Note: The Table of Contents have been linked to the various sections of the report.

Within the text of the report you will find bolded words. These words are linked to their Glossary definitions.

Using Administrative Data to Develop Indicators of Quality in Family Practice

March 2004

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Dedication

We dedicate this report to Fred Toll. Fred died on December 4, 2003 after a brief fight with cancer.

Although "retired," Fred provided a valuable link between MCHP and Manitoba Health since MCHP first opened its doors in 1991. Whenever we needed to understand better how things worked at Manitoba Health, we knew we could count on Fred. He would track down the answer and report back with thoroughness and detail. This thoroughness was borne out in the history he wrote for us, *Key Events and Dates in Manitoba's Health Care System*. His attention to detail served us well in his role as proofreader. When we thought we had finished writing a report, we handed it to Fred to check. The report would always be returned festooned with yellow Post-it notes pointing out errors and inconsistencies we had missed. This report is the last one to benefit from his careful eye.

But we'll miss far more than the tasks Fred did for us. We'll miss his good cheer, his energy, his ready smile, his inquisitiveness, his warm sympathy, and his constant readiness to be of help. We are sad to see him go, but he'll live in our memories.

The Manitoba Centre For Health Policy

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

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

We thank the University of Manitoba, Faculty of Medicine, Health Research Ethics Board for their review of this project. The Manitoba Centre for Health Policy 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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The principal author, Alan Katz, thanks all members of the research team whose knowledge, skills and expertise were essential to the generation of this report. It has been a privilege to work with this committed group. In particular, Carolyn De Coster for her guidance and patience, Bogdan Bogdanovic for his programming and insight into the data repository, and Ruth-Ann Soodeen for keeping us on track and her significant contribution to the final report. Dan Chateau's statistical expertise provided an essential component to the research.

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The external academic review provided by Dr Marie-Dominique Beaulieu was thoughtful, insightful and constructively critical.

Two groups of community-based family physicians attended focus groups in Winnipeg and one group in rural Manitoba. Their input into the development of the indicators was an essential part of the study.

We acknowledge the financial support of the Department of Health of the Province of Manitoba. The results and conclusions are those of the authors and no official endorsement by Manitoba Health was intended or should be inferred. This report was prepared at the request of Manitoba Health, as part of the contract between the University of Manitoba and Manitoba Health.

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Purpose of the Study

Medical practitioners have traditionally relied upon "professional standards" and their patients' trust as an indication of the quality of service provided to patients. However, these standards are rarely explicitly defined. Although quality assurance initiatives have been growing more common in the United Kingdom and the United States, in Canada the quality improvement movement has had very little impact on the medical profession. The Sinclair Report based on the inquiry into Paediatric Cardiac Surgery deaths in Winnipeg highlighted the need for ongoing monitoring of the quality of care in Manitoba. The Manitoba Minister of Health responded to this report with the introduction of the Medical Amendment Act, which received assent on August 9, 2002. This Act provides for the creation of individual physician profiles by the College of Physicians and Surgeons of Manitoba which are to be made available to the public.

In light of the growing interest in quality of care in Manitoba, the Manitoba Center for Health Policy undertook this study. Its primary goal was to develop acceptable indicators of quality of care that can be used to measure quality in primary care focussing on family physician behaviour. To accomplish this, we had three main objectives. Our first objective was to identify indicators that were acceptable to practising family physicians. If the goal of the quality improvement exercise is to change family physician behaviour, the family physicians need to be involved in the development of the indicators to be used. Our second objective was to explore the validity of measuring the selected indicators using administrative data available in the Population Health Research Data Repository (Repository). The appropriate approach to measuring quality depends on the indicator(s) of interest. Possible approaches include medical record audit, surveys of patients or physicians, direct observation of patient-physician interactions, and administrative data analysis. Although the validity of administrative data from ambulatory care has been questioned by clinicians, numerous studies have established the reliability of administrative data when compared to other sources of data. The availability of administrative data makes a compelling case for their use. Our third objective was to describe the quality of care provided by Manitoba family physicians using the selected indicators.

The analyses for this report were based on the administrative data contained in the Population Health Research Data Repository housed at the Manitoba Centre for Health Policy (MCHP). The Repository is a comprehensive database that contains records for all Manitobans' contacts with physicians, hospitals, home care, personal care homes, and pharmaceutical prescriptions. The Repository records are anonymous, as prior to data transfer Manitoba

Health processes the records to encrypt all personal identifiers and remove names and addresses of both patients and physicians.

Methods

Indicators were developed based on a review of the literature, their feasibility using administrative data, and the input of community-based practising family physicians. We consulted with three physician focus groups, two in Winnipeg and one in rural Manitoba; the groups reviewed our initial list and suggested modifications. A Working Group was established to advise and provide feedback on the project. The list of indicators was divided into two groups: disease prevention/health promotion, and acute and chronic disease management. Each family physician in Manitoba was 'scored' on each of the indicators. Comparisons were made between physicians in Winnipeg, Brandon and the rest of Manitoba (Non-Urban).

Following feedback from the Working Group, standardized summary scores were created across the included indicators for each physician. These scores, (the Quality Index), were the outcome variables in regression models developed to determine the practice and physician characteristics that were associated with differences in quality. The six physician characteristics were age, sex, training (Canadian vs. other), years practising in Manitoba (up to 11 years, as per data availability), payment method (salaried vs. fee-for-service), and whether the physician had hospital privileges. The practice characteristics were practice size (i.e., total number of visits), average patient age and sex, average neighbourhood income level of patients, intensity of the practice (average total costs per patient), patient morbidity, and continuity of care.

Defining Practice Populations

Before we could measure the quality indicators, it was first necessary to define each physician's practice population by assigning patients to physicians. The quality of care indicators were then applied to those patients who make up the practice population of each physician. A fundamental assumption for this study was that patients should be assigned to the physician who provided most of that patient's care. Once a patient had been allocated to a specific physician, all the relevant services they received—visits, immunizations, drug prescriptions or laboratory tests—were used in the measurement of the indicators, regardless of which physician (or nurse) initiated those services. Our method of assignment was based on the value of the visits (excluding procedures) provided. We assumed that a visit for a Complete History and Physical Examination demonstrated a stronger link with a physician than a lower-valued regional intermediate visit, which in turn was a stronger link than the lower-valued regional basic visit. If two physicians supplied primary care visits of equal value to the same patient, the patient was allocated to the physician whose referrals to other services (e.g., lab and imaging) and to other specialists generated the highest expenditures. All analyses were carried out on these "virtual" practices of allocated patients.

The Indicators: Definitions

The indicators that required laboratory information include only Winnipeg physicians due to data limitations; these have been identified with an asterisk in the following list.

A. Disease Prevention/Health Promotion Indicators

1. *Childhood Immunization*: The percentage of patients (born in 1998) who received their primary course of immunization (DPT-HiB and Polio x4, and MMR) by age 24 months.
2. *Influenza Vaccination*: The percentage of patients, aged 65 years or older, who received at least one influenza vaccine in the past two years
3. *Cervical Cancer Screening*: The percentage of female patients aged 18 to 60 (excluding those who have undergone a hysterectomy) who had at least one Pap test in the last three years.
4. *Cholesterol Screening**: The percentage of male patients over 40 years old and female patients over age 50 who had a test in the past five years.
5. *Blood Sugar Screening**: The percentage of patients aged 48 years or older who had at least one blood sugar test in the previous three years.

B. Acute and Chronic Disease Management

1. *Anticoagulation Medication Monitoring**: The percentage of patients with a 30-day supply (or more) of anticoagulants who had at least one blood clotting test per each 45-day period.
2. *Antidepressant Prescription Follow-up*: The percentage of patients with a new prescription for an antidepressant associated with a depression diagnosis (within two weeks of each other) who had three subsequent ambulatory visits within four months of the prescription being filled.
3. *Asthma Care*: The percentage of patients with an asthma diagnosis (defined as those who had one repeat prescription of a beta 2-agonist in the past year) who filled a prescription for medications recommended for long term control of asthma (i.e., inhaled corticosteroids or leukotriene modifiers, an alternate anti-inflammatory medication).
4. *Potentially inappropriate prescribing of benzodiazepines for older adults*: The percentage of patients aged 75 years or older with prescription(s) for two or more benzodiazepines or prescriptions for greater than a 30-day supply of medication. **Note**: For this indicator, a lower percentage for the outcome is desirable.
5. *Diabetes Care: Cholesterol Testing**: The percentage of diabetic patients (defined as those who had at least one drug used to treat diabetes) who had a cholesterol screening test in the same fiscal year as the prescription.
6. *Diabetes care: Eye Examination*: The percentage of diabetic patients (defined as those who had at least one drug used to treat diabetes) who saw either an optometrist or ophthalmologist in the same fiscal year as the prescription.

7. *Post-Myocardial Infarction Care*: *Beta-Blocker Prescribing*: The percentage of patients discharged alive from hospital in the preceding three years with a discharge diagnosis of myocardial infarction (excluding those with a prior diagnosis of asthma, COPD or peripheral vascular disease) who filled at least one prescription for a beta-blocker within four months of the first infarction.
8. *Post-Myocardial Infarction Care*: *Cholesterol testing**: The percentage of patients discharged alive from hospital in the preceding three years with a discharge diagnosis of myocardial infarction who had a cholesterol test within four months of discharge.

The Indicators: Results

Our results are illustrated in Table 1. In order to describe the family physicians' quality of care for each indicator, we measured the proportion of patients, allocated to a given physician, who met the target. So, for example, if 1,000 women (who had not undergone hysterectomy) between the ages of 18 and 60 were allocated to a particular physician, and 800 of them had received a Pap test in the prior three years (regardless of whether it was provided by the primary physician or a different physician), then the 'score' for that physician was 80%. The table gives the averages of these scores for all practices in a particular region.

Table 1: Comparison of physician rates for each indicator by location of practice

Indicator	Proportion of eligible patients for whom the physicians met the target (mean for all physicians in region)			Comment
	Winnipeg	Brandon	Non-Urban	
Childhood Immunization	64%	68%	67%	No significant differences between regions
Influenza Vaccination	63%	65%	57%	Rate for Non-Urban significantly lower
Cervical cancer screening	71%	71%	60%	Rate for Non-Urban significantly lower
Cholesterol screening[1]	**68%**	--	--	
Blood sugar screening[1]	**70%**	--	--	
Anticoagulation medication monitoring[1]	**35%**	--	--	
Antidepressant prescription follow-up	49%	51%	43%	Winnipeg significantly higher than Non-Urban
Asthma care	59%	61%	64%	Winnipeg significantly lower than Non-Urban
Benzodiazepine prescribing[2]	15%	16%	13%	Winnipeg significantly higher than Non-Urban
Diabetes: Cholesterol screening[1]	**54%**	--	--	
Diabetes: Eye exams	37%	48%	40%	All three regions significantly different from each other
Post MI: Beta-blocker prescribing	63%	62%	54%	Winnipeg significantly higher than Non-Urban
Post MI: Cholesterol testing[1]	**35%**	--	--	

[1] Available for Winnipeg practices only
[2] For this indicator, a lower value is more desirable.

Quality of Care Index: Results

Separate regression models were run for Urban (Winnipeg, Brandon) and Non-Urban physicians for both the prevention and the disease management indicators (i.e., four models). In the regressions, the Quality Index score was the outcome variable and the potential explanatory variables were physician and practice characteristics.

There was significant variation across Manitoba physicians; many met published standards while others did not meet either national targets or the standards prescribed in clinical practice guidelines. We found patient and practice characteristics that were associated with higher quality preventive care.

Our models for the Preventive Care Index had high R^2 values, 38% for Non-Urban and 44% for Urban. In Non-Urban practices, the characteristics associated with higher quality preventive care were being a younger physician, providing higher intensity of care, having more female patients, older patients, and higher-income patients. For Urban practices, higher scores on the Preventive Care Index were associated with being a Canadian graduate, having hospital privileges, providing higher continuity and higher intensity of care, having fewer patient visits, and having practices with more females, lower average morbidity and higher incomes.

The R^2 values for the Disease Management Quality Index models were very low, explaining less than 10% of the variability. Although some of the predictor variables were statistically significant, the low R^2 means that we have yet to identify the characteristics that explain the variability in the Disease Management Quality Index.

The findings of this study suggest the need for action on three levels. At the level of the individual primary care physician there must be recognition of the need for their active engagement in a quality improvement process. No attempt to initiate change in clinical practice is likely to succeed if it is not fully embraced by clinicians.

At the next level, policy-makers face the challenge of establishing a culture of support for quality improvement. Examples from the United States and the United Kingdom demonstrate how quality improvement can be incorporated into physician remuneration packages (U.S.) or as part of a funding model (U.K.). Further, infrastructure (e.g. electronic information technology) is necessary to facilitate this process. By creating such a supportive culture, policy-makers in those jurisdictions have facilitated the growth of quality improvement activities. Specific areas have been identified where quality

improvement will best be achieved through system changes. The use of an electronic medical record would facilitate the systematic application of recommended preventive health measures, as well as some chronic disease management procedures. The access to female providers for cervical screening in rural areas could potentially be addressed with mobile screening clinics staffed by female providers such as nurse practitioners.

At the third level, in the Manitoba context, both the Manitoba College of Family Physicians and the Continuing Medical Education Department of the University of Manitoba play important roles in providing educational opportunities to practicing primary care physicians. This study identified specific areas where the quality of care should be improved; educational activities should be targeted accordingly.

In the current environment of primary care reform, the finding regarding physicians who retain hospital privileges may also be important. While the present study provides evidence of better quality preventive care provided by this group of physicians, we have not demonstrated a causal relationship. Thus, from a quality perspective, the trend for family physicians to remove themselves from providing in-hospital service requires further study.

This study, like previous MCHP studies, has identified significant shortcomings in the availability of data from rural Manitoba. As laboratory test data are not centrally reported, we were not able to report on rates of adherence to cholesterol and blood sugar testing guidelines. This issue should be addressed to facilitate this quality improvement process.

The indicators that were developed for this study reflect certain aspects of quality of care, specifically clinical effectiveness, but do not represent the complete picture. Those aspects of quality that are not amenable to measurement using administrative data, such as interpersonal effectiveness, are not less important than those measured in this study, but they fall outside the scope of this work.

Our list of indicators, developed from the literature, was well accepted by the focus group participants and the Working Group. We are thus confident that they are acceptable to community-based primary care physicians. We believe these 13 indicators to be well suited for use in quality assurance programs because of their accessibility in the Population Health Research Data Repository.

1.0 INTRODUCTION AND BACKGROUND

1.1 Goals and Objectives

The primary goal of this study was to develop acceptable indicators of **quality of care**[1] that can be used to measure quality in primary care[2] focussing on physician[3] behaviour.

To accomplish this goal, we defined three specific objectives:

- Identify indicators of quality care acceptable to practising **family physicians.**
- Explore the validity of measuring these indicators using **administrative data.**
- Describe the quality of care provided by Manitoba physicians using the selected indicators.

The study goal was to develop acceptable indicators of quality of care that can be used to measure quality in primary care. Our focus was on physician behaviour.

Three research questions guided our analyses:

1. What indicators of quality in primary care are both quantifiable using administrative data available to MCHP and acceptable to community-based **primary care physicians**?
2. How do the behaviours of Manitoba primary care physicians measure up using these indicators?
3. Which physician and practice characteristics impact upon the quality of care physicians provide as measured by these indicators?

1.2 Background

Medical practitioners have traditionally relied upon "professional standards" and their patients' trust as an indication of the quality of service provided to patients. However, these standards are rarely explicitly defined and the professional bodies responsible for self-regulation (e.g., in Manitoba, the College of Physicians and Surgeons) are primarily concerned with physicians against whom complaints have been lodged, rather than monitoring all practitioners. The New England Journal of Medicine recognized the lack of attention to the issue of quality of care in 1996 with the publication of a six-part series on the topic (Blumenthal, 1996).

In the United Kingdom, reforms in the National Health Service in the 1990s have focussed heavily on a governance system that promotes quality assurance and improvement (Secretary of State for Health, 1997). A parallel growth in interest in quality assurance has also been noted in the United States over the past 10 years, driven primarily by the for-profit managed care industry (Blumenthal, 1996). In addition, recent publications by the Institute of Medicine, focussing on medical error and quality, have led to significantly greater interest in the quality of care provided by the medical system (Greiner and Knebel, 2003). In Canada, however, the quality

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

[2] In this report, 'primary care' refers specifically to ambulatory care provided by a generalist physician.

[3] The terms, physician, primary care physician, family practitioner, and family physician are used interchangeably in this report.

improvement movement has had very little impact on the medical profession. The provincial governments, which have primary responsibility for overseeing health care in their respective provinces, have yet to emphasize accountability for physician services. The Sinclair Report based on the inquiry into Paediatric Cardiac Surgery deaths in Winnipeg (Government of Manitoba, 2001) highlighted the need for ongoing monitoring of the quality of care in Manitoba. The Manitoba Minister of Health responded to this report with the introduction of the Medical Amendment Act, which received assent on August 9, 2002. This Act provides for the creation of individual physician profiles by the College of Physicians and Surgeons of Manitoba which are to be made available to the public (Bill 31, 2002). The Romanow report also placed significant emphasis on the need for accountability in the health care system (Romanow, 2002).

Since most health problems are first addressed in the primary care system, there is new interest in the quality of primary care.

Historically, attention to issues of quality of care and health outcomes generally focussed on the hospital sector, due to its associated high costs and strong interest in high-technology medicine. Most health problems, however, are initially addressed in the primary care system where preventive services are also provided. This reality has led to a new interest in the quality of primary care (Seddon et al., 2001).

1.3 Quality of Care

Quality of care is a complex construct and many different definitions of the quality of health care have been proposed (Blumenthal, 1996). For example, Donabedian (1980) defined high quality care as "that kind of care which is expected to maximize an inclusive measure of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts." The American Medical Association (1986) defined it more broadly:"which consistently contributes to the improvement or maintenance of quality and/or duration of life." The Institute of Medicine's 1990 definition is still widely cited: "Quality is the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (Lohr, 1990).

In the context of primary care—the focus of this study—Campbell et al. (1998) suggested that two dimensions of quality must be addressed by any definition of quality of care: access to, and effectiveness of care; effectiveness is further divided into clinical and **interpersonal care**. Quality indicators measuring each of these components may also be defined in terms of the domain in which they fall. There are three key domains:

1. **Process measures** refer to the actual care given, encompassing both clinical effectiveness and interpersonal effectiveness.
2. **Structure** refers to the organization of the system in which the care is delivered, having a major impact upon access to care.

3. **Outcome measures** reflect the consequences of care rather than the components of care (Campbell et al., 2000).

While health outcomes are perhaps the ultimate measure of quality, they depend on many factors both within and unrelated to the health care system, such as socioeconomic status (Sheldon, 1998). The outcome of care is also dependent on the quality of care provided at all levels— primary, **secondary** and **tertiary**.

In their systematic review of quality of care in general practice, Seddon et al. (2001) found that accepted standards of practice were rarely attained. These studies, published between 1995 and 1999, were mainly from the United Kingdom, with four from Australia and four from New Zealand. No Canadian studies were cited, and a thorough search of health literature databases for the current study revealed a lack of comparable North American research.

Our study focussed on process measures, specifically clinical effectiveness, which are easily accessible through administrative data. Indicators of interpersonal effectiveness are not captured in administrative data.

1.3.1 Guidelines

The advent of **clinical practice guidelines** as an offshoot of the growth of **evidence-based medicine** resulted in the hope that publication of these guidelines would lead to an improvement in the quality of clinical care (Cabana et al., 1999; Grol, 2001; Woolf, 1990). Specifically, they were intended to identify for practitioners the key components of good quality care and provide accepted standards that could serve as benchmarks for measuring the quality of care provided. Practitioners have, however, been shown to be reluctant to change their style of practice and slow to implement clinical practice guidelines (Greco and Eisenberg, 1993). This is partly because many guidelines rely heavily upon expert opinion rather than on evidence. There is also conflicting advice in different guidelines for the same condition. There is an extensive literature exploring the facilitators and barriers to physician adherence to clinical practice guidelines (Cabana et al., 1999, Forrest et al., 1996, Trivedi et al., 2002). The use of feedback using specific quality indicators, such as the percentage of children fully immunized and the frequency of follow-up for chronic diseases has, however, been more successful in changing physician practice (Herbert et al., 2001, Kiefe et al., 2001).

Practitioners have been reluctant to change their style of practice and slow to implement clinical practice guidelines. However using feedback for specific quality indicators helps change physician practice.

1.3.2 Measuring Quality of Care

Many approaches are available to access the data necessary to measure quality of care. These include medical record audit, the use of surveys of either

patients and/or physicians, direct observation of patient-physician interactions and administrative data analysis (Brook et al., 1996). The appropriate method of measuring quality indicators depends on the specific component(s) of quality that are of interest. For example, while patient surveys allow for the collection of data about satisfaction with the process of and accessibility to care, further information about the access to care would be obtained by surveying providers. Interpersonal care may be measured either subjectively through patient surveys or objectively via direct observation of the patient-physician interaction. Administrative data provide the opportunity to analyze limited components of clinical effectiveness, while medical record audit provides a more comprehensive view of this component of care.

The method chosen in any particular study is a reflection of the objective of the study and the availability of the data source. Administrative data have the advantage of being population-based and are relatively inexpensive compared to the other potential sources of data for primary care evaluation. The validity of administrative data from **ambulatory care** has been questioned by clinicians. Numerous studies have, however, established the reliability of the Manitoba data when compared to other sources of data (Hux et al., 2002; Roos et al., 1982; Roos et al., 1993; Roos and Nicol, 1999). Whatever their source, the usefulness of indicators for quality improvement is limited by the extent of their acceptance by those who are to use them (Sheldon, 1998). While studies describing the quality of care provided may be useful to address the issue of accountability, there is considerable value in developing indicators that can subsequently be used for quality improvement. If the goal of the quality improvement exercise is to change primary care physician behaviour, these physicians need to be involved in the development and acceptance of the indicators to be used.

Primary care physicians need to be involved in the development and acceptance of indicators.

1.3.3 Limitations to the Measurement of Quality of Care

Because quality care is made up of the various components mentioned above, it is important to understand the potential relationships between them. Can we presume that demonstrated quality with regard to access to care is associated with quality in one of the other components of quality, such as interpersonal effectiveness? While one might presume that physicians who provide high quality in the realm of clinical effectiveness also provide high quality care with regard to interpersonal effectiveness, the evidence does not support this assumption. One study that compared the results from the different components of quality in primary care (Gandhi et al., 2002) demonstrated very poor correlation between each of these domains. None of the domains, including process (as a measure of clinical effectiveness, screening and chronic disease management), outcome (patient satisfaction) and structure (clinic function) were correlated with any of the other domains. Quality of care is a complex concept and it is important to recognize that physicians scoring high on one aspect (e.g. interpersonal) will not necessarily

Physicians scoring high on one domain of quality will not necessarily score high on another. Caution is necessary when interpretating all measures of quality in primary care.

score high on another aspect (e.g. ensuring patients get all their tests). This means that all measures of quality in primary care need to be interpreted with caution.

2.0 METHODS & RESULTS

2.1 Overview

Indicators were developed based on a literature review, the feasibility of using administrative data, and the input of physician focus groups.

Indicators were developed based on a review of the literature, the feasibility of using administrative data, and the input of physician focus groups. A Working Group comprising representatives from Manitoba Health, University of Manitoba Departments of Family Medicine and Continuing Medical Education, and the Manitoba College of Family Physicians was established to advise and provide feedback on the project. Once the list of indicators was selected, each family physician in Manitoba was 'scored' on each of the indicators. Physicians were then grouped according to the proportion of the patients allocated to their practice who were eligible for the specific indicator. Comparisons were made between physicians in Winnipeg, Brandon and the rest of Manitoba (**Non-Urban**). Following feedback from the Working Group, a Quality Index was created as a standardized summary score for each physician. Regression models, in which the Quality Index score was the outcome variable, were then run to determine the practice and physician characteristics that were associated with differences in quality. Each of these steps will be described in more detail.

2.2 Data Sources

To develop practical indicators the data needed to be readily accessible in the Repository, and family physicians needed to accept the validity of each indicator as a good measure of quality of care in their own practice.

The analyses for this report were based on the administrative data contained in the **Population Health Research Data Repository** (Repository), which is housed at the Manitoba Centre for Health Policy (MCHP). The Repository is a comprehensive database that contains records for all Manitobans' contacts with physicians, hospitals, home care, personal care homes, and pharmaceutical prescriptions. The Repository records are anonymous, as prior to data transfer Manitoba Health processes the records to encrypt all personal identifiers and remove all names and addresses. Specific files used in this study include **hospital discharge abstracts data**, **physician claims**, pharmaceutical use (**Drug Programs Information Network** (**DPIN**) data), **physician data**, and the **Manitoba Immunization Monitoring Program** (**MIMS**) files. The most recent files available at the time of the study (2001/02) were used for all analyses.

2.3 Indicator Development

We addressed two essential components in the development of practical quality of care indicators. First, the data necessary to measure each indicator needed to be readily accessible in the routinely generated administrative data available to MCHP. Second, practising, community-based family physicians needed to accept the validity of each indicator as an acceptable measure of quality of care relevant to their own practice.

In order to address these criteria the following methods were adopted. First, a review of the literature identified previously used indicators of quality in family practice. Most of the published studies in this area come from the United Kingdom where the National Health Service has placed considerable importance on accountability over the past five years, resulting in the development of the National Performance Framework. The National Committee for Quality Assurance is the major source of health quality indicators in the United States. It has developed HEDIS, the Health Plan Employer Data and Information Set, which is designed as "part of an integrated system to establish accountability in managed care" (National Committee for Quality Assurance, 2002). A comparison between these two approaches (Campbell et al., 1998) demonstrates considerable overlap. The differences between them appear to be based on the relative availability of data rather than substantive disagreements.

These indicators were then sorted into those potentially measurable with the administrative data available at MCHP, and those which required other sources of data. The latter group was excluded from the study. A refined list of potential indicators was then presented to three groups of family physicians in a series of focus groups. This process provided the opportunity for input from practising physicians to ensure that each indicator chosen was relevant and acceptable. The intent was to facilitate an interactive process to arrive at a final list of acceptable indicators. Minor changes to some definitions were made during the initial analyses when it became clear that the original definitions were not sensitive enough. The final list is composed of 13 indicators (Table 2).

Table 2: Indicators of quality primary care

Indicator	Definition
A. Disease Prevention/Health Promotion	
1. Childhood immunization	Percentage of patients (born in 1998) who received their primary course of immunization (i.e., DPT-HiB[1], polio x4, and MMR[2]) by age 24 months
2. Influenza vaccination	Percentage of patients aged 65 years or older who received at least one influenza vaccine in the past two years
3. Cervical cancer screening	Percentage of female patients aged 18–60 years who had not undergone a hysterectomy, and who had at least one Papaniculaou test in the last three years
4. Cholesterol screening*	Percentage of male patients aged 40 years or older and female patients aged 50 years or older who had at least one cholesterol screening test in the last five years
5. Blood sugar screening*	Percentage of patients aged 48 years or older who had at least one blood sugar test in the previous three years
B. Acute & Chronic Disease Management	
1. Anticoagulant medication management	Percentage of patients with a 30-day supply (or more) of anticoagulants who had at least one blood clotting test per each 45-day period
2. Antidepressant medication management	Percentage of patients with a new prescription for an antidepressant associated with a depression diagnosis (within two weeks of each other) who had three subsequent ambulatory visits within four months of the prescription being filled
3. Asthma care	Percentage of patients with an asthma diagnosis (defined as one repeat prescription of a $ß_2$ - agonist in the past year) who filled a prescription for medications recommended for long term control of asthma (i.e., inhaled corticosteroids or leukotriene modifiers, an alternate anti-inflammatory medication)
4. Potentially inappropriate prescribing of Benzodiazepines for older adults	Percentage of patients aged 75 years or older with prescription(s) for two or more benzodiazepines or prescriptions for greater than a 30-day supply of medication
5. Diabetes care: Cholesterol testing*	Percentage of diabetic patients (defined as those who had at least one drug used to treat diabetes) who had a cholesterol screening test in the same fiscal year as the prescription
6. Diabetes care: Eye examination	Percentage of diabetic patients (defined as those who had at least one drug used to treat diabetes) who saw either an optometrist or ophthalmologist in the same fiscal year as the prescription
7. Post-myocardial infarction care: Beta-Blocker prescribing	Percentage of patients discharged alive from hospital in the preceding three years with a discharge diagnosis of myocardial infarction (excluding those with prior diagnosis of asthma, COPD or peripheral vascular disease) who filled at least one prescription for a beta-blocker within four months of the first infarction
8. Post-myocardial infarction care: Cholesterol testing*	Percentage of patients discharged alive from hospital in the preceding three years with a discharge diagnosis of myocardial infarction who had a cholesterol test within four months of discharge
C. Other Measures **	
1. Antibiotic prescribing rates	Average number of prescriptions for antibiotics per assigned patient in the past year.
2. Consultation rates	Adjusted clinical group standardized rate of patients referred to a consultant.
3. Thyroid (TSH) function screening /testing	Percentage of patients who had a test in the past year; and the percentage of those tested who subsequently receive prescriptions based on the test results.

* Data only available for Winnipeg

** Although initially considered as potential indicators, we did not pursue these measures as no "correct" rate for these indicators are described in the literature. They are presented here for descriptive purposes only.

[1] DPT-HiB: Diphtheria, Pertussis, Tetanus, Haemophilus influenza B

[2] MMR: Measles, Mumps, Rubella

2.3.1 Family Physician Focus Groups

Focus groups were held at three clinics (two in Winnipeg, one in rural Manitoba). The sites were purposely selected based on the following criteria:

- More than six family physicians working full-time at the clinic.
- An accessible physician contact who could help arrange the focus group.
- Community-based, non-academic physicians.
- The clinic included both physicians with and without hospital privileges.

Each group had between six and ten participants. The physician contact at each site invited all the physicians working at the clinic to the scheduled session. Two of the sessions occurred at lunchtime, and the third was held in the evening immediately following the afternoon clinic.

After obtaining written, informed consent from each of the participants, every group of physicians was presented with a list of 16 potential indicators along with a brief explanation of each indicator and its intended use. The physicians reviewed the list independently and, for each indicator, determined whether they agreed with it as a valid indicator of quality in primary care, had concerns about it, or did not support its use as an indicator. The researchers then facilitated a discussion with the group and reviewed their responses to the list. Dialogue continued until consensus was reached within the group. The results of each session were presented to the subsequent groups as part of their discussions.

Each group accepted all the indicators, some with caveats. Most of the concerns expressed related to the definitions of the indicators as presented rather than substantive content, resulting in minor changes to the definitions. Further clarification of the abbreviated written descriptions satisfied many of the other concerns expressed, while others were more relevant to the interpretation of the results. For example, in response to the indicator for influenza vaccination, physicians reported the frequent refusal by patients to receive this vaccination. However, administrative data only include those who had actually received the immunization, not those who had been offered the injection but refused it. While it may be reasonable to assume that omissions in care are a reflection of physician behaviour in general, this example demonstrates the role of patient preference in the study results. This limitation applies to many of the indicators and needs to be considered when interpreting all of the results. Further details about the responses to each of the indicators will be presented in the relevant discussion of the definition and interpretation of each indicator.

The influence of patient preference needs to be considered when interpreting all of the study results.

Two indicators (Spirometry for asthma care and PSA testing) were suggested by participants in the second focus group and subsequently agreed upon by the others. These were added to the list of indicators; however, further

exploration of the feasibility of capturing the necessary data for these indicators resulted in them being omitted. Three other indicators were initially identified (antibiotic prescribing rates, consultation rates, and thyroid (TSH) functioning screening/testing) but were not pursued as no benchmarks were available for comparison.

2.4 Defining Practice Populations

Before it is possible to measure the quality indicators, it is first necessary to define each physician's **practice population**. The quality of care indicators can then be applied to those patients who make up the practice population of each physician. When patients are formally assigned to physicians as part of the funding formula, such as the **capitation system** used in the United Kingdom, this is a relatively simple task—practice populations are defined in terms of this formal, established relationship (e.g., the National Health Service in the U.K. and some managed care organizations in the U.S.).

In 2000/2001, Winnipeg residents visited an average of 1.9 family physicians; those who made more than ten visits saw an average of 3.56 family physicians.

In Manitoba, however, whether primary care physicians practice within a **fee-for-service** environment or in a **salaried** position, access to physicians is not formally restricted. Patients are able to seek consultations with any primary care physician. As a result, patients tend to visit different physicians over time. This may represent a change in the physician that the individual chooses to see for their ongoing care, or it may be a series of visits to different physicians whose care is being sought based on patient convenience (e.g., walk-in clinics) or the patient's desire for a second opinion. The reality is that the residents of Winnipeg visited an average of 1.9 family practitioners in the 2000/2001 fiscal year, with those who made more than ten visits over the year, each visiting an average of 3.6 physicians (Watson et al., 2003).

Patients were allocated to the physician most responsible for their primary care.

The method used to assign patients to individual physician practices is a fundamental step in the development of quality indicators. Several different methods have been used in previous MCHP studies (Menec et al., 2000; Reid et al., 2001). The goal of the approach used in this study was to assign each patient to that primary care physician who was **most responsible** for the patient's primary care. To do this we used the expenditure on primary care **physician visits** as our primary criterion. Thus, **patient allocation** was based initially on the value of the visits (excluding procedures) provided within this sector rather than on the number of visits or sequence of visits (see Appendix A).

We assumed that a visit for a Periodic Health Examination (Complete History and Physical Examination—Billing code 8540)[4] was an indication of a stronger link with a physician than a lower valued **regional intermediate visit** (Billing code 8529). Similarly, a **regional basic visit** (Billing code

[4] Manitoba Health Insured Benefits Branch: Manitoba Physician's Manual.

8509) is of lower economic value than the intermediate visit and was therefore presumed to represent a weaker link in determining the strength of the patient-physician relationship. The physician with the strongest link was assumed to be the most responsible for the patient's primary care. In cases where two physicians supplied primary care visits of equal value to the same patient, the patient was allocated to the physician with the higher expenditure based on referral for other services attributable to this physician. These would include referrals for laboratory and imaging services, as well as consultations with **specialist physicians**.

Under the plurality approach, all visits, immunizations, prescriptions or lab tests ordered for a patient were credited to the assigned physician regardless of who provided those services.

The **plurality approach** described above is an extension of prior work by Reid et al. (2001). It allows for the allocation of all patients who have seen a primary care physician to the most responsible physician for their care during the period of interest. Once a patient has been allocated to a specific physician, all the relevant services they received are used in the measurement of the indicators, regardless of which physician initiated those services. The assumption is that the assigned primary physician bears overall responsibility for that patient's primary care. This means that all visits, immunizations, drug prescriptions or laboratory tests ordered by any physician the patient sees, or services provided by another health professional such as a public health nurse (e.g., immunization programs) are credited to the assigned primary care physician. For example, a patient who receives 60% of their care (based on expenditure) from one physician, and the remaining 40% from another physician is assigned exclusively to the first physician's practice. The first physician also "benefits" from those desired services provided by the other "secondary" physician, but is also penalized for those undesirable services provided by the secondary physician. Secondary physicians, however, receive no credit for this care, whether positive or negative.

"Virtual" profiles of physicians were based on the total care received by their patients, rather than on the care provided by that specific physician.

This allocation process results in "virtual" profiles of physicians based on the total care received by each allocated patient rather than on the care provided by that specific physician. Accordingly, those physicians who provide the majority of care to most of the patients they have seen are credited with all the visits for those patients, including those made to other physicians. They are therefore likely to be allocated more visits than they actually provided. Physicians who provide less care for any patient than do other physicians are not credited with any of the visits provided to that patient, resulting in the likelihood of being credited with less visits than they actually provided. This method credits the physician with any suggested course of action (drug prescription, **screening** test, immunization or follow-up visit) even if another physician provided the service. Because the ultimate goal is to ensure the patient received the recommended service, who actually provided the service is not as important. Logically, the provision of services that were previously provided by another physician represents unnecessary repetition and is a costly drain on the system. It thus seemed appropriate to credit the physi-

cian for those services provided to the patient by others. Physicians who tend to provide the minority of care to their patients do not have those patients allocated to their practice, and their quality indicators are measured using fewer visits than they actually provided.

The above process allowed us to define physician practices to measure the provision of services to allocated patients. This served as the basis of the indicators of quality care described in this report. The indicators were based on the needs of that patient as defined by their age, gender and state of health. By allocating that patient to a physician, all care the patient received during the study period, whether from a family physician or a specialist, was also ascribed to that physician. Even though chronic disease management frequently involves a collaborative effort between a consultant and the primary care physician, all care was allocated to the most responsible family physician.

2.5 Geographical Areas

Physicians were divided into three geographical areas—Winnipeg, Brandon, and Non-Urban.

A number of factors that influence the style of physician practice vary from region to region in Manitoba, particularly between urban and rural areas. To properly capture these differences in our descriptive analyses, we divided physicians into three **geographical areas**—Winnipeg, Brandon, and **Non-Urban** (all other regions of Manitoba). Primary care physicians in Winnipeg, and to a lesser extent Brandon, have direct access to consultants, both in the community and hospital setting. Many diagnostic services are only available in Winnipeg or Brandon, and patients in Winnipeg have access to walk-in clinics and urgent care facilities, which are not as readily available in rural areas. **Public health nurses** also play different roles in the different geographical areas, being the principal providers of childhood immunizations in the Non-Urban areas. Finally, rural women are less likely to attend a local male family physician for a Papanicolaou (Pap) test (Lurie et al., 1997; Simoes et al., 1999), while also having poorer access to specialists to perform the test.

The same geographical regions were used to profile physicians and their practices. We found that depending on the characteristic, Brandon physicians were sometimes more similar to those who practiced in Winnipeg than to those in Non-Urban areas, and other times, the opposite was true. For example, Brandon physicians were more similar to Non-Urban physicians with respect to hospital privileges; 89% of Brandon physicians and 93% of Non-Urban physicians had hospital privileges while this was true for only 52% of Winnipeg physicians. In contrast, with regard to fee-for-service versus salaried physicians, both Brandon and Winnipeg had few physicians employed on salary (4% and 7%, respectively) compared to 38% of Non-Urban physicians. Like Non-Urban Manitoba however, Brandon had more

physicians who trained outside of Canada than those who graduated from a Canadian university. Of Winnipeg physicians, 66% were trained in Canada.

Brandon physicians also had some unique characteristics—on average they saw considerably more discrete patients (2,158) than did physicians in Winnipeg (1,630) or in Non-Urban areas (1,272). They also had less contact with their patients. In one year, Brandon physicians saw each of their patients an average of 2.07 times per year whereas Non-Urban physicians saw their patients an average of 2.45 times per year and Winnipeg physicians had an average of 2.74 visits per year. Finally, in terms of the stability of the physician population, Brandon was between Winnipeg and the rest of Manitoba. Almost 60% of Winnipeg family practitioners were in practice over the full 11 years of data available for the study, compared to only 30% of Non-Urban physicians.

In the final stage of analyses, the creation and evaluation of a quality index, due to the relatively small number of physicians in Brandon, separate regressions could not be run on this region. Significance testing indicated that, generally, Brandon was more similar to Winnipeg than to Non-Urban areas; thus, we decided to present the Index results as three geographical-based models: Manitoba, **Urban** (Winnipeg, Brandon) and Non-Urban. The development and modeling of the Quality Index are described in Chapter 4.

2.6 Measuring the Quality Indicators

The cohort for each indicator included only those physicians with patients to whom the indicator applies; physicians whose practices lacked sufficient numbers of eligible patients were excluded from each cohort. For most indicators, only physicians with 10 or more eligible patients were included; for several indicators—childhood immunization, antidepressant medication management, and post-myocardial infarction (cholesterol screening and beta-blocker prescribing)—the cut-off was five because the overall numbers per physician for the province were relatively small.

2.6.1 Data Limitations: Laboratory Use

Physicians do not submit billing claims for laboratory tests that they recommend to patients; rather, they complete a laboratory requisition form listing the required tests. The patient presents this form at the laboratory, which then records the patient's demographic data and the referring physician's identity. When the laboratory submits a claim for that test to Manitoba Health, the claim includes both the identity of the physician who initiated the test as well as the name of the patient. A record is then created to link the patient to the specific test at that point in time. This process is the norm when tests are performed in private laboratories, as is the case for most tests ordered in Winnipeg and Brandon. In rural areas, such work is referred to

hospitals, which do not bill on a fee-for-service basis, or to the provincial laboratory (Cadham Provincial Laboratory), which reports global, rather than per patient costs. Hence, there are no records from these facilities to link patients to specific tests, so we cannot track laboratory tests done on patients outside of Winnipeg and Brandon. There are also no patient-specific records for tests done only in hospital laboratories. Despite this limitation, we included the five indicators that rely on laboratory tests as they represent important measures for over 50% of Manitoba family practitioners. Due to relatively few physicians in Brandon, we chose to exclude this region from these analyses, thereby protecting their confidentiality and focussed solely on Winnipeg physicians.

3.0 THE INDICATORS

The 13 indicators of quality are divided into two categories: 1) Disease Prevention/Health Promotion, and 2) Acute & Chronic Disease Management.

In this chapter we report on the development of each of the indicators of quality in primary care and their application to Manitoba family practitioners. The indictors are divided into two categories. The first category, ***Disease Prevention/Health Promotion*** includes five indicators: rates of primary childhood immunization, and rates of influenza vaccination for adults aged 65 years and older, as well as indicators for three screening tests (cervical cancer, cholesterol, and blood sugar). The other eight indicators are grouped under the heading ***Acute and Chronic Disease Management***; this includes indicators for appropriate drug prescribing, laboratory testing, and visit rates for specific conditions.

The description of each indicator includes the final definition that was used to identify appropriate patients for analyses, an explanation of how the definition was developed, the results of the descriptive analyses, results of regional comparisons using **Analysis of Variance** (**ANOVA**) (see Table 3), and a brief discussion of these findings in light of current literature. Each definition has two parts—eligibility criteria for patient inclusion (e.g. children born in 1998), and the target procedure, test, or action (e.g. 13 immunizations required by age two) physicians should provide. Table 4 lists the codes used to define each indicator. The indicators that require laboratory information (such as cholesterol and blood sugar screening and testing, and monitoring anticoagulation dosage) only include Winnipeg physicians due to the limitations described above.

Table 3: ANOVA results: Comparison of physician rates for each indicator by location of practice

	Proportion of Eligible Patients For Whom Physicians Met The Target			
	Winnipeg (W)	Brandon (B)	Non-Urban (NU)	Different At 0.05
Childhood Immunization	0.64	0.68	0.67	W=B=NU
Influenza Vaccination	0.63	0.65	0.57	W=B, **B≠NU, W≠NU**
Cervical Cancer Screening	0.71	0.71	0.60	W=B, **B≠NU, W≠NU**
Antidepressant Management	0.49	0.51	0.43	W=B, B=NU, **W≠NU**
Asthma Care	0.59	0.61	0.64	W=B, B=NU, **W≠NU**
Benzodiazepine Prescribing*	0.15	0.16	0.13	W=B, B=NU, **W≠NU**
Diabetes Care: Eye Examination	0.37	0.48	0.40	**W≠B≠NU**
Post-MI Care: Beta – Blocker Prescribing	0.63	0.62	0.54	W=B, B=NU, **W≠NU**

* For this indicator, lower rates are desirable
See p 17 for explanation of how each physician rate was calculated.

Table 4: Codes used to define quality of care indicators

Indicator	Codes
Childhood Immunization	
DPT-HiB, Polio (X4)	**Tarriffs** 8802, 8804, 8806, 8807
MMR	**Tarriff** 8870
Influenza Vaccination	**Tarriffs** 8791, 8792, 8799
Cervical Cancer Screening	**Tarriffs** 8470, 8495, 8496, 8498, 9795
Cholesterol Screening	**Tarriff** 9075 or 9220
Blood Sugar Screening	**Tarriff** 9141
Anticoagulation Medication Monitoring	
Coumadin or warfarin	**ATC** B01A A
Prothrombin time (INR)	**Tarriff** 9252
Antidepressant Medication Management[1]	
Depression	**ICD-9-CM** 311 or 296
Antidepressant	**ATC** N06A A,B,F,G,X
Asthma Care	
Beta 2-agonist[2]	**ATC** R03A A, B, C
Inhaled corticosteroids	**ATC** R03B A
Leukotriene modifiers	**ATC** R03D C
Benzodiazepine Prescribing	**ATC** N05B
Diabetes Care	
Diabetes[2]	**ATC** A10 A&B
Cholesterol testing	**Tarriff** 9075 or 9220
Optometrist/Ophthalmologist	**MD Bloc**[3] 051 or 053
Post Myocardial Infarction Care	
Myocardial infarction[4]	**ICD-9-CM** 410
Excluding:	
Asthma	**ICD-9-CM** 493
COPD	**ICD-9-CM** 491 or 492
Peripheral vascular disease	**ICD-9-CM** 443, 459
Beta-blocker	**ATC** C07A A,B
Cholesterol testing	**Tarriff** 9075 or 9220

[1] Definition uses both diagnosis and drug codes
[2] Drug-based definition
[3] Physician specialty code
[4] In-hospital diagnosis

3.1 Understanding the Results

Our primary focus is on physician behaviour, rather than on population events.

As you read the results of our analyses presented in the remainder of this report, it is important to keep in mind that our primary focus is on physician behaviour rather than on population events. Thus, although some population-based[5] results are presented we emphasize physician-based results; in some cases, these two sets of results are similar.

3.1.1 Physician-Based vs. Population-Based: What's the Difference?

The following example using a small sample of childhood immunization data illustrates the differences in how these two sets of results were calculated and what they mean. Each row in the table below contains data for one of the five physicians included. Column B shows the number of allocated patients who met the eligibility criteria for this indicator. Column C presents the number of patients for whom the physician met the target (in this case, those who were fully immunized by age two), and the last column reflects this number as a proportion of the number of eligible patients.

A FP	B # Eligible	C # for Whom the FP Met the Target	D % for Whom the FP Met the Target
1	5	0	0%
2	15	2	13%
3	6	1	17%
4	6	1	17%
5	11	2	18%
TOTAL:	43	6	--
AVERAGE:	--	--	13%

The average of 13% in the heavy-lined cell is the average of column D; it is calculated by summing this column and dividing the result by the number of physicians. Thus, it reflects the 'rate' of childhood immunizing per physician (i.e., on average, physicians met the target for 13% of their eligible patients).

The population-based rate, the proportion of eligible patients in the entire sample for whom the physicians met the target, is calculated by summing Column C and dividing the total by Column B:

$$\frac{6}{43} = .1395$$

Thus, 14% of all eligible patients included in this indicator were fully immunized. These two methods of calculating the rates for each indicator yield different results.

[5] Based on the total number of eligible patients for each indicator.

The results of the indicators are presented graphically; for each indicator, physicians were grouped according to the proportion of their eligible patients who received the recommended care. Table 3 presents the results of our regional comparisons of the physician averages.

3.1.2 A Word About the Graphs

It has been our experience that these graphs are somewhat difficult to interpret; hence, the following explanation. Looking at the graph of the first indicator, **Childhood Immunization**, (see Figure 1) the horizontal axis shows the proportion of two-year-olds who were fully immunized. In total, 8,820 of the children assigned to a family physician (FP) were eligible for this indicator. Each vertical bar shows the proportion of physicians in each geographical region; in total, 535 Manitoba physicians were included in this indicator (see graph legend). Thus, the '80-89' category along the horizontal axis indicates that 18% of Winnipeg family physicians had fully immunized between 80 and 89% of their two-year-old patients. The second and third bars in that grouping indicate that 19% of Brandon physicians and 18% of Non-Urban physicians achieved this same level of immunization. The fourth bar provides the provincial average (18%).

Note also that by adding bars, a cumulative measure can be estimated. For example, by summing across the 'Winnipeg' bars for 70-79 (17%), 80-89 (18%) and 90+ (7%), we can tell that for 42% of Winnipeg family physicians, at least 70% of their two-year-old patients were immunized.

3.2 Disease Prevention and Health Promotion

3.2.1 Childhood Immunization

Definition: The percentage of patients (born in 1998) who received their primary course of immunization (i.e., DPT-HiB[6] , Polio x4, and MMR[7]) by age 24 months).

Parents in Manitoba are encouraged to have their children immunized against a variety of preventable childhood illnesses according to provincial and Canadian guidelines (Health Canada, 1997; Health Canada, 1999). The recommendations include 13 immunizations within the first two years of life (see Table 5 for Manitoba's schedule). Most of these are provided in the form of injections, which include up to five immunizations in one shot.

Table 5: Manitoba's routine childhood immunization schedule (as of January 2001)

AGE	DaPTP*	Hib*	MMR
2 months	X	X	--
4 months	X	X	--
6 months	X	X	--
12 months	--	--	X
18 months	X	X	--

*DaPTP and Hib are given as "one needle"

D or d	-	diphtheria	M	-	measles (red measles)
aP	-	accelular pertussis (whooping cough)	M	-	mumps
			R	-	rubella (german measles)
T	-	tetanus	HBV	-	hepatitis B
P	-	polio			
Hib	-	haemophilus influenza type B			

Source: Routine Childhood Immunization Schedule (as of January 2001). Communicable Disease Control Unit, Manitoba Health, May 2001

Each immunization is recorded by the provincial immunization system called the **Manitoba Immunization Monitoring System** (**MIMS**) based on submissions by the individual responsible for the immunization. In Winnipeg and Brandon this is usually the primary care physician (family practitioner or paediatrician), while in rural areas, public health nurses provide most immunizations. MIMS monitors immunization status in the month of the first, second, fifth and sixth birthdays. Missing or incorrectly coded immunizations produce a letter to the family and/or provider requesting correction or completion. "Reminders" are distributed through public health offices with amended records returned for data entry. Children whose records remain incomplete are actively followed by public health offices and offered immunization (Gupta et al., 2003).

[6] DPT-HiB: Diphtheria, Pertussis, Tetanus, Haemophilus influenza.
[7] MMR: Measles, Mumps, Rubella.

In order to include all children who had turned two in the year prior to April 1, 2002, we focussed on the cohort of children born in 1998. We then accessed the immunization status of these children according to MIMS as of March 31, 2001. It is recommended that the primary course of immunization be completed by 18 months of age. Thus, our method allowed a minimum of eight months after the time of the final recommended immunization.

Our method of allocating patients to practices described earlier allowed us to attribute the child's immunization status (complete [13 immunizations before age two years] or incomplete) to the most responsible family practitioner. The actual vaccinations may have been provided by a combination of public health nurses, other physicians, or by the physician to whom that child was assigned. We included primary care physicians with a minimum of five eligible patients in the indicator.

Results & Discussion

There were no statistical differences in the mean childhood immunization rates between physicians in all three regions.

There were no statistical differences in the mean childhood immunization rates between physicians in Winnipeg (64%), Brandon (68%) or Non-Urban Manitoba (67%) (see Table 3). This regional comparison combines the individual physician rates, the distribution of which is presented in Figure 1. Approximately 10% of the 8,820 eligible patients who were allocated to a physician practice in Manitoba did not receive any of the recommended immunizations, despite having seen a physician at least once during the study period. These patients were evenly distributed across the geographical areas.

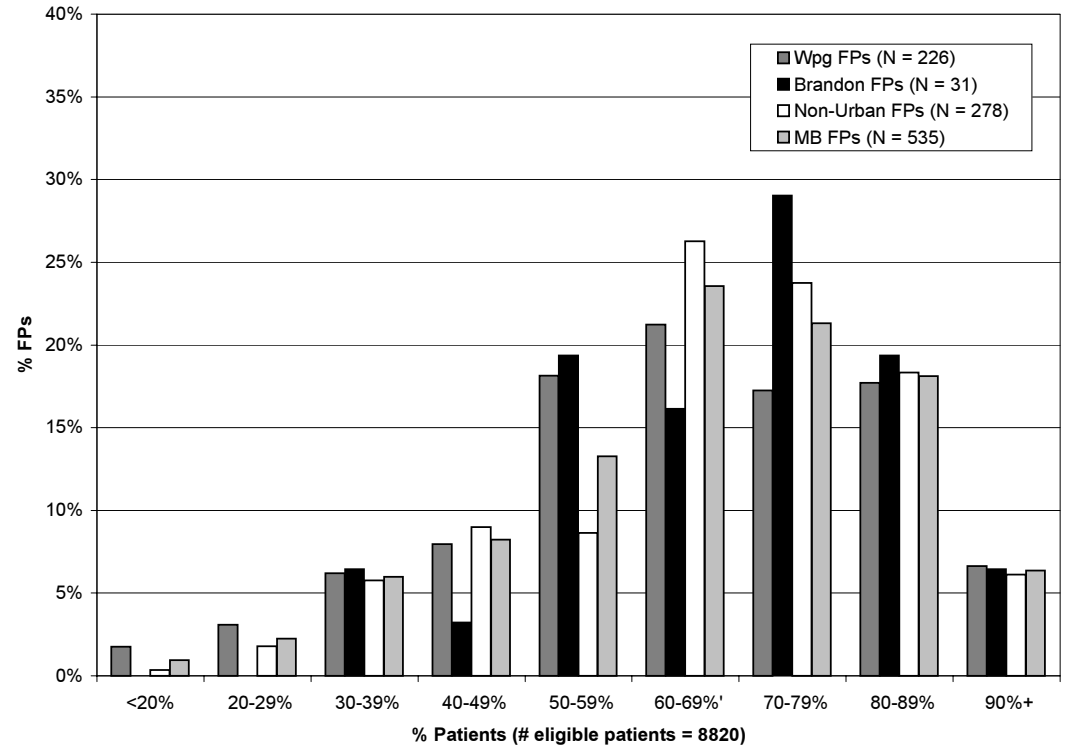
Previous research at MCHP found that immunization rates fall off over the first two years of life (Gupta et al., 2002). However, we chose to include the second year of life in our indicator because the natural break in the clinical sequence of care occurs after the 18-month immunization. Gupta et al. (2003) also demonstrated significant differences in immunization rates across income quintiles in Manitoba for urban (but not rural) children, with those in the highest income quintile having substantially higher rates of immunization than those in the lowest quintile.

Primary care physicians provide childhood immunizations in Winnipeg and Brandon, while in rural Manitoba this service is generally provided by public health nurses. This regional difference has provided a natural experiment between the two service delivery systems, both of which are reinforced by MIMS. The lack of a statistical difference in the rates between the geographical areas using these two delivery models may be because immunization rates are not provider-dependent or because in rural areas public health nurses are compensating for lower physician-provided immunization rates.

Rates reported in the present study are below the estimated Canadian rates.

Most published studies have used community surveys to extrapolate population immunization rates (Gore et al., 1999; Kimmel et al., 1996; Salsberry et al., 1994; Sullivan, et al., 1998); rates vary from 31% (Salsberry et al., 1994) to 79% (Szilagyi et al., 2000). Canadian data are generally better than the U.S. data (75% vs. 64%, respectively) possibly due to Canada's universal health insurance coverage. The rates reported in the present report are below the estimated Canadian rates. It is possible that the Canadian estimates are higher than reality as they are based on surveys which may under-represent hard to reach populations (e.g., those living in poverty) whose rates are lower than the average. Alternatively the Manitoba rates may simply be below the national average. Brownell et al. (2001) reported 72% immunization rates at two years of age in Manitoba. Because our analysis was provider-focussed and we excluded providers with fewer than five eligible patients, we have probably underestimated the population rate. However, it is unlikely that this accounts for the physician-specific rates falling well below the Health Canada targets of 95% or higher.

Figure 1: Per cent FPs Whose Assigned Patients (born in 1998) Were Fully Immunized by Two Years of Age: 2001/02



*__Note__: Excludes FPs with less than 5 eligible patients

3.2.2 Influenza Vaccination

Definition: The percentage of patients aged 65 years or older who received at least one influenza vaccine in the past two years.

Provincial guidelines recommend that all adults aged 65 years or older receive annual influenza vaccinations. These vaccines are covered by the provincial health insurance plan and are administered in doctors' offices, by public health nurses and at nurse-run clinics set up in the community specifically for this purpose. In addition to the widely accepted guidelines for professionals, Manitoba Health also promotes influenza vaccination with an annual public campaign. Although all individuals with chronic diseases are also encouraged to be vaccinated, our focus was only on those aged 65 years or older. As with childhood immunizations, all influenza vaccinations are recorded in the MIMS. Public health nurses also provide many of these immunizations, but in contrast to childhood immunizations, this is more common in Winnipeg than in rural areas.

Results & Discussion

The mean physician rate for Non-Urban was significantly lower than the rates for both Winnipeg and Brandon.

As presented in Table 3, the average physician vaccination rates in Winnipeg and Brandon were 63% and 65%, respectively; they covered just over two-thirds of their older patients. The mean physician rate for Non-Urban (57%) was significantly lower than the rates for both Winnipeg and Brandon. Together, most of the physicians in Brandon and Non-Urban vaccinated between 50% and 69% of their patients, whereas in Winnipeg, about half of the physicians fell in that category with an additional 26% in the 70-79% category. (See Figure 2).

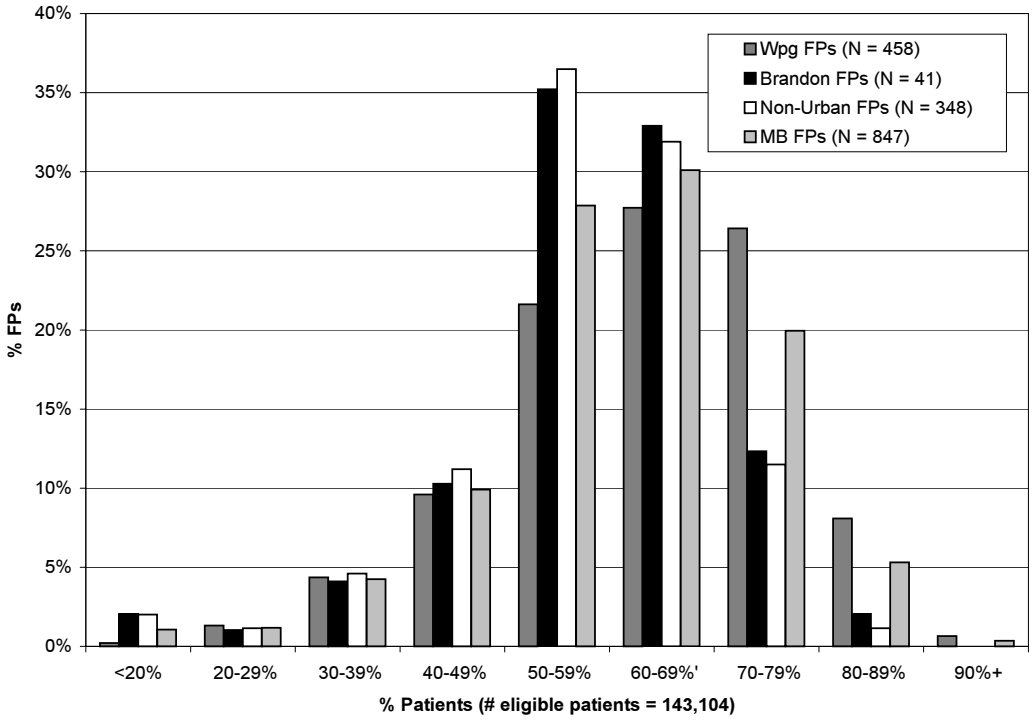
Over one-third of older adults are not being vaccinated.

The delivery system for the influenza vaccine includes primary care physicians, public health nurses, as well as hospital-based specialty clinics, which also provide this service to at-risk patients. Regardless of provider, all of these vaccinations are captured by MIMS and we attributed them to the most responsible primary care physician. Despite Manitoba Health's public campaign as well as evidence that the influenza vaccination has a significant impact on mortality rates among those aged 65 and older (Nichol et al., 1998), over one-third of older adults are not being vaccinated. While some physicians may fail to recommend vaccination, this result may also reflect the public's reluctance to accept preventive health interventions that have possible side effects but may or may not offer any benefit (e.g., the influenza vaccine is not a guarantee against developing the flu).

The higher rates of vaccination in Winnipeg and Brandon compared to Non-Urban may be due to the involvement of public health nurses in providing this service. Specific influenza vaccination clinics are provided in seniors' residential blocks and drop-in centres throughout the city every fall.

Published rates of influenza vaccination vary widely across different jurisdictions (Kiefe et al., 2001; Tacken et al., 2002). Our rates are consistent with other published rates prior to the introduction of specific interventions to increase vaccination rates. Nevertheless, rates have been shown to be highly responsive to a variety of simple interventions suggesting the potential for significant improvement with minimal investment (Matthews et al., 2002; Tacken et al., 2002).

Figure 2: Per cent FPs Whose Assigned Patients Aged 65 Yrs and Older Had at Least One Flu Vaccine in the Past Two Years: 2001/02



3.2.3 Cervical Cancer Screening

Definition: The percentage of female patients aged 18-60 years who had not undergone a hysterectomy, and who had at least one Papaniculaou test in the last three years.

There are numerous guidelines for screening for early cervical changes using the **Papaniculaou (Pap) smear**. These vary in the recommended frequency of testing based on prevailing levels of monitoring. The most conservative of the guidelines recommends that each eligible patient be screened at least every three years (Katz, 1998), but most recommend annual screening unless there is a monitoring system in place to ensure appropriate follow-up. The **Manitoba Cervical Screening Program** was established in 2000 to monitor **cervical cancer** screening but is not yet fully functional; neither physicians nor patients currently receive reminders about the need for testing from the program. Active monitoring is left to the physicians' discretion and some offices do have organized reminder systems to facilitate regular patient follow-up. Because we do not have information on the presence of these monitoring systems, we chose to give physicians the benefit of assuming an effective monitoring system. Information on the provision of this service is available from physician claims, which capture an estimated 95% of Pap tests performed in Manitoba (Cohen, 1993; Roos et al., 1999).

Results & Discussion

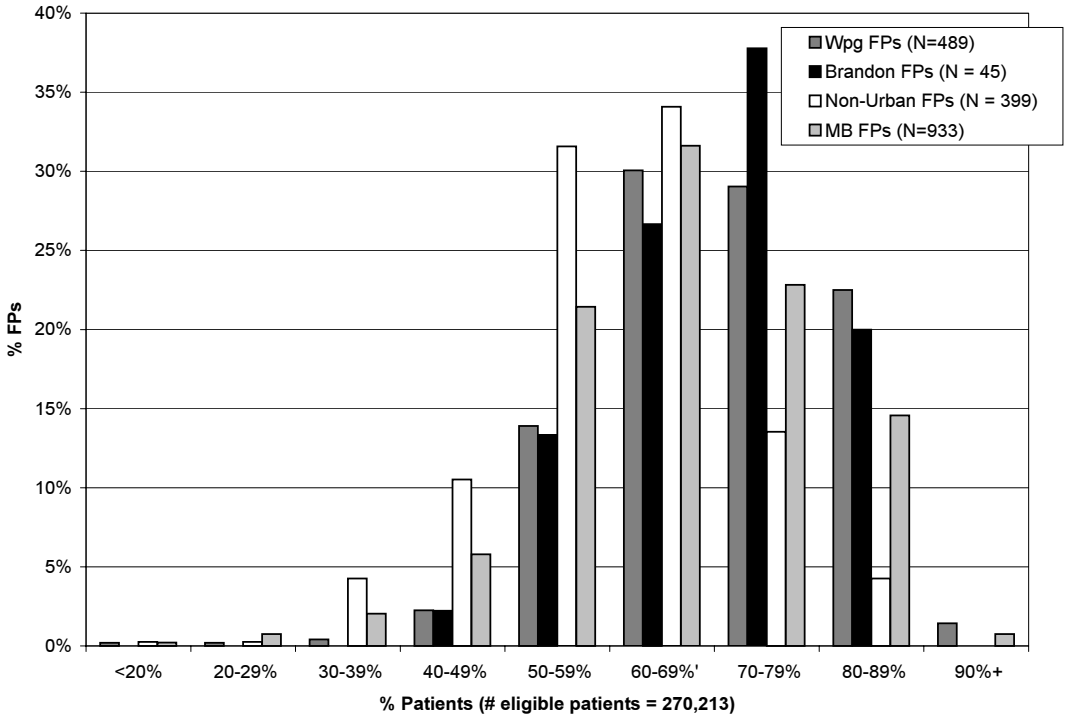
Non-Urban physicians' screening rate was significantly lower than for Winnipeg or Brandon.

The distribution of physicians whose eligible patients were screened for cervical cancer is presented in Figure 3. The Non-Urban physician rate of 60% was significantly lower than for Winnipeg and Brandon's rate of 71% (see Table 3).

From the patients' perspective, a greater proportion of eligible women in Winnipeg and Brandon were screened for cervical cancer than in Non-Urban Manitoba. Rural women are generally reluctant to have pelvic examinations done by a male physician with whom they may have a social relationship (Goel, 1994). Indeed, female physicians have been shown to provide more cervical screening services to their patients than do their male counterparts (Lurie et al., 1997). Urban women who do not wish to visit their family physician have access to more alternatives than do rural women. They may have easier access to female physicians, they may go to a gynaecologist, or they may choose to see a family physician with whom they are not well acquainted. In this study, all of these examinations would have been attributed back to the most responsible primary care physician. Women from rural areas who had this screening test in Winnipeg would also have had the test attributed back to their Non-Urban primary care provider if that physician provided the majority of her care.

The provincial Cervical Cancer Screening Program was implemented to address the low rate of screening in Manitoba. It will provide a surveillance and feedback function rather than addressing the issue of access to acceptable providers, which may be the major issue for many of the women who are currently not being screened (Goel, 1994; Harlan et al., 1991; Perkins et al., 1999). The Manitoba rate is however within the same range as published rates from British Columbia, which has had an organized program since 1960, as well as from other international jurisdictions (Health Canada, 1998). In one study from the United Kingdom where the capitation system results in a more formal relationship between the primary care physician and patient, 74% of practices achieved the target of having 80% of their eligible patients receive cervical screening (Campbell et al., 2001).

Figure 3: Per cent FPs Whose Assigned Female Patients (18-60 yrs) Had at Least One Pap Test in the Past Three Years: 2001/02



3.2.4 Cholesterol Screening

Definition: The percentage of male patients aged 40 years or older and female patients aged 50 years or older who had at least one cholesterol screening test in the last five years.

This indicator only applies to Winnipeg physicians.

The 1998 guidelines for prevention of cardiovascular disease recommend that males aged 40 years and older, and females 50 years of age or older undergo **cholesterol screening** every five years (Canadian Consensus Conference on Cholesterol, 1988). These are the most conservative of the current guidelines (many others recommend more frequent testing often starting at a younger age). Our focus group participants supported this target, allowing the physicians the benefit of accepting the least restrictive target in meeting the criteria for this indicator. Physicians who adopted more aggressive screening guidelines in their practices would have also met the criteria. Due to the data limitations described earlier, this indicator only applies to Winnipeg physicians.

Results & Discussion

The cholesterol screening rate was 68%.

Figure 4 displays the distribution of physicians whose eligible patients had a cholesterol screening test. On average, physicians met the target for 68% of their eligible patients.

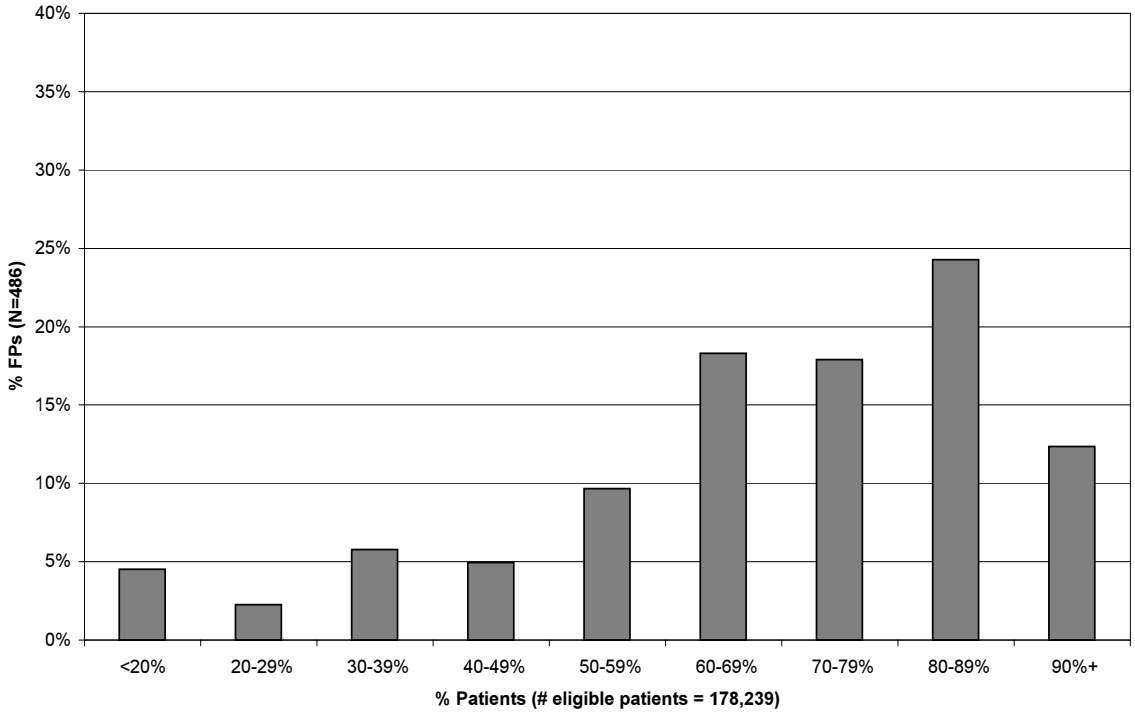
The reported rate is higher than the rate specifically attributable to screening, since it included patients who were tested as part of disease management (e.g. patients with diabetes or MI).

Our methodology does not allow us to determine the purpose of any procedure or test. We know that the patient underwent the test on that particular date, but the test may have been ordered as a screening test or as part of disease management. For this indicator the outcome includes all tests without excluding patients who may have been previously diagnosed with diseases requiring cholesterol monitoring. For example, those patients with a diagnosis of diabetes or myocardial infarction (MI), who were also eligible for screening based on their age and gender, were included even though their tests may have been done as part of disease monitoring. The rate of cholesterol testing we report is thus higher than the rate specifically attributable to screening.

Telephone survey results from the U.S. Behavioural Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2000) indicated a wide variation between state-specific rates. The target rate of screening for the year 2000 was 75% of the eligible population. Only nine states reached this target, with rates ranging from 60% to 80%. No comparable data exist for Canada, but our results are similar or better than the population rates for 19 U.S. states.

Patients may be reluctant to be screened for their cholesterol level if they feel that they would not make any changes based on the test result. Those who follow appropriate low-fat diets, exercise regularly, and are unwilling to initiate treatment with cholesterol lowering drugs would not benefit from the knowledge that their cholesterol level is elevated. They may thus refuse testing if offered by their physicians.

Figure 4: Per cent FPs Whose Assigned Patients[1] Had a Cholesterol Test in the Past Five Years: 2001/02 (Winnipeg only)



[1] Males over 40 yrs and Females over 50 yrs of age

3.2.5 Blood Sugar Screening

Definition: The percentage of patients aged 48 years or older who had at least one blood sugar test in the previous three years.

The Canadian Diabetes Association recommends that patients undergo **blood sugar screening** for diabetes due to the high prevalence of this disease (Harris et al., 1998). Currently, national standards suggest that those aged 45 years and older should have a screening test at least once every three years (Meltzer et al., 1998). As the **tariff** information does not allow us to differentiate between fasting blood sugar tests and a random blood sugar test, we were unable to identify tests done specifically for screening purposes and those done for other reasons. We therefore decided to include any measurement of blood sugar in the three-year period as fulfilling the requirements for this indicator. This was consistent with our desire to give the physician the benefit of the doubt, recognizing the potential limitations of our methodology. Since this indicator required patient-level records for lab tests, physicians outside of Winnipeg were not included.

This indicator only applies to Winnipeg physicians.

Results & Discussion

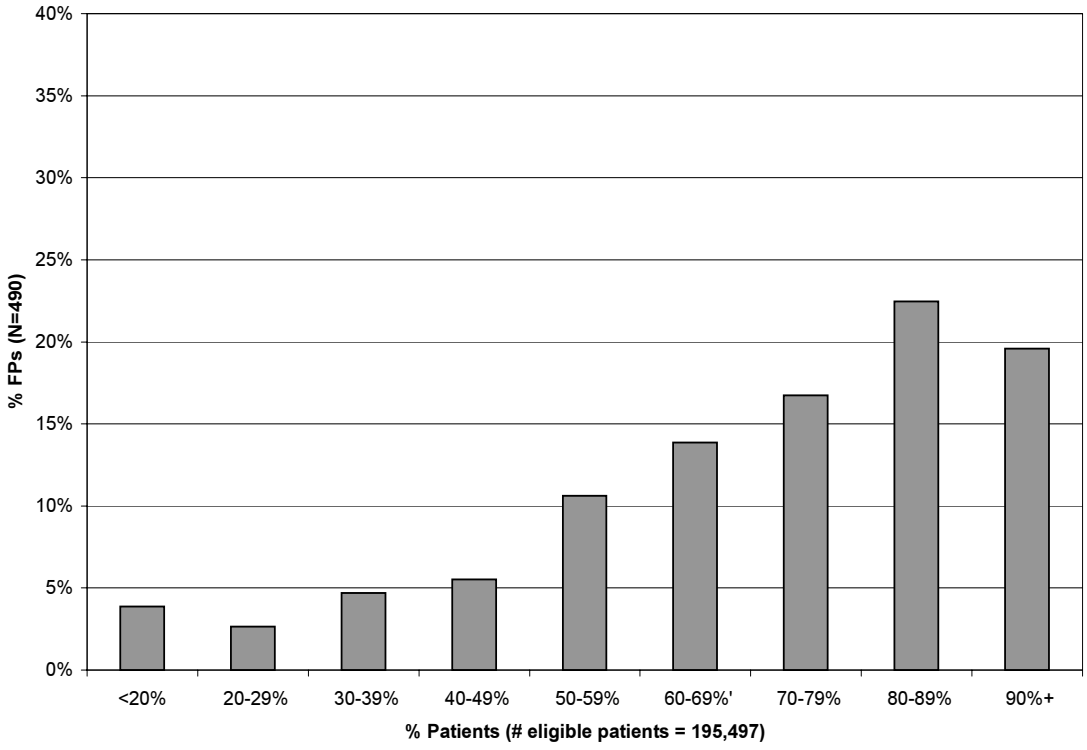
Figure 5 displays the distribution of physicians who met the screening target for their eligible patients. The percentage of physicians achieving the target for blood sugar screening was similar to that for the other prevention procedures, at 70%.

Similar to other preventive procedures, physicians achieved the target for 70% of eligible patients.

Screening however, is not the only reason for a patient to have a blood sugar test; patients who present with symptoms suggestive of diabetes will be tested as part of the investigation of those symptoms. Others who have been diagnosed with diabetes will be tested as part of the monitoring of their disease. Tests done for these reasons were all included when we measured the targets for this indicator. Thus, our findings likely overestimate the true age-based screening rates. One U.S. study that looked at the screening rates in a large survey population found that 31% of the sample reported being screened in the past year (Cowie et al., 1994). While the rate of screening increased from 23% for those 18 to 39 years old, to 46% for those older than 65 years of age, it is not appropriate to compare these annual population-based rates with our rates as we have included only patients who have a family physician and we are focussing on screening rates from the physician perspective.

The reported rate overestimates the true screening rate as it also includes patients tested for suspected diabetes and diabetic patients tested as part of their disease management.

Figure 5: Per cent FPs Whose Assigned Patients Aged 48 Yrs and Older Had at Least One Blood Sugar Test in the Past Three Years: 2001/02 (Winnipeg only)



3.3 Acute and Chronic Disease Management

3.3.1 Anticoagulation Medication Monitoring

Definition: The percentage of patients with a 30-day supply (or more) of anticoagulants who had at least one blood clotting test per each 45-day period.

Patients who are prescribed **anticoagulants** (coumadin or warfarin) should have regular blood testing to monitor the drug dosage. Inadequate drug dosages will result in ineffective treatment while overdosage will place the patient at risk for haemorrhage. This delicate balance requires regular monitoring with a blood test known as an **International Normalized Ratio (INR)**. We chose to include patients with a 30-day or more supply of medication (indicating chronic usage of the anticoagulant), with the outcome of interest being at least one INR for each 45-day supply of anticoagulant. As we did not have access to the results of the monitoring blood tests, we were unable to measure the response to these results. The minimum requirement, however, is that the monitoring of the anticoagulation take place at least once for every month of treatment. By using the 45-day period we provided some leeway to allow for the patient having the test later than at exactly every 30 days. Since this indicator required patient-level records for lab tests, physicians outside of Winnipeg were not included.

This indicator only applies to Winnipeg physicians.

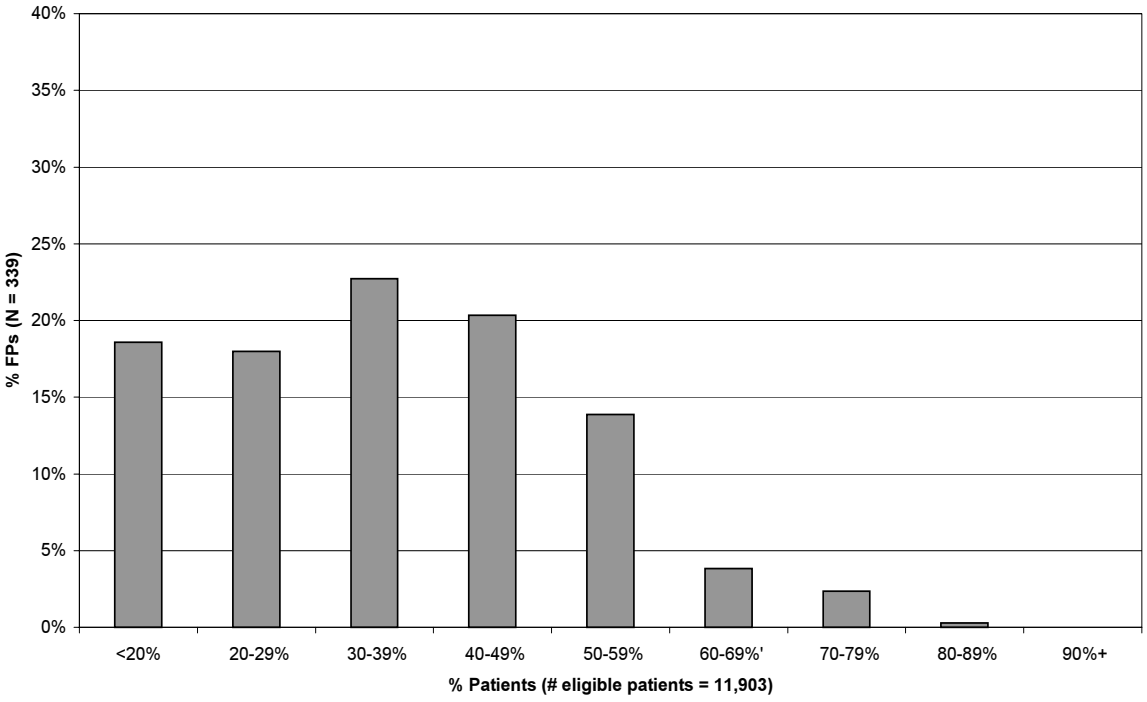
Results & Discussion

The overall physician anticoagulant monitoring rate was quite low, at 35%. Figure 6 presents the distribution for these physicians. When we used a less stringent criterion of one test every 90 days, this rate increased to 43%.

The overall physician monitoring rate was 35%.

The use of anticoagulants as preventive treatment to avoid thrombotic events is recommended for a number of conditions. For the treatment to be useful, the dosage should be closely monitored to ensure that enough medication is provided to achieve the desired positive effects, while also avoiding the dangerous potential consequences of overdosing. Many patients take this medication for years and both patients and their physicians may underestimate the need for ongoing monitoring after an extended period of stable dosing. It is common for physicians to provide their patients with a requisition for monthly testing on an annual basis and to rely on the patient to attend for these tests. Physicians do not typically monitor patient adherence for the tests. This process would require an appropriate office management system to keep track of all patients on anticoagulation therapy. The lack of these systems may have contributed to the inadequate rate of monitoring demonstrated by our findings and in other studies, placing these patients at increased risk of either thrombosis (blood clot) or haemorrhage. The death rate for those with an increase of one unit of the INR above the recommended value (2.5), doubled in one study (Oden and Fahlen, 2002).

Figure 6: Per cent FPs Whose Assigned Patients Receiving Anticoagulants Had at Least One Blood Clotting Test Within each 45-Day Period: 2001/02 (Winnipeg only)



3.3.2 Antidepressant Prescription Follow-up

Definition: The percentage of patients with a new prescription for an antidepressant associated with a depression diagnosis (within two weeks of each other) who had three subsequent **ambulatory visits** within four months of the prescription being filled.

Primary care physicians with a minimum of five eligible patients were included in this indicator.

Patients who are prescribed **antidepressants** for the first time should have appropriate follow-up to monitor both their depression and their response to the medication. Recognizing that there are other reasons for prescribing antidepressant medications, we included those new prescriptions for antidepressant medication associated with a depression diagnosis within two weeks of each other. These patients are presumed to have a diagnosis of depression and have been prescribed antidepressant medication for the first time. As these patients have depression severe enough to warrant prescription medication, they should have follow-up visits to monitor their progress. We included primary care physicians with a minimum of five eligible patients in this indicator.

The Non-Urban follow-up rate was significantly lower than for Winnipeg or Brandon.

Results & Discussion

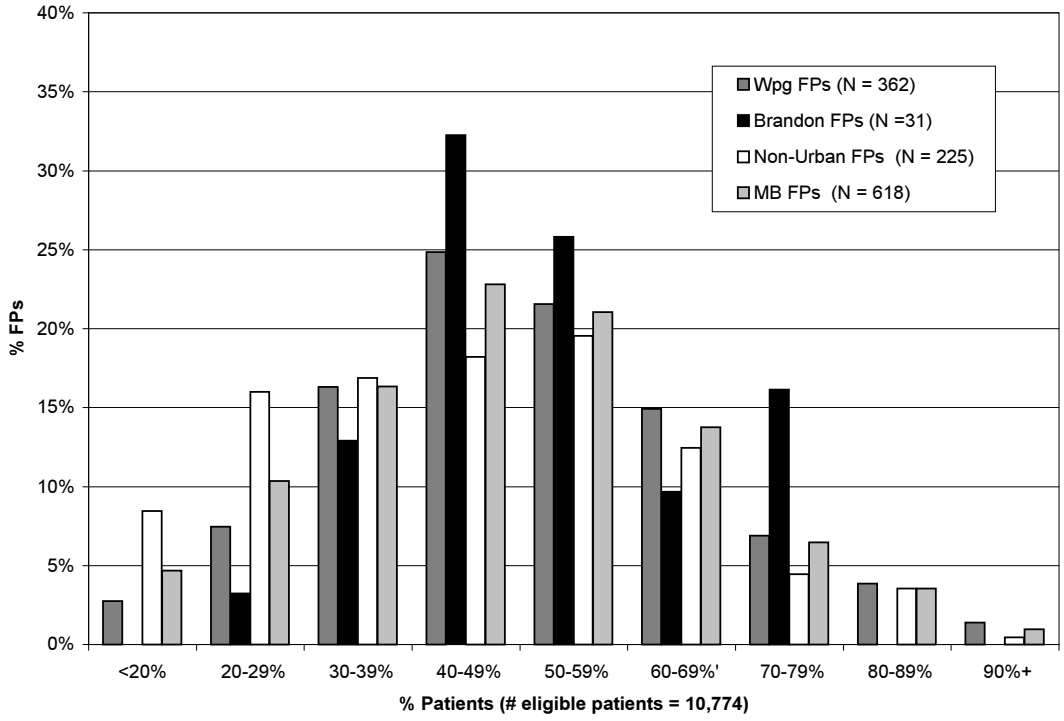
Figure 7 presents the distribution of physicians who provided the three expected follow-up visits for their eligible patients. The average for Winnipeg physicians was very similar to that of Brandon physicians (49% and 51%, respectively), but was significantly higher than the Non-Urban physician average of 43% (see Table 3).

Only 10% of eligible patients without physician follow-up and 26% with follow-up visited a psychiatrist.

Regular follow-up (non-pharmacological treatment) for patients taking this medication is important because antidepressants do not begin to have a clinical effect on the patient for some time after initiating therapy (how long depends on which drug is prescribed), and patients with a major depression are at risk of suicide. There is strong evidence to support a therapeutic role for this form of treatment (Canadian Network for Mood and Anxiety Treatments, 2001; Coulehan et al., 1997; Green, 1996; Schulberg et al., 2002). There are, however, a number of reasons why physicians may not initiate this follow-up. For patients with more severe illness the primary care physician may have initiated a referral to a psychiatrist, who may have provided the recommended follow-up. When we looked at this possibility in the data, we found that only 10% of eligible patients without family physician follow-up visited a psychiatrist, while 26% of those with follow-up visited a psychiatrist. This suggests that those patients thought to be more severely depressed received both family physician and psychiatric follow-up. While this is encouraging, it does not account for the majority of depressed patients who did not receive adequate follow-up from their primary care physician.

It is possible that those patients for whom follow-up is not provided are suffering from less severe illness. The spectrum of patients diagnosed with depression varies considerably and it is possible that the physicians feel that these patients are not at risk of suicide and are waiting till that time when the medication should have started working before seeing the patient to monitor if it is indeed helping. Alternatively, patients may have chosen not to attend for follow-up while they wait for the medication to start working. Others may have failed to attend due to the effects of the depression. The difference in follow-up rates between the Urban and Non-Urban areas may be related to decreased access in Non-Urban areas.

Figure 7: Per cent FPs Whose Assigned Depressed Patients Had Three Subsequent Ambulatory Visits within Four Months of Filling their Antidepressant Prescription: 2001/02



***Note**: Excludes FPs with <5 eligible patients

3.3.3 Asthma Care

Definition: The percentage of patients with an asthma diagnosis (defined as one repeat prescription of a **beta 2-agonist** (ß-agonist in the past year) who filled a prescription for medications recommend ed for long-term control of asthma (i.e., inhaled corticosteroids or leukotriene modifiers, an alternate anti-inflammatory medication).

Guidelines for the treatment of **asthma** recommend that all patients who require the use of their acute treatment medication (ß-agonist) more than once a day should also be treated with long acting anti-inflammatory medication for long-term control (Boulet et al., 1999). This is usually in the form of inhaled **corticosteroids**, as reflected in the above definition. To address any concerns about the validity of an asthma diagnosis, we only included those patients with a filled prescription for ß-agonist as the denominator for this indicator.

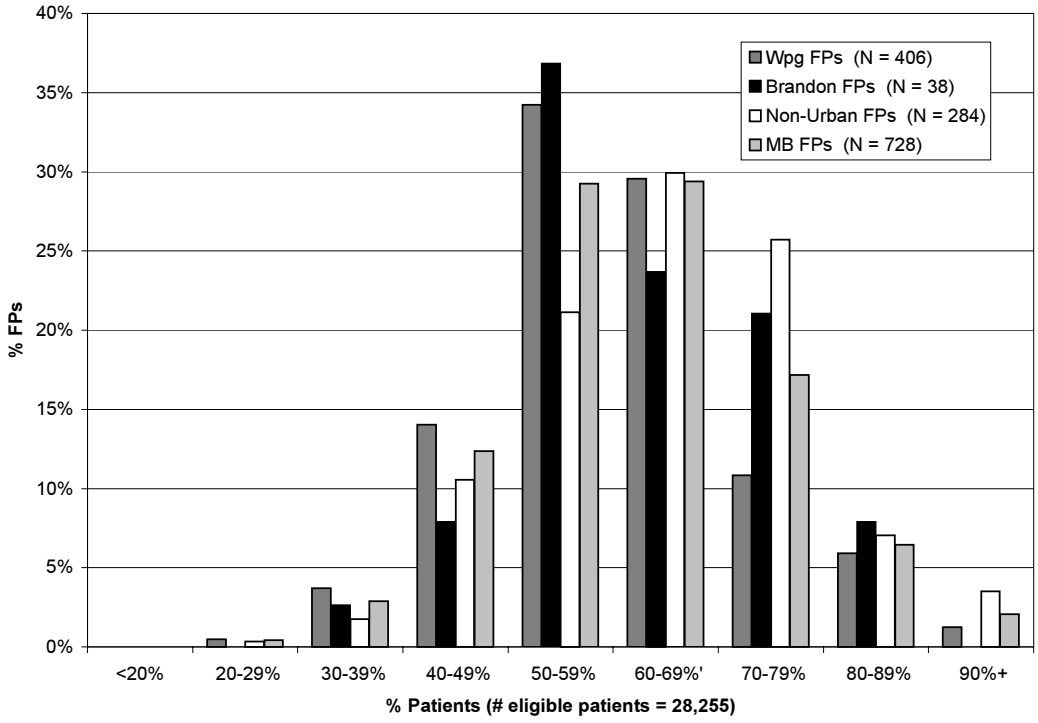
About three-quarters of physicians met the target for between 50% and 79% of their asthmatic patients.

Results & Discussion

The average rate of recommended prescribing for all Manitoba physicians was 61%; the distribution of physicians in each region is presented in Figure 8. As Table 3 shows, the only significant regional difference was between Winnipeg and Non-Urban (59% vs. 64%, respectively). The majority of physicians (about three-quarters) met the target for between 50% and 79% of their asthmatic patients.

Literature from the United Kingdom has focussed on the ratio between the prescribing of bronchodilators and inhaled corticosteroids (Shelley et al., 1996; Sturdy et al., 1995). This measure was developed to meet the same purpose as the quality indicator we used in the current study. These studies indicate that this measure is a good predictor of hospitalization for asthma. The ratio of prescribing corticosteroids to bronchodilators varies from 0.24 for one practice to a high of 1.53. While these fndings are not directly comparable to our indicator, the physician with a ratio of 0.24 would have a maximum of 24% of their patients meeting our criteria for quality prescribing. Population-based comparisons are not available to indicate how well Manitoba physicians are doing in comparison to physicians in other jurisdictions. However, there is clearly potential for improvement in this aspect of care.

Figure 8: Per cent FPs Whose Assigned Asthmatic Patients Had at Least One Prescription for Long-Term Control of Asthma: 2001/02



3.3.4 Potentially Inappropriate Prescribing of Benzodiazepines for Older Adults

Definition: The percentage of patients aged 75 years or older with prescription(s) for two or more benzodiazepines or prescriptions for greater than a 30-day supply of medication.

The potential side effects of certain medications in older adults have been well described (McLeod et al., 1997). To avoid these side effects it has been suggested that older patients should not be prescribed certain drugs, or if these drugs are indeed prescribed to these patients it should be done with extreme caution. **Benzodiazepines** are a group of drugs to which this caution applies. In particular, long-term use of these drugs is not recommended for older patients (Allard et al., 2001; McLeod et al., 1997). However, several family practitioners in the focus group told us that many older patients have been using benzodiazepines for many years and that it is extremely difficult to wean them off these drugs. Patients are often reluctant to be weaned off the drug and it was suggested that, on occasion, it might be more detrimental to the patient's health to stop the drug than to continue using the drug in a controlled fashion.

Winnipeg physicians were significantly more likely to prescribe benzodiazepines to their older patients than Non-Urban physicians.

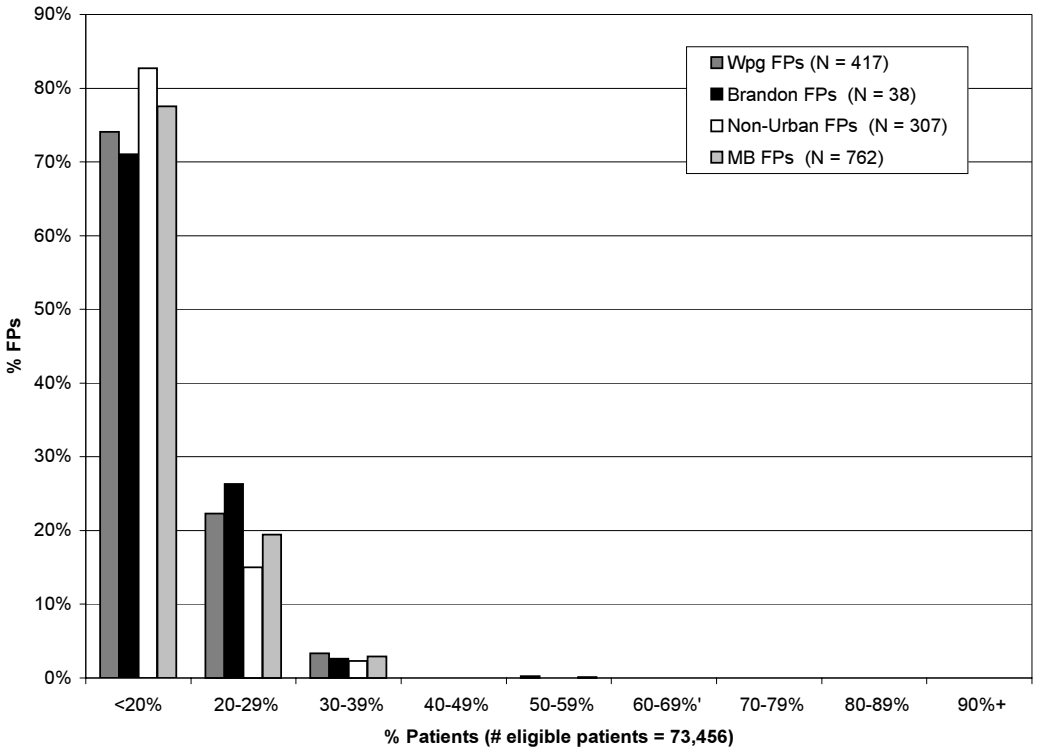
Results & Discussion

Personal care home residents were excluded from the analyses on the advice of focus group members. For this indicator, lower percentages are desirable as they reflect less inappropriate prescribing. According to the distributions presented in Figure 9, physicians in all regions had low prescribing rates. The overall prescribing rate for Manitoba physicians was 15%. Winnipeg physicians were significantly more likely than Non-Urban physicians to prescribe benzodiazepines to their older patients (15% vs. 13%) (see Table 3).

One Quebec study estimated that 31% of the older population in Quebec received benzodiazepines for more than 30 consecutive days (Tamblyn et al., 1994). The prevalence of inappropriate prescribing was higher for female patients than for males. The rate of inappropriate prescribing among physicians who participated in an intervention trial in Ontario matched our 15% rate (Pimlott et al., 2003). The intervention did not have any impact on the rate, suggesting that it may be as low as can be expected considering that many of these patients have been on these drugs for many years. Further insight into this issue was offered by Damestoy (1999) who found, in a qualitative study, that physicians justified their prescribing of benzodiazepines to older patients based on patient distress.

However, in another Ontario study, Tu et al. (2001) noted a significant decline of benzodiazepine prescribing for older patients over time. This encouraging trend may also be present in Manitoba as physicians are recognizing the long-term risks of this drug and fewer of them are initiating benzodiazepine therapy.

Figure 9: Per cent FPs Whose Assigned Patients Aged 75 and Older Had Either 2+ Prescriptions or >30-day Supply of Benzodiazapine: 2001/02



3.3.5 Diabetes Care: Cholesterol Testing

Definition: The percentage of diabetic patients (defined as those who had at least one drug used to treat diabetes) who had a cholesterol screening test in the same fiscal year as the prescription.

This indicator applies only to Winnipeg physicians.

The two most commonly accepted indicators of **diabetes** care (haemoglobin A1c determination and testing for the presence of urine microproteinuria) involve tests performed at the teaching hospital laboratories in Manitoba regardless of where the blood is drawn. However, due to the previously outlined data limitations for hospital lab test data, we were unable to include these tests as indicators of quality care for diabetes. An additional measure of appropriate diabetes care would be to ensure that patients diagnosed with diabetes have had a cholesterol test. As hypercholesterolemia (elevated blood cholesterol level) is an independent risk factor for patients with diabetes, and the target values are different for diabetic patients, it is essential to ensure that such patients who also have high cholesterol are appropriately treated. Management guidelines for diabetes include the measurement of cholesterol as an appropriate strategy in diabetic patients (Harris et al., 1998). We included an annual cholesterol test as an indicator even though the data are not available for patients outside of Winnipeg.

We defined diabetic patients as those who were receiving active treatment (i.e., medication) for diabetes. This was measured using the drug information (i.e., DPIN) data available in the Repository. All patients who received a repeat prescription for a medication specifically intended to treat diabetes were included. Thus, rather than relying on physician-generated diagnoses of diabetes, we used the drug utilization data.

The overall testing average for Winnipeg physicians was 54%.

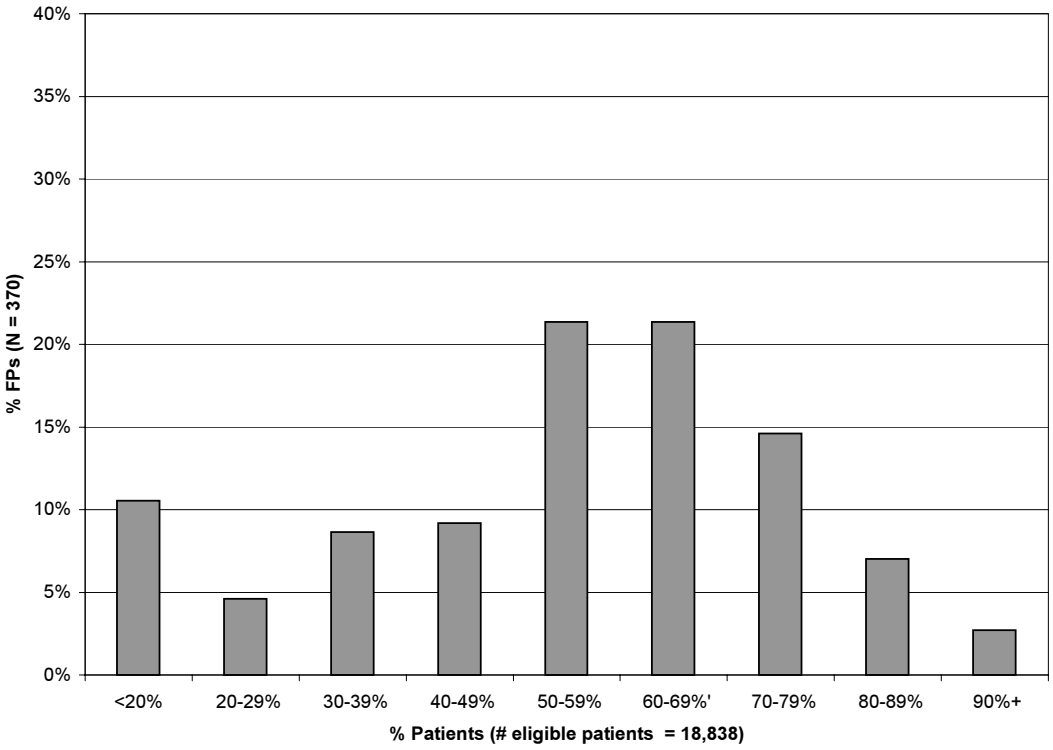
Results & Discussion

The distribution of Winnipeg physicians meeting the target for their eligible diabetic patients is presented in Figure 10. The overall testing average for these physicians was 54%.

A recent chart review by Harris et al. (2003) in Southeastern Ontario looked at various indicators of the quality of diabetes care provided by primary care physicians. Over a one-year period, 57% of patients had a cholesterol level documented in their charts. This is slightly higher than our 54%. Tests performed either while patients are in hospital or by endocrinologists in hospital ambulatory care (outpatient) departments are not captured in our data, which may explain the difference between these results.

Other research found that physicians who see more patients (i.e., busier physicians) are less likely to send their diabetic patients for both cholesterol testing and ophthalmological examinations (Streja and Rabkin, 1999). We addressed this issue in our analysis of the Quality Index, which will be discussed in the next chapter.

Figure 10: Per cent FPs Whose Assigned Diabetic Patients Had a Cholesterol Test in the Current Year: 2001/02 (Winnipeg only)



3.3.6 Diabetes Care: Eye Examination

Definition: The percentage of diabetic patients (defined as those who had at least one drug used to treat diabetes) who saw either an optometrist or ophthalmologist in the same fiscal year as the prescription.

Retinal examination by an experienced practitioner is recommended for all diabetic patients.

As one of the most common and serious complications of diabetes relates to damage to the retina, it is recommended that all diabetic patients undergo regular examination of their retinas by somebody experienced in doing this procedure (Harris et al., 1998). This examination involves the dilation of the pupil and therefore requires a practitioner who can confidently perform **fundoscopy**. While some family physicians may have the skill to perform this examination themselves, most of them choose to have this examination performed by a specialist in this area. Often, patients have a relationship with the **optometrist** or **ophthalmologist** who ensures that the patient returns annually for a regular examination. This may occur after consultation with the family practitioner or it may represent an independent relationship.

Our method of allocation of services did not require that the consultation be initiated by the family practitioners, only that the patients had undergone the necessary examination, as reflected in the definition.

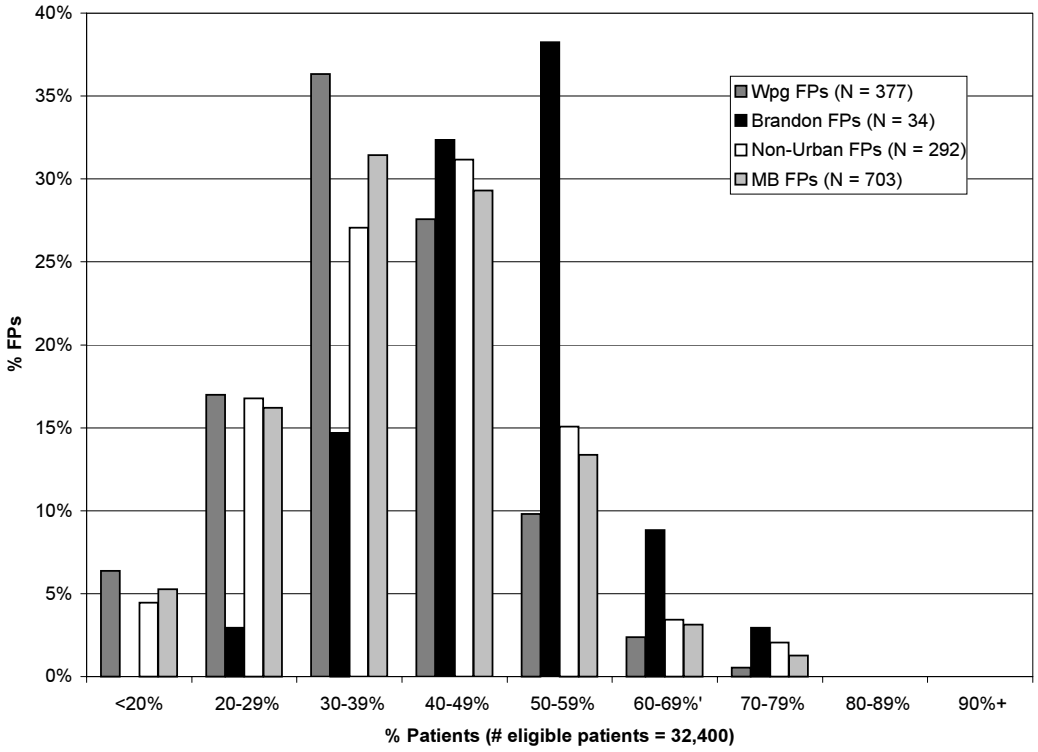
Results & Discussion

Physician rates for all three regions were significantly different from one another.

As illustrated in Figure 11, the percentage of physicians whose diabetic patients had the appropriate eye examination was generally low. On average, Winnipeg physicians met the target for only 37% of their patients, while the rates were better for Brandon and Non-Urban physicians (48% and 40%, respectively); the three regions were significantly different from one another.

Ontario findings, over a two-year period, are better than Manitoba's overall rate (39%), with 46% of diabetics showing evidence of an optometrist or ophthalmologist visit (Harris et al., 2003). The lower overall rate we found for Manitoba may be due to billing guidelines for optometrists. Manitoba optometrists only submit a claim to Manitoba Health for services that have been defined as "medically necessary;" all other services are billed directly to the patient. There appear to be different interpretations of what constitutes "medically necessary" services and this in turn affects billing patterns. This may also account, in part, for the different rates reported for the various geographical areas. Clinicians who use a more liberal interpretation of what is "medically necessary," would have more patients with optometrist visits recorded in the Repository, while for others more of these visits may be billed directly to the patient.

Figure 11: Per cent FPs Whose Assigned Diabetic Patients Saw an Optometrist or Ophthalmologist in the Current Year: 2001/02



3.3.7 Post-Myocardial Infarction Care: Beta-Blocker Prescribing

Definition: The percentage of patients discharged alive from hospital in the preceding three years with a discharge diagnosis of **myocardial infarction** (**MI**)(excluding those with prior diagnosis of asthma, COPD or peripheral vascular disease) who filled at least one prescription for a beta-blocker within four months of the first infarction.

Physicians with at least five eligible patients were included in this indicator.

The two indicators relating to patients who had an MI use the **hospital discharge** data to identify patients who were discharged from hospital following an acute MI. As the number of patients in this category was relatively small we chose to use three years (1999, 2000, 2001) of data to identify appropriate patients. We included physicians with at least five eligible patients in the indicator.

It is recommended that all patients be treated with a drug from the **beta-blocker** class of drugs after suffering an MI (Krumholz et al., 1998). Patients with a prior diagnosis of asthma, chronic obstructive pulmonary disease (COPD) or peripheral vascular disease were excluded, as these are **contraindications** to the use of beta-blockers. All other patients who filled at least one prescription for a beta-blocker within four months following hospital discharge for their first MI fulfilled the criteria for this indicator.

The prescribing rate for Winnipeg physicians was significantly higher than for Non-Urban physicians.

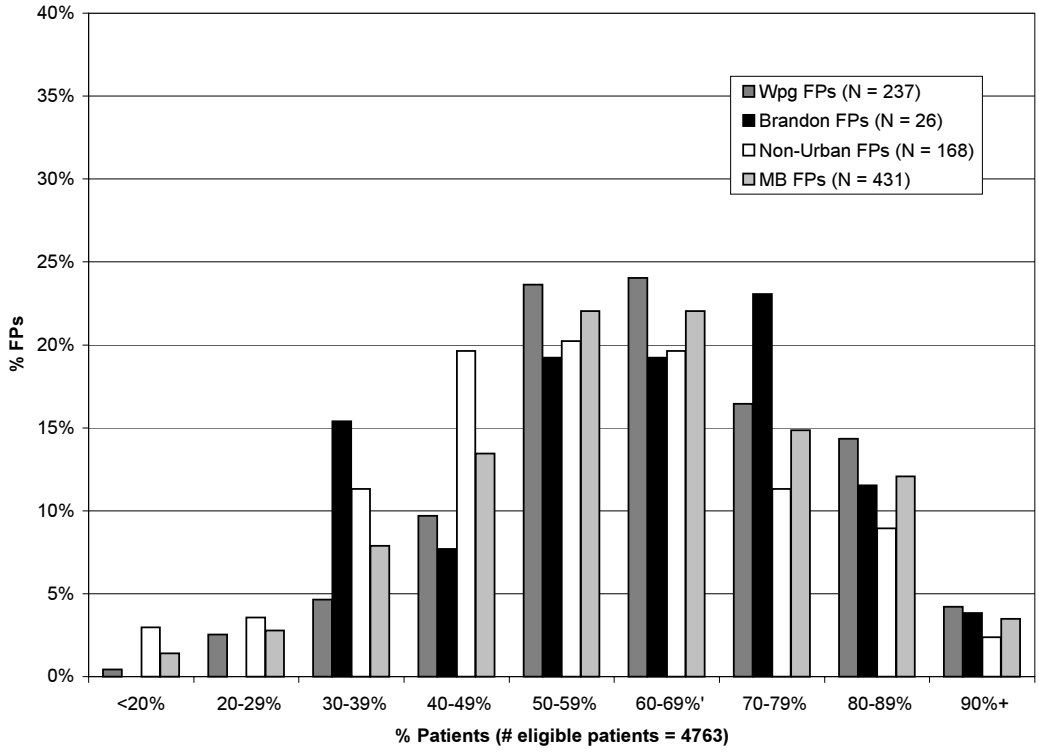
Results & Discussion

The overall rate of prescribing in Manitoba was 59%. The distribution of physicians is presented in Figure 12. Winnipeg and Brandon had similar rates at 63% and 62%, respectively. The prescribing rate for Winnipeg physicians was significantly higher than Non-Urban physicians (54%) (see Table 3).

Only 6% of Manitoba physicians met the recently published minimum target of 85% of ideal candidates receiving beta-blockers at hospital discharge.

Previous research has shown a 14% lower risk of mortality at one year in those patients prescribed beta-blockers after suffering an acute myocardial infarction (AMI) (Krumholz et al., 1998). The rates of prescribing for family physicians in that study were lower than those of specialists and the overall rates were lower than our rates (50% vs. 59%). There was however considerable regional variation by state, ranging from 30% to 77%. The recently published Canadian Quality Indicators for Acute Myocardial Care (Tran et al., 2003) has established a minimum target of 85% of ideal candidates receiving beta-blockers on discharge from hospital. Clear communication between the hospital admitting physician and the community-based physician is essential if this target is to be reached as many Winnipeg patients will be cared for by specialists while in hospital. Only 6% of Manitoba physicians currently meet this target and improvement in this area of practice could have a significant impact upon patient outcome.

Figure 12: Per cent FPs Whose Assigned Post-Myocardial Infarction Patients Had at Least One Prescription for a Beta- Blocker Within Four Months of the First Infarction: 2001/02



***Note:** Excludes FPs with <5 eligible patients

3.3.8 Post-Myocardial Infarction Care: Cholesterol Testing

Definition: The percentage of patients discharged alive from hospital in the preceding three years with a discharge diagnosis of MI who had a cholesterol test within four months of discharge.

Physicians with at least five eligible patients were included in this indicator.

Guidelines suggest that all patients should have their cholesterol measured at the time of, or immediately following an MI. It is also suggested that this measurement should not be done within six weeks of the acute phase of the infarction. We thus allocated a four-month period following the infarction in which patients should have had a cholesterol test. This test may have been the first one done approximately six weeks post-MI or it may have been a follow-up test if an initial test was done immediately upon admission to hospital. Either one confirms that the patient has undergone appropriate testing. As explained in the Data Limitations section of the previous chapter, this indicator was measured only in Winnipeg. Only physicians with at least five eligible patients were included.

Results & Discussion

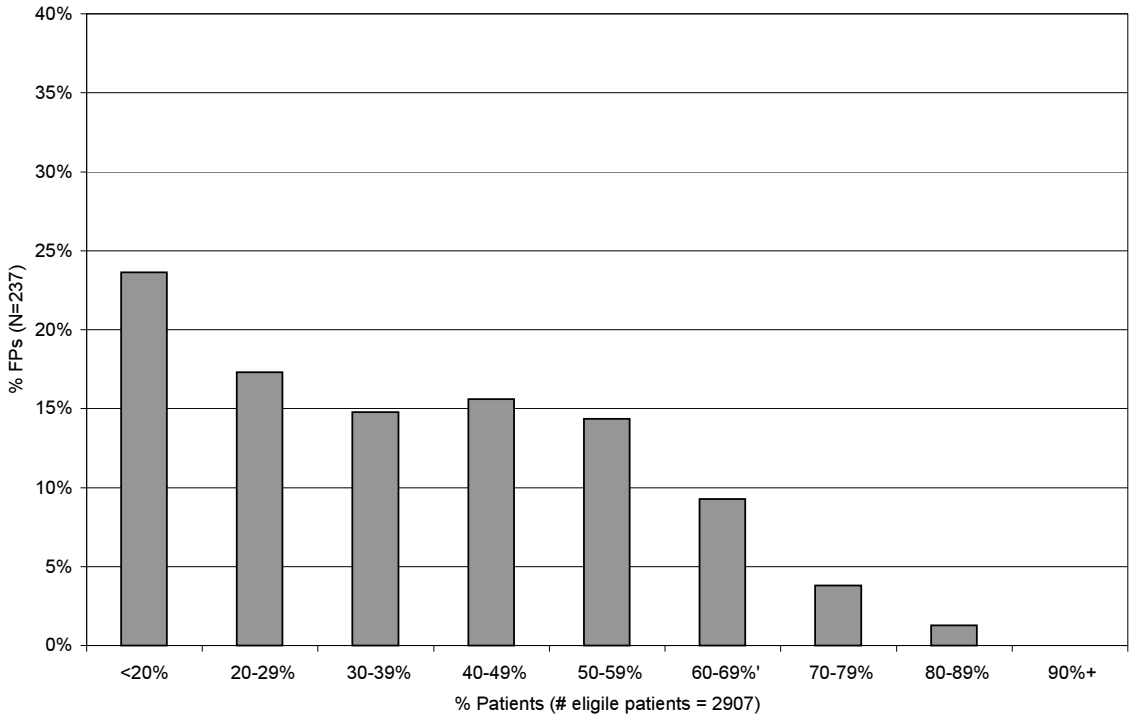
The overall testing average for Winnipeg physicians was 35%.

Figure 13 presents the distribution for Winnipeg physicians. On average, physicians only tested 35% of eligible patients within four months of hospital discharge.

It is possible that we are missing some evidence of testing even within Winnipeg. When the follow-up visits are provided by specialists at hospital ambulatory care (outpatient) departments, the tests are done at the hospital laboratory; these are not recorded in the Repository. There is also a small group of physicians who refer their patients to the Seven Oaks Hospital for laboratory tests, which are also not captured in the Repository; these represent less than 1% of all tests that were done.

Researchers using a simulated model of the U.S. population (35-84 years of age) found that prevention is more beneficial as risk levels increase (Goldman et al., 1999). Thus, decreasing cholesterol levels for adults with coronary heart disease (i.e. **secondary prevention**) is more effective than for high or medium risk individuals without this disease (i.e. **primary prevention**). This does not imply that primary prevention should be abandoned, rather treating patients with coronary heart disease should be an identified priority for primary care physicians.

Figure 13: Per cent FPs Whose Assigned Post-Myocardial Infarction Patients Had a Cholesterol Test Within Four Months of Hospital Discharge: 2001/02 (Winnipeg only)



***Note:** Excludes FPs with <5 eligible patients

4.0 QUALITY OF CARE INDEX

An important part of evaluating quality of care is to determine if specific characteristics of physicians and/or their practices are related to the care physicians provide. Presenting the data based on each quality indicator does not give an overall picture of how individual physicians fare in terms of quality of care across all the indicators. Further, given the number of indicators included, a more streamlined approach to this component of the project was necessary. The solution was to develop an index to summarize the level of care provided across many indicators simultaneously. This section describes how we created such an index, and discusses several issues that had to be addressed during this process.

4.1 Methods

All physicians who had eligible patients for at least one indicator were included in the Quality Index.

The Quality Index was based on the cohort of physicians used in the indicator development; all physicians who had eligible patients for at least one indicator were included. For each indicator, every physician was given a score to reflect the proportion of their patients with the desired outcome out of all their eligible patients. Averages of all scores were calculated for each physician and then for all physicians overall. This latter score served as the standard of comparison; individual physicians whose scores were less than the standard were considered "below average" and those higher than the standard were deemed "above average" compared to their colleagues. Two main problems that arose during this step will be discussed in the next section. In the final stage of the analyses, the index score served as the outcome; several regressions were run to predict which physicians and practice characteristics affect the quality score.

Two indices were developed: 1) Preventive Care, and 2) Disease Management. Only indicators that could apply to all physicians in Manitoba were included.

Throughout this study we differentiated between indicators of quality based on **preventive care** and those that reflect acute or chronic disease management. Thus, two indices were developed: 1) Preventive Care (for childhood immunization, influenza vaccination, and cervical screening), and 2) Disease Management (for diabetes [eye examination], asthma, post-MI [beta-blocker prescription], antidepressant management, and benzodiazepine prescribing). In order to facilitate comparisons between physicians practising in Winnipeg and those practising in other parts of the province, we chose to include only those indicators that could apply to all physicians regardless of location. The indicators that rely on laboratory information were thus excluded, as they were only relevant for Winnipeg physicians.

4.1.1 Equalizing the Indicators

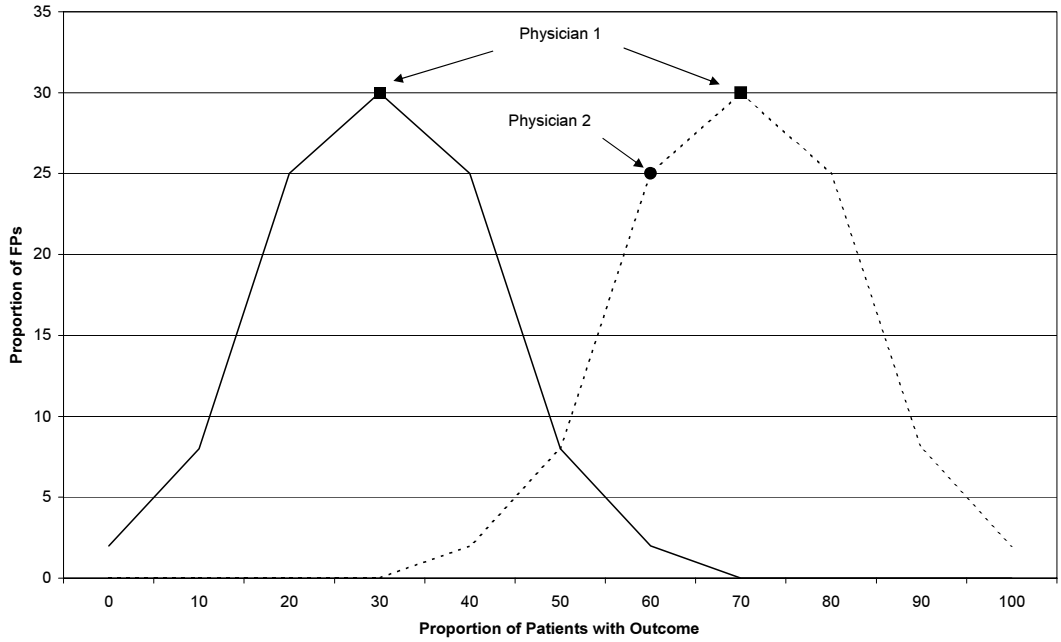
One concern in developing the indices was the fact that there were very few doctors for whom all of the included indicators applied. As described earlier, to be included in an indicator, physicians needed a minimum number of eli-

Physicians were only scored on indicators for which they qualified. Their overall index score was based on these averages.

gible patients (5 or 10, depending on the indicator). In creating the indices, physicians were only scored on indicators for which they qualified; similarly, their overall index score was based solely on the averages of these indicators. Taking a simple average was a problem because different indicators did not have the same base rates. In other words, the desired clinical outcome was more likely for some indicators than for others.

Figure 14 illustrates this issue with fictional distributions for two indicators using just the raw data; Physician 1 has scores for both indicators, while Physician 2 is only included in one indicator.

Figure 14: Example Distribution of Physician Index Scores: Unstandardized



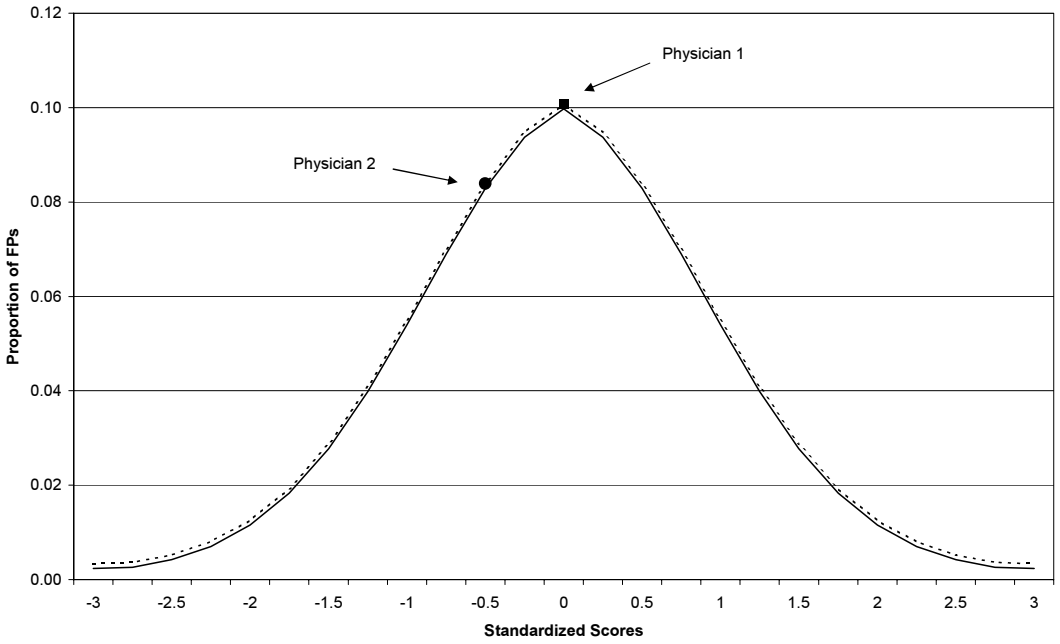
Physician 1 has an average proportion of 0.53, while Physician 2 has an average proportion of 0.60. Physician 1, therefore, appears to be worse than Physician 2 even though Physician 1's score is higher on the indicator the two physicians have in common. As this example demonstrates, an index based on the simple average of these indicators could result in biased scores for some physicians because they would not include all of the same indicators.

The solution to this problem was to equalize the indicators. To do so, all of the indicators involved in the two indices were transformed to have a mean of zero and a standard deviation of one. This transformation resulted in a

measure for which negative scores indicated a level of care below the average and positive scores indicated a level of care above the average. Importantly, all indicators had the same base rate (i.e., 0). Using the average of the physicians' scores on these transformed indicators provided unbiased estimates, because all of the indicators had the same distribution.

Returning to the example of the two physicians, when the scores are standardized the distributions are identical (see Figure 15). Physician 1, who was at the average on both indicators, now has the average index score, while Physician 2, who only qualified for one indicator and had a below-average score is lower on the Index. The process of standardization, therefore, corrects for the differences between the individual indicators.

Figure 15: Example Distribution of Physician Index Scores: Standardized



4.1.2 Weighting Index Scores

The number of eligible patients differed among the indicators for the physicians. This raised the question of whether to weight the index scores to account for these differences. Without weighting, each indicator would have equal impact upon each physician's overall index score. However, weighting the score of each indicator based on the number of eligible patients would adjust a physician's overall index score. Thus, indicators with many more patients than other indicators would have a greater impact on a physician's index score than would other indicators with fewer patients.

For example, if a physician had a standardized score of 1 on the antidepressant indicator with 20 eligible patients, and a standardized score of 0.5 on the asthma care indicator with 10 eligible patients, the weighted average of the two would be 0.88. This is because the antidepressant indicator would have double the impact upon the average score than would the asthma care indicator. The unweighted average would simply be 0.75, because each of the indicators would have the same impact when determining the average score. Different decisions regarding weighting were made for the two Quality Indices.

Each indicator in the Disease Management Index was weighted according to the number of eligible patients. The Preventive Care Index score was not weighted.

No single indicator included in the Disease Management Index had substantially more eligible patients than the other indicators across all of the physicians; each indicator was weighted according to the number of eligible patients. This means that if post-MI care, for example, is a larger part of some physicians' practices than are the other indicators, this would be reflected in the index score. For the Preventive Care Index, however, the number of eligible patients for the cervical screening indicator was much larger than for either the childhood immunization indicator or the influenza vaccination indicator for almost every physician. A weighted index score would have unfairly represented the physician's performance on cervical screening, with almost no impact on their performance on the other two indicators. The Index score was therefore not based on weighted indicators. Rather, each of the three indicators contributed equally to the physicians' scores.

4.1.3 Modelling Quality of Care

The final stage in the analyses was to determine if there were any systematic relationships between physicians' overall index scores and the characteristics of the physician and/or the practice. For example, it could be the case that physicians who have been in practice longer are more likely to provide the appropriate care, or vice versa. On the other hand, the characteristics of the patients in the practice, such as age, sex, or even socioeconomic status, might also play a role. Physicians who treat a relatively higher proportion of older patients may be more likely to follow guidelines for flu vaccination, while physicians with many younger patients may be more likely to follow the guidelines for childhood immunization.

Physician and practice characteristics that could influence the outcome for each indicator were identified.

Based on the current literature, we identified several physician and practice characteristics that could potentially influence the outcome for each quality indicator. The six **physician characteristics** were age, sex, training (Canadian vs. other), years practising in Manitoba (up to 11 years, as per data availability), how they are paid (salaried vs. fee-for-service), and whether the physician had hospital privileges (see Table 6). Geographic region of the practice was also included, and for these analyses, was defined as Urban (Winnipeg

and Brandon) or Non-Urban (all other regions of Manitoba). The **practice characteristics** were practice size (i.e., total number of visits), average age, sex, and average income quintiles of patients, intensity of the practice, patient morbidity, and continuity of care (see Table 7). Both sets of characteristics are described in detail in the next section.

Multiple regression models were run on each Index to determine which characteristics were important for quality of care. This statistical method identifies which set of variables, if any, are best able to predict the index score for a physician. A significant positive result for a variable means that as the value of the variable (e.g., number of years practising) increases so does the index score, indicating that the level of care improves. A significant negative result for a variable indicates that as the value of the variable (e.g., average patient morbidity) increases, the index score decreases, and the care worsens.

Brandon was combined with Winnipeg, because its physician average was more similar to Winnipeg than Non-Urban for most of the indicators.

Because of the small number of physicians in Brandon, running separate regressions was inappropriate. According to the results of statistical significance tests comparing the physician averages across different regions for each indicator, Brandon was more similar to Winnipeg than to Non-Urban for most of the indicators; thus, it was combined with Winnipeg. Three models are presented for each Index: Manitoba, Urban (Winnipeg and Brandon), and Non-Urban (all other regions in Manitoba).

4.1.4 Independent Variables

Physician Characteristics

As mentioned, we examined six physician characteristics: physician sex, age, years of practice in Manitoba (to a maximum of 11 years as per data availability), principal method of payment (fee-for-service or salaried), whether they graduated from a Canadian medical school, and whether they had hospital privileges.[8] The distributions of these variables are presented in Table 6. In general, Winnipeg had a higher proportion of female family physicians compared to Brandon or Non-Urban. Brandon and Non-Urban tended to have a younger age distribution of family physicians and, perhaps related to that, a larger proportion who had been practising five or fewer years. Non-Urban family physicians were more likely to be salaried. A larger proportion of Winnipeg family physicians graduated from a Canadian medical school but fewer had hospital privileges.

[8] Personal care home privilege was initially included but the results were so similar to hospital privileges that it did not provide any additional information, and was dropped from the analyses.

Table 6: Distributions of physician (personal) characteristics: 2001/02

Characteristic	% (N of physicians) Winnipeg	Brandon	Non-Urban
1. Sex			
Female	33.0 (165)	25.5 (12)	24.1 (97)
Male	67.0 (336)	74.5 (35)	75.9 (305)
2. Age			
< 30	3.9 (19)	19.1 (9)	20.5 (79)
30-39	20.7 (102)	31.9 (15)	31.9 (123)
40-49	37.0 (182)	25.5 (12)	25.4 (98)
50-59	22.2 (109)	19.1 (9)	14.2 (55)
60-69	12.0 (59)	4.3 (2)	6.2 (24)
70+	4.3 (21)	0.0	1.8 (7)
3. Years in Practice			
< 2	3.4 (17)	6.4 (3)	15.4 (62)
2-3	6.8 (34)	40.4 (19)	23.1 (93)
4-5	7.0 (35)	8.5 (4)	16.4 (66)
6-7	5.8 (29)	2.1 (1)	6.0 (24)
8-10	16.2 (81)	6.4 (3)	8.5 (34)
11	60.9 (305)	36.2 (17)	30.6 (123)
4. Salaried			
Yes	7.0 (35)	4.2 (2)	38.0 (152)
No	93.0 (466)	95.8 (45)	62.0 (250)
5. Canadian Graduate			
Yes	65.5 (328)	36.2 (17)	31.4 (126)
No	34.5 (173)	63.8 (30)	68.6 (276)
6. Hospital Privileges			
Yes	51.6 (259)	89.3 (42)	93.0 (374)
No	48.4 (242)	10.7 (5)	7.0 (28)

Note: Due to rounding, the percentages do not all sum to 100%

Practice Characteristics

Actual practice populations were used to describe the characteristics of these populations. These characteristics reflect actual visits made to the physician.

Although presented as indicators of physician behaviour, many of the quality indicators used in this study are also affected by patient factors. They require that patients adhere to physician-initiated behaviours. For example, as noted by the focus group participants, patients may refuse suggested immunizations, they may not fill prescriptions for recommended medications, or they may fail to return for follow-up appointments. The focus group participants, however, accepted the value of these indicators, noting that the underlying patient-physician relationship reflects a physician's ability to establish an appropriate working relationship with the patient. In this context, the characteristics of each physician's practice population are important to consider when describing quality based on the identified indicators. We used the actual practice populations for each family physician rather than virtual practices created by the plurality allocation process to describe the characteristics of these populations. Thus, these characteristics reflect the actual visits made to that physician. The seven relevant practice-based characteristics included in the study are described below.

To gauge the "busyness" of the practices, the **practice size** (defined as the total number of real visits to that physician in the year) was measured.

Intensity of the practice reflects the amount of care provided to the patients in the practice. It is the average total cost of care per discrete patient for the physician's entire practice, and includes both direct care (e.g., visits) and indirect care (e.g., referrals to specialists, lab procedures etc.). In areas of the province with a severe shortage of physicians, intensity is likely to be reduced by the poor accessibility to the physician's practice. Thus, a variable examining the effect of region was included. Average age and sex of the practice were calculated based on the visits to that physician in the study year rather than on the number of discrete patients the physician saw. The distributions of these characteristics are presented in Table 7.

Table 7: Distributions of practice characteristics: 2001/02

	% (N of physicians)		
Characteristic	**Winnipeg**	**Brandon**	**Non-Urban**
1. Practice size (# visits)			
≤ 1999	26.1 (131)	27.7 (13)	36.1 (145)
2000-3999	23.4 (117)	21.3 (10)	33.8 (136)
4000-5999	16.0 (80)	23.4 (11)	16.7 (67)
6000-7999	18.8 (94)	21.3 (10)	8.5 (34)
8000-9999	9.0 (45)	4.3 (2)	3.7 (15)
10 000+	6.8 (34)	2.1 (1)	1.2 (5)
2. Sex			
Female	60.0 (1,412,905)[1]	61.0 (125,701)	59.0 (761,535)
Male	40.0 (941,936)	39.0 (80,366)	41.0 (529,202)
3. Age			
≤ 29	3.2 (16)	4.3 (2)	3.7 (15)
30-39	20.2 (101)	23.4 (11)	24.4 (98)
40-49	38.9 (195)	55.3 (26)	42.3 (170)
50-59	27.9 (140)	14.9 (7)	25.6 (103)
60+	9.8 (49)	2.1 (1)	4.0 (16)
4. Income Quintiles[2]			
1-1.9	9.2 (46)	0.0	17.9 (72)
2-2.9	35.9 (180)	95.7 (45)	54.0 (217)
3-3.9	53.3 (267)	4.3 (2)	24.9 (100)
4+	1.6 (8)	0.0	3.2 (13)
5. Intensity of Practice[3]			
Highest	17.6 (88)	17.0 (8)	3.2 (13)
Above average	33.5 (168)	17.0 (8)	24.1 (97)
Average	18.6 (93)	34.0 (16)	33.3 (134)
Below average	23.0 (115)	21.3 (10)	28.4 (114)
Lowest	7.4 (37)	10.6 (5)	10.9 (44)
6. Patient Morbidity (ACG)[4]			
Low	49.1 (246)	48.9 (23)	43.8 (176)
Medium	38.9 (195)	44.7 (21)	53.2 (214)
High	12.0 (60)	6.4 (3)	3.0 (12)
7. Continuity of Care[5]			
20-40%	26.3 (132)	55.3 (26)	25.6 (103)
41-60%	31.1 (156)	36.2 (17)	50.2 (202)
61-80%	34.7 (174)	8.5 (4)	22.1 (89)
81%+	7.8 (39)	0.0	2.0 (8)

[1] These numbers represent the number of visits
[2] Due to the averaging of the practice quintiles, no practices fell into the fifth quintile
[3] Highest = $201 +, Above average = $121-200, Average = $81-120, Below average = $41-80, Lowest = < $41
[4] Low = 0.71-2.04, Medium = 2.05-3.38, High = 3.39-10.11
[5] Reflects the proportion of patients' total primary care provided by the most responsible physician

The table shows that Winnipeg family physicians tended to have a higher number of patient visits than Brandon or Non-Urban family physicians. In all three regions, about 60% of the visits were made by female patients. Winnipeg family physicians had a higher proportion of visits made by patients who were 60 years or older. A higher proportion of Winnipeg family physicians had greater than average visit intensity, that is, a higher number of visits per patient. Three other important variables shown in Table 7—continuity of care, income quintile, and patient morbidity—are described in detail below.

Continuity of Care

Many of the indicators of quality used in this study are theoretically related to **continuity of care**. Although this is a complex construct that is interpreted in different ways in different disciplines (Reid et al., 2002), the fact that a patient returns to see the same physician repeatedly allows the physician to develop and implement a care plan over time. When a patient sees different physicians, this opportunity does not exist and a comprehensive care plan addressing a variety of issues is less likely to be implemented. Many of the indicators involve appropriate follow-up on monitoring which requires regular contact with the same physician.

Continuity of care reflects the proportion of ambulatory care provided by primary care physicians to a patient by any one particular physician.

The continuity of care variable was developed to reflect the proportion of ambulatory care provided by primary care physicians to a patient by any one particular physician. The continuity of care score for each physician represents an average of the proportion of care (measured by the cost of real visits) that a physician provided to all the patients who accessed them for care compared to other physicians who provided care for those same patients. Possible scores range from just greater than 0 to 1; thus, a practitioner who was a patient's only primary care physician (and who provided care during the study year) was allocated a score of 1 for that patient. If a patient accessed two physicians for equal proportions of their care, each of those physicians were allocated a score of 0.5. Table 7 shows the distributions of these characteristics across Manitoba.

Income Quintiles

Income quintiles are a commonly used indicator of socioeconomic status (SES).

Income quintiles, based on the average household income of a neighbourhood, provide a commonly used indicator of socioeconomic status (SES). Previous work at MCHP has shown a correlation between health status and SES (Mustard et al., 2003). Using the plurality method for allocating patients to practices, Reid et al. (2001) demonstrated significant differences in patient SES between larger clinics. In separate analyses for Urban (Winnipeg, Brandon) and Non-Urban areas, we divided residents into five equal-sized groups based on average neighbourhood household income derived from public census data. Those in the highest income neighbourhoods were allocated to Income Quintile Five, and those in the lowest

income were allocated to Income Quintile One. The average of the neighbourhood rankings was then calculated for each physician practice population. The results of this process are presented in Table 7. Winnipeg practices tended to have a higher average income quintile compared to Brandon or Non-Urban practices.

Patient Morbidity

The ACG Morbidity Index is a valid measure of the relative morbidity of assigned patients. An ACG score was calculated for each physician.

Previous research found considerable differences in patient **morbidity** levels between some of the larger primary care practices, particularly in Winnipeg, with some practices having higher morbidity levels. A valid measure of the relative morbidity of patients assigned to a practice is the **Adjusted Clinical Group (ACG) Morbidity Index** (Reid et al., 1999). It is based on the **ACG System** developed by Johns Hopkins School of Public Health (Johns Hopkins University School of Hygiene and Public Health, 2000). The Index uses all the diagnoses assigned to each patient in the Repository to allocate the patients to the most appropriate ACG. The development of the Index and its application to Manitoba residents is described in detail by Reid et al. (2003). An ACG score was calculated for each physician indicating the relative average morbidity of all the patients who accessed them for care.

Table 7 indicates that there was a wider distribution of patient morbidity between practices in Winnipeg, with some practices seeing patients of lower average morbidity and others seeing patients of higher morbidity. In contrast, each Non-Urban practices tended to see more patients with medium morbidity.

4.2 Regression Results

We identified independent variables that were statistically significant and had a major impact on the quality of preventive care provided.

The strength of a model in predicting the outcome is reflected by the R^2 of that model. The greater the R^2, the more of the variability in the outcome is explained by the independent variables. Our models for the Preventive Care Index (See Table B1 of Appendix B) had high R^2 values (0.43 for Manitoba, 0.44 for Urban, and 0.38 for Non-Urban), indicating that we identified independent variables that were not only statistically significant but also had a major impact on the quality of preventive care provided. This provides the opportunity to identify physician and practice-based characteristics that are associated with higher quality preventive care.

Table 8 presents the characteristics associated with higher quality preventive care for Manitoba physicians. Two physician characteristics and three practice characteristics were relevant to Non-Urban physicians. The physician characteristics associated with higher quality on the Preventive Care Index for Non-Urban physicians were being younger and providing more intensive services to their patients (i.e., higher costs per patient). The significant practice characteristics were having more female patients, older patients, and more higher income patients. For Urban physicians, the physician character-

istics associated with higher scores on the Preventive Care Index were being a Canadian graduate, having hospital privileges, providing fewer patient visits, higher total costs, and having higher continuity of care. The practice characteristics associated with higher scores were having more female patients with higher incomes, and lower average morbidity.

Table 8: Prevention modeling results: Significant practice and physician characteristics by geographical region

	Manitoba	Urban	Non-Urban
Physician Characteristics			
Younger	X	--	X
Practised longer	X	--	--
Canadian graduate	X	X	--
Hospital privileges	X	X	--
Fewer patient visits	X	X	--
Higher intensity	X	--	X
Higher total costs	X	X	--
Higher continuity	--	X	--
Practice Characteristics			
Urban	X	NA	NA
More females	X	X	X
Older	X	--	X
Higher income	X	X	X
Lower morbidity	X	X	--
Model R^2	0.43	0.44	0.38

The R^2 values for the Disease Management Index explained less than 10% of the variability.

The R^2 values for the Disease Management Index models (see Table B2 of Appendix B) were very low (0.057 for Manitoba, 0.023 for Urban, and 0.095 for Non-Urban). Thus, despite the fact that there was considerable variability in the quality index scores, the independent variables that we measured collectively explained less than 10% of this variability. Table 9 presents those variables that were statistically significant in the model. Due to the low model R^2 they are of questionable practical value.

Table 9: Disease management modeling results: Significant practice and physician characteristics by geographical region

	Manitoba	Urban	Non-Urban
Physician Characteristics			
Salaried	--	X	--
Practice Characteristics			
Rural	X	NA	NA
Younger	X	X	--
Higher income	X	X	--
Lower morbidity	--	--	X
Male	--	X	--
Model R^2	0.057	0.023	0.095

4.2.1 Discussion

The regression models indicate that Urban physicians provided more preventive services than their Non-Urban colleagues.

The regression models indicate that Urban physicians provided more preventive services than their Non-Urban colleagues. There are a number of potential explanations for this. Because the study used administrative data we relied on physician billing patterns for the data to be included in the Repository. All of the outcomes included are billable services, suggesting that fee-for-service physicians are very likely to have billed for the services provided. While only 5% of the primary care physicians in Winnipeg and 4% in Brandon would not benefit financially from submitting the claims necessary to have these services included in the Repository, 34% of Non-Urban physicians are not paid by fee-for-service. Thus, these data may not be as complete as the Urban data. The findings however, concur with previous studies, which have shown that cervical screening, in particular, is provided more consistently in urban than rural areas (Cyrus-David et al., 2002; Goel, 1994; Harlan et al., 1991).

Physicians with residency training are more likely to provide preventive services; however, not all physicians practising in Manitoba have undergone this training.

Another potential explanation for our results may lie with physician training. Preventive services and relevant Canadian guidelines are emphasized in local Family Medicine residency programs and as Borgiel et al. (1989) have shown, physicians with residency training are more likely to provide preventive services. However, not all physicians practising in Manitoba have undergone this training. For example, international medical graduates and older physicians are less likely than local, younger graduates to have had such training.

A recent study has raised questions about the feasibility of meeting prevention guidelines as part of routine primary care practice (Yarnall et al., 2003). Yarnall et al. suggests that the time taken to meet the guidelines would leave little time to provide other medical services. This may explain our finding that physicians who provided more visits per patient were more likely to provide these preventive services to their patients, with the extra time taken for the provision of preventive services explaining the increased intensity of care.

Physicians who have hospital privileges regularly interact with colleagues and consultants who are caring for their patients in hospitals. They are also required to attend sicker patients, which may result in them being more current with guidelines. Alternatively, physicians who are more compliant with guidelines may be more inclined to retain their hospital privileges. The lack of variability in hospital privileges for Non-Urban physicians may explain why this variable was not significant for these physicians.

Despite the major influence of cervical cancer screening on the Preventive Care Index, physician sex was not found to be a significant influence on the

Index. This is in contrast to previous studies (Ely et al., 1998; Henderson and Weisman, 2001; Lurie et al., 1997) which found that female physicians are more likely to provide preventive services to their patients. A possible explanation for this inconsistency is that in our study the services received by the patients from any physician were allocated to the most responsible primary care physician. Thus, when a female patient attended a female physician only for a Pap test but saw a male for the rest of her care, the Pap test was allocated to the male primary care physician.

Our findings confirm that the socioeconomic inequity in receiving preventive care is not addressed by our universal health care system.

Socioeconomic status is a consistent predictor of reduced access to preventive services (Cohen and Hammastrand, 1989; Goel, 1994; Perkins et al., 1999; Wain et al., 2001). Our findings confirm that this inequity is not addressed by our universal access health care system and that further work is required to improve the use of preventive services by the economically disadvantaged.

The importance of continuity of care has been studied extensively due to its role as one of the foundations of family practice. It is thus reassuring that in the case of Urban family physicians, those who provided greater continuity of care, also provide more of the recommended preventive services. In the Non-Urban areas almost all physicians had high continuity, which may explain why this characteristic was only relevant for Urban physicians. Put another way, patients seeing Non-Urban physicians are more likely to obtain most of their care from the local provider and, therefore, there is not much variation between physicians on this measure in Non-Urban areas.

To improve the provision of preventive care, professional development programs might focus on international graduates, older physicians and those without hospital privileges.

The physician characteristics used in this study give opportunities for focussed interventions to improve the provision of these preventive services. Graduates of foreign medical schools, older physicians and those without hospital privileges, could be the focus of professional development programs designed to promote the provision of these services.

The small R^2 for the Disease Management Index models indicate that we have yet to identify the real explanation for the variability in this Index. For Non-Urban physicians we were able to include only one statistically significant explanatory variable in the model. The six significant variables for the Manitoba model only explained 5% of the variability and the four significant variables for the Urban model explained only 9% of the variability. Amongst these were some of the same variables that were significant for the Preventive Care Index model. Patients from higher income geographical areas once again received better care. Despite the fact that there were very few salaried physicians in Winnipeg and Brandon, the disease management they provided was significantly better than that of their fee-for-service colleagues. The same difference was not present for Non-Urban physicians.

5.0 DISCUSSION

The goal of this study was to develop acceptable indicators of quality of care that can be used to assess the delivery of primary care in Manitoba. To achieve this goal we identified three research questions; we address each of these questions in the following discussion.

Question 1: What indicators of quality in primary care are both quantifiable using administrative data available within the Repository and acceptable to community-based primary care physicians?

The two major issues that our primary care physicians addressed in the focus groups were related to the clinical relevance of the potential indicators presented to them and secondly, the validity of the measurement of these indicators using administrative data. To address the latter concerns we specifically did not rely on **ICD-9-CM** diagnostic codes as used in physician billing, as these are believed to be unreliable by primary care physicians. We thus chose to verify those eligible for a specific indicator by either using hospital discharge diagnoses, a combination of diagnosis codes and drug treatment, or other cross-references from administrative files to confirm the case definitions.

Our initial list of indicators was developed from the literature and was well-accepted by the focus group participants, and the Working Group. Concerns raised in the consultation process did not focus on the clinical relevance of the indicators, but rather on the specific definitions. For example, our informants did not question the importance of seeing a patient diagnosed with depression in follow-up, or the relevance of measuring this process as an indicator of quality care; however there was discussion about the appropriate timing of the follow-up visits. We responded to these discussions by adjusting our indicators to represent the least restrictive standards proposed.

We were thus confident that our indicators were acceptable to these community-based primary care physicians prior to addressing the feasibility of measuring each of these indicators using the administrative data available to us. This does not suggest that the indicators would be supported by all or even most family physicians. Prior to their use, further work would be required with the family physician community at large. The major problem we encountered when operationalizing these indicators was with regard to the availability of laboratory testing data. While we would have liked to have used some alternative indicators for diabetes (glycosylated haemoglobin and microalbuminuria) we were aware from the outset that these data were not included in the Repository. We also found a further limitation in the availability of all laboratory testing done in rural Manitoba. This limitation

resulted in some of our indicators being measured for only Winnipeg physicians and also limited the scope of the final Quality Indices for prevention and disease management. For the Preventive Care Index, we were unable to include the indicators for screening for diabetes and hypercholesterolemia. For the Disease Management Index, we excluded the indicators for anticoagulation monitoring and the measurement of cholesterol levels as part of both diabetes management and post-myocardial infarction care.

Despite these limitations we described 13 indicators of quality primary care. We believe these indicators to be well-suited for use in quality improvement programs because of their accessibility in the Repository. For each indicator we also identified comparison data based on published national targets or results from other jurisdictions. It should be noted that while the indicators we developed reflect some process measures of quality care, they do not represent the complete picture. Those aspects of quality that are not amenable to measurement using administrative data, such as interpersonal care, are not less important than those measured in this study but fall outside the scope of this work.

Question 2: How do the behaviours of Manitoba primary care physicians measure up using these indicators?

This research question is especially important to consider when reflecting on the results presented for each indicator. The data presented in this report are not population-based. For each indicator, physicians had to have a minimum number of eligible patients to be included; thus, patients allocated to physicians who did not meet this criterion were excluded. For most of our indicators this minimum was 10 patients. This resulted in a different number of physicians (and patients) being included in each indicator. It therefore becomes difficult to compare our results to previous studies, which have used population-based measurement. Further, our focus was on physician behaviour in general rather than for a specific group of patients. It is, however, important to compare our results to previous research, and we do so recognizing this limitation. As we excluded records for patients who did not see a primary care physician during the study years, it can be anticipated that our rates would generally be higher than population-based rates.

We have, however, identified indicators where the quality of care provided by the majority of Manitoba primary care physicians was either below that published from other jurisdictions, or did not meet national targets. While recognizing that our findings are not a reflection of the actions of family physicians alone, we have demonstrated a quality gap. There is extensive research in the area of quality improvement/quality control in primary care from other jurisdictions (Epstein, 1998; Jha et al., 2003; Seddon et al., 2001) which address this issue.

There appears to be a "ceiling effect" with all of the preventive health care procedures reaching similar proportions of the eligible population. The literature does support the success of numerous interventions that have increased the uptake of preventive health procedures (Borgiel et al., 1989; Cheney and Ramsdell, 1987; Cohen et al., 1982; Korn et al., 1988; McDonald et al., 1984; Rosser et al., 1991; Schreiner et al., 1988; Shank et al., 1989; Tierney et al., 1986). The distribution of compliance with the preventive care indicators does vary amongst physicians, however, and the discussion of the Preventive Care Index in the previous section identified potential target groups of physicians whose practice patterns show more potential for improvement than others. It is, however, likely that there are different factors impacting on physician actions specific to the different indicators.

Question 3: Which physician and practice characteristics impact the quality of the care that physicians provide as measured by these indicators?

To properly address this question, we developed two quality indices that summarized the level of care provided across many indicators simultaneously. For the Preventive Care Index we were able to identify 13 characteristics that explained a high percentage of the difference in quality between physicians (see Table 8). For the Disease Management Index, however, the characteristics we measured did not explain most of the difference (See Table 9). The use of a quality index has simplified our attempt to understand the determinants of the preventive care provided by primary care physicians, but has not contributed to our understanding of the quality of acute and chronic disease management. This is likely due to patient-related variability that is not captured by our methods. Disease management may also be significantly affected by the influence of specialist consultants. When we looked at this influence for the asthma prescribing and depression indicators however, we were not able to demonstrate differences for those patients who had seen consultants as part of their care. Further research should look into both the possibility of alternative explanatory variables and the impact of the characteristics identified on the individual quality indicators by methods such as hierarchical analysis.

5.1 Implications of the Study

This study, like previous MCHP studies, has identified significant shortcomings in the availability of data from rural Manitoba. As laboratory test data are not centrally reported, we were not able to report on rates of adherence to cholesterol and blood sugar testing guidelines. We were also limited in our ability to develop other indicators based on diagnostic testing especially those done in the hospital sector. These gaps in an otherwise remark-

ably valuable source of data could be addressed to facilitate this quality improvement process.

There may be those whose response to the findings of this study is to be overly critical of Manitoba family physicians. The reality is that the care reflected here is often the result of collaboration between family physicians and specialist consultants. Furthermore, the contribution of the lack of patient adherence to suggested treatment, cannot be captured by our methods. Our purpose was not to judge family physicians but to provide some landmarks by which to diagnose problems within our system, and to identify areas where improvement is needed. If we are indeed to address the issue of quality of care, this study represents an important first step.

The findings suggest the need for action on three levels. At the level of the individual primary care physician there must be recognition of the need for their active engagement in a quality improvement process. No attempt to initiate change in clinical practice is likely to succeed if it is not fully embraced by clinicians. Each physician needs to consider his/her own clinical practice in relation to quality indicators such as those we have presented and explore potential areas for improvement.

At the next level, policy-makers face the challenge of establishing a culture of support for quality improvement. The major shifts in attitude towards quality improvement in the United States and the United Kingdom have been initiated by the policy decisions of health care funders. Managed care organizations in the U.S. have been responsible for establishing an environment where quality improvement is built into physician remuneration packages and the new primary care governance structure in the U.K. also incorporates quality assurance into its funding model. Both of these environments have also provided the necessary infrastructure through electronic information technology to facilitate this process. By creating such a supportive culture, policy-makers in those jurisdictions have facilitated the growth of quality improvement activities.

Specific areas have been identified where quality improvement will best be achieved through system changes. The use of an electronic medical record would facilitate the systematic application of recommended preventive health measures, as well as some chronic disease management procedures. The access to female providers for cervical screening in rural areas could potentially be addressed with mobile screening clinics staffed by female providers such as nurse practitioners.

At the third level, in the Manitoba context, both the Manitoba College of Family Physicians and the Continuing Medical Education Department of the University of Manitoba play important roles in providing educational

opportunities to practising primary care physicians. This study identified specific areas where the quality of care could be improved. These organizations could focus educational initiatives on these areas as part of the proposed quality improvement process. Individual commitments on the part of physicians and a supportive environment created by policy-makers, funders, and educators are necessary for significant quality improvement.

Finally, in the current environment of primary care reform, the finding regarding physicians who retain hospital privileges may be important. It has long been believed that providing care to hospital in-patients is necessary for physicians to maintain their level of competency and to provide continuity of care to their patients. While the present study provides evidence of better quality preventive care provided by this group of physicians, we have not demonstrated a causal relationship. Thus, from a quality perspective, the trend for family physicians to remove themselves from providing in-hospital service requires further study.

5.2 Limitations of the Study

As with any study, it is important to recognize the limitations of this study. Although administrative data provide a rich, reliable source of information, they did introduce some limitations to our study of quality of primary care. We had to restrict our study to the processes of care as indicators of quality. We focussed on clinical effectiveness but could not directly address two critical components of primary care, namely access to care and interpersonal care (Campbell et al., 1998). While some aspects of these components of care may have influenced the indicators we measured, they are not reflected in our indicators. This is a limitation of working with data collected for other purposes and is in contrast to the benefit of taking advantage of the availability of the data in the Repository. While there are clear advantages to being able to measure the quality of care more completely using primary data collection, the financial costs of this approach are significant. The areas of potential improvement identified in this study are no less relevant because they are not fully comprehensive.

Another limitation of administrative data involves the physician claims files. While we know that physicians whose income is dependent on their fee-for-service billings reliably submit claims for the services they provide, the reliability of the claims of those paid by other mechanisms is not well established. It is quite possible that 20% or more of these services are not recorded in the Repository; this would result in these physicians appearing to provide poorer quality care than they do in reality. Thus, as Non-Urban Manitoba has a much higher percentage of family physicians that are not paid via fee-for-service, this may have affected the regional analyses.

While our analyses do involve data from more than one calendar year to accommodate the definitions of some of the indicators, we have really only presented a snapshot of a dynamic picture. It is always wise to include more than one vantage point in describing data. The true value of these indicators is in their potential to be used over time to monitor the quality of care Manitobans receive from their family physicians. The patterns of quality can only be established over time.

Our health care system supports the rights of patients to choose their physician(s) and places no limits on which family physician(s) the patient visits. In order to quantify the care provided by physicians it was necessary to create "virtual" practices by assigning patients to the most responsible family physician. Therefore we have reported on the quality of care which we attributed to physicians who did not necessarily provide that care. The approach we have taken does, however, allow us to use the available administrative data to report on these quality indicators.

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GLOSSARY

Adjusted Clinical Group (ACG) Morbidity Index
Developed at MCHP, this methodology is based on the **ACG System** and measures the "disease burden" of individuals and populations using diagnostic codes routinely collected in administrative data. The index can be viewed as the sum of the "portions" of each patient's morbidity seen in a practice.

Adjusted Clinical Group (ACG) System
A risk adjustment tool developed to measure the illness burden of individual patients and enrolled populations. This system quantifies morbidity by grouping individuals based on their age, gender and constellation of diagnoses assigned by their health care providers over a defined time period (typically, one year).

Administrative Data
A collection of data that documents services provided by hospitals, nursing homes, and physicians. The data tracks hospital discharge summaries, physician billing claims, claims for prescription drugs, and other health related data. Using this data, researchers can study the utilization of health resources over time and the variations in rates within and across the provinces.

Ambulatory Care (Physician)
Care provided by a physician to a patient while the patient is not a hospital in-patient; it includes visits to a physician's office, emergency rooms, outpatient clinics, and personal care homes.

Ambulatory Visits (Physician)
Any contact between a patient and physician at one of the following locations: physician's office, outpatient or emergency department, clinics, personal care home, the patient's home, or northern/remote nursing stations. Contacts with patients while they are in hospital are not included.

Analysis of Variance (ANOVA)
A statistical technique that tests the significance of the differences in means between two or more groups, by comparing the variation between the groups with the variation within them.

Anticoagulants
Drugs used to either prevent clot formation or to prevent a clot that has formed from enlarging. See Table 4 for the codes used to identify anticoagulants.

Antidepressants
Drugs used to treat serious, continuing mental depression that interferes with a person's ability to function. See Table 4 for the codes used to identify antidepressants.

Asthma
A disease in which inflammation of the airways causes airflow into and out of the lungs to be restricted. See Table 4 for the code used to identify asthmatic patients.

Benzodiazepines
Benzodiazepines belong to the group of medicines called central nervous system (CNS) depressants (medicines that slow down the nervous system).

Beta 2-agonist (ß-agonist)
A group of drugs that is used as a first line treatment to alleviate asthma symptoms. See Table 4 for the code used to identify ß-agonists.

Beta-Blocker
Beta-blockers, properly known as beta-adrenergic blocking drugs, have been shown to lower the risk of subsequent heart attacks. See Table 4 for the code used to identify beta blockers.

Blood Sugar Screening
A test done to measure the amount of sugar (glucose) in the blood. Our data do not allow us to differentiate between fasting and random blood sugar tests, or between tests for screening or disease monitoring purposes. See Table 4 for the code used to identify these tests.

Capitation System
A per capita method of compensation for physicians. The amount of revenue a practice receives is based on an amount paid per patient (capitation fee) times the number of patients the practice treats (practice population) regardless of the number of visits.

Cervical Cancer
Cancer of the uterine cervix, the portion of the uterus attached to the top of the vagina. Papaniculaou (Pap) smears screen for—but do not diagnose—pre-cancerous changes and cancer.

Childhood Immunization
An intervention to initiate or increase resistance against infectious disease. Manitoba's recommended immunization schedule for children under two years of age is presented in Table 5.

Cholesterol Screening
Cholesterol tests measure the amount of cholesterol and triglycerides in the blood. Our data do not allow us to distinguish between cholesterol tests done for screening purposes and those done for diagnostic or disease monitoring reasons. See Table 4 for codes used to identify these tests.

Clinical Practice Guidelines (CPG)
Systematically developed statements that assist in decision-making about appropriate care for specific clinical conditions.

Continuity of Care (Ambulatory)
In this study, we defined continuity of care as the proportion of the total care provided to a patient by any one particular physician during the study year. The continuity of care score for each physician represents an average of the proportion of care (measured by the cost of real visits) that a physician provided to all the patients who accessed him/her for care compared to other physicians who provided care for those same patients. Possible scores range from just greater than zero to one; thus, a practitioner who was a patient's only primary care physician (and who provided care during the study year) was allocated a score of 1 for that patient. For a patient who accessed two physicians for equal proportions of his/her care, each of those physicians were allocated a score of 0.5.

Contraindications
Any circumstances (e.g. a disease) which render some particular line of treatment improper or undesirable.

Corticosteroids (Inhaled)
Cortisone-like medicines used to treat serious inflammatory conditions. In asthma, they address the underlying disease process, thus preventing its symptoms.

Diabetes
Diabetes mellitus is a condition characterized by increased levels of blood sugar. The data for this study only includes patients treated with oral medication (i.e. those with Type II diabetes). See Table 4 for the code used to identify it in this study.

Drug Programs Information Network (DPIN)
Administrative claims database of prescriptions dispensed for out-of-hospital usage in Manitoba to its resident population; it also includes most prescriptions for outpatient use dispensed by hospitals. DPIN is administered through real-time computer links with every community-based pharmacy in the province and is maintained by the Government of Manitoba's Ministry of Health.

Evidence-Based Medicine
"The conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research." (Sackett et al., 2000)

Family Physician (FP)
A generalist physician who provides and coordinates personal, continuing, comprehensive primary health care to individuals and families.

Fee-For-Service
Method of payment whereby physicians bill for each service rendered, according to a pre-arranged schedule of fees and services.

Focus Group
A method of data collection in which a small group of individuals is brought together to discuss their opinions about topics, issues, or questions. In this study, the focus groups involved family physicians who discussed their opinions regarding the validity of the indicators of quality care to be used.

Fundoscopy (aka Ophthalmoscopy)
An examination of the back part of the eyeball (fundus), which includes the retina, optic disc, choroid, and blood vessels.

Geographical Area
The location of a physician's practice based on where the majority of his/her patients live using municipal code (which is assigned to each municipality in Manitoba for administrative and funding purposes). Geographical area is identified by a variable in the physician database.

Hospital Discharge
A discharge from hospital occurs anytime a patient leaves because of death, discharge, sign-out against medical advice, or transfer. In this study, the two indicators for post-myocardial infarction care only included individuals who were discharged alive from hospital.

Hospital Discharge Abstract Data
Information recorded on a form (discharge abstract) upon a patient's discharge, including patient information/characteristics such as an encrypted PHIN, residence, length of stay, diagnoses and procedures, using **ICD-9-CM** codes, and service type (inpatient, day surgery, outpatient).

ICD-9-CM
The 9th version of the ICD (International Classification of Disease) coding system (with Clinical Modifications), developed by the World Health Organization (WHO) that is used to classify diseases, health conditions and procedures.

Income Quintiles
A method to measure the average (mean) household income of residents, ranking them from poorest to wealthiest, and then grouping them into five income quintiles (1 being poorest and 5 being wealthiest); each quintile contains approximately 20% of the population. Income quintiles are available for both urban and rural populations. Often used as a proxy for socioeconomic status.

Intensity of Practice
Intensity is a construct that reflects the amount of care provided to the patients in a practice. A high intensity practice is one where patients receive more visits and/or services than would be provided in a low intensity practice. Expenditure to the health care system, incurred by a practice, is a well-accepted proxy for intensity. Thus, intensity refers to the average cost of care (per discrete patient) for a physician's entire practice, and includes both direct care (e.g., visits) and indirect care (e.g., referrals to specialists, lab procedures etc.). More information regarding this variable can be found in Appendix B.

International Normalized Ratio (INR)
A system established by the World Health Organization (WHO) and the International Committee on Thrombosis and Hemostasis for reporting the results of blood clotting tests.

Interpersonal Care
One of two key processes of care, it "describes the interaction of health care professionals and users or their carers" (Campbell et al., 2000). The other key process is **technical care**.

Manitoba Cervical Screening Program
Manitoba Health established this Program in 2000 to monitor cervical cancer screening; it is managed by CancerCare Manitoba. As of April 2001, the Program maintains the Manitoba Cervical Cancer Screening Registry, a central and confidential record of Pap smears and related follow-up test results for all Manitoba women.

Manitoba Immunization Monitoring System (MIMS)
MIMS is a population-based monitoring system that provides monitoring and reminders to help achieve high levels of immunization. Immunization

status is monitored by comparing the system record and the recommended schedule.

Morbidity
Any departure, subjective or objective, from a state of physiological or psychological well-being (i.e., sickness or illness) (Last et al., 2001).

Most Responsible Physician
The physician who provided the majority of the patient's primary care. In this study, we used cost of the physician visits as our main criterion to identify this physician. See Appendix A for more information.

Multiple Regression
A statistical technique that predicts values of one variable on the basis of two or more other variables.

Myocardial Infarction (MI)
A heart attack (myocardial infarction) occurs when an area of heart muscle dies or is permanently damaged because of an inadequate supply of oxygen to that area.

Non-Urban
For this study, Non-Urban includes all regions outside Winnipeg and Brandon, classified by postal code and/or municipal code.

Ophthalmologist
A medical doctor who has undergone specialty training to diagnose and treat disorders of the eye. An ophthalmologist is qualified to prescribe medication, prescribe and adjust eyeglasses and contact lenses and is qualified to perform laser treatment and surgery.

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.

Outcome Measures
Reflect the consequences of care rather than the components of care. One of three key categories of measurement of quality of care, its two main domains are health status and user evaluation. The other categories are process measures and structure (Campbell et al., 2000).

Papaniculaou (Pap) Smears
A microscopic examination of cells scraped from the cervix used to detect pre-cancerous changes in cervical cells, and cancers. See Table 4 for codes used to identify these tests.

Patient Allocation
The process of allocating all patients who have seen a physician to the one most responsible for their care during the study period. This is necessary in order to define the physician's practice. In this study we used the **plurality approach**.

Physician Characteristics
Personal characteristics of the physician that may affect the outcome for each indicator used in this study. Six characteristics were identified: physician sex, age, years of practice in Manitoba (to a maximum of 11 years), principal method of payment (**fee-for-service** or **salaried**), whether they had hospital privileges, and whether they graduated from a Canadian medical school.

Physician Claims
Claims that are submitted to the provincial government by individual physicians for services they provide. **Fee-for-service** physicians receive payment based on these claims, while those submitted by **salaried physicians** are only for administrative purposes. The physician claims data file is part of the **Population Health Research Data Repository**.

Physician Data
This data file contains information about physicians and their practices such as demographic characteristics (e.g. age, sex, place of graduation etc.) and aggregate measures of workload and/or practice profiles (e.g. method of payment, physician specialty etc.).

Physician Visits
See **Ambulatory Visits**

Plurality Approach to Patient Allocation
This method assigns patients exclusively to the physician where they had received the highest intensity of care (i.e., the greatest proportion of expenditures). In this study, the specific plurality approach used assigned patients to the family physician to whom they paid the most visits (determined by value of the visit). When more than one physician provided equal care, the patient was assigned to the physician with the greatest total cost. Calculation of total cost includes direct care (i.e., visits) and indirect care (i.e., referrals for other services and consults).

Population Health Research Data Repository
The Population Health Research Data Repository is a comprehensive database developed to describe and explain patterns of health care, and profiles of health and illness. It includes information derived from the population's contact with the health care system: physicians, hospitals, nursing homes,

home care, and pharmaceutical prescriptions. The database is anonymous, as a government department has encrypted all personal identifiers prior to data transfer, and deleted all names and addresses. The Repository also includes data from other agencies, for example, Statistics Canada data at the level of the enumeration area. Subsets of the data are used in specific approved research projects.

Practice Characteristics

Characteristics of the physician's patient population that may affect the outcome for each indicator used in this study. Seven characteristics were identified: practice size, average patient age, sex, socioeconomic status, and patient morbidity, as well as **intensity of practice** and **continuity of care**.

Practice Population

In general, this refers to all individuals who receive care from one particular physician. For the first phase of our analyses (i.e., descriptive analyses of each indicator), patients were allocated to a family physician based on whether they received most of their care from that physician during the study period. In the regression analyses, however, each physician's practice population included all patients who visited them during the study period, regardless of whether they also received care from other physicians.

Practice Size

Used in the regression analyses, this was defined as the total number of patient visits to the physician in the study year.

Preventive Care

Medical services delivered by physicians that are directed at prevention or early detection of disease. This study included two levels or types of preventive care: **primary prevention** (e.g., immunizations) and **secondary prevention** (i.e., early detection).

Primary Care Physicians

Family physicians/general practitioners who serve as a patient's first contact.

Primary Prevention

Care aimed at preventing a disease (e.g. immunizations).

Process Measures

These measures reflect the actual delivery and receipt of care, encompassing both clinical effectiveness and interpersonal effectiveness. One of three key categories of measurement of quality of care, it encompasses both clinical and interpersonal effectiveness and includes technical interventions and interpersonal interactions between users and members of the health care system. The other categories are outcome measures and structure (Campbell et al., 2000).

Public Health Nurses (PHNs)
Nurses with expertise in areas such as communicable diseases, maternal-child and school health. PHNs deliver services within communities using a community-based model whereby services are driven by the needs and resources of a defined community.

Quality of Care (Primary Care)
The extent to which care meets accepted standards. In this study, we focussed on **process measures**, specifically clinical effectiveness, which are easily accessible through administrative data.

Regional Basic Visit
A service rendered to a patient who consults the physician for a condition—usually relatively minor. The assessment of the patient's condition is problem-focussed and little or no physical examination is included. Generally, less than 10 minutes of the physician's time is required.

Regional Intermediate Visit
A problem specific visit that includes a history of the presenting complaint(s), an examination of the parts or systems related to the complaint(s), a review of all pertinent investigations, and a complete written record and advice to the patient. The visit requires at least 10 minutes of physician time.

Salaried Physicians
Physicians who are paid on an annual or sessional salary (rather than **fee-for-service**). The claims they submit are for administrative purposes only.

Screening
A process (tests, examinations or other procedures) to distinguish between well individuals who probably have (or are likely to develop) a particular disease from those who probably do not have it. The administrative data used in this study are limited in that they are unable to distinguish between cholesterol and blood sugar tests which are done for screening purposes and those done for diagnostic or monitoring reasons.

Secondary Care
Care provided by a specialist health care professional usually after referral from a primary care physician.

Secondary Prevention
A set of measures used for early detection and prompt intervention to control disease and minimize disability (e.g., by the use of screening programs) (Last et al., 2001).

Specialist Physicians
Physicians whose practices are limited to a specific area of medicine in which they have undergone additional training.

Structure
The organizational factors of the system in which the care is delivered, having a major impact upon access to care. One of three categories used for measuring of quality of care, it includes physician characteristics (resources, organization, and management), and staff characteristics (skill-mix and teamworking). The other categories are outcome measures and process measures (Campbell et al., 2000).

Tariff
The fee schedule for each service provided by a physician.

Technical Care
One of two key processes of care, it refers to "the application of clinical medicine to a personal health problem. It is based upon a theory of function which can be evaluated for efficacy and generally standardized" (Campbell et al., 2000). The other key process is **interpersonal care**.

Tertiary Care
Care that requires specialized skills, technology and support services.

Urban
Winnipeg and Brandon, classified by postal code and/or municipal code.

APPENDIX A: PLURALITY APPROACH TO PATIENT ALLOCATION

Patient allocation is based on visits; we identified four potential approaches based on the plurality rule:

1) A patient is allocated to the physician with the most number of visits. In case of a tie, the patient is arbitrarily allocated to the physician with the lowest physician billing number.

2) A patient is allocated to the physician with the most visits as defined by cost. In case of a tie, the patient is arbitrarily allocated to the physician with lowest physician billing number.

3) A patient is allocated to the physician with the most visits (as defined by cost). In case of a tie, the patient is allocated to the physician with the greatest total cost. Total cost calculations include direct care (i.e., visits) and indirect care (i.e., referrals to other physicians or for services such as lab tests and x-rays).

4) A patient is allocated to the physician who generates the most cost providing both direct and indirect care.

To determine the most appropriate method, each approach was tested for physicians who had at least 1,000 observed visits. The table below presents the results.

	Number and Percent of Visits and Patients by Allocation Approach			
	# Visits	% Visits*	# Patients	% Patients**
Approach 1	3,703,344	104.5	780,695	57.5
Approach 2	3,690,374	104.1	778,731	57.3
Approach 3	3,690,449	104.1	778,877	57.3
Approach 4	3,659,284	103.3	776,263	57.1

* relative to total observed visits: 3,544,014
** relative to total observed patients: 1,358,713

Next, the results of each allocation approach was correlated with the observed visits and observed patients. The results are presented in the following table.

	Correlation of Observed Visits and Patients to Allocated Visits and Patients by Approach	
	Visits	**Patients**
Approach 1	0.9521	0.78789
Approach 2	0.9553	0.79351
Approach 3	0.9555	0.79233
Approach 4	0.9231	0.7661

Based on these results, Approach 3 was chosen as it had the highest correlation for visits.

APPENDIX B: REGRESSION MODELS FOR THE PREVENTIVE CARE AND DISEASE MANAGEMENT INDICES

All the variables included in the prevention and care management models, with the exception of 'Patient load', are defined in the Methods chapter of this report.

Patient load refers to the inverse of the number of discrete patients in a practice and was included as part of the intensity measure. Intensity, as defined for the regression models, is a measure of the level of care provided for each patient. It is the ratio of the total cost of care (direct [e.g., visits] and indirect [e.g., referrals for specialists, lab tests etc.]) incurred by a physician's practice to the number of discrete patients. The higher this number is, the greater the intensity of care offered to the average patient in the practice.

Statistically, this ratio is actually an interaction term of the costs and the inverse of the number of patients (called 'Patient load' in the tables). As such, both of these main effects were also included in the regression models.

Thus, intensity is defined as:

$$\text{Total cost} \times \frac{1}{\text{\# patients}} = \frac{\text{Total cost}}{\text{\# patients}}$$

For the Preventive Care Index model, the results for the effect of patient load means that as the number of allocated patients increases so does the prevention care index (i.e., quality of care is better). Although the intensity and patient load variables were initially entered into the models for both Indices, they are only presented in the Preventive Care Index model because they were not statistically significant in the model for the Disease Management Index.

Table B1: Regression models for the Preventive Care Index

MANITOBA MODEL (R^2 = 0.429)	**Source**	**DF**	**F-value**	**P**
	Model	13	52.72	<.001
	Error	911	--	--
	Parameter Estimate		**t-value**	**P**
Urban	0.328		5.94	<0.001
Physician age	-0.008		-3.56	<0.001
Years in practice	0.018		2.26	0.024
Canadian graduate	0.119		2.45	0.015
Hospital privileges	0.126		2.30	0.022
Practice size	-0.034		-2.12	0.034
Practice sex	1.498		8.04	<0.001
Practice age	0.020		6.99	<0.001
Practice income quintiles	0.254		7.17	<0.001
Intensity of practice[1]	0.002		3.59	<0.001
Patient load	-27.757		-2.57	0.010
Total cost[2]	0.107		2.57	0.011
Patient morbidity	-0.200		-7.84	<0.001
NON-URBAN MODEL (R^2 = 0.375)	**Source**	**DF**	**F-value**	**P**
	Model	8	28.31	<0.001
	Error	377	--	--
	Parameter Estimate		**t-value**	**P**
Physician age	-0.008		-2.72	0.007
Practice sex	-2.366		7.16	<0.001
Practice age	0.032		7.36	<0.001
Practice income quintiles	0.305		6.65	<0.001
Intensity of practice[1]	0.003		2.45	0.015
Patient load	-66.789		-3.55	<0.001
Total cost[2]	0.044		0.53	0.594
URBAN MODEL (R^2 = 0.435)	**Source**	**DF**	**F-value**	**P**
	Model	10	40.71	<.001
	Error	528	--	--
	Parameter Estimate		**t-value**	**P**
Canadian graduate	0.127		2.23	0.026
Hospital privileges	0.133		2.33	0.020
Practice size	-0.081		-4.20	<.001
Practice sex	1.368		6.56	<0.001
Practice income quintiles	0.363		7.18	<0.001
Total cost[2]	0.197		4.12	<.001
Patient morbidity	-0.118		-4.43	<0.001
Continuity of care	0.833		3.24	0.001

This table presents only the significant variables.

[1] Intensity of practice is derived from Patient load and Total cost. These variables are defined in the preceding discussion of this Appendix.
[2] Expressed in hundreds of thousands of dollars

Table B2: Regression models for the Disease Management Index

MANITOBA MODEL (R^2 = 0.057)	**Source**	**DF**	**F-value**	**P**
	Model	3	16.15	<.001
	Error	797	--	--
	Parameter Estimate		**t-value**	**P**
Urban	-0.020		-3.62	<0.001
Practice age	-0.016		-5.76	<0.001
Practice income quintiles	0.102		2.46	0.014
NON-URBAN MODEL (R^2 = 0.023)	**Source**	**DF**	**F-value**	**P**
	Model	1	7.58	0.006
	Error	316	--	--
	Parameter Estimate		**t-value**	**P**
Patient morbidity	-0.205		-2.75	0.006
URBAN MODEL (R^2 = 0.095)	**Source**	**DF**	**F-value**	**P**
	Model	4	12.51	<.001
	Error	478	--	--
	Parameter Estimate		**t-value**	**P**
Salaried physician	0.462		2.94	0.004
Practice sex	-0.592		-2.37	0.018
Practice age	-0.019		-5.90	<0.001
Practice income quintiles	0.213		3.59	<0.001

This table presents only the significant variables