Without Diabetes (Definition 3) Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years

Adjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	4.97	2.66	2.70	6.39	2.97	2.78
Central	4.46	2.49	2.50	5.76	2.45	2.09
Assiniboine	4.21	2.41	2.38	5.45	2.19	1.86
Brandon	4.28	2.38	2.51	5.65	2.48	2.02
Winnipeg	4.54	2.55	2.51	5.86	2.43	2.05
Interlake	4.37	2.48	2.39	5.61	2.26	1.86
North Eastman	4.35	2.52	2.31	5.50	2.20	2.05
Parkland	4.35	2.55	2.30	5.57	1.92	1.55
Nor-Man	4.98	2.75	2.48	6.07	2.40	1.86
Burntwood	5.76	2.99	2.72	6.90	3.11	2.93
Manitoba	4.49	2.53	2.47	5.78	2.36	1.98

Unadjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	4.18	2.27	3.91	5.23	4.99	5.28
Central	3.58	2.14	3.65	4.62	4.14	3.22
Assiniboine	3.12	2.05	3.21	3.96	3.21	2.75
Brandon	3.38	2.19	3.59	4.42	4.36	2.78
Winnipeg	3.51	2.30	3.53	4.36	4.43	3.08
Interlake	3.52	2.19	3.55	4.61	4.03	2.82
North Eastman	3.26	2.17	3.61	4.13	3.24	2.24
Parkland	3.15	2.10	3.23	4.15	3.19	2.40
Nor-Man	3.10	2.34	2.99	4.18	3.80	1.66
Burntwood	4.00	2.65	3.39	5.81	4.98	6.88
Manitoba	3.46	2.23	3.54	4.42	4.12	2.94

Note 1: regions ordered by PMR

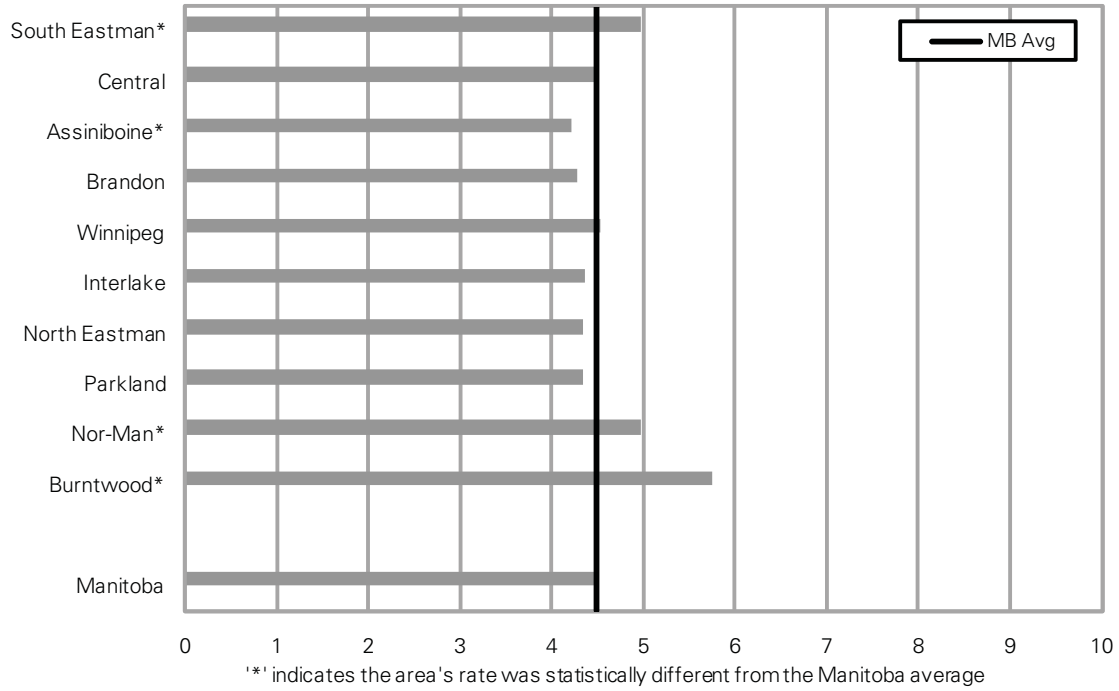
Note 2: see methods section for more information on how this indicator was defined

Note 3: blank cell = suppressed data due to small numbers

Source: Manitoba Centre for Health Policy, 2010

Figure 3.25: Ratio of Total Costs for Individuals With and Without Diabetes (Definition 3), Apr 1, 2005-Mar 31, 2007

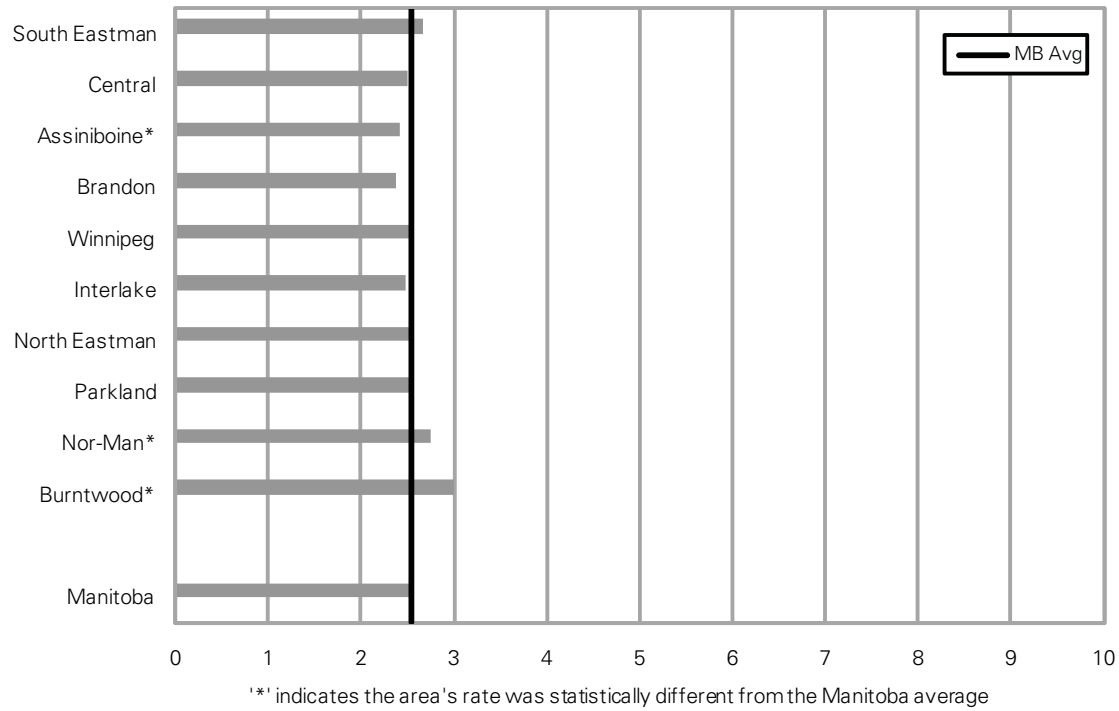
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.26: Ratio of Physician Costs for Individuals With and Without Diabetes (Definition 3), Apr 1, 2005-Mar 31, 2007

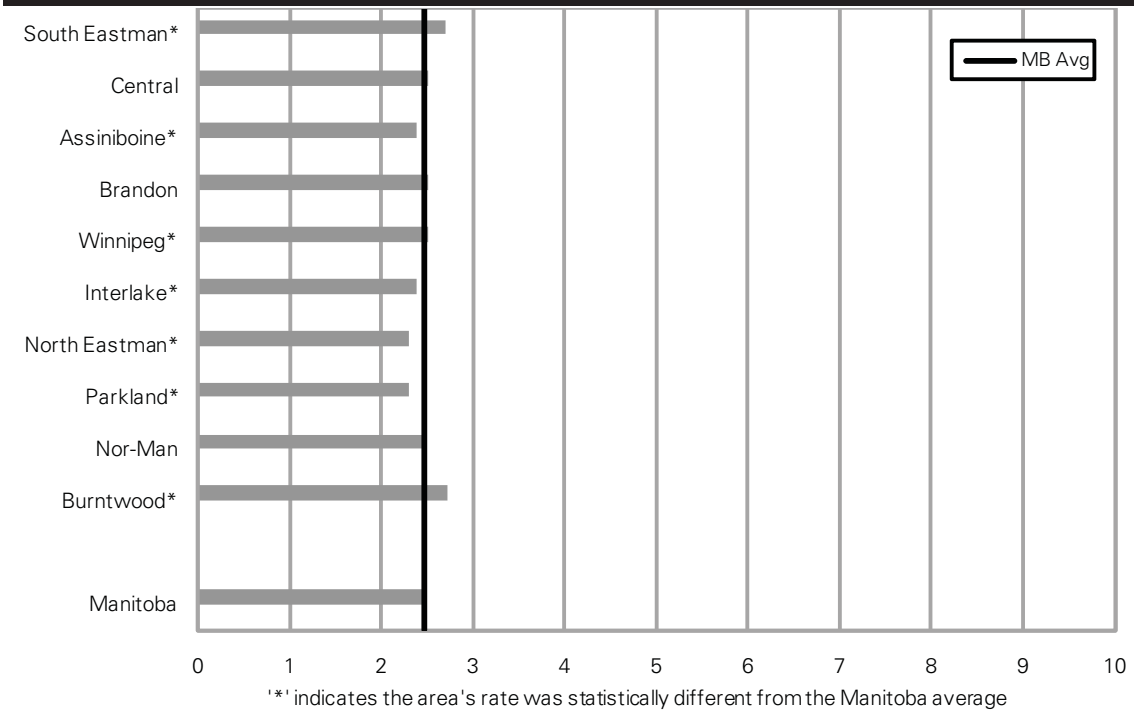
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.27: Ratio of Hospital Costs for Individuals With and Without Diabetes (Definition 3), Apr 1, 2005-Mar 31, 2007

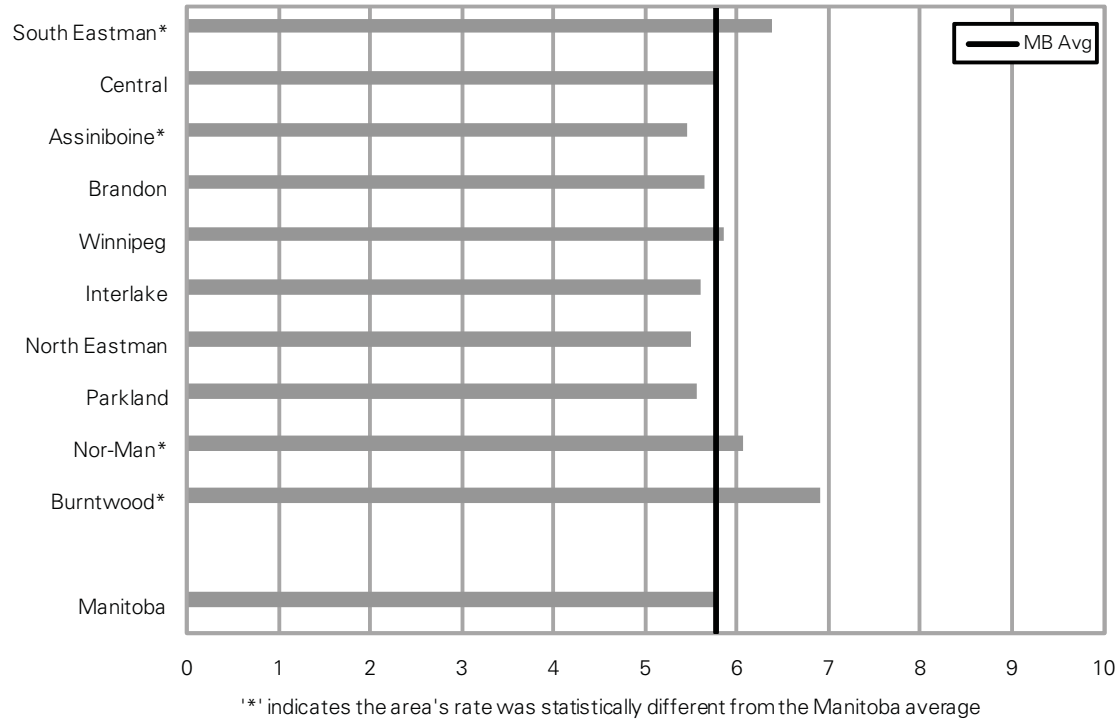
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.28: Ratio of Prescription Drug Costs for Individuals With and Without Diabetes (Definition 3), Apr 1, 2005-Mar 31, 2007

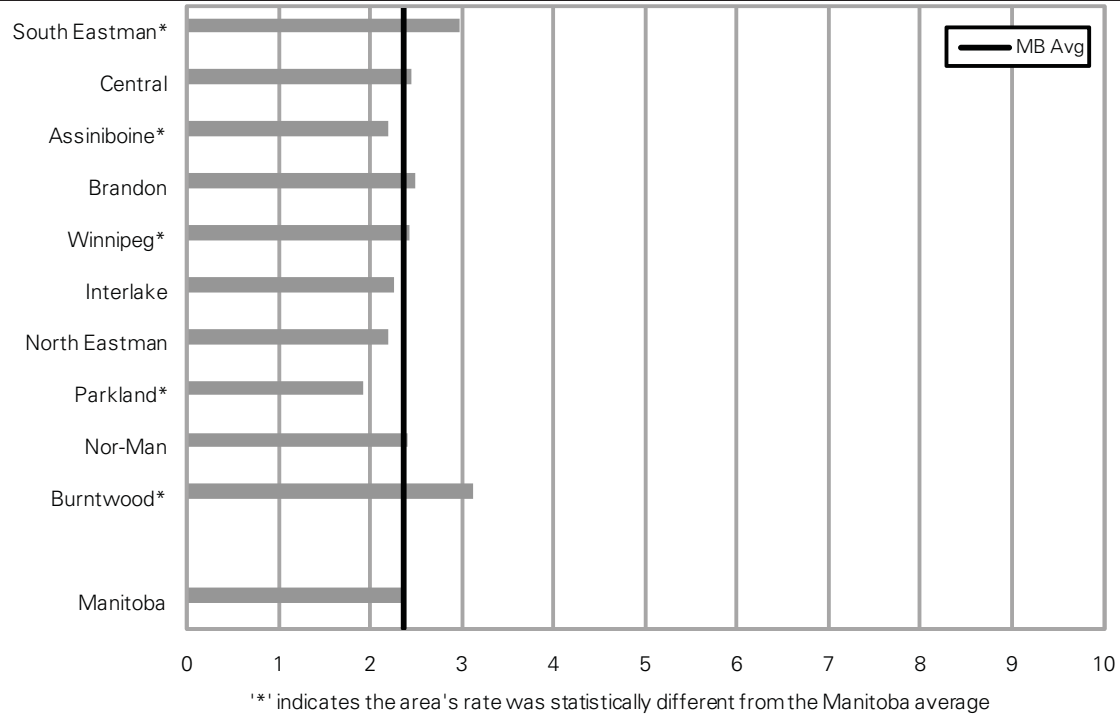
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.29: Ratio of Home Care Costs for Individuals With and Without Diabetes (Definition 3), Apr 1, 2005-Mar 31, 2007

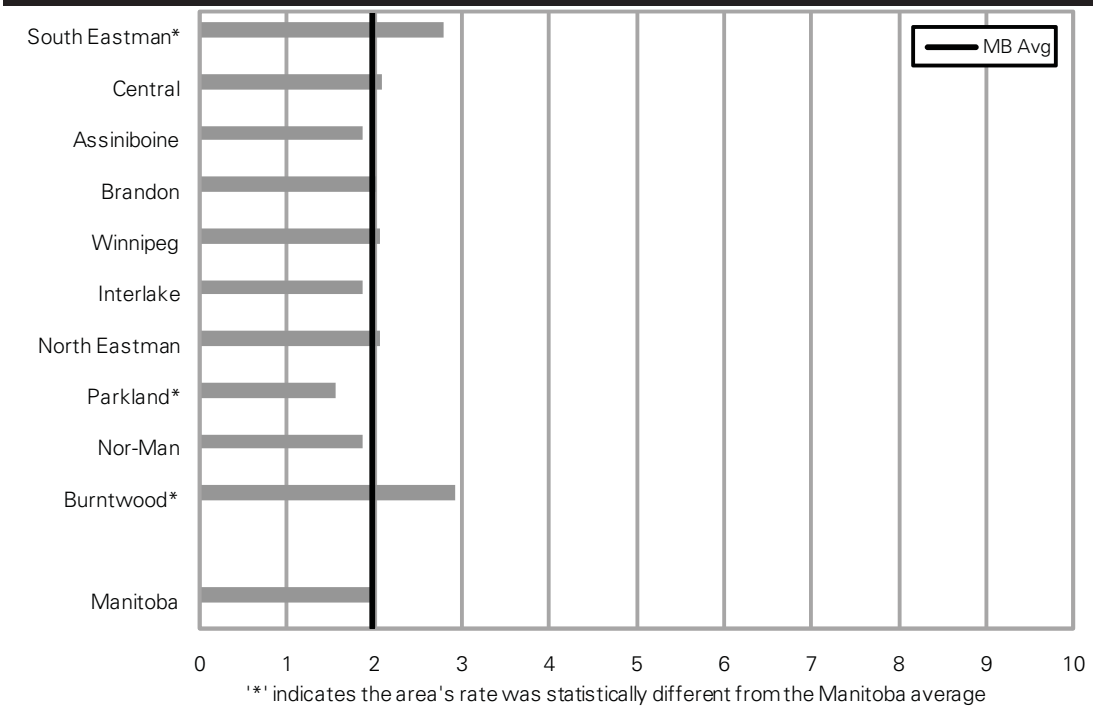
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.30: Ratio of PCH Costs for Individuals With and Without Diabetes (Definition 3), Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

CORONARY HEART DISEASE (CHD)

Noteworthy:

The average cost for treating people with coronary heart disease is relatively high. In fact, it is the second highest of all of the conditions we are considering. However, there are relatively few people who have CHD (approximately 7% of the population in this study). Overall the cost of healthcare is six times greater for people with CHD than people without it. Assiniboine, North Eastman, and Interlake have lower ratios for all services; and Parkland has lower ratios in all but one. Winnipeg and South Eastman have higher ratios for all services except physician services.

Table 3.13: Actual Costs for Indivicuals With and Without Coronary Heart Disease, Apr 1, 2005-Mar 31, 2007

	Population-Based Approach		Matched Approach	
	Manitobans With	Manitobans Without	Manitobans With	Manitobans Without
Number of People	57,170	746,149	57,170	57,170
Total Expenditures				
All Services	$925,244,640	$2,603,314,793	$925,244,640	$536,457,069
Physician Services	114,443,136	585,401,354	114,443,136	68,873,152
Hospital	251,150,001	659,405,814	251,150,001	124,434,042
Prescription Drugs	244,448,009	803,092,182	244,448,009	111,268,555
Home Care	123,137,227	223,756,440	123,137,227	75,788,143
Personal Care Home Residence	192,066,268	331,659,003	192,066,268	156,093,176
Mean Expenditures				
All Services	$16,184	$3,489	$16,184	$9,384
Physician Services	2,002	785	2,002	1,205
Hospital	4,393	884	4,393	2,177
Prescription Drugs	4,276	1,076	4,276	1,946
Home Care	2,154	300	2,154	1,326
Personal Care Home Residence	3,360	444	3,360	2,730

Source: Manitoba Centre for Health Policy, 2010

Table 3.14: Ratio of Costs for Individuals With and Without Coronary Heart Disease, Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years

Adjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	6.58	3.32	5.29	6.27	8.07	8.81
Central	6.16	3.18	5.09	5.82	7.15	7.38
Assiniboine	5.41	2.98	4.66	5.19	5.54	5.23
Brandon	6.09	3.16	5.17	5.84	7.34	7.71
Winnipeg	6.43	3.32	5.22	6.05	7.61	8.16
Interlake	5.16	2.89	4.58	5.01	5.92	5.94
North Eastman	5.26	2.95	4.52	5.07	5.79	5.90
Parkland	5.68	3.11	4.74	5.36	5.58	5.08
Nor-Man	6.30	3.32	4.91	5.84	6.72	6.43
Burntwood	6.76	3.57	5.16	6.32	8.28	10.95
Manitoba	6.22	3.25	5.10	5.87	7.19	7.53

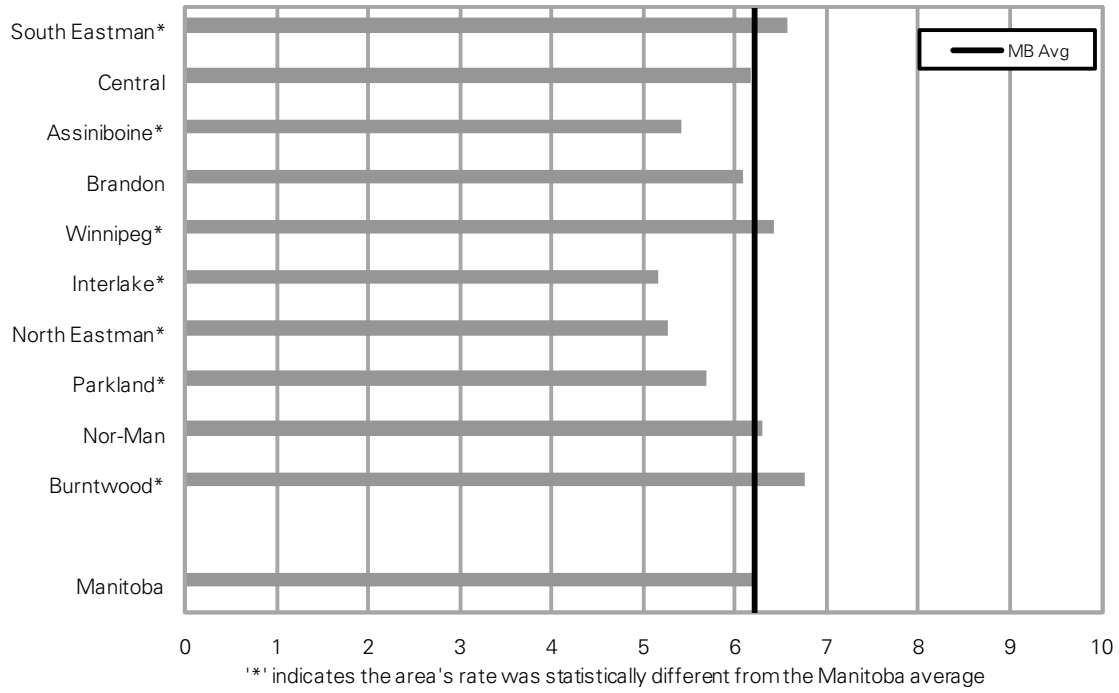
Unadjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	4.98	2.52	5.08	4.83	8.70	7.70
Central	4.68	2.47	5.09	4.34	6.62	6.14
Assiniboine	3.87	2.36	4.26	3.62	4.77	4.57
Brandon	4.74	2.50	5.14	4.03	6.31	7.63
Winnipeg	4.89	2.59	5.32	3.88	7.73	9.35
Interlake	3.95	2.42	4.14	3.79	5.88	5.26
North Eastman	3.89	2.42	4.59	3.76	4.96	4.94
Parkland	3.88	2.41	4.26	3.89	5.33	3.88
Nor-Man	3.85	2.77	4.03	4.05	6.93	2.62
Burntwood	4.09	2.99	3.99	4.59	5.20	27.56
Manitoba	4.64	2.55	4.97	3.97	7.18	7.56

Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Note 3: blank cell = suppressed data due to small numbers
Source: Manitoba Centre for Health Policy, 2010

Figure 3.31: Ratio of Total Costs for Individuals With and Without Coronary Heart Disease, Apr 1, 2005-Mar 31, 2007

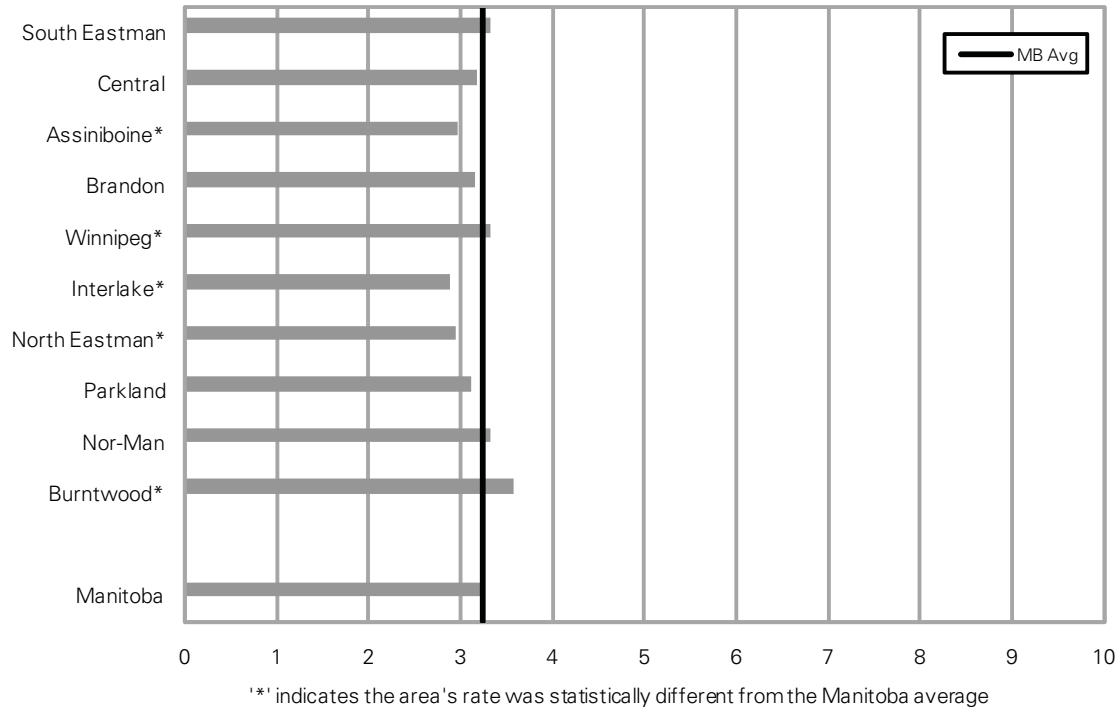
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.32: Ratio of Physician Costs for Individuals With and Without Coronary Heart Disease, Apr 1, 2005-Mar 31, 2007

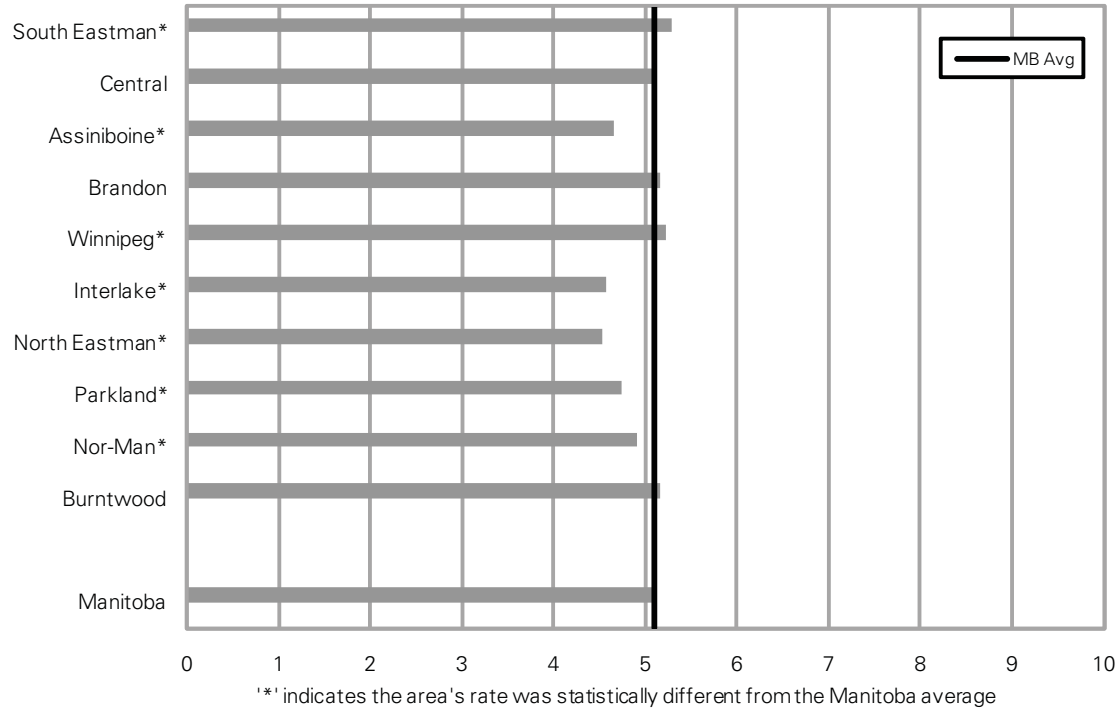
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.33: Ratio of Hospital Costs for Individuals With and Without Coronary Heart Disease, Apr 1, 2005-Mar 31, 2007

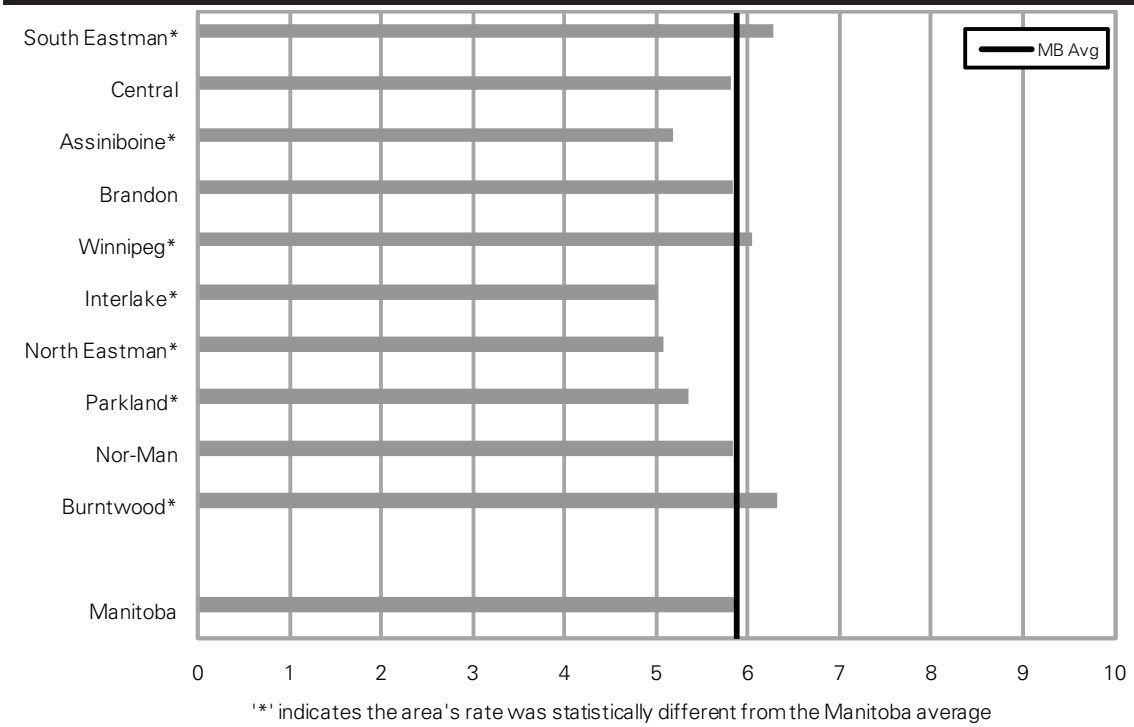
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.34: Ratio of Prescription Drug Costs for Individuals With and Without Coronary Heart Disease, Apr 1, 2005-Mar 31, 2007

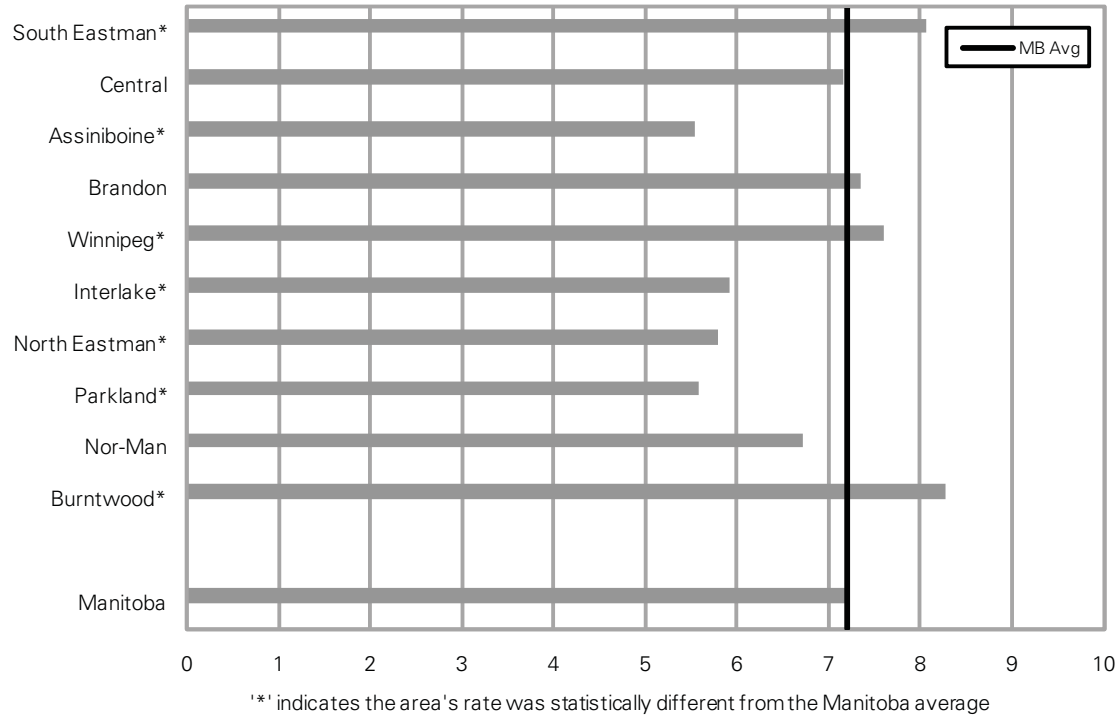
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.35: Ratio of Home Care Costs for Individuals With and Without Coronary Heart Disease, Apr 1, 2005-Mar 31, 2007

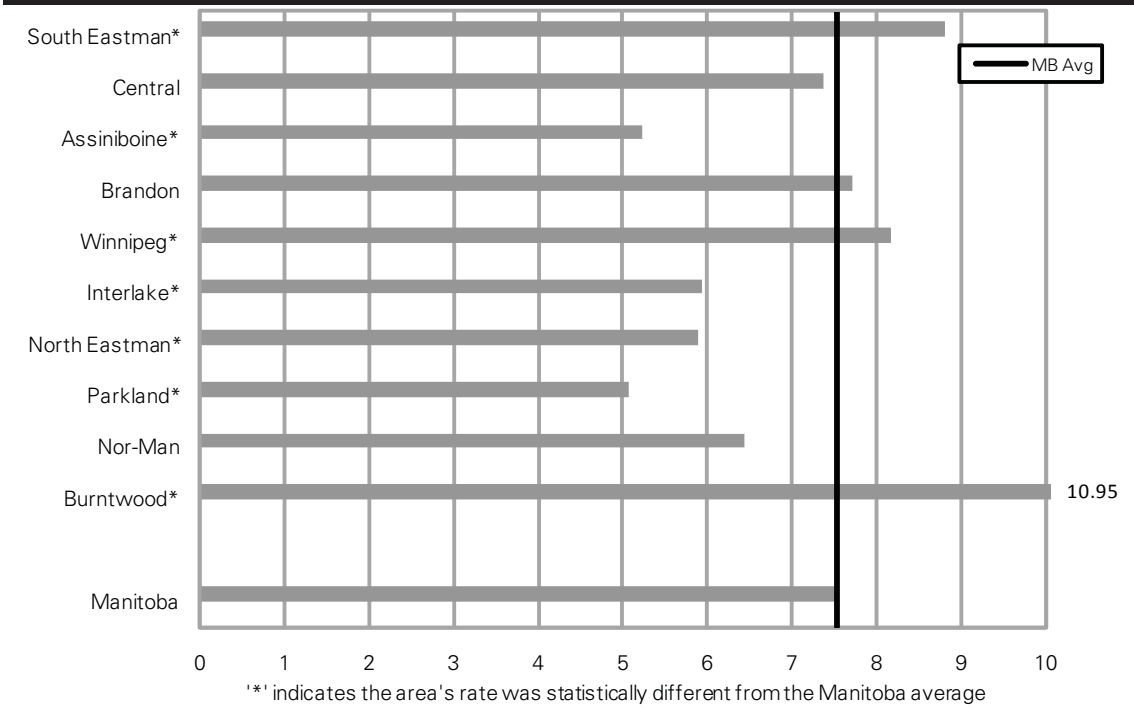
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.36: Ratio of PCH Costs for Individuals With and Without Coronary Heart Disease, Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

STROKE

Noteworthy:

Stroke has the lowest prevalence of all of the conditions on which we report (approximately 3% of persons in this study). But these individuals have the highest cost of healthcare with an overall ratio of over eight times the cost after adjusting for age, sex, comorbidity and hypertension. Personal Care Home residence use is the greatest with 20 times more the cost for people who have had a stroke than for people who have not. Winnipeg has a higher ratio for all services. North Eastman has a higher cost for PCH care but lower for all other services except home care, which is similar to the provincial mean.

Table 3.15: Actual Costs for Individuals With and Without Stroke, Apr 1, 2005-Mar 31, 2007

	Population-Based Approach		Matched Approach	
	Manitobans With	Manitobans Without	Manitobans With	Manitobans Without
Number of People	26,493	781,089	26,493	79,479
Total Expenditures				
All Services	$588,660,452	$2,967,834,827	$588,660,452	$816,915,767
Physician Services	53,705,638	656,568,561	53,705,638	106,342,054
Hospital	138,303,397	787,842,769	138,303,397	199,841,200
Prescription Drugs	110,514,899	949,165,655	110,514,899	178,598,840
Home Care	78,044,217	266,566,926	78,044,217	123,340,405
Personal Care Home Residence	208,092,302	307,690,916	208,092,302	208,793,268
Mean Expenditures				
All Services	$22,219	$3,800	$22,219	$10,278
Physician Services	2,027	841	2,027	1,338
Hospital	5,220	1,009	5,220	2,514
Prescription Drugs	4,171	1,215	4,171	2,247
Home Care	2,946	341	2,946	1,552
Personal Care Home Residence	7,855	394	7,855	2,627

Source: Manitoba Centre for Health Policy, 2010

Table 3.16: Ratio of Costs for Individuals With and Without a Stroke, Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years

Adjusted Rates:

RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	8.56	3.23	5.84	5.60	10.71	25.74
Central	7.97	3.04	5.52	5.22	9.33	21.07
Assiniboine	6.71	2.76	4.90	4.44	7.08	14.64
Brandon	6.97	2.82	4.98	4.56	7.64	16.04
Winnipeg	8.71	3.33	5.65	5.55	9.35	20.91
Interlake	7.13	2.89	5.05	4.65	7.93	17.17
North Eastman	6.91	2.78	5.10	4.63	8.87	23.43
Parkland	6.20	2.63	4.73	4.18	6.75	13.75
Nor-Man	7.34	2.95	5.21	4.88	8.99	20.10
Burntwood	8.96	3.56	5.45	5.69	9.94	25.82
Manitoba	8.16	3.17	5.47	5.27	8.97	19.94

Unadjusted Rates:

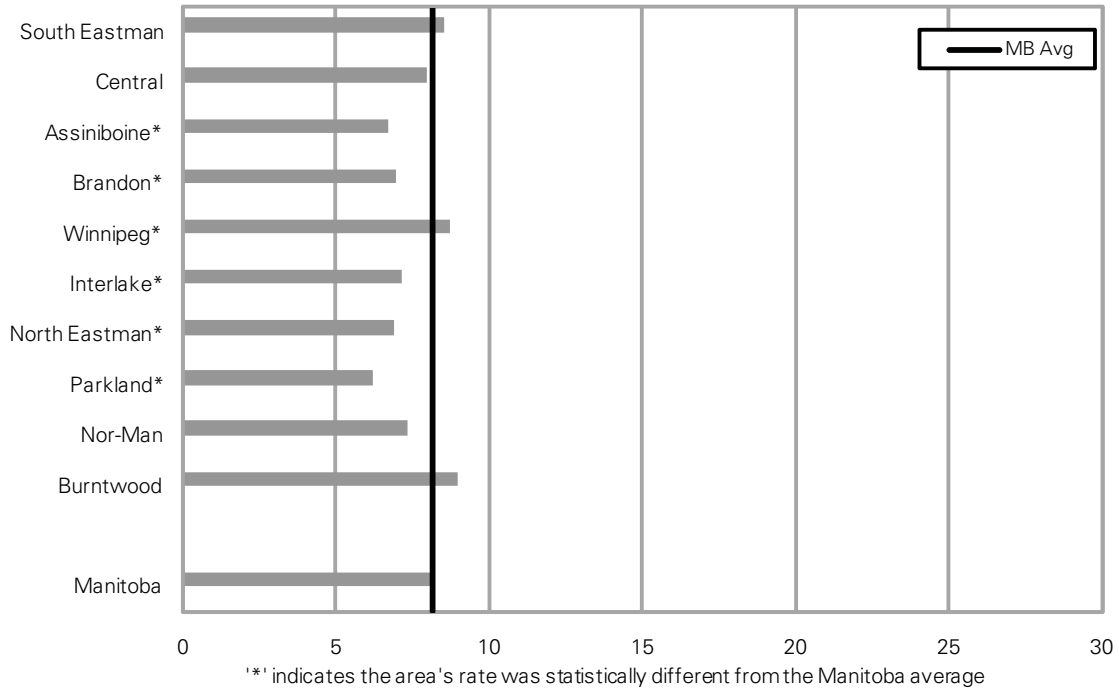
RHA	Total	Physician	Hospital	Prescription Drugs	Home Care	PCH
South Eastman	6.54	2.39	5.66	4.29	10.62	23.79
Central	6.05	2.31	5.30	3.53	8.43	17.00
Assiniboine	5.12	2.24	4.97	3.04	6.12	11.61
Brandon	5.58	2.41	5.36	3.38	7.26	13.89
Winnipeg	6.14	2.44	5.39	3.42	9.10	23.64
Interlake	5.15	2.31	4.73	3.23	7.52	17.02
North Eastman	5.31	2.34	5.20	3.63	8.61	21.17
Parkland	4.67	2.14	4.32	3.11	6.25	11.45
Nor-Man	5.30	2.56	3.41	3.22	7.44	24.66
Burntwood	3.88	2.84	3.58	4.00	8.07	.
Manitoba	5.85	2.41	5.18	3.43	8.63	19.94

Note 1: regions ordered by PMR

Note 2: see methods section for more information on how this indicator was defined

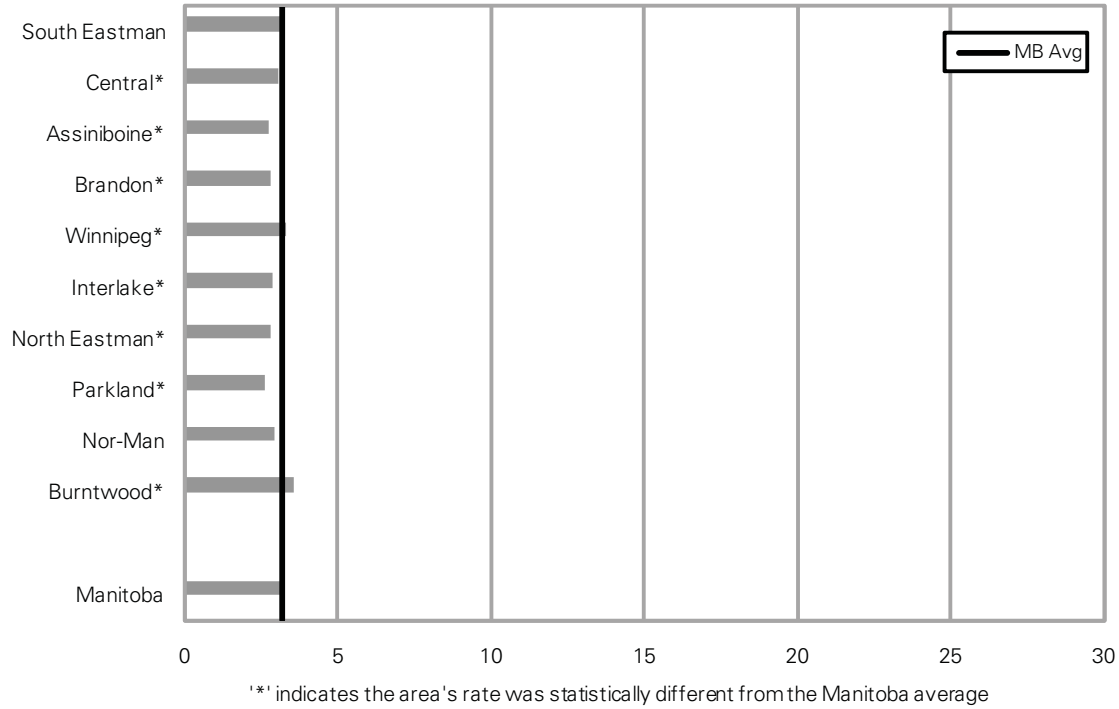
Source: Manitoba Centre for Health Policy, 2010

Figure 3.37: Ratio of Total Costs for Individuals With and Without a Stroke, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

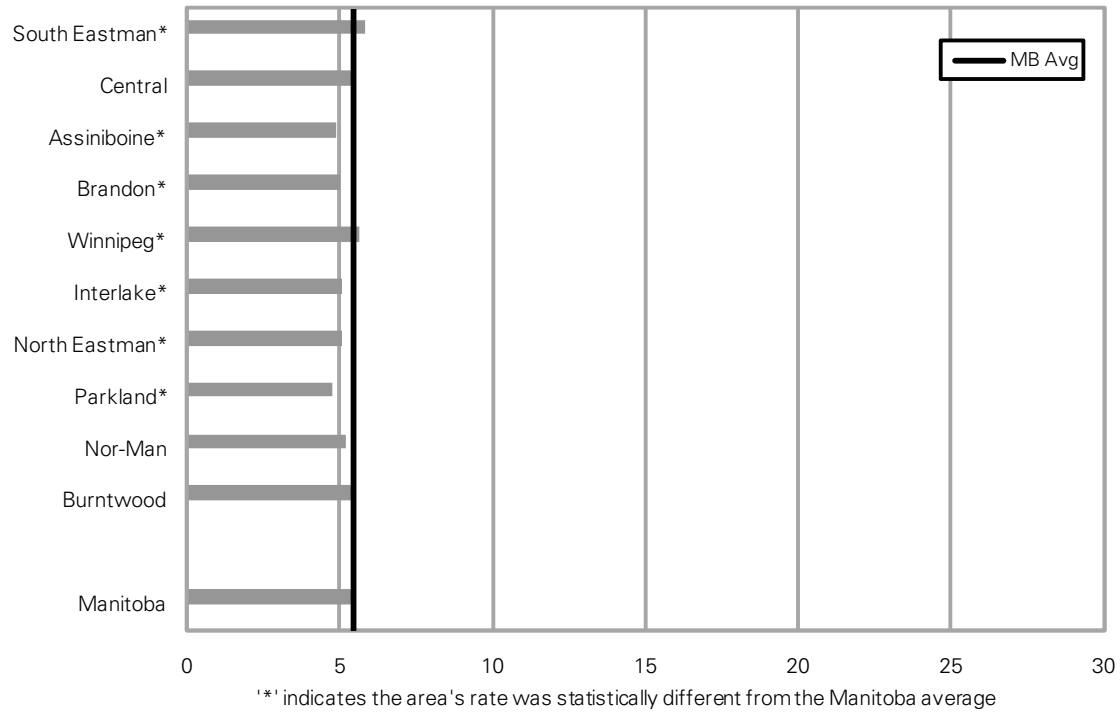
Figure 3.38: Ratio of Physician Costs for Individuals With and Without a Stroke, Apr 1, 2005-Mar 31, 2007
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.39: Ratio of Hospital Costs for Individuals With and Without a Stroke, Apr 1, 2005-Mar 31, 2007

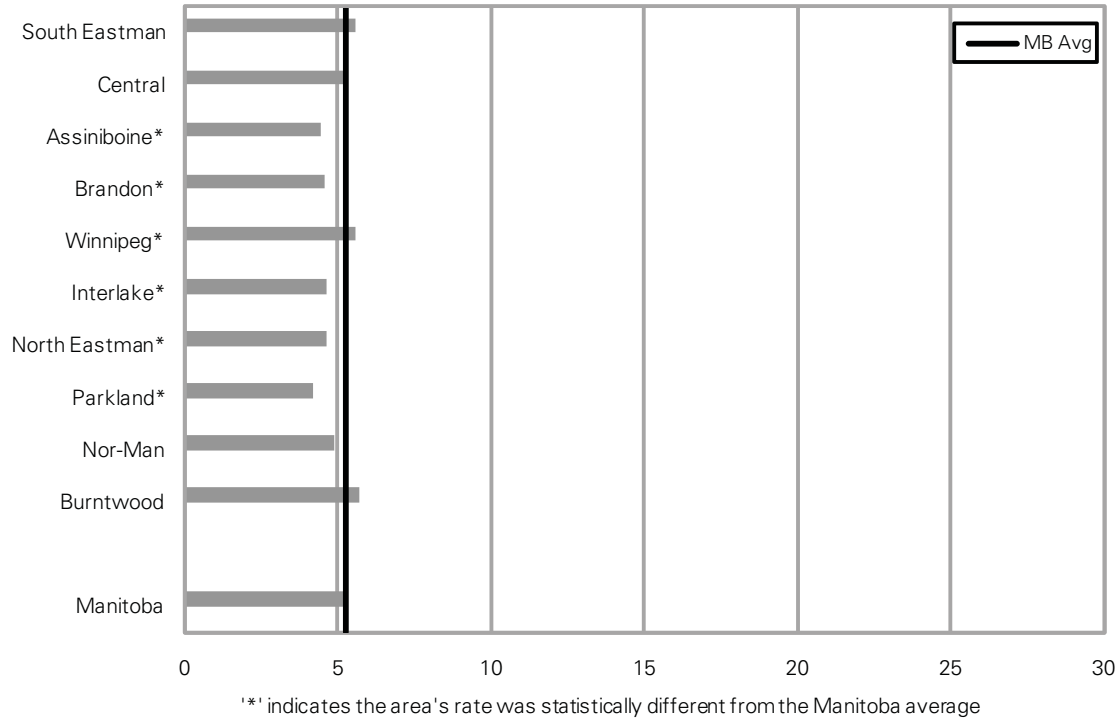
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.40: Ratio of Prescription Drug Costs for Individuals With and Without a Stroke, Apr 1, 2005-Mar 31, 2007

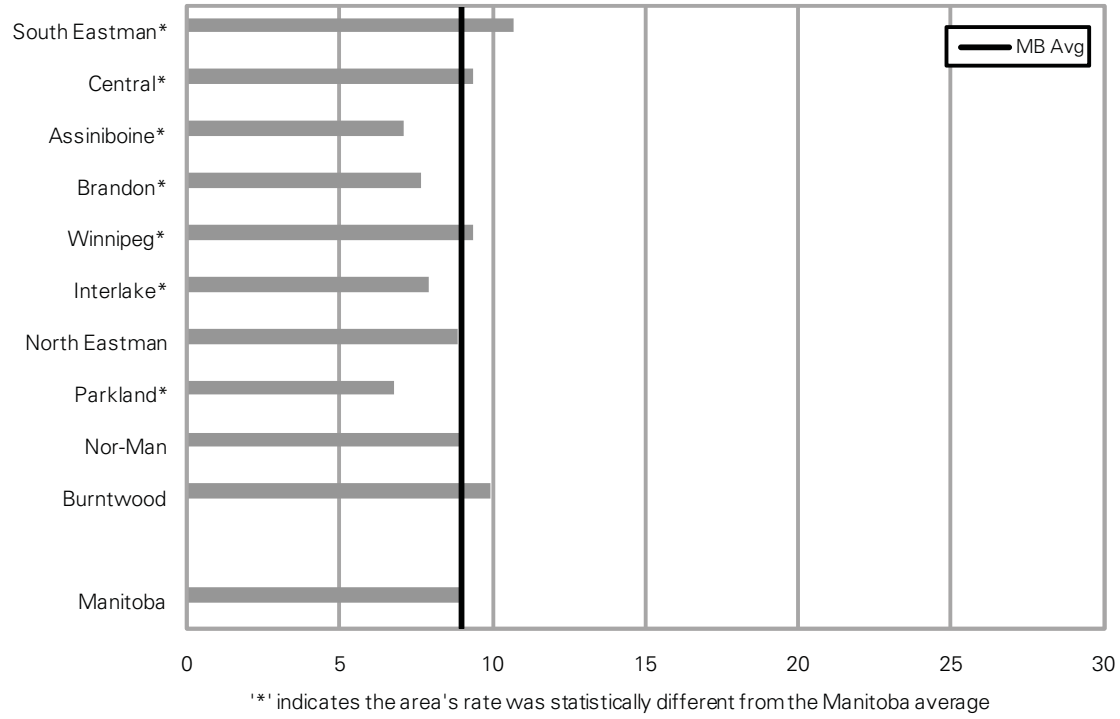
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.41: Ratio of Home Care Costs for Individuals With and Without a Stroke, Apr 1, 2005-Mar 31, 2007

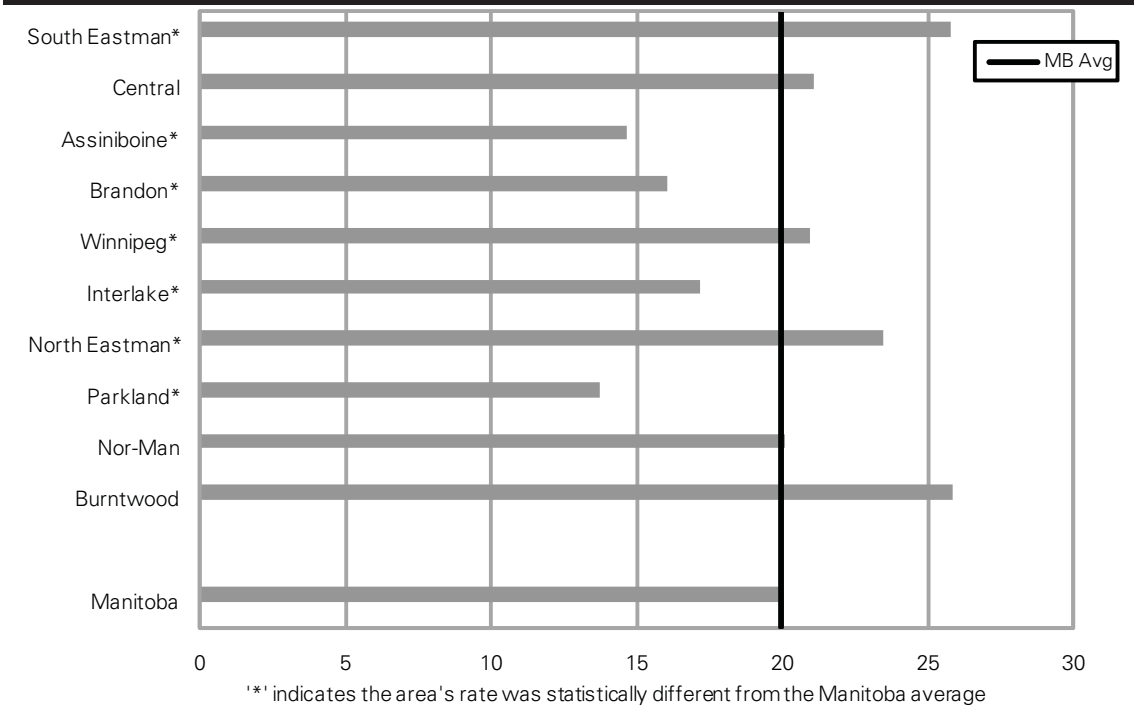
After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

Figure 3.42: Ratio of PCH Costs for Individuals With and Without a Stroke, Apr 1, 2005-Mar 31, 2007

After controlling for number of ADGs, age, sex, hypertension and cases; population: aged 19+ years



Note 1: regions ordered by PMR
Note 2: see methods section for more information on how this indicator was defined
Source: Manitoba Centre for Health Policy, 2010

SUMMARY

People who have a chronic condition have greater costs for healthcare services than people without. Even after adjusting for age, sex, and comorbidity, the average costs range from 2.6 times as much for people who have asthma/COPD when compared with people who do not have asthma/COPD to 8.2 times as much for people who have had a stroke compared with those who have not. This ratio varies by health service—prescription drugs shows the highest ratio for asthma/COPD and diabetes and home care and personal care homes are the highest for arthritis, coronary heart disease, and stroke.

There is variation between regions in the ratios even when the cost of services is held constant. There are many situations where the cost of services received by individuals in a given region is higher or lower than the provincial average, reflecting either differences in the way the healthcare system is being used or other important factors that have an impact on healthcare utilization that were not or could not be measured in this study.

Chapter 4: Discussion

In this report, we have presented the cost for healthcare services that are incurred by people who have at least one of five chronic diseases when compared with others who do not have the condition. We have looked at it by comparing the costs for people with a chronic condition to a matched cohort of people who do not have the condition and to the entire population. To further refine the comparisons, we have used statistical techniques to control for other individual factors known to affect the utilization of healthcare—specifically age, sex, and comorbidity. We have not limited the analysis to the costs of treating the chronic condition but rather have looked at all of the costs associated with providing health services to an individual with one of these conditions. For the first time we have been able to quantify the differential in healthcare costs between people who have one of these conditions and those who do not.

Like other studies we have found that, on average, people with a chronic condition have higher healthcare costs than those who do not have the condition. We can look at the dollars that are involved by reviewing the total expenditures for people with at least one of the conditions, as is shown in Table 4.1. It is important to note that it is not possible to sum these columns as an individual may have multiple conditions and therefore will appear in multiple rows of the table.

Table 4.1: Summary of Total Unadjusted Cost for Healthcare of People With Chronic Conditions, 2005/06 -2006/07

	Number of People	Total Health Care Costs
Arthritis	249,402	$2,011,806,337
Asthma/COPD	119,193	1,014,211,099
Coronary Heart Disease	57,170	925,244,640
Diabetes (definition 3)	58,153	774,108,939
Stroke	26,493	588,660,452

Source: Manitoba Centre for Health Policy, 2010

This table raises two important issues. First, a substantial number of Manitobans are affected by at least one of these five chronic conditions. Second, substantial costs are incurred in providing healthcare for these individuals. Any reduction in the prevalence of these conditions would result in decreased costs for the healthcare system. Similarly, changes in approaches to healthcare have the potential to reduce costs, for example educating people in self–management may avoid visits to physicians. Lorig et al. have shown the effect that self–management can have on health services utilization (1999; 2001).

One of the features of this report is that we have made comparisons between people with at least one of the chronic conditions and two different groups—a group that is matched on age and sex and a group composed of all of the other people living in the same region as those with the chronic condition. Ideally, we would have liked to match people according to their age, sex, and region of residence but this was not possible due to differences in the prevalence of the conditions between regions. So on a provincial level, we can make comparisons between matched cohorts; while at the regional level, we can make comparisons between those who have and do not have the particular chronic condition. Under both approaches we see people with chronic disease have relatively higher healthcare costs. It is

noteworthy that in all cases the mean cost for individuals without the chronic condition in the matched cohort approach is greater than the population–based approach, regardless of whether a person has a chronic condition or not. This reflects the impact of age on the prevalence of chronic disease. The matched approach is biased towards older individuals, while the population–based approach includes many younger people.

In much of the work done at MCHP, we make a statistical adjustment for the socioeconomic status (SES) of people in the study in addition to age and sex. This has the effect of making two or more groups similar so that comparisons can be made. In this work, we have chosen not to adjust for socioeconomic status as that would have the unrealistic effect of removing SES as a contributor to chronic illness. What we have shown here is the actual difference between those who have a chronic condition and those who do not, ensuring that the age and sex composition of the two groups is the same. Further research into how SES is associated with both the prevalence and the associated cost would be a very important next step in this area of research.

One of the most interesting stories that emerges from this analysis is that the ratio of cost for providing healthcare to people who have or do not have a chronic condition varies by region. This is surprising given that the costs were equalized across the province; that is (for example), a person who was hospitalized for the same condition in Thompson, Winnipeg, or Dauphin would be assigned the same cost. While it was not the intent of this work to analyze why these differences exist, there are some possibilities. First, there may be differences in the way funds are allocated within the regions. Some regions may provide funding to hospitals rather than home care thereby increasing the length of stay and cost of hospital care. But this argument does not hold up for the provincially administered programs, specifically physicians and prescription drugs. The only explanation for differences in these costs is differential utilization between regions, i.e., people in some regions use or are provided with these healthcare services more than in others. This raises the question of what is the "right" level of service utilization; its consideration is beyond the scope of this report. However, we have provided data that may be used for further discussion about both the appropriate level of services and for further investigation about the outcomes that are associated with the different utilization of services. In our earlier work, we accepted the provincial mean level of utilization (after adjusting for a variety of factors including age, sex, and socioeconomic status) as a way of allocating healthcare funds to regions (Finlayson et al., 2007). We have made comparisons to the provincial average in two ways in this report, and both tell a slightly different story. In the Executive Summary (Table 2), we compare the average cost of healthcare for people with a chronic condition in each region to the average cost for all people in Manitoba without the condition. Table 3.1 (and the regional comparisons in Chapter 3) compares those living with the condition in each region to those living in the same region without the condition. These different presentations tell different stories. For example for people living with asthma and COPD in South Eastman, the ratio of the cost of healthcare in relation to those living in South Eastman without asthma and COPD is greater than the provincial average ratio. However, in relation to the provincial average cost for treating asthma/COPD, the South Eastman ratio is lower. Conversely, Brandon RHA has a lower than average ratio when making comparisons within the region, but a higher than average ratio when compared to the provincial average. This suggests that when making comparisons within a region the overall health status of the population needs to be considered, as well as access to services. The use of provincial averages may be a starting point for attempting to determine what level of service is most appropriate.

A further issue that adds complexity to the interpretation of these results is that of comorbidity, and we have dealt with it in two ways. First, we have used hypertension as a covariate when modelling our results for coronary heart disease, diabetes, and stroke. This recognizes that the presence or absence of hypertension likely affects the cost/severity of the other conditions. Secondly, we use a gross measure of morbidity in people—one that counts the different types of health problems a person has—to control for the effect of multiple health problems. We chose not to look at just the cost of treating chronic conditions; and while unique among most studies of this sort, it considers the reality of providing health services to people—it is important to treat the whole person rather than just a disease in isolation. Table 4.2 reports the level of comorbidity among our study population.

Table 4.2: Morbidity/Comorbidity of Arthritis, Asthma/COPD, Coronary Heart Disease, Diabetes, and Stroke

Number of Conditions	Number of People	% of People
1	220,754	69.6%
2	73,139	23.1%
3	18,345	5.8%
4	4,375	1.4%
5	539	0.2%

Source: Manitoba Centre for Health Policy, 2010

Comorbidity associated with diabetes has been considered an important issue. Like other studies that found diabetes was primarily comorbid with cardiovascular conditions (in our case, coronary heart disease and stroke), we found 24% of our cohort with diabetes has one or more of these conditions. However, the most common single comorbid condition was arthritis with 23% which is most common in older people. This suggests that there is an important relationship between aging and level of comorbidity in individuals. Table 4.3 shows the Top 10 comorbid conditions with diabetes.

Table 4.3: Diabetes Comorbidity

Diabetes alone	12656	32%
Diabetes and...		
Arthritis	8991	23%
Arthritis & Asthma/COPD	3707	9%
Arthritis & CHD	2691	7%
Asthma/COPD	2674	7%
CHD	2268	6%
Arthritis, CHD & Asthma/COPD	1704	4%
CHD & Asthma/COPD	803	2%
Arthritis & Stroke	751	2%
Arthritis, CHD & Stroke	730	2%
Stroke	631	2%

Source: Manitoba Centre for Health Policy, 2010

Appendix 1 provides details regarding comorbidity among Manitobans. About 70% of people with one of the chronic conditions we have investigated have just one condition and, of that group, about 60% have arthritis and over 87% have both arthritis and asthma/COPD. Arguably these conditions are least likely to be reduced through prevention programs, so alternative approaches to healthcare (including self–management) should be considered.

Another way of looking at the impact of comorbidity is to create two matched cohorts where one group has one of the chronic conditions (or may have more than one) and the other group has none of the conditions. Table 4.4 provides this comparison. We see that people who have diabetes (and potentially other conditions) have 3.3 times greater healthcare costs than people who do not have diabetes, asthma/COPD, arthritis, coronary heart disease, or stroke. This compares with a ratio of 2.2 times greater cost for a cohort where our only requirement is that the matched person not have the condition, but may have one of the other conditions. Similar results are found for the other conditions: asthma/COPD, 2.5 times versus 1.7 times; coronary heart disease, 2.8 times versus 1.7 times; stroke, 3.1 times versus 2.2 times. These results indicate that comorbidity has an important impact on costs and, not surprisingly, further shows that healthier people have lower costs than people who have a chronic condition.

Table 4.4: Comparison of Total Healthcare Cost for People With a Chronic Condition and Those Without Any of the Chronic Conditions

	People with the Condition		Age-Sex Matched Cohort with None of the Conditions		
	Number	Average Two Year Total Healthcare Cost	Number	Average Two Year Total Healthcare Cost	Ratio
Asthma/COPD	119,193	8,509	119,193	3,467	2.45
Coronary Heart Disease	57,170	16,184	57,170	5,720	2.83
Diabetes (Definition 2)	48,268	13,998	48,268	4,189	3.34
Stroke	26,493	22,219	26,493	7,226	3.07

Source: Manitoba Centre for Health Policy, 2010

This research has quantified the additional healthcare costs associated with individuals who have one or more chronic conditions. This provides strong evidence to support the suggestion that if we were able to reduce the prevalence of these conditions, and/or adopt alternative approaches to healthcare, we would experience reduced costs across the system. Other research has shown that a number of things can be done to reduce the likelihood of a person developing one of these conditions whether it is availability/affordability and use of healthy foods, the presence of environmental contaminants, or lifestyle practices such as physical activity and not smoking. Similarly, social and personal features can play an important role in health status—things like social supports, community social capital, and insufficient income to meet basic needs for housing. There is also evidence that chronic disease self–management can reduce need for health services. Further research will be needed to determine the impact that population–based changes may have on the cost of healthcare for Manitobans. This report can be considered an impetus and starting point towards considering questions such as the ones on the following page.

- Why are there inter–regional differences in the cost of providing healthcare to people with chronic disease?
- What is the "right" level of care, or put another way, are lower or higher ratios of healthcare expenses for people with chronic disease good or bad?
- How does spending on chronic disease management affect outcomes?
- What can be done to reduce costs?
  - Prevention
  - Clinical practice
  - Self–management
- What is the relationship between SES and chronic disease, and how could changes in SES affect chronic disease prevalence?
- What other social factors affect both prevalence and cost of chronic disease?

GLOSSARY

Acronyms

ACG – Adjusted Clinical Group

ADG – Adjusted Diagnostic Group

CIHI – Canadian Institute for Health Information

DAD - Discharge Abstract Database

DPIN – Drug Plan Information Network Database

MADG – Major ADG

MCHP –Manitoba Centre for Health Policy

MB Health – Manitoba Health

PCH – Personal care home

RIW – Resource Intensity Weight

SES – Socioeconomic status

Adjusted Clinical Group (ACG)

A risk adjustment tool developed to measure the illness burden (morbidity) of individual patients and enrolled populations. This system quantifies morbidity by grouping individuals based on their age, sex, and all known medical diagnoses assigned by their health care providers over a defined time period (typically one year). Previously called "Ambulatory Care Group". (The John Hopkins University Bloomberg School of Public Health, Health Services Research & Development Center. The John Hopkins ACG® Case-Mix System Version 6.0 Release Notes. Editor in Chief: Jonathan P. Weiner. The John Hopkins University. April, 2003.) (Finlayson et al., 2007, page 39)

Adjusted Diagnostic Group (ADG)

Formerly known as Ambulatory Diagnostic Groups, ADGs continue to be part of the Adjusted Clinical Group (ACG) case-mix system. The ACG method groups every ICD-9/ICD-9-CM medical diagnosis code assigned to a patient into one of 32 different ADGs based on five clinical and expected utilization criteria: 1) duration of the condition (acute, recurrent, or chronic); 2) severity of the condition (e.g., minor and stable versus major and unstable); 3) diagnostic certainty (symptoms focusing on diagnostic evaluation versus documented disease focusing on treatment services); 4) etiology of the condition (infectious, injury, or other); and 5) specialty care involvement (medical, surgical, obstetric, haematology, etc.). See "Chronic Disease" and "Comorbidity". (The John Hopkins University Bloomberg School of Public Health, Health Services Research & Development Center. The John Hopkins ACG® Case-Mix System Version 6.0 Release Notes Editor in Chief: Jonathan P. Weiner. The John Hopkins University. April, 2003.) (Finlayson et al., 2007, page 40)

Algorithm

A procedure or formula for solving a problem

(Whatis.com http://whatis.techtarget.com/definition/0,,sid9_gci211545,00.html; accessed Jan 22, 2010).

Arthritis

A group of conditions that affect the health of the bone joints in the body. Arthritic diseases include rheumatoid arthritis and psoriatic arthritis, which are autoimmune diseases; septic arthritis caused by joint infection; and the more common osteoarthritis or degenerative joint disease. Arthritis can be caused from strains and injuries caused by repetitive motion, sports, overexertion, and falls. Unlike the autoimmune diseases, osteoarthritis largely affects older people and results from the degeneration of joint cartilage (Lix et al., 2006, page 128).

In this study, arthritis is defined as one or more hospitalizations OR two or more physician visits over a five-year time period (2000/01-2004/05) for those aged 19+ where the events are coded with an ICD code representing arthritis.

Asthma

A disease in which inflammation of the airways causes airflow into and out of the lungs to be restricted (Lix et al., 2006, page 129).

For this study, asthma is defined as one or more hospitalizations OR one or more physician visits OR one or more prescriptions over a five-year time period (2000/01-2004/05) for those aged 24+ where the events are coded with an ICD code representing asthma/COPD or a prescription is dispensed for an asthma/COPD medication. In this report we refer to asthma and chronic obstructive pulmonary disease as the same condition as it is not usually clinically possible to definitively distinguish between the two conditions.

Bootstrapping

A technique for estimating the variance and the bias of an estimator by repeatedly drawing random samples with replacement from the observations at hand. One applies the estimator to each sample drawn, thus obtaining a set of estimates. The observed variance of this set is the bootstrap estimate of variance. The difference between the average of the set of estimates and the original estimate is the bootstrap estimate of bias (Last, 1995; in the MCHP Glossary)

Comorbidity

This is the simultaneous existence of more than one medical condition in an individual (Finlayson et al., 2007, page 43).

In this study, comorbidity was assessed by assigning ADGs to each individual. The count of the number of ADGs to which a person was assigned was the value used in the model.

Charlson Index

This index contains 19 categories of comorbidity, originally based on ICD-9-CM diagnoses and procedure codes, and their associated weights that provide an overall comorbidity score to reflect the cumulative increased likelihood of one-year mortality (MCHP glossary).

Chronic Disease/Condition

Conditions that are generally incurable, often caused by a complex interaction of factors, and usually have a prolonged clinical course (MCHP Glossary).

Chronic Obstructive Pulmonary Disease (COPD)

A group of lung diseases characterized by limited airflow with variable degrees of air sack enlargement and lung tissue destruction. Emphysema (permanently enlarged air sacks of the lung with reduced lung elasticity) and chronic bronchitis (inflamed and narrowed airways) are the most common forms of chronic obstructive pulmonary disease (from MedlinePlus®; in MCHP Glossary).

For this study, COPD is defined as one or more hospitalizations OR one or more physician visits OR one or more prescriptions over a five-year time period (2000/01-2004/05) for those aged 19+ where the events are coded with an ICD code representing COPD or asthma or a prescription is dispensed for an COPD/asthma medication. In this report, we refer to chronic obstructive pulmonary disease and asthma as the same condition as it is not usually clinically possible to definitively distinguish between the two conditions.

Coronary Heart Disease (CHD)

The end result of the accumulation of atheromatousplaques within the walls of the arteries that supply the myocardium (the muscle of the heart). While the symptoms and signs of coronary heart disease are noted in the advanced state of disease, most individuals with coronary heart disease show no evidence of disease for decades as the disease progresses before the first onset of symptoms, often a "sudden" heart attack, finally arise. After decades of progression, some of these atheromatous plaques may rupture and (along with the activation of the blood clotting system) start limiting blood flow to the heart muscle. The disease is the most common cause of sudden death (MCHP glossary).

For this study, CHD is defined as one or more hospitalizations OR one or more physician visits over a five-year time period (2000/01-2004/05) for those aged 19+ where the events are coded with an ICD code representing CHD.

Diabetes

A chronic condition in which the pancreas no longer produces enough insulin (Type I Diabetes) or when cells stop responding to the insulin that is produced (Type II Diabetes), so that glucose in the blood cannot be absorbed into the cells of the body. The most common endocrine disorder, Diabetes Mellitus affects many organs and body functions, especially those involved in metabolism and can cause serious health complications including renal failure, heart disease, stroke, and blindness. (Lix et al., 2006, page 130).

In this study, diabetes was measured three different ways. The first definition is one or more hospitalizations OR one or more physician visits OR one or more prescriptions in a two-year period (2003/04-2004/05) for those aged 19+. The second definition is one or more hospitalizations OR two or more physician visits in a two-year period (2003/04-2004/05) for those aged 19+. The third definition is one or more hospitalizations OR two or more physician visits OR one or more prescriptions over a three-year period (2002/03-2004/05) for those aged 19+. In all cases, the events will have been coded with an ICD code representing diabetes or a prescription has been dispensed for treating diabetes.

Drug Plan Information Network database (DPIN)

An electronic, on-line, point-of-sale prescription drug database. It links all community pharmacies (but not hospitals or nursing care homes/personal care homes [PCHs]) and captures information about all Manitoba residents, including most prescriptions dispensed to status Indians. DPIN contains information such as unique patient identification, age, birth date, sex, medication history, over-the-counter medication history, patient postal code, new drug prescribed, date dispensed, and unique pharmacy identification number. DPIN is maintained by the Government of Manitoba's Ministry of Health. (Lix et al., 2006, page 135)

Hypertension

"Hypertension is a disorder characterized by high blood pressure; generally this includes systolic blood pressure consistently higher than 140 or diastolic blood pressure consistently over 90" (MCHP concept dictionary, Term: Hypertension - Measuring Prevalence, accessed on Jan. 6, 2010). "Hypertension is a major health problem, especially because it often has no symptoms. If left untreated, hypertension can lead to heart attack, stroke, enlarged heart, or kidney damage" (MCHP glossary).

In this study, hypertension is defined as one or more hospitalizations OR one or more physician visits OR two or more prescriptions over a two-year time period (2005/06-2006/07) for those aged 19+ where the events are coded with an ICD code representing hypertension or a prescription is dispensed for an hypertension medication.

Incidence

The number of new cases of a specific disease/condition/event over a specified time period. The incidence rate uses new cases in the numerator; individuals with a history of the disease/condition are not included. The denominator for incidence rates is the population at risk (MCHP Glossary).

Kappa

A measure of agreement between two sources, each of which is measured on a binary scale (i.e., disease present/absent). (Lix et al., 2006, page 132)

Matching

Matching cases and controls involves matching a study participant with a particular condition or treatment (i.e., case) to a study participant without that condition or treatment (i.e., control) (MCHP glossary).

In this study, matching was dictated by the prevalence of each condition based on age and sex. For example, arthritis is so prevalent that in some age groups there were more people with arthritis than without, so it was not possible to create a matched cohort. The remaining conditions were matched as follows: asthma 1:2, coronary heart disease 1:1, diabetes 1:3, stroke 1:3.

Micro-Costs

User-specific or individual costs (vs. standard or average costs). In this study, micro-costing is done for physician services and prescription drugs, where a claim with a specified cost is submitted for each service or prescription provided to individuals.

Modelling

A statistical approach to looking at relationships between variables. There are two major stages in modelling—the model specification and the development of estimates. The specification stage involves the testing of theoretically relevant variables to see if they actually predict differences in an outcome. Once the variables that will be used in the model are selected (i.e., the characteristics that are both theoretically relevant and have been found to predict the outcome), weights for each of the variables are developed (MCHP Glossary).

Negative Predictive Value

The negative predictive value of a test is the probability that the patient will not have the disease/condition when restricted to all patients/subjects who test negative. You can compute the negative predictive value as NPV = TN / (TN + FN) where TN and FN are the number of true negative and false negative results, respectively. Notice that the denominator for negative predictive value is the number of patients/subjects who test negative (MCHP Glossary).

Per diem

The daily cost/amount reimbursed for providing services (MCHP Glossary).

Population Health Research Data Repository

A comprehensive collection of administrative, registry, survey, and other databases primarily composed of residents of Manitoba. This repository is housed at the Manitoba Centre for Health Policy (MCHP). It was developed to describe and explain patterns of health care and profiles of health and illness, facilitating inter-sectoral research in areas such as health care, education, and social services. The

administrative health database, for example, holds records for virtually all contacts with the provincial health care system, the Manitoba Health Services Insurance Plan (including physicians, hospitals, personal care homes, home care, and pharmaceutical prescriptions) of all registered individuals. MCHP acts as a trustee of the information in the Repository for agencies such as Manitoba Health. This term is now commonly referred to as the Repository (MCHP Glossary).

Positive Predictive Value

The positive predictive value of a test is the probability that the patient/subject has the disease/condition when restricted to those patients/subjects who test positive. This term is sometimes abbreviated as PPV. You can compute the positive predictive value as PPV = TP / (TP + FP) where TP and FP are the number of true positive and false positive results, respectively. Notice that the denominator for positive predictive value is the number of patients/subjects who test positive (MCHP Glossary).

Prevalence

The proportion of the population that "has" a given disease at a given time. Prevalence data provide an indication of the extent of a condition and may have implications for the provision of services needed in a community (MCHP Glossary).

Regional Health Authority (RHA)

In 1997, Manitoba established 11 RHAs as governance structures for northern and rural health services: South Eastman, South Westman, Brandon, Central, Marquette, Parkland, North Eastman, Interlake, Burntwood, Norman and Churchill. Winnipeg was originally divided into two additional authorities: the Winnipeg Community and Long Term Care Authority and the Winnipeg Hospital Authority. In February 2000, these amalgamated to from the Winnipeg Regional Health Authority (WRHA). On July 1, 2002, Marquette and South Westman amalgamated to form the Assiniboine RHA. Each RHA has the responsibility for providing for the delivery and administration of health services in a specified geographic area (MCHP Glossary).

Sensitivity

One of two indices (the other is specificity) used to evaluate the accuracy of a test that predicts dichotomous outcomes. It is the number of "true positives" (those testing positive who have the disease) divided by all those with the disease. (Lix et al., 2006, page 136)

Shadow Claims

Claims (billings) submitted to the provincial government by physicians on alternate payment plans (APP) for services they provide. Unlike physician claims submitted by fee-for-service physicians for payment, these claims are for administrative purposes only (i.e., as a record of services provided). Also known as "Evaluation Claims" and "Dummy Claims" (MCHP Glossary).

Specificity

One of two indices (the other is sensitivity) used to evaluate the accuracy of a test that predicts dichotomous outcomes. It is the number of "true negatives" (those testing negative who do not have the disease) divided by all those without the disease. (Lix et al., 2006, page 136)

Standard Costs

An average cost (vs. micro-cost or user-specific cost) per service provided. In this study, standard costing is done for hospital care, personal care homes, and home care where an average cost for services is determined based on total expenditures divided by the total units of service (e.g., days). This average cost is then applied to each individual case. For example, PCH costs for an individual are determined by the average cost per day multiplied by the number of days the person was a PCH resident.

Standard Error

In statistics, the standard error of a measurement, value, or quantity is the standard deviation of the process by which it was generated, after adjusting for sample size. In other words the standard error is the standard deviation of the sample mean. The standard error of a sample from a population is the standard deviation of the sampling distribution and may be estimated by the formula:

σ / n

where σ is the standard deviation of the population distribution and n is the size (number of items) in the sample. It is primarily used to determine the confidence interval of a parameter, such as a mean or rate, as it defines the range of expected values for the measurement (MCHP glossary).

Stroke

A stroke occurs when there is a sudden death of brain cells due to a lack of oxygen when the blood flow to the brain is impaired by blockage or rupture of an artery to the brain. Symptoms of a stroke depend on the area of the brain affected. The most common symptom is weakness or paralysis of one side of the body with partial or complete loss of voluntary movement or sensation in a leg or arm. Other common symptoms include speech problems, weak facial muscles, numbness, and tingling. A stroke involving the base of the brain can affect balance, vision, swallowing, breathing, and consciousness. (Lix et al., 2006, page 136)

In this study, stroke is defined as one or more hospitalizations OR one or more physician visits over a five-year time period (2000/01-2004/05) for those aged 19+ where the events are coded with an ICD code representing stroke.

Youden's Index

The index is defined as sensitivity + specificity – 1, where sensitivity and specificity are calculated as proportions. Youden's index has minimum and maximum values of –1 and +1, respectively, with a value of +1 representing the optimal value for an algorithm. (Lix et al., 2006, page 147)

Zero-Inflated Negative Binomial Distribution

Used to model data that have excess zero values. Zero-Inflated Negative Binomial models assume that the data are a mixture of two separate data generation processes: one generates only zeros and the other process generates counts from a negative binomial model. The result of a Bernoulli trial is then used to determine which of the two processes generates an observation.

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Appendix 1: Comorbid Conditions

Table A1.1: Comorbid Conditions

Arthritis	Asthma/ COPD	Coronary Heart Disease	Diabetes	Stroke	Number of People	Number of People in the Group	Percent of People in the Group
People with one of the chronic conditions						220,754	69.6%
X	-	-	-	-	136,344		
-	X	-	-	-	56,469		
-	-	-	X	-	12,656		
-	-	X	-	-	11,004		
-	-	-	-	X	4,281		
People with two of the chronic conditions						73,139	23.1%
X	X	-	-	-	37,097		
X	-	X	-	-	11,513		
X	-	-	X	-	8,991		
X	-	-	-	X	4,684		
-	X	X	-	-	2,913		
-	X	-	X	-	2,674		
-	-	X	X	-	2,268		
-	-	X	-	X	1,418		
-	X	-	-	X	950		
-	-	-	X	X	631		
People with three of the chronic conditions						18,345	5.8%
X	X	X	-	-	5,162		
X	X	-	X	-	3,707		
X	-	X	X	-	2,691		
X	-	X	-	X	2,383		
X	X	-	-	X	1,718		
-	X	X	X	-	803		
X	-	-	X	X	751		
-	-	X	X	X	490		
-	X	X	-	X	474		
-	X	-	X	X	166		
People with four of the chronic conditions						4,375	1.4%
X	X	X	X	-	1,704		
X	X	X	-	X	1,361		
X	-	X	X	X	730		
X	X	-	X	X	402		
-	X	X	X	X	178		
People with all of the chronic conditions							
X	X	X	X	X	539	539	0.2%

Appendix 2: Description of Definitions of Chronic Conditions

Arthritis

ICD–9–CM Codes (in hospital records or physician claims)

714:	rheumatoid arthritis
715:	osteoarthritis
446, 710:	connective tissue disorders (446 = Polyarteritis nodosa and allied conditions; 710 = Diffuse diseases of connective tissue)
720:	ankylosing spondylitis
274:	gout
711–713, 716, 717, 718, 719, 721, 725–729, 739:	other arthritis and related conditions

Prescription Drugs for Arthritis

Table A2.1: Supplementary Data for Arthritis Alogorithms

	ATC Code	Generic Name
Disease-Modifying and Anti-Rheumatic Drugs (DMARDS): Xenobiotic Agents	A07EC01	sulfasalazine
	J01AA08	minocycline
	L01AA01	cyclophosphamide
	L01BA01	methotrexate
	L04AA01	cyclosporine
	L04AA13	leflunomide
	L04AX01	azathioprine
	L04AX03	methotrexate
	M01CB01	sodium aurothiomalate
	M01CB03	auranofin
	M01CB04	aurothioglucose
	M01CC01	penicillamine
	P01BA02	hydroxychloroquine
DMARDS: Biological Agents	L04AA11	etanercept
	L04AA12	infliximab
	L04AA14	anakinra
	L04AA17	adalimumab
Analgesics	N02AA05	oxycodone
	N02AD01	pentazocine
	N02BA51	codeine in combination
	N02BE01	acetaminophen
	N02BE51	paracetamol, combinations excluding psycholeptics
	R05DA03	hydrocodone
	R05DA04	codeine
	R05DA05	opium alkaloids with morphine
Glucocorticosteroids	H02AB04	methylprednisolone
	H02AB06	prednisolone
	H02AB07	prednisone
	H02AB08	triamcinolone
	H02AB10	cortisone

Asthma and Chronic Obstructive Pulmonary Disease

ICD–9–CM Codes (in hospital records or physician claims)

493: asthma

Prescription Drugs for Asthma

Table A2.2: ATC Codes for Drugs Selected for Asthma Algorithms

Group	ATC Code	Generic Name	Route	Notes
R03A ADRENERGICS, INHALANTS	R03AA01	EPINEPHRINE	Inhaled	Include English product names Vaponefrin, Procaterol or DINs '00900400','00900700' Include only DINs '00026298','00026301','00033227','00033219','01923870','01928449','02017660'. Exclude all other DINs.
	R03AB02	ISOPROTERENOL ORCIPRENALINE	Inhaled	
	R03AB03	SALBUTAMOL	Inhaled	
	R03AC02		Inhaled	Include only DINs '00444774','00786616','00818739','00980838'. Exclude all other DINs.
	R03AC03	TERBUTALINE	Inhaled	
	R03AC04	FENOTEROL	Inhaled	
	R03AC08	PIRBUTEROL	Inhaled	
	R03AC12	SALMETEROL	Inhaled	Exclude only DINs '02163705','02163713','00824216'. Exclude all other DINs.
	R03AC13	FORMOTEROL	Inhaled	
	R03AK01	EPINEPHRINE IPRATROPIUM/FENOTEROL	Inhaled	
	R03AK03	IPRATROPIUM/SALBUTAMOL	Inhaled	Include English product names Advair
	R03AK04	FLUTICASONE/SALMETEROL	Inhaled	
	R03AK06		Inhaled	
R03B OTHER DRUGS FOR OBSTRUCTIVE AIRWAY DISEASES, INHALANTS	R03BA01	BECLOMETHASONE	Inhaled	
	R03BA02	BUDESONIDE	Inhaled	
	R03BA03	FLUNISOLIDE	Inhaled	
	R03BA05	FLUTICASONE	Inhaled	
	R03BA06	TRIAMCINOLONE	Inhaled	
	R03BB01	IPRATROPIUM	Inhaled	
	R03BC01	SODIUM CROMOGLYCATE NEDOCROMIL	Inhaled	
	R03BC03		Oral	
R03C ADRENERGICS FOR SYSTEMIC USE	R03CB01	ISOPROTERENOL	Oral	
	R03CB03	ORCIPRENALINE	Oral	
	R03CC02	SALBUTAMOL	Oral	
	R03CC03	TERBUTALINE	Oral	
	R03CC07	PIRBUTEROL	Oral	
	R03CC53	TERBUTALINE	Oral	
	R03CK	BUDESONIDE/FORMOTEROL	Inhaled	
	R03DA02			
	R03DA04	OXTRIPHYLLINE	Oral	
	R03DA05	THEOPHYLLINE	Oral	
	R03DA43	AMINOPHYLLINE	Oral	
R03D OTHER SYSTEMIC DRUGS FOR OBSTRUCTIVE AIRWAY DISEASES	R03DA53	THEOPHYLLINE	Oral	
	R03DA54	THEOPHYLLINE	Oral	
	R03DA55	THEOPHYLLINE AMINOPHYLLINE	Oral	
	R03DA74	THEOPHYLLINE	Oral	
	R03DB05	AMINOPHYLLINE	Oral	

Coronary Heart Disease

ICD–9–CM Codes (in hospital records or physician claims)

410:	acute myocardial infarction
411:	other acute and subacute forms of ischemic heart disease
412:	history of myocardial infarction
413:	angina pectoris
414:	All other forms of chronic ischemic heart disease

Prescription Drugs for Coronary Heart Disease

All DINs associated with the following second level ATC Codes:

C01:	cardiac therapy
C07:	beta–blocking agents
C08:	calcium channel blockers
C09:	agents acting on the renin–angiotensin system

Diabetes

ICD–9–CM Codes (in hospital records or physician claims)

250:	diabetes mellitus

Prescription Drugs for Diabetes

All DINs associated with the following second level ATC Code:

A10:	drugs used in diabetes

Hypertension

ICD–9–CM Codes (in hospital records or physician claims)

401:	essential hypertension

Prescription Drugs for Hypertension

All DINs associated with the following second level ATC Codes:

C02:	anti–hypertensives
C03:	diuretics
C07:	beta blocking agents
C08:	calcium channel blockers
C09:	agents acting on the renin–angiotensin system

Stroke

ICD–9–CM Codes (in hospital records or physician claims)

430–438: cerebrovascular disease

Prescription Drugs

All DINs associated with the following fifth level ATC Codes:
B01AA02, B01AA03, B01AA07, B01AC07,
B01AB01, B01AC30, B01AC05, B01AC06, B01AC04, B01AB09,
B01AB04, B01AB10

Specific Drugs:

anti–platelet agents such as aspirin (ASA) at 81 or 325 mg once a day
clopidogrel
ticlopidine
dipyridamole
combination agents such as Aggrenox (ASA 25mg dipyridamole 200mg slow release)
oral anti–coagulants such as warfarin, pheninidione, and nicoumalone

Appendix 3: Unadjusted Costs by Regional Health Authority

Table A3.1: Unadjusted Costs by Regional Health Authority and Type of Healthcare Service

Note: as these values are not adjusted for the age and sex structure of the region comparisons should not be made between regions. In addition, readers are should use caution when making comparisons between conditions. These are costs for providing health care for **individuals** with and without each chronic condition, not the cost that can be directly attributable to the condition. Therefore, costs will be higher for conditions that primarily affect older adults as these people typically use more health services.

Mean Crude Two-Year Cost for People with and Without a Chronic Condition, 2005/06-2006/07

South Eastman

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$7,091	$2,420	$1,204	$570	$2,019	$680	$2,112	$731	$761	$183	$995	$255
Asthma/COPD	$8,186	$3,426	$1,247	$732	$2,139	$982	$2,776	$988	$920	$308	$1,105	$415
Diabetes Definition 1	$13,416	$3,240	$1,613	$723	$3,486	$936	$4,756	$912	$1,428	$288	$2,133	$380
Diabetes Definition 2	$14,627	$3,339	$1,710	$733	$4,003	$950	$5,216	$945	$1,554	$300	$2,143	$410
Diabetes Definition 3	$13,824	$3,304	$1,655	$729	$3,698	$946	$4,880	$933	$1,477	$296	$2,114	$400
Coronary Heart Disease	$14,908	$2,991	$1,748	$694	$4,176	$822	$4,381	$907	$2,052	$236	$2,551	$331
Stroke	$21,661	$3,312	$1,787	$747	$5,300	$936	$4,492	$1,048	$2,995	$282	$7,086	$298

Central

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$8,026	$2,816	$1,135	$543	$2,394	$861	$2,095	$785	$790	$187	$1,611	$441
Asthma/COPD	$7,994	$4,167	$1,135	$692	$2,410	$1,212	$2,436	$1,084	$851	$333	$1,162	$846
Diabetes Definition 1	$12,856	$3,764	$1,432	$684	$3,912	$1,145	$4,211	$949	$1,198	$308	$2,103	$679
Diabetes Definition 2	$14,625	$3,838	$1,555	$692	$4,588	$1,164	$4,736	$975	$1,399	$313	$2,347	$694
Diabetes Definition 3	$13,651	$3,809	$1,479	$690	$4,228	$1,160	$4,454	$964	$1,284	$310	$2,205	$685
Coronary Heart Disease	$16,226	$3,469	$1,628	$658	$5,094	$1,001	$4,185	$964	$1,760	$266	$3,559	$580
Stroke	$22,557	$3,726	$1,618	$702	$5,997	$1,132	$3,854	$1,092	$2,464	$292	$8,624	$507

Table A3.1: Unadjusted Costs by Regional Health Authority and Type of Healthcare Service

Assiniboine

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$9,009	$3,463	$1,213	$560	$2,737	$1,001	$2,352	$1,021	$783	$240	$1,923	$641
Asthma/COPD	$10,013	$4,953	$1,263	$749	$3,067	$1,456	$3,057	$1,320	$876	$380	$1,750	$1,049
Diabetes Definition 1	$13,898	$4,602	$1,482	$728	$4,290	$1,365	$4,562	$1,176	$1,124	$355	$2,438	$978
Diabetes Definition 2	$15,172	$4,721	$1,587	$739	$4,817	$1,388	$5,013	$1,220	$1,218	$365	$2,537	$1,008
Diabetes Definition 3	$14,493	$4,643	$1,509	$735	$4,424	$1,380	$4,725	$1,193	$1,151	$358	$2,684	$976
Coronary Heart Disease	$16,665	$4,310	$1,668	$706	$5,201	$1,220	$4,423	$1,222	$1,542	$323	$3,831	$838
Stroke	$23,610	$4,614	$1,698	$757	$6,789	$1,367	$4,207	$1,384	$2,156	$352	$8,759	$755

Brandon

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$8,747	$3,244	$1,491	$697	$2,565	$892	$2,256	$955	$541	$136	$1,893	$564
Asthma/COPD	$9,242	$4,854	$1,510	$934	$2,601	$1,396	$2,614	$1,307	$617	$248	$1,900	$969
Diabetes Definition 1	$14,427	$4,348	$1,932	$902	$4,225	$1,248	$4,692	$1,099	$926	$220	$2,652	$880
Diabetes Definition 2	$15,776	$4,456	$2,026	$915	$4,692	$1,268	$5,198	$1,133	$971	$227	$2,891	$912
Diabetes Definition 3	$14,942	$4,418	$1,989	$910	$4,516	$1,258	$4,924	$1,115	$977	$224	$2,535	$910
Coronary Heart Disease	$19,213	$4,052	$2,201	$879	$5,693	$1,109	$4,652	$1,155	$1,261	$200	$5,407	$709
Stroke	$24,076	$4,318	$2,234	$926	$6,545	$1,221	$4,325	$1,279	$1,558	$215	$9,414	$678

Winnipeg

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$8,083	$2,743	$1,483	$682	$1,901	$683	$2,206	$872	$1,047	$246	$1,446	$260
Asthma/COPD	$8,424	$4,067	$1,492	$896	$2,012	$963	$2,657	$1,146	$1,092	$441	$1,171	$620
Diabetes Definition 1	$12,928	$3,768	$1,955	$867	$3,100	$912	$4,362	$1,037	$1,703	$402	$1,808	$551
Diabetes Definition 2	$14,000	$3,870	$2,081	$880	$3,361	$928	$4,857	$1,066	$1,911	$411	$1,790	$583
Diabetes Definition 3	$13,448	$3,837	$2,014	$876	$3,263	$924	$4,589	$1,054	$1,806	$408	$1,776	$576
Coronary Heart Disease	$16,626	$3,400	$2,179	$840	$4,126	$775	$4,139	$1,067	$2,544	$329	$3,638	$389
Stroke	$22,831	$3,721	$2,196	$900	$4,823	$895	$4,091	$1,198	$3,452	$379	$8,269	$350

Table A3.1: Unadjusted Costs by Regional Health Authority and Type of Healthcare Service

Interlake

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$7,546	$2,809	$1,248	$592	$1,954	$737	$2,393	$948	$731	$207	$1,219	$325
Asthma/COPD	$7,900	$3,846	$1,249	$752	$2,055	$993	$2,728	$1,233	$744	$324	$1,124	$543
Diabetes Definition 1	$12,131	$3,553	$1,586	$735	$3,213	$931	$4,786	$1,064	$1,127	$295	$1,419	$527
Diabetes Definition 2	$13,170	$3,645	$1,712	$743	$3,587	$943	$5,312	$1,104	$1,289	$302	$1,269	$553
Diabetes Definition 3	$12,636	$3,591	$1,620	$741	$3,347	$944	$4,979	$1,081	$1,202	$298	$1,488	$527
Coronary Heart Disease	$13,740	$3,480	$1,749	$722	$3,611	$872	$4,400	$1,160	$1,580	$269	$2,400	$456
Stroke	$19,158	$3,716	$1,783	$771	$4,610	$974	$4,209	$1,304	$2,228	$296	$6,328	$372

North Eastman

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$6,931	$2,627	$1,313	$589	$2,075	$707	$2,268	$833	$603	$168	$673	$330
Asthma/COPD	$8,028	$3,465	$1,382	$768	$2,370	$964	$2,736	$1,118	$638	$272	$903	$342
Diabetes Definition 1	$10,674	$3,388	$1,632	$765	$3,310	$960	$4,031	$1,018	$813	$261	$888	$384
Diabetes Definition 2	$11,762	$3,490	$1,771	$779	$3,716	$984	$4,599	$1,054	$897	$269	$779	$404
Diabetes Definition 3	$11,243	$3,450	$1,685	$776	$3,535	$979	$4,291	$1,040	$858	$265	$875	$390
Coronary Heart Disease	$13,017	$3,348	$1,843	$761	$4,161	$906	$4,147	$1,102	$1,224	$247	$1,642	$333
Stroke	$18,503	$3,484	$1,887	$805	$5,211	$1,001	$4,381	$1,206	$2,023	$235	$5,002	$236

Parkland

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$9,873	$3,563	$1,299	$576	$3,058	$1,050	$2,885	$1,066	$1,060	$275	$1,571	$597
Asthma/COPD	$11,262	$5,149	$1,383	$776	$3,476	$1,494	$3,699	$1,483	$1,172	$508	$1,532	$889
Diabetes Definition 1	$15,406	$4,967	$1,623	$783	$4,779	$1,522	$5,375	$1,340	$1,459	$485	$2,170	$837
Diabetes Definition 2	$16,738	$5,103	$1,750	$793	$5,343	$1,542	$5,998	$1,383	$1,660	$492	$1,987	$893
Diabetes Definition 3	$15,937	$5,053	$1,661	$791	$4,982	$1,542	$5,648	$1,362	$1,547	$485	$2,098	$873
Coronary Heart Disease	$17,010	$4,389	$1,742	$723	$5,381	$1,263	$5,050	$1,297	$2,024	$380	$2,813	$726
Stroke	$23,781	$5,091	$1,754	$819	$6,653	$1,539	$5,031	$1,619	$2,899	$464	$7,445	$650

Table A3.1: Unadjusted Costs by Regional Health Authority and Type of Healthcare Service

Churchill

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$5,309	$1,919	$704	$361	$2,110	$714	$1,767	$722	$727	$122	$0	$0
Asthma/COPD	$4,979	$2,068	$615	$368	$1,544	$752	$1,873	$810	$947	$138	$0	$0
Diabetes Definition 1	$8,136	$1,880	$851	$390	$2,294	$769	$3,222	$649	$1,769	$71	$0	$0
Diabetes Definition 2	$9,481	$1,936	$868	$403	$2,558	$771	$3,587	$694	$2,468	$68	$0	$0
Diabetes Definition 3	$8,775	$1,846	$878	$391	$2,507	$753	$3,329	$666	$2,061	$36	$0	$0
Coronary Heart Disease	$10,045	$2,326	$845	$423	$4,017	$876	$3,509	$840	$1,674	$187	$0	$0
Stroke	$13,803	$2,660	$1,192	$446	$2,317	$1,078	$2,785	$956	$7,509	$181	$0	$0

Nor-Man

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$6,996	$2,357	$1,077	$453	$1,978	$821	$2,372	$729	$797	$137	$773	$218
Asthma/COPD	$7,397	$3,597	$1,102	$613	$2,203	$1,020	$2,699	$1,130	$941	$274	$452	$559
Diabetes Definition 1	$9,786	$3,233	$1,353	$581	$2,847	$1,015	$3,865	$929	$966	$267	$755	$441
Diabetes Definition 2	$11,082	$3,293	$1,493	$589	$3,265	$1,019	$4,395	$967	$1,146	$276	$784	$442
Diabetes Definition 3	$10,217	$3,293	$1,378	$590	$3,067	$1,027	$3,985	$952	$1,038	$273	$750	$451
Coronary Heart Disease	$12,766	$3,319	$1,629	$589	$3,930	$975	$4,309	$1,064	$1,747	$252	$1,152	$439
Stroke	$18,742	$3,536	$1,635	$640	$3,763	$1,103	$3,881	$1,204	$2,188	$294	$7,275	$295

Burntwood

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$6,551	$2,522	$1,150	$496	$2,614	$1,162	$2,441	$779	$321	$66	$26	$19
Asthma/COPD	$7,039	$3,032	$1,175	$590	$2,666	$1,259	$2,777	$1,065	$390	$95	$31	$23
Diabetes Definition 1	$9,673	$2,460	$1,401	$540	$3,768	$1,121	$4,026	$704	$405	$82	$73	$12
Diabetes Definition 2	$11,529	$2,577	$1,644	$551	$4,535	$1,162	$4,736	$768	$508	$85	$107	$11
Diabetes Definition 3	$10,101	$2,527	$1,454	$548	$3,926	$1,157	$4,218	$725	$424	$85	$80	$12
Coronary Heart Disease	$12,303	$3,010	$1,781	$596	$5,195	$1,304	$4,578	$997	$547	$105	$201	$7
Stroke	$12,506	$3,221	$1,791	$630	$4,985	$1,393	$4,364	$1,092	$857	$106	$508	$0

Table A3.1: Unadjusted Costs by Regional Health Authority and Type of Healthcare Service

Manitoba

	Total Costs		Physician Services		Hospital		Prescription Drugs		Home Care		Personal Care Home	
	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition	People with the Condition	People without the Condition
Arthritis	$8,067	$2,806	$1,381	$635	$2,107	$760	$2,257	$874	$916	$221	$1,405	$317
Asthma/COPD	$8,509	$4,093	$1,401	$831	$2,227	$1,063	$2,718	$1,165	$973	$390	$1,190	$645
Diabetes Definition 1	$12,779	$3,782	$1,773	$808	$3,420	$1,005	$4,427	$1,034	$1,410	$357	$1,749	$577
Diabetes Definition 2	$13,998	$3,882	$1,906	$820	$3,793	$1,023	$4,943	$1,067	$1,596	$366	$1,760	$606
Diabetes Definition 3	$13,312	$3,845	$1,823	$816	$3,601	$1,018	$4,644	$1,052	$1,492	$362	$1,751	$596
Coronary Heart Disease	$16,184	$3,489	$2,002	$785	$4,393	$884	$4,276	$1,076	$2,154	$300	$3,360	$444
Stroke	$22,219	$3,800	$2,027	$841	$5,220	$1,009	$4,171	$1,215	$2,946	$341	$7,855	$394

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