UNDERSTANDING THE HEALTH SYSTEM USE OF AMBULATORY CARE PATIENTS

MARCH 2013

MANITOBA CENTER FOR HEALTH POLICY
DEPARTMENT OF COMMUNITY HEALTH SCIENCES
FACULTY OF MEDICINE, UNIVERSITY OF MANITOBA

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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 healthcare 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.

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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 Manitoba Health.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

ATC	Anatomical Therapeutic Chemical
CHF	Congestive Heart Failure
DPIN	Drug Program Information Network
ENT	Ear, Nose and Throat Surgeons
ICD	International Classification of Diseases
IHD	Ischemic Heart Disease
MCHP	Manitoba Centre for Health Policy
MIMS	Manitoba Immunization Monitoring System
OOP	Ophthalmologists
PCH	Personal Care Home
PCP	Primary Care Physician
RHA	Regional Health Authority
SES	Socioeconomic Status
SP	Specialist Physician
TRM	Total Respiratory Morbidity

EXECUTIVE SUMMARY

Ambulatory care (medical) services in Manitoba are provided in a variety of environments by different types of providers: primary care physicians (PCP), nurse practitioners, and specialist physicians (SP). While primary care is the foundation of the Canadian Healthcare system and the preferred route of access to advanced medical care, there are Manitobans who access SP care directly and others who receive their routine care from SPs. How often this happens, and what the consequences of this alternative model of care are, is not known. In addition, numerous studies have shown that continuity of care (receiving care from a single primary care provider) results in better access to preventive care and better health outcomes.

This report describes the provision of ambulatory care services over a three–year period between the fiscal years 2007/08 and 2009/10 for Manitoba residents aged 19 and older and focuses on those who had previously been diagnosed with at least one of six chronic conditions: hypertension (188,602 patients), total respiratory morbidity (157,742), mood and anxiety disorders (76,402), diabetes mellitus (65,260), ischemic heart disease (37,123), and congestive heart failure (8,258).

We included those patients who had made at least four ambulatory visits during the three–year period so that patterns of care could be identified. Our final chronic–condition cohort includes 347,606 patients and we analysed 7,662,411 ambulatory care visits. Thirty–one percent of the cohort is between 19 and 44 years old and 41% is between 45 and 64. Sixty–two percent live in Winnipeg and 61% have only one chronic condition identified in our data system.

Patterns of Care

When describing service use we defined nine different types of visits based on type of physician. For each patient, an "assigned" PCP was determined as the physician from whom that patient received most of their visits. Most visits (53% in Winnipeg; and 58% for Brandon and rural Manitoba) were made to the "assigned" PCP, and this is the physician who provided the majority of care to that patient. The next most common type of visit was to another PCP, and these comprised 17% of chronic condition patient's visits for urban residents and 23% for rural Manitobans. The other visit type to a PCP was where the assigned physician was an SP. These represent 1.4% of Winnipeg patient visits and 0.4% of rural patient visits.

Winnipeg patients with visits to SPs were divided into those with a referral from another physician and those without a referral. The referrals could have come from the patient's assigned PCP (6%), another PCP (5%), or a different SP (2%). Visits to SPs without a referral include those where that SP is that patient's assigned physician (8%), the assigned physician is another SP (2%), and the assigned physician is a PCP (4%).

Winnipeg residents with chronic conditions had an average of 23 ambulatory visits over the three–year study period, while rural chronic condition patients had 21 visits on average. Patients, in both rural and urban areas, without a chronic condition had an average of 11 visits over three years.

In order to describe the patterns between the nine types of visits, we performed cluster analysis. This type of analysis puts patients with similar visit patterns into groups or clusters. The number of clusters developed in the analysis depends on the actual patterns of visits. While the focus of the study is on comparisons between the quality of care received by patients with chronic conditions based on the patterns of care they received, it is also important for completeness to describe the patterns of care of those without a chronic condition. For Manitobans without a chronic condition, the cluster analysis resulted in 11 different clusters.

Results of Cluster Analysis

Sixty–nine percent of Manitobans without a chronic condition have seven visits over three years on average and most of these visits are to their assigned PCP. The next most common cluster for those without a chronic condition accounts for 21% of this group. They see their assigned PCP more often (an average of 11 times over the three–year study period) with very few other visits. Five percent of those without a chronic condition receive most of their ambulatory care from SPs despite not having one of these ailments.

The cluster analysis for those with a chronic condition resulted in 15 clusters. Eighty–four percent of all Manitobans in the chronic–condition cohort fall in clusters where most of their care is provided by their assigned PCP. Once again, the majority share a pattern of care and fall within one large cluster (60%, which represents 208,756 people). They receive most of their care from their assigned PCP and access care relatively infrequently (an average of 13 visits per person over three years). They have almost two visits over three years to SPs on average, but the majority of these visits are without a referral from their PCP. Fifty–four percent of this cluster is female, 60% live in Winnipeg, and their median age is 51 years.

Eighteen percent of those with a chronic condition make up the next largest cluster, with an average of 31 visits over three years mostly to their assigned PCP. A further 2% make up another cluster where most of their visits are to their assigned PCP (20 visits over three years), but they have almost the same number of visits to SPs without a referral.

When looking at the chronic condition clusters, there are a number of patients with patterns of care which raise concerns. While each of these represents a small proportion of the population, they either have patterns that indicate a lack of continuity of care, are receiving the majority of their care from one or more SPs, or have very high system use. There are clusters where the majority of care is provided by SPs—clusters that are overrepresented with Winnipeg residents (89% in Cluster 3 and 93% of the people in Cluster 12 live in Winnipeg). Other clusters are underrepresented by Winnipeg residents (40% in Cluster 8 and 50% in Cluster 4).

Quality of Care

We compared the quality of care received by patients with chronic conditions across the clusters for each of the chronic conditions. The quality indicators presented in this report have been used in previous MCHP studies and were validated with Manitoba physicians. Some are generic and apply to most patients with any of the chronic conditions (e.g., influenza vaccination), while others are condition–specific (e.g., stroke in patients with hypertension). Some of the quality indicators represent evidence–based care that is recommended for some patients to receive (e.g., eye examinations for diabetic patients), while others are the negative consequences of the condition that could be avoided with high quality care (e.g., renal failure for hypertensive patients).

We determined the impact of the patterns of care for each quality indicator by statistical modeling. Each model included the clusters representing the pattern of ambulatory care as well as each of the other chronic conditions, the patient's age, and socioeconomic status as represented by the income quintile assigned to their residence.

There is no single pattern of care that does better than others across the indicators nor is there a pattern of care that does poorly consistently. Clusters where care is provided predominantly by SPs do not do well with preventative care possibly because these are sicker patients whose care is focused on caring for their current illnesses. Clusters with few visits per year to a primary care provider do poorly on a number of indicators. More than seven visits per year seem to be required for patients to get all the care they need.

Conclusions

This report provides new information about the use of ambulatory care services in Manitoba by the use of the cluster method. This information places current primary care reform initiatives in context. The findings support the focus on reform related to primary care providers (physicians and nurse practitioners) as they provide the vast majority of primary care. There are however patterns of care that require further exploration. Many of the visits to SPs result from referrals from physicians other than the assigned primary care provider. While it is beyond the scope of this study to explain these visits, they clearly warrant further investigation. There are also patterns of care that involve frequent visits to both primary care providers and SPs. There may be more effective ways of providing care to these patients. It is however reassuring to note that these patterns of care are restricted to a very small group of patients.

While it is disappointing that we were not able to identify pattern(s) of care that represent high quality care across a variety of indicators, our findings support the role of PCPs in providing preventive care and indicate the need for regular contact for this care to be provided.

CHAPTER 1: INTRODUCTION

The vast majority of healthcare is provided in the community (Green, Fryer, Yawn, Lanier, & Dovey, 2001; White, Williams, & Greenberg, 1961). This applies to both physician services and services provided by other healthcare providers. The Canadian healthcare system is widely perceived to be based on a strong **primary care**[1] focus, which has been shown to be the foundation for a cost–effective system leading to better population health (Starfield, 2012). In attempting to bring healthcare spending under control, recognition of the importance of a high functioning primary care system has led to significant investment in primary care renewal. The idea is that a high functioning primary care system will result in a healthier population and less use of expensive secondary and tertiary care. Almost all Canadian provinces have invested in primary care renewal over the last 10 years, including Manitoba (Hutchison, Levesque, Strumpf, & Coyle, 2011; Strumpf et al., 2012). As a result, Manitoba has declared primary care to be "the foundation of the health care system" (Manitoba Health, 2012); and Manitoba has initiated changes to support primary care reform and renewal (Hutchison et al., 2011).

This study originated in the desire to better understand which types of physicians are providing "primary care type services" to Manitobans and what impact this has on the quality of care received. This study is limited to ambulatory care services (see **ambulatory visits**) provided to Manitobans over a three–year period. Ambulatory care services are those provided in the community, outside of hospitals and personal care homes. In particular, the focus is on Manitobans with at least one of six chronic conditions. These conditions have valid definitions using the **administrative data** in the **Population Health Research Data Repository (Repository)**. This group was chosen as the focus of the study because those with a chronic condition tend to use the healthcare system more frequently and they are more likely to benefit from continuity of care and high quality primary care services.

Continuity of care is both a fundamental component of primary care and a significant contributor to good **health outcomes** (Freeman, Olesen, & Hjortdah, 2003; Gray et al., 2003; Stokes et al., 2005). Numerous studies have demonstrated the importance of continuity of care in receiving evidence–based preventative health services, such as immunizations and cancer screening (Gill, Saldarriaga, Mainous, & Under, 2002; Irigoyen et al., 2004; Menec, Sirski, & Attawar, 2005; O'Malley, Mandelblatt, Gold, Cagney, & Kerner, 1997; Reid & Rozier, 2006). It is therefore important to determine if patients with chronic conditions are receiving their care from **primary care physicians (PCPs)** or other **specialist physicians (SPs)** and whether their care fits within recommended patterns, including continuity of care with one physician. Little was previously known about how many Manitobans see SPs for routine ambulatory care and whether SP visits are initiated on referral from a PCP, self–referral, or referral from another SP. Also, there have not been previous studies that determined if there are differences in quality of care based on these potential patterns of care.

1 Terms in **bold** typeface are defined in the Glossary at the end of this report.

This report presents information on a series of groups or **cohorts** that formed the basis of the analyses. Those with at least one **chronic condition** diagnosis represent the chronic–condition cohort. We have described the visit patterns of each of the six condition–specific cohorts of patients.

The focus of the study is describing the patterns of ambulatory care received by Manitoba residents with a chronic condition. Our second objective was to determine how these patterns of care impact on the quality of care received by patients using previously validated measures of quality primary care. It is also important, for completeness, to describe the patterns of care of those without a chronic condition. Chapter 4 includes analyses of the patterns of ambulatory care for both those with and without chronic conditions.

The analyses in this study were completed before the recent amalgamation of the **Regional Health Authorities (RHAs)**[2] in Manitoba. References to RHAs in this report are based on the 11 RHAs that existed at the time of the analyses.

2 During the production of this report, the RHAs were amalgamated into larger regions: Winnipeg (Winnipeg, Churchill), Interlake–Eastern (Interlake, North Eastman), Western (Assiniboine, Brandon, Parkland), Southern (Central, South Eastman), and Northern (Burntwood, NOR–MAN) (Canadian Legal Information Institute, 2012; Ho et al., 2004).

CHAPTER 2: METHODS

Data Sources and Data Period

The study used data available in the Repository housed at the **Manitoba Centre for Health Policy (MCHP)**. Most of these data are derived from administrative claims data that are collected by **Manitoba Health** in order to administer the universal healthcare system within Manitoba. The Repository contains information of key interest to health planners. It includes person–level data such as birth and mortality, contacts with physicians and hospitals, pharmaceutical dispensing, use of nursing homes, and area–level data such as region of residence.

All data files in the Repository are "de–identified", meaning that names and other identifying fields are not available, but unique (scrambled) identifiers are used to allow linkage across files and follow–up over time. Data in the Repository have been extensively documented and validated for this kind of research (Roos, Gupta, Soodeen, & Jebamani, 2005).

Databases that were used in this study included the **Manitoba Health Insurance Registry**, **Hospital Abstracts**, **Medical Services**, **Drug Program Information Network (DPIN)**, **Physician Resource**, Canadian **Census**, and **Vital Statistics**. Although the visit pattern and **quality of care indicator** analyses (e.g., influenza immunization and drug prescription) are for the 2007/08–2009/10 **fiscal years**, data used to determine chronic condition **prevalence** was from
2001/02–2006/07; and for some quality indicator measurements, where the indicator represents an outcome of the care previously provided (e.g., **renal failure** and **stroke**), we used data from 2010/11.

Inclusion Criteria

For inclusion in any of the cohorts, an individual had to meet the following conditions:

1. Was included in the Manitoba Health Insurance Registry
2. Had Manitoba health coverage throughout the study period
3. Was 19 years of age or older at the start of the study period
4. To be included in the chronic–condition cohort, the individual must have met the definition criteria for at least one of the specific chronic conditions included in the study and have made an ambulatory visit to a PCP or SP. Note that although the diagnosis and drug codes (Appendix Table A1.1) were used for placing people into the cohort, all ambulatory visits regardless of visit reason, were included when analyzing the visit patterns. For ambulatory visits to SPs, we excluded radiologists, pathologists, and anesthesiologists as they do not provide ambulatory care that could be considered primary care.
5. Made at least four ambulatory visits within the three–year study period. People with fewer than four ambulatory visits were excluded as assignment of these patients to a provider would not be possible using the MCHP assignment algorithm, which will be described in depth in the "Physician Assignment Algorithm" section.

Exclusion Criteria

We excluded people who were not living in Manitoba for the entire study period and the year following the study period. This was done for two reasons. First, the patterns of care experienced by patients during the last six months of life differ from their normal pattern (Menec et al., 2004). Secondly, one year of follow–up was necessary as some of our indicators required the ability to measure outcomes after the period of study. People that only had records of visits to **emergency departments**, **inpatient hospitalizations**, or doctors that were not active throughout the entire three–year study period, as well as people whose only visits were referrals, were excluded. These people were excluded as they could not be assigned to a physician using the assignment algorithm, which is a key component of assigning visit patterns.

While our goal was to understand the patterns of ambulatory care use in all of Manitoba, our initial analyses indicated significant differences in the patterns across the province. Visit patterns in Burntwood and NOR–MAN are quite different from the other RHAs. This is potentially due to the presence of salaried physicians that practice in these areas and the possibility that some of the **physician claims** were missing from the data. Previous research at MCHP has shown that up to one third of visits to salaried physicians may not be reflected in administrative claims data (Katz et al., 2009). Additionally, our analyses indicated significant turnover of physicians practicing in these RHAs, making the application of the physician assignment algorithm difficult. It is common practice in epidemiology to explore data and exclude outliers which would unduly bias the results. Due to these findings, Burntwood and NOR–MAN were excluded from this study as outliers. Churchill was excluded due to the small sample size.

Tables 2.1 and 2.2 present the impact of the inclusion and exclusion criteria on the final study sample. The numbers presented are the visits made rather than the numbers of people. The inclusion and exclusion criteria have a smaller impact on the chronic–condition cohort than on the cohort of those without a chronic condition. Almost 30% of the visits by those without a chronic condition were excluded because the patients were less than 19 years of age. End of health coverage and death of the people making the visits were the next most common reasons for exclusion, followed by the visits made by those in the northern RHAs, which were excluded for reasons explained above. It is important to recognize that the process of exclusion took place one step at a time. The exclusions were performed in the order of that they are presented in the table thus the percentage of visits excluded for any reason in the table applies to those visits left in the sample after removing all the visits for exclusions higher up in the table.

Table 2.1: Final Study Cohort Development: Exclusion of Visits, 2007/08–2009/10

TOTAL VISITS (before exclusions)		Any Chronic Condition	No Chronic Condition	Hypertension	Total Respiratory Morbidity	Mood Disorders	Diabetes Mellitus	Ischemic Heart Disease	Congestive Heart Failure
All Visits	Number	10,819,484	5,807,075	6,045,884	5,410,565	2,838,539	2,326,253	1,503,044	569,360
	Percent	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Cohort	Number	7,662,411	3,037,490	4,558,499	3,535,172	2,252,637	1,710,837	1,088,058	295,734
	Percent	70.82	52.31	75.40	65.34	79.36	73.54	72.39	51.94
EXCLUSION CRITERIA									
Patients									
Not in Registry	Number	230	0	111	182	144	85	96	0
	Percent	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00
Visits									
Under 19 Years of Age in 2007	Number	1,048,172	1,710,151	34,488	940,133	123,139	20,725	422	1,396
	Percent	9.69	29.45	0.57	17.38	4.34	0.89	0.03	0.25
Death Between April-December 2010	Number	318,971	35,831	276,467	147,211	58,679	102,994	104,497	77,227
	Percent	2.95	0.62	4.57	2.72	2.07	4.43	6.95	13.56
End of Health Coverage (before 03/31/2010)	Number	554,249	131,561	453,301	230,121	96,754	171,045	166,288	148,052
	Percent	5.12	2.27	7.50	4.25	3.41	7.35	11.06	26.00
Start of Health Coverage (after 04/01/2007)	Number	129,246	159,613	52,418	61,128	39,668	25,151	9,041	2,242
	Percent	1.19	2.75	0.87	1.13	1.40	1.08	0.60	0.39
Visits to Emergency Departments; Inpatient Settings; Doctors not Active Consistently; Visits with Referrals	Number	77,352	52,230	57,935	29,430	17,506	20,098	11,553	7,970
	Percent	0.71	0.90	0.96	0.54	0.62	0.86	0.77	1.40
Visits to Part-Time Physicians	Number	446,695	202,494	264,684	211,609	120,861	106,808	58,585	17,570
	Percent	4.13	3.49	4.38	3.91	4.26	4.59	3.90	3.09
Visits to Pediatrics, Radiology, Pathology, Anesthesiology	Number	298,107	198,680	163,909	134,863	79,406	61,633	29,599	7,924
	Percent	2.76	3.42	2.71	2.49	2.80	2.65	1.97	1.39
Resides in Northern Manitoba	Number	261,298	105,815	178,294	105,174	49,276	104,661	34,509	11,207
	Percent	2.42	1.82	2.95	1.94	1.74	4.50	2.30	1.97
PHINs with Fewer Than 4 Visits	Number	22,753	173,210	5,778	15,542	469	2,216	396	38
	Percent	0.21	2.98	0.10	0.29	0.02	0.10	0.03	0.01

Table 2.2: Final Study Cohort Development: Exclusion of Manitoba Patients with Three or Less Visits from the Chronic–Condition Cohort, 2007/08–2009/10

	Winnipeg	Non-Winnipeg	Total
Total Number of Patients with Any Chronic Condition	220,371	136,186	356,557
Number of Patients INCLUDED in the Chronic-Condition Cohort (four or more visits)	215,153	132,453	347,606
Percent	97.63	97.26	
Number of Patients EXCLUDED from the Chronic-Condition Cohort (three or less visits)	5,218	3,733	8,951
Percent	2.37	2.74	

Measuring and Presenting the Quality of Care Indicators

For this report, six chronic conditions and 10 quality of care indicators were analyzed. These conditions and indicators are described in Table 2.3, as well as in Chapters 3 and 5. All indicators were measured using medical (physician/hospital) claims and/or drug prescriptions provided in the Repository data. Specific codes used in these definitions can be found in Appendix Table A1.1.

The following information for chronic conditions and indicators is presented in this report:

- Eligible population: This is based on the person having a particular condition (e.g., congestive heart failure). Each condition in the chronic–condition cohort has a short description of the eligible population and a table of visits (Chapter 3).
- Process indicators: Definitions of how a particular indicator was measured using the Repository data are presented in Chapter 5. Each indicator has a table of the number of patients in the chronic–condition cohort with this indicator and a figure of the indicator`s rate within each chronic condition cluster.
- Health outcomes: Definitions of how a particular outcome was measured using the Repository data are presented in Chapter 5. Each outcome has a table of the number of patients in the chronic–condition cohort with this outcome and a table of the outcome's rate in each chronic condition cluster.
- Quality of care models: Regression models (see Statistical Analysis section of this chapter) of all factors associated with **process indicators** or health outcomes are presented in tables in Chapter 5. Our primary interest in interpreting these results was to determine which patterns of care, as represented by clusters, might be most suitable for continuity of care and management of chronic conditions.

Statistical Testing

We did not perform statistical testing to determine if the results between regions or other groups were statically different to each other because we are dealing with population based data. The only testing done for this report was to determine the relative impact of the visit type clusters on the quality indicators using regression analyses (see Chapter 5).

Cohorts

A cohort was created for each of the six chronic conditions analyzed in this report: **diabetes (diabetes mellitus)**, **congestive heart failure (CHF)**, **mood disorders**, **ischemic heart disease (IHD)**, **total respiratory morbidity (TRM)**, and **hypertension**. The cohorts were defined based on previous research using the Repository (Lix et al., 2004). Patients with multi–morbidity (Table 3.3) were included in the analyses for each relevant condition.

A person was considered an **incident** case for a condition if they met the criteria for diagnosis with the condition within the three–year study period (2007/08–2009/10). Prevalence was defined as meeting the criteria for the condition within the five years prior to the start of the study period (2001/02–2005/06). Preliminary analyses revealed that the visit patterns for those who were prevalent for a condition were very similar to those who were incident, so these two groups were combined for all analyses.

Table 2.3: Description of Conditions and Relevant Quality of Care Indicators for Patients in the Chronic–Condition Cohort, 2007/08–2010/11

Chronic Conditions and Quality of Care Indicators	Description
Hypertension	
Influenza Vaccination	**Eligibility:** Patients with hypertension. **Process Indicator:** At least one influenza vaccination during the study period.
Myocardial Infarction	**Eligibility:** Patients with hypertension who have not had myocardial infarction during the study period. **Health Outcome:** At least one mycardial infarction within a year after the study period.
Renal Failure	**Eligibility:** Patients with hypertension who have not had renal failure during the study period. **Health Outcome:** At least one renal failure within a year after the study period.
Stroke	**Eligibility:** Patients with hypertension who have not had a stroke during the study period. **Health Outcome:** At least one stroke within a year after the study period.
Total Respiratory Morbidity	
Influenza Vaccination	**Eligibility:** Patients with total respiratory morbidity during the study period. **Process Indicator:** At least one influenza vaccination during the study period.
Asthma	
Drug Prescription	**Eligibility:** Patients with beta-2 agonist prescription during the study period. **Process Indicator:** Prescription for medications recommended for long–term control of asthma (e.g., inhaled corticosteroids, leukotriene antagonists, adrenergics) during the study period.
Mood Disorders	
Follow-Up Appointment for Depression	**Eligibility:** Patients with a depression diagnosis during the study period that is within two weeks of an antidepressant prescription. **Process Indicator:** Three subsequent ambulatory visits within four months of the prescription being filled.
Diabetes Mellitus	
Influenza Vaccination	**Eligibility:** Patients with diabetes. **Process Indicator:** At least one influenza vaccination during the study period.
Eye Examination	**Eligibility:** Patients with diabetes. **Process Indicator:** At least one visit to an optometrist* or ophthalmologist* during the study period.
Lower Limb Amputation	**Eligibility:** Patients with diabetes who have not lower limb amputation during the study period. **Health Outcome:** At least one lower limb amputation within a year after the study period.
Ischemic Heart Disease	
Influenza Vaccination	**Eligibility:** Patients with ischemic heart disease. **Process Indicator:** At least one influenza vaccination during the study period.
Myocardial Infarction Care: Drug Prescription	**Eligibility:** Patients with ischemic heart disease who have had at least one myocardial infarction during the study period. **Process Indicator:** At least one prescription for beta-blockers, except prescriptions for chronic obstructive pulmonary disease.
Congestive Heart Failure	
Influenza Vaccination	**Eligibility:** Patients with congestive heart failure. **Process Indicator:** At least one influenza vaccination during the study period.
Drug Prescription	**Eligibility:** Patients with congestive heart failure. **Process Indicator:** Prescription for Angiotensin Converting Enzyme Inhibitor (ACEI) or Angiotensin II Receptor Blockers (ARB) during the study period.

* See Glossary definition

Physician Assignment Algorithm

The physician assignment algorithm we used to assign all individuals within the chronic–condition cohort to a physician has been used in previous MCHP studies (Frohlich et al., 2006; Katz et al., 2009; Katz, Bogdanovic, & Soodeen, 2010; Katz, De Coster, Bogdanovic, Soodeen, & Chateau, 2004; Martens et al., 2010). It is based on the frequency of ambulatory visits the patient has made to each physician. Only patients who have made at least four visits during the three–year study period were assigned to a physician by the algorithm in our study. Where there is a tie in the number of visits to more than one physician, the visits with a higher fee are assigned a greater value to break the tie. This study analyzed the choice of doctor patients made when seeking ambulatory care; therefore, prior to physician assignment, all visits that resulted from a referral from one physician to another (as indicated by a referral code in the medical claim) were excluded from the algorithm. We also excluded visits to emergency departments, visits to an inpatient setting, visits for maternity care, and visits to doctors that were not active during the entire study period.

The assignment algorithm operated as follows:

1. Patients that only saw one doctor throughout the study period were assigned to that doctor.
2. Patients who saw multiple doctors were assigned to the doctor to whom they made the greatest number of visits.
3. If the number of visits made by a patient was tied between a PCP and an SP, the patient was assigned to the PCP.
4. If the number of visits made by a patient was tied among multiple PCPs or among multiple SPs, the patient was assigned to the doctor that billed the greatest fees for those ambulatory visits. It was assumed that this doctor likely provided a higher level of care to that patient.
5. For patients that had the same number of visits to either multiple PCPs or multiple SPs and the amount of fees billed was tied among these doctors, patients were randomly assigned to one of the doctors.

Ambulatory Care Visit Patterns

Primary Care Physician Visits

Ambulatory visits to PCPs were separated into three subcategories that differentiated visits based on the type of physician an individual was assigned to as well as the type of physician they were visiting (Table 2.4). The first visit category was for patients who visited their assigned PCP. Next, there were visits by patients to another (non–assigned) PCP, even though they had an assigned PCP. This category included visits to PCPs located in the same clinic as the assigned PCP or in other clinics. Visiting a different PCP located in the same clinic as an individual's assigned PCP occurs commonly, for example, if their assigned PCP is away or if they go to their regular clinic as a walk–in patient. This would often not be of great concern since these unassigned PCPs still have access to the person's medical file. However, due to our inability to accurately assign both physicians and visits to specific clinics, the location of the PCP was not taken into account. The third subcategory of PCP visits identified patients who visited a PCP but were actually assigned to an SP. For all three visit patterns to a PCP, there was no referral associated with the visits.

Specialist Visits

These visits were subdivided into SP visits with or without a referral (Table 2.4). The referring doctor could have been an SP, a PCP, an inpatient physician, or an emergency department physician. Although inpatient and emergency department visits were excluded from the main analyses, they were included for determining referrals as often these doctors provide referrals for future ambulatory care.

The initial visit that resulted from a referral is identified by the use of a specific billing code in the medical claims file. However in some situations, one visit with the referred doctor is insufficient and additional follow–up is required. For this study, any visit to an SP that occurred within six months of the first referred visit was also considered a visit

with referral. Six months was the cut–off point because, beyond this time period, an SP usually requires a new referral.

The patterns of SP visits with a referral were divided into three subcategories based on who made the referral: the patient's assigned PCP, another PCP, or another SP (for patients who were assigned to a PCP).

SP visits without a referral were also divided into three subcategories based on the type of assigned physician. One subcategory consisted of patients who were assigned to a PCP. Another subcategory included people who were visiting the SP to whom they were assigned. The third subcategory was made up of people who were visiting an SP that was different from their assigned SP.

The visit pattern category "all others" was created to group together all other visit patterns not included in the categories described above. Table 2.4 shows the various visit pattern categories that comprise the "all others" category.

Table 2.4: Visit Patterns of Manitoba Patients by Visit Type and Physician Assignment, 2007/08–2009/10

Visit Type	Physician Assignment	Referring Physician
Primary Care Physician (PCP) Visits		
Assigned PCP	PCP	–
Another PCP	PCP	–
PCP	SP	–
Specialist (SP) Visits without Referral		
SP	PCP	–
Assigned SP	SP	–
Another SP	SP	–
Specialist Visits with Referral		
SP	PCP	Assigned PCP
SP	PCP	Another PCP
SP	PCP	SP
Others		
Assigned PCP	PCP	SP
SP	SP	Assigned SP
SP	SP	Another SP
Assigned SP	SP	PCP
Assigned SP	SP	Another SP

Table 2.5 presents the specialty types included with the percent of visits made to each type of SP by patients in the chronic–condition cohort over the three–year study period (each row sums to 100%). The most frequent visit type to **internists** was when the patient's assigned physician was a PCP, representing 34.3% of internist visits without referral and 23.6% of visits with referral from the assigned PCP. This pattern was consistent with good continuity of care. The next most common visit to an internist was a referral when the referring doctor was not the assigned PCP (11.0%). In contrast, 62.7% of visits to **psychiatrists** were made when the psychiatrist was the patient's assigned physician. The most common visit type to general surgeons was almost evenly split between visits with no referral (32.0%) and visits with a referral (33.7%) when the patient's assigned physician was a PCP. For ENT (ear, nose, and throat) surgeons and **ophthalmologists**, 43.2% of visits were made without a referral by patients with an assigned PCP and 20.3% were on referral from another SP when the assigned doctor was a PCP. The patterns for **dermatologists** and specialist surgeons were similar to that of general surgeons: 38.0% visits to the dermatologist without a referral from the assigned PCP and 35.8% visits to the surgeon without a referral; for visits on referral from the assigned PCP, 33.3% were for dermatologists and 28.1% for surgeons.

Table 2.5: Type of Visits by Manitoba Patients in the Chronic–Condition Cohort to Specific Specialists, 2007/08–2009/10

	Visit Type						
	Specialist (SP) Visit with No Referral			Specialist Visit with Referral from			All Others
	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Internist	34.34	16.21	5.65	23.60	10.98	5.23	3.99
Psychiatrist	19.81	62.71	4.10	4.61	3.67	1.59	3.52
General Surgeon	31.97	5.95	2.98	33.72	16.08	5.23	4.07
ENT-OOP*	43.21	6.23	4.88	12.69	8.17	20.30	4.51
Dermatologist	38.01	5.09	5.81	33.29	8.98	3.58	5.24
Specialist Surgeon	35.75	1.79	3.24	28.14	12.25	12.67	6.15

* Ear, nose, and throat (ENT) surgeons and ophthalmologists (OOP)

Clusters

Cluster analysis was performed separately for the chronic–condition cohort and the no–chronic–condition cohort. Cluster analysis is a mathematical procedure that places people or objects into similar groups (i.e., clusters) based on a set of included indicators. In this case, the number of visits for each of nine visit types (e.g., visits to assigned PCP, visits to another PCP, visits to an SP with referral from assigned PCP) was included in the analysis. The analysis begins with each person as an individual 'cluster'. It groups people that are most similar (or even identical) to each other in terms of their visit pattern, gradually reducing the criteria for inclusion in the same cluster. This procedure is analogous to Factor Analysis, except that it groups cases together across a set of variables (based on distance in a multidimensional space), rather than grouping variables together across a set of cases (based on covariance). The SAS procedure PROC FASTCLUS was used to analyse the pattern of visits using methods described by Anderberg (1973) and Everitt (1980), with slight modifications based on Hartigan (1975). An automatic algorithm determines the number of clusters present in the dataset under analysis, whereby the individuals within a cluster are as similar as possible while also maximising the differences between clusters.

The groups of ambulatory visit types shown for the cluster analyses in this study differed slightly from those of the visit pattern analyses. For the latter, groupings were based predominantly on the attending doctor with less emphasis on the referring doctor. Additionally, the frequency of each visit type was included in building the clusters. For the cluster analyses, it was not logical to have an 'all others' category, which is comprised of a wide variety of visit types (Table 2.4). Since the purpose of clustering is to group people on the basis of similarity in visit patterns, visit types of low frequency were instead grouped with other similar visits. See Tables 2.6 and 2.7 for the cluster categories.

The clusters that resulted were then used as the basis for studying the quality of care and outcomes. As the patterns of ambulatory care visits differ for people based on their region of residence, we compared the distribution of the Winnipeg and non–Winnipeg populations across the clusters. Note that although Brandon is Manitoba's second largest urban community, the visit patterns of Brandon residents were more similar to rural Manitobans than to Winnipeggers. Therefore, cohorts were divided into Winnipeg and non–Winnipeg rather than into rural and urban.

Table 2.6: Cluster Categories for Manitoba Patients in the Chronic–Condition Cohort, 2007/08–2009/10

Cluster	Cluster Description
1	Patient is assigned to a specialist (SP) with about 7 visits per year Patient sees other primary care physicians (PCPs) more than 7 visits
2	Patient is assigned to a PCP with about 15 visits per year
3	Patient is assigned to a SP with about 18 visits per year
4	Patient is assigned to a PCP with about 18 visits per year Patient sees other PCPs about the same amount
5	Patient is assigned to a PCP with about 4 visits per year Patient sees other PCPs about the same amount
6	Patient is assigned to a PCP with about 7 visits per year
7	Patient is assigned to a PCP with about 3 visits per year
8	Patient is assigned to a PCP with about 33 visits per year
9	Patient is assigned to a PCP with about 7 visits per year Patient sees SPs about the same amount (no referral)
10	Patient is assigned to a PCP with about 6 visits per year Patient sees other PCPs for 12 visits per year
11	Patient is assigned to a SP with about 4 visits per year
12	Patient is assigned to a SP with about 43 visits per year
13	Patient is assigned to a SP with about 6 visits per year Patient sees other SPs for about 12 per year
14	Patient is assigned to a SP with about 3 visits per year Patient sees PCPs with about 28 visits per year
15	Patient is assigned to a PCP with about 6 visits per year Patient sees other PCPs with about 30 visits per year

Table 2.7: Cluster Categories for Manitoba Patients in the No–Chronic–Condition Cohort, 2007/08–2009/10

Cluster	Cluster Description
1	Patient is assigned to a primary care physician (PCP) with about 5 visits per year Patient sees specialists (SP) about the same amount
2	Patient is assigned to a SP with about 1 visits per year Patient sees PCPs about the same amount
3	Patient is assigned to a SP with about 30 visits per year
4	Patient is assigned to a SP with about 7 visits per year Patient sees other PCPs about the same amount
5	Patient is assigned to a SP with about 2 visits per year Patient sees other PCPs with about 6 visits per year
6	Patient is assigned to a PCP with about 3 visits per year Patient sees other PCPs with about 6 visits per year
7	Patient is assigned to a PCP with about 1 visit per year
8	Patient is assigned to a PCP with about 1 visits per year Patient sees a SP with referral about 6 visits per year
9	Patient is assigned to a PCP with about 16 visits per year
10	Patient is assigned to a PCP with about 8 visits per year
11	Patient is assigned to a PCP with about 4 visits per year

Quality of Care Indicators

The quality of care indicators used in this study were selected from previous MCHP research (Katz et al., 2010; Katz et al., 2004; Martens et al., 2010). Indicators were analysed for each condition–specific cohort and in the chronic condition clusters. Table 2.3 (see page 7) shows the quality of care indicators for each of the chronic conditions.

Statistical Analysis

In order to understand the impact of different patterns of care on patients and their health, we analysed the relationships between a variety of explanatory variables and each of the six condition's quality indicators. We used **logistic regression** modelling as this provides the opportunity to describe the specific impact of the pattern of care (the variable we are interested in for this study and represented by the different clusters) after accounting (or controlling) for the other variables included in the regression model.

For each quality indicator, we analysed the impact of the following: the presence of each of the other chronic conditions (i.e., **comorbidity**), age of the patient, cluster, and **socioeconomic status (SES)** as represented by the **income quintile** assigned to their postal code. Because the SES quintiles are calculated separately for Winnipeg and non–Winnipeg postal codes the analyses include place of residence.

All data management, programming, and analyses were performed using SAS® statistical analysis software, version 9.2.

Data Limitations

As with all studies, there are limitations as to what analyses the available data supported. The specific limitations related to this study are primarily related to the limitations in administrative claims data for physician visits. While the majority of Manitoba physicians are remunerated on a fee for service basis, the number of physicians who are paid through other mechanisms (see Glossary definition of Physician Claims) is not inconsequential. This results in missing data. If a claim is not submitted for a specific visit, this means we cannot include that visit in our analysis. The number of visits to PCPs outside of Winnipeg is likely to be underestimated, as up to 40% of these physicians are paid via alternative funding arrangements (Katz et al., 2004). Previous work at MCHP has suggested that up to one–third of the visits to alternative funded physicians may be missing from the claims data (Katz et al., 2009). There are also missing claims from PCPs in Winnipeg because some of these are paid via alternative funding mechanisms (less than 10% of PCPs) and because services provided by **nurse practitioners** are not included during the years of study. We have not **adjusted** the results to address these gaps in the data but were forced to remove three northern regions with a high **rate** of alternative funded PCPs.

CHAPTER 3: COHORTS

This chapter describes the populations in the chronic–condition and no–chronic–condition cohorts for the province, the distribution of the chronic conditions across the population, and the number and types of visits made by patients diagnosed with each of the chronic conditions.

A total of 627,460 patients 19 and older are included in the analyses. Table 3.1 presents the age distribution of the two cohorts. A little more than half of the eligible population (55.4%) were diagnosed with at least one chronic condition. The percent of the population in the chronic–condition cohort increases age—40.5% of those between 19 and 44 have at least one chronic condition while 80.4% of those 65 and older fall into this category.

Table 3.1: Age Distribution of Manitoba Patients in the Chronic–Condition Cohort and the No–Chronic–Condition Cohort, 2007/08–2009/10

Age Group (Years)	Patients	Cohort		
		Chronic Condition	No Chronic Condition	Total
19-44	Number	107,214	157,745	264,959
	Percent	40.46	59.54	
45-64	Number	141,413	98,016	239,429
	Percent	59.06	40.94	
65 +	Number	98,979	24,093	123,072
	Percent	80.42	19.58	
Total	Total Number	347,606	279,854	627,460
	Total Percent	55.40	44.60	100

The distribution of the 347,606 patients with at least one chronic condition, the number of conditions, and area of residence (Winnipeg or non–Winnipeg) are presented in Table 3.2.

Table 3.2: Distribution of Manitoba Patients in the Chronic–Condition Cohort by Location of Residence, 2007/08–2009/10

Number of Conditions	Non-Winnipeg		Winnipeg		Total Number of Patients
	Number of Patients	Percent of Patients	Number of Patients	Percent of Patients	
1	79,229	37.26	133,405	62.74	212,634
2	37,297	39.29	57,634	60.71	94,931
3	12,161	39.38	18,720	60.62	30,881
4	3,127	40.81	4,535	59.19	7,662
5	594	42.80	794	57.20	1,388
6	45	40.91	65	59.09	110
Total	132,453	38.10	215,153	61.90	347,606

Table 3.3 presents the actual number of patients (and percent of patients) with each combination of chronic conditions. Hypertension was the most common chronic condition included in our study; the first section of rows in Table 3.3 represents these patients. The last row in the hypertension section shows that 77,149 people (22.2% of the chronic–condition cohort) were diagnosed with hypertension and had no other comorbidities. The rest of the section describes the number of Manitobans who have been diagnosed with each of the other comorbidities in addition to hypertension. In total, there were 188,602 Manitobans diagnosed with hypertension according to the algorithm we used.

The second section of the table presents patients with TRM and the other comorbidities, but not hypertension. Of the 157,742 people diagnosed with TRM, 84,484 had only TRM and no other comorbidities (while the 24,607 people with TRM and hypertension but no other comorbidities are presented in the hypertension section above). From the next section of the table, 38,185 with only mood disorders out of 76,402 Manitobans with mood disorders; then, 11,327 with only diabetes out of the total of 65,260 people with diabetes; then, 1,401 (37,123 total diagnoses of IHD) with only ischemic heart disease; and finally, 88 (out of 8,258 of a total of Manitobans with a diagnosis of congestive heart failure) had none of the other chronic conditions included in the study.

Table 3.3: Comorbidities Among Specified Chronic Conditions for Manitoba Patients in the Chronic–Condition Cohort, 2007/08–2009/10

Hypertension	Total Respiratory Morbidity	Mood Disorders	Diabetes Mellitus	Ischemic Heart Disease	Congestive Heart Failure	Number of Patients	Percent of Patients
					X	88	0.03
				X		1,401	0.40
				X	X	19	0.01
			X			11,327	3.26
			X		X	14	0.00
			X	X		147	0.04
			X	X	X	11	0.00
		X				38,185	10.99
		X			X	13	0.00
		X		X		159	0.05
		X		X	X	s	s
		X	X			1,248	0.36
		X	X		X	s	s
		X	X	X		23	0.01
	X					84,484	24.30
	X				X	70	0.02
	X			X		547	0.16
	X			X	X	16	0.00
	X		X			3,820	1.10
	X		X		X	8	0.00
	X		X	X		65	0.02
	X		X	X	X	s	s
	X	X				16,374	4.71
	X	X			X	17	0.00
	X	X		X		114	0.03
	X	X		X	X	6	0.00
	X	X	X			820	0.24
	X	X	X		X	s	s
	X	X	X	X		17	0.00
	X	X	X	X	X	s	s
X						77,149	22.19
X					X	1,146	0.33
X				X		14,202	4.09
X				X	X	1,366	0.39
X			X			24,547	7.06
X			X		X	541	0.16
X			X	X		5,274	1.52
X			X	X	X	935	0.27
X		X				8,018	2.31
X		X			X	114	0.03
X		X		X		1,206	0.35
X		X		X	X	147	0.04
X		X	X			1,992	0.57
X		X	X		X	49	0.01
X		X	X	X		460	0.13
X		X	X	X	X	78	0.02
X	X					24,607	7.08
X	X				X	940	0.27
X	X			X		5,379	1.55
X	X			X	X	1,035	0.30
X	X		X			8,540	2.46
X	X		X		X	438	0.13
X	X		X	X		2,336	0.67
X	X		X	X	X	749	0.22
X	X	X				4,450	1.28
X	X	X			X	118	0.03
X	X	X		X		817	0.24
X	X	X		X	X	156	0.04
X	X	X	X			1,299	0.37
X	X	X	X		X	63	0.02
X	X	X	X	X		341	0.10
X	X	X	X	X	X	110	0.03

X Indicates the presence of a chronic condition listed in the corresponding columns. For example, in the first row, 88 patients (0.03% of the chronic-condition cohort) had congestive heart failure. In the very last row, 110 patients (0.03%) of the chronic-condition cohort) had all six chronic conditions: hypertension, total respiratory morbidity, mood disorders, diabetes mellitus, ischemic heart disease, and congestive heart failure.

s Indicates data suppressed due to small numbers

The next section of this chapter presents the numbers and types of visits made for the chronic–condition cohort and no–chronic–condition cohort for patients living in Winnipeg and those outside of Winnipeg. The total number of visits and the percent for each category over the three–year study period are presented in Table 3.4. The percent of all visits to the assigned PCP for each Manitoban is very similar for Winnipeg and non–Winnipeg residents (52.8% for Winnipeg and 57.3% for non–Winnipeg residents). For Winnipeg, the percent for the chronic–condition and no–chronic–condition cohorts are even more similar (52.6% and 53.4%, respectively). For non–Winnipeg residents, these percentages are 58.3 (chronic–condition cohort) and 54.8 (no–chronic–condition cohort).

The proportion of all visits that were made to SPs is low compared to PCP visits. SP visits represented a greater percent of visits for Winnipeg residents and were equally divided between referred and non–referred visits regardless of geography. The highest percent of visits was to SPs who were assigned as the principal provider for that patient. This represents 8.3% of visits for Winnipeg patients with a chronic condition vs. 5.0% for non–Winnipeg residents with a chronic condition.

Table 3.4: Type of Visits by Manitoba Patients in Winnipeg and Non–Winnipeg Areas and Physician Assignment, 2007/08–2009/10

	Number of Visits	Visit Type								
		Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
		With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Total Winnipeg	6,795,153	52.78	18.35	1.23	3.37	7.65	1.53	5.56	4.98	2.46
Chronic-Condition Cohort	4,894,455	52.55	17.31	1.38	3.51	8.33	1.56	6.15	4.81	2.38
No-Chronic-Condition Cohort	1,900,698	53.39	21.02	0.85	3.01	5.90	1.45	4.04	5.41	2.68
Total Non-Winnipeg	3,904,742	57.28	24.16	0.32	1.53	4.59	1.33	1.81	4.35	2.03
Chronic-Condition Cohort	2,767,956	58.29	23.10	0.35	1.48	4.97	1.37	1.87	4.19	1.93
No-Chronic-Condition Cohort	1,136,786	54.81	26.73	0.25	1.64	3.66	1.24	1.66	4.75	2.28

Table 3.5 presents visit rates over the three–year study period. As expected, visit rates per person are higher for those with at least one chronic condition (23.8 visits over the three–year study period for Winnipeg residents and 20.9 for non–Winnipeg residents) compared to 11.0 visits per person over three years for Winnipeg and 10.5 for non–Winnipeg residents without a chronic condition.

Table 3.5: Three–Year Visit Rates of Manitoba Patients in Winnipeg and Non–Winnipeg Areas by Visit Type, 2007/08–2009/10

	Number of Patients	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
Total Winnipeg	387,106	6,795,153	17.55	5,126,104	13.24	1,669,049	4.31
Chronic-Condition Cohort	215,185	4,894,455	22.75	3,632,747	16.88	1,261,708	5.86
No-Chronic-Condition Cohort	171,921	1,900,698	11.06	1,493,357	8.69	407,341	2.37
Total Non-Winnipeg	240,354	3,904,742	16.25	3,323,993	13.83	580,749	2.42
Chronic-Condition Cohort	132,421	2,767,956	20.90	2,350,554	17.75	417,402	3.15
No-Chronic-Condition Cohort	107,933	1,136,786	10.53	973,439	9.02	163,347	1.51

The following sections of this chapter follow the same pattern. For each cohort, two tables are presented. First, the proportion of visits that fall in each of the nine visit types is presented by RHA. The second table presents the total number of visits for the cohort and the average number of visits per patient over the three–year period for each region. Separate tables are presented for the following cohorts—patients with any of the selected chronic condition diagnoses; those with no chronic condition diagnosis; and then one for patients diagnosed with each of the chronic conditions: hypertension, TRM, mood disorders, diabetes, IHD, and CHF.

Any Chronic Condition Cohort (n=347,606)

The next two tables present information about the chronic condition cohort for each of the RHAs included in the study. We have presented these regional analyses because access to SP care is not uniform across the province. The comparison between the RHAs provides the opportunity to reflect on the impact of the distribution of SPs on the types of visits provided.

The percent of visits made to the assigned PCP varies from a high of 64.5% in Parkland to a low of 52.6% in Winnipeg (Table 3.6). In contrast, Brandon has the highest percent of visits to a different PCP (29.5%) and Winnipeg has the lowest (17.31%). Winnipeg has the highest percent of visits to an SP, whether referred or not. While the proportion of referred visits from the assigned PCP was highest in Winnipeg (more than twice the proportion of all RHAs), the pattern of visits with referrals from another PCP is noticeably different. The proportion of visits with a referral from another PCP is considerably higher than that of the assigned PCPs across all other regions. While the vast majority of SPs in Manitoba are in Winnipeg with a smaller number in Brandon and even fewer in other regions, the pattern of visits does not support increased access for referred visits for Winnipeg patients.

Visit rates are presented in Table 3.7. The average number of visits per person varies by RHA (from a high of 24.6 visits over the three–year period in Brandon to a low of 18.7 in South Eastman). Brandon and Parkland have the highest average number of visits to PCPs per person, while Winnipeg has the highest average number of visits to SP per person.

Table 3.6: Type of Visits by Manitoba Patients in the Chronic–Condition Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Visit Type								
	Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
	With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
South Eastman	58.36	20.53	0.38	1.44	5.93	1.60	1.89	5.21	2.10
Central	56.31	23.56	0.46	1.68	5.67	1.54	2.28	4.10	1.84
Assiniboine	60.32	24.77	0.12	0.87	3.82	1.37	0.94	3.30	1.89
Brandon	53.20	29.50	0.22	1.80	4.12	1.10	2.60	3.79	1.75
Winnipeg	52.55	17.31	1.38	3.51	8.33	1.56	6.15	4.81	2.38
Interlake	57.78	19.29	0.64	2.23	6.74	1.58	2.74	4.71	2.18
North Eastman	59.80	20.59	0.43	1.54	5.81	1.34	1.84	4.19	2.16
Parkland	64.45	22.05	0.11	0.44	2.38	1.01	0.31	4.33	1.62
Manitoba	54.62	19.40	1.01	2.78	7.11	1.49	4.60	4.58	2.21

Table 3.7: Three–Year Visit Rates by Manitoba Patients in the Chronic–Condition Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
South Eastman	284,706	18.68	234,719	15.40	49,987	3.28
Central	505,341	19.38	422,451	16.20	82,890	3.18
Assiniboine	433,558	20.17	383,067	17.82	50,491	2.35
Brandon	426,855	24.55	367,612	21.15	59,243	3.41
Winnipeg	4,894,455	22.75	3,632,747	16.88	1,261,708	5.86
Interlake	498,254	20.17	402,276	16.29	95,978	3.89
North Eastman	276,425	20.84	231,488	17.45	44,937	3.39
Parkland	342,817	24.05	308,941	21.68	33,876	2.38
Manitoba	7,662,411	22.04	5,983,301	17.21	1,679,110	4.83

No–Chronic–Condition Cohort (n=279,854)

Tables 3.8 and 3.9 present the same analyses for the no–chronic–condition cohort.

The percent of visits made to the assigned PCP is lower for the no–chronic–condition cohort, with a high of 59.2% in Parkland and low of 51.2% in Brandon (Table 3.8). While the percent of this visit type was lower for most regions, it was higher for Winnipeg. The percent of visits to an SP who is the assigned physician was noticeably lower than the chronic–condition cohort. This was consistent across the regions. In contrast, the proportion of visits to another PCP was higher in the no–chronic–condition cohort.

Manitobans without a chronic condition diagnosis made about half the number of physician visits compared to those with a chronic condition diagnosis (Tables 3.7 and 3.9). As with the chronic–condition cohort, Brandon residents had the highest average number of PCP visits per person and South Eastman residents had the lowest. Both the percent of visits to SPs and the average number of visits per person was considerably lower for the no–chronic–condition cohort as compared to the chronic–condition cohort.

Table 3.8: Type of Visits by Manitoba Patients in the No–Chronic–Condition Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Visit Type								
	Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
	With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
	%	%	%	%	%	%	%	%	%
South Eastman	54.48	25.08	0.27	1.84	3.95	1.40	1.91	5.78	2.48
Central	52.19	29.05	0.26	1.81	3.86	1.23	1.97	4.58	2.05
Assiniboine	56.76	27.81	0.09	0.86	2.79	1.11	0.87	3.91	2.28
Brandon	51.20	34.55	0.09	1.03	2.86	1.01	1.11	4.17	1.84
Winnipeg	53.39	21.02	0.85	3.01	5.90	1.45	4.04	5.41	2.68
Interlake	55.16	22.20	0.48	2.59	4.87	1.49	2.49	5.29	2.68
North Eastman	58.99	20.45	0.39	2.17	4.67	1.39	1.99	4.92	2.64
Parkland	59.19	25.48	0.08	0.73	1.92	0.92	0.61	4.58	2.05
Manitoba	53.92	23.16	0.62	2.50	5.06	1.37	3.15	5.17	2.53

Table 3.9: Three–Year Visit Rates by Manitoba Patients in the No–Chronic–Condition Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
South Eastman	161,812	9.59	135,268	8.02	26,544	1.57
Central	263,425	10.20	225,236	8.72	38,189	1.48
Assiniboine	165,207	10.59	146,469	9.39	18,738	1.20
Brandon	145,340	12.31	128,952	10.93	16,388	1.39
Winnipeg	1,900,698	11.06	1,493,357	8.69	407,341	2.37
Interlake	194,684	10.19	159,171	8.33	35,513	1.86
North Eastman	102,841	10.49	85,615	8.73	17,226	1.76
Parkland	103,477	11.60	92,728	10.40	10,749	1.21
Manitoba	3,037,484	10.85	2,466,796	8.81	570,688	2.04

Hypertension Cohort (n=188,602)

Eligibility: Patients with a diagnosis of hypertensive disease in at least one hospital separation; hypertensive disease in at least two ambulatory visits in three years; OR at least two prescriptions of anti–hypertensives, diuretics, beta blocking agents, calcium channel blocker, angiotensin converting enzyme inhibitors (ACEI), or angiotensin II antagonists in three years.

Table 3.10 shows that the proportion of visits to the assigned PCP for the hypertension cohort was 57.0%, which was higher than the chronic–condition cohort (54.6%, Table 3.6). The range in regional variation was similar to the larger chronic–condition cohort, which included the hypertension group. As expected, Winnipeg had the highest percent of visits to SPs, followed by Interlake (Table 3.10).

The number of visits in this cohort is presented in Table 3.11. The average number of visits per person was slightly higher than for the chronic–condition cohort (24.2 vs. 22.0 visits) as was the average number of SP visits per person (5.5 vs. 4.8 visits, Tables 3.7 and 3.11). Patients in Brandon had the most visits per person (26.8) and South Eastman had the least (20.2). Residents in Winnipeg had the most visits to SPs on average (6.9) (Table 3.11).

Table 3.10: Type of Visits by Manitoba Patients in the Hypertension Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Visit Type								
	Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
	With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
South Eastman	59.33	18.04	0.46	1.14	7.01	1.94	1.56	5.61	2.19
Central	58.88	20.46	0.52	1.33	6.46	1.84	1.66	4.40	1.86
Assiniboine	62.65	22.22	0.11	0.65	4.21	1.58	0.67	3.45	1.88
Brandon	57.59	23.86	0.24	1.42	4.92	1.47	2.37	4.48	1.67
Winnipeg	54.64	14.52	1.56	2.97	9.99	1.83	4.61	5.27	2.56
Interlake	59.26	17.33	0.69	1.93	7.67	1.81	2.01	4.98	2.16
North Eastman	60.92	18.39	0.45	1.34	6.83	1.55	1.37	4.48	2.32
Parkland	66.08	19.13	0.12	0.38	2.80	1.23	0.26	4.89	1.68
Manitoba	56.95	16.65	1.10	2.28	8.34	1.76	3.38	4.99	2.33

Table 3.11: Three–Year Visit Rates by Manitoba Patients in the Hypertension Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
South Eastman	173,289	20.15	139,982	16.28	33,307	3.87
Central	327,565	20.81	271,402	17.24	56,163	3.57
Assiniboine	302,083	21.84	265,616	19.21	36,467	2.64
Brandon	234,475	26.76	198,275	22.63	36,200	4.13
Winnipeg	2,790,394	25.35	2,036,830	18.50	753,564	6.85
Interlake	328,222	22.07	262,595	17.65	65,627	4.41
North Eastman	177,520	22.63	146,537	18.68	30,983	3.95
Parkland	224,951	25.38	200,000	22.56	24,951	2.81
Manitoba	4,558,499	24.17	3,521,237	18.67	1,037,262	5.50

Total Respiratory Morbidity Cohort (n=157,742)

Eligibility: Patients with a diagnosis of bronchitis, bronchiolitis, emphysema, asthma, or chronic airway obstruction in at least one hospital separation or ambulatory visit in three years.

The percent of visits to the assigned PCP and to the assigned SP in the TRM cohort was similar to the chronic–condition cohort, as was the proportion of SP visits with referral from another SP (Tables 3.6 and 3.12). The percent of SP visits with a referral from a PCP was comparable to the chronic–condition cohort.

The average number of visits per person was very similar to that for the chronic–condition cohort (Tables 3.7 and 3.13). Residents of Parkland had the highest average number of visits per person (26.7) and South Eastman the lowest (19.4) (Table 3.13).

Table 3.12: Type of Visits by Manitoba Patients in the Total Respiratory Morbidity Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Visit Type								
	Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
	With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
	%	%	%	%	%	%	%	%	%
South Eastman	57.42	23.79	0.21	1.32	5.33	1.36	0.93	5.30	2.02
Central	53.92	28.48	0.23	1.64	4.95	1.29	1.56	3.88	1.88
Assiniboine	57.28	28.78	0.08	0.84	3.56	1.22	0.65	3.13	2.00
Brandon	51.34	34.40	0.17	1.35	3.58	0.89	1.69	3.20	1.73
Winnipeg	52.74	21.17	0.88	3.17	7.64	1.43	4.24	4.67	2.36
Interlake	56.81	22.43	0.53	1.95	6.13	1.47	1.98	4.56	2.19
North Eastman	58.51	24.55	0.21	1.24	4.95	1.11	1.06	3.95	2.05
Parkland	63.37	24.43	0.04	0.48	2.09	0.80	0.26	3.84	1.55
Manitoba	54.12	23.29	0.65	2.50	6.46	1.33	3.17	4.39	2.20

Table 3.13: Three–Year Visit Rates by Manitoba Patients in the Total Respiratory Morbidity Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
South Eastman	113,936	19.38	96,341	16.39	17,595	2.99
Central	197,123	19.87	169,259	17.06	27,864	2.81
Assiniboine	187,221	21.01	167,044	18.75	20,177	2.26
Brandon	226,913	25.51	200,908	22.59	26,005	2.92
Winnipeg	2,277,752	22.61	1,774,778	17.62	502,974	4.99
Interlake	220,672	20.74	182,362	17.14	38,310	3.60
North Eastman	134,670	21.97	116,290	18.97	18,380	3.00
Parkland	176,885	26.64	161,561	24.34	15,324	2.31
Manitoba	3,535,172	22.41	2,868,543	18.19	666,629	4.23

Mood Disorders Cohort (n=76,402)

Eligibility: Patients with a diagnosis of mood, stress, and adjustment disorders; mental and behavioural disorders; or emotional disorders in one hospital separation in three years; OR a diagnosis of mood disorders, reaction to stress and adjustment disorders, or depressive disorders in three ambulatory visits in three years; OR a diagnosis of anxiety disorders, depressive disorders, mood disorders, obsessive–compulsive disorders, dissociative disorders, or somatoform disorders in one hospital separation in three years AND at least one prescription of antidepressants and mood stabilizers in three years; OR a diagnosis of anxiety disorders in three ambulatory visits in three years AND at least one prescription of antidepressants and mood stabilizers in three years.

While it appears that the ambulatory care and hospitalization diagnoses used to define eligibility are different, this is because of the different combinations of diagnoses used in the ICD–9 (ambulatory) coding used and ICD–10 (hospital discharge) coding used. We included a broad range of codes to include all relevant diagnoses from both coding systems.

The proportion of visits to an assigned PCP was a little lower for patients with mood disorders (48.8 vs. 54.5%) as was the proportion of visits to an assigned SP (6.4 vs. 7.1%, Tables 3.6 and 3.14).

On average, patients with a mood disorder made more visits per person than the chronic–condition cohort (29.5 vs. 22.0 visits, Tables 3.7 and 3.15). There were also more visits to SPs per person (7.4 vs. 4.8 visits).

Table 3.14: Type of Visits by Manitoba Patients in the Mood Disorders Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Visit Type								
	Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
	With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
	%	%	%	%	%	%	%	%	%
South Eastman	57.81	21.84	0.26	2.02	5.04	1.09	3.68	3.99	2.05
Central	52.14	24.83	0.52	3.04	5.04	1.02	5.27	3.32	1.90
Assiniboine	53.72	29.71	0.16	2.22	3.77	0.79	2.52	2.78	1.87
Brandon	46.84	31.86	0.38	3.78	4.65	0.70	4.73	3.03	1.95
Winnipeg	46.47	17.57	1.68	5.73	7.26	1.19	11.88	3.82	2.16
Interlake	54.50	19.71	0.84	3.69	5.67	1.08	6.54	3.84	1.95
North Eastman	56.53	24.53	0.51	2.08	4.38	0.76	3.70	2.91	1.86
Parkland	62.29	26.83	0.15	0.38	1.77	0.67	0.43	3.18	1.42
Manitoba	48.79	20.19	1.28	4.78	6.38	1.09	9.46	3.65	2.07

Table 3.15: Three–Year Visit Rates by Manitoba Patients in the Mood Disorders Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
South Eastman	77,973	23.95	65,063	19.99	12,910	3.97
Central	123,139	25.35	100,955	20.79	22,184	4.57
Assiniboine	84,376	26.01	74,057	22.83	10,319	3.18
Brandon	147,858	33.33	124,279	28.02	23,579	5.32
Winnipeg	1,550,435	30.25	1,093,436	21.33	456,999	8.92
Interlake	113,327	25.77	89,792	20.42	23,535	5.35
North Eastman	68,332	29.10	58,310	24.83	10,022	4.27
Parkland	87,197	33.40	80,487	30.83	6,710	2.57
Manitoba	2,252,637	29.48	1,686,379	22.07	566,258	7.41

Diabetes Mellitus Cohort (n=65,260)

Eligibility: Patients with a diagnosis of diabetes in at least one hospital separation in three years; OR a diagnosis of diabetes in at least two ambulatory visits in three years; OR at least one prescription of insulin, insulin analogues, or blood glucose lowering drugs.

While the percent of visits to an assigned PCP was similar to the chronic–condition cohort, the percent of visits to other PCPs was lower (16.7 vs. 19.4%, Tables 3.6 and 3.16). This difference may have been accounted for by the higher percent of visits that were made to an assigned SP where that SP treated the patient's diabetes (9.1 vs. 7.1%, Tables 3.6 and 3.16). Parkland had the highest proportion of visits to an assigned PCP (65.8%) and Winnipeg the lowest (52.0%) (Table 3.16).

Patients with diabetes made more visits on average per person than the chronic–condition cohort (26.2 vs. 22.0, Tables 3.7 and 3.17).

Table 3.16: Type of Visits by Manitoba Patients in the Diabetes Mellitus Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Visit Type								
	Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
	With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
	%	%	%	%	%	%	%	%	%
South Eastman	58.91	17.18	0.50	1.46	7.94	2.10	1.87	5.48	1.99
Central	57.08	20.88	0.74	1.76	7.14	1.97	2.17	3.96	1.86
Assiniboine	61.73	23.00	0.17	0.93	4.35	1.59	0.94	3.11	1.78
Brandon	57.81	24.06	0.29	1.34	4.94	1.59	2.18	4.19	1.79
Winnipeg	52.02	14.54	1.95	3.46	10.89	1.99	5.38	4.78	2.62
Interlake	56.09	18.52	0.96	2.41	8.52	2.11	2.15	4.51	2.32
North Eastman	58.18	20.33	0.45	1.32	7.46	1.70	1.60	3.93	2.48
Parkland	65.78	19.71	0.28	0.57	2.87	1.22	0.39	4.15	1.67
Manitoba	54.78	16.88	1.40	2.69	9.08	1.90	3.94	4.53	2.38

Table 3.17: Three–Year Visit Rates by Manitoba Patients in the Diabetes Mellitus Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
South Eastman	60,594	22.16	48,238	17.64	12,356	4.52
Central	110,813	22.44	90,403	18.31	20,410	4.13
Assiniboine	110,236	24.16	96,807	21.22	13,429	2.94
Brandon	86,952	28.87	73,706	24.47	13,246	4.40
Winnipeg	1,055,111	27.26	748,301	19.34	306,810	7.93
Interlake	126,172	23.82	99,079	18.70	27,093	5.11
North Eastman	72,326	24.97	59,184	20.43	13,142	4.54
Parkland	88,633	28.43	79,065	25.36	9,568	3.07
Manitoba	1,710,837	26.22	1,294,783	19.84	416,054	6.38

Ischemic Heart Disease Cohort (n=37,123)

Eligibility: Patients with a diagnosis of IHD in at least one hospital separation OR in at least two ambulatory visits in three years; OR a diagnosis of IHD in at least one ambulatory visit in three years AND at least two prescriptions of vasodilators beta blocking agents, calcium channel blockers, angiotensin converting enzyme inhibitors (ACEI), angiotensin II antagonists, or other cardiac drugs in three years.

While the percent of visits to an assigned PCP in the IHD cohort was similar to the chronic–condition cohort, the percent of visits to another PCP was lower (15.6 vs. 19.4%; Tables 3.6 and 3.18). The percent of SP visits on referral from the assigned PCP was lower than the chronic–condition cohort (2.9 vs. 4.6%). In contrast, SP visits on referral from another PCP and visits without referral from the assigned SP were higher than the chronic–condition cohort. These findings may be related to either the severity of illness or the long–term relationship with the assigned PCP which may have obviated the need for more frequent visits.

Table 3.18: Type of Visits by Manitoba Patients in the Ischemic Heart Disease Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Visit Type								
	Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
	With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
	%	%	%	%	%	%	%	%	%
South Eastman	57.41	16.93	0.38	0.95	8.68	2.22	0.73	6.87	2.55
Central	57.68	19.76	0.37	0.83	8.09	2.18	0.91	5.11	2.24
Assiniboine	62.15	21.44	0.08	0.36	4.92	1.67	0.42	3.99	2.19
Brandon	58.26	22.92	0.23	1.17	5.41	1.68	1.57	4.92	1.97
Winnipeg	51.57	13.47	1.71	2.78	12.62	2.18	4.07	6.19	3.29
Interlake	57.42	15.93	0.65	1.64	9.84	2.07	1.63	5.97	2.54
North Eastman	56.35	17.56	0.60	1.59	8.82	1.87	1.66	5.73	2.72
Parkland	64.44	18.20	0.07	0.25	3.16	1.40	0.16	6.28	2.18
Manitoba	54.63	15.59	1.17	2.06	10.37	2.05	2.87	5.93	2.91

Patients in the ischemic heart disease cohort made an average of 29.3 visits per person vs. 22.0 in the chronic–condition cohort (Tables 3.7 and 3.19). Patients in South Eastman had the lowest number of visits on average (24.4) and Brandon residents had the highest (32.6) (Table 3.19). The number of all visits in all RHAs is consistently higher in patients with this diagnosis. This is true both for PCP visits and SP visits.

Table 3.19: Three–Year Visit Rates by Manitoba Patients in the Ischemic Heart Disease Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
South Eastman	41,115	24.44	32,144	19.11	8,971	5.33
Central	69,212	24.97	55,929	20.18	13,283	4.79
Assiniboine	68,694	26.28	59,490	22.76	9,204	3.52
Brandon	51,703	32.64	43,454	27.43	8,249	5.21
Winnipeg	670,076	30.50	459,865	20.93	210,211	9.57
Interlake	72,302	27.73	55,455	21.27	16,847	6.46
North Eastman	38,455	27.97	30,000	21.82	8,455	6.15
Parkland	76,501	30.33	66,275	26.28	10,226	4.05
Manitoba	1,088,058	29.31	802,612	21.62	285,446	7.69

Congestive Heart Failure Cohort (n=8,258)

Eligibility: Patients with a diagnosis of heart failure or CHF in at least one hospital separation in three years OR a diagnosis of heart failure in at least three ambulatory visits in three years.

The percent of visits that were made to an assigned PCP in the CHF cohort was lower than the chronic–condition cohort (52.7 vs. 54.6%, Tables 3.6 and 3.20). The percent of visits to an SP on referral from the assigned PCP were also lower in the CHF cohort (2.9 vs. 4.6%). This may have been offset by the higher percent of visits to SPs on referral from another SP (3.4%) and the higher percent of visits to an assigned SP (10.5 vs. 7.1%).

Table 3.20: Type of Visits by Manitoba Patients in the Congestive Heart Failure Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Visit Type								
	Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
	With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
	%	%	%	%	%	%	%	%	%
South Eastman	57.97	16.89	0.27	2.26	8.40	3.08	0.81	5.36	2.76
Central	57.24	20.82	0.27	1.72	7.73	2.28	1.59	3.85	1.91
Assiniboine	61.63	23.54	0.08	0.47	5.03	1.65	0.24	3.12	1.92
Brandon	56.03	23.42	0.28	1.68	5.74	2.23	2.58	3.72	2.29
Winnipeg	48.10	14.35	1.89	4.03	13.29	2.58	4.08	5.08	4.22
Interlake	55.47	18.41	0.88	1.67	9.39	2.46	1.87	4.73	2.83
North Eastman	60.19	17.15	0.41	1.96	7.84	1.63	1.05	4.27	2.15
Parkland	64.75	18.23	0.20	0.90	3.48	1.68	0.30	5.28	1.78
Manitoba	52.72	16.70	1.25	2.94	10.52	2.38	2.88	4.76	3.37

The average number of visits per patient was higher (35.8 vs. 22.0 visits), as were visits to both types of providers—PCPs (26.4 vs. 17.2) and SPs (9.4 vs. 4.8) (Tables 3.7 and 3.21).

Table 3.21: Three–Year Visit Rates by Manitoba Patients in the Congestive Heart Failure Cohort by Regional Health Authority, 2007/08–2009/10

Regional Health Authority	Total Number of Visits	Average Number of Visits per Person	Number of Visits to Primary Care Physicians	Average Number of Visits to Primary Care Physicians per Person	Number of Visits to Specialists	Average Number of Visits to Specialists per Person
South Eastman	9,296	30.78	7,357	24.36	1,939	6.42
Central	23,515	29.92	19,275	24.52	4,240	5.39
Assiniboine	19,761	34.85	17,343	30.59	2,418	4.26
Brandon	13,964	40.48	11,544	33.46	2,420	7.01
Winnipeg	172,858	37.20	116,107	24.99	56,751	12.21
Interlake	21,687	34.10	16,745	26.33	4,942	7.77
North Eastman	11,850	31.77	9,726	26.08	2,124	5.69
Parkland	22,803	37.88	19,843	32.96	2,960	4.92
Manitoba	295,734	35.81	217,940	26.39	77,794	9.42

CHAPTER 4: CLUSTERS

The process of placing each Manitoba resident into a cluster was described in Chapter 2. This chapter describes the demographics and the visit types of the people allocated to each of the clusters.

Clusters for Patients in the Chronic–Condition Cohort

Table 2.6 shows the essential characteristics of each of the clusters, presented in the order developed by the analytic software. (Note: for the ease of the reader, there is a foldout of Tables 2.6 and 2.7 next to the back cover of this report.) The numbering of the clusters does not represent any characteristic of note and is not a reflection of a particular value judgement on the pattern of visits represented by that cluster.

The clusters vary in a number of different characteristics. Firstly, the assignment depends on whether the patient was assigned to a PCP or SP. In Clusters 2, 4–10, and 15, the patients were assigned to a PCP; patients in all other clusters (1, 3, and 11–14) were assigned to SPs. The number of visits made per year varied substantially with patients in Cluster 7 making the fewest visits (about three visits to their assigned PCP per year), and those in Cluster 8 making the most visits (about 33 per year). Each cluster was further divided by visits the patients make to doctors other than to their assigned PCP. These could be to other PCPs (Clusters 4, 5, 10, and 15) or to SPs (Cluster 9). Many of the clusters had very few patients assigned to them, with six clusters (4, 8, 12, 13, 14, and 15) having fewer than 500 patients (0.1% of the cohort) assigned to each (Table 4.2).

Table 4.1 presents the percent of the cluster that lived in Winnipeg (a range of 40.4% in Cluster 8 to 93.3% in Cluster 12), that were female (from 45.8% of Cluster 13 to 74.9% of Cluster 15), the cluster median age (45 to 79 years), the distribution across the three age groups, and the income quintile distribution for the clusters. The income quintiles were calculated for the Manitoba population. There were clear differences in income quintiles that stand out. First, the majority of those assigned to Cluster 14 had an unknown income quintile. This was because these were residents of personal care (nursing) homes. Cluster 4 had a disproportionally high level of people in the lowest income level (43.8% rather than the expected 20%) and very few people in the highest income quintile (3.6%).

Table 4.2 presents the key cluster characteristics. Cluster 7 included 60% (208,756 patients) of the chronic–condition cohort. These patients made on average 7.9 visits to their assigned PCP over the three–year period and 2.8 visits to another PCP. They made an average of only 0.9 visits to an SP without a referral where the assigned physician is a PCP, and just over one visit to an SP with a referral. Approximately half of these referrals came from the assigned PCP. These visits are presented graphically in Figure 4.1.

There were a few striking findings, but they are limited to a very small number of patients. The 312 patients in Cluster 8 made about 100 visits to their assigned PCP in the three years. While making relatively more SP visits than most other patients, the absolute number of SP visits was very low compared to the number of PCP visits. In contrast, the 313 patients in Cluster 12 averaged 129 visits each over the three years to their assigned SP. These patients also each made approximately 15 visits to a PCP. Ninety–three percent of patients in this cluster lived in Winnipeg; and on further review, they were all assigned to psychiatrists in our analyses indicating that this group of patients are living with mental illness and have ongoing care relationships with a psychiatrist.

Table 4.1: Demographics of Clusters of Manitoba Patients in the Chronic–Condition Cohort, 2007/08–2009/10

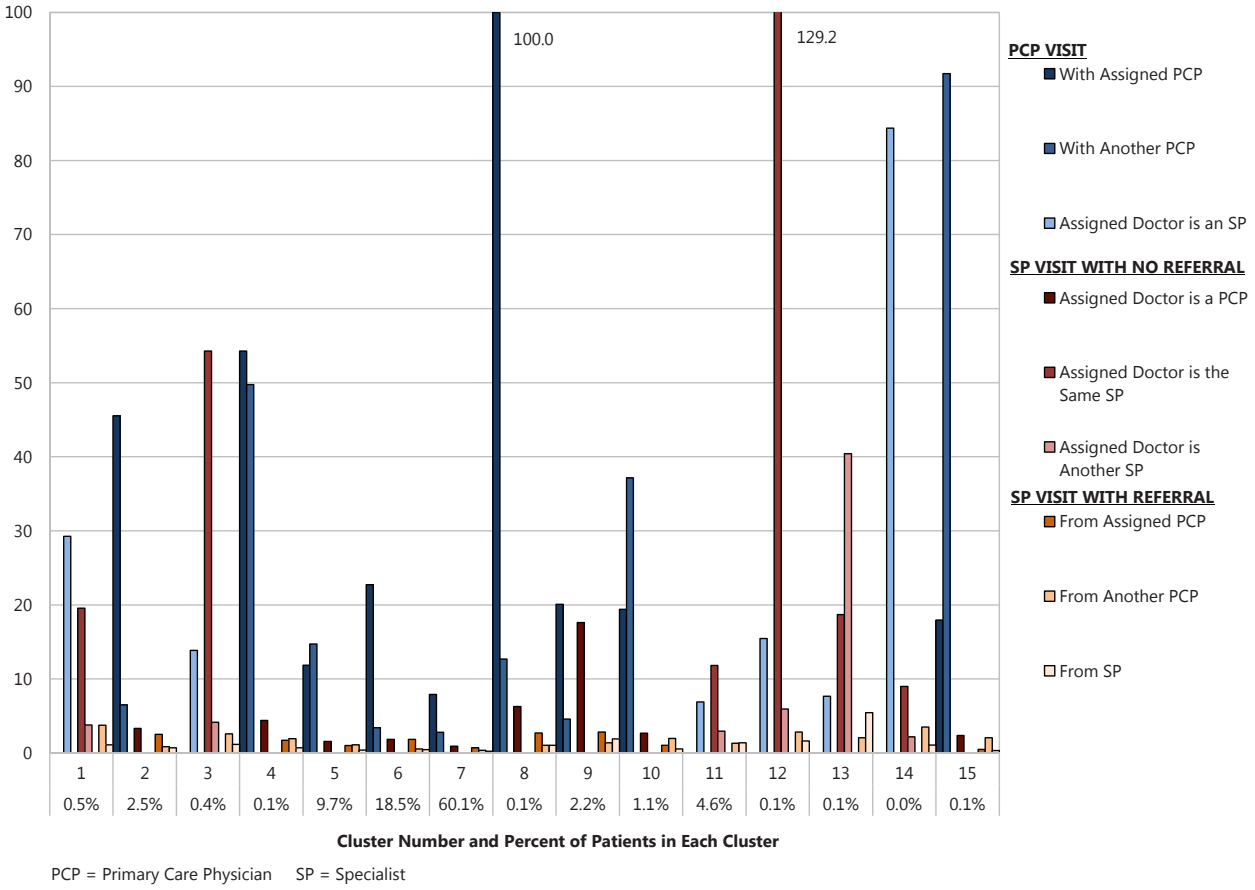
Cluster	Number of Patients in Cluster	Winnipeg (%)	Female (%)	Median Age (Years)	Age Group (Years)			Income Quintiles (%)					
					19-44	45-64	65+	Q1	Q2	Q3	Q4	Q5	Income Unknown*
1	1,856	79.47	66.38	54.0	27.16	43.97	28.88	22.31	15.52	17.89	13.85	13.63	16.81
2	8,719	59.11	60.59	60.0	19.93	40.14	39.92	30.89	19.96	19.47	15.24	10.10	4.34
3	1,387	89.19	60.49	48.0	38.86	50.83	10.31	19.68	18.17	18.39	16.94	22.86	3.97
4	443	49.89	64.79	45.0	47.18	38.83	14.00	43.79	18.51	21.90	7.22	3.61	4.97
5	33,553	54.02	66.95	52.0	36.97	35.86	27.17	25.93	19.89	19.91	15.93	12.79	5.56
6	64,240	63.12	59.35	61.0	17.15	43.63	39.22	20.66	20.08	20.26	19.64	15.30	4.06
7	208,756	60.32	54.00	51.0	35.14	43.29	21.57	17.14	19.83	20.43	20.12	18.90	3.57
8	312	40.38	66.35	56.5	22.12	45.51	32.37	29.17	19.55	24.04	12.82	11.86	2.56
9	7,766	82.95	56.17	64.0	11.96	42.65	45.39	19.39	17.18	19.03	19.12	20.19	5.09
10	3,707	57.57	69.17	51.0	39.63	28.68	31.70	39.06	15.19	16.29	10.36	7.01	12.09
11	15,943	81.51	50.35	55.0	29.36	42.28	28.36	18.92	17.51	18.44	18.79	21.62	4.72
12	313	93.29	67.73	47.0	42.49	53.35	4.15	14.38	11.82	21.09	19.49	29.07	4.15
13	262	83.97	45.80	51.5	32.06	46.18	21.76	20.99	19.47	20.23	15.65	18.70	4.96
14	146	87.67	73.97	79.0	9.59	17.12	73.29	19.86	4.79	6.16	7.53	5.48	56.16
15	203	66.50	74.88	62.0	37.93	15.27	46.80	35.47	15.27	14.29	4.93	7.39	22.66

* See Glossary definition of Income Quintiles

Table 4.2: Number of Visits per Manitoba Patient in the Chronic Condition Clusters by Visit Type, 2007/08–2009/10

Cluster	Number of Patients in Cluster	Percent of Patients in Chronic-Condition Cohort	Number of Visits by Visit Type								
			Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist Visit with Referral from		
			With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
1	1,856	0.53	0.00	0.00	29.25	0.00	19.55	3.78	0.00	3.75	1.11
2	8,719	2.51	45.53	6.49	0.00	3.33	0.00	0.00	2.52	0.85	0.70
3	1,387	0.40	0.00	0.00	13.87	0.00	54.27	4.16	0.00	2.59	1.18
4	443	0.13	54.26	49.75	0.00	4.39	0.00	0.00	1.73	1.94	0.70
5	33,553	9.65	11.87	14.73	0.00	1.58	0.00	0.00	1.01	1.11	0.38
6	64,240	18.48	22.73	3.43	0.00	1.85	0.00	0.00	1.83	0.54	0.45
7	208,756	60.06	7.90	2.81	0.07	0.92	0.03	0.02	0.72	0.36	0.25
8	312	0.09	99.99	12.70	0.00	6.27	0.00	0.00	2.72	1.03	1.05
9	7,766	2.23	20.09	4.58	0.00	17.62	0.00	0.00	2.83	1.37	1.89
10	3,707	1.07	19.40	37.15	0.00	2.69	0.00	0.00	1.05	1.97	0.54
11	15,943	4.59	0.00	0.00	6.91	0.00	11.82	2.95	0.00	1.33	1.38
12	313	0.09	0.00	0.00	15.47	0.00	129.15	5.93	0.00	2.83	1.62
13	262	0.08	0.00	0.00	7.65	0.00	18.68	40.41	0.00	2.07	5.46
14	146	0.04	0.00	0.00	84.36	0.00	8.98	2.20	0.00	3.51	1.06
15	203	0.06	17.96	91.74	0.00	2.36	0.00	0.00	0.49	2.06	0.34

Figure 4.1: Number of Visits per Manitoba Patient in the Chronic Condition Clusters by Visit Type, 2007/08–2009/10



PCP = Primary Care Physician SP = Specialist

Clusters for Patients in the No–Chronic–Condition Cohort

While the primary focus of this report is on Manitobans with a diagnosis of at least one of six chronic conditions, we also performed a cluster analysis on the visits of those in the no–chronic–condition cohort. It should be noted that at least some of these patients are likely to have been diagnosed with chronic conditions other than the six we included in our chronic–condition cohort.

This analysis resulted in 11 clusters (the characteristics of which were presented in Table 2.7). Over 35% of those in Cluster 3 lived in areas with the highest income quintile and over 90% of them lived in Winnipeg (Table 4.3). The high visit rate to assigned SPs that characterized cluster 3 was surprising; however, this cluster only included 62 people (Table 4.4). Almost 70% of the no–chronic–condition cohort (192,219 people) fell into Cluster 7 with an average of only one visit per year (Table 4.4). There were only two other clusters that included over 5% of the cohort, Cluster 2 (5.4%) and Cluster 11 (20.7%).

The cluster visit patterns presented in Table 4.4 are shown graphically in Figure 4.2.

Table 4.3: Demographics of Clusters of Manitoba Patients in the No–Chronic–Condition Cohort, 2007/08–2009/10

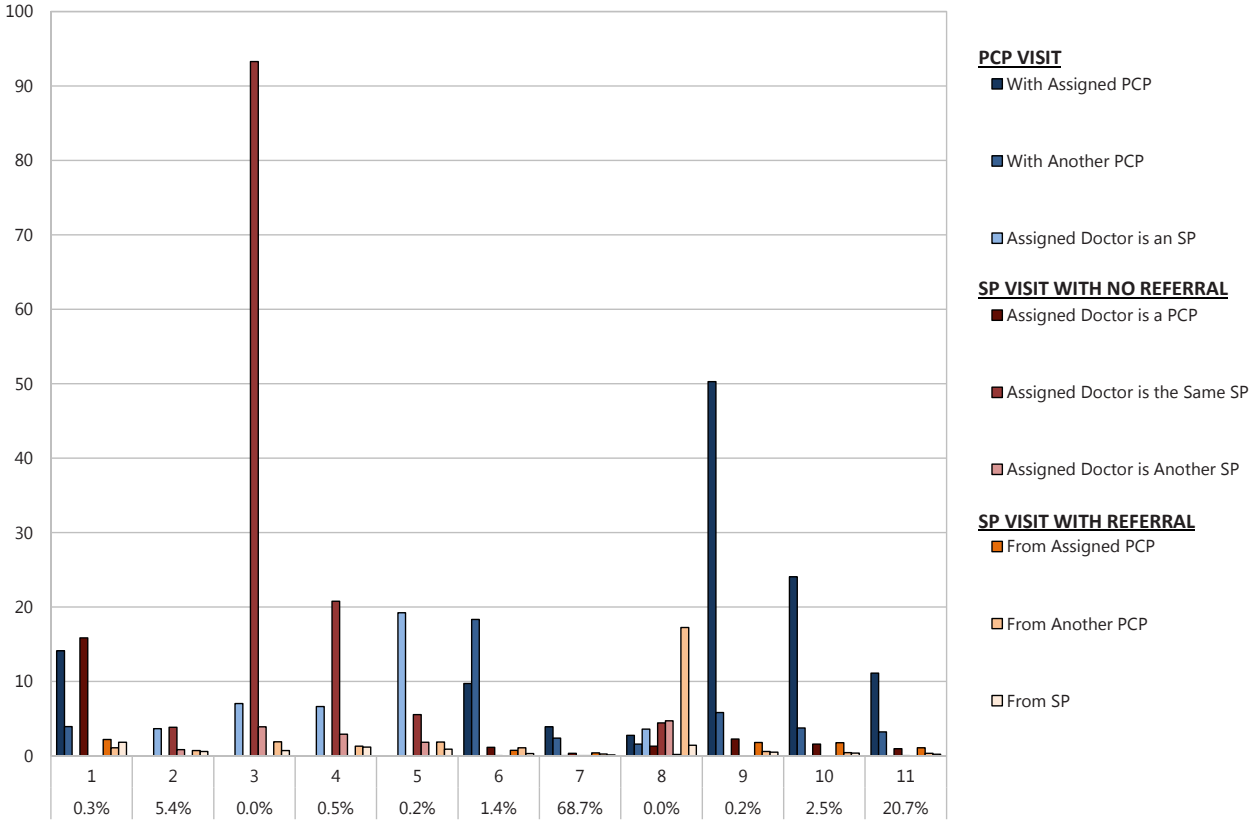
Cluster	Number of Patients in Cluster	Winnipeg (%)	Female (%)	Median Age (Years)	Age Group (Years)			Income Quintiles (%)					
					19-44	45-64	65+	Q1	Q2	Q3	Q4	Q5	Income Unknown*
1	747	80.59	59.97	59.0	20.62	44.71	34.67	13.25	14.46	18.34	21.02	28.11	4.82
2	15,207	75.08	52.98	44.0	51.46	36.99	11.55	15.11	17.09	17.58	20.68	25.70	3.83
3	62	91.94	51.61	44.0	56.45	40.32	3.23	19.35	17.74	14.52	8.06	35.48	4.84
4	1,322	84.12	45.31	47.0	43.65	41.23	15.13	20.20	15.66	16.57	18.91	22.62	6.05
5	641	74.42	63.18	47.0	46.18	32.45	21.37	17.32	14.35	19.03	15.29	20.12	13.88
6	4,038	51.34	70.11	39.0	60.77	27.27	11.96	25.61	18.52	21.22	15.70	13.62	5.32
7	192,219	59.93	52.91	40.0	61.52	33.38	5.10	14.86	18.13	20.06	20.66	22.63	3.65
8	89	75.28	43.82	47.0	42.70	43.82	13.48	14.61	21.35	12.36	23.60	16.85	11.24
9	486	65.43	52.06	51.0	31.48	45.47	23.05	25.51	20.37	18.72	19.34	11.11	4.94
10	7,076	61.86	61.02	51.0	34.38	43.87	21.75	20.59	17.78	20.90	18.81	17.78	4.14
11	57,967	62.44	64.00	47.0	44.04	43.19	12.77	14.43	17.43	20.01	21.57	22.61	3.95

* See Glossary definition of Income Quintiles

Table 4.4: Number of Visits per Manitoba Patient in the No Chronic Condition Clusters by Visit Type, 2007/08–2009/10

Cluster	Number of Patients in Cluster	Percent of Patients in No-Chronic-Condition Cohort	Number of Visits by Visit Type								
			Primary Care Physician (PCP) Visit			Specialist (SP) Visit with No Referral			Specialist (SP) Visit with Referral from		
			With Assigned PCP	With Another PCP	Assigned Doctor is SP	Assigned Doctor is PCP	Assigned Doctor is Same SP	Assigned Doctor is Another SP	Assigned PCP	Another PCP	SP, Assigned Doctor is PCP
1	747	0.27	14.13	3.93	0.00	15.86	0.00	0.00	2.21	1.10	1.83
2	15,207	5.43	0.00	0.00	3.64	0.00	3.84	0.84	0.00	0.71	0.58
3	62	0.02	0.00	0.00	7.03	0.00	93.27	3.90	0.00	1.90	0.71
4	1,322	0.47	0.00	0.00	6.62	0.00	20.77	2.92	0.00	1.29	1.18
5	641	0.23	0.00	0.00	19.24	0.00	5.53	1.84	0.00	1.86	0.90
6	4,038	1.44	9.74	18.33	0.00	1.15	0.00	0.00	0.73	1.09	0.31
7	192,219	68.69	3.91	2.37	0.00	0.36	0.00	0.00	0.40	0.25	0.12
8	89	0.03	2.76	1.60	3.60	1.30	4.42	4.71	0.18	17.25	1.44
9	486	0.17	50.29	5.83	0.00	2.25	0.00	0.00	1.79	0.58	0.51
10	7,076	2.53	24.07	3.76	0.00	1.58	0.00	0.00	1.75	0.45	0.37
11	57,967	20.71	11.12	3.21	0.00	0.97	0.00	0.00	1.07	0.33	0.22

Figure 4.2: Number of Visits per Manitoba Patient in the No Chronic Condition Clusters by Visit Type, 2007/08–2009/10



PCP = Primary Care Physician SP = Specialist

CHAPTER 5: QUALITY OF CARE

The quality of care indicators used in this study were all developed in previous MCHP studies (Katz et al., 2010; Katz et al., 2004; Martens et al., 2010). They include both preventative care process indicators for some of the chronic conditions and health outcome indicators where available. This chapter describes the indicator results by cluster. When analysing the results by cluster for those with a chronic condition, it was determined that Clusters 14 and 15 were largely composed of people living in personal care homes. We excluded these two clusters from all the quality of care analyses as the focus of the study was on ambulatory care visits provided to community dwelling adults. We also excluded personal care home residents from the other clusters for the quality of care analyses.

For some of the conditions, the indicators are calculated for only a subset of the patients included in the diagnostic group. For example, our definition of patients with mood disorders includes patients with both anxiety and **depression**. The process indicator used only applies to those diagnosed with depression, so the indicator was applied to only this subset of the mood disorder patients.

The results in this chapter refer to the association between the clusters, other relevant variables, and the process indicators and outcomes. To simplify the interpretation of the results we have also presented analyses based on cluster groups. We categorized the clusters into three groups: clusters 2, 6, 7, 8, and 9 where the care is predominantly provided by PCPs; clusters 1, 3, 11, and 12 where care is provided predominantly by SPs; and a mixed care group including clusters 4, 5, and 10. This allows us to compare the quality of care provided by physician type without the frequency of visits.

Hypertension

We have included four quality indictors relevant to patients diagnosed with hypertension. The provision of influenza vaccination is a process indicator reflecting preventative care recommended for hypertensive patients. The other three indicators (**myocardial infarction**, stroke and renal failure) are negative consequences of poorly controlled hypertension.

Process Indicator

Influenza vaccination definition: Hypertensive patients with annual vaccinations over three years (2007/08–2009/10).

Of the 188,602 patients included with a diagnosis of hypertension, only 15% meet the requirement of having annual influenza vaccination during the study period. Only 40.8% have had at least one influenza vaccination over the three years (Table 5.1).

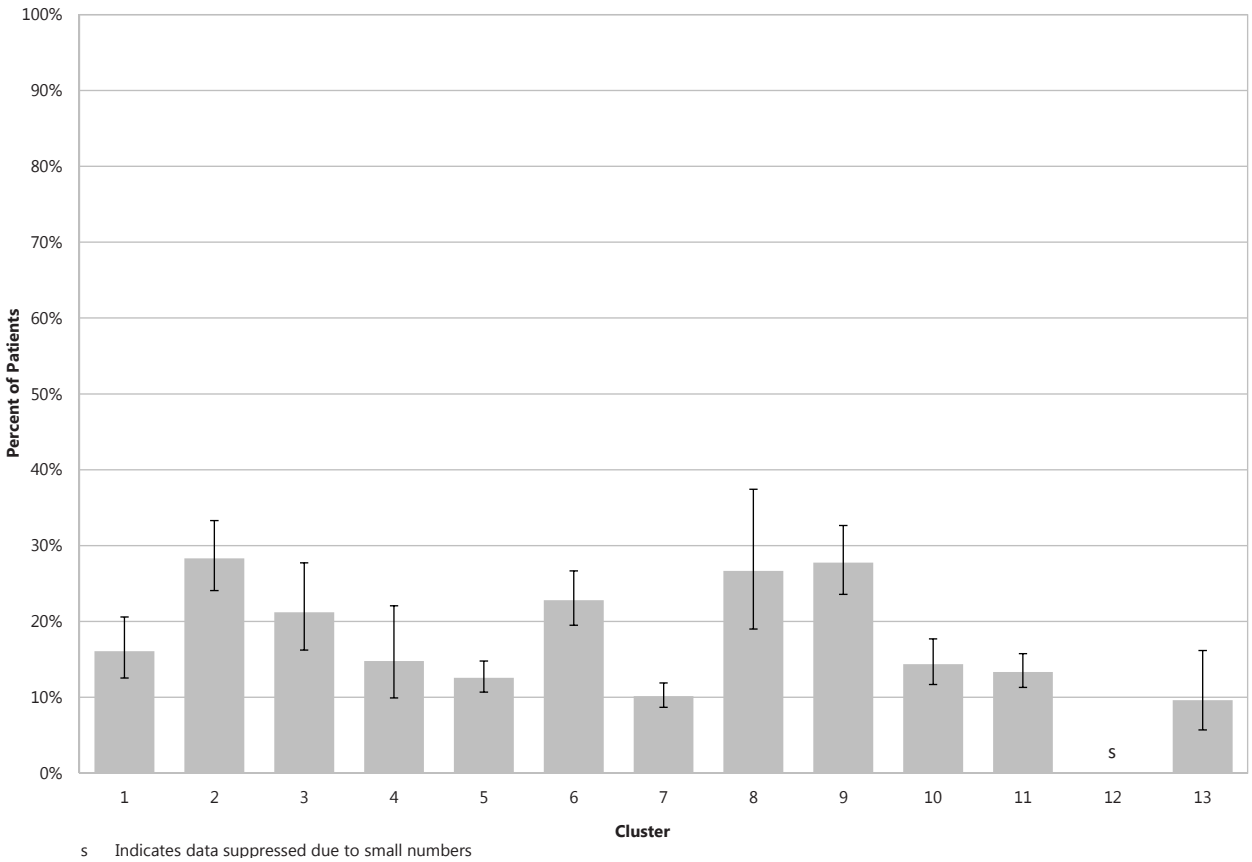
Table 5.1: Quality of Care for Manitoba Patients with Hypertension, 2007/08–2009/10

Influenza Vaccination	Number of Patients	Percent of Patients
0	110,027	59.23
1–2	47,986	25.83
3+	27,747	14.94

The age– and sex–adjusted rates of having three annual influenza vaccinations by cluster are presented in Figure 5.1. While it is clear that the rates for some clusters (2, 6, 8, and 9) are higher than others, it is important to look at the **confidence intervals** included in the figure. Where the confidence intervals overlap, the rates are not statistically different. For example, the rates for Clusters 1 and 2 are different from each other while those for Clusters 2 and 3 are not.

Figure 5.1: Quality of Care for Manitoba Patients with Hypertension by Cluster, 2007/08–2009/10

Age– & sex–adjusted rates for three influenza vaccinations over three years



s Indicates data suppressed due to small numbers

Health Outcomes

Stroke definition: Hypertensive patients who have not had a diagnosis of stroke in a hospital separation in three years (2007/08–2009/10) AND who have had a diagnosis of stroke in at least one hospital separation in the following year (2010/11).

Myocardial infarction definition: Hypertensive patients who have not had a diagnosis of myocardial infarction in a hospital separation in three years (2007/08–2009/10) AND who have had a diagnosis of myocardial infarction in at least one hospital separation in the following year (2010/11).

Renal failure definition: Hypertensive patients who have not had a diagnosis of renal failure or dependence on renal dialysis in a hospital separation in three years (2007/08–2009/10) AND who have had a diagnosis of renal failure or dependence on renal dialysis in a hospital separation in the following year (2010/11).

The health outcomes associated with hypertension presented in Tables 5.2 and 5.3 are negative consequences of having poorly controlled hypertension. They are rare events affecting less than 6% of patients with hypertension. The most common is renal failure (4,025 individuals).

Table 5.2: Health Outcomes for Manitoba Patients with Hypertension, 2010/11

Stroke	Renal Failure	Myocardial Infarction	Number of Patients	Percent of Patients
Yes	**Yes**	**Yes**	19	0.01
Yes	**Yes**		237	0.14
Yes		**Yes**	61	0.04
Yes			3,596	2.13
	Yes	**Yes**	125	0.07
	Yes		3,644	2.16
		Yes	934	0.55
			160,144	94.90

Table 5.3: Adjusted Rates of Health Outcomes per 1,000 Manitoba Patients with Hypertension by Cluster, 2010/11

Cluster	Stroke	Renal Failure	Myocardial Infarction
1	30.15	31.28	s
2	34.12	42.44	11.51
3	35.66	25.31	s
4	56.93	s	s
5	26.88	24.79	8.13
6	27.09	28.34	7.84
7	19.33	18.40	5.88
8	s	48.84	s
9	32.77	49.31	8.52
10	32.06	44.37	6.36
11	22.71	32.82	4.76
12	s	s	*
13	s	112.35	s

* Indicates no outcome in this cluster

s Indicates data suppressed due to small numbers

Because of the rarity of many of the events, many of the rates are suppressed (see Glossary term **suppression**) in Table 5.3. The rates presented in Table 5.3 should be interpreted with caution as they are influenced by many other factors. For example, the presence of hypertension is just one of many risk factors that contribute to a myocardial infarction. Others, such as having high cholesterol or diabetes, may be more important than the presence of hypertension. To address this, we used logistic regression models to better understand the impact of the patterns of care, as reflected by the clusters, on the outcomes of interest.

Quality of Care Models

In order to determine the impact of various factors on the health outcome indicators, we developed a set of logistic regression models. These models tell us if the variable presented in the left column in Table 5.4 is an independent predictor of the outcome–in this case influenza vaccination after controlling for the effects of the other variables in the model. The bolded results in the middle column are statistically significant ($p<0.05$). The 95% confidence limits are presented in parentheses. Where one of these two numbers is less than 1 and the other greater than 1, the result is not statistically significant. If the odds ratio is greater than 1, then the variable in the left hand column is positively associated with the outcome; and if it is below 1, it is negatively associated with the outcome. So in Table 5.4, patients with TRM are more likely to have received annual influenza vaccination; while those with mood disorders are less likely to have received the vaccination. It is worth noting that the income quintiles are calculated separately for Winnipeg and Brandon (urban) and the rest of Manitoba (rural) which is different to previous analyses where Brandon was included with Rural Manitoba (Winnipeg vs. non–Winnipeg). For the income quintiles and clusters, we used urban income quintile 5 and Cluster 6 as our references for comparison. Cluster 6 was chosen as our reference cluster as this cluster represents the pattern of care which could be theorised as the ideal pattern of care. While there is little evidence in the literature to support any particular pattern of care, Cluster 6 is PCP based with little SP care needed. Cluster 6 differs from Cluster 7 in the number of visits provided. The choice of Cluster 6 as the normative cluster is based on the recognition that patients with chronic conditions require regular monitoring of those conditions and are generally older than those without these conditions. Previous research at MCHP has established an average of over three visits per year for all Manitobans (Fransoo et al., 2009). It is logical to presume that those with chronic conditions would require more care than the average.

Patients with TRM, diabetes, or IHD were more likely to have received three influenza vaccinations. Rural residents, people in the lowest urban income quintile and those in Clusters 1, 5, 7, and 10 to 13 are less likely to receive vaccinations. Those in Clusters 2 and 8 are more likely to receive three influenza vaccinations during the study period than those in Cluster 6.

Table 5.4: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Hypertension by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.063 (1.062, 1.065)**	**<.0001**
Comorbidity		
Total Respiratory Morbidity	**1.249 (1.211, 1.288)**	**<.0001**
Mood Disorders	**0.827 (0.787, 0.869)**	**<.0001**
Diabetes Mellitus	**1.438 (1.394, 1.483)**	**<.0001**
Ischemic Heart Disease	**1.194 (1.154, 1.235)**	**<.0001**
Congestive Heart Failure	**0.689 (0.647, 0.735)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.139 (0.126, 0.154)**	**<.0001**
R2	**0.198 (0.182, 0.215)**	**<.0001**
R3	**0.224 (0.207, 0.242)**	**<.0001**
R4	**0.434 (0.405, 0.465)**	**<.0001**
R5	**0.455 (0.421, 0.493)**	**<.0001**
Urban 1 (U1)	**0.815 (0.773, 0.858)**	**<.0001**
U2	0.986 (0.936, 1.039)	0.5972
U3	0.989 (0.939, 1.041)	0.6768
U4	1.032 (0.979, 1.088)	0.2411
Cluster (ref = Cluster 6)		
1	**0.685 (0.549, 0.855)**	**0.0008**
2	**1.569 (1.468, 1.676)**	**<.0001**
3	0.880 (0.680, 1.138)	0.3285
4	0.941 (0.616, 1.437)	0.7769
5	**0.528 (0.501, 0.558)**	**<.0001**
7	**0.410 (0.396, 0.423)**	**<.0001**
8	**1.810 (1.247, 2.626)**	**0.0018**
9	1.021 (0.956, 1.089)	0.5363
10	**0.745 (0.635, 0.875)**	**0.0003**
11	**0.421 (0.392, 0.451)**	**<.0001**
12	**0.300 (0.108, 0.831)**	**0.0206**
13	**0.371 (0.218, 0.630)**	**0.0002**

* Values in **bold** typeface are statistically significant at $p<0.05$

Table 5.4A shows that the provision of influenza vaccination to hypertensive patients is considerably better for patients in the PCP cluster group. This analysis also results in the impact of mood disorder comorbidity changing from being associated with decreased likelihood of immunization to an increased likelihood of immunization. Because the regression models present the relationship between each indicator and the outcome it is not surprising that the change in the indicators included results in small changes in the adjusted odds ratios in the models presented in 5.4 and 5.4A.

Table 5.4A: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Hypertension by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.066 (1.065, 1.068)**	**<.0001**
Comorbidity		
Total Respiratory Morbidity	**1.474 (1.431, 1.519)**	**<.0001**
Mood Disorders	**1.125 (1.073, 1.180)**	**<.0001**
Diabetes Mellitus	**1.618 (1.570, 1.668)**	**<.0001**
Ischemic Heart Disease	**1.318 (1.275, 1.363)**	**<.0001**
Congestive Heart Failure	**0.799 (0.751, 0.851)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.142 (0.129, 0.157)**	**<.0001**
R2	**0.194 (0.179, 0.211)**	**<.0001**
R3	**0.224 (0.207, 0.242)**	**<.0001**
R4	**0.440 (0.411, 0.471)**	**<.0001**
R5	**0.448 (0.415, 0.485)**	**<.0001**
Urban 1 (U1)	**0.860 (0.817, 0.906)**	**<.0001**
U2	1.019 (0.968, 1.072)	0.4790
U3	1.019 (0.968, 1.072)	0.4747
U4	1.051 (0.998, 1.107)	0.0610
Cluster Group* (ref = PCP Group)		
SP	**0.687 (0.645, 0.731)**	**<.0001**
Mixed	**0.809 (0.770, 0.850)**	**<.0001**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

Tables 5.5 to 5.7 present the results of the analyses for stroke, renal failure, and myocardial infarction. For strokes, being diagnosed with any of the other five conditions increases the likelihood, as does living in the poorest and third urban quintiles. Patients in Clusters 2, 3, and 4 are more likely to have strokes than Cluster 6; Cluster 7 is less likely to have a stroke.

Table 5.5: Factors Associated with Stroke in Manitoba Patients with Hypertension by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	1.055 (1.052, 1.058)	<.0001
Comorbidity		
Total Respiratory Morbidity	**1.094 (1.018, 1.176)**	**0.0147**
Mood Disorders	**1.269 (1.137, 1.417)**	**<.0001**
Diabetes Mellitus	**1.366 (1.272, 1.467)**	**<.0001**
Ischemic Heart Disease	**1.400 (1.298, 1.510)**	**<.0001**
Congestive Heart Failure	**1.244 (1.088, 1.421)**	**0.0014**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	1.089 (0.924, 1.284)	0.3074
R2	1.003 (0.856, 1.175)	0.9733
R3	1.041 (0.891, 1.216)	0.6108
R4	0.924 (0.781, 1.093)	0.3577
R5	1.059 (0.883, 1.270)	0.5342
Urban 1 (U1)	**1.281 (1.120, 1.464)**	**0.0003**
U2	1.140 (0.992, 1.311)	0.0655
U3	**1.155 (1.006, 1.326)**	**0.0405**
U4	1.010 (0.872, 1.170)	0.8923
Cluster (ref = Cluster 6)		
1	1.125 (0.687, 1.841)	0.6402
2	**1.178 (1.002, 1.385)**	**0.0476**
3	**1.346 (0.749, 2.418)**	**0.3204**
4	**2.243 (1.120, 4.492)**	**0.0226**
5	1.052 (0.935, 1.184)	0.3982
7	**0.833 (0.770, 0.901)**	**<.0001**
8	1.153 (0.421, 3.157)	0.7824
9	1.110 (0.939, 1.311)	0.2213
10	1.222 (0.870, 1.715)	0.2472
11	0.872 (0.741, 1.027)	0.1006
12	0.909 (0.125, 6.608)	0.9248
13	1.053 (0.254, 4.362)	0.9428

* Values in **bold** typeface are statistically significant at p<0.05

Patients in the mixed care cluster group do worse on the stroke prevention indicator than the PCP care cluster group (Table 5.5A).

Table 5.5A: Factors Associated with Stroke in Manitoba Patients with Hypertension by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.056 (1.053, 1.058)**	**<.0001**
Comorbidity		
Total Respiratory Morbidity	**1.141 (1.063, 1.225)**	**0.0003**
Mood Disorders	**1.385 (1.245, 1.540)**	**<.0001**
Diabetes Mellitus	**1.404 (1.308, 1.507)**	**<.0001**
Ischemic Heart Disease	**1.435 (1.331, 1.548)**	**<.0001**
Congestive Heart Failure	**1.294 (1.133, 1.478)**	**0.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	1.081 (0.918, 1.274)	0.3503
R2	0.984 (0.840, 1.153)	0.8463
R3	1.027 (0.880, 1.200)	0.7321
R4	0.917 (0.776, 1.085)	0.3150
R5	1.048 (0.874, 1.256)	0.6146
Urban 1 (U1)	**1.293 (1.132, 1.478)**	**0.0002**
U2	1.142 (0.993, 1.313)	0.0623
U3	**1.161 (1.012, 1.333)**	**0.0333**
U4	1.012 (0.874, 1.172)	0.8689
Cluster Group* (ref = PCP Group)		
SP	0.985 (0.852, 1.139)	0.8370
Mixed	**1.162 (1.048, 1.288)**	**0.0044**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

Renal failure was more likely to occur in hypertensive patients with the other comorbidities except mood disorders, those living in the poorest rural and urban income quintiles, and Clusters 2, 9, 10, 11, and 13. Renal failure was less likely to occur in those in Cluster 7 (Table 5.6).

Table 5.6: Factors Associated with Renal Failure in Manitoba Patients with Hypertension by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.039 (1.036, 1.042)**	**<.0001**
Comorbidity		
Total Respiratory Morbidity	**1.079 (1.005, 1.159)**	**0.0354**
Mood Disorders	0.923 (0.821, 1.038)	0.1796
Diabetes Mellitus	**1.927 (1.804, 2.060)**	**<.0001**
Ischemic Heart Disease	**1.119 (1.034, 1.210)**	**0.0050**
Congestive Heart Failure	**2.466 (2.206, 2.756)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**1.359 (1.169, 1.580)**	**<.0001**
R2	1.011 (0.865, 1.181)	0.8931
R3	1.046 (0.898, 1.217)	0.5637
R4	1.116 (0.955, 1.304)	0.1666
R5	0.901 (0.749, 1.083)	0.2664
Urban 1 (U1)	**1.226 (1.076, 1.397)**	**0.0022**
U2	1.010 (0.880, 1.160)	0.8836
U3	0.994 (0.866, 1.140)	0.9274
U4	0.998 (0.867, 1.150)	0.9828
Cluster (ref = Cluster 6)		
1	1.209 (0.748, 1.955)	0.4380
2	**1.358 (1.168, 1.579)**	**<.0001**
3	1.036 (0.530, 2.026)	0.9179
4	0.858 (0.313, 2.351)	0.7653
5	0.906 (0.802, 1.023)	0.1097
7	**0.739 (0.683, 0.800)**	**<.0001**
8	1.598 (0.692, 3.689)	0.2726
9	**1.602 (1.387, 1.852)**	**<.0001**
10	**1.587 (1.182, 2.130)**	**0.0021**
11	**1.272 (1.105, 1.463)**	**0.0008**
12	0.955 (0.131, 6.941)	0.9639
13	**4.236 (1.884, 9.526)**	**0.0005**

* Values in **bold** typeface are statistically significant at p<0.05

Table 5.6A indicates that patients in the SP care cluster group have the highest **odds** of being diagnosed with renal failure.

Table 5.6A: Factors Associated with Renal Failure in Manitoba Patients with Hypertension by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.041 (1.038, 1.043)**	**<.0001**
Comorbidity		
Total Respiratory Morbidity	**1.163 (1.084, 1.247)**	**<.0001**
Mood Disorders	1.068 (0.953, 1.197)	0.2552
Diabetes Mellitus	**2.041 (1.911, 2.179)**	**<.0001**
Ischemic Heart Disease	**1.184 (1.095, 1.280)**	**<.0001**
Congestive Heart Failure	**2.650 (2.372, 2.959)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**1.319 (1.135, 1.533)**	**0.0003**
R2	0.961 (0.823, 1.122)	0.6159
R3	1.006 (0.864, 1.170)	0.9398
R4	1.090 (0.934, 1.273)	0.2749
R5	0.873 (0.726, 1.050)	0.1495
Urban 1 (U1)	**1.246 (1.093, 1.419)**	**0.0010**
U2	1.021 (0.889, 1.172)	0.7671
U3	1.005 (0.876, 1.153)	0.9439
U4	1.004 (0.871, 1.156)	0.9595
Cluster Group* (ref = PCP Group)		
SP	**1.395 (1.229, 1.582)**	**<.0001**
Mixed	1.056 (0.950, 1.174)	0.3134

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

Myocardial infarction was more likely to occur in hypertensive patients with TRM, diabetes, or IHD. It was also associated with being from any of the rural income quintiles and urban quintiles 1 and 2. Those in Cluster 11 were less likely to experience this outcome than those in Cluster 6 (Table 5.7).

Table 5.7: Factors Associated with Myocardial Infarction in Manitoba Patients with Hypertension by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.033 (1.028, 1.038)**	**<.0001**
Comorbidity		
Total Respiratory Morbidity	**1.161 (1.018, 1.323)**	**0.0257**
Mood Disorders	0.908 (0.723, 1.141)	0.4093
Diabetes Mellitus	**1.469 (1.295, 1.666)**	**<.0001**
Ischemic Heart Disease	**2.098 (1.842, 2.390)**	**<.0001**
Congestive Heart Failure	1.094 (0.850, 1.407)	0.4872
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**1.887 (1.425, 2.499)**	**<.0001**
R2	**1.510 (1.137, 2.004)**	**0.0044**
R3	**1.550 (1.174, 2.047)**	**0.0020**
R4	**1.520 (1.138, 2.029)**	**0.0046**
R5	**1.461 (1.064, 2.008)**	**0.0192**
Urban 1 (U1)	**1.385 (1.066, 1.799)**	**0.0148**
U2	**1.339 (1.026, 1.748)**	**0.0318**
U3	1.053 (0.798, 1.389)	0.7136
U4	0.976 (0.731, 1.302)	0.8665
Cluster (ref = Cluster 6)		
1	0.793 (0.252, 2.493)	0.6920
2	1.300 (0.977, 1.730)	0.0721
3	0.907 (0.224, 3.680)	0.8918
4	0.819 (0.113, 5.925)	0.8432
5	1.058 (0.852, 1.315)	0.6084
7	0.896 (0.776, 1.036)	0.1375
8	3.088 (0.964, 9.890)	0.0576
9	1.050 (0.758, 1.456)	0.7681
10	0.769 (0.361, 1.638)	0.4956
11	**0.700 (0.494, 0.991)**	**0.0443**
12	**	**
13	2.054 (0.281, 15.030)	0.4784

* Values in **bold** typeface are statistically significant at p<0.05

** Indicates no outcome in this cluster

There is no difference between cluster groups in the likelihood of patients with hypertension having a myocardial infarction (Table 5.7A)

Table 5.7A: Factors Associated with Myocardial Infarction in Manitoba Patients with Hypertension by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.033 (1.028, 1.038)**	**<.0001**
Comorbidity		
Total Respiratory Morbidity	**1.201 (1.056, 1.365)**	**0.0052**
Mood Disorders	0.957 (0.766, 1.196)	0.6984
Diabetes Mellitus	**1.496 (1.320, 1.696)**	**<.0001**
Ischemic Heart Disease	**2.142 (1.882, 2.437)**	**<.0001**
Congestive Heart Failure	1.131 (0.880, 1.454)	0.3365
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**1.888 (1.427, 2.498)**	**<.0001**
R2	**1.496 (1.128, 1.985)**	**0.0052**
R3	**1.542 (1.169, 2.035)**	**0.0022**
R4	**1.518 (1.138, 2.026)**	**0.0046**
R5	**1.459 (1.063, 2.005)**	**0.0195**
Urban 1 (U1)	**1.390 (1.070, 1.806)**	**0.0137**
U2	**1.346 (1.031, 1.757)**	**0.0288**
U3	1.059 (0.803, 1.397)	0.6856
U4	0.978 (0.733, 1.306)	0.8821
Cluster Group* (ref = PCP Group)		
SP	0.741 (0.540, 1.016)	0.0625
Mixed	1.071 (0.883, 1.298)	0.4855

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

Total Respiratory Morbidity

Process Indicators

The indicators for TRM are both process indicators, which reflect the care provided to these patients.

Influenza vaccination definition: TRM patients with annual influenza vaccination over three years (2007/08–2009/10).

Asthma drug prescription definition: Patients in the chronic–condition cohort with at least two prescriptions of beta 2–adrenoreceptor agonists (reliever drug) in three years (2007/08–2009/10) AND at least one prescription of inhaled corticosteroid or leukotriene antagonists (preventer drugs) in three years (2007/08–2009/10).

The provision of influenza vaccination is indicated for all TRM patients, however only 8.9% received the expected three vaccinations (Table 5.8).

Table 5.8: Quality of Care for Manitoba Patients with Total Respiratory Morbidity, 2007/08–2009/10

Influenza Vaccination	Number of Patients	Percent of Patients
0	111,001	70.92
1–2	31,661	20.23
3+	13,856	8.85

In addition, patients diagnosed with **asthma** were also analysed to determine if they meet the asthma drug prescription standard (Table 5.9). The standard is based on the fact that people using "rescue" medications to overcome asthma attacks should be also on long–term "controller" medications to prevent these attacks.

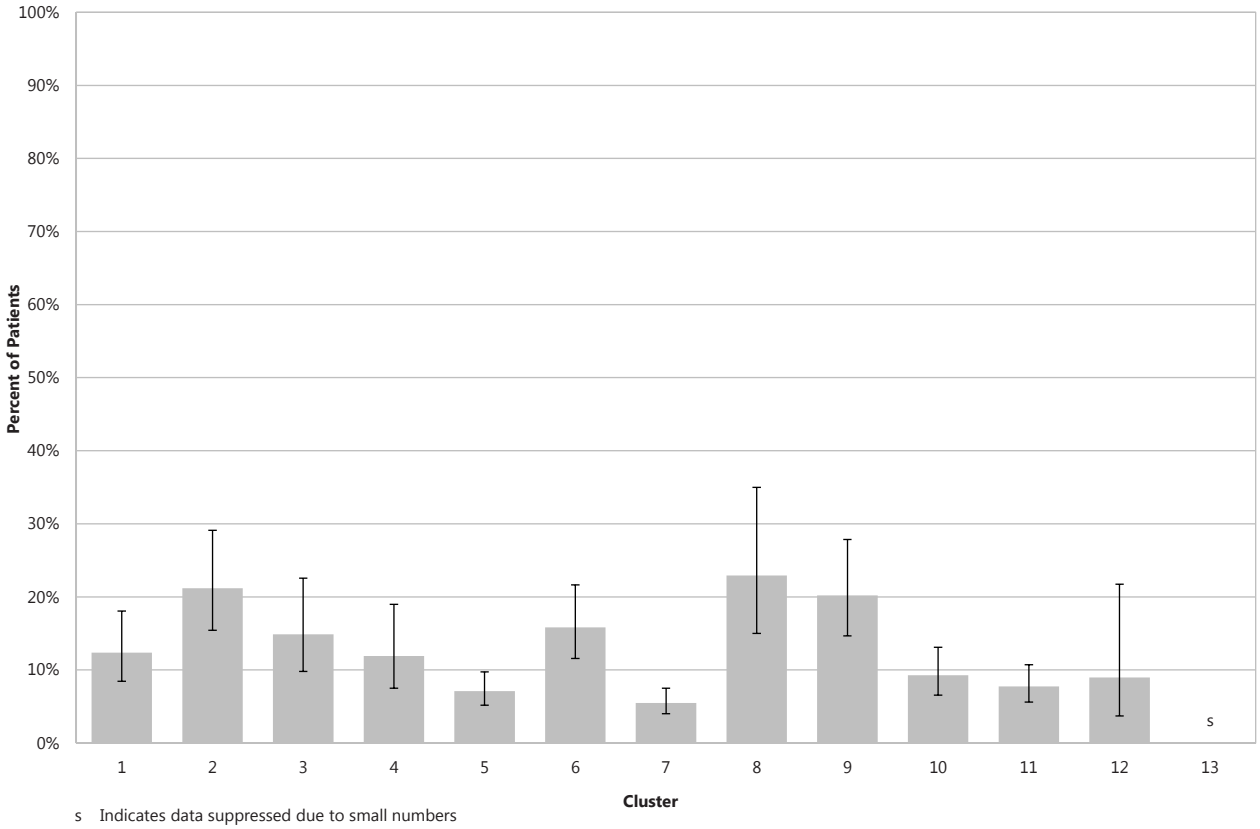
Table 5.9: Quality of Care for Manitoba Patients with Asthma, 2007/08–2009/10

Asthma Drug Prescription	Number of Patients	Percent of Patients
Yes	29,268	67.11
No	14,345	32.89

Figures 5.2 and 5.3 present these results by cluster. All of the clusters had very similar rates of optimal asthma drug prescribing. No clusters stood out as having acceptable influenza vaccination rates.

Figure 5.2: Quality of Care for Manitoba Patients with Total Respiratory Morbidity by Cluster, 2007/08–2009/10

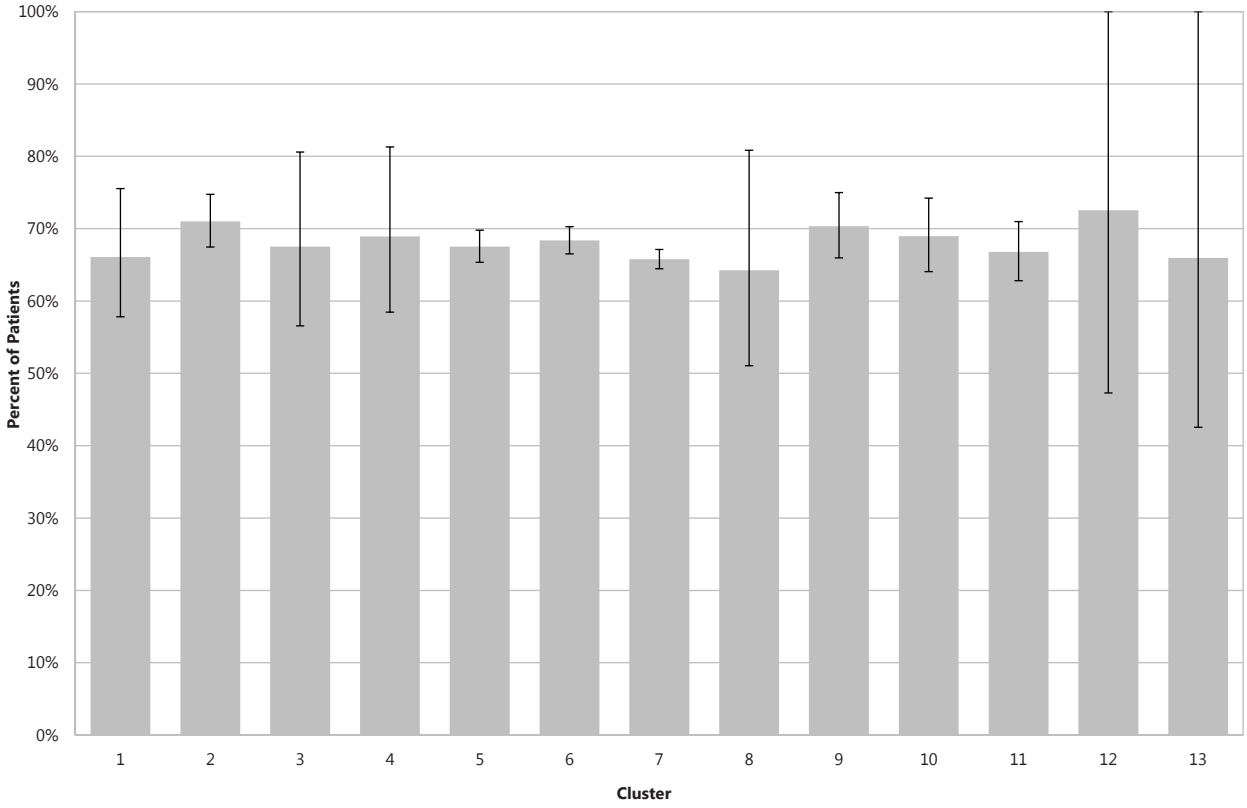
Age– & sex–adjusted rates for three influenza vaccinations over three years



s Indicates data suppressed due to small numbers

Figure 5.3: Quality of Care for Manitoba Patients with Asthma by Cluster, 2007/08–2009/10

Age– & sex–adjusted rates for asthma drug prescription



Quality of Care Models

The modelling of select outcomes helps us understand the impact of each of the variables on the outcome when controlling for the other variables included in the model. Having hypertension, diabetes, or IHD was associated with increased likelihood of immunization; while having CHF and mood disorders was associated with decreased odds of vaccination (Table 5.10). Rural residents and patients in the lowest urban income quintile had lower odds in all the SES quintiles while Clusters 2 and 8 were associated with higher odds of immunization after controlling for other factors. Of note is the number of patterns of care that were associated with lower rates of immunization, including Cluster 7 which contains 60% of the population.

Table 5.10: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Total Respiratory Morbidity by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.069 (1.067, 1.070)**	**<.0001**
Comorbidity		
Hypertension	**1.271 (1.213, 1.333)**	**<.0001**
Mood Disorders	**0.907 (0.856, 0.961)**	**0.0009**
Diabetes Mellitus	**1.358 (1.292, 1.427)**	**<.0001**
Ischemic Heart Disease	**1.102 (1.041, 1.167)**	**0.0009**
Congestive Heart Failure	**0.636 (0.580, 0.699)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.159 (0.138, 0.183)**	**<.0001**
R2	**0.243 (0.216, 0.273)**	**<.0001**
R3	**0.237 (0.210, 0.266)**	**<.0001**
R4	**0.492 (0.445, 0.544)**	**<.0001**
R5	**0.603 (0.542, 0.671)**	**<.0001**
Urban 1 (U1)	**0.859 (0.799, 0.924)**	**<.0001**
U2	0.971 (0.903, 1.045)	0.4332
U3	0.947 (0.880, 1.020)	0.1492
U4	1.008 (0.935, 1.087)	0.8392
Cluster (ref = Cluster 6)		
1	0.808 (0.634, 1.030)	0.0847
2	**1.763 (1.629, 1.908)**	**<.0001**
3	0.948 (0.699, 1.286)	0.7315
4	1.190 (0.818, 1.732)	0.3630
5	**0.497 (0.464, 0.533)**	**<.0001**
7	**0.353 (0.336, 0.371)**	**<.0001**
8	**2.525 (1.765, 3.610)**	**<.0001**
9	1.026 (0.936, 1.125)	0.5870
10	**0.789 (0.671, 0.929)**	**0.0044**
11	**0.390 (0.348, 0.436)**	**<.0001**
12	0.561 (0.240, 1.311)	0.1818
13	**0.209 (0.063, 0.693)**	**0.0105**

* Values in **bold** typeface are statistically significant at $p<0.05$

In Table 5.10A, there are two changes to the likelihood of having an influenza vaccination as compared to Table 5.10. The association with mood disorders changes from being negative (less likely to be immunized) to positive and the effect of income in urban quintile 1 is no longer statistically significant. The actual changes in both cases are very small but statistically significant. The PCP clusters do better than both other cluster groups in this model.

Table 5.10A: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Total Respiratory Morbidity by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.072 (1.070, 1.073)**	**<.0001**
Comorbidity		
Hypertension	**1.556 (1.487, 1.630)**	**<.0001**
Mood Disorders	**1.341 (1.270, 1.416)**	**<.0001**
Diabetes Mellitus	**1.595 (1.519, 1.674)**	**<.0001**
Ischemic Heart Disease	**1.236 (1.169, 1.307)**	**<.0001**
Congestive Heart Failure	**0.731 (0.667, 0.801)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.174 (0.151, 0.200)**	**<.0001**
R2	**0.243 (0.217, 0.273)**	**<.0001**
R3	**0.241 (0.215, 0.271)**	**<.0001**
R4	**0.513 (0.465, 0.566)**	**<.0001**
R5	**0.591 (0.532, 0.656)**	**<.0001**
Urban 1 (U1)	0.941 (0.877, 1.010)	0.0934
U2	1.016 (0.945, 1.091)	0.6732
U3	0.985 (0.916, 1.058)	0.6736
U4	1.017 (0.945, 1.095)	0.6507
Cluster Group* (ref = PCP Group)		
SP	**0.692 (0.628, 0.762)**	**<.0001**
Mixed	**0.800 (0.753, 0.850)**	**<.0001**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

For the asthma drug prescription indicator, having hypertension, mood disorders, or diabetes as comorbidities decreased the likelihood of meeting the desired quality measure (Table 5.11). All urban residents and the poorest rural residents had reduced odds of the desired prescribing pattern. Clusters 2 and 9 did better than the reference cluster, while Cluster 7 did worse.

Table 5.11: Factors Associated with Drug Prescription in Manitoba Patients with Asthma by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	1.007 (1.006, 1.009)	<.0001
Comorbidity		
Hypertension	**0.876 (0.831, 0.923)**	**<.0001**
Mood Disorders	**0.833 (0.788, 0.880)**	**<.0001**
Diabetes Mellitus	**0.867 (0.818, 0.918)**	**<.0001**
Ischemic Heart Disease	0.974 (0.902, 1.051)	0.4918
Congestive Heart Failure	0.972 (0.873, 1.082)	0.6032
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.780 (0.705, 0.863)**	**<.0001**
R2	0.993 (0.891, 1.106)	0.8948
R3	0.963 (0.867, 1.069)	0.4745
R4	0.918 (0.826, 1.020)	0.1103
R5	0.972 (0.869, 1.087)	0.6197
Urban 1 (U1)	**0.851 (0.783, 0.924)**	**0.0001**
U2	**0.872 (0.800, 0.951)**	**0.0019**
U3	**0.858 (0.785, 0.938)**	**0.0007**
U4	**0.823 (0.751, 0.901)**	**<.0001**
Cluster (ref = Cluster 6)		
1	0.990 (0.782, 1.253)	0.9305
2	**1.210 (1.089, 1.344)**	**0.0004**
3	1.048 (0.765, 1.434)	0.7719
4	1.196 (0.886, 1.614)	0.2429
5	0.961 (0.895, 1.032)	0.2766
7	**0.828 (0.782, 0.876)**	**<.0001**
8	0.946 (0.640, 1.398)	0.7807
9	**1.149 (1.012, 1.305)**	**0.0326**
10	1.134 (0.986, 1.304)	0.0783
11	0.907 (0.809, 1.017)	0.0951
12	1.423 (0.628, 3.224)	0.3984
13	0.988 (0.460, 2.118)	0.9744

* Values in **bold** typeface are statistically significant at $p<0.05$

Table 5.11A indicates that the mixed care clusters do better than both the PCP and SP cluster groups for the asthma drug prescription indicator.

Table 5.11A: Factors Associated with Drug Prescription in Manitoba Patients with Asthma by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.008 (1.007, 1.009)**	**<.0001**
Comorbidity		
Hypertension	**0.907 (0.861, 0.955)**	**0.0002**
Mood Disorders	**0.902 (0.857, 0.950)**	**<.0001**
Diabetes Mellitus	**0.897 (0.847, 0.950)**	**0.0002**
Ischemic Heart Disease	1.000 (0.927, 1.079)	0.9917
Congestive Heart Failure	1.003 (0.901, 1.116)	0.9634
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.785 (0.710, 0.868)**	**<.0001**
R2	0.981 (0.881, 1.093)	0.7275
R3	0.959 (0.864, 1.064)	0.4281
R4	0.915 (0.823, 1.016)	0.0958
R5	0.965 (0.862, 1.079)	0.5305
Urban 1 (U1)	**0.870 (0.801, 0.945)**	**0.0009**
U2	**0.880 (0.807, 0.959)**	**0.0035**
U3	**0.864 (0.791, 0.944)**	**0.0012**
U4	**0.826 (0.754, 0.905)**	**<.0001**
Cluster Group* (ref = PCP Group)		
SP	1.018 (0.927, 1.118)	0.7114
Mixed	**1.082 (1.024, 1.144)**	**0.0053**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

Depression

Process Indicator

Follow–up appointment definition: Patients diagnosed with depression in at least one hospital separation in three years (2007/08–2009/10) OR a new diagnosis of depression in one ambulatory visit with an antidepressant prescription within two week of the diagnosis AND three subsequent ambulatory visits within four months of the first drug prescription.

There is only one quality indicator for patients with depression, namely the provision of adequate follow–up care after the diagnosis of depression with an associated new prescription for an antidepressant drug.

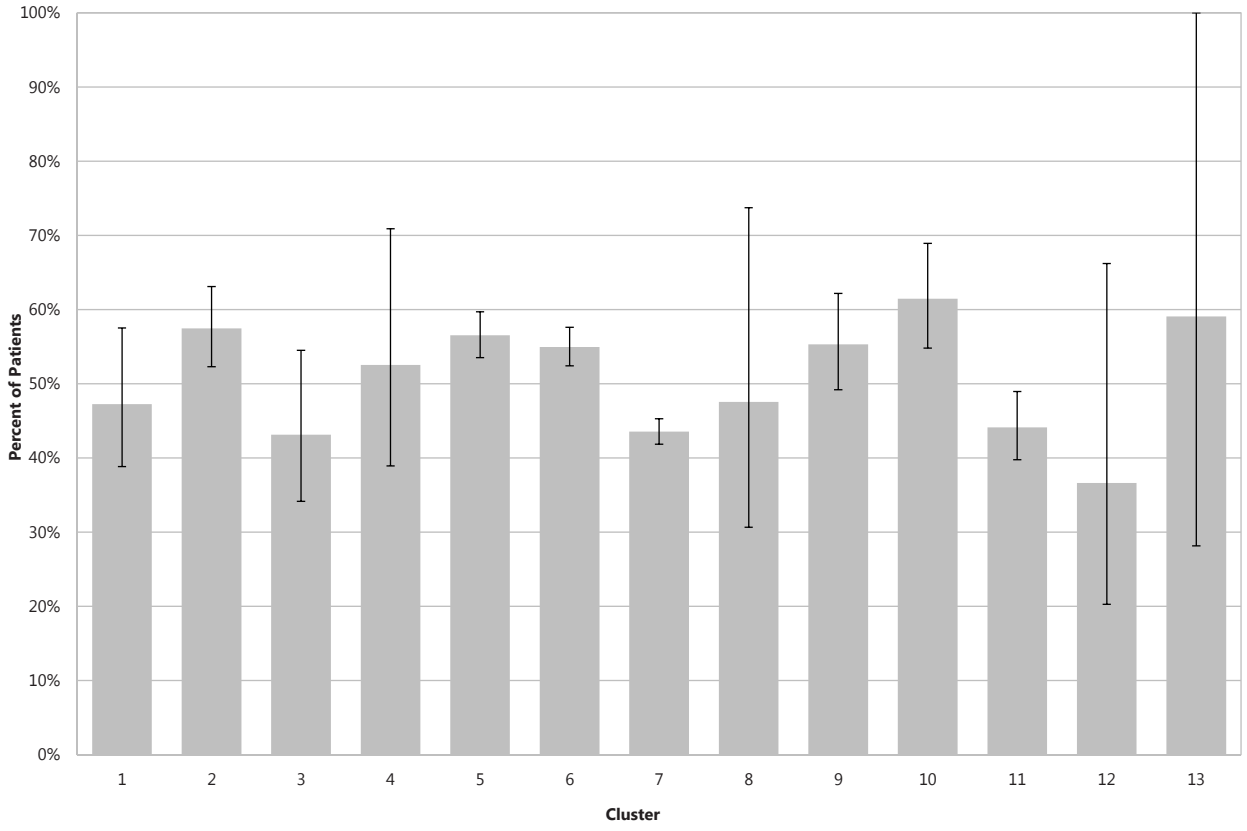
The results are presented in Table 5.12 and Figure 5.4. Approximately 50% of patients with depression received three follow–up appointments. The bars in the graph include confidence limits which are quite wide for many of the clusters because of the small number of cases in many of the clusters. The rate of follow–up care was below 50% in Clusters 7 and 11.

Table 5.12: Quality of Care for Manitoba Patients with Depression, 2007/08–2009/10

Follow-Up Appointment	Number of Patients	Percent of Patients
Yes	9,689	49.43
No	9,912	50.57

Figure 5.4: Quality of Care for Manitoba Patients with Depression by Cluster, 2007/08–2009/10

Age– & sex–adjusted rates for depression follow–up appointment



Quality of Care Models

The regression model showed that, of the comorbidities, only patients with hypertension and TRM in addition to depression were more likely to meet the requirement for the three follow up visits. Rural patients (except patients in the highest rural income quintile), patients in urban income quintile 2, and those in Cluster 10 (six visits to the assigned PCP and 12 visits to other PCPs) were more likely to meet this requirement (Table 5.13). Clusters 1, 3, 7 (which included the majority of the population), and 11 had reduced odds of meeting the quality indicator.

Table 5.13: Factors Associated with Follow–Up Appointments in Manitoba Patients with Depression by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**0.996 (0.994, 0.998)**	**0.0002**
Comorbidity		
Hypertension	**1.149 (1.059, 1.246)**	**0.0008**
Total Respiratory Morbidity	**1.085 (1.018, 1.155)**	**0.0115**
Diabetes Mellitus	1.075 (0.963, 1.200)	0.1973
Ischemic Heart Disease	1.083 (0.931, 1.261)	0.3009
Congestive Heart Failure	0.846 (0.639, 1.120)	0.2418
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**1.212 (1.040, 1.413)**	**0.0139**
R2	**1.280 (1.105, 1.483)**	**0.0010**
R3	**1.163 (1.012, 1.336)**	**0.0334**
R4	**1.273 (1.106, 1.467)**	**0.0008**
R5	1.116 (0.967, 1.289)	0.1344
Urban 1 (U1)	1.024 (0.916, 1.145)	0.6794
U2	**1.134 (1.012, 1.271)**	**0.0300**
U3	1.051 (0.937, 1.179)	0.3958
U4	1.089 (0.966, 1.227)	0.1633
Cluster (ref = Cluster 6)		
1	**0.736 (0.559, 0.970)**	**0.0294**
2	1.070 (0.919, 1.246)	0.3836
3	**0.657 (0.480, 0.900)**	**0.0089**
4	0.853 (0.549, 1.323)	0.4770
5	1.053 (0.956, 1.160)	0.2938
7	**0.646 (0.599, 0.697)**	**<.0001**
8	0.692 (0.376, 1.276)	0.2383
9	1.026 (0.856, 1.231)	0.7789
10	**1.251 (1.032, 1.518)**	**0.0228**
11	**0.676 (0.583, 0.785)**	**<.0001**
12	0.513 (0.243, 1.082)	0.0795
13	1.178 (0.372, 3.728)	0.7803

* Values in **bold** typeface are statistically significant at $p<0.05$

There are two changes between the models presented in Tables 5.13 and 5.13A. The comorbidity with diabetes becomes significant as an association with follow up visits for depression and rural income quintile 3 loses its statistical significance. While the SP cluster group patients are less likely to be associated with meeting the follow up visit requirement than the PCP cluster group patients, the mixed care cluster group does better than the PCP group. This would support the "shared mental health care" model supported by Manitoba Health.

Table 5.13A: Factors Associated with Follow–Up Appointments in Manitoba Patients with Depression by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**0.998 (0.996, 1.000)**	**0.0399**
Comorbidity		
Hypertension	**1.225 (1.131, 1.327)**	**<.0001**
Total Respiratory Morbidity	**1.159 (1.090, 1.233)**	**<.0001**
Diabetes Mellitus	**1.137 (1.019, 1.268)**	**0.0212**
Ischemic Heart Disease	1.114 (0.958, 1.296)	0.1619
Congestive Heart Failure	0.837 (0.633, 1.107)	0.2123
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**1.214 (1.042, 1.414)**	**0.0127**
R2	**1.259 (1.088, 1.457)**	**0.0020**
R3	1.142 (0.994, 1.311)	0.0599
R4	**1.271 (1.105, 1.463)**	**0.0008**
R5	1.103 (0.956, 1.273)	0.1801
Urban 1 (U1)	1.053 (0.942, 1.177)	0.3606
U2	**1.156 (1.032, 1.295)**	**0.0122**
U3	1.066 (0.950, 1.195)	0.2759
U4	1.102 (0.979, 1.242)	0.1077
Cluster Group* (ref = PCP Group)		
SP	**0.886 (0.789, 0.996)**	**0.0418**
Mixed	**1.382 (1.279, 1.492)**	**<.0001**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

Diabetes Mellitus

There are two process indicators and one health outcome related to diabetes.

Process Indicators

Influenza vaccination definition: Diabetes patients with annual influenza vaccinations over three years (2007/08–2009/10).

Eye examination definition: Diabetes patients with one or more visits to an optometrist or an ophthalmologist in three years (2007/08–2009/10).

A little over 50% of diabetic patients had the recommended eye examinations and a little less than 50% had at least one vaccination. Almost 30% had neither an eye examination nor a vaccination (Table 5.14). Only 9.2% received both eye examinations and the recommended three vaccinations.

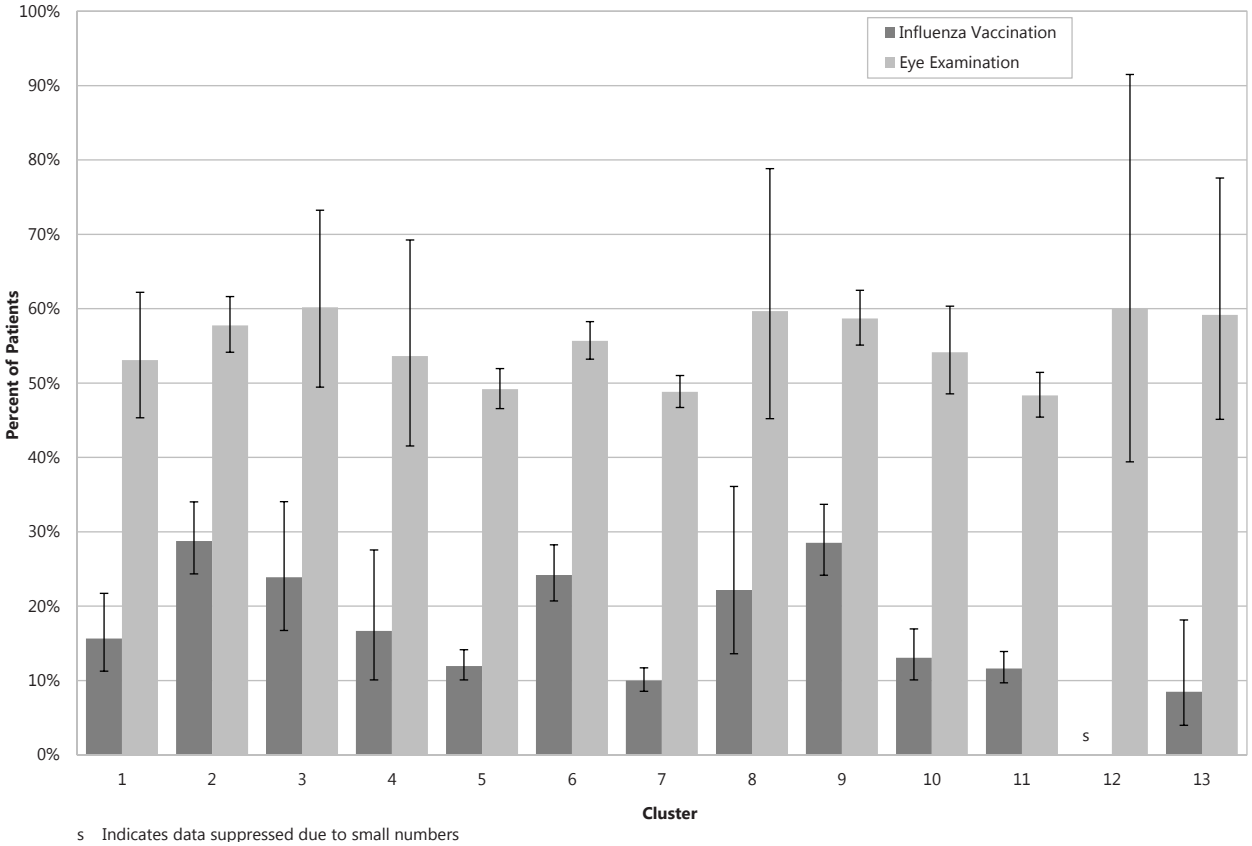
Figure 5.5 presents the results for influenza vaccination and eye care by cluster. The influenza vaccination rate for Cluster 12 was suppressed due to the small number of patients in the cluster being vaccinated. The figure demonstrates the narrow range in outcomes for eye care (48–60%) and the low vaccination rates in all clusters.

Table 5.14: Quality of Care for Manitoba Patients with Diabetes Mellitus, 2007/08–2009/10

Influenza Vaccination 1-2	Influenza Vaccination 3+	Eye Examination	Number of Patients	Percent of Patients
Yes		**Yes**	9,975	15.50
Yes			8,488	13.19
	Yes	**Yes**	5,938	9.23
	Yes		4,170	6.48
		Yes	17,227	26.77
			18,562	28.84

Figure 5.5: Quality of Care for Manitoba Patients with Diabetes Mellitus by Cluster, 2007/08–2009/10

Age– & sex–adjusted rates for eye examination and three influenza vaccinations over three years



s Indicates data suppressed due to small numbers

Health Outcome

Lower limb amputation definition: Diabetes patients who have not had an amputation of a lower limb in three years (2007/08–2009/10) AND who have had at least one lower limb amputation in the following year (2010/11)—excludes lower limb amputations due to accidental injury.

The health outcome indicator for diabetes (**lower limb amputation**) is a negative or undesirable outcome. It is also a rare outcome with only 101 events in the year of follow–up data (Tables 5.15 and 5.16).

Table 5.15: Health Outcomes for Manitoba Patients with Diabetes Mellitus, 2010/11

Lower Limb Amputation	Number of Patients	Percent of Patients
Yes	101	0.16
No	64,010	99.84

Table 5.16: Adjusted Rates of Lower Limb Amputation per 1,000 Manitoba Patients with Diabetes Mellitus by Cluster, 2010/11

Cluster	Lower Limb Amputation
1	*
2	4.44
3	*
4	9.59
5	2.04
6	1.17
7	1.09
8	*
9	5.00
10	3.07
11	1.77
12	*
13	10.63

* Event did not occur in cluster and cluster was removed from model

Quality of Care Models

Separate models are reported for influenza vaccination and eye examinations. Those with co–morbid hypertension and TRM were more likely to be vaccinated; people with diabetes and mood disorders or CHF were less likely to be vaccinated (Table 5.17). Rural patients and patients in the poorest urban income quintile were less likely to be vaccinated. Cluster 2 was the only cluster with increased odds of being vaccinated, while patients in Clusters 1, 5, 7, and 10 to 13 were less likely to be vaccinated than those in the reference cluster (Cluster 6)

Table 5.17: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Diabetes Mellitus by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.053 (1.051, 1.055)**	**<.0001**
Comorbidity		
Hypertension	**1.321 (1.238, 1.409)**	**<.0001**
Total Respiratory Morbidity	**1.131 (1.074, 1.190)**	**<.0001**
Mood Disorders	**0.776 (0.714, 0.844)**	**<.0001**
Ischemic Heart Disease	1.034 (0.974, 1.099)	0.2734
Congestive Heart Failure	**0.710 (0.639, 0.788)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.114 (0.097, 0.135)**	**<.0001**
R2	**0.199 (0.173, 0.228)**	**<.0001**
R3	**0.218 (0.191, 0.249)**	**<.0001**
R4	**0.432 (0.384, 0.487)**	**<.0001**
R5	**0.484 (0.424, 0.551)**	**<.0001**
Urban 1 (U1)	**0.779 (0.714, 0.850)**	**<.0001**
U2	0.941 (0.862, 1.028)	0.1792
U3	0.937 (0.857, 1.024)	0.1501
U4	0.994 (0.908, 1.088)	0.8921
Cluster (ref = Cluster 6)		
1	**0.609 (0.437, 0.850)**	**0.0035**
2	**1.580 (1.428, 1.748)**	**<.0001**
3	0.912 (0.621, 1.337)	0.6357
4	1.008 (0.580, 1.751)	0.9769
5	**0.489 (0.447, 0.535)**	**<.0001**
7	**0.372 (0.351, 0.393)**	**<.0001**
8	1.610 (0.924, 2.806)	0.0926
9	1.064 (0.969, 1.169)	0.1928
10	**0.692 (0.544, 0.880)**	**0.0026**
11	**0.356 (0.319, 0.398)**	**<.0001**
12	**0.132 (0.018, 0.974)**	**0.0470**
13	**0.288 (0.130, 0.634)**	**0.0020**

* Values in **bold** typeface are statistically significant at $p<0.05$

In the provision of influenza vaccination to patients with diabetes, neither the SP cluster group nor the mixed care cluster group patients do as well as the patients in the PCP cluster group. The analyses presented in Table 5.17A also indicate minor changes in the impact of associated comorbidity on the outcome with regard to mood disorders and IHD.

Table 5.17A: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Diabetes Mellitus by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.056 (1.053, 1.058)**	**<.0001**
Comorbidity		
Hypertension	**1.504 (1.411, 1.603)**	**<.0001**
Total Respiratory Morbidity	**1.367 (1.300, 1.437)**	**<.0001**
Mood Disorders	1.074 (0.991, 1.165)	0.0822
Ischemic Heart Disease	**1.175 (1.107, 1.246)**	**<.0001**
Congestive Heart Failure	**0.823 (0.743, 0.912)**	**0.0002**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.117 (0.099, 0.138)**	**<.0001**
R2	**0.194 (0.169, 0.222)**	**<.0001**
R3	**0.222 (0.195, 0.253)**	**<.0001**
R4	**0.441 (0.393, 0.495)**	**<.0001**
R5	**0.477 (0.419, 0.542)**	**<.0001**
Urban 1 (U1)	**0.839 (0.770, 0.913)**	**<.0001**
U2	0.988 (0.906, 1.077)	0.7785
U3	0.977 (0.896, 1.066)	0.6027
U4	1.029 (0.942, 1.124)	0.5242
Cluster Group* (ref = PCP Group)		
SP	**0.589 (0.534, 0.650)**	**<.0001**
Mixed	**0.739 (0.682, 0.801)**	**<.0001**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at p<0.05

Eye examinations were more likely for those with hypertension, mood disorders, and IHD but less likely for CHF patients (Table 5.18). All rural diabetic residents were more likely to have undergone eye exams, while the two poorest urban income quintiles were less likely to have undergone eye exams. Cluster 3, a cluster with SP assignment, was associated with the highest odds of meeting the criterion for this indicator. Cluster 2 and 9 also had increased odds of having an eye examination while Clusters 5, 7, and 11 had lower odds.

Table 5.18: Factors Associated with Eye Examination in Manitoba Patients with Diabetes Mellitus by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.028 (1.026, 1.029)**	**<.0001**
Comorbidity		
Hypertension	**1.180 (1.134, 1.228)**	**<.0001**
Total Respiratory Morbidity	0.998 (0.962, 1.036)	0.9168
Mood Disorders	**1.091 (1.031, 1.156)**	**0.0028**
Ischemic Heart Disease	**1.094 (1.043, 1.147)**	**0.0002**
Congestive Heart Failure	**0.870 (0.801, 0.945)**	**0.0010**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**1.300 (1.205, 1.402)**	**<.0001**
R2	**1.790 (1.651, 1.941)**	**<.0001**
R3	**1.479 (1.367, 1.600)**	**<.0001**
R4	**1.402 (1.292, 1.521)**	**<.0001**
R5	**1.295 (1.186, 1.414)**	**<.0001**
Urban 1 (U1)	**0.722 (0.675, 0.772)**	**<.0001**
U2	**0.921 (0.860, 0.986)**	**0.0181**
U3	0.963 (0.899, 1.032)	0.2891
U4	1.010 (0.941, 1.083)	0.7881
Cluster (ref = Cluster 6)		
1	1.066 (0.847, 1.342)	0.5851
2	**1.103 (1.010, 1.206)**	**0.0301**
3	**1.385 (1.017, 1.884)**	**0.0385**
4	1.001 (0.686, 1.461)	0.9946
5	**0.792 (0.745, 0.842)**	**<.0001**
7	**0.778 (0.746, 0.810)**	**<.0001**
8	1.119 (0.717, 1.746)	0.6208
9	**1.216 (1.118, 1.323)**	**<.0001**
10	1.088 (0.930, 1.272)	0.2910
11	**0.897 (0.834, 0.965)**	**0.0034**
12	1.487 (0.782, 2.825)	0.2259
13	1.315 (0.872, 1.984)	0.1915

* Values in **bold** typeface are statistically significant at $p<0.05$

In Table 5.18A, the association of eye examinations with TRM comorbidity becomes significant. The mixed care cluster group patients are less likely than the PCP cluster group patients to have their eye examinations.

Table 5.18A: Factors Associated with Eye Examination in Manitoba Patients with Diabetes Mellitus by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.029 (1.027, 1.030)**	**<.0001**
Comorbidity		
Hypertension	**1.222 (1.175, 1.271)**	**<.0001**
Total Respiratory Morbidity	**1.052 (1.014, 1.090)**	**0.0066**
Mood Disorders	**1.209 (1.144, 1.277)**	**<.0001**
Ischemic Heart Disease	**1.139 (1.086, 1.194)**	**<.0001**
Congestive Heart Failure	**0.913 (0.840, 0.991)**	**0.0295**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**1.283 (1.189, 1.383)**	**<.0001**
R2	**1.745 (1.610, 1.892)**	**<.0001**
R3	**1.452 (1.342, 1.571)**	**<.0001**
R4	**1.386 (1.278, 1.504)**	**<.0001**
R5	**1.280 (1.173, 1.398)**	**<.0001**
Urban 1 (U1)	**0.736 (0.688, 0.786)**	**<.0001**
U2	**0.930 (0.868, 0.995)**	**0.0359**
U3	0.970 (0.906, 1.040)	0.3948
U4	1.017 (0.948, 1.091)	0.6426
Cluster Group* (ref = PCP Group)		
SP	1.056 (0.991, 1.125)	0.0951
Mixed	**0.920 (0.873, 0.970)**	**0.0019**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

While the numbers of amputations were small, the model revealed some striking results. There were very high odds ratios for the poorest socioeconomic groups in urban and rural areas. Clusters 2 and 9 also have very high odds rations for amputations (Table 5.19).

Table 5.19: Factors Associated with Lower Limb Amputation in Manitoba Patients with Diabetes Mellitus by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	0.997 (0.982, 1.013)	0.7412
Comorbidity		
Hypertension	**2.563 (1.238, 5.306)**	**0.0112**
Total Respiratory Morbidity	0.879 (0.562, 1.374)	0.5703
Mood Disorders	0.590 (0.265, 1.317)	0.1981
Ischemic Heart Disease	**1.896 (1.200, 2.996)**	**0.0062**
Congestive Heart Failure	**1.878 (1.040, 3.391)**	**0.0365**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**5.533 (2.079, 14.725)**	**0.0006**
R2	2.242 (0.726, 6.926)	0.1605
R3	1.839 (0.577, 5.859)	0.3025
R4	0.596 (0.115, 3.083)	0.5369
R5	0.397 (0.046, 3.411)	0.4002
Urban 1 (U1)	**2.720 (1.024, 7.224)**	**0.0447**
U2	1.887 (0.670, 5.310)	0.2291
U3	1.207 (0.394, 3.698)	0.7413
U4	0.664 (0.178, 2.478)	0.5427
Cluster (ref = Cluster 6)**		
2	**2.993 (1.401, 6.394)**	**0.0046**
4	6.296 (0.786, 50.412)	0.0830
5	1.540 (0.741, 3.198)	0.2471
7	1.081 (0.605, 1.930)	0.7934
9	**4.308 (2.125, 8.736)**	**<.0001**
10	1.881 (0.426, 8.298)	0.4042
11	1.917 (0.794, 4.624)	0.1476
13	6.846 (0.879, 53.343)	0.0663

* Values in **bold** typeface are statistically significant at $p<0.05$

** Clusters with no amputations were removed from the model

There are no significant differences in the outcome of lower limb amputation between the three cluster groups (Table 5.19A).

Table 5.19A: Factors Associated with Lower Limb Amputation in Manitoba Patients with Diabetes Mellitus by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	0.998 (0.983, 1.014)	0.8348
Comorbidity		
Hypertension	**2.755 (1.335, 5.687)**	**0.0061**
Total Respiratory Morbidity	0.993 (0.643, 1.533)	0.9741
Mood Disorders	0.737 (0.337, 1.611)	0.4449
Ischemic Heart Disease	**2.088 (1.327, 3.284)**	**0.0015**
Congestive Heart Failure	**2.047 (1.124, 3.728)**	**0.0192**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**4.748 (1.794, 12.567)**	**0.0017**
R2	1.926 (0.627, 5.916)	0.2522
R3	1.593 (0.503, 5.043)	0.4287
R4	0.536 (0.104, 2.771)	0.4573
R5	0.365 (0.043, 3.129)	0.3579
Urban 1 (U1)	**2.741 (1.033, 7.273)**	**0.0428**
U2	1.857 (0.660, 5.220)	0.2408
U3	1.214 (0.396, 3.714)	0.7345
U4	0.659 (0.177, 2.457)	0.5345
Cluster Group* (ref = PCP Group)		
SP	1.216 (0.556, 2.662)	0.6238
Mixed	1.196 (0.679, 2.106)	0.5364

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

Ischemic Heart Disease

Process Indicators

Influenza vaccination definition: IHD patients with annual influenza vaccination over three years (2007/08–2009/10).

Post–myocardial infarction drug prescription definition: IHD patients with a diagnosis of myocardial infarction in at least one hospital separation, excluding a diagnosis of bronchitis, emphysema, chronic obstructive pulmonary disease, asthma, or peripheral vascular disease AND at least one prescription of beta–blockers in the three years after the myocardial infarction (2007/08–2009/10).

We analysed two process indicators for patients with IHD. Once again influenza vaccination was indicated. We also included a drug prescription indicator (Table 2.3). A little more than 50% of patients with IHD were vaccinated at least once and about one–third met the drug prescribing indicator requirements (Tables 5.20 and 5.21). It should be noted that the latter indicator does not apply to all patients with IHD but only those who have previously had a myocardial infarction as a consequence of their IHD. Thus, the indicator represents those with a previous myocardial infarction who were treated with beta blockers.

Table 5.20: Quality of Care for Manitoba Patients with Ischemic Heart Disease, 2007/08–2009/10

Influenza Vaccination	Number of Patients	Percent of Patients
0	17,320	47.71
1–2	11,284	31.08
3+	7,702	21.21

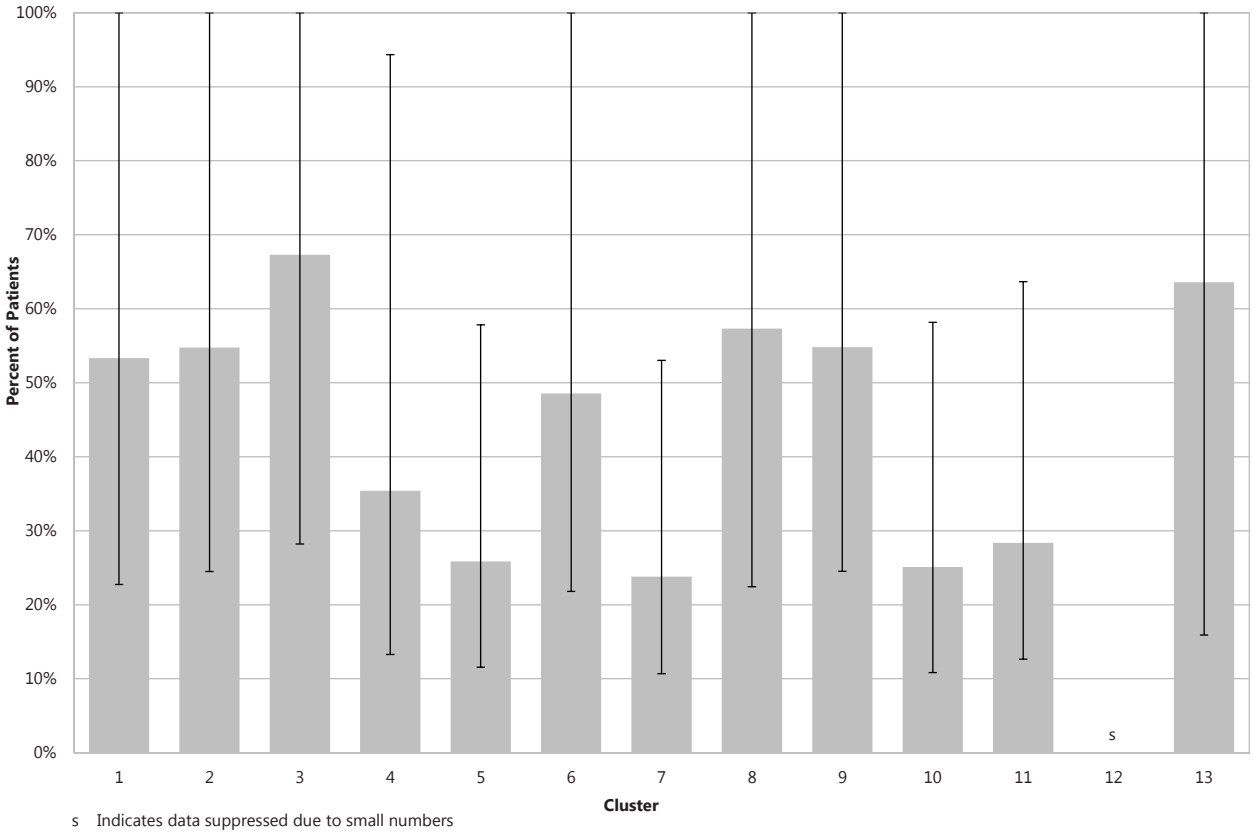
Table 5.21: Quality of Care Indicator for Manitoba Patients with Myocardial Infarction, 2007/08–2009/10

Beta Blocker Prescription	Number of Patients	Percent of Patients
Yes	1,627	31.81
No	3,488	68.19

The small numbers of patients included in this indicator result in very large confidence intervals in Figure 5.6, and these results should be interpreted with caution. Figure 5.7 is noteworthy for the suppression of the results in five of the 13 clusters. None of the clusters had over 50% of patients meeting beta blocker prescription standard.

Figure 5.6: Quality of Care for Manitoba Patients with Ischemic Heart Disease by Cluster, 2007/08–2009/10

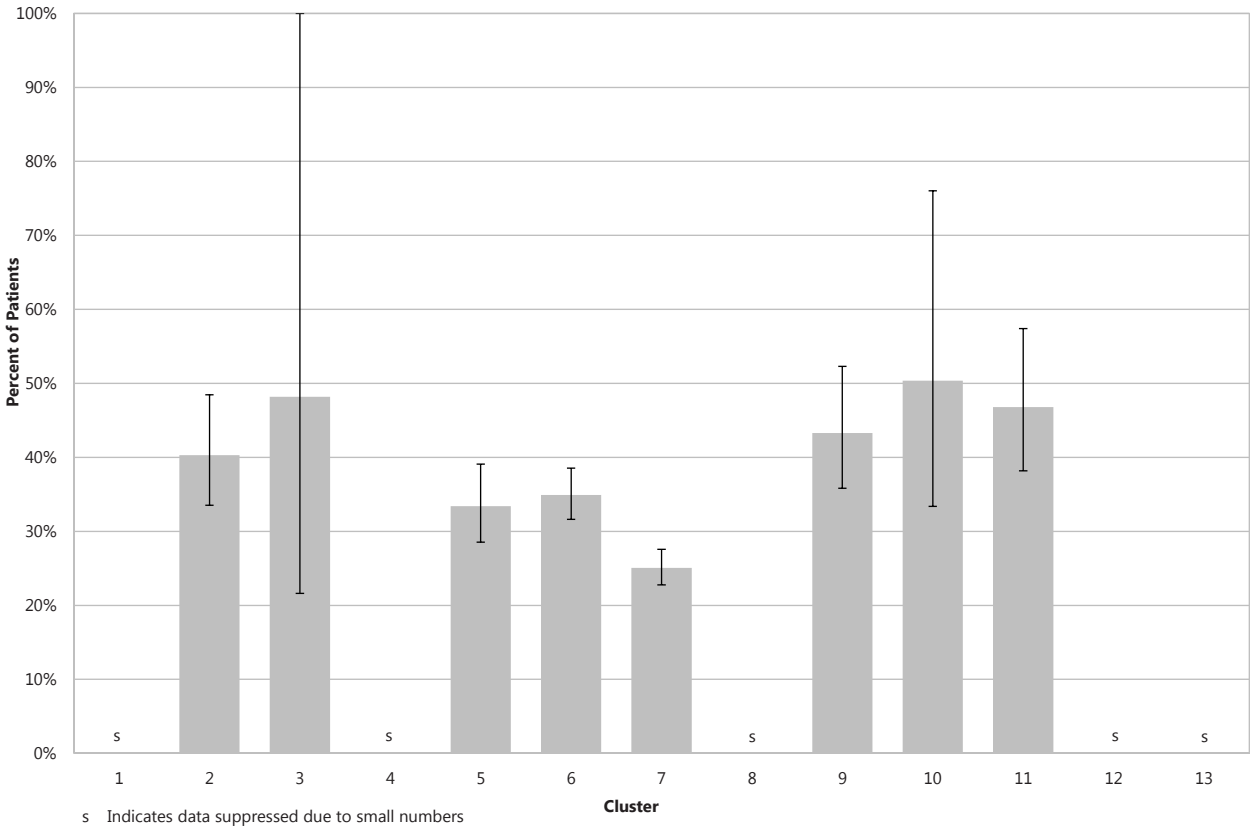
Age– & sex–adjusted rates for three influenza vaccinations over three years



s Indicates data suppressed due to small numbers

Figure 5.7: Quality of Care for Manitoba Patients with Myocardial Infarction by Cluster, 2007/08–2009/10

Age– & sex–adjusted rates for beta blocker prescription



s Indicates data suppressed due to small numbers

Quality of Care Models

Tables 5.22 and 5.23 present the models for the influenza vaccination and beta blocker prescribing indicators.

Rural residents and residents in the poorest urban income quintile had lower odds of being vaccinated, which is consistent with previously described vaccination indicators. Clusters 2 and 8 had higher odds of vaccination (Table 5.22). Clusters 5, 7, 10, 11, and 13 had lower odds of receiving influenza vaccination.

Table 5.22: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Ischemic Heart Disease by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.052 (1.050, 1.055)**	**<.0001**
Comorbidity		
Hypertension	**1.217 (1.075, 1.379)**	**0.0019**
Total Respiratory Morbidity	**1.177 (1.109, 1.248)**	**<.0001**
Mood Disorders	**0.823 (0.747, 0.907)**	**<.0001**
Diabetes Mellitus	**1.175 (1.105, 1.249)**	**<.0001**
Congestive Heart Failure	**0.713 (0.655, 0.775)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.113 (0.093, 0.136)**	**<.0001**
R2	**0.181 (0.154, 0.213)**	**<.0001**
R3	**0.202 (0.174, 0.236)**	**<.0001**
R4	**0.384 (0.334, 0.441)**	**<.0001**
R5	**0.383 (0.326, 0.449)**	**<.0001**
Urban 1 (U1)	**0.752 (0.679, 0.833)**	**<.0001**
U2	0.924 (0.834, 1.024)	0.1310
U3	0.923 (0.833, 1.022)	0.1241
U4	0.992 (0.892, 1.102)	0.8745
Cluster (ref = Cluster 6)		
1	1.089 (0.744, 1.594)	0.6615
2	**1.423 (1.270, 1.593)**	**<.0001**
3	1.373 (0.865, 2.179)	0.1793
4	0.960 (0.489, 1.883)	0.9049
5	**0.487 (0.438, 0.541)**	**<.0001**
7	**0.420 (0.393, 0.448)**	**<.0001**
8	**2.000 (1.061, 3.767)**	**0.0320**
9	0.916 (0.822, 1.022)	0.1177
10	**0.539 (0.400, 0.725)**	**<.0001**
11	**0.359 (0.312, 0.412)**	**<.0001**
12	1.346 (0.342, 5.291)	0.6708
13	**0.309 (0.129, 0.741)**	**0.0085**

* Values in **bold** typeface are statistically significant at p<0.05

Table 5.22A indicates that comorbid mood disorders are not significantly associated with increased likelihood of influenza vaccination in patients with IHD and that patients in the PCP cluster group are more likely to receive these immunizations that patients in either of the other cluster groups.

Table 5.22A: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Ischemic Heart Disease by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.056 (1.053, 1.059)**	**<.0001**
Comorbidity		
Hypertension	**1.354 (1.198, 1.530)**	**<.0001**
Total Respiratory Morbidity	**1.374 (1.297, 1.455)**	**<.0001**
Mood Disorders	1.085 (0.988, 1.191)	0.0870
Diabetes Mellitus	**1.334 (1.256, 1.416)**	**<.0001**
Congestive Heart Failure	**0.809 (0.745, 0.878)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.120 (0.099, 0.144)**	**<.0001**
R2	**0.180 (0.153, 0.211)**	**<.0001**
R3	**0.209 (0.180, 0.243)**	**<.0001**
R4	**0.395 (0.344, 0.452)**	**<.0001**
R5	**0.388 (0.331, 0.453)**	**<.0001**
Urban 1 (U1)	**0.790 (0.715, 0.873)**	**<.0001**
U2	0.959 (0.867, 1.061)	0.4155
U3	0.950 (0.859, 1.051)	0.3193
U4	1.014 (0.914, 1.125)	0.7959
Cluster Group* (ref = PCP Group)		
SP	**0.606 (0.536, 0.684)**	**<.0001**
Mixed	**0.674 (0.613, 0.742)**	**<.0001**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at p<0.05

The model for the prescription of beta blockers for patients after a myocardial infarction is presented in Table 5.23. There were no significant differences based on income quintile. Patients with hypertension had much higher odds of receiving a beta blocker than those with the other conditions shown. It should be noted that beta blockers are used to treat hypertension as well, which may explain this increased use. Clusters 9 and 11 also had higher odds, while Cluster 7 had lower odds of being prescribed a beta blocker compared to the reference cluster.

Table 5.23: Factors Associated with Beta Blocker Prescription for Manitoba Patients Post Myocardial Infarction by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.034 (1.028, 1.039)**	**<.0001**
Comorbidity		
Hypertension	**6.227 (3.878, 9.999)**	**<.0001**
Total Respiratory Morbidity	1.050 (0.914, 1.206)	0.4940
Mood Disorders	1.187 (0.958, 1.471)	0.1172
Diabetes Mellitus	**1.516 (1.325, 1.734)**	**<.0001**
Congestive Heart Failure	**1.379 (1.189, 1.600)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	0.953 (0.691, 1.313)	0.7676
R2	0.949 (0.695, 1.295)	0.7411
R3	1.235 (0.914, 1.669)	0.1692
R4	1.178 (0.872, 1.591)	0.2870
R5	1.122 (0.789, 1.595)	0.5209
Urban 1 (U1)	1.229 (0.935, 1.616)	0.1393
U2	1.063 (0.803, 1.406)	0.6710
U3	0.902 (0.679, 1.200)	0.4797
U4	1.220 (0.916, 1.624)	0.1732
Cluster (ref = Cluster 6)		
1	0.791 (0.267, 2.349)	0.6735
2	1.202 (0.917, 1.577)	0.1827
3	1.637 (0.496, 5.405)	0.4183
4	0.323 (0.037, 2.798)	0.3050
5	0.992 (0.794, 1.239)	0.9416
7	**0.775 (0.664, 0.905)**	**0.0013**
8	0.967 (0.223, 4.194)	0.9637
9	**1.313 (0.990, 1.740)**	**0.0589**
10	1.900 (0.999, 3.614)	0.0504
11	**1.772 (1.299, 2.418)**	**0.0003**
12	**	**
13	1.524 (0.245, 9.478)	0.6514

* Values in **bold** typeface are statistically significant at $p<0.05$

** Event did not occur in cluster; cluster was removed from the model

There is a positive association with comorbid mood disorders and beta blocker prescription in Table 5.23A; patients in the SP cluster group do better than those in the PCP cluster group.

Table 5.23A: Factors Associated with Beta Blocker Prescription for Manitoba Patients Post Myocardial Infarction by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.036 (1.030, 1.041)**	**<.0001**
Comorbidity		
Hypertension	**6.676 (4.164, 10.704)**	**<.0001**
Total Respiratory Morbidity	1.109 (0.968, 1.271)	0.1355
Mood Disorders	**1.288 (1.046, 1.585)**	**0.0169**
Diabetes Mellitus	**1.608 (1.409, 1.835)**	**<.0001**
Congestive Heart Failure	**1.415 (1.221, 1.640)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	0.912 (0.663, 1.254)	0.5704
R2	0.924 (0.679, 1.258)	0.6171
R3	1.200 (0.890, 1.617)	0.2321
R4	1.154 (0.856, 1.555)	0.3485
R5	1.100 (0.775, 1.561)	0.5951
Urban 1 (U1)	1.235 (0.941, 1.621)	0.1278
U2	1.050 (0.795, 1.388)	0.7316
U3	0.904 (0.681, 1.200)	0.4849
U4	1.224 (0.921, 1.627)	0.1641
Cluster Group* (ref = PCP Group)		
SP	**1.807 (1.365, 2.394)**	**<.0001**
Mixed	1.119 (0.919, 1.362)	0.2623

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at p<0.05

Congestive Heart Failure Quality of Care Indicators

Process Indicators

Influenza vaccination definition: CHF patients with an annual influenza vaccination over three years (2007/08–2009/10).

Drug prescription definition: CHF patients with at least one prescription for angiotensin converting enzyme inhibitor (ACEI) or angiotensin II receptor blockers (ARB) in three years (2007/08–2009/10).

There are two process quality indicators for CHF. As with IHD, the influenza vaccination rate is supplemented with a drug prescription quality indicator. A little over 55% of those eligible have had at least one vaccination and almost 70% meet the drug prescription criterion, but only 15.4% of those eligible received the three annual immunizations and the prescriptions that are recommended (Table 5.24).

Table 5.24: Quality of Care for Manitoba Patients with Congestive Heart Failure, 2007/08–2009/10

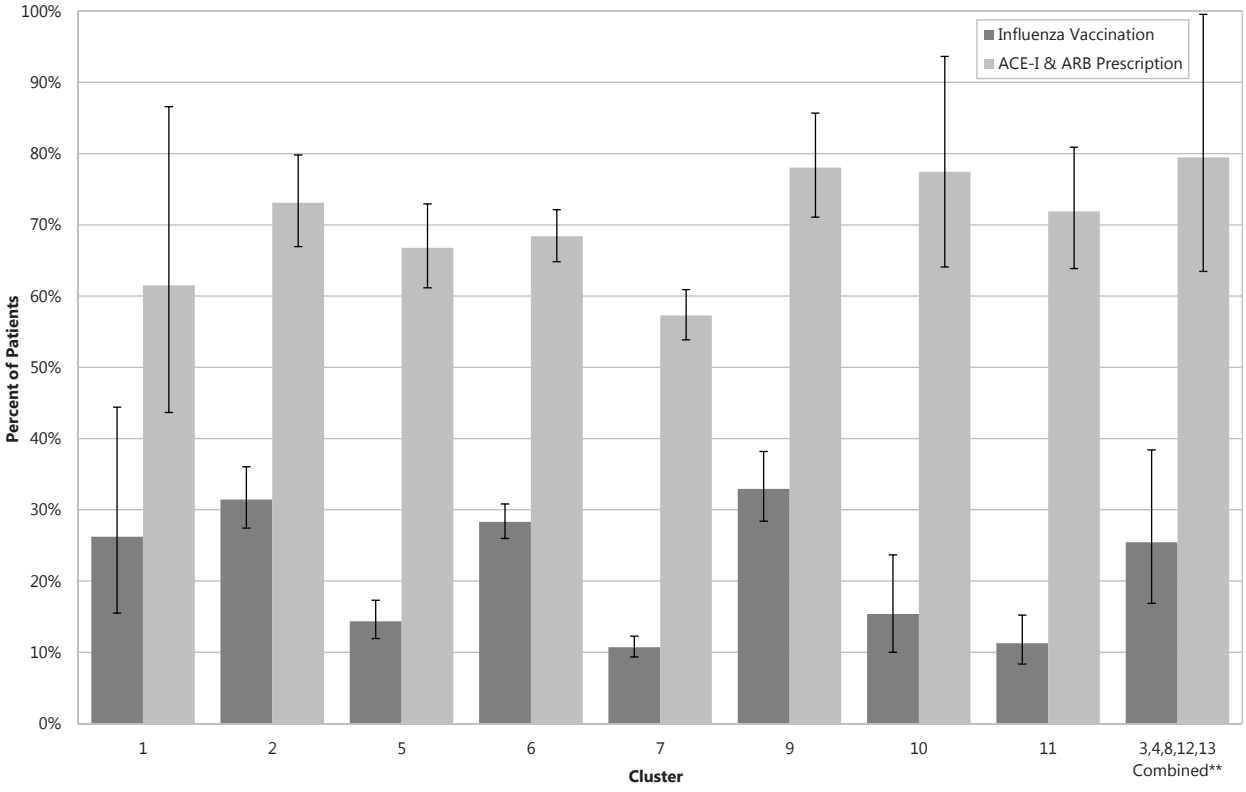
Influenza Vaccination 1-2	Influenza Vaccination 3+	ACE-I & ARB* Prescription	Number of Patients	Percent of Patients
Yes		**Yes**	1,814	23.36
Yes			872	11.23
	Yes	**Yes**	1,196	15.40
	Yes		461	5.94
		Yes	2,171	27.95
			1,253	16.13

* Angiotensin Converting Enzyme Inhibitor (ACE-I)
Angiotensin II Receptor Blocker (ARB)

Figure 5.8 demonstrates the distribution of the outcomes for the quality indicators for CHF patients. We combined clusters 3, 4, 8, 12, and 13 for this figure due to the very small number of patients included in these clusters.

Figure 5.8: Quality of Care for Manitoba Patients with Congestive Heart Failure by Cluster, 2007/08–2009/10

Age– & sex–adjusted rates for ACE–I & ARB* prescription and three influenza vaccinations over three years



* Angiotensin Converting Enzyme Inhibitor (ACE-I) and Angiotensin II Receptor Blocker (ARB)
** Clusters were combined due to small numbers

Quality of Care Models

The two models are presented in Tables 5.25 and 5.26. Those with mood disorders were less likely to be vaccinated, as were rural patients. Patients in Cluster 2 were more likely to be vaccinated. Cluster 7, which represented the majority of the population, had an odds ratio of 0.3 of influenza vaccination compared to Cluster 6. Clusters 5, 10, and 11 also had a lower odds ratio of influenza vaccination.

Table 5.25: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Congestive Heart Failure by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio* (95% Confidence Limits)	p-value*
Age (in 2007)	**1.033 (1.028, 1.039)**	**<.0001**
Comorbidity		
Hypertension	1.510 (0.991, 2.300)	0.0554
Total Respiratory Morbidity	1.104 (0.981, 1.243)	0.1010
Mood Disorders	**0.735 (0.598, 0.904)**	**0.0035**
Diabetes Mellitus	1.067 (0.942, 1.209)	0.3082
Ischemic Heart Disease	1.005 (0.890, 1.135)	0.9378
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	**0.121 (0.081, 0.179)**	**<.0001**
R2	**0.275 (0.199, 0.379)**	**<.0001**
R3	**0.286 (0.207, 0.396)**	**<.0001**
R4	**0.503 (0.373, 0.678)**	**<.0001**
R5	**0.580 (0.409, 0.823)**	**0.0023**
Urban 1 (U1)	0.932 (0.737, 1.177)	0.5522
U2	1.170 (0.916, 1.494)	0.2098
U3	1.190 (0.929, 1.526)	0.1690
U4	1.185 (0.910, 1.543)	0.2085
Cluster (ref = Cluster 6)		
1	0.874 (0.459, 1.663)	0.6807
2	**1.275 (1.057, 1.539)**	**0.0112**
3	1.107 (0.450, 2.719)	0.8253
4	1.438 (0.495, 4.172)	0.5043
5	**0.470 (0.377, 0.586)**	**<.0001**
7	**0.313 (0.265, 0.369)**	**<.0001**
8	1.695 (0.738, 3.893)	0.2132
9	0.952 (0.780, 1.162)	0.6299
10	**0.605 (0.368, 0.994)**	**0.0472**
11	**0.256 (0.184, 0.357)**	**<.0001**
12	**	**
13	0.160 (0.021, 1.221)	0.0772

* Values in **bold** typeface are statistically significant at p<0.05

** Event did not occur in cluster

Table 5.25A presents the model of influenza vaccination in patients with CHF including the cluster groups rather the actual clusters. There are changes to the impact of three of the comorbidities on influenza vaccination after controlling for the cluster groups. The changes are minor but result in different comorbidities being significant. Patients in the mixed cluster group are likely to have lower rates of vaccination than the PCP group.

Table 5.25A: Factors Associated with Annual Influenza Vaccinations in Manitoba Patients with Congestive Heart Failure by Cluster Group*, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	1.035 (1.029, 1.040)	0.2199
Comorbidity		
Hypertension	**1.865 (1.235, 2.815)**	**<.0001**
Total Respiratory Morbidity	**1.278 (1.140, 1.434)**	**0.0030**
Mood Disorders	**0.919 (0.752, 1.124)**	**<.0001**
Diabetes Mellitus	1.192 (1.056, 1.347)	0.4112
Ischemic Heart Disease	**1.099 (0.977, 1.238)**	**0.0046**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	0.125 (0.085, 0.185)	0.0714
R2	**0.268 (0.196, 0.367)**	**<.0001**
R3	**0.281 (0.205, 0.387)**	**<.0001**
R4	**0.518 (0.387, 0.694)**	**<.0001**
R5	**0.555 (0.394, 0.782)**	**<.0001**
Urban 1 (U1)	**0.948 (0.755, 1.191)**	**0.0008**
U2	1.155 (0.910, 1.467)	0.6461
U3	1.207 (0.947, 1.537)	0.2366
U4	1.175 (0.908, 1.521)	0.1280
Cluster Group* (ref = PCP Group)		
SP	0.450 (0.343, 0.592)	0.1415
Mixed	**0.644 (0.530, 0.782)**	**<.0001**

* Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

** Values in **bold** typeface are statistically significant at $p<0.05$

The drugs recommended for CHF are similar to those used for the treatment of hypertension resulting in a very high odds ratio for hypertensive patients. As a result, patients with hypertension comorbidity had very high odds of drug prescription (Table 5.26). CHF patients with diabetes or IHD, and patients in rural income quintile 4 also had higher odds of drug prescription. Cluster 4 had a very high odds ratio for receiving an ACE–I prescription. Clusters 9 and 11 had odds of drug prescription, while cluster 7 was not likely to get a prescription.

Table 5.26: Factors Associated with ACE–I & ARB* Prescription in Manitoba Patients with Congestive Heart Failure by Cluster, 2007/08–2009/10

Covariates	Adjusted Odds Ratio** (95% Confidence Limits)	p-value**
Age (in 2007)	**1.016 (1.012, 1.020)**	**<.0001**
Comorbidity		
Hypertension	**16.019 (10.206, 25.141)**	**<.0001**
Total Respiratory Morbidity	1.045 (0.943, 1.159)	0.4010
Mood Disorders	0.949 (0.798, 1.130)	0.5597
Diabetes Mellitus	**3.136 (2.789, 3.526)**	**<.0001**
Ischemic Heart Disease	**1.191 (1.073, 1.321)**	**0.0010**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	1.189 (0.925, 1.530)	0.1769
R2	1.047 (0.814, 1.348)	0.7191
R3	1.107 (0.858, 1.428)	0.4346
R4	**1.333 (1.022, 1.740)**	**0.0342**
R5	0.998 (0.741, 1.343)	0.9876
Urban 1 (U1)	0.944 (0.756, 1.179)	0.6130
U2	0.929 (0.734, 1.177)	0.5434
U3	0.992 (0.779, 1.263)	0.9468
U4	0.985 (0.763, 1.272)	0.9079
Cluster (ref = Cluster 6)		
1	0.790 (0.443, 1.410)	0.4255
2	1.186 (0.980, 1.436)	0.0795
3	0.957 (0.386, 2.375)	0.9245
4	**7.941 (1.052, 59.916)**	**0.0445**
5	0.923 (0.774, 1.102)	0.3769
7	**0.742 (0.654, 0.842)**	**<.0001**
8	1.403 (0.580, 3.391)	0.4521
9	**1.536 (1.232, 1.914)**	**0.0001**
10	1.416 (0.926, 2.165)	0.1088
11	**1.374 (1.073, 1.759)**	**0.0119**
12	1.118 (0.045, 27.778)	0.9456
13	3.743 (0.922, 15.201)	0.0649

* Angiotensin Converting Enzyme Inhibitor (ACE-I)
Angiotensin II Receptor Blocker (ARB)

** Values in **bold** typeface are statistically significant at $p<0.05$

The inclusion of the cluster groups leads to three changes presented in Table 5.26A. Rural quintile 4 is no longer significant. Patients with a TRM diagnosis are significantly more likely to be associated with filling the recommended drug prescriptions; patients with diabetes are no longer significantly associated with filling these prescriptions. Patients in the mixed cluster group are more likely to be associated with filling the prescriptions.

Table 5.26A: Factors Associated with ACE–I & ARB* Prescription in Manitoba Patients with Congestive Heart Failure by Cluster Group**, 2007/08–2009/10

Covariates	Adjusted Odds Ratio† (95% Confidence Limits)	p-value†
Age (in 2007)	1.017 (1.012, 1.021)	0.9592
Comorbidity		
Hypertension	**17.071 (10.895, 26.749)**	**<.0001**
Total Respiratory Morbidity	**1.103 (0.996, 1.221)**	**<.0001**
Mood Disorders	1.052 (0.887, 1.247)	0.0594
Diabetes Mellitus	3.296 (2.933, 3.703)	0.5597
Ischemic Heart Disease	**1.241 (1.120, 1.376)**	**<.0001**
Income Quintile (ref = Urban 5)		
Rural 1 (R1)	1.139 (0.888, 1.462)	0.2248
R2	0.984 (0.766, 1.264)	0.3062
R3	1.043 (0.811, 1.343)	0.9014
R4	1.281 (0.983, 1.668)	0.7417
R5	0.954 (0.710, 1.281)	0.0663
Urban 1 (U1)	0.941 (0.755, 1.174)	0.7531
U2	0.915 (0.724, 1.157)	0.5916
U3	0.984 (0.774, 1.250)	0.4582
U4	0.993 (0.771, 1.280)	0.8926
Cluster Group (ref = PCP Group)**		
SP	1.320 (1.064, 1.638)	0.1878
Mixed	**1.048 (0.898, 1.224)**	**0.0117**

* Angiotension Converting Enzyme Inhibitor (ACE-I)
Angiotensin II Receptor Blocker (ARB)

** Primary care physician (PCP) cluster group: clusters 2, 6, 7, 8 & 9
Specialist (SP) cluster group: clusters 1, 3, 11 & 12
Mixed cluster group: clusters 4, 5 & 10

† Values in **bold** typeface are statistically significant at $p<0.05$

CHAPTER 6: DISCUSSION

Patterns of Care

At the outset of this study, we were unable to identify any previous studies that described patterns of ambulatory care. While there is considerable literature focusing on the concept of continuity of care, there are no studies that explore the use of different types of physicians by patients with chronic conditions. We were initially interested in adding the element of time to our analyses. However, it became clear that there are multiple types of visits and that the addition of the sequence of visits to different physicians would make our task exponentially more complex. Thus we focused our efforts on describing the different types of visits made in ambulatory care and patients' patterns of care using these visit types.

The physician assignment algorithm used in this study has been used in numerous previous studies. In the absence of a formal rostering or allocation process, this algorithm assigns patients to the physician from whom they received more care than any other. While we use the term "assigned" to describe this designation, it is important to note that this assignment was based retrospectively on the patient's actual use of physician services. As expected, the majority of visits were to PCPs. When we performed the cluster analysis to further describe the patterns of care, patients had been assigned to a PCP for five of the twelve chronic condition clusters. In four chronic condition clusters, the patient was assigned to an SP. It is reassuring however that these six clusters only included a total of 5.7% of the chronic–condition cohort. Over 90% (327,699 people) of the Manitoba population designated as having at least one of the chronic conditions we studied received the majority of their care from a PCP. For those not diagnosed with a chronic condition, a very similar percent of the cohort (6.2%) was assigned to a cluster where a majority of care was provided by SPs.

There are two visit types by the chronic–condition cohort that are of note and potential concern. Over half of all visits to PCPs were not to the assigned PCP. This means these visits may have occurred without the benefit of continuity of care and an ongoing patient–physician relationship. The benefits of continuity of care have been demonstrated in previous MCHP studies, particularly with regard to preventive healthcare (Brownell et al., 2008; Brownell, Chartier, Au, & Schultz, 2010; Chartier et al., 2012; Fransoo et al., 2009; Frohlich et al., 2006; Hilderman et al., 2011; Martens et al., 2010). It should be noted, however, that our analyses were based on the individual physician providing this care. Primary care reform initiatives throughout Canada have promoted interdisciplinary team–based care. While there are limited Manitoba initiatives specifically supporting team–based care, PCPs are increasingly sharing the care of their patients. In particular, "advanced or open access" scheduling encourages clinics to schedule an appointment with another PCP when the assigned PCP is not available (Mainous III & Salisbury, 2009). This is regarded as a more patient–centred

approach to scheduling even though it means seeing another PCP. In this study, the rates of patients seeing another PCP were higher in those living outside Winnipeg despite the general belief that access to PCPs is reduced outside of Winnipeg.

Secondly, in an optimally functioning system with a strong primary care foundation, we would expect almost all SP visits to be with a referral from the assigned PCP. This is not the case: not in Winnipeg or the rest of Manitoba, not for Manitobans with a chronic condition, or those without a chronic condition. The highest proportion of SP visits with referral for all groups was with referral from a non–assigned PCP. This pattern of care is likely to jeopardise the communication between the SP and the assigned PCP. When the referral comes from a different PCP, the assigned PCP would be less likely to receive a report from the SP and would not be in a position to fully use the SP's expert opinion in providing care to the patient. It is, however, encouraging to note that the vast majority of care is being provided by PCPs, with very little primary care being provided by SPs.

There is a lack of guidelines or recommendations about how frequently patients should be seen for care. This is partly because of the variability in each patient's condition. For example, a patient with well controlled hypertension, where the patient's blood pressure is consistently within the normal range on stable medication, may "need" to be seen relatively infrequently compared to a similar patient whose blood pressure was high, requiring medication adjustment to optimize blood pressure control. The data used in this study did not permit analyses to determine the "need" for more frequent visits. The severity of the condition is not captured in administrative claims data, which limited our analysis to co–morbidity of six conditions. A previous study showed a high degree of variability in how frequently patients with similar medical conditions are seen by their physicians (Roos, Carrière, & Friesen, 1998).

We were also unable to determine the reasons for the different patterns of care. Are patients seeing other PCPs (at the same clinic or at a different clinic) because they could not get access to their assigned PCP? While advanced access and open access are designed to increase same day/next day visits with a person's own PCP, in practice patients may be diverted to another doctor with more availability that day. Are they seeing other PCPs because they are unhappy with the care they receive from their assigned PCP? They may be seeking a second opinion from the non–assigned PCP. This may explain why many visits to other PCPs result in referrals to SPs.

Our chief purpose in developing the clusters of care patterns was to allow us to determine the impact of the patterns of care on the quality of care received by the patients (Chapter 5). This will be discussed more extensively later in this chapter. The cluster analysis provides us with useful information but also has some limitations. Some of the clusters represented very unusual patterns of care (very few people in the cluster and multiple visits) that did not contribute much to an understanding of the broader patterns of care (e.g., Cluster 12 is defined by about 43 SP visits per year). Studies of this nature tend to explore patterns of healthcare system use with a view to understanding how the system is functioning and identifying areas that may warrant change. The cluster analysis raised some questions that warrant further exploration, while identifying extreme patterns that were rare and did not impact significantly on the system.

It is not surprising that the clusters with more SP visits had a higher proportion of people living in Winnipeg. This reflects the fact that Winnipeg residents have greater access to SPs than non–Winnipeg residents. We did not explore the age differences between patients in different clusters, but there are some obvious differences that may warrant further explanation. For example, only 4.2% of those in Cluster 12 were in the 65 and older age group, while 73.3% of those in Cluster 14 (personal care home residents) were in the same age group. There were also noticeable differences in the distribution of income quintiles in each cluster. The lowest quintiles were over–represented in Clusters 4, 10, and 12. While this represented less than 2% of the cohort, these were clusters with a high rate of visits to different PCPs, indicating poor continuity of care in populations living in low income neighbourhoods.

Prevalence of Chronic Conditions

The chronic conditions included in this study are common. While this is a population–based study, the analysis does not include all Manitobans. As explained in the methods, we excluded Manitobans who had less than four ambulatory care visits during the three–year study period, which would exclude more males than females. We also excluded residents of northern Manitoba. In reality, our study included 70% of all visits made by people with one of these chronic conditions. This will affect the reported prevalence, values, and any condition rates quoted in this report should not be interpreted as being population–based prevalence. For example, when we calculated the prevalence of hypertension based on the definition for inclusion in this study and the total population included in this study (i.e., those with a chronic condition and those without a chronic condition), the prevalence of hypertension was 30%. This was considerably higher than the usually quoted population rate of approximately 24% (Centre for Chronic Disease Prevention and Control, 2010). When looking at the total number of people in the province in the included age range (19 and older), it is apparent that our study population excluded approximately 20% of residents, resulting in inflated population prevalence estimates, because those excluded were those with less than four visits, so were likely healthier.

Thus, we have not presented population prevalence for the conditions represented in this study due to this discrepancy. Comparisons between the prevalence in this study and those in other published papers would be inappropriate due to the methodology used in this study.

Quality of Care

Over the past 10 years, there have been numerous MCHP studies that have reported on aspects of the quality of primary care. The indicators reported here include both process indicators and, where feasible, health outcomes. It is widely accepted that the use of health outcomes as indicators of quality of care in primary care is challenging. This can be attributed to two related reasons. First, there is generally a significant time lag between the provision of primary care services and measurable health outcomes; our study may not have provided enough time. Second, this passage of time provides the opportunity for many factors other than primary care services to impact the outcome. Despite these limitations, we have included health outcomes in our analyses because we recognize that these health outcomes are important to patients and the system. A number of patterns emerged from the modeling of the quality indicators. Providing an influenza vaccination is accepted as good quality care in all of the conditions included except mood disorders. Patients whose patterns of care fell in Clusters 2 or 8 had significantly better rates of vaccination across all of the conditions (see Chapter 5). These two clusters are both associated with care being provided by an assigned PCP with a high number of visits (approximately 15 and 33 visits per year, respectively). In contrast, the SP and mixed cluster groups performed poorly on this indicator. While it is clear that PCPs are more likely to provide their patients with annual influenza vaccination, it is less clear why this is the case. It could be simply that the greater number of visits leads to a greater number of opportunities for preventive care.

Another finding of interest is that there were no patterns of care (as represented by clusters or cluster groups) that were consistently associated with better outcomes across the quality indicators. This means that we are unable to recommend a particular pattern of care. Cluster 7 (three visits per year to an assigned PCP) did well in preventing stroke and renal failure for hypertensive patients, but this may be a reflection of very mild disease that is unlikely to lead to these poor outcomes even if not well managed. In contrast, prevention of myocardial infarction in patients with hypertension was best achieved with care by an SP (Cluster 11). This pattern of care also resulted in good compliance with beta blocker prescribing for those who had suffered a myocardial infarction. For asthma prescribing, patients who see their assigned PCP seven to 15 times per year and/or see SPs without a referral an

additional seven times did best (Clusters 2 and 9). For depression patients, those who see their assigned PCP six times per year and also see other PCPs 12 times per year did best (Cluster 10). In depression care, patients in Cluster 7 did worst. Patients in Cluster 4 (assigned to a PCP with 18 visits per year and with 18 visits to other PCPs) did best for the prescribing of medications to patients with CHF.

Diabetes is common and can result in significant health problems. Eye examinations were included as a process indicator as they are considered a key procedure to avoid blindness in diabetic patients. Cluster 3 (assigned to an SP with 18 visits per year) did best for this indicator and Cluster 7 (three visits per year to an assigned PCP) did the worst. Lower limb amputations are a rare negative consequence of poorly controlled diabetes, but they occurred more often for Cluster 9 (seven visits per year to their assigned PCP and to SPs without referral).

The analyses comparing the care provided between different clusters used Cluster 6 as the reference cluster. The choice of Cluster 6 as the reference was based on a theoretical expectation that seeing the same PCP consistently would lead to high quality care and that an average of seven visits per year would be sufficient to provide that high quality care. Cluster 6 was the second largest cluster with 18.5% of the chronic–condition cohort. The majority of the cohort (60.1%) followed the pattern of care that falls in to Cluster 7 (patient assigned to a PCP with three visits per year). None of the other clusters made up more than 10% of the cohort.

The analyses of the cluster groups used the PCP cluster group as the reference for comparison (Table 6.1). The mixed group had better outcomes for three indicators (asthma drug and congestive heart failure prescribing and follow up appointments for depression) while the SP cluster group was only better beta blocker prescribing post myocardial infarction.

Overall, it is difficult to draw any general conclusions about the patterns of care and quality of care provided. No patterns did well across all indicators and no patterns did poorly across all indicators. Seeing an SP almost exclusively resulted in preventive care such as immunizations being neglected but resulted in better rates of beta blocker prescription use. The frequency of visits to a PCP also seemed important for the provision of both preventative care and the other quality indicators.

Limitations

There are limitations that apply to the use of administrative claims data for research of this nature and other limitations that apply specifically to this study. Some of these have been described previously. The data used were not developed for research purposes and have several drawbacks. For example, despite our interest in doing a provincial population based study not all the provinces' population could be included. Some of the condition and outcome definitions used differ from those used in other jurisdictions and some have not been validated. A one–year timeframe for the outcomes meant that some outcomes like renal failure, MI, and stroke had small numbers which resulted in under–powered analyses. Finally, the large number of comparisons means that some findings that appear to be of statistical significance would have occurred by chance. Despite these limitations these results provide new and useful insights into the provision of primary care services in Manitoba.

Table 6.1: Summary of Cluster Performance for Process Indicators (2007/08–2009/10) and Health Outcomes (2010/11)* of Quality of Care

Chronic Condition	Better Performance Than PCP Cluster Group**	Worse Performance Than PCP Cluster Group
Hypertension		
Influenza Vaccination		SP and Mixed
Stroke		Mixed
Renal Failure		SP
Myocardial Infarction		
Total Respiratory Morbidity		
Influenza Vaccination		SP and Mixed
Asthma Drug Prescription	Mixed	
Depression		
Follow-Up Appointment	Mixed	SP
Diabetes Mellitus		
Influenza Vaccination		SP and Mixed
Eye Examination		Mixed
Lower Limb Amputation		
Ischemic Heart Disease		
Influenza Vaccination		SP and Mixed
Beta Blocker Prescription	SP	
Congestive Heart Failure		
Influenza Vaccination		Mixed
ACE-I & ARB Prescription †	Mixed	

* Only statistically significant results are presented

** Primary care physician (PCP) cluster group: reference group; Clusters 2, 6, 7, 8, and 9
Specialist (SP) cluster group: Clusters 1, 3, 11, and 12
Mixed cluster group: Clusters 4, 5, and 10

† Angiotensin Converting Enzyme Inhibitor (ACE-I)
Angiotensin II Receptor Blocker (ARB)

Conclusions

This report provides new information about the use of ambulatory care services in Manitoba. This information places current primary care reform initiatives in context. The findings support the focus on reform related to primary care providers as they provide the vast majority of primary care. There are, however, patterns of care that require further exploration. Many of the visits to SPs result from referrals from physicians other than the assigned primary care provider. While it is beyond the scope of this study to explain these visits, they clearly warrant further investigation. There are also patterns of care that involve very frequent visits to both primary care providers and SPs. There may be more effective ways of providing care to these patients. It is reassuring to note that these patterns of care are restricted to a very small group of patients.

While it is disappointing that we were not able to identify pattern(s) of care that represent high quality care across a variety of indicators, our findings support the role of PCPs in providing preventive care and indicate the need for regular contact for this care to be provided.

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GLOSSARY

Adjusted

Standardized across groups, in order to allow for comparison across groups. For example, **prevalence** or **rate** of an area may be adjusted by age and sex so as to provide an estimate of what an area's prevalence or rate might have been if that area's age and sex distribution was the same as that for the province overall. This adjustment removes the effects of demographic differences.

Administrative Data

Information collected "usually by government, for some administrative purpose (e.g., keeping track of the population eligible for certain benefits, paying doctors or hospitals), but not primarily for research or surveillance purposes" (Spasoff, 1999). Research at the **Manitoba Centre for Health Policy (MCHP)** uses administrative data from **hospital discharge abstracts**, physician (billing) claims, claims for prescription drugs, and other health related data. Using these data, researchers can study the utilization of health resources over time and the variations in rates within and across the provinces.

Spasoff, RA. *Epidemiologic Methods for Health Policy*. New York, NY: Oxford University Press; 1999

Ambulatory Visits

In this study, almost all contacts with physicians, including office visits, walk–in clinics, home visits, and visits to outpatient departments. Services provided to patients while admitted to hospital, **personal care homes (PCHs)**, or emergency departments; visits to pediatrics, radiology, pathology, and anaesthesiology; and most visits for prenatal care are excluded.

Anatomical Therapeutic Chemical (ATC) Drug Classification System

A drug classification system that is often used for research purposes. Drugs are divided into five main groups according to the target organ or system and/or the drug's therapeutic and chemical characteristics. The ATC classification is a component of the Health Canada Drug Product Database (Health Canada, 2011). ATC classifications are available online from the World Health Organization and are updated and published once a year (WHO Collaborating Centre for Drug Statistics Methodology, 2011).

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Asthma

A **chronic condition** in which inflammation of the airways restricts airflow into and out of the lungs.

Census

The official count of a population, often including demographic information such as age, sex, employment and income. **Statistics Canada** conducts a Census every five years. It takes account of persons living in Canada, including any individuals residing in Canada on a temporary basis and Canadians abroad on military missions or on merchant vessels that are registered in Canada (Statistics Canada, 2009).

Statistics Canada. 2006 Census Reference Material. 2009. http://www12.statcan.gc.ca/census–recensement/2006/index–eng.cfm. Accessed August 1, 2012.

Chronic Condition

A health condition that is generally incurable, is often caused by a complex interaction of factors, and usually has a prolonged clinical course.

Cluster Analysis

"A set of statistical methods used to group variables or observations in strongly interrelated subgroups" (Last, 2001). The process starts with each person/object as an individual cluster, groups items that are most similar, and gradually relaxes the grouping criteria until one overall group is formed. Unlike traditional statistics, cluster analysis does not calculate the ideal number of statistically different groups, but relies on people, using both mathematical and context specific knowledge, to decide when the clustering technique should stop.

Last JM, Spasoff RA, Harris SS, et al., (eds). A Dictionary of Epidemiology. 4th Edition. New York, NY: Oxford University Press; 2001.

Cohort

A group of subjects under examination in a study who share at least one common characteristic (e.g., age, health status).

Comorbidity

Coexistence or presence of more than one **chronic condition**. The number of comorbid conditions can be used to provide an indication of the health status of patients.

Confidence Interval

A computed interval with a given probability that the true value of a variable (e.g., an average or rate) is contained within the interval. For example, a 95% confidence interval would have a 95% probability of containing the true population value.

Congestive Heart Failure (CHF)

A **chronic condition** that is often referred to as heart failure or congestive cardiac failure. This condition is characterized by the inability of the heart to pump a sufficient amount of blood throughout the body or by the requirement for elevated filling pressures in order to pump effectively.

Continuity of Care

The extent to which individuals see a given healthcare provider (versus two or more other providers) over a specified period of time. A provider may be defined either as an individual physician, a physician group practice, or a clinic.

Depression

A mood disorder characterized by feelings of sadness, despair, discouragement, anger, frustration, and a lack of interest in activities that persist to the point that they interfere with daily life for an extended period of time (Miller, 2003).

Miller, B.F. *Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health*. 7th ed. Philadelphia, PA: Saunders; 2003.

Dermatologist

A physician that deals with the diagnosis and treatment of skin diseases (Miller, 2003).

Miller, B.F. *Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health*. 7th ed. Philadelphia, PA: Saunders; 2003.

Diabetes (Diabetes Mellitus)

A chronic endocrine disease relating to either a deficiency of the hormone insulin or an insensitivity of the target cells to insulin.

Dissemination Area (DA)

A small, relatively stable geographic unit composed of one or more blocks. It is the smallest standard area for which all **Census** data are disseminated. Dissemination areas cover all the territory of Canada; and in 2001, it replaced the enumeration area as a basic unit for dissemination (Statistics Canada, 2009).

Statistics Canada. 2006 Census Reference Material. 2009. http://www12.statcan.gc.ca/census–recensement/2006/index–eng.cfm. Accessed August 1, 2012.

Drug Program Information Network (DPIN)

An electronic, on–line, point–of–sale drug database. It links all community pharmacies (excluding pharmacies in hospitals or nursing homes/personal care homes) and captures information about drugs dispensed to Manitoba residents. DPIN is maintained by the Government of Manitoba's Ministry of Health.

Emergency Department

Hospital unit that is intended to provide rapid access to essential care for acutely ill patients.

Fiscal Year

For most Canadian government agencies and healthcare institutions, the fiscal year was defined as starting April 1 and ending the following year on March 31.

Health Outcomes (Outcome Indicators) – see Quality Indicators

Hospital Abstracts Database

A health administrative database consisting of hospital abstracts (forms/computerized records) filled out upon a patient's discharge (separation) from acute care hospitals and chronic care facilities. The latter were excluded from this study.

Hypertension

A **chronic condition** characterized by high blood pressure.

Incident

A new case (e.g., first diagnosis) of a specific disease, condition, or event within a specified time period. Incidence can be used to determine causality of diseases and to define and compare disease–specific cohorts.

Income Quintiles

A method used to measure the average household income of residents by aggregating household income to the **dissemination area (DA)** derived from **Census** data, ranking the DAs from poorest to wealthiest, and then grouping them into five income quintiles. Each quintile contains approximately 20% of the population of interest. In Manitoba, Q1 represents the poorest income quintile in the province and Q5 the wealthiest. Income quintiles for urban populations (Winnipeg and Brandon) span from U1 to U5, and income quintiles for rural populations (other Manitoba areas) span R1 to R5. Individuals that cannot be assigned an income quintile from census data are assigned to the Income Unknown group. This category includes individuals residing in facilities such as personal care homes, psychiatric facilities, prisons, or wards of the Public Trustee and Child and Family Services. Residents of areas reporting no income in the Census and households in areas with populations less than 250 persons are also grouped in this category. Income quintiles are often used as a proxy measure of **socioeconomic status**.

Inpatient Hospitalization

Hospital stays in which patients are admitted to hospital for at least one day.

International Classification of Diseases (ICD)

A classification system of diseases, health conditions, and procedures developed by the World Health Organization, the United Nations agency for health, which represents the international standard for the labeling and numeric coding of diseases and health related problems (morbidity). ICD–9–CM includes Clinical Modifications and is used extensively in Canadian hospitals. ICD–10–CA includes Canadian Enhancements, developed by Canadian Institute for Health Information for use in Canadian hospitals and other medical facilities. ICD–10–CA has been in use in Manitoba hospital abstracts since April 1, 2004.

Internists

"A specialist in diseases of the internal organs" (Miller & Brackman, 1972)

Miller BF, Brackman KC. *Encyclopedia and Dictionary of Medicine and Nursing*. Philadelpia, PA: W. B. Saunders Company; 1972.

Ischemic Heart Disease (IHD)

Also called coronary artery disease or coronary heart disease, this **chronic condition** is characterized by narrowed heart arteries, which lead to lack of blood and oxygen supply to the heart muscle and, subsequently, to heart problems. This condition can ultimately lead to a heart attack.

Logistic Regression

A statistical technique used when the outcome is a dichotomous (binary) variable. Logistic regressions model the probability of an event as a function of other factors. These models provide information about the association between the outcome and explanatory variables. The outcome may be associated with an increase or a decrease in the explanatory variables. This relationship is not necessarily causal because these relationships are based on observational data for the most recent time period.

Lower Limb Amputation

Removal of the lower leg below or including the knee by amputation.

Manitoba Centre for Health Policy (MCHP)

A unit within the Department of Community Health Sciences, Faculty of Medicine, University of Manitoba. MCHP is active in health services research, evaluation, and policy analysis, which concentrate on using the Manitoba **Population Health Research Data Repository (Repository)** to describe and explain patterns of care and profiles of health and illness.

Manitoba Health

A provincial government department responsible for providing healthcare services in Manitoba.

Manitoba Health Insurance Registry

A longitudinal population–based registry of all individuals who have been registered with **Manitoba Health** at any time since 1970. This registry includes date fields for registration, birth, entry into province, migration in/out of province, and death. This information can be used to track residents in longitudinal and intergenerational analyses. This follow–up can be achieved through the system of primary identification put in place by **Manitoba Health**. This system is based on the assignment of a registration number to every family in Manitoba and the assignment of a unique **Personal Health Identification Number (PHIN)** to every individual. The PHIN in the registry data received by MCHP is encrypted so that individuals cannot be identified. Individuals moving into the province and not yet eligible for coverage, families of military personnel (insured federally), and members of the RCMP (insured federally) are not included in the registry. "Snapshot files" of the Manitoba Health Insurance Registry data, received semi–annually at the **Manitoba Centre for Health Policy (MCHP)** from Manitoba Health, are used to create and maintain information in the **MCHP Research Registry**.

Manitoba Immunization Monitoring System (MIMS)

A population–based monitoring system that provides monitoring and reminders to help achieve high levels of immunization. The goal of this system is to compile information on all immunizations administered in Manitoba, in order to ensure that recommended immunizations are received. Immunization status is monitored by comparing the system record and the recommended schedule. This system also gives information on immunization histories and some demographic information from the **Manitoba Health Insurance Registry**. In 2005/06, the MIMS database included approximately 200,000 immunization records and about 170 data elements that were input by 134 sites in Manitoba with MIMS access.

MCHP Research Registry (Research Registry)

A longitudinal population–based research registry that is derived from data in the **Manitoba Health Insurance Registry** and other data files in the MCHP Data Repository. "Snapshot files" of the Manitoba Health Insurance Registry data, received semi–annually at the **Manitoba Centre for Health Policy (MCHP)** from **Manitoba Health**, are integrated with historical registry data at MCHP to maintain the MCHP Research Registry. Consistent programming efforts are applied to the repository data files in order to provide value–added data from the MCHP Research Registry. The Research Registry is a key resource for the research conducted at MCHP and is central to the use of the **Population Health Research Data Repository**.

Medical Services Database

An administrative health database consisting of medical (hospital/physician) claims for physician visits in offices, hospitals, and outpatient departments; fee–for–service components for tests such as lab and x–ray procedures performed in offices and hospitals; and payments for on–call agreements. In Manitoba, fee–for–service providers must submit claims to **Manitoba Health** for reimbursement and a small proportion of salaried physicians also submit evaluation claims (shadow billing).

Mood Disorders

Mood disorder is the term given for a group of diagnoses in the Diagnostic and Statistical Manual of Mental Disorders classification system where a disturbance in the person's mood is hypothesized to be the main underlying feature.

Myocardial Infarction

Also known as a heart attack, a myocardial infarction occurs when an area of the heart muscle (myocardium) dies or is permanently damaged due to inadequate supply of blood flow and oxygen to that area. The interruption of blood is usually caused by narrowing of the coronary arteries; this may lead to accumulation of cholesterol on the inner wall of blood vessels that distribute blood to the heart muscle and a blood clot.

Nurse Practitioners

Registered nurses with advanced training that allows them to provide a full range of primary care services to patients in a variety of settings.

Odds Ratio

The ratio of the odds (likelihood) of an event occurring in one group to the odds of it occurring in another group or to a data–based estimate of that ratio. These groups might be men and women, an experimental group and a control group, or any other dichotomous classification.

Ophthalmologist

A medical doctor who has undergone specialty training to diagnose and treat disorders of the eye.

Optometrist

Although not a doctor of medicine, an optometrist is specifically trained to diagnose eye abnormalities and prescribe, supply, and adjust eyeglasses and contact lenses.

Personal Health Information Number (PHIN)

A unique numeric identifier assigned by **Manitoba Health** to every person registered for health insurance in Manitoba and to non–residents who are treated at facilities that submit claims electronically. Introduced as a linkage key in 1984, it was issued to the public in 1994 as the basic access identifier for the Pharmacare/**Drug Programs Information Network (DPIN)**. At the Manitoba Centre for Health Policy (MCHP), the PHIN is a scrambled (encrypted) version of the Manitoba Health PHIN assigned via the Research Registry. Unique numeric identifiers are assigned to individuals who do not have scrambled numeric PHINs.

Physician Claims

Also called physician billing claims, these data are stored in the **Medical Services Database** and contain information about ambulatory services: physician service information (which identify provider), type of service provided, when and to whom the service was provided, and the fee or tariff related to the service. Fee–for–service physicians receive payment based on these claims, while those submitted by physicians on alternate payment plans (APP) are for administrative purposes only (sometimes referred to as "shadow billing").

Physician Resource Database

An elaboration of the basic physician information available to the Population Health Research Data Repository (Repository) from Manitoba Health. It contains physicians' demographic data and information derived from analysis of their practice patterns. These data can be used to analyze other components of the Repository from the perspective of physicians.

Population Health Research Data Repository (Repository)

A comprehensive collection of administrative, registry, survey, and other databases primarily comprised of residents of Manitoba. This repository is housed at the **Manitoba Centre for Health Policy (MCHP)**, where it was developed to describe and explain patterns of healthcare and profiles of health and illness. The repository was designed to facilitate inter–sectorial research in areas such as healthcare, education, and social services.

Primary Care

The first contact of a patient with the healthcare system that "includes assessment, diagnosis, treatment, and prevention of common illnesses generally provided by family physicians and nurses" (Manitoba Health, 2012).

Manitoba Health. Primary Care. 2012. http://www.gov.mb.ca/health/primarycare. Accessed on October 2, 2012.

Primary Care Physician (PCP)

A general practitioner or family physician who assesses, diagnoses, and treats common illnesses and who typically serves as a patient's first contact with the healthcare system (Orgain, 2009).

Orgain, JC. Primary–Care Physician. In: Mullner, R.M., ed. *Encyclopedia of Health Services Research*. Thousand Oaks, CA: SAGE Publications Inc.; 2009.

Prevalence

Proportion of the population with a given disease at a given time. The measure of a condition in a population at a specific point in time is referred to as point prevalence. Period prevalence measures the number of individuals with a particular condition in the population during a period of time. Period prevalence is the most common measure of prevalence used in studies at the **Manitoba Centre for Health (MCHP)**. Prevalence data provide an indication of the extent of a condition and may have implications for the provision of services needed in a community. Prevalence could potentially be affected by the age and sex distribution of an area; hence, prevalence is often **adjusted** for fair comparisons between areas.

Process Indicators – see Quality Indicators

Psychiatrist

A physician that deals with the study, treatment, and prevention of mental disorders (Miller, 2003).

Miller, B.F. *Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health*. 7th ed. Philadelphia, PA: Saunders; 2003

Quality Indicators (Quality of Care Indicators)

Markers that have been developed at the **Manitoba Centre for Health Policy (MCHP)** to reflect the presence or absence of potential shortcomings in the provision of primary care. These indicators are not intended to identify definitive problems in the quality of healthcare provision, but, rather, are intended to serve as triggers for decision–makers and healthcare providers to conduct further exploration. Quality of care indicators are grouped into four categories: structural, diagnostic, process, and outcome. In this study, process indicators and health outcomes (outcome indicators) were investigated. Process indicators reflect the standards of care provided by evaluating the clinical and interpersonal effectiveness (care) of healthcare staff. Outcome indicators reflect the consequences of care by evaluating the health status of individuals (Campbell et al., 2000).

Campbell SM, Cantrill JA, Roberts D. Prescribing indicators for UK general practice: Delphi consultation study. *BMJ* 2000;321(7258):425–428.

Rate

The number of people with a given condition or procedure divided by the number of people living in that area. Rates are helpful in determining the burden of disease and the number of residents with that condition or procedure. Rates could potentially be affected by the age and sex distribution of an area; hence, most rates are **adjusted** for fair comparisons between areas.

Regional Health Authority (RHA)

Regional governance structure set up by the province to be responsible for the delivery and administration of health services in specified areas. In Manitoba, between July 1, 2002 and May 31, 2012, there were 11 RHAs: Winnipeg, Brandon, South Eastman, Assiniboine, Central, Parkland, North Eastman, Interlake, Burntwood, NOR–MAN, and Churchill. On June 1, 2012, the 11 RHAs were amalgamated into five larger regions, which were not used in this report: Winnipeg (Winnipeg, Churchill), Interlake–Eastern (Interlake, North Eastman), Western (Assiniboine, Brandon, Parkland), Southern (Central, South Eastman), and Northern (Burntwood, NOR–MAN) (Canadian Legal Information Institute, 2012).

Canadian Legal Information Institute. Amalgamation of Regional Health Authorities Regulation, 2012. C.C.S.M. c. R34. 2012.

Renal Failure

The loss of the kidneys' ability to remove wastes, concentrate urine, and maintain electrolytes levels in the blood.

Socioeconomic Status (SES)

Characteristics of economic, social, and physical environments in which individuals live and work, as well as, their demographic and genetic characteristics. As done in this study, it is ranked from 1 (poor) to 5 (wealthy), based on **income quintiles** that measure mean household income, and grouped into five income quintiles, each quintile assigned to 20% of the population.

Statistics Canada

A federal government agency commissioned with producing statistics to help better understand Canada's population, resources, economy, society, and culture (Statistics Canada, 2012).

Statistics Canada. About Us. 2012. http://www.statcan.gc.ca/about–apercu/about–apropos–eng.htm. Accessed August 2, 2012.

Specialist Physician (SP)

A physician whose practice is limited to a specific area of medicine that requires additional training. SPs are identified by a code in the **Physician Resource Database**. This includes physicians in the area of psychiatry, pediatrics, obstetrics and gynecology, medical specialty (internal, neurology, geriatrics, rheumatology, dermatology), general surgery, oral surgery, and surgery SP (thoracic and cardio, plastic, urological, orthopaedic, neurological, ophthalmology, otorhinolaryngology).

Stroke

The rapidly developing loss of brain functions due to an interruption in the supply of blood to the brain.

Suppression

At the **Manitoba Centre for Health Policy (MCHP)**, in order to avoid potential identification of individuals in an area, data are suppressed when the number of persons or events involved is five or less. Data are not suppressed when the actual event count is zero. This process of suppressing data is conducted to protect the anonymity of study participants.

Total Respiratory Morbidity (TRM)

A measure of the burden of respiratory illnesses in the population. This may include any respiratory illnesses: asthma, chronic or acute bronchitis, emphysema, chronic airway obstruction, or chronic obstructive pulmonary disease (COPD). This combination of diagnoses is used to overcome problems resulting from different **primary care physicians (PCPs)** or **specialist physicians (SPs)** using different diagnosis codes for the same underlying illness (e.g., asthma versus chronic bronchitis).

Vital Statistics (Mortality) Database

A database of mortality records and causes of death of people who died in Manitoba. This database is maintained by the Manitoba Vital Statistics Agency, a member of the Vital Statistics Council for Canada. The Vital Statistics Agency is responsible for keeping records and registries of all births, stillbirths, deaths, marriages, and name changes that take place in Manitoba (Vital Statistics Agency, 2012).

Vital Statistics Agency. Vital Statistics Agency. 2012. http://vitalstats.gov.mb.ca. Accessed October 5, 2012.

Appendix Table A1.1: Definitions and Codes Used for Chronic Conditions and Relevant Quality of Care Indicators, 2007/08–2010/11

Chronic Conditions and Quality of Care Indicators	Definitions and Codes
Hypertension	
	• at least one hospital diagnosis: hypertensive diseases (ICD10-CA codes: I10-I15) in three years **OR** • at least two ambulatory visit diagnoses: hypertensive and chronic kidney diseases (ICD-9-CM codes: 401-405) in three years **OR** • at least two prescriptions: antihypertensives (ATC codes: C02AB01, C02DC01), diuretics (ATC codes: C03BA11, C03DB02), beta blocking agents (ATC codes: C07AA12, C07AB03, C07CA03), calcium channel blocker (ATC codes: C08DA01), angiotensin converting enzyme inhibitors (ACEI; ATC codes: C09AA05, C09BA02), angiotensin II antagonists (ATC codes: C09CA01, C09DA01) in three years
Influenza Vaccination	• at least one influenza vaccination (tariff: 8791) in three years
Myocardial Infarction	• no hospital diagnosis in three years: myocardial infarction (ICD-10-CA codes: I21.0-I21.4, I21.9-I22.1, I22.8, I22.9, I51.3)**AND** at least one hospital diagnosis: myocardial infarction (ICD-10-CA codes: I21.0-I21.4, I21.9-I22.1, I22.8, I22.9, I51.3) in the year following the three-year period
Renal Failure	• no hospital diagnosis in three years: renal failure (ICD-10-CA codes: N17-N19), dependence on renal dialysis (ICD-10-CA codes: Z99.2) **AND** at least one hospital diagnosis: renal failure (ICD-10-CA codes: N17-N19), dependence on renal dialysis (ICD 10-CA codes: Z99.2) in the year following the three-year period
Stroke	• no hospital diagnosis in three years: stroke (ICD-10-CA: I61, I63, I64) **AND** at least one hospital diagnosis: stroke (ICD-10-CA: I61, I63, I64) in the year following the three-year period
Total Respiratory Morbidity (TRM)	
	• at least one hospital diagnosis: bronchitis and bronchiolitis (ICD-10-CA codes: J20, J21, J40, J41, J42), emphysema (ICD-10-CA code: J43), asthma (ICD-10-CA code: J45), chronic airway obstruction (ICD-10-CA code: J44) in three years **OR** • at least one ambulatory visit diagnosis: bronchitis and bronchiolitis (ICD-9-CM codes: 466, 490, 491), emphysema (ICD-9-CM codes: 492), asthma (ICD-9-CM code: 493), chronic airway obstruction (ICD-9-CM code: 496) in three years
Influenza Vaccination	• at least one influenza vaccination (tariff: 8791) in three years
Asthma	
	• member of the chronic cohort in three years **AND** at least two prescriptions: beta 2-adrenoreceptor agonists (ATC code: R03AA, R03AB, R03AC) in three years
Drug Prescription	• at least one prescription: inhaled corticosteroids (ATC code: R03BA), leukotriene antagonists (R03DC), adrenergics (ATC codes: R03AK) in three years

Appendix Table A1.1:Continued

Mood Disorders	
	• one hospital diagnosis: mood disorders (ICD-10-CA codes: F36, F33, F38, F38.1), stress and adjustment disorders (ICD-10-CA codes: F43,F43.2,F43.8), mental and behavioural disorders (ICD-10-CA codes: F53), emotional disorders (ICD-10-CA codes: F93) in three years **OR** • three ambulatory visit diagnoses: mood disorders (ICD-9-CM codes: 296), reaction to stress and adjustment disorders (ICD-9-CM codes: 309), depressive disorders (ICD-9-CM codes: 311) in three years **OR** • one hospital diagnosis: anxiety disorders (ICD-10-CA codes: F40, F41, F41.1), depressive disorders (ICD-10-CA code: F32), mood disorders (ICD-10-CA code: F34.1), obsessive-compulsive disorders (ICD-10-CA code: F42), dissociative disorders (ICD-10-CA code: F44), somatoform disorders (ICD-10-CA codes: F45.0, F45.1) in three years **AND** at least one prescription: antidepressants and mood stabilizers (ATC codes: N03AB02, N03AB52, N03AF01, N06A) in three years **OR** • three ambulatory visit diagnoses: anxiety disorders (ICD-9-CM code: 300) in three years **AND** at least one prescription antidepressants and mood stabilizers (ATC codes: N03AB02,N03AB52,N03AF01,N06A) in three years
Follow-Up Appointment for Depression	• at least one hospital diagnosis: depression (ICD-10-CA codes: F36, F33, F38, F38.1) in three years **OR** a new ambulatory care diagnosis: depression (ICD-9-CA codes: 296, 311) with an antidepressant prescription (ATC codes: N06AA, N06AB, N06AF, N06AG, N06AX) within two weeks **AND** • three subsequent ambulatory visits within four months of the first drug prescription
Diabetes Mellitus (Diabetes)	
	• at least one hospital diagnosis: diabetes (ICD-10-CA codes: E10-E14) in three years **OR** • at least two ambulatory visit diagnoses: diabetes (ICD-9-CM code: 250) in three years **OR** • at least one prescription: insulin and analogues (ATC code: 10A), blood glucose lowering drugs, excluding prescriptions for insulin (ATC code: 10B) in three years
Influenza Vaccination	• at least one influenza vaccination (tariff: 8791) in three years
Eye Examination	• one or more visits to an optometrist (MD Bloc: 053) in three years **OR** • one or more visits to an ophthalmologist (MD Bloc: 051) in three years
Lower Limb Amputation	• no lower limb amputation (ICD–9–CM procedures: 84.10–84.17; CCI code: 1.VC.93, 1.VG.93, 1.VQ.93, 1.WA.93, 1.WE.93, 1.WJ.93, 1.WL.93, 1.WM.93) in three years **AND** at least one lower limb amputation (ICD–9–CM procedures: 84.10–84.17; CCI codes: 1.VC.93, 1.VG.93, 1.VQ.93, 1.WA.93, 1.WE.93, 1.WJ.93, 1.WL.93, 1.WM.93) in the year following the three-year period, **excluding** amputations due to accidental injury (ICD–9–CM codes: 895, 896, 897; ICD–10–CA codes: S78, S88, S98, T05.3, T05.4, T05.5, T13.6)

Appendix Table A1.1: Continued

Ischemic Heart Disease (IHD)	
	• at least one hospital diagnosis: IHD (ICD-10-CA codes: I20-I25) in three years **OR** • at least two ambulatory visit diagnoses: IHD (ICD-9-CM codes: 410-414) in three years **OR** • at least one ambulatory visit diagnosis: IHD (ICD-9-CM codes: 410-414) in three years **AND** at least two prescriptions: vasodilators (ATC codes: C01DA02, C01DA05, C01DA08, C01DA14), other cardiac drugs (ATC codes: C01EB09), beta blocking agents (ATC codes: C07AA02, C07AA03, C07AA05, C07AA06, C07AA12, C07AB02, C07AB03, C07AB04, C07AB07, C07AG01, C07BA05, C07BA06, C07BA12, C07CA03, C07CB03), calcium channel blockers (ATC codes: C08CA01, C08CA02, C08CA04, C08CA05, C08CA06, C08DA01, C08DB01), angiotensin converting enzyme inhibitors (ACEI; ATC codes: C09AA01, C09AA02, C09AA03, C09AA04, C09AA05, C09AA06, C09AA07, C09AA08, C09AA09, C09AA10, C09BA02, C09BA03, C09BA04, C09BA06, C09BA08), angiotensin II antagonists (ATC codes: C09CA01, C09CA02, C09CA03, C09CA04, C09CA06, C09CA07, C09DA01, C09DA02, C09DA03, C09DA04, C09DA06, C09DA07) in three years
Influenza Vaccination	• at least one influenza vaccination (tariff: 8791) in three years
Drug Prescription for Myocardial Infarction	• at least one hospital diagnosis: myocardial infarction (ICD-10-CA codes: I21.0-I21.4, I21.9-I22.1, I22.8, I22.9, I51.3), **excluding** hospital diagnoses of bronchitis (ICD-10-CA codes: J41.0, J41.1, J41.8, J42), emphysema (ICD-10-CA codes: J43.0-J43.2, J43.8, J43.9), chronic obstructive pulmonary disease (ICD-10-CA codes: J44.1, J44.8), asthma (ICD-10-CA codes: J45.0, J45.01, J45.10, J45.11, J45.80, J45.81, J45.90, J45.91), peripheral vascular disease (ICD-10-CA codes: I73.0, I73.1, I73.8, I73.9, I79.2) in three years **AND** at least one prescription: beta-blockers (ATC codes: C07AA, C07AB) in three years
Congestive Heart Failure (CHF)	
	• at least one hospital diagnosis: heart failure (ICD-10-CA code: I50), congestive heart failure (ICD-10-CA code: I50.0) in three years **OR** • at least three ambulatory visit diagnoses: heart failure (ICD-9-CM code: 402, 428) in three years
Influenza Vaccination	• at least one influenza vaccination (tariff: 8791) in three years
Drug Prescription	• at least one prescription: angiotensin converting enzyme inhibitor (ACEI; ATC codes: C09A, C09B), angiotensin II receptor blockers (ARB; ATC codes: C09C, C09D) in three years

APPENDIX 2: CRUDE RATES OF QUALITY OF CARE INDICATORS

Appendix Table A2.1: Crude Rates of a Process Indicator per 100 Manitoba Patients with Hypertension by Cluster, 2007/08–2009/10

Cluster	Annual Influenza Vaccination
1	15.03
2	30.84
3	18.38
4	13.06
5	12.90
6	24.34
7	9.52
8	24.18
9	29.79
10	14.10
11	13.76
12	s
13	8.04

s Indicates data suppressed due to small numbers

Appendix Table A2.2: Crude Rates of Health Outcomes per 1,000 Manitoba Patients with Hypertension by Cluster, 2010/11

Cluster	Stroke	Renal Failure	Myocardial Infarction
1	27.11	28.71	s
2	38.12	45.78	12.02
3	29.85	22.39	s
4	47.62	s	s
5	27.01	24.73	7.81
6	29.39	30.28	8.14
7	18.35	17.36	5.78
8	s	41.67	s
9	37.35	53.61	9.23
10	29.79	41.06	5.64
11	24.36	35.50	5.01
12	s	s	*
13	s	114.75	s

* Indicates no outcome in this cluster

s Indicates data suppressed due to small numbers

Appendix Table A2.3: Crude Rates of a Process Indicator per 100 Manitoba Patients with Total Respiratory Morbidity by Cluster, 2007/08–2009/10

Cluster	Annual Influenza Vaccination
1	12.47
2	26.78
3	13.10
4	11.25
5	7.07
6	19.74
7	4.36
8	25.00
9	26.70
10	9.32
11	8.33
12	6.82
13	s

s Indicates data suppressed due to small numbers

Appendix Table A2.4: Crude Rates of a Process Indicator per 100 Manitoba Patients with Asthma by Cluster, 2007/08–2009/10

Cluster Number	Asthma Drug Prescription
1	66.36
2	71.67
3	67.21
4	68.60
5	67.50
6	69.14
7	65.37
8	64.60
9	71.42
10	68.74
11	66.77
12	72.41
13	66.67

Appendix Table A2.5: Crude Rates of a Process Indicator per 100 Manitoba Patients with Depression by Cluster, 2007/08–2009/10

Cluster	Follow-Up Appointment
1	47.20
2	57.32
3	43.03
4	52.44
5	56.72
6	54.87
7	43.53
8	47.62
9	55.04
10	61.65
11	43.93
12	36.67
13	58.33

Appendix Table A2.6: Crude Rates of Process Indicators per 100 Manitoba Patients with Diabetes Mellitus by Cluster, 2007/08–2009/10

Cluster	Annual Influenza Vaccination	Eye Examination
1	14.51	52.37
2	30.91	59.72
3	21.35	58.99
4	14.53	52.14
5	11.87	49.47
6	25.86	57.44
7	9.32	47.59
8	20.93	59.30
9	30.54	60.65
10	12.23	53.57
11	11.24	48.32
12	s	56.41
13	7.29	56.25

s Indicates data suppressed due to small numbers

Appendix Table A2.7: Crude Rates of a Health Outcomes per 1,000 Manitoba Patients with Diabetes Mellitus by Cluster, 2010/11

Cluster	Lower Limb Amputation
1	*
2	4.37
3	*
4	s
5	1.94
6	1.18
7	1.09
8	*
9	5.07
10	s
11	1.79
12	*
13	s

* Indicates no outcome in this cluster

s Indicates data suppressed due to small numbers

Appendix Table A2.8: Crude Rates of a Process Indicator per 100 Manitoba Patients with Ischemic Heart Disease by Cluster, 2007/08–2009/10

Cluster	Annual Influenza Vaccination
1	31.25
2	34.23
3	37.93
4	19.36
5	15.72
6	30.19
7	13.59
8	31.37
9	33.33
10	14.98
11	17.16
12	s
13	10.71

s Indicates data suppressed due to small numbers

Appendix Table A2.9: Crude Rates of a Process Indicator per 100 Manitoba Patients with Myocardial Infarction by Cluster, 2007/08–2009/10

Cluster	Beta Blocker Prescription
1	s
2	42.81
3	50.00
4	s
5	33.79
6	36.61
7	23.87
8	s
9	45.64
10	53.49
11	47.34
12	*
13	s

* Indicates no outcome in this cluster

s Indicates data suppressed due to small numbers

Appendix Table A2.10: Crude Rates of Process Indicators per 100 Manitoba Patients with Congestive Heart Failure by Cluster, 2007/08–2009/10

Cluster	Annual Influenza Vaccination	ACE-I & ARB* Prescription
1	0.2593	0.6111
2	0.3133	0.7307
5	0.1455	0.6675
6	0.2874	0.6838
7	0.1069	0.5729
9	0.3188	0.7816
10	0.1489	0.7731
11	0.1092	0.7196
3,4,8,12,13**	0.2371	0.7938

* Angiotensin Converting Enzyme Inhibitor (ACE-I)
Angiotensin II Receptor Blocker (ARB)

** Clusters were combined due to small numbers

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