# Waiting Times for Surgery, Manitoba 1999/2000 to 2003/04

June 2007

**Manitoba Centre for Health Policy**
Department of Community Health Sciences
Faculty of Medicine, University of Manitoba

University of Manitoba

Carolyn De Coster, PhD, RN
Dan Chateau, PhD
Matt Dahl, BSc
Ruth-Ann Soodeen, MSc
Nancy McKeen, PhD

This report is produced and published by the Manitoba Centre for Health Policy (MCHP). It is also available in PDF format on our website at **http://www.umanitoba.ca/centres/mchp/reports.htm**

Information concerning this report or any other report produced by MCHP can be obtained by contacting:

Manitoba Centre for Health Policy
Dept. of Community Health Sciences
Faculty of Medicine, University of Manitoba
4th Floor, Room 408
727 McDermot Avenue
Winnipeg, Manitoba, Canada R3E 3P5

Email: reports@cpe.umanitoba.ca
Phone: (204) 789 3819
Fax: (204) 789 3910

**How to cite this report:**

Carolyn De Coster, Dan Chateau, Matt Dahl, Ruth-Ann Soodeen, Nancy McKeen. *Waiting Times for Surgery, Manitoba, 1999/2000 to 2003/04*. Winnipeg, Manitoba Centre for Health Policy, June 2007.

**Legal Deposit:**
Manitoba Legislative Library
National Library of Canada

ISBN #978-1-896489-28-5



1st Printing 06/08/2007

# 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 healthcare decision-makers, analysts and providers, so they can offer services which are effective and efficient in maintaining and improving the health of Manitobans. Our researchers rely upon the unique **Population Health Research Data Repository** (Repository) to describe and explain patterns of care and profiles of illness, and to explore other factors that influence health, including income, education, employment and social status. This Repository is unique in terms of its comprehensiveness, degree of integration, and orientation around an anonymized population registry.

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

# ACKNOWLEDGEMENTS

The authors wish to acknowledge the contributions of many individuals whose efforts and expertise made it possible to produce this report. We appreciate the assistance of:

Colleagues at MCHP for their valuable input: Marni Brownell, Lisa Lix, and Patricia Martens. Data, programming and administrative support from Pat Nicol, Janine Harasymchuk, and Wendy Guenette.

The Working Group: Eric Bohm (Department of Surgery, WRHA and University of Manitoba), Jean Cox (Manitoba Health), Francis Labossiére (Cardiac Sciences, WRHA), Teresa Mrozek (Manitoba Health), Scott Murray (Manitoba Health), Lorinda Schramm (RHA - Central Manitoba Inc.), Mark Taylor (Department of Surgery, WRHA and University of Manitoba), Jan Trumble Waddell (WRHA), Laurie Walus (Surgery Program, WRHA).

External reviewers: Jack Tu (Institute for Clinical Evaluative Sciences), Diane Watson (Canada Health Council).

Colleagues from the Winnipeg Regional Health Authority who provided assistance and insight: Peg Holt, Lorne Bellan, Steve Latosinsky, Linda McDonald, Michael Moffatt, Luis Oppenheimer, and Tara Sawchuk.

Brie Morey from the Wait Times Task Force, Manitoba Health.

# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF APPENDIX TABLES

## LIST OF FIGURES

## LIST OF APPENDIX FIGURES

# EXECUTIVE SUMMARY

Wait times to access health services are a continuous and growing complaint in Canada, sometimes described as the Achilles' heel of the healthcare system. Much attention has been directed towards this issue on the part of policy-makers, providers, politicians and the public. The Manitoba Centre for Health Policy (MCHP) conducted this research, as part of its contract with Manitoba Health, to provide methods of measuring wait times, not only for high priority areas like cataract, cardiac and hip/knee replacement (HKR) surgery, but for other surgical procedures which do not have a centralized patient registry to track wait times. The objectives of this study are to:

1. Update the wait times analysis that MCHP first published in 1998 and again in 2000.
2. Develop a method using administrative data to monitor wait times for longer wait procedures, e.g., hip and knee replacement.
3. Describe factors that are related to variation in wait times.

A Working Group comprising surgeons, surgery program managers from the Winnipeg Regional Health Authority (WRHA), a rural RHA representative, and Manitoba Health representatives advised on the design, methods and interpretation of results. Their front-line expertise provided valuable insights to the study.

There are three analytical sections to this report. First is an update of the previous two deliverables, followed by a description of the work using wait time registries merged with healthcare administrative data. Third is a brief section analyzing negative events that occurred while waiting for coronary artery bypass graft (CABG) surgery.

## Data Sources

Data for this study were primarily from the Repository housed at MCHP. Additionally, WRHA wait time registry data for three surgical procedures—namely cardiac, cataract and total hip/knee replacement surgery—were merged with the Repository data and analyzed. All data used for this study are anonymized.

## Update

Data from 1999/2000 to 2003/04 were analyzed. Following the methods used for the previous MCHP reports, a list of eight common surgical procedures was identified using hospital abstract data, after which physician claims were searched for a pre-operative visit to the surgeon, and this visit was used as the marker for the beginning of the wait time. The eight common procedures were:

- *Excision of breast lesions:* Both benign and malignant lesions were included, breast biopsies were excluded.
- *Carotid endarterectomy*: A procedure to remove plaque from the carotid artery which supplies blood to the brain, thus preventing stroke.

- *Cholecystectomy (removal of gallbladder)*: We excluded patients who had surgery for malignancies or for pancreatitis. The main diagnoses that we included were gallstones, cholecystitis or abdominal pain.
- *Carpal Tunnel Release*: For carpal tunnel syndrome.
- *Transurethral Prostatectomy (TURP)*: For benign hyperplasia, malignancies excluded.
- *Hernia repair*: We included inguinal and femoral hernia without gangrene.
- *Tonsillectomy and Adenoidectomy (T&A)*: For tonsillitis or hypertrophy; not for middle ear infections. We included both tonsillectomy and adenoidectomy, alone or combined.
- *Stripping/Ligation of Varicose Veins*: Removal of varicose veins in the legs only; not esophageal or gastric.

For all procedures, the crude, or unadjusted, wait times are shown using box plots, which provide information on not only the median wait, or how long it took for 50 per cent of patients to receive their surgery, but also the $10^{th}$, $25^{th}$, $75^{th}$, and $90^{th}$ percentile wait times. In addition, models were developed to permit fair statistical comparisons between years or RHAs after taking into account differences in other important characteristics, such as age, sex, socioeconomic status, and level of illness of the population. We used a technique called parametric survival analysis to model adjusted median wait times. This is a new addition to this deliverable, not done in MCHP's other waiting time reports, and indeed, not previously reported in the literature.

**Results**

Our analyses of the eight common elective procedures suggests that unadjusted wait times are increasing over time though not for all procedures, and not always by a great deal. If one can assume that a difference of one week for most non-emergency procedures is not clinically relevant, then wait times did not change for cholecystectomy, hernia repair, excision of breast lesions, or carotid endarterectomy. For these procedures, the difference between 1999/2000 and 2003/04 was 2 to 4 days. Waits did however increase for stripping/ligation of varicose veins, carpal tunnel release, T&A and TURP. Between 1999/2000 and 2003/04, the median wait went from 62 to 93 days for varicose veins, from 49 to 58 days for carpal tunnel, from 27 to 38 days for TURP and from 61 to 70 days for tonsillectomy. Most of these latter four procedures showed a gradual increase over time, except for TURP, which jumped suddenly in the last year of analysis.

The variables that were significant in the survival models were year, RHA and being hospitalized during the wait. The trends were similar to those seen in the descriptive analysis, but the survival models provided more information about significant differences. For every procedure except carotid endarterectomy, the adjusted median waits were shorter in earlier years compared to 2003/04. Compared to Winnipeg, residents of Nor-Man and Central tended towards shorter waits and residents of Brandon and South Eastman tended towards longer waits, but not for every procedure. These findings counteract the perception that access to care is worse in more remote areas and better in urban centres. Of note, age, sex and income were generally not significant, meaning that individuals did not wait different times based on their age, sex or income level.

The reasons for the increase in wait times for the eight common procedures are not clear. There is a widely-held belief that if wait times increased, then the available resources probably decreased. The rate of surgery decreased for most of these procedures over the study period. Decreases may be due to a variety of reasons, including fewer resources, changes in the health of the population, and changes in clinical practice which might reduce the need for surgery.

The relationship between volume of surgery and wait time is not direct and consistent. Wait times may increase or decrease irrespective of the volume. For instance, we found that both the rate and the wait time for carpal tunnel surgery increased in this time period, while both the rate and wait time for carotid endarterectomy decreased. When we constructed the multivariate models, we used a measure of volume as one of the independent variables: the volume of surgery averaged over each quarter of that individual's wait time. For the eight common procedures, volume was significant (and negative) only for cholecystectomy, carpal tunnel release, and hernia repair, that is, for these procedures a higher volume of surgery over the individual's wait time was associated with a shorter wait. Thus the relationship between the wait time and the volume of surgery is complex.

We also noted marked seasonal fluctuations in the volume of surgery for most of these procedures with fewer procedures performed during summer months, likely due to patient preference as well as hospital staff vacations. These fluctuations in supply may be contributing to the increased wait times. Even if the average supply and average demand over a year are similar, if there are times when capacity is constrained, then queues can develop or grow. More research is required on this issue.

## Registry Comparison and Analysis

We merged anonymized data from the WRHA cataract, cardiac, and HKR surgery registries with data in the Repository. We wanted to develop algorithms to estimate wait times using administrative data, using the Registry wait time as a comparator. This assumes that the Registry wait time is the "gold standard." The start of the wait time may be imprecise in both administrative and registry data: the administrative data method uses a proxy for the beginning of the wait, and the start of the wait time in the registry may be poorly defined. However, by assessing waits using two data sources, a more accurate estimate of wait times can be made. We were successful in developing algorithms from the administrative data that closely matched the wait times using registry data for cataract and cardiac surgery, but not for HKR surgery.

We created box plots for these procedures and developed multivariate models. For cataract surgery we analyzed Registry data from 1999/2000 to 2003/04, and for cardiac and HKR from 2000/01 to 2003/04.

For cataract surgery, the median wait, using the administrative data method, was 22 weeks in 1999/2000, rose to 25 weeks in 2001/02 and fell to 16 weeks in 2003/04.

For non-emergency CABG, the median wait, using the administrative data method was 58 days at the beginning of the study period, rose to 70 days in 2000/01 and then decreased for the remainder of the study period. Non-emergency heart valve replacement followed a similar pattern, with median waits starting at 77 days in 1999/2000, rising to 125 days the next year and then decreasing to between 65 and 68 days for the remainder of the study period.

The median wait for primary hip replacement, according to the HKR registry, was 12 weeks in 2000/01, increasing to 28 weeks in 2003/04. For primary knee replacement, the median wait increased from 15 weeks in 2000/01 to 31 weeks in 2003/04.

A benefit of linking registry and administrative data is that registries provide clinical or functional information that can be used in addition to variables in the administrative data to explore characteristics of patients that were associated with variation in wait times. Our ability to use these additional variables from the registries was mixed. For cataract surgery, the data are virtually 100% complete, whereas for the other two registries, there were significant gaps in some of the fields. There was however evidence for both of these registries that data were more complete over time; perhaps at the start-up of the registries there were some difficulties in obtaining data that were overcome with time.

We found that average volume during the wait and being hospitalized during the wait (for some other reason) were consistently associated with variation in wait times for these procedures. A higher volume of surgery was found to be associated with shorter wait times, suggesting that the great efforts being made to provide more of these procedures does work to reduce wait times. Shorter waits for cataract and CABG surgery were associated with greater dysfunction or urgency. The specific surgeon was also found to be associated with a great deal of the variation in wait times.

## Events While Waiting

We analyzed events associated with waiting for scheduled CABG. We could identify only eight patients who died while waiting for CABG—well within what has been reported in the literature for death rates while waiting for CABG—which was too few to model. On the advice of the working group, we looked at hospitalizations for acute coronary syndrome (ACS). Patients waiting for CABG were found to be at a much higher risk of being hospitalized for ACS while waiting, however there was no relationship between the length of time waiting and the risk of being hospitalized for ACS. The rate of being hospitalized for ACS decreased significantly in the year after CABG surgery, demonstrating the benefits of the procedure.

## Key Messages

**Eight Common Procedures**

1. Waits for eight common elective surgical procedures were studied: Excision of breast lesions; carotid endarterectomy, cholecystectomy, carpal tunnel release, TURP (for benign disease), hernia repair, T&A, and stripping/ligation of varicose veins.
2. A visit to the surgeon prior to surgery was used as a marker for the beginning of the wait time. There is evidence to support the validity of using this method, and it is a relatively easy and inexpensive way to track wait times especially for procedures for which there is no surgical registry.
3. Wait times for cholecystectomy, hernia repair, excision of breast lesions, and carotid endarterectomy did not show a clinically relevant change. Waits did however increase for varicose veins, carpal tunnel release, T&A and TURP. The longest median wait was for varicose vein surgery at 93 days in 2003/04.
4. Adjusted waits tended to be shorter for residents of Nor-Man and Central; longer for residents of Brandon and South Eastman.
5. An individual's age, sex or neighbourhood income level generally did not influence their wait times.

**Cataract, Cardiac and Hip/Knee Replacement**

6. Linking of administrative and registry data can be used to develop or validate the estimation of wait times with administrative data. We were able to develop valid algorithms to estimate waits for cataract and cardiac surgery, but not for HKR.
7. Median waits increased over the time period of the study for HKR, and decreased for cataract and cardiac surgery.
8. For cataract, CABG, and HKR, a higher average volume of surgery was associated with shorter wait times.
9. Patients waiting for elective CABG have an increased risk of being hospitalized for acute coronary syndrome. The risk decreases after CABG surgery.

**More Research**

10. There has been a great deal of attention focussed on reducing wait times for surgical procedures that were prioritized by the Federal/Provincial/Territorial First Ministers: cataract, cardiac and HKR surgery. There are now concerns that concentration in these areas may squeeze out other services. Our method of tracking wait times for commonly performed non-emergency surgery could be used to explore this issue and would be worth looking at again in future.
11. Longer wait times might be related to seasonal fluctuations in the volume of surgery performed. More research is necessary to confirm this.
12. The evidence supporting benchmark wait times is limited, therefore additional research on the outcomes of waiting is required.

# 1.0 INTRODUCTION AND OBJECTIVES

Wait times to access health services are a continuous and growing complaint in Canada, sometimes described as the Achilles' heel of the healthcare system. The September 2004 Federal/Provincial/Territorial (FPT) First Ministers' health accord recognized this concern (Health Canada, 2004). **Wait times**[1] and access were highlighted in the accord with the creation of the Wait Times Reduction Fund, an investment by the federal government of $4.5 billion over six years, beginning in 2004/05, and the commitment to establish evidence-informed wait time benchmarks in the priority areas of cancer, heart, diagnostic imaging procedures, joint replacements, and sight restoration by December 31, 2005 (Health Canada, 2006). The benchmarks were informed by synthesis research performed by several research teams who were awarded peer-reviewed grants by CIHR through a special competition funded by the FPT ministers. The announced benchmarks are:

- Radiation therapy: within 4 weeks of patient being ready to treat
- Hip fracture fixation: 48 hours
- Hip joint replacement: 26 weeks
- Knee joint replacement: 26 weeks
- Cataract surgery: 16 weeks for high-risk patients
- Breast cancer screening: every 2 years for women age 50 to 69 years
- Cervical cancer screening: every 3 years for women age 18 to 69 after 2 normal tests
- Cardiac bypass surgery: Level 1 patients 2 weeks; Level 2 patients 6 weeks; Level 3 patients 26 weeks

Manitoba received $155 million of the federal Wait Times Reduction Fund. A Wait Time Task force was established, and after consultation with physicians and **Regional Health Authorities** (**RHAs**), priority areas were selected. In addition to the five areas named by the FPT First Ministers, Manitoba has added sleep, pain and pediatric dentistry. According to Manitoba Health's website, funds will be divided among more surgeries ($57.1 million), more diagnostic testing ($25.5 million), more health professionals ($12.4 million), prevention and health promotion ($17.2 million), system innovation and better wait-list management ($10.5 million) (Manitoba Health, a).

Concurrently with other activities undertaken by the province to reduce wait times and improve access, Manitoba Health as part of its contract with the University of Manitoba, asked the Manitoba Centre For Health Policy (MCHP) to conduct a research study to provide a measurement of surgical wait times in Manitoba. The purpose was to provide methods of measuring wait

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

times, not only for the priority areas, but for other surgical procedures which do not have a centralized patient registry to track wait times. The objectives of this study are to:

1. Update the wait times analysis that the Manitoba Centre for Health Policy (and Evaluation) first published in 1998 (De Coster et al., 1998) and again in 2000 (De Coster et al., 2000).
2. Develop a method using **administrative data** to monitor wait times for longer wait procedures, e.g., hip and knee replacement.
3. Describe factors that are related to variation in wait times.

Questions that were explored in this study are:

- Have wait times for previously-studied procedures changed since 1998/99?
- Do wait times vary by age, sex, socioeconomic status, or region of residence?
- Are factors such as age, sex, income, health status, being hospitalized, or hospital surgical resources associated with variation in wait times?
- Are administrative data a valid source by which to estimate wait times for knee or hip joint replacement, **cataract**, and coronary artery bypass surgeries?
- Is there a relationship between negative outcomes and longer wait times for cardiac surgery?

A Working Group was established to review the project methods and design, suggesting improvements where appropriate, to provide feedback on the analysis and interpretation of findings, to review and comment on draft reports, and to provide advice on recommendations arising from the report. The Working Group comprised surgeons, surgery program managers from the Winnipeg Regional Health Authority (WRHA), a rural RHA representative and Manitoba Health representatives.

There are three analytical sections to this report. First, the Update section repeats and improves upon the analyses of MCHP's previous two deliverables, with the addition of five more years of data. Next, the Registry Comparison and Analysis section describes work using wait time registries merged with healthcare administrative data. Third is a brief section analyzing negative events that occurred while waiting for CABG surgery. In each of these sections the methods are described first and followed by the results. Finally there is a Discussion section which includes key findings and makes a few suggestions for further research. This study focusses only on surgical wait times, and does not include waits for diagnostic testing or waits to see physicians.

# 2.0 Update Section

## 2.1 Methods

### 2.1.1 Data Sources

The analyses for this section of the report were based on the administrative data contained in the **Population Health Research Data Repository** (**Repository**) housed at 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 section were the **Research Registry** (for population counts), **hospital discharge abstracts** data and **physician claims**. The **Physician Resource Database** provided a unique identifier that was used to match the surgeon for the pre-op visit and the actual surgery. Data analyses were performed using SAS® statistical analysis software, versions 8.2 and 9.1.

### 2.1.2 Study Period

The period of interest for the update was 1999/2000 to 2003/04. The last study on wait times at MCHP ended with the 1998/99 fiscal year; therefore, five more years of data were analyzed. At the time the current analyses were performed, 2003/04 was the most recent year of data available. For the survival analyses, we also included 1997/98 and 1998/99 so that we had baseline data for comparison purposes.

### 2.1.3 Approach

Our method for estimating the wait times for surgery is to identify the date of surgery from the hospital abstract data, after which physician claims were searched for a pre-surgical visit to the surgeon; this visit is used as the marker for the beginning of the wait time. The underlying assumption for this method is that the family physician refers the patient to a surgeon, the decision is made with the surgeon to have surgery, after which the patient is not seen again by the surgeon until the date of surgery.[2]

Since there is no field in the administrative data that indicates when the patient and physician made a decision to proceed with surgery, a marker is needed to flag the beginning of the wait for surgery. The marker has to be present in a high proportion of cases, and it has to make sense to clinicians. We chose the pre-surgical visit to the operating surgeon as the marker for when wait time begins. That is, we defined the wait time as the time between the

[2] It is not possible with the data in the Repository to assess the wait time between the patient seeing a family physician and the surgeon.

surgery date and the date of the patient's visit to the surgeon beforehand. The codes used to identify a pre-operative marker are the physician **tariff codes** for the appropriate years identified from the Manitoba Physician's Manual (Manitoba Health, b) (See Appendix 1).

In keeping with the previous wait time deliverables, we have analyzed wait times for eight relatively common surgical procedures. We chose these procedures to represent a spectrum of commonly performed general surgical procedures. These are not the procedures that have attracted a great deal of attention from the public, politicians, decision-makers and providers. Hence there are no centralized patient registries to keep track of how long patients are waiting for these procedures. Some of these procedures are considered more urgent (e.g., **carotid endarterectomy**), and some more discretionary (e.g., **tonsillectomy & adenoidectomy**, **varicose vein** repair). Our hypothesis was that wait times for the more discretionary procedures would be the most likely to increase if there were increased pressure on available resources.

For each procedure, we used a combination of **ICD-9-CM** procedure and diagnostic codes to include them in the study (See Appendix 1); the procedure code had to be in the first position indicating that it was the principal procedure, and where applicable, a diagnostic code, also in the first position indicating that it was the most responsible diagnosis for the patient's stay in hospital. The eight common procedures are:

- *Excision of breast lesions*: Both benign and malignant lesions were included, breast biopsies were excluded.
- *Carotid endarterectomy*: A procedure to remove plaque from the carotid artery which supplies blood to the brain, thus preventing stroke.
- *Cholecystectomy (removal of gallbladder)*: We excluded patients who had surgery for malignancies or for pancreatitis. The main diagnoses that we included were gallstones, cholecystitis or abdominal pain.
- *Carpal Tunnel Release*: For carpal tunnel syndrome .
- *Transurethral Prostatectomy (TURP)*: For benign hyperplasia. Excludes all malignancies.
- *Hernia Repair*: We included inguinal and femoral hernia without gangrene.
- *Tonsillectomy & Adenoidectomy (T&A)*: For tonsillitis or hypertrophy; not for middle ear infections. We included both tonsillectomy and adenoidectomy, alone or combined.
- *Stripping/Ligation of Varicose Veins*: Removal of varicose veins in the legs only, not esophageal or gastric.

## Inclusions and Restrictions

Patients who had one of the above-defined procedures during the period 1999/2000 to 2003/04 were identified in the hospital claims. Only **elective** or **day procedures** were included; those coded as **urgent** or **emergent** were excluded. There had to be a visit before

surgery to the surgeon who did the surgery, and that visit had to be four or more days before surgery in order to exclude potentially more urgent cases. In cases where there was more than one visit to the surgeon, we selected the closest visit.

For the box plots (described below), we counted only the first procedure over the five years, in order to simplify the analyses. Furthermore, we searched back three years prior to the study period (1996/97 to 1998/99) to avoid having people enter the study already waiting for a procedure.

**Duplicate** procedures are those that recur, usually procedures that can be bilateral, such as **carpal tunnel release**; **subsequent** procedures refer to the same individual having two or more procedures from the list of eight, for example, a carotid endarterectomy and later a TURP. Our data showed that the exclusion of duplicate and subsequent procedures resulted in the loss of from 2.7% of procedures when the first procedure was a tonsillectomy, up to 32.1% of procedures when the first procedure was a carpal tunnel release. None of the **median** wait times were significantly different with these exclusions.

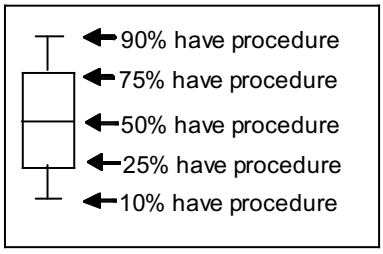
### Rates

In order to provide some context for understanding wait times we calculated the overall rates of surgery. Rates are age-sex standardized to the 2001 Manitoba population.

## Descriptive Analyses Using Box Plots

Because of the skewed distribution of wait times, we report the median rather than the mean wait times. The median tells us how long it took 50% of patients to receive the procedure. However the median provides no information about the range of wait times. Therefore in this report we make use of box plots. The central line in the box plot is the median, the top and bottom edges of the box are the 75$^{th}$ and 25$^{th}$ percentiles, respectively, and the ends of the whiskers denote the 90$^{th}$ and 10$^{th}$ percentiles. See Box Plot Legend (inset). The percentile values tell us how long it took for X% of patients to receive their surgery. For example, if the 75$^{th}$ percentile is 61 days, then 75% of patients received their surgery within 61 days and 25% waited more than 61 days. The box plots therefore provide more information about the variation in the distribution of wait times.

**Box Plot Legend**



Box plots are provided by year and by Regional Health Authority (RHA). For the box plots by year, the volume of surgery is shown at the foot of each graph, both the number of surgeries that were used in the calculation of the waits, and the total volume in the province. RHA analyses are based on where patients lived, not the region in which the procedure took place. The ordering of the RHAs is consistent for all figures and is according to the volume of these eight surgical procedures per 1,000 persons over the five-year time period, with the lowest volume on the left (or top) of the figure and the highest volume on the right (or bottom). In addition to box plots for each procedure by year and by RHA, tables in Appendix 2 provide the percentile wait times used in the construction of the box plots.

### 2.1.4 Using Models to Explore Variation in Waiting Times

Comparing the median wait times across years or RHAs may be inappropriate because the patients being treated within an RHA or within a year may be fundamentally different from the patients being treated within another RHA or year. In order to make comparisons fairly, the median wait times need to be adjusted so that each RHA or year is 'equal' on all other important factors that may influence wait times.

Multivariate models were used to obtain a predicted estimate of median wait time for the surgical procedures after taking into account the influence of demographic variables and other factors such as the individual's health, the number of each of the surgical procedures being performed in the province over the wait time, and whether or not the individual was hospitalized while he or she was waiting. Modeling was done separately for each of the surgical procedures studied.

The nature of wait time distributions affects the methods that must be used to analyse the data. Wait time distributions generally rise quickly and stretch out to the right. Methods that assume a normal distribution, such as ordinary least squares regression, or other methods based on the general linear model, should not be employed. The statistical modeling technique that is best suited to model wait time data is **parametric survival analysis**. This type of regression is intended to analyse the "time to X" where X represents some event, in this case, surgery.

To provide a better fit of the data, extreme outliers were removed from the dataset before the analyses.[3] This change allowed us to include the number of concurrent waits as a potential predictor of wait times. The variable was later dropped because fewer than 0.25% of people had concurrent waits.

[3] Using the Tukey method of calculation, outliers are defined as a wait time greater than 3 times the interquartile range at the 75th percentile or less than 3 times the interquartile range at the 25th percentile.

## Variables included in the multivariate models

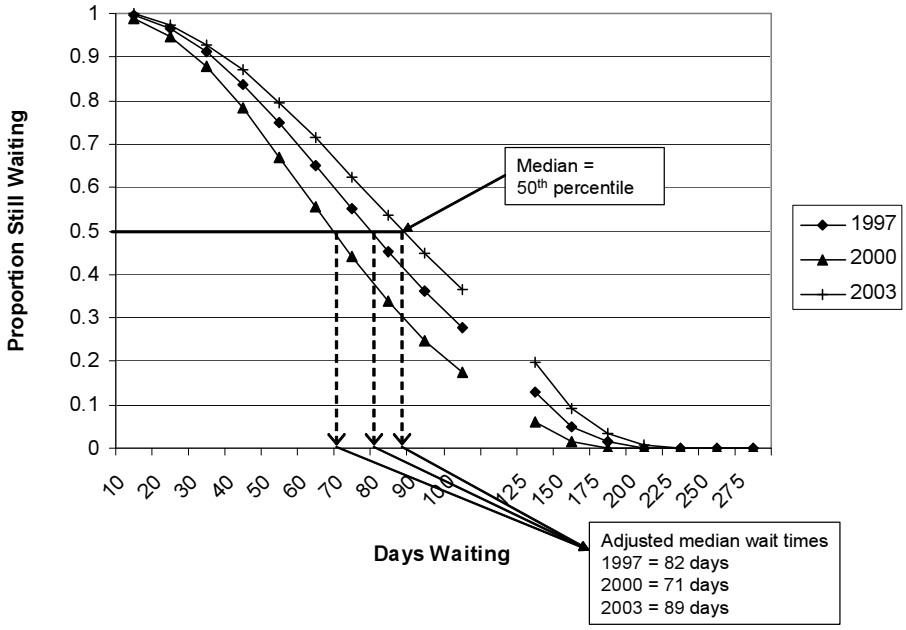
- *Age*: Age was defined as the age on the date of surgery.
- *Sex*
- *Year*: 1997/98 to 2003/04 inclusive. 1997/98 and 1998/99 were included in the multivariate models for the purposes of baseline comparisons.
- *RHA*: RHA of residence, not the RHA where surgery took place.
- *Income Quintile*: An **income quintile** divides the population into five income groups (from lowest income to highest income) such that 20% of the population is in each group. The quintiles are based on **enumeration area** (**EA**) or **dissemination area** (**DA**) level average household income values from a public-use census file. Each person within an EA is "attributed" the average household income of the EA, so this is not an individual income but rather an area income. We excluded people with public trustee postal codes, as they could not be further identified by region or income quintile (n = 111).
- *Urban/Rural*: Urban includes Winnipeg and Brandon; rural includes all other areas. The urban/rural variable was used as an interaction term with income quintile.
- *Morbidity (using ACG score)*: The **Adjusted Clinical Group** (**ACG**) system groups individuals based on their age, gender, and all known medical diagnoses in hospital and physician claims assigned over a period of time, typically one year. The ACG value is a **morbidity** measure of the individual's consumption of medical care in the year prior to the date of surgery.
- *Hospitalization during wait period*: yes/no
- *Total length of stay in hospital during wait period*: in days
- *Volume*: One of the factors influencing wait times is the availability of resources. The Working Group pointed out that over the study period, there were fluctuations due to anaesthetist shortages, ICU nursing shortages, vacation relief, flu epidemics and so on. These fluctuations cannot be captured in the data but may affect the volume of surgery performed. In order to capture a measure of available resources, we included a volume measure which was the total number of surgeries averaged over each quarter that the patient waited.

## Interpreting the models

From the completed analysis, an adjusted wait time curve can be calculated for each group that is to be compared (e.g., each of the RHAs, or each of the years in the study period). These curves can then be compared directly because they are equated on all other variables included in the statistical model. This example figure shows the adjusted medians (see Example Figure on next page). They are simply the point at which the model predicts 50% of the patients in a group have had their surgery and 50% are still waiting. Note that these adjusted medians do not represent the actual median wait times and are for comparison purposes only.

**Example Figure**

**Adjusted Wait Time Curves**




For each procedure, we display the adjusted median wait times by year and by RHA as bar charts. The referent for the year bar charts is 2003/04 and the referent for the RHA bar charts is Winnipeg. Statistically significant differences are marked with an asterisk.

## 2.2 Findings

Table 1 shows the age/sex standardized rates of each of the eight common surgical procedures from 1999/2000 to 2003/04, per 1,000 population. Rates for most of these procedures decreased over the time period. Decreases may be due to a variety of reasons, including less availability of resources, changes in the health of the population, and changes in clinical practice which might reduce the need for surgery. For instance, published guidelines for the care of patients with benign prostatic hypertrophy may have led to decreases in TURP rates (Nickel et al., 2005; de la Rosette et al., 2001; AUA Guideline, 2003). Guidelines and recommendations for carotid endarterectomy outlined which patients were more likely to benefit or not benefit from the procedure which may have influenced the demand for this procedure (Findlay et al., 1997; Barnett et al., 2002).

**Table 1: Age/sex standardized rates of surgery, Manitoba, 1999/2000 to 2003/04**

| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 | % Change |
|---|---|---|---|---|---|---|
| **Excision of breast lesions** (females only) | 3.1 | 3.1 | 2.5 | 2.5 | 2.3 | -26.0% |
| **Carotid endarterectomy** | 0.4 | 0.3 | 0.3 | 0.2 | 0.2 | -42.6% |
| **Cholecystectomy** | 2.8 | 2.9 | 2.7 | 2.7 | 2.6 | - 7.2% |
| **Carpal tunnel release** | 1.1 | 1.2 | 1.1 | 1.1 | 1.3 | +20.6% |
| **TURP** (males only) | 1.6 | 1.4 | 1.3 | 1.1 | 1.2 | -25.0% |
| **Hernia repair** | 2.1 | 2.2 | 2.1 | 2.0 | 2.0 | -3.8% |
| **T&A** | 1.7 | 1.7 | 1.7 | 1.6 | 1.3 | -23.0% |
| **Stripping or ligation of varicose veins** | 0.34 | 0.32 | 0.31 | 0.33 | 0.28 | -19.2% |

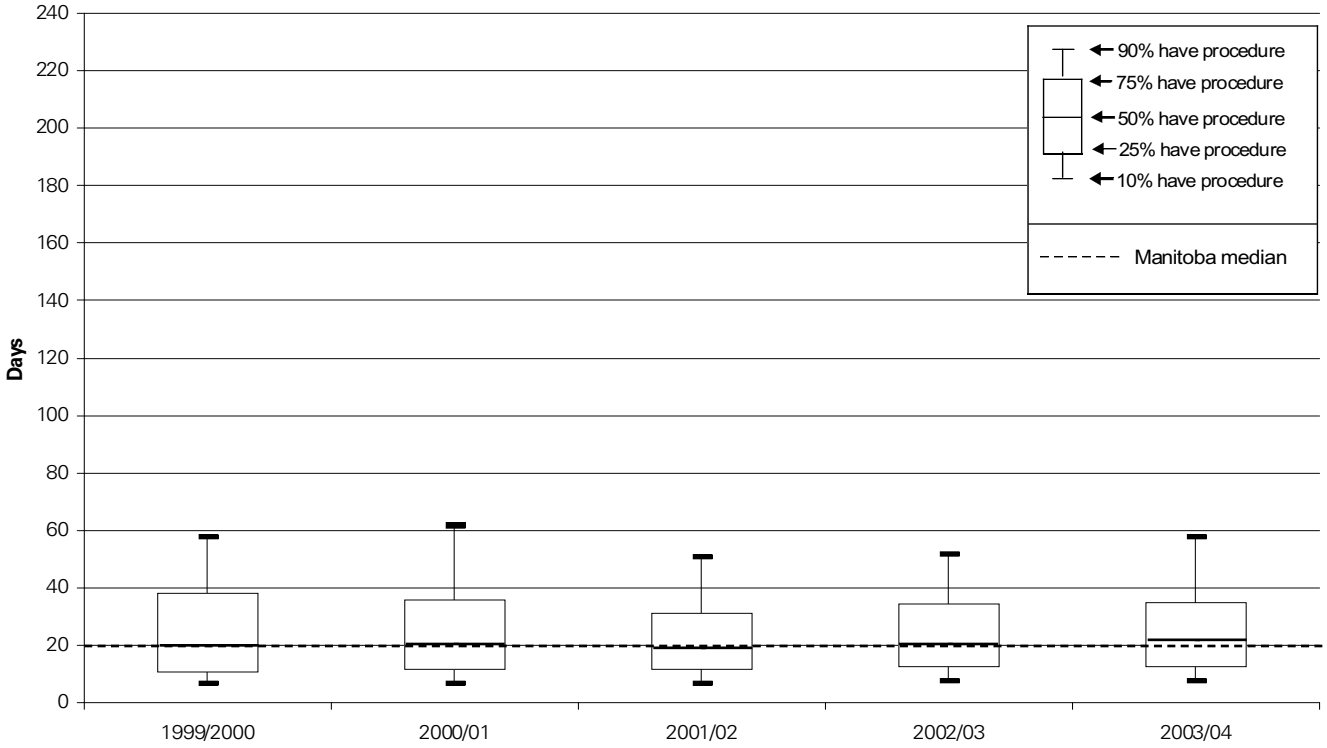
Source: Manitoba Centre for Health Policy, 2007

## 2.2.1 Excision of Breast Lesions

The Manitoba five-year unadjusted median wait time for breast tumour surgery was 20 days and the spread between the 25th and 75th percentile was only 23 days (from 12 to 35 days), showing relatively rapid access to this procedure compared to some of the other procedures in the study. From 1999/2000 to 2003/04, the median fluctuated between 19 and 22 days. The 75th percentile, that is, the time it took for 75% of women to receive breast tumour surgery, ranged between 31 and 38 days. By RHA, the crude median wait times ranged between 16 (Parkland and Central) and 30 days (Burntwood/Churchill) though most of the RHAs showed medians that were close to the Manitoba median of 20 days.

**Figure 1: Excision of Breast Lesions Waits by Year, Manitoba, 1999/2000 - 2003/04**

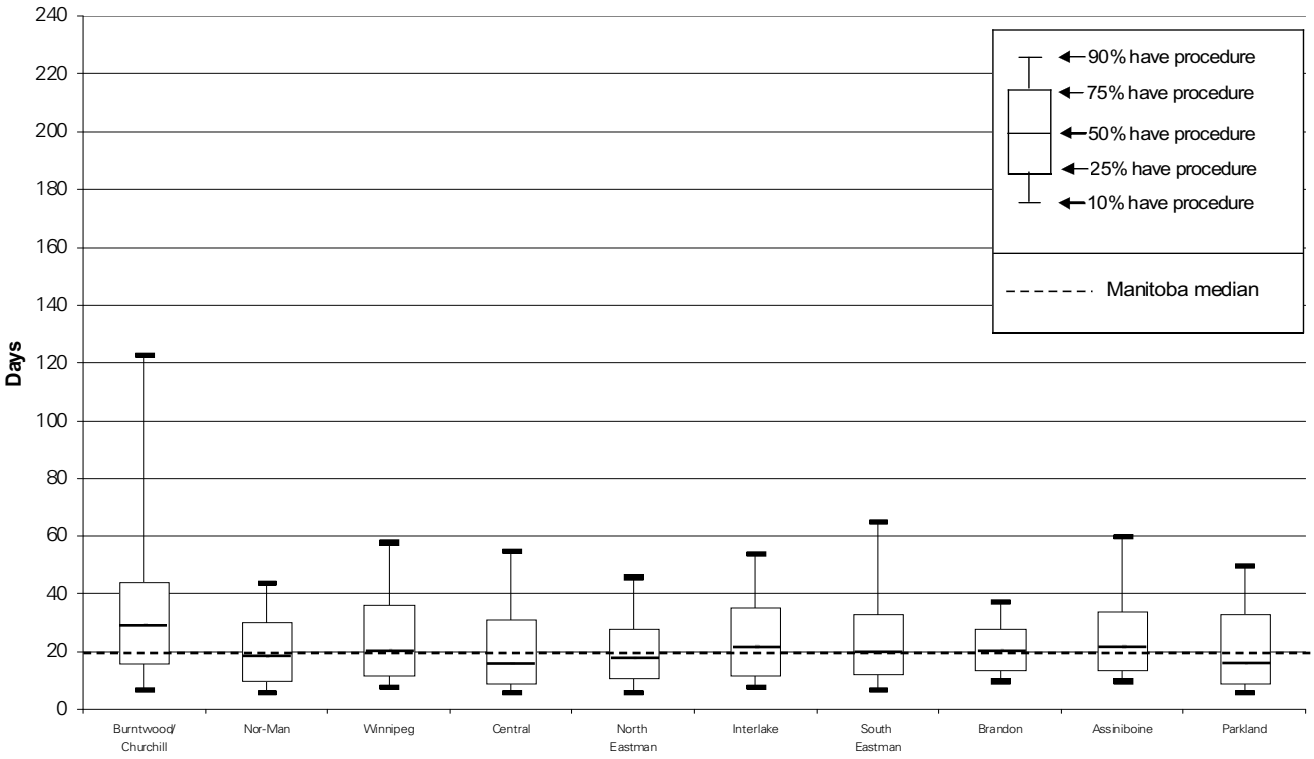
Unadjusted wait times (days)




| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 1,781 | 1,790 | 1,445 | 1,488 | 1,376 |
| Total Procedures Analyzed | 1,181 | 1,150 | 911 | 984 | 887 |

Source: Manitoba Centre for Health Policy, 2007

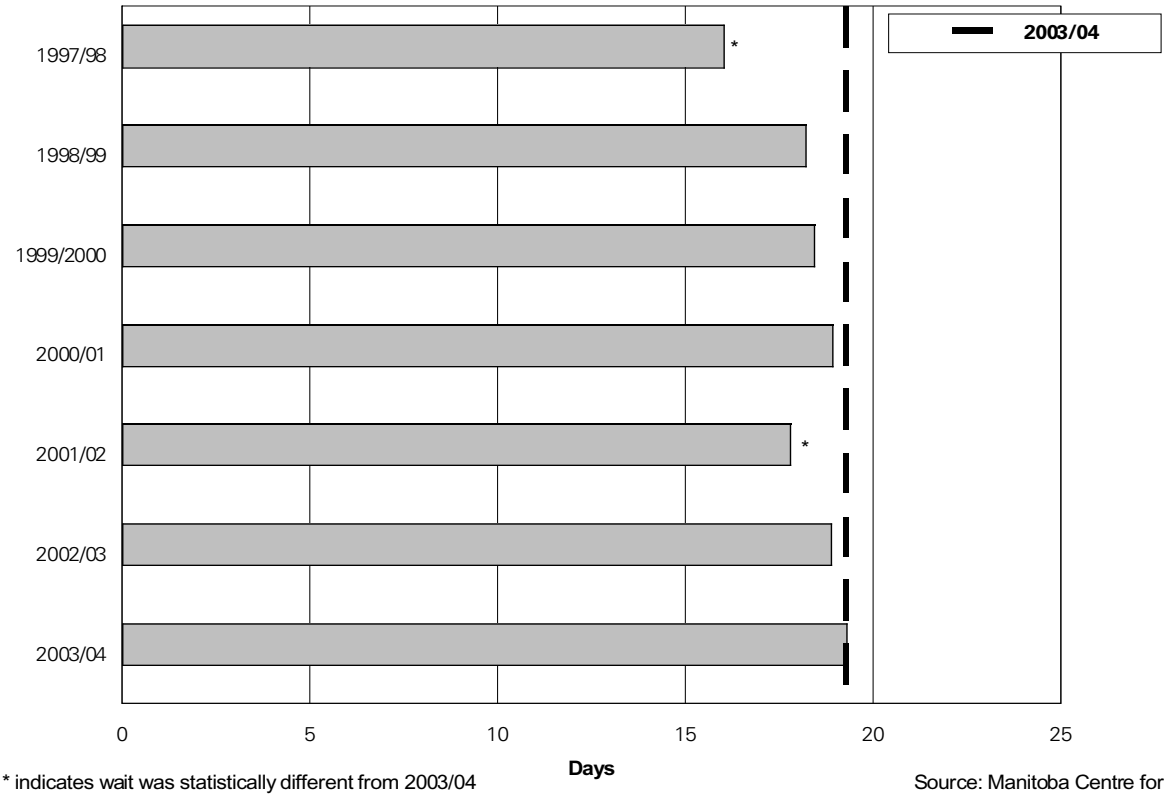
**Figure 2: Excision of Breast Lesion Waits by RHA, Manitoba, 1999/2000 - 2003/04**
Unadjusted wait times (days)




Source: Manitoba Centre for Health Policy, 2007

The adjusted median wait times show that 1997/98 (16.0 days) and 2001/02 (17.8 days) had a statistically significant shorter wait time compared to 2003/04 (19.3 days). Compared to Winnipeg (18.7 days), significantly shorter wait times were experienced by residents of Nor-Man (15.2 days), Central (15.4 days) and Parkland (15.3 days). No RHA had significantly longer wait times. Other variables that were significant in the model were whether the patient had been hospitalized during the wait, which predicted a longer wait time, and age and ACG which were inversely related to wait time.

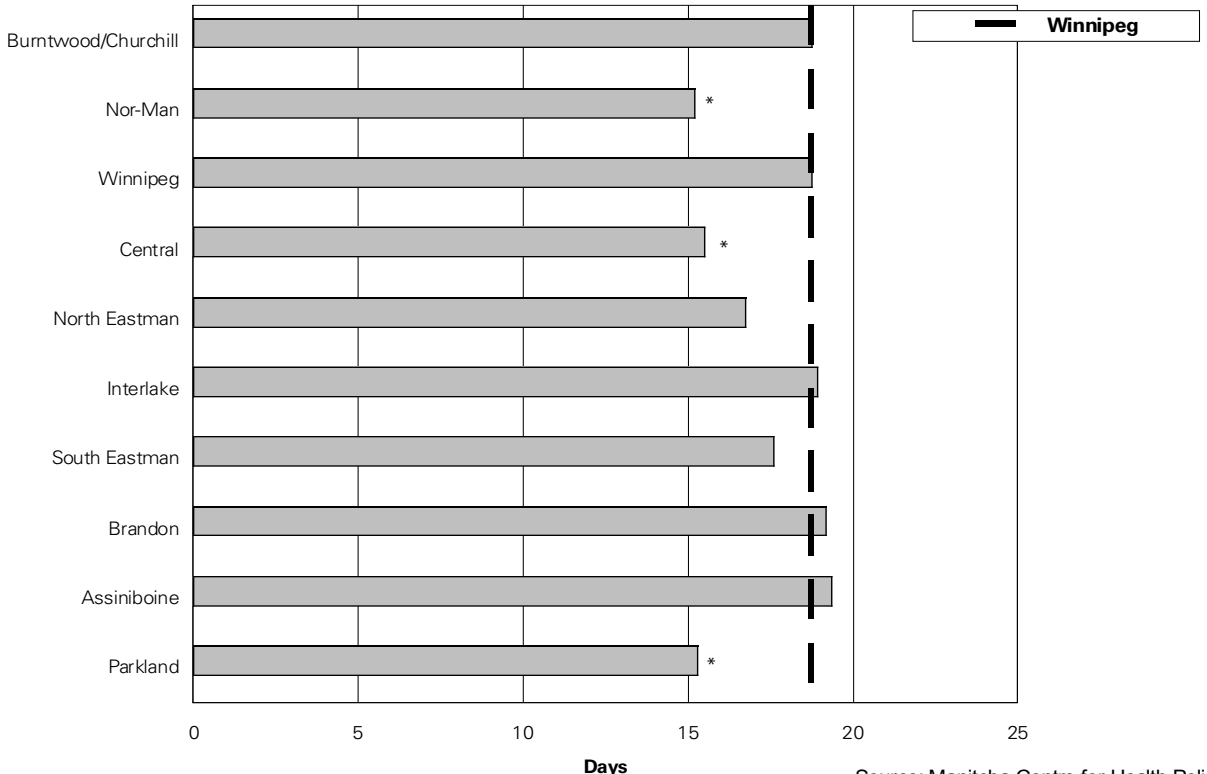
**Figure 3: Excision of Breast Lesions Waits by Year, 1997/98 - 2003/04**
Adjusted median wait times (days)




* indicates wait was statistically different from 2003/04

Source: Manitoba Centre for Health Policy, 2007

**Figure 4: Excision of Breast Lesions Waits by RHA, 1999/2000 - 2003/04**
Adjusted median wait times (days)



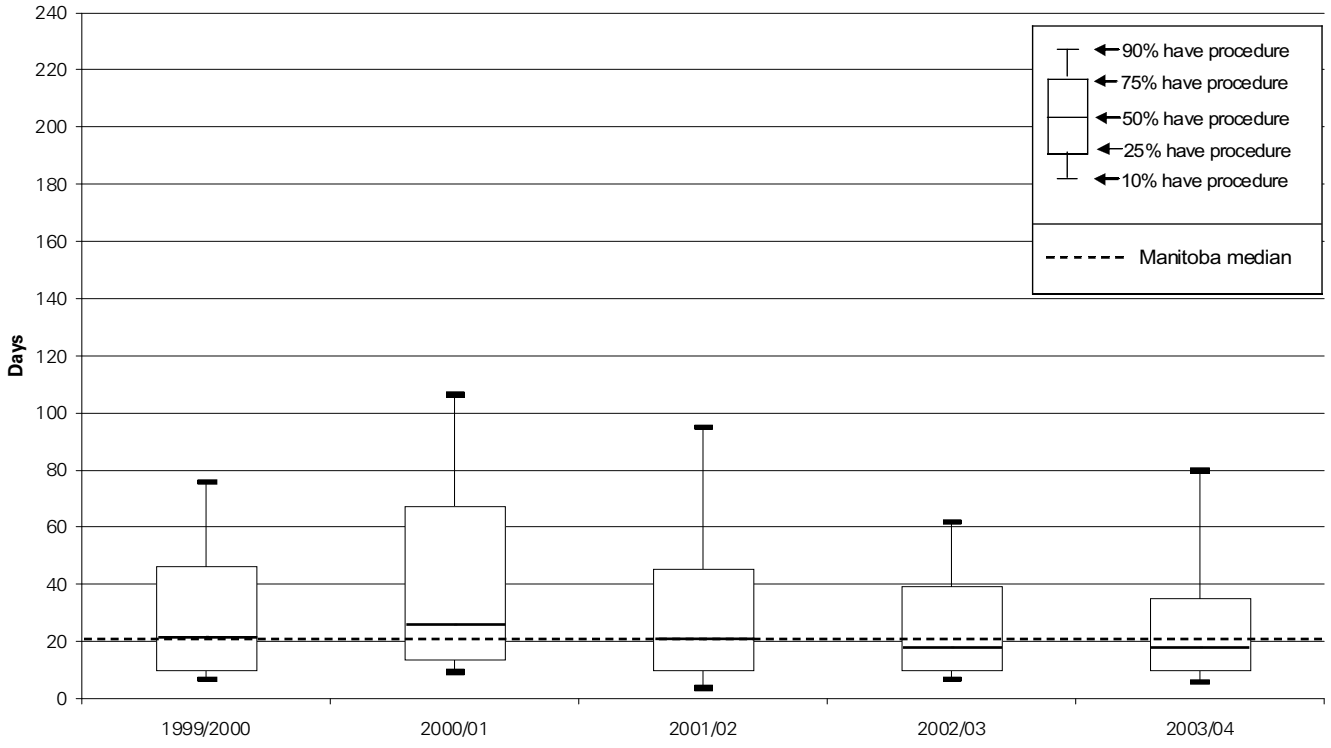

* indicates RHA wait was statistically different from Winnipeg

Source: Manitoba Centre for Health Policy, 2007

## 2.2. Carotid Endarterectomy

The Manitoba five-year unadjusted median wait time for carotid endarterectomy was 22 days and the spread between the 25th and 75th percentile was only 35 days (from 11 to 46 days), showing that patients are receiving this procedure fairly quickly, compared to some of the other procedures in the study. The median ranged from a high of 26 days in 2000/01 and a low of 18 days in 2002/03 and 2003/04. The 75th percentile was also highest in 2000/01 at 67 days, but falling thereafter to 35 days in 2003/04. By RHA, the shortest waits were for residents of Nor-Man (13 days) and Central (15 days) and longest for Interlake residents (26 days). Even the longest of the 75th percentile wait times, in North Eastman at 62 days, was relatively short.

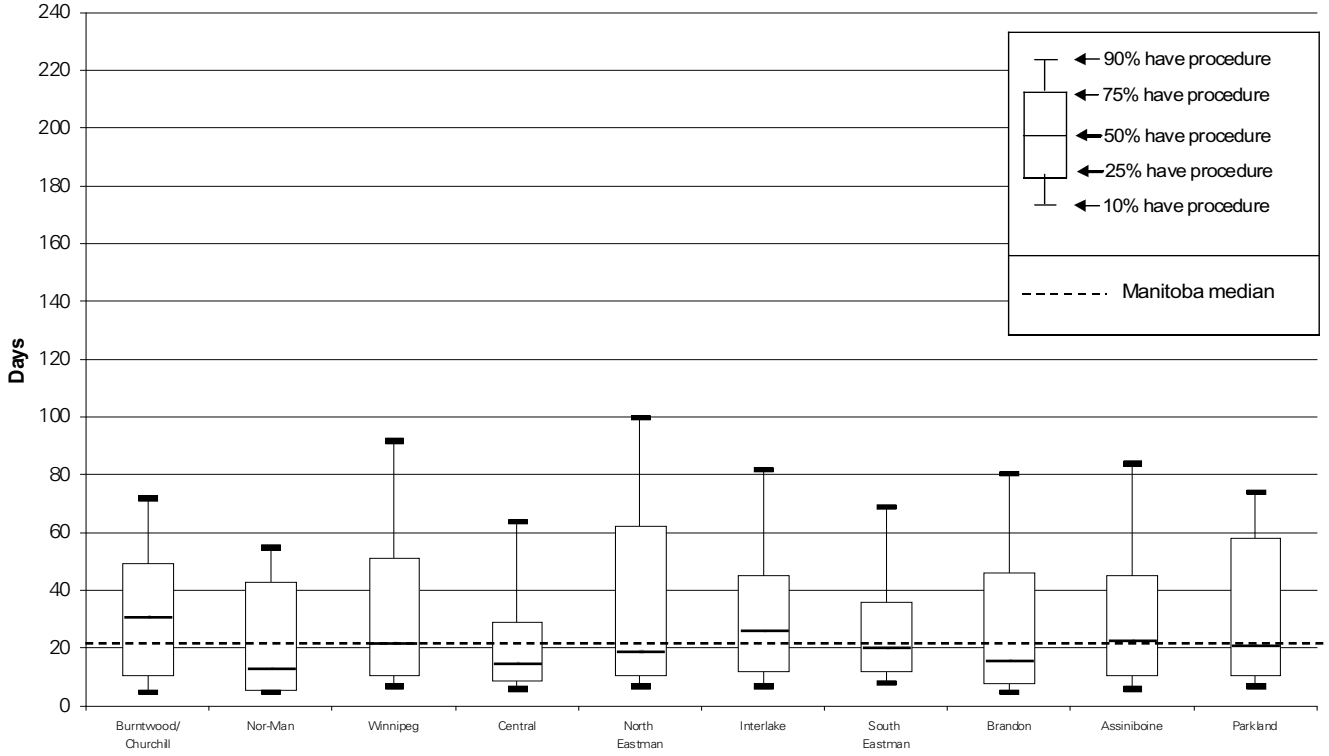
**Figure 5: Carotid Endarterectomy Waits by Year, Manitoba, 1999/2000 - 2003/04**
Unadjusted wait times (days)




| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 391 | 358 | 335 | 221 | 234 |
| Total Procedures Analyzed | 235 | 200 | 214 | 143 | 125 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 6: Carotid Endarterectomy Waits by RHA, Manitoba, 1999/2000 - 2003/04**
Unadjusted wait times (days)

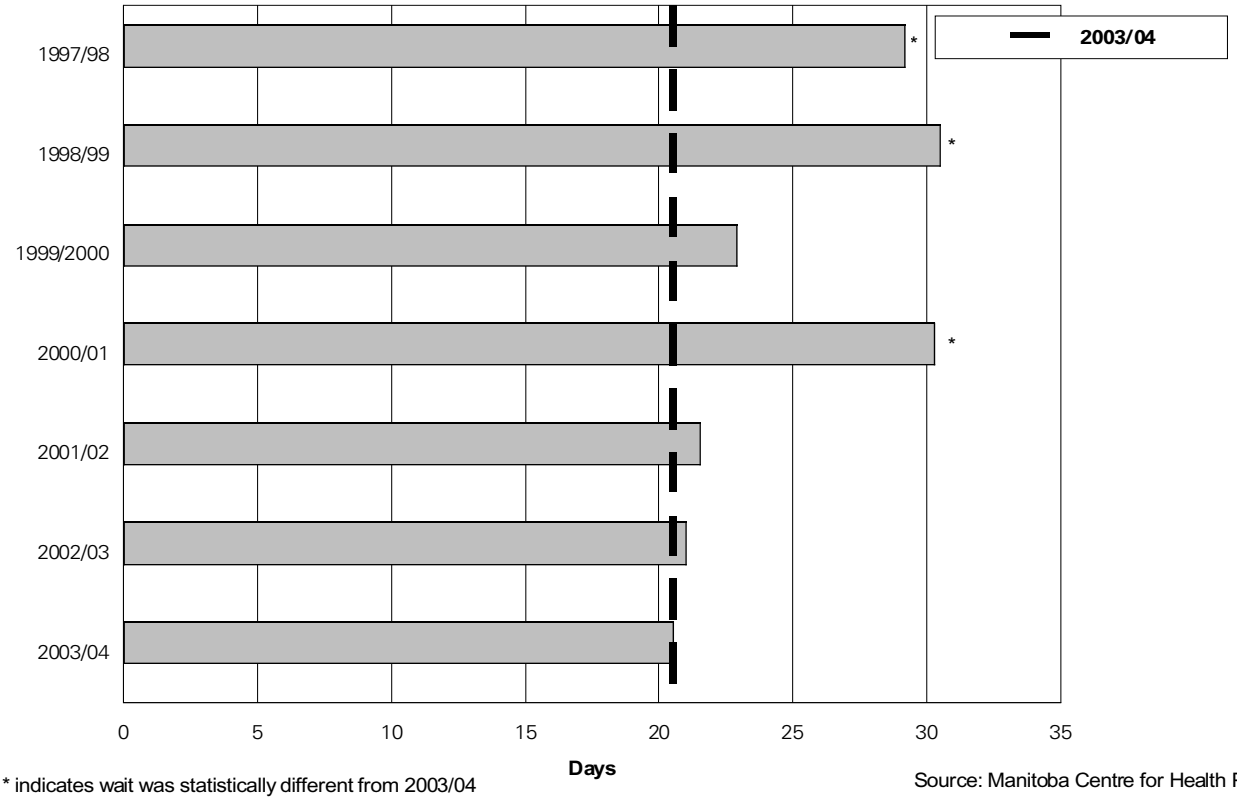



Source: Manitoba Centre for Health Policy, 2007

The adjusted median wait times were significantly longer in 1997/98 (29.2 days), 1998/99 (30.5) and 2000/01 (30.3 days) compared to 2003/04 (20.5 days). Therefore wait times for carotid endarterectomy became shorter over the time period. By RHA, none had significantly different waits compared to Winnipeg (28.6 days). The only other variable that was significant in the model was whether the patient had been hospitalized during the wait, which predicted a longer wait time.

**Figure 7: Carotid Endarterectomy Waits by Year, 1997/98 - 2003/04**

Adjusted median wait times (days)

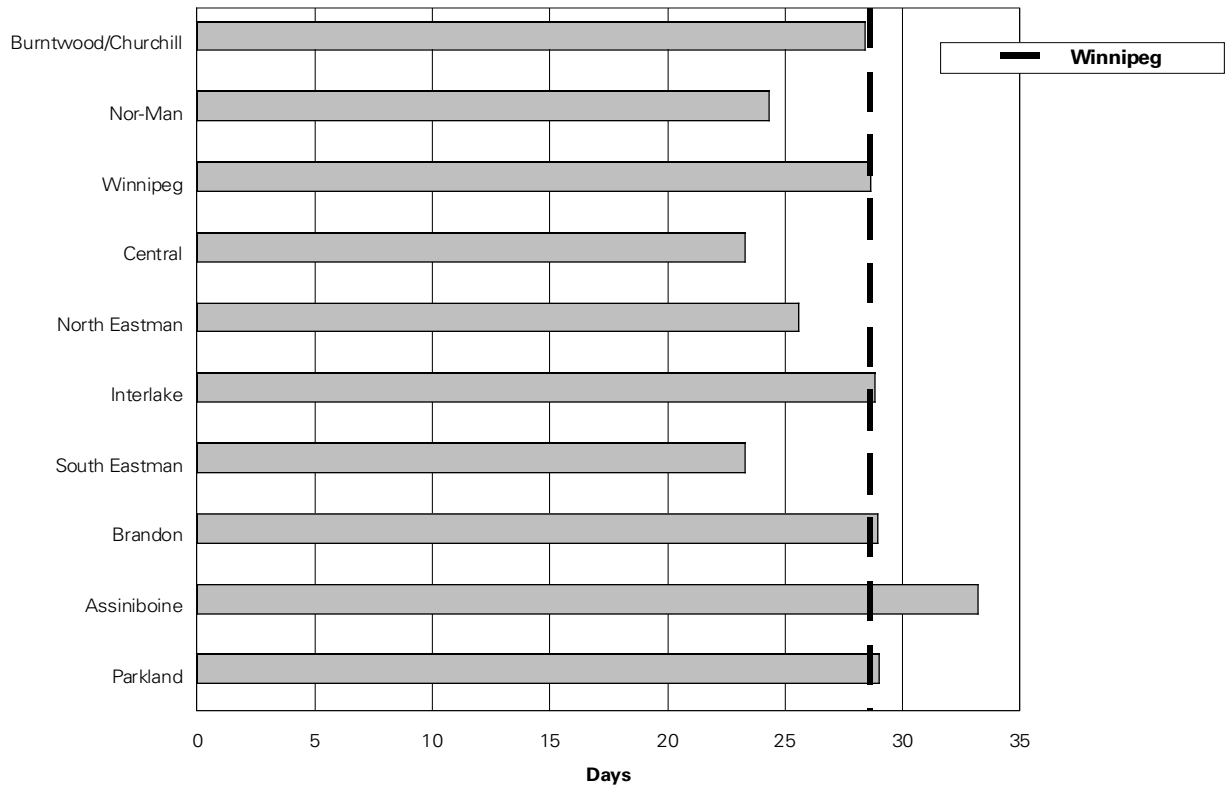



* indicates wait was statistically different from 2003/04

Source: Manitoba Centre for Health Policy, 2007

**Figure 8: Carotid Endarterectomy Waits by RHA, 1999/2000 - 2003/04**

Adjusted median wait times (days)



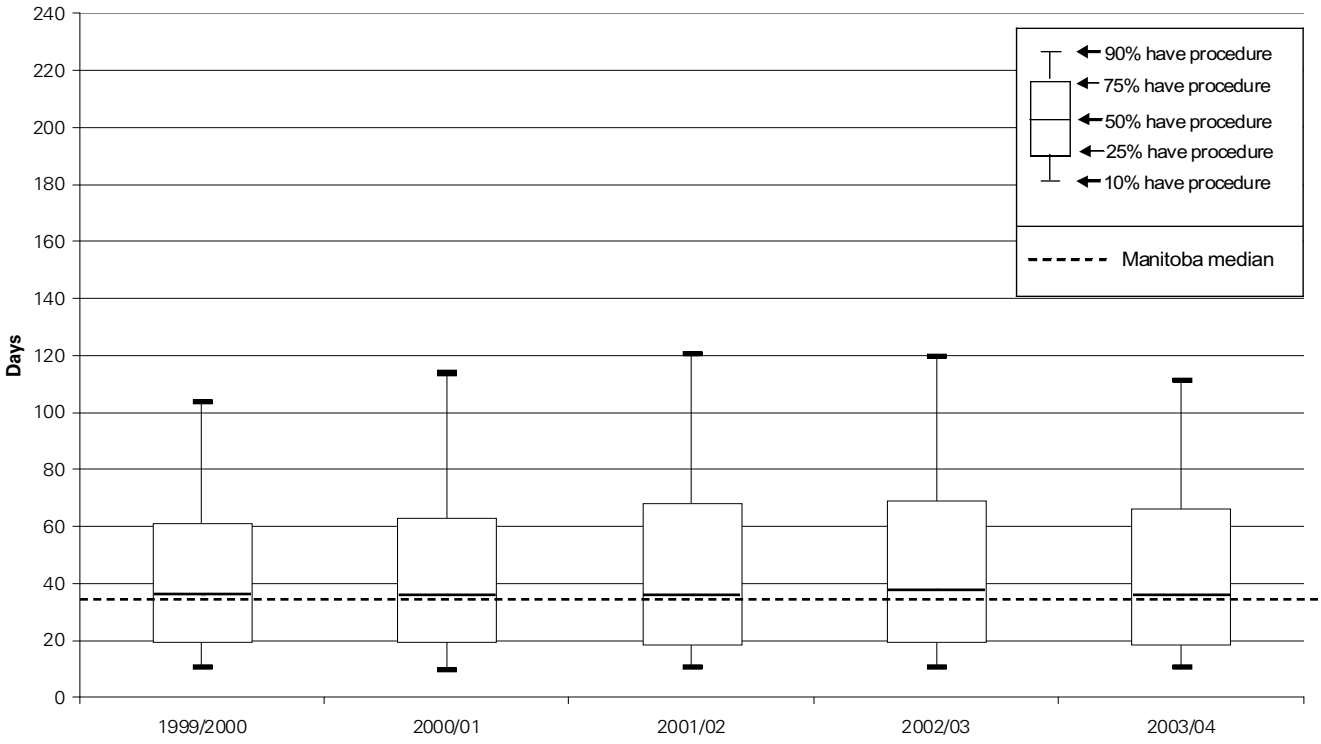

* indicates RHA wait was statistically different from Winnipeg

Source: Manitoba Centre for Health Policy, 2007

### 2.2.3 Cholecystectomy

The Manitoba five-year unadjusted median wait time for **cholecystectomy** was 36 days, and the 25th and 75th percentiles were 20 and 65 days. The median barely fluctuated from year to year, however the 75th and 90th percentiles showed wider variation: both were shortest in 1999/00 at 61 days and 104 days for the 75th and 90th percentiles, respectively. The 75th percentile was longest in 2002/03 at 69 days and the 90th percentile was longest in 2001/02 at 121 days. By RHA, residents of Nor-Man (25 days) and Central (26 days) had the shortest waits and those of Burntwood/Churchill (47 days), South Eastman (48 days) and Brandon (55 days) had the longest median waits.

**Figure 9: Cholecystectomy Waits by Year, Manitoba, 1999/2000 - 2003/04**
Unadjusted wait times (days)

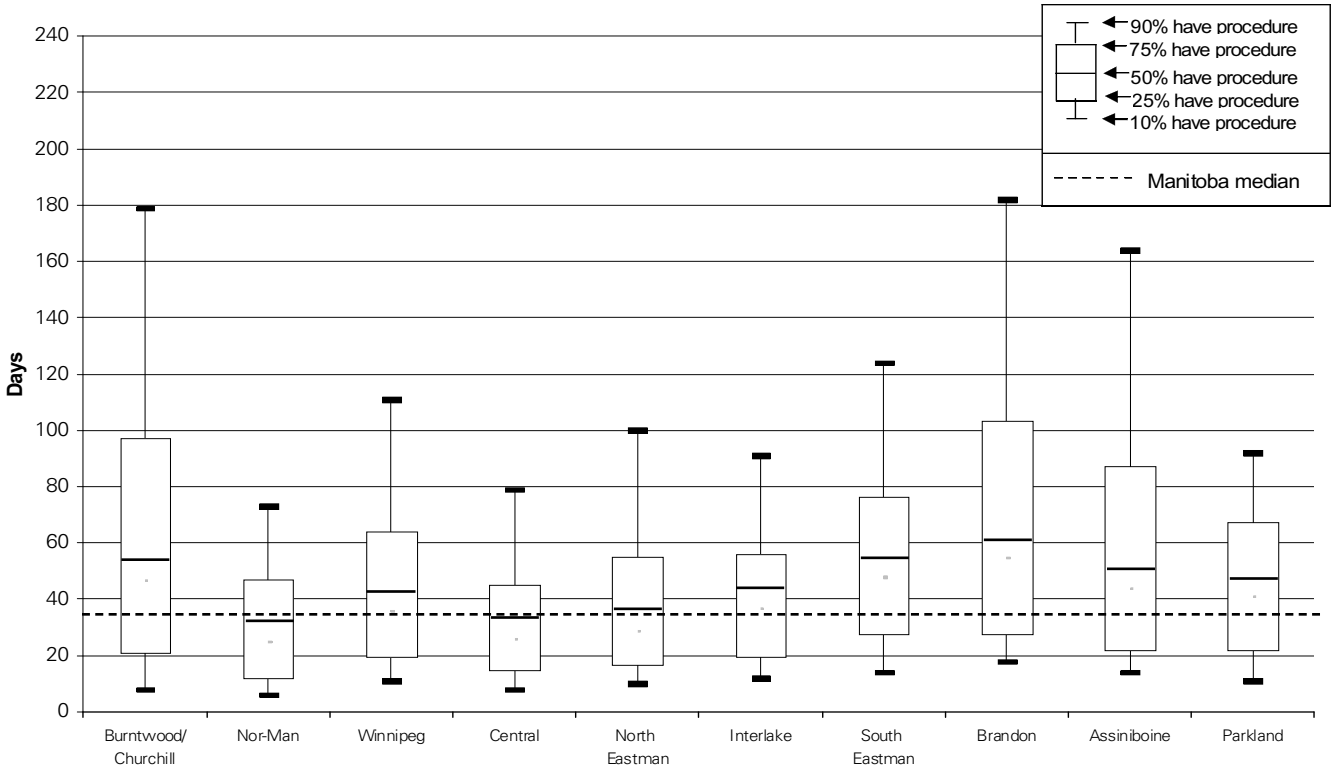



| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 3,183 | 3,292 | 3,170 | 3,164 | 3,049 |
| Total Procedures Analyzed | 2,073 | 2,196 | 2,078 | 2,028 | 2,070 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 10: Cholecystectomy Waits by RHA, Manitoba, 1999/2000 - 2003/04**

Unnadjusted wait times (days)

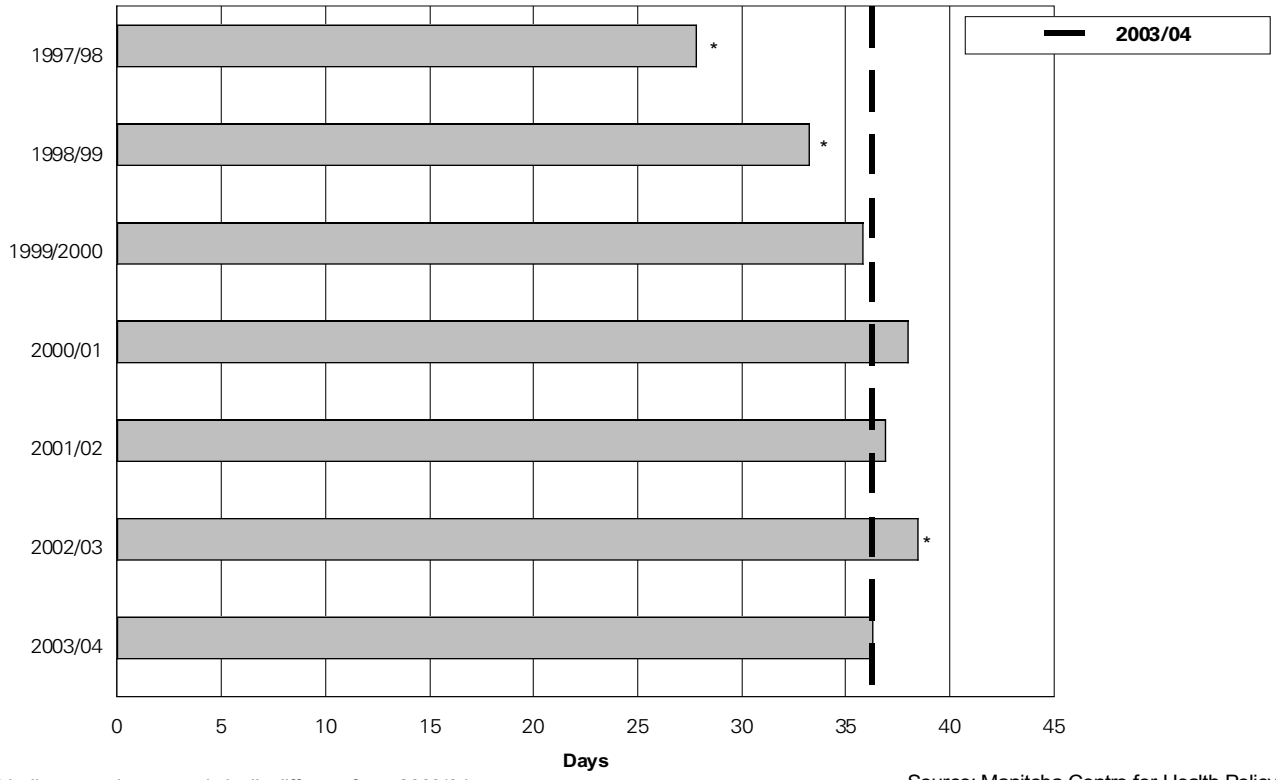



Source: Manitoba Centre for Health Policy, 2007

The adjusted median wait times for cholecystectomy were significantly shorter in 1997/98 (27.7 days) and 1998/99 (33.2 days) compared to 2003/04 (36.3 days). By RHA, residents of Nor-Man (23.9 days) and Central (27.3 days) had significant shorter waits compared to Winnipeg residents (35.5 days), and residents of Assiniboine (39.9 days), Burntwood/Churchill (41.0 days), South Eastman (41.4 days), and Brandon (47.1 days) had significantly longer waits than Winnipeg residents. Several variables were significant in the survival models for cholecystectomy. Mean surgical volume and higher level of illness predicted shorter waits, whereas older age, being hospitalized during the wait, and length of stay in hospital predicted longer waits.

**Figure 11: Cholecystectomy Waits by Year, 1997/98 - 2003/04**

Adjusted median wait times (days)

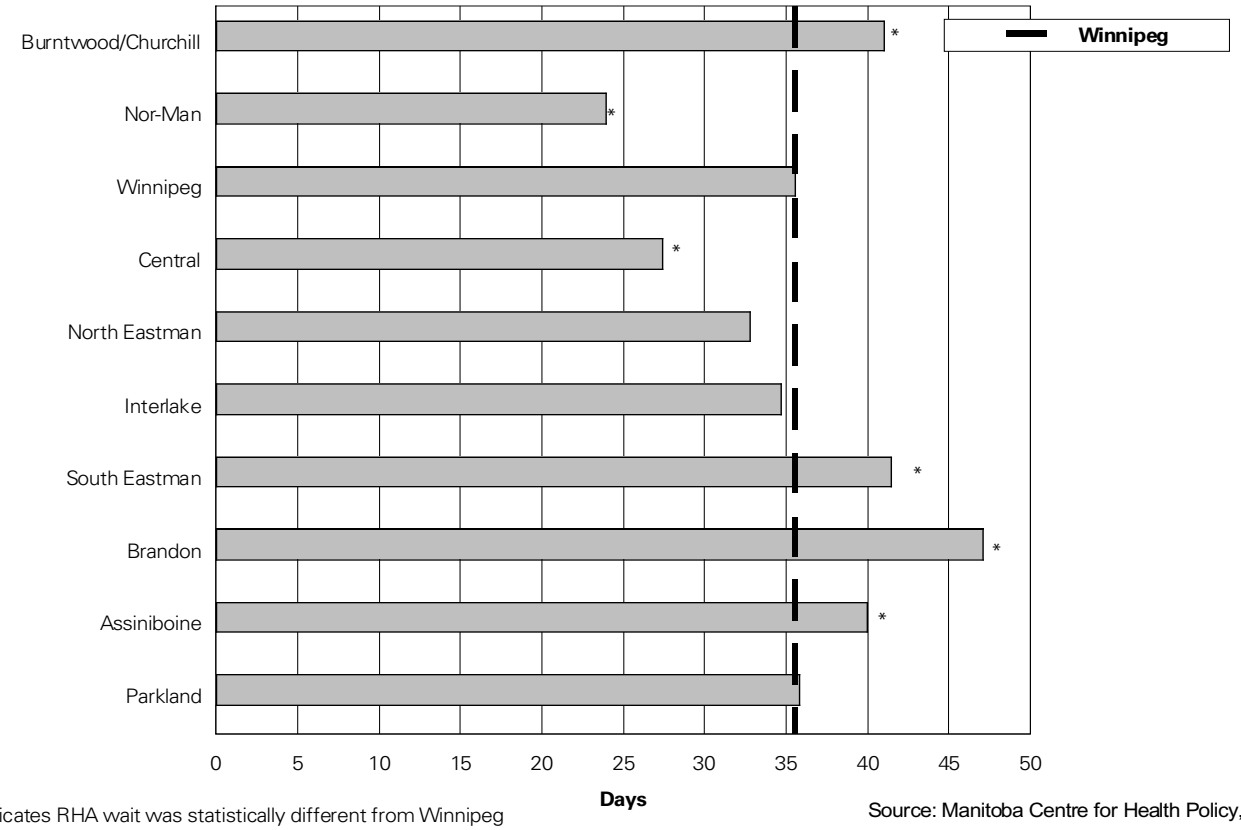



* indicates wait was statistically different from 2003/04

Source: Manitoba Centre for Health Policy, 2007

**Figure 12: Cholecystectomy Waits by RHA, 1999/2000 - 2003/04**

Adjusted median wait times (days)




* indicates RHA wait was statistically different from Winnipeg

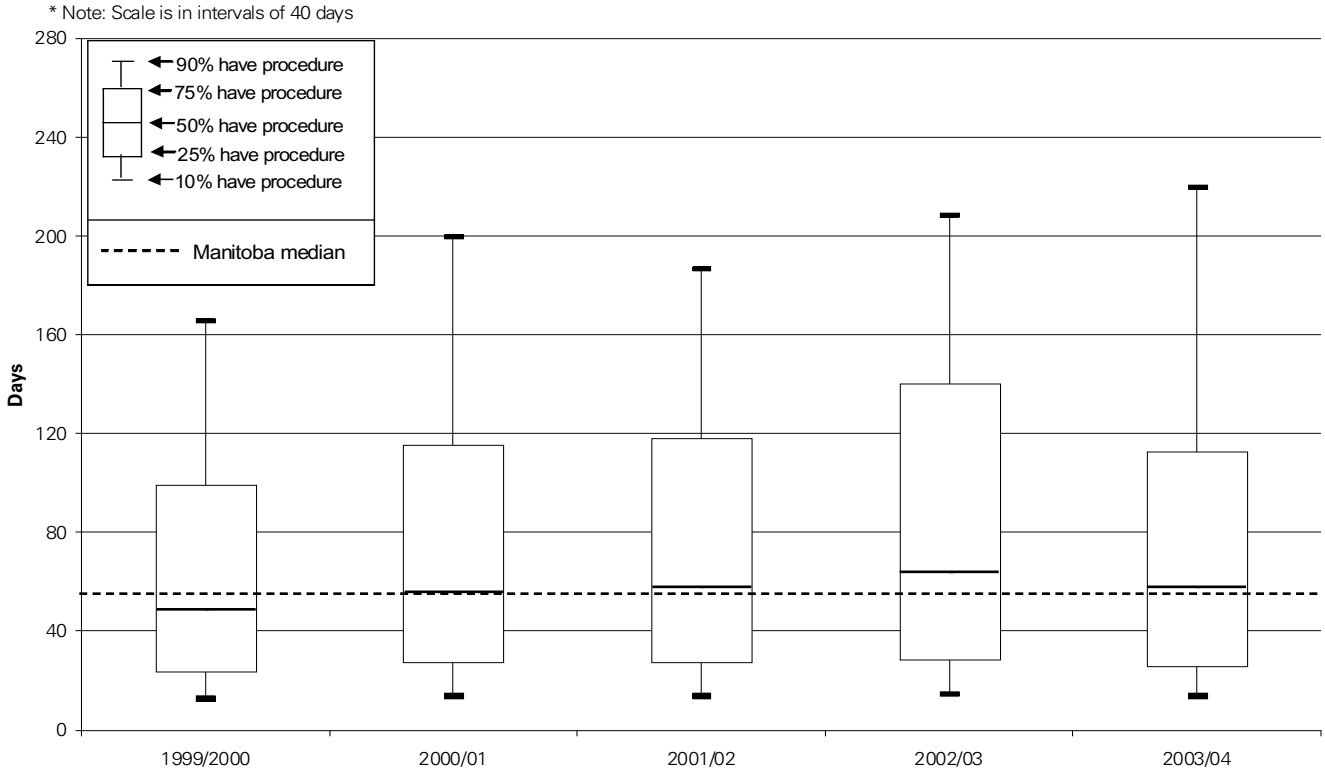
Source: Manitoba Centre for Health Policy, 2007

### 2.2.4 Carpal Tunnel Release

The Manitoba five-year unadjusted median wait time for carpal tunnel release was 56 days, and the 25th and 75th percentiles were 27 and 117 days. The longest median wait was in 2002/03 at 64 days. For 2000/01, 2001/02 and 2003/04 the median waits were similar at 56 to 58 days. The 75th percentile wait times went from 99 days in 1999/2000 to a high of 140 days in 2002/03, falling back to 113 days in 2003/04. By RHA, the crude median waits were shortest for Nor-Man residents at 17 days and longest for Winnipeg at 77 days. Two regions, Parkland and Assiniboine, had waits around 40 days, and two, Brandon and North Eastman, were around 50 days. The shortest 75th percentile wait was for Nor-Man residents at 46 days, jumping then to Parkland and Central around 70 days; the longest was for Winnipeg residents at 151 days.

**Figure 13: Carpal Tunnel Release Waits by Year, Manitoba, 1999/2000 - 2003/04**

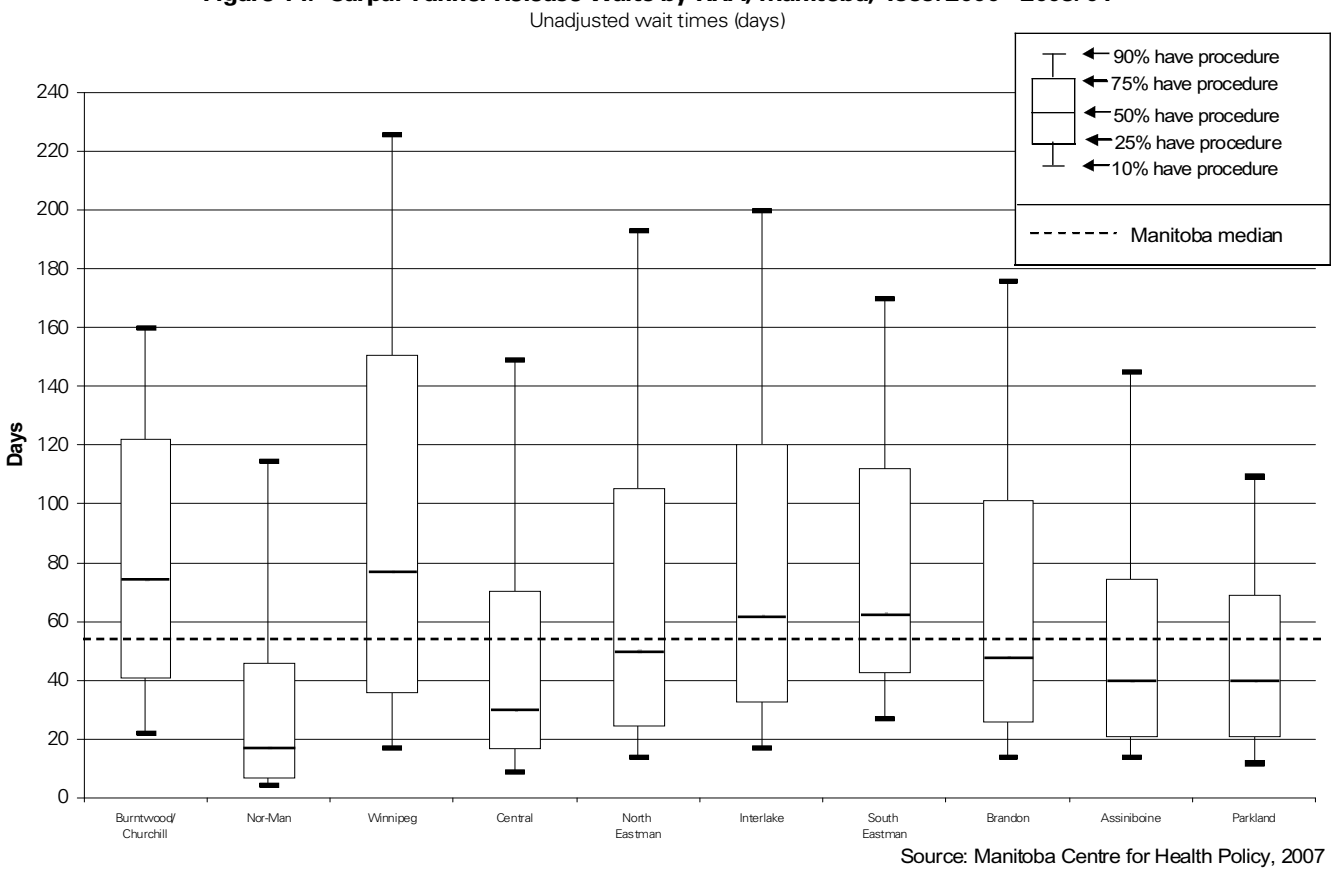
Unadjusted wait times (days)




| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 1,238 | 1,389 | 1,248 | 1,263 | 1,560 |
| Total Procedures Analyzed | 835 | 879 | 733 | 750 | 932 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 14: Carpal Tunnel Release Waits by RHA, Manitoba, 1999/2000 - 2003/04**

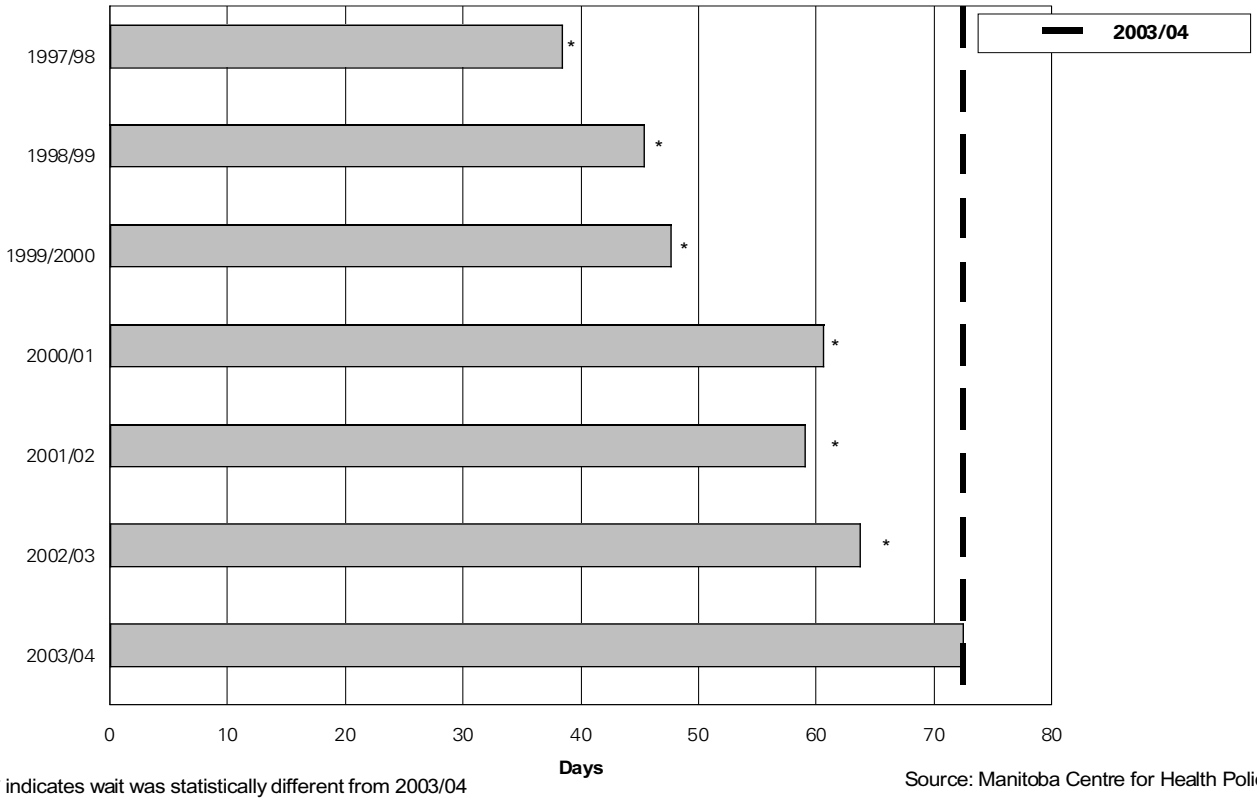



Source: Manitoba Centre for Health Policy, 2007

There was a steady increase in the adjusted median wait times over the period of the study, and the waits in 2003/04 (72.4 days) were significantly longer than every other year of the study. By RHA, adjusted median wait times were longest for Winnipeg residents (67.8 days) and were significantly shorter for residents of Nor-Man (25.1 days), Central (37.3 days), Parkland (37.5 days), Assiniboine (44.8 days), North Eastman (51.4 days) and Brandon (53.4 days). In the survival models, higher mean surgical volume while waiting and level of illness predicted shorter waits, whereas being hospitalized while waiting and longer length of stay predicted a longer wait.

**Figure 15: Carpal Tunnel Release Waits by Year, 1997/98 - 2003/04**

Adjusted median wait times (days)

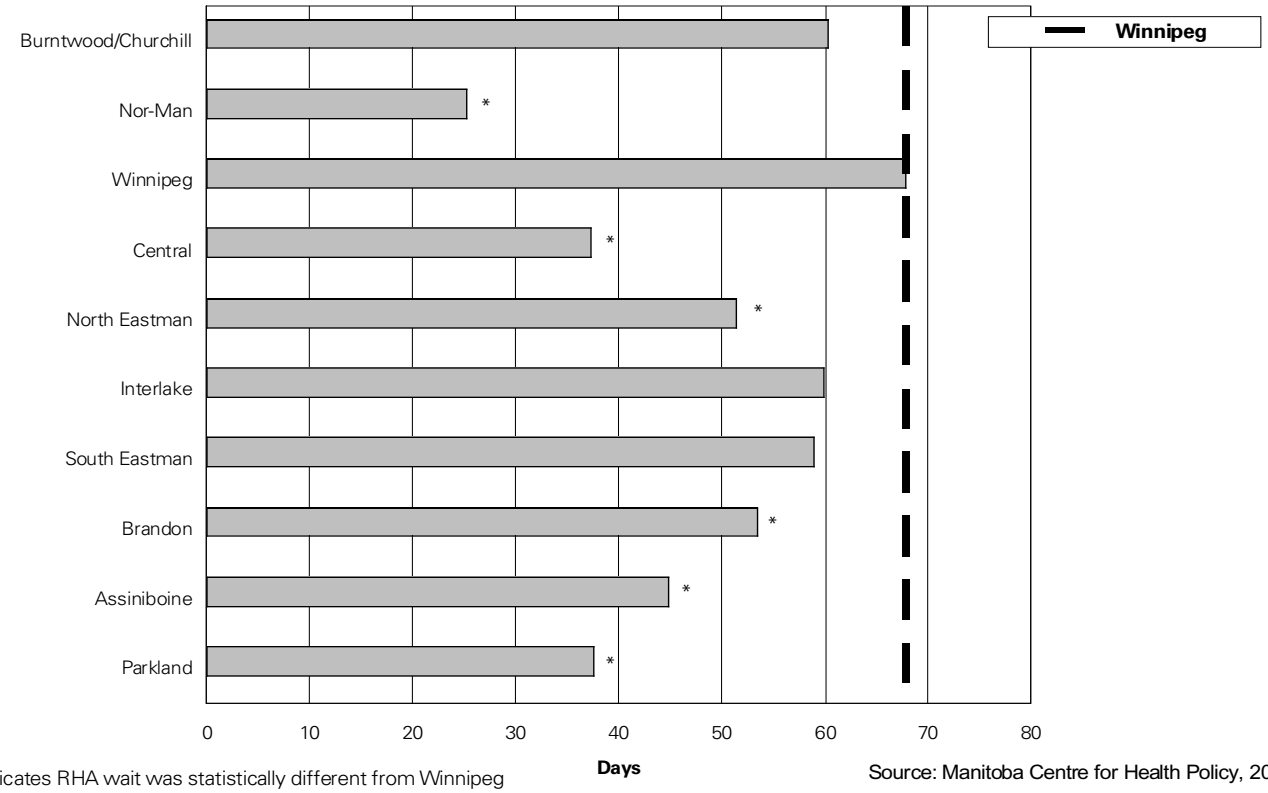



* indicates wait was statistically different from 2003/04

Source: Manitoba Centre for Health Policy, 2007

**Figure 16: Carpal Tunnel Release Waits by RHA, 1999/2000 - 2003/04**

Adjusted median wait times (days)



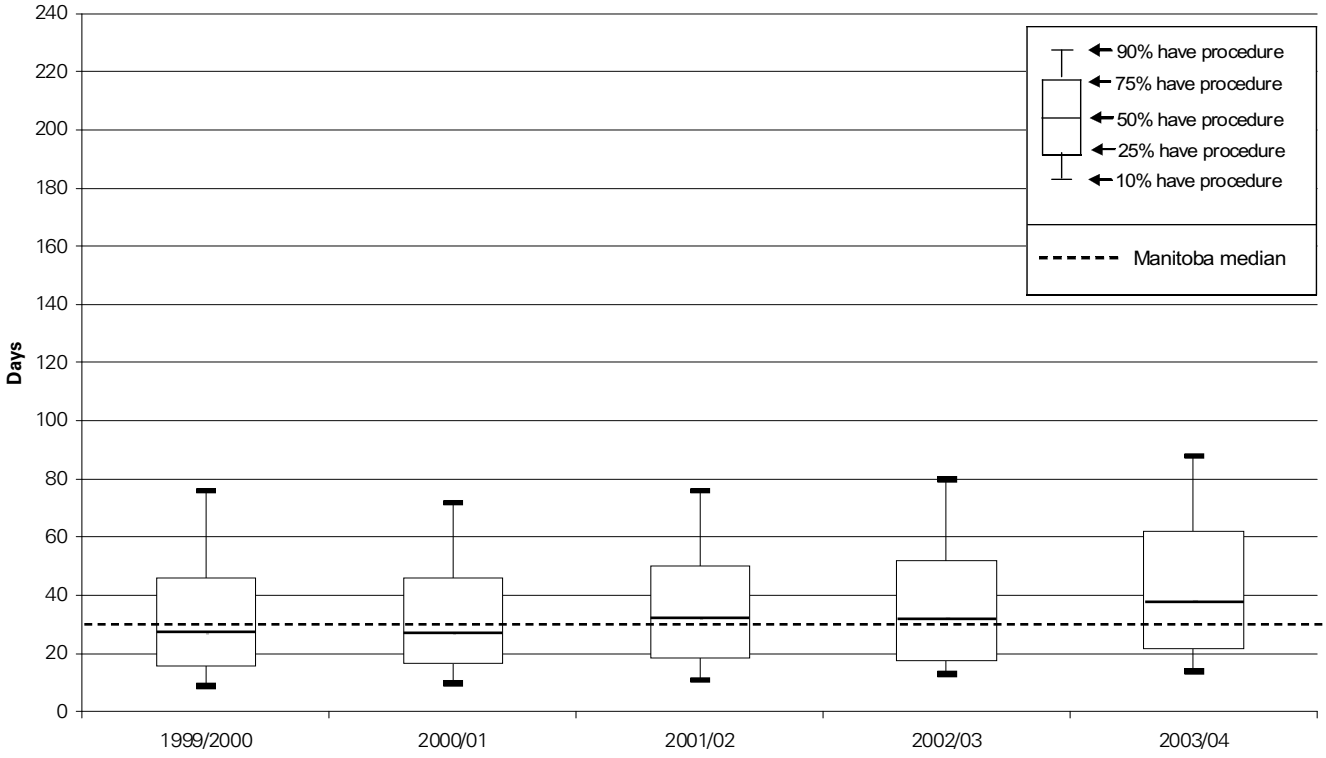

* indicates RHA wait was statistically different from Winnipeg

Source: Manitoba Centre for Health Policy, 2007

## 2.2.5 Transurethral prostatectomy (TURP)

The Manitoba five-year unadjusted median wait time for TURP was 31 days, and the 25th and 75th percentile waits were 18 and 50 days. The median was 27 days for 1999/2000 and 2000/01, 32 days for the next two years, then 38 days for 2003/04. Seventy-five per cent of men had their surgery by 46 days in 1999/2000 and 2000/01, but in 2003/04, it was 62 days before 75% of men had received the procedure. By RHA, the median waits were in a narrower range: 29 days for residents of Winnipeg, Central and North Eastman to around 36 days for Assiniboine, Burntwood/Churchill and Parkland. The 75th percentile waits ranged from 48 days in Central to 63 days in Parkland.

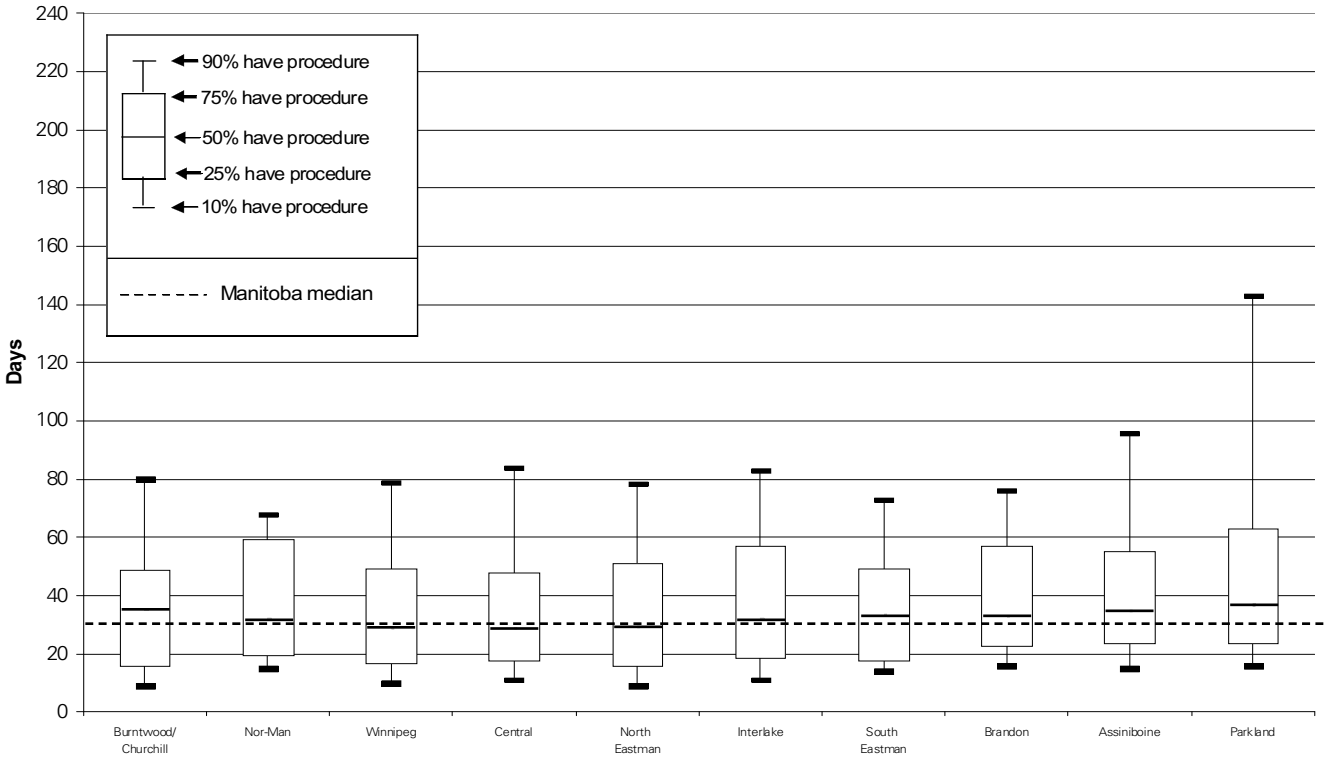
**Figure 17: Transurethral Prostatectomy Waits by Year, Manitoba, 1999/2000 - 2003/04**
Unadjusted wait times (days)




| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 899 | 777 | 758 | 617 | 714 |
| Total Procedures Analyzed | 513 | 415 | 399 | 335 | 385 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 18: Transurethral Prostatectomy Waits by RHA, Manitoba, 1999/2000 - 2003/04**
Unadjusted wait times (days)

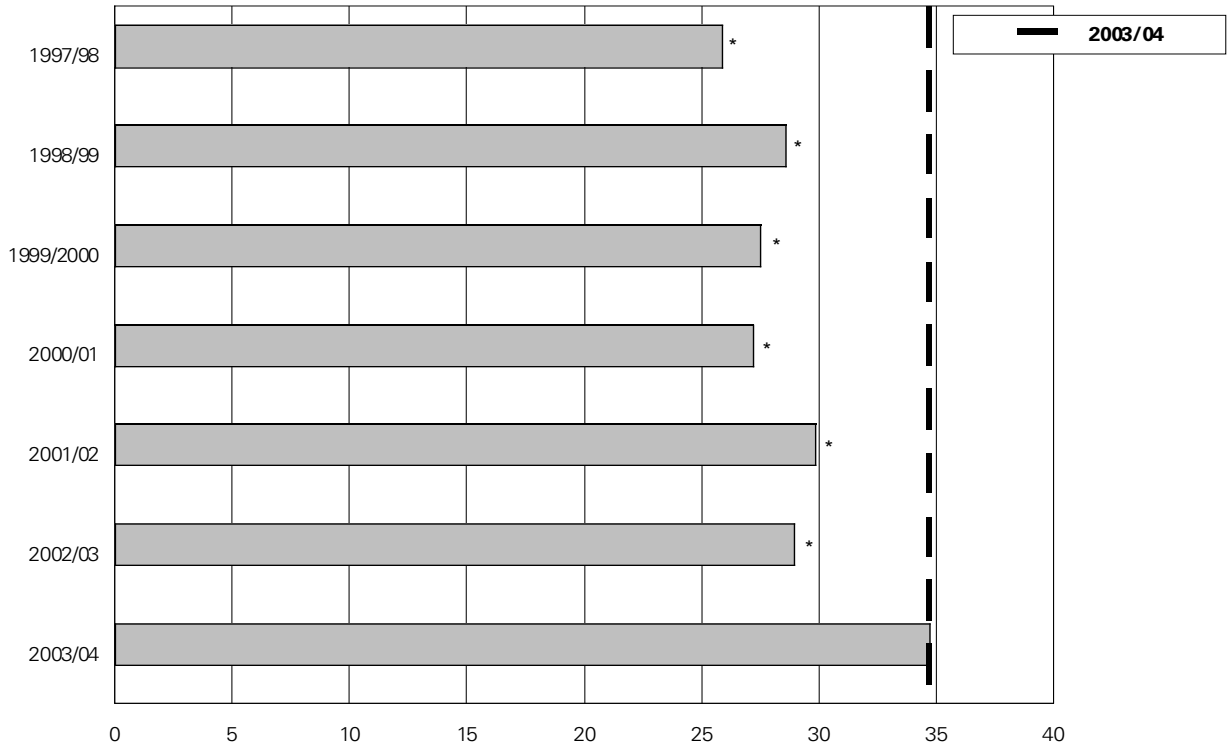



Source: Manitoba Centre for Health Policy, 2007

The adjusted median wait times were fairly stable from 1998/99 to 2002/03 at about 28 days, but then increased significantly to 34.7 days in 2003/04. Residents of Winnipeg had the shortest waits (27.0 days) and significantly longer waits were seen in Interlake (31.0 days), South Eastman (32.7 days), Brandon (32.7 days), Parkland (34.8 days) and Assiniboine (35.2 days). As with other procedures, being hospitalized during the wait and a longer hospital stay predicted a longer wait.

**Figure 19: Transurethral Prostatectomy Waits by Year, 1997/98 - 2003/04**

Adjusted median wait times (days)

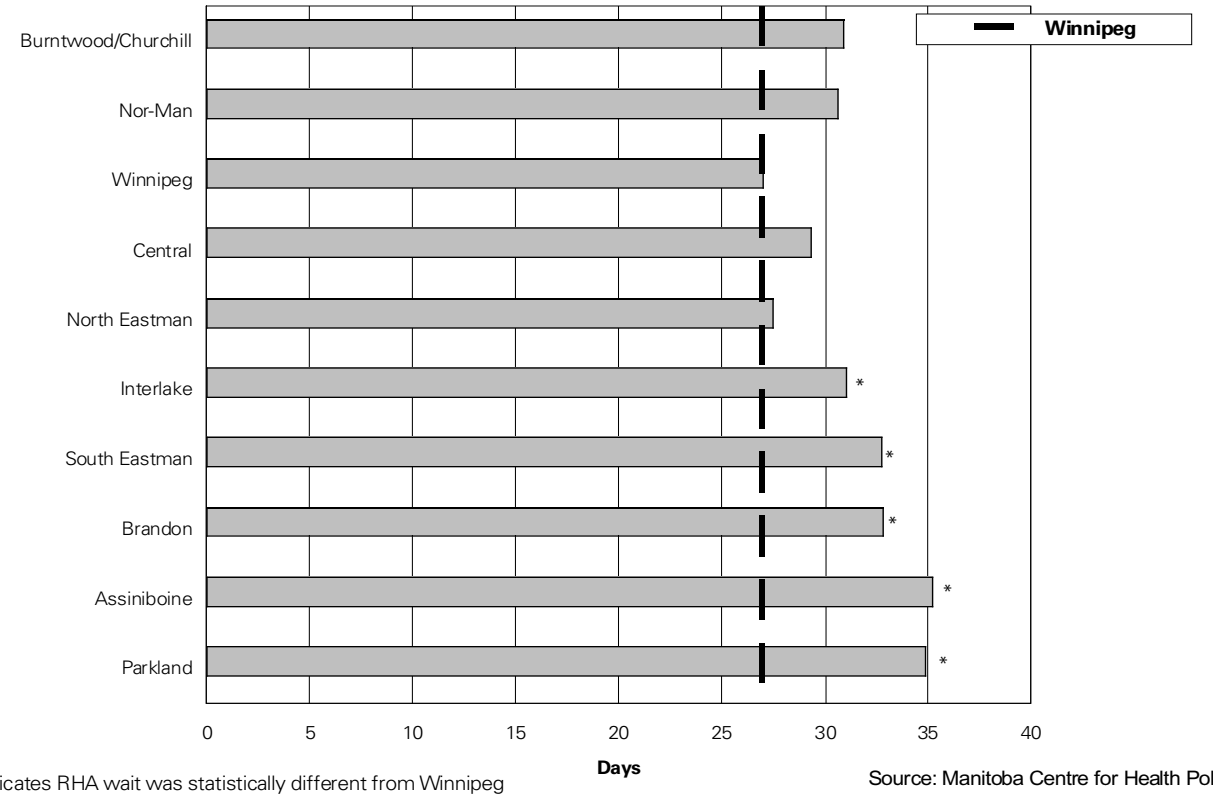



* indicates wait was statistically different from 2003/04

Source: Manitoba Centre for Health Policy, 2007

**Figure 20: Transurethral Prostatectomy Waits by RHA, 1999/2000 - 2003/04**

Adjusted median wait times (days)



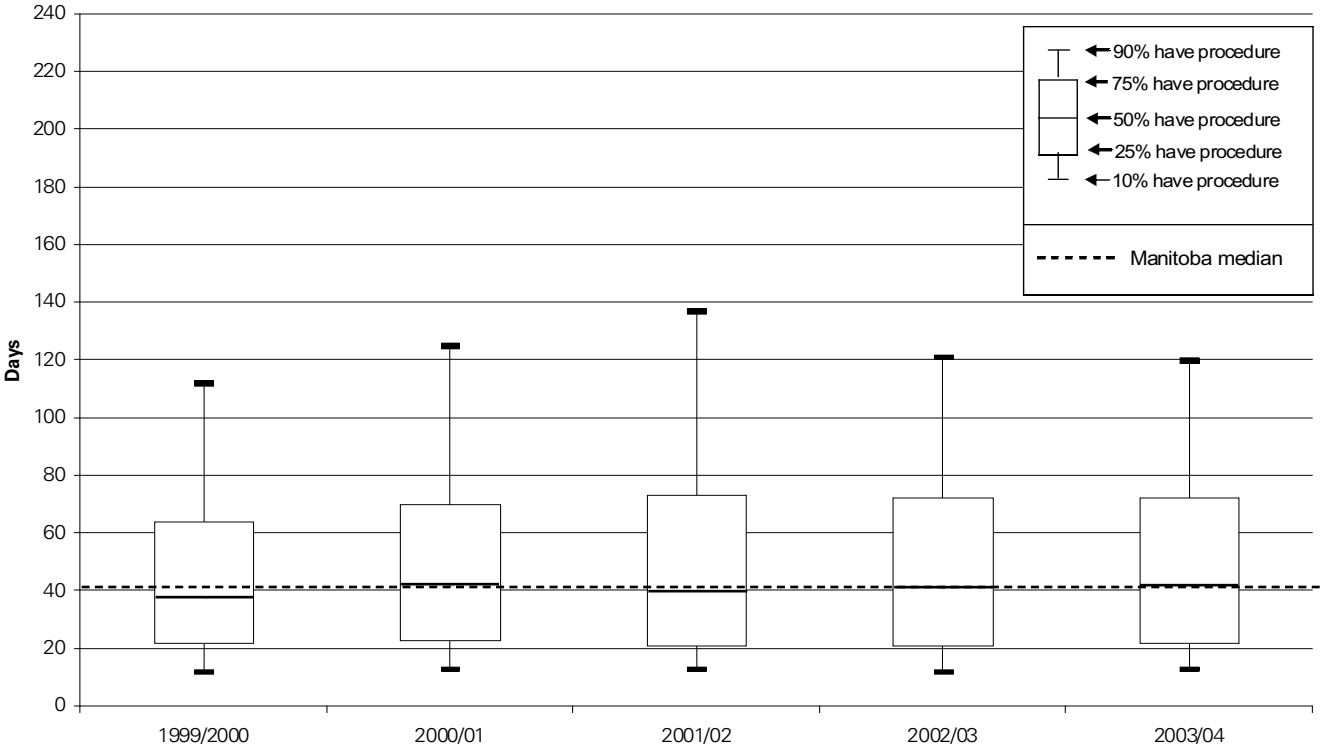

* indicates RHA wait was statistically different from Winnipeg

Source: Manitoba Centre for Health Policy, 2007

## 2.2.6 Hernia Repair

The Manitoba five-year unadjusted median wait time for **hernia repair** was 41 days, and the 25th and 75th percentiles were 22 and 70 days. Median waits for this procedure were similar throughout the time period, ranging between 38 and 42 days. Seventy-five per cent of procedures were performed by 72 days or about ten weeks. Residents of Nor-Man had the shortest median waits (20 days), whereas residents of Brandon (53 days) and South Eastman (54 days) had the longest. The 75th percentile wait was also shortest in Nor-Man (35 days) and longest in Brandon (102 days), but not South Eastman (79 days).

**Figure 21: Hernia Repair Waits by Year, Manitoba, 1999/2000 - 2003/04**
Unadjusted wait times (days)

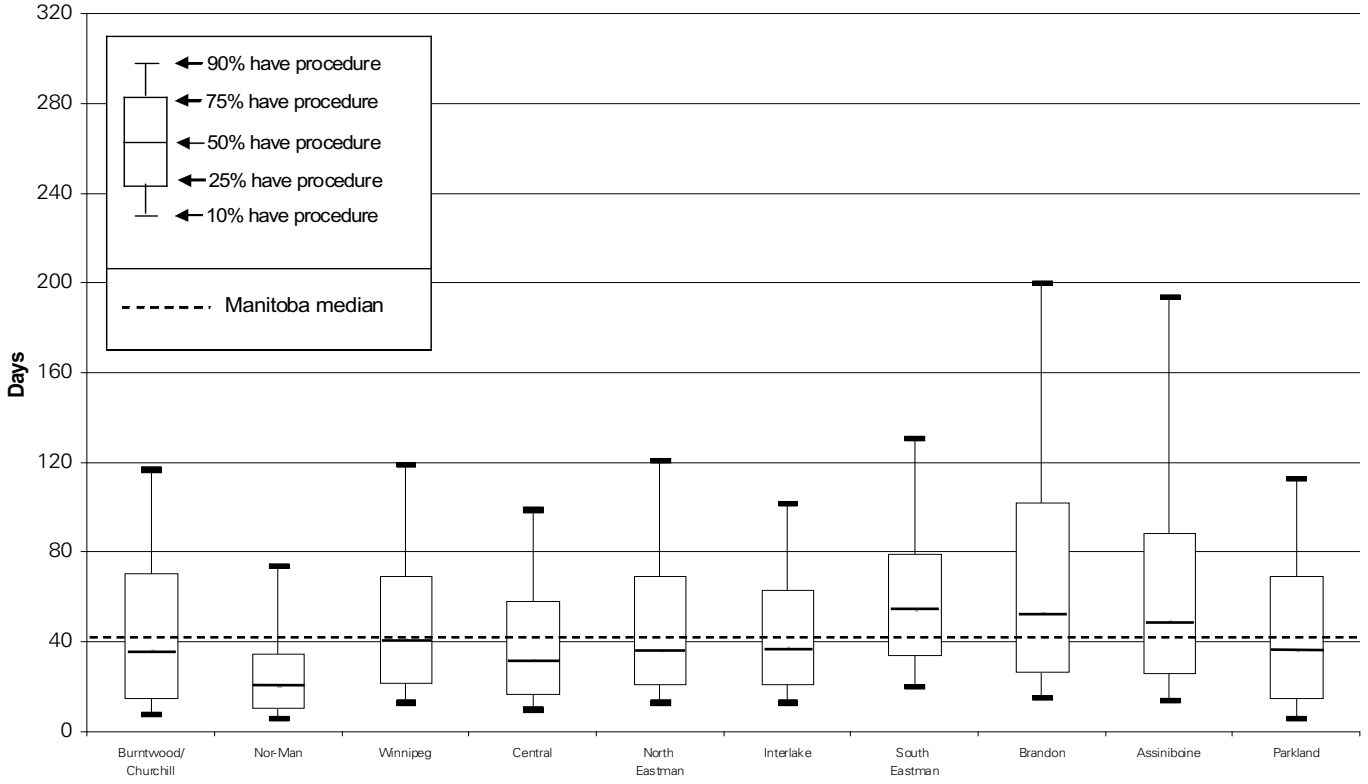



| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 2,391 | 2,475 | 2,439 | 2,333 | 2,386 |
| Total Procedures Analyzed | 1,763 | 1,836 | 1,784 | 1,733 | 1,738 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 22: Hernia Repair Waits by RHA, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (days)

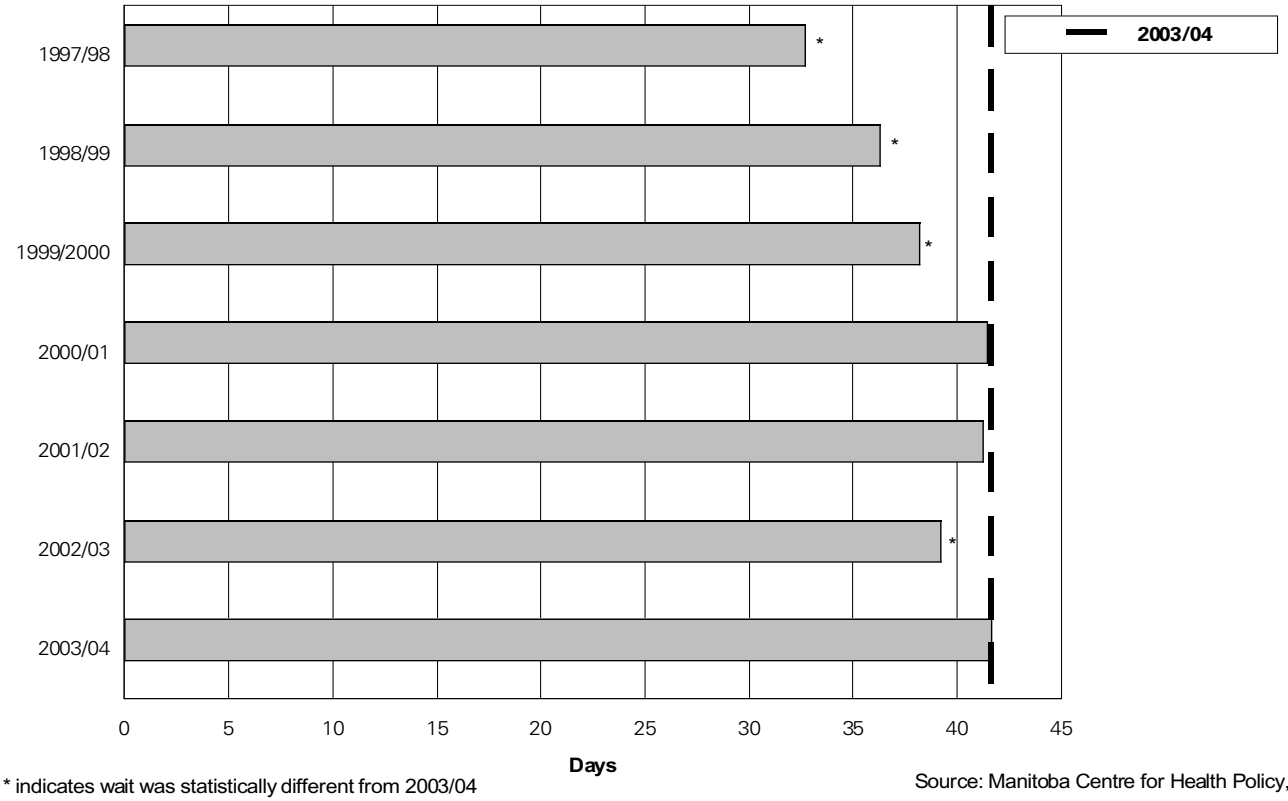



Source: Manitoba Centre for Health Policy, 2007

The adjusted median wait times were shorter for 1997/98 (32.6 days), 1998/99 (36.3 days), 1999/2000 (38.1 days), and 2002/03 (39.1 days) compared to 2003/04 (41.7 days). Residents of Nor-Man (18.9 days), Central (32.7 days) and Parkland (34.0 days) had shorter wait times than Winnipeg (38.5 days), whereas patients living in Brandon (45.7 days) and Assiniboine (47.7 days) and South Eastman (48.6 days) had longer waits. In the survival models, higher mean volume of surgery and level of illness were associated with a shorter wait, males had shorter waits than females, and older age and being hospitalized while waiting were associated with a longer wait.

**Figure 23: Hernia Repair Waits by Year, 1997/98 - 2003/04**

Adjusted median wait times (days)

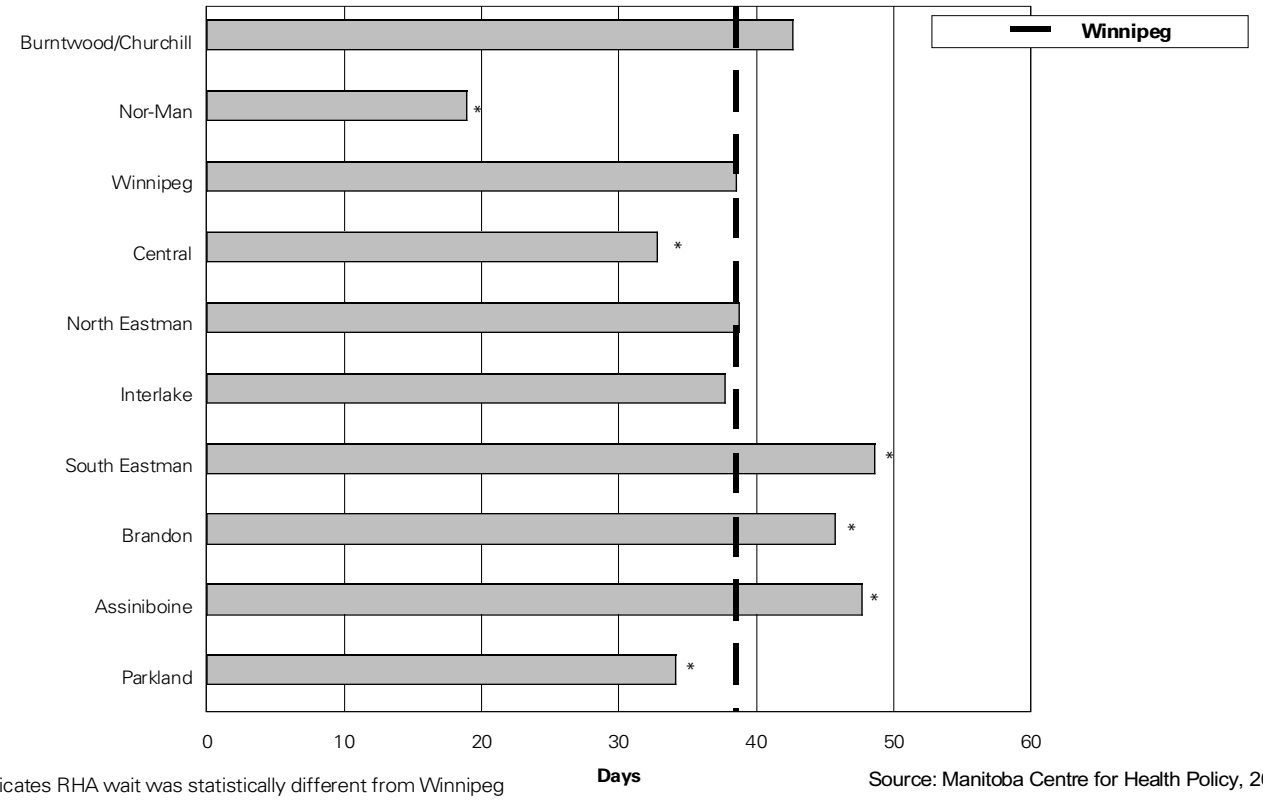



* indicates wait was statistically different from 2003/04

Source: Manitoba Centre for Health Policy, 2007

**Figure 24: Hernia Repair Waits by RHA, 1999/2000 - 2003/04**

Adjusted median wait times (days)



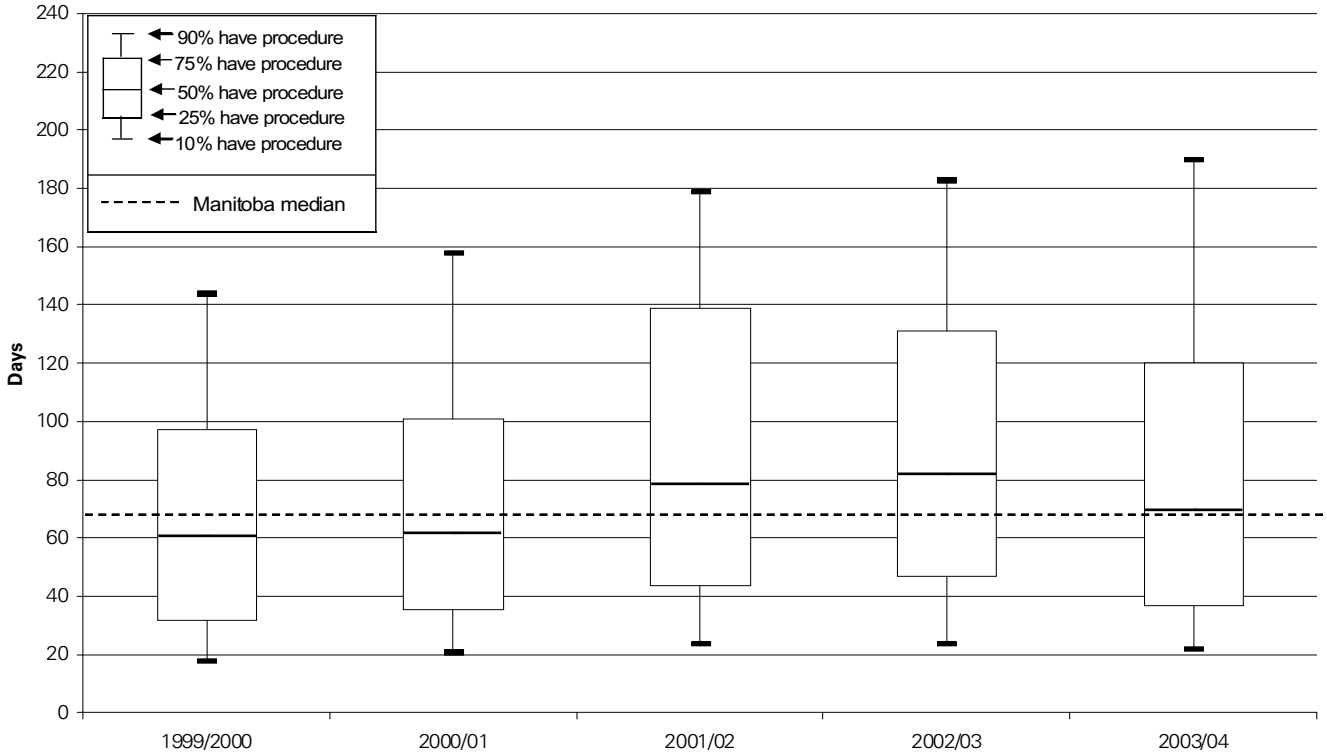

* indicates RHA wait was statistically different from Winnipeg

Source: Manitoba Centre for Health Policy, 2007

### 2.2.7 Tonsillectomy and Adenoidectomy (T&A)

The Manitoba five-year unadjusted median wait time for T&A was 69 days, and the 25th and 75th percentiles were 39 and 116 days. The waits were shorter in 1999/2000 and 2000/01 (61 and 62 days, respectively), around 80 days for the subsequent two years, and then fell a little to 70 days in 2003/04. The 75th percentile showed similar fluctuations. It was around 100 days in the first two years, rose to 139 days in 2001/02, then fell to 131 days in 2002/03 and fell again to 120 days in 2003/04. The median wait was shortest for Nor-Man residents (35 days) and longest for Brandon residents (85 days). Several RHAs had waits of about 65 days: Central (61), South Eastman (65) and Burntwood/Churchill (67).

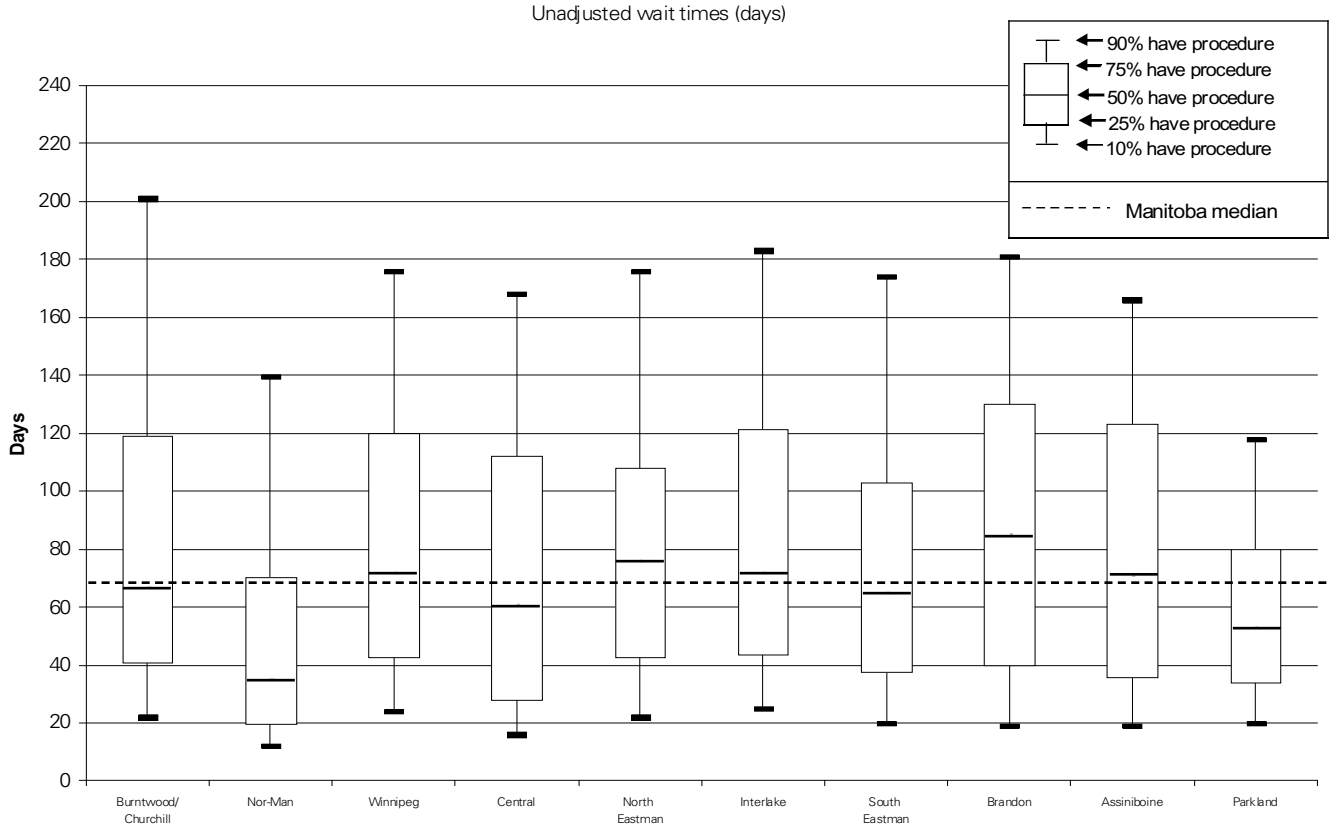
**Figure 25: Tonsillectomy & Adenoidectomy Waits by Year, Manitoba, 1999/2000 - 2003/04**
Unadjusted wait times (days)




| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 2,007 | 1,955 | 1,912 | 1,809 | 1,525 |
| Total Procedures Analyzed | 1,727 | 1,658 | 1,688 | 1,579 | 1,326 |

Source: Manitoba Centre for Health Policy, 2007

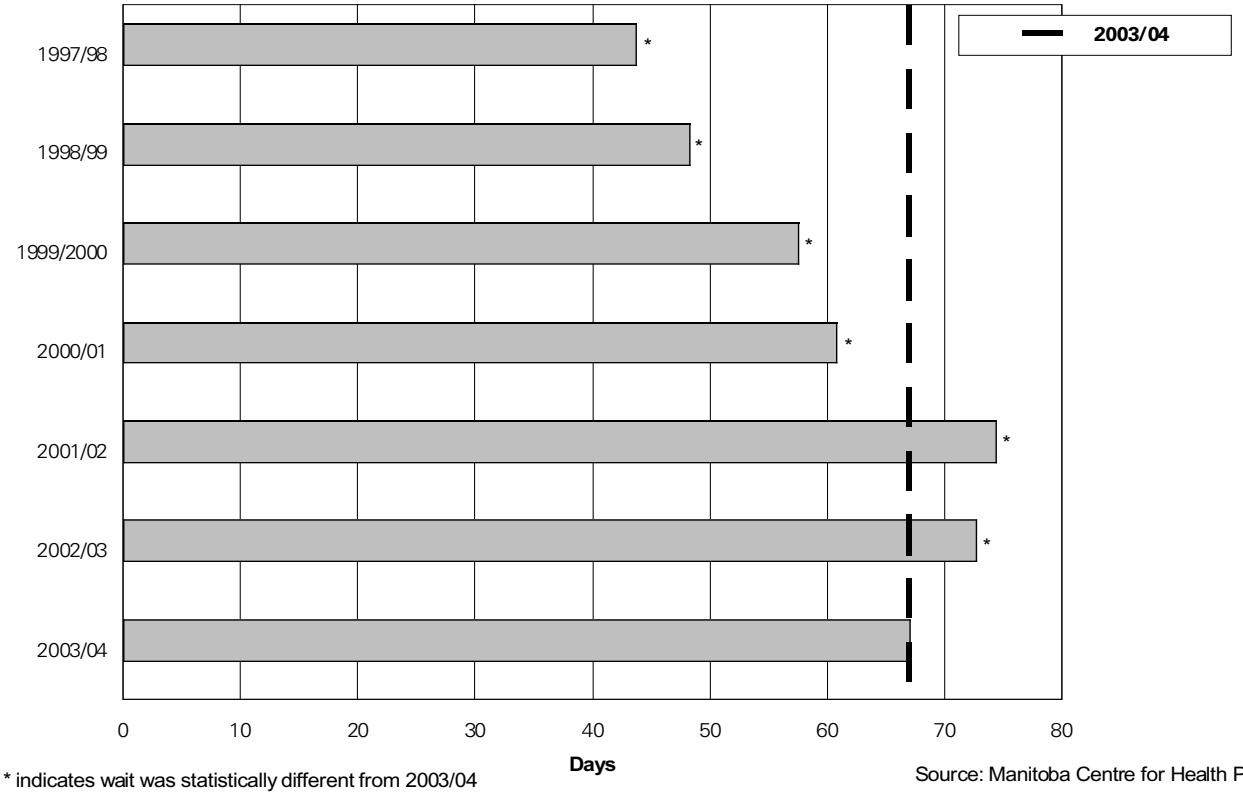
**Figure 26: Tonsillectomy & Adenoidectomy Waits by RHA, Manitoba, 1999/2000 - 2003/04**




Source: Manitoba Centre for Health Policy, 2007

The adjusted median waits were significantly shorter than 2003/04 (67.0 days) in 1997/98 to 2000/01 (43.7 days to 60.7 days), and significantly longer in 2001/02 (74.4 days) and 2002/03 (72.7 days). Residents of four RHAs had significantly shorter adjusted waits compared to Winnipeg (62.4 days): Nor-Man (41.0 days), Parkland (48.3 days), Central (54.0 days), and South Eastman (55.6 days). Burntwood/Churchill had significantly longer waits (66.9 days). Other variables significant in the survival model were younger age and whether the patient had been hospitalized during the wait, which were associated with a longer wait time.

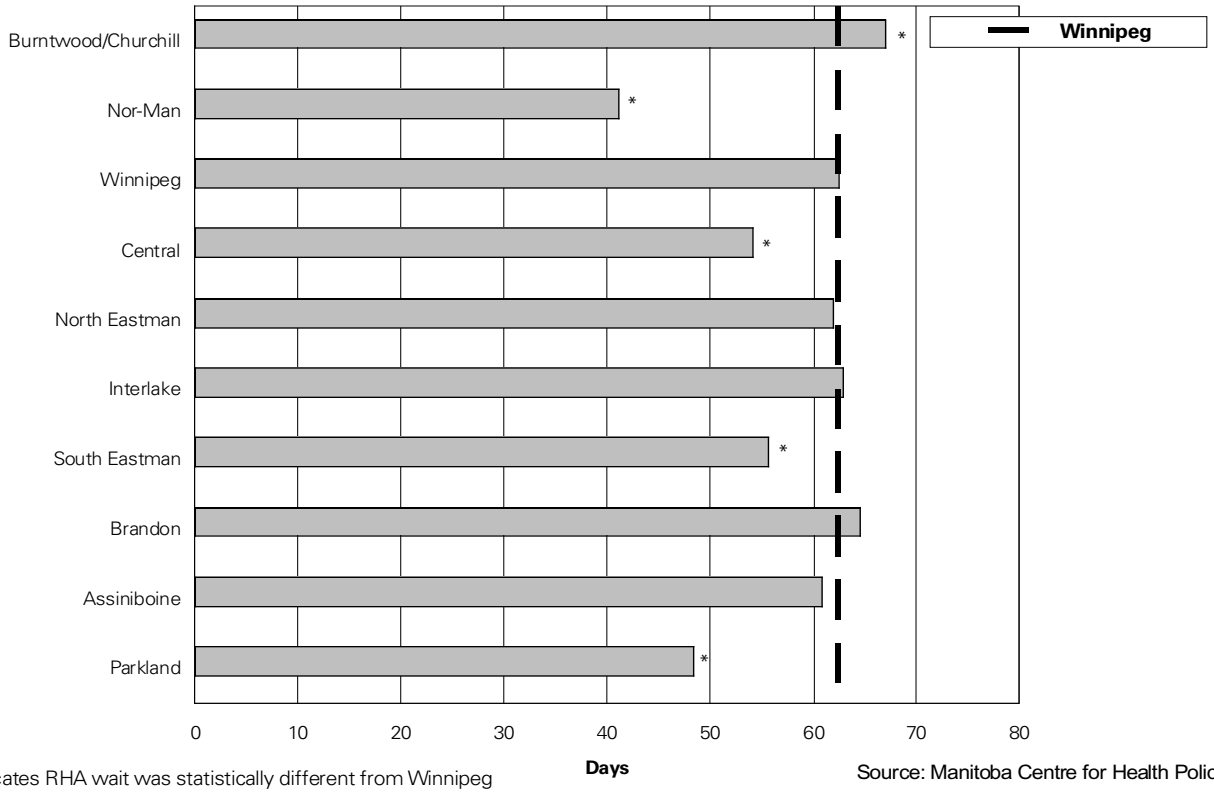
**Figure 27: Tonsillectomy & Adenoidectomy Waits by Year, 1997/98 - 2003/04**
Adjusted median wait times (days)




* indicates wait was statistically different from 2003/04

Source: Manitoba Centre for Health Policy, 2007

**Figure 28: Tonsillectomy & Adenoidectomy Waits by RHA, 1999/2000 - 2003/04**
Adjusted median wait times (days)




* indicates RHA wait was statistically different from Winnipeg

Source: Manitoba Centre for Health Policy, 2007

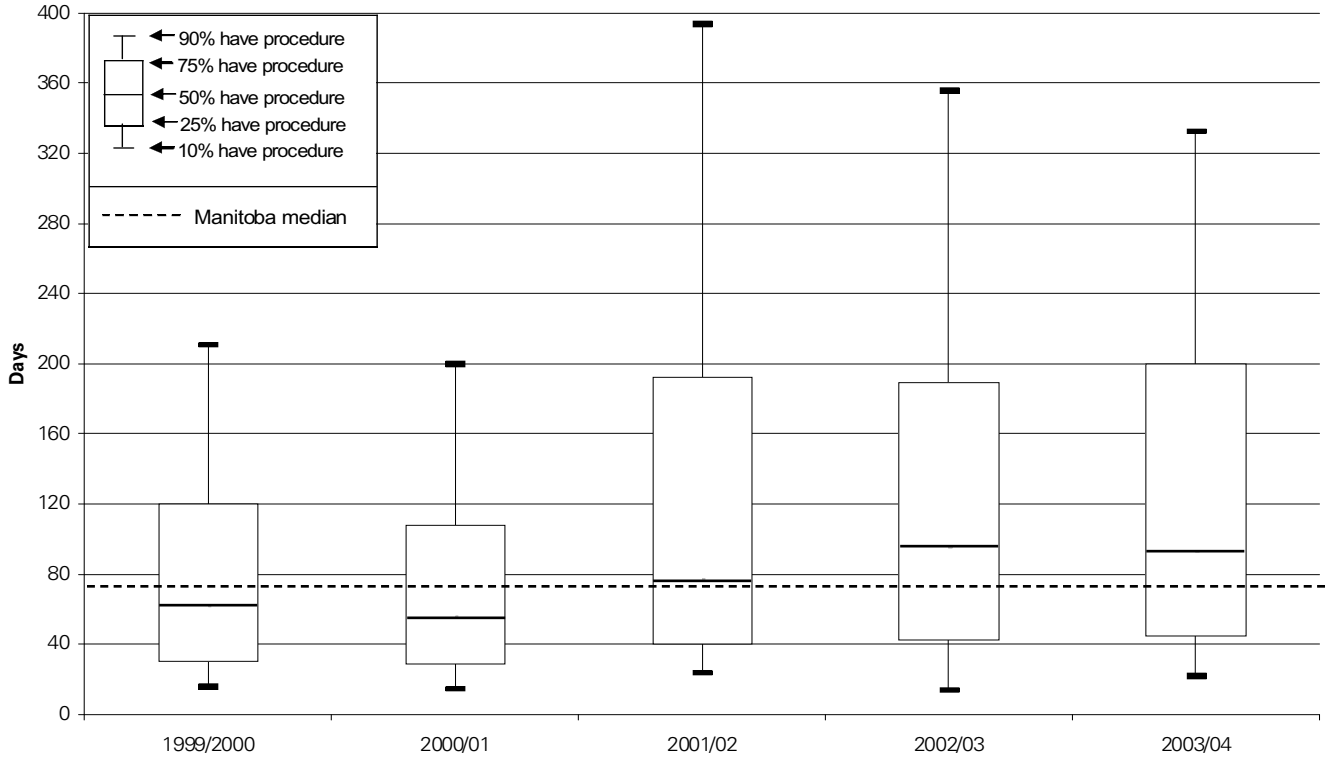
## 2.2.8 Stripping or Ligation of Varicose Veins

The Manitoba five-year unadjusted median wait time for varicose vein surgery was 72 days, and the difference between the 25th and 75th percentile, 36 and 154 days, was larger compared to the other seven procedures. The waits for this procedure fluctuated dramatically: the shortest median was 56 days in 2000/01 and the longest was 96 days in 2002/03, a difference of almost six weeks. The 90th percentile for this procedure was quite long, around the one-year mark for 2001/02, 2002/03 and 2003/04. The 75th percentile for those same three years was close to 200 days, meaning that it took about six months for 75% of patients to receive their varicose vein surgery. The median waits were shorter for residents of Nor-Man at 20 days and longest for residents of North Eastman at 128 days.

**Figure 29: Varicose Vein Stripping/Ligation Waits by Year, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (days)

* Note: Scale is in intervals of 40 days



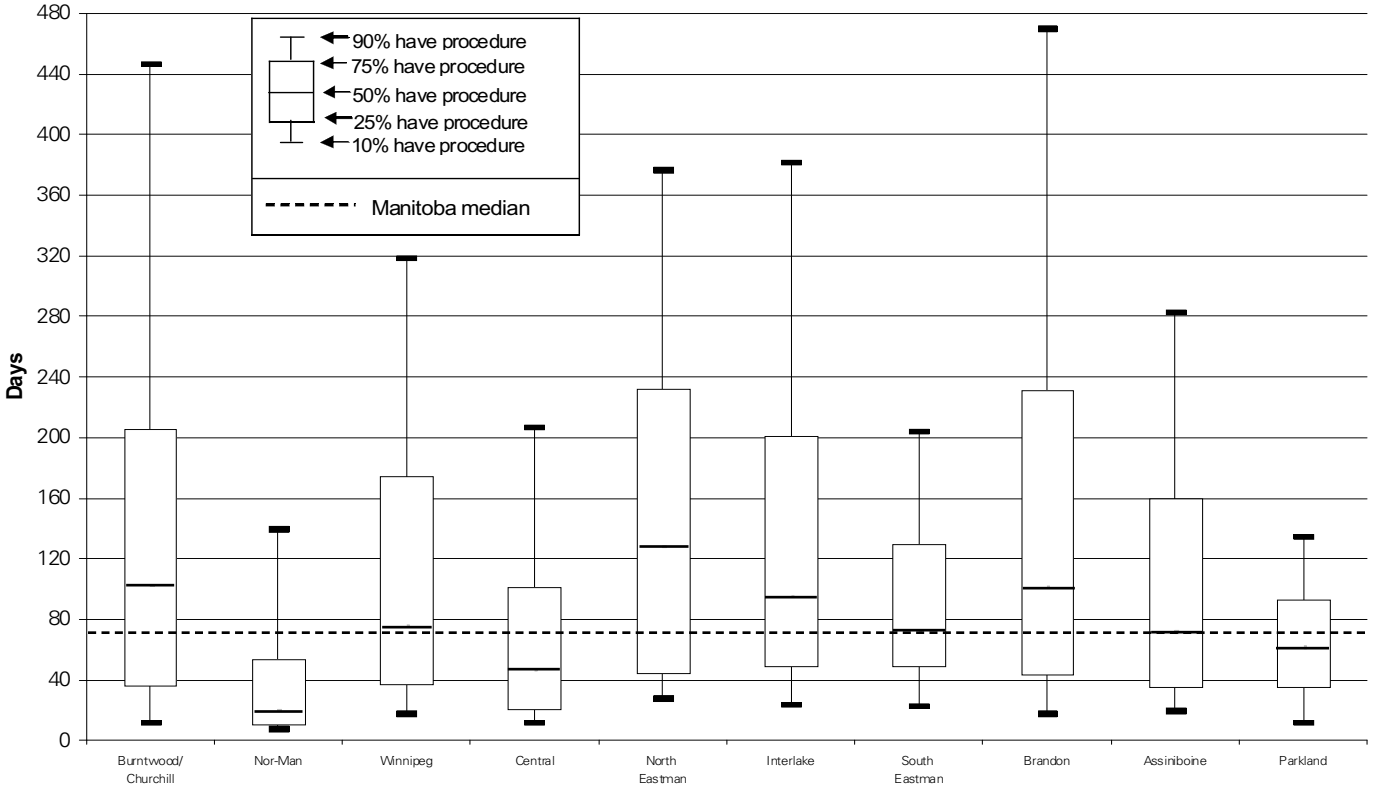

| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 387 | 365 | 354 | 384 | 324 |
| Total Procedures Analyzed | 313 | 291 | 275 | 294 | 248 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 30: Varicose Vein Stripping/Ligation Waits by RHA, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (days)

* Note: Scale is in intervals of 40

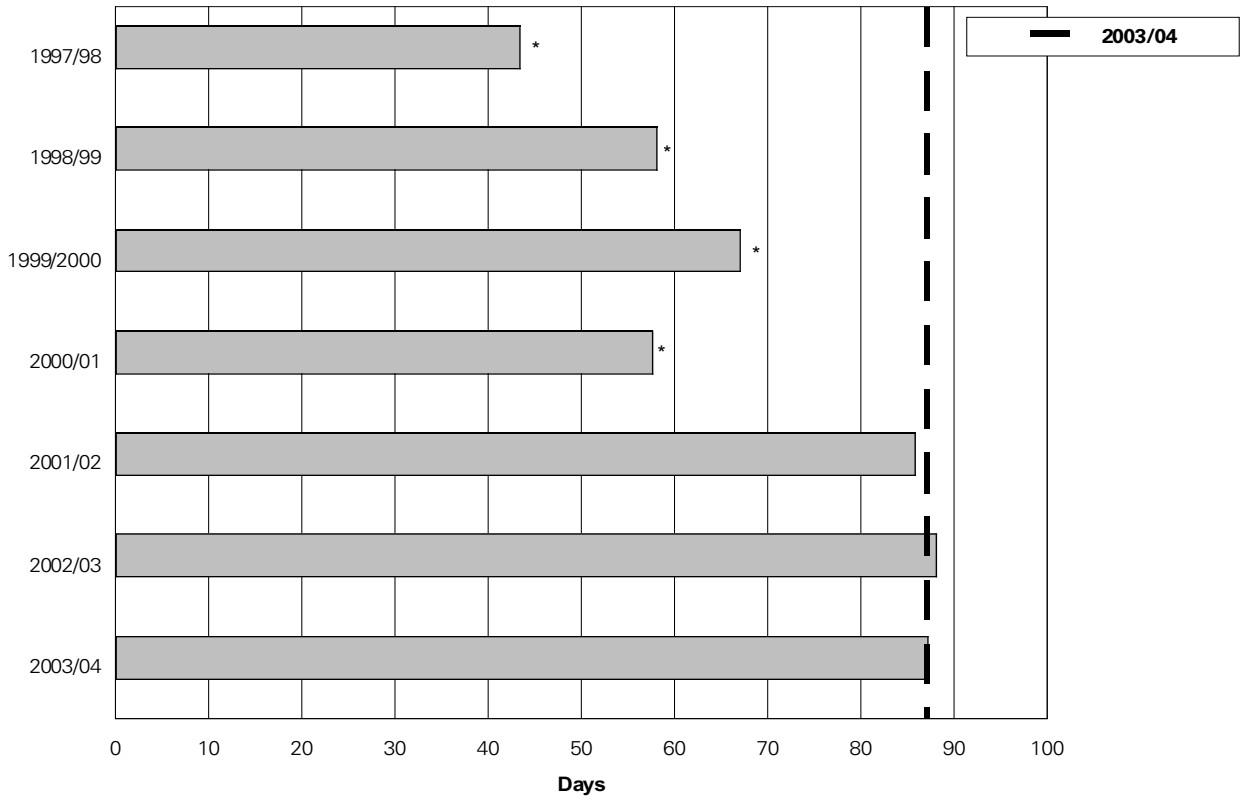



Source: Manitoba Centre for Health Policy, 2007

The adjusted median wait times showed a trend to increase over the first three years and then stabilize over the last three years of the study period. They were significantly shorter for 1997/98 (43.3days), 1998/99 (58.1 days), 1999/2000 (67.0 days) and 2000/01 (57.6 days) compared to 2003/04 (87.1 days). Residents of Nor-Man (41.4 days) and Central (53.1 days) had significantly shorter waits than residents of Winnipeg (68.3 days); no region had significantly longer waits. The mean number of procedures performed during the wait was not significant. The only other variable that was significant in the model was whether the patient had been hospitalized during the wait, which predicted a longer wait time.

**Figure 30: Varicose Vein Stripping/Ligation Waits by Year, 1997/98 - 2003/04**

Adjusted median wait times (days)

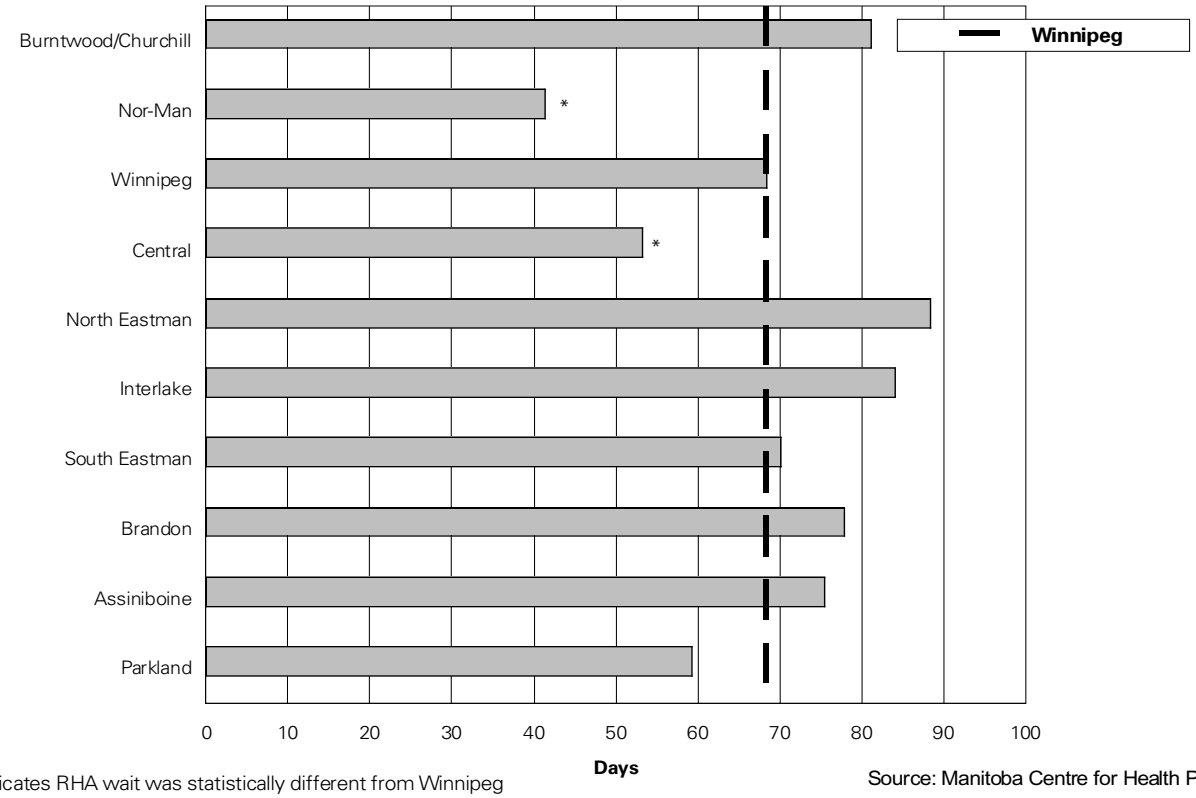



* indicates wait was statistically different from 2003/04

Source: Manitoba Centre for Health Policy, 2007

**Figure 32: Varicose Vein Stripping/Ligation Waits by RHA, 1999/2000 - 2003/04**

Adjusted median wait times (days)




* indicates RHA wait was statistically different from Winnipeg

Source: Manitoba Centre for Health Policy, 2007

# 3.0 REGISTRY COMPARISON AND ANALYSIS FOR CATARACT, CARDIAC AND HIP/KNEE REPLACEMENT SURGERY

In the WRHA, patient registries are maintained for cataract surgery, hip/knee replacement (HKR) and cardiac surgery. Patient data are entered into these registries at the point when they have agreed to undergo the surgical procedure. Thus, at any time, it is possible to monitor how many patients are waiting and for how long. When the surgery has been performed, that date is entered into the registry so up-to-date wait times are available. Along with patient demographic and wait time data, the registries generally contain some clinical and/or functional information that is not available in administrative data.

Registries therefore possess clear advantages in providing real time information about patient wait times. Furthermore, they often contain additional data that can assist with prioritization. One potential disadvantage of patient registries is that some patients may not be entered into the registry, especially if the registry is voluntary, as was the HKR registry for this time period. In that case, the waits will only be known for patients in the registry and could therefore miss a large proportion of cases.

MCHP obtained copies of de-identified WRHA registry data for cataract, HKR, and cardiac surgery for this study. By merging the registry data with administrative data, it is possible:

1. To compare the two data sources to assess the validity of the wait time estimates derived from administrative data.
2. To incorporate clinical and functional data in the multivariate models to determine which variables are related to variation in wait times.

## 3.1 Methods

### 3.1.1 Data Sources and Study Period

The three sources of registry data were the **Manitoba Cataract Surgery Waiting List Program** (**MCWLP**)registry, the **Cardiaccess registry**, and the Hip/Knee Replacement registry. Data sharing agreements were signed between MCHP and the WRHA. All data were de-identified, and encrypted **Personal Health Identification Numbers** (**PHINs**) were assigned by Manitoba Health prior to receipt by MCHP. Each registry file was then linked to the population files of the Repository. For the purposes of this study, data were analyzed up to March 31, 2004, the most recent year available at the time of the analyses. The fiscal years available varied by registry, as described below.

The MCWLP contains all cataract surgery procedures performed at three sites in Winnipeg, about 90% of the cataract procedures performed in Manitoba. When a patient has agreed to surgery, the surgeon's office submits the name to the registry office. Registry staff contact the patient to administer a questionnaire about their visual function, the VF-14, with three additional questions concerning work and driving. The results of the questionnaire are entered into a database which automatically calculates a priority score; the score is based on a combination of the visual function scores and the length of time the patient has been waiting. Each ophthalmologist receives a monthly report listing all of his or her patients and their priority scores. The surgeons then decide which of their patients to operate on three months hence. Once patients have received their surgery or have been cancelled for some other reason, their records are moved to the archives. The archive was the source of data for this study. Cataract registry data were obtained from 1999/2000 on (De Coster 2002).

The WRHA registry for cardiac surgery is a satellite unit of the **Cardiac Care Network of Ontario**. All cardiac surgery in Manitoba is performed in Winnipeg. When a patient's name is submitted to the registry, coordinators follow-up with a chart review to abstract the necessary data onto a paper form; the data are subsequently entered into the system. For patients waiting for **coronary artery bypass graft (CABG)** surgery, a recommended maximum wait time (RMWT) is calculated based on their symptoms and the number and location of the diseased coronary arteries (Naylor et al., 1990). The RMWT can vary from 'Immediate' to '3 to 6 months.' For valve replacement surgery, there is no formal RMWT and the RMWT is defaulted to 6 months. Patients are monitored by the Cardiac Surgery Co-ordinators, and surgeons are informed if their patients are having increasing symptoms, and when they are close to their RMWT. Patients receive a letter from the Network informing them that they are on the wait list for surgery and they are asked to call the office then, every month thereafter and also if they have any questions or concerns. Cardiac surgery registry data were received from 2000/01.

The Joint Replacement Waiting List Registry captures total joint replacement surgery performed in Winnipeg only. For the years of this study, 90% to 94% of HKR surgery was performed in Winnipeg. The registry was voluntary; the proportion of HKR surgery performed in Winnipeg that was captured by the registry increased from 42% in 2000/01 to 89% in 2003/04. Patient demographic and procedure data were submitted from the surgeon's offices when a decision was made to proceed with surgery. These data were later verified by the operating rooms. Additional information on patient's health status and function was collected directly from the patient via a mail questionnaire. Since mid-2005, the registry has undergone significant revision, with implementation in phases throughout Winnipeg and it is now mandatory for elective surgical patients. HKR registry data were available from 2000/01. All analyses in this study are for primary HKR, not revisions.

The methods used to develop algorithms for wait times using administrative data are found in Appendix 3. We were able to develop or modify accurate measures of wait times from the administrative data for cataract and cardiac procedures. The closest visit was a good proxy measure for the start of the wait for scheduled CABG, and if no visit to the surgeon was found, then the date of an angiogram was used. For heart valve replacement, it was necessary to make a modification and take the second closest visit (if there was one) if the closest visit was within 28 days of surgery. Our previously developed algorithm for measuring cataract surgery wait times was found to perform well (De Coster, 2002). However, we were unable to develop an algorithm to estimate wait times for HKR. In trying to find a relationship between the start-date in the registry data and the date of a pre-surgical visit, we noted that there was no consistent pattern: only 20% of the registry start-dates were near to the closest visit and a further 35% were near to the second-closest visit. Thus, if one makes the assumption that the registry is the gold standard—an assumption that would itself need to be validated by comparisons with patient records or surveys of patients and providers—we cannot use the administrative data to estimate wait times for HKR.

### 3.1.2 Descriptive Analyses

As we did for the eight common elective procedures, we report unadjusted wait times using box plots (see page 5). Box plots are used to illustrate the wait times by year and by RHA of residence. For cardiac valve replacement surgery, the waits are shown by four regions—Winnipeg, Brandon, the **Rural South** (Assiniboine, Parkland, Interlake, Central, North Eastman and South Eastman) and the North (Burntwood, Churchill and Nor-Man)—because there were too few cases to analyze by RHA. Appendix tables provide the numeric values for the percentiles displayed in the box plots. We also included a table of the overall rates of surgery for these procedures.

### 3.1.3 Modelling

Multivariate models were developed to estimate the factors that were associated with variation in wait times; these methods were described previously (see page 6). The outcome was wait time according to the respective registry.[4] In addition to the explanatory variables used in the previous analyses, we wanted to incorporate the additional clinical and/or functional information that was available in the registry data. However, there was a problem in that many of the fields were blank; if subjects were excluded from the model because of missing data, then a large number of cases would have been excluded, introducing bias into the analyses.

[4] The cataract and cardiac models were also run with the wait time estimated from administrative data as the outcome, and the results were the same.

Frequency tables identified the extent to which registry variables of interest were missing; variables that were missing from a large number of records were dropped from further analyses. Subsequently, logistic regressions were run for each procedure with "missing" as the outcome; these models incorporated all independent variables used previously, with the addition of a variable for the specific surgeon who performed the procedures. (For ease of discussion, we will call these variables administrative variables; and variables from the registries will be called registry variables.) If patients were missing any of the registry variables, they were coded as missing. The objective of these regressions was to determine if variables were missing systematically or if they were missing randomly. Any variable that was associated with 'missingness' could not be interpreted in the models, although it had to be included in the models to avoid bias. Then models were created in two steps. At the first step of modelling, all the administrative variables were included. At the second step, the variables of interest from the registry were added to the models. This second step is a **pattern mixture model** and removes bias in the calculation of effects that could be due to 'missingness.'

## 3.2 Findings

### 3.2.1 Wait Times (Unadjusted) for Cataract, Cardiac and HKR Surgeries

Table 2 shows the age/sex standardized rates for cataract, cardiac and HKR surgeries. The volume of cataract surgery increased by 1000 procedures between 1999/00 and 2003/04, and the rate increased 8%. The rate of CABG did not change. The rate of heart valve replacement surgery was 17% lower in 2003/04 compared to 1999/2000; however the actual number of surgeries performed fluctuated up and down by about 20 procedures from year to year over the time period, probably based on the need for surgery. While it looks as though the rate of HKR surgery stayed about the same, the overall volume of these procedures combined increased by about 200 over the time period.

**Table 2: Age/sex standardized rates of surgery per 1,000 population, Manitoba, 1999/2000 - 2003/04**

| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 | % Change |
|---|---|---|---|---|---|---|
| **Cataract** | 7.3 | 7.7 | 7.8 | 8.5 | 7.9 | +8.2% |
| **Coronary Artery Bypass Graft** | 0.68 | 0.62 | 0.62 | 0.61 | 0.68 | - |
| **Heart Valve Replacement** | 0.12 | .011 | 0.12 | 0.12 | 0.10 | -16.7% |
| **Primary Hip Replacement** | 0.65 | 0.60 | 0.57 | 0.62 | 0.63 | -3.1% |
| **Primary Knee Replacement** | 0.98 | 0.94 | 0.92 | 1.0 | 0.97 | -1.0% |

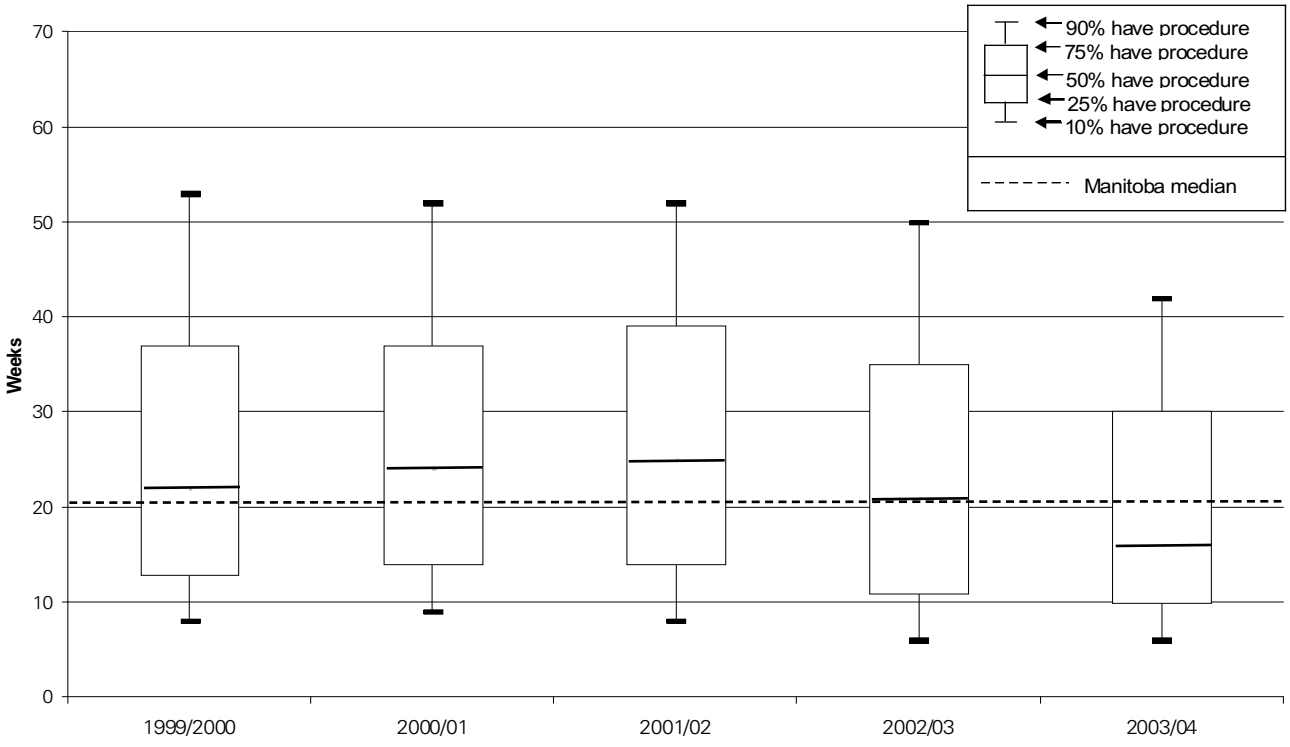
Source: Manitoba Centre for Health Policy, 2007

## Cataract

The box plots for cataract surgery used the administrative data to estimate the wait times so that we were able to include all persons who received cataract surgery, not only those who had the surgery in Winnipeg. We looked at first eye cataract surgery only. The median wait times were 22 weeks at the beginning of the study period, rose to 25 weeks in 2001/02 and fell to 16 weeks in 2003/04. The benchmark wait time stated by the FPT Ministers of Health is 16 weeks for at-risk cataract patients; there is no definition of "at-risk" (FPT Ministers of Health, 2005). By RHA, the median wait was shortest for residents of Brandon and Assiniboine at 17 weeks, and the longest median wait was for residents of Parkland at 29 weeks.

**Figure 33: Cataract Waits by Year, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (weeks), first eye only

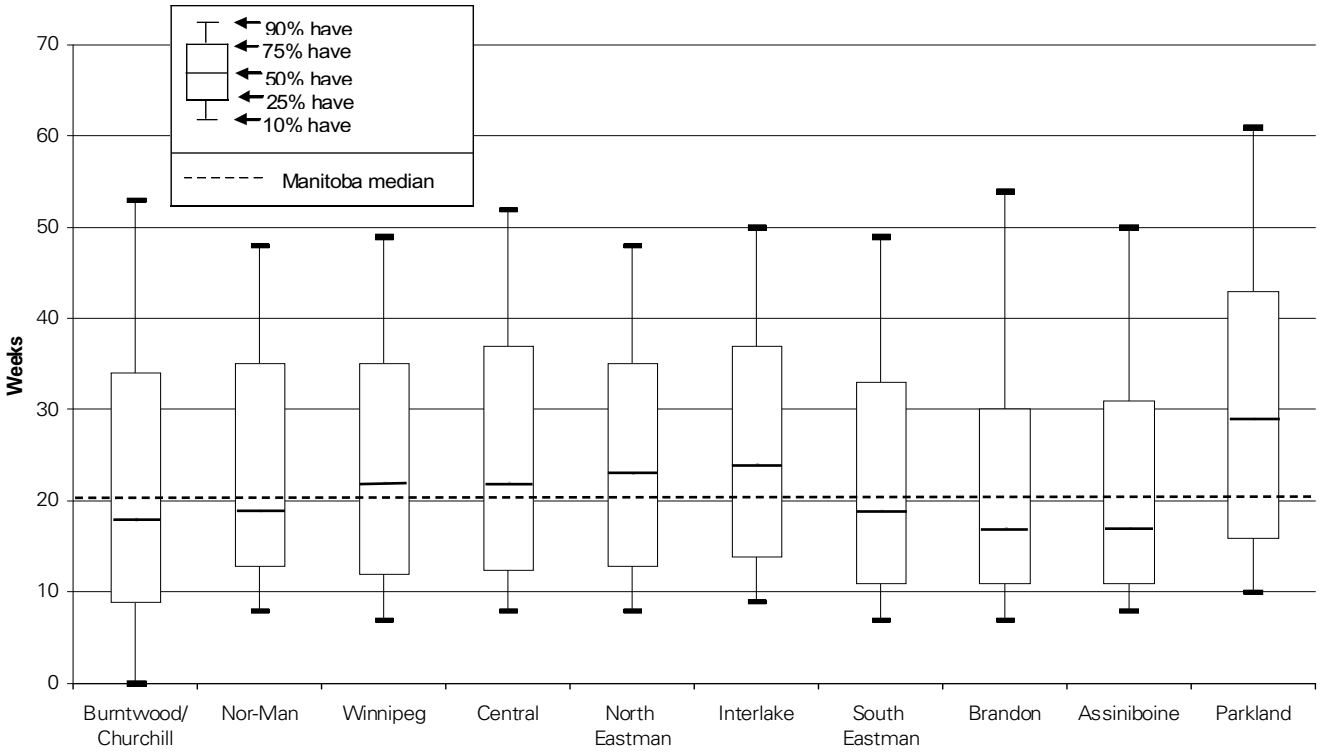



| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 8,283 | 8,780 | 8,972 | 9,878 | 9,287 |
| Total Procedures Analyzed | 5,432 | 5,408 | 5,333 | 5,743 | 5,417 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 34: Cataract Waits by RHA, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (weeks), first eye only




Source: Manitoba Centre for Health Policy, 2007

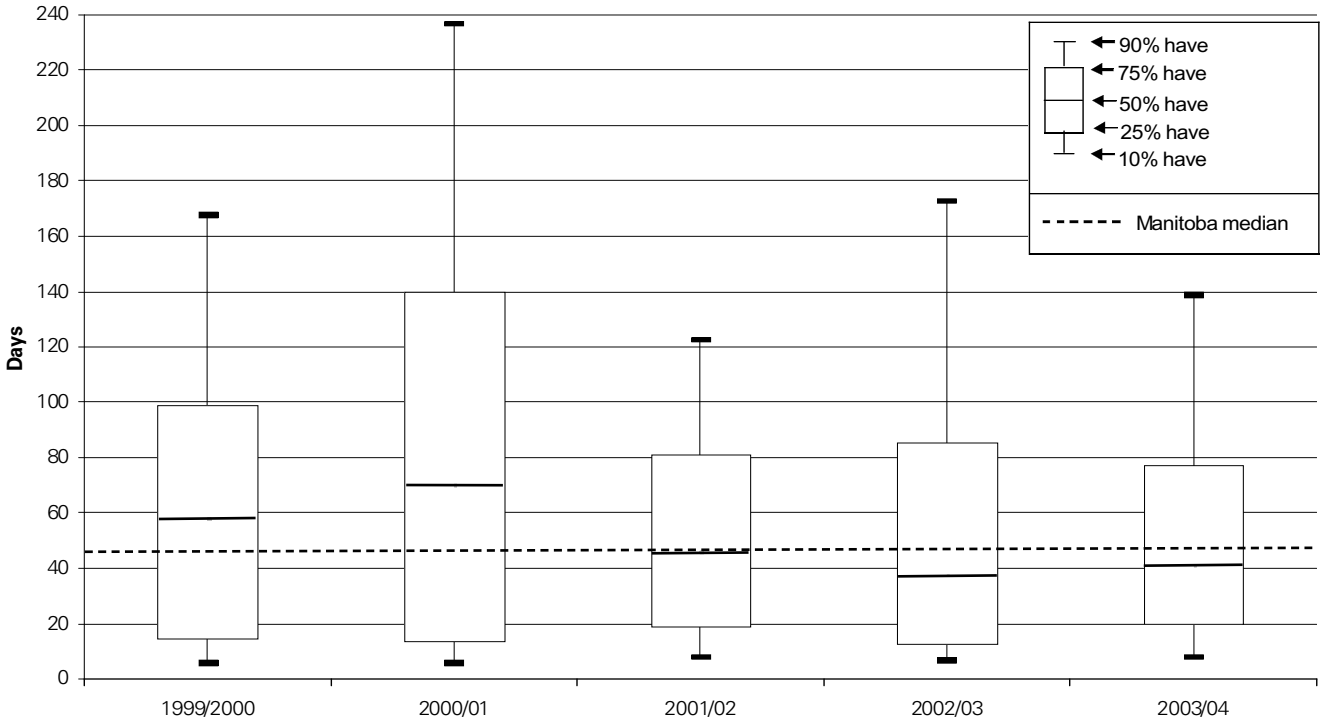
## Cardiac

For urgent/emergent CABG, using the administrative data wait times, the median wait times did not change over the course of the study, staying around 7 days, and the 75th percentile stayed at around 13 days throughout. By RHA, access to urgent CABG was roughly the same across the province, around 7 days (see Appendix 2).

The benchmark wait times stated by the FPT Ministers of Health vary by urgency level for elective CABG: 2 weeks for Level I patients, 6 weeks for Level II, and 26 weeks for Level III (FPT Ministers of Health, 2005). These levels have been left for each province to interpret. Manitoba uses the RMWT that are assigned based on clinical findings in the Cardiaccess

**Figure 35: Coronary Artery Bypass Graft (Elective) Waits by Fiscal Year, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (days)

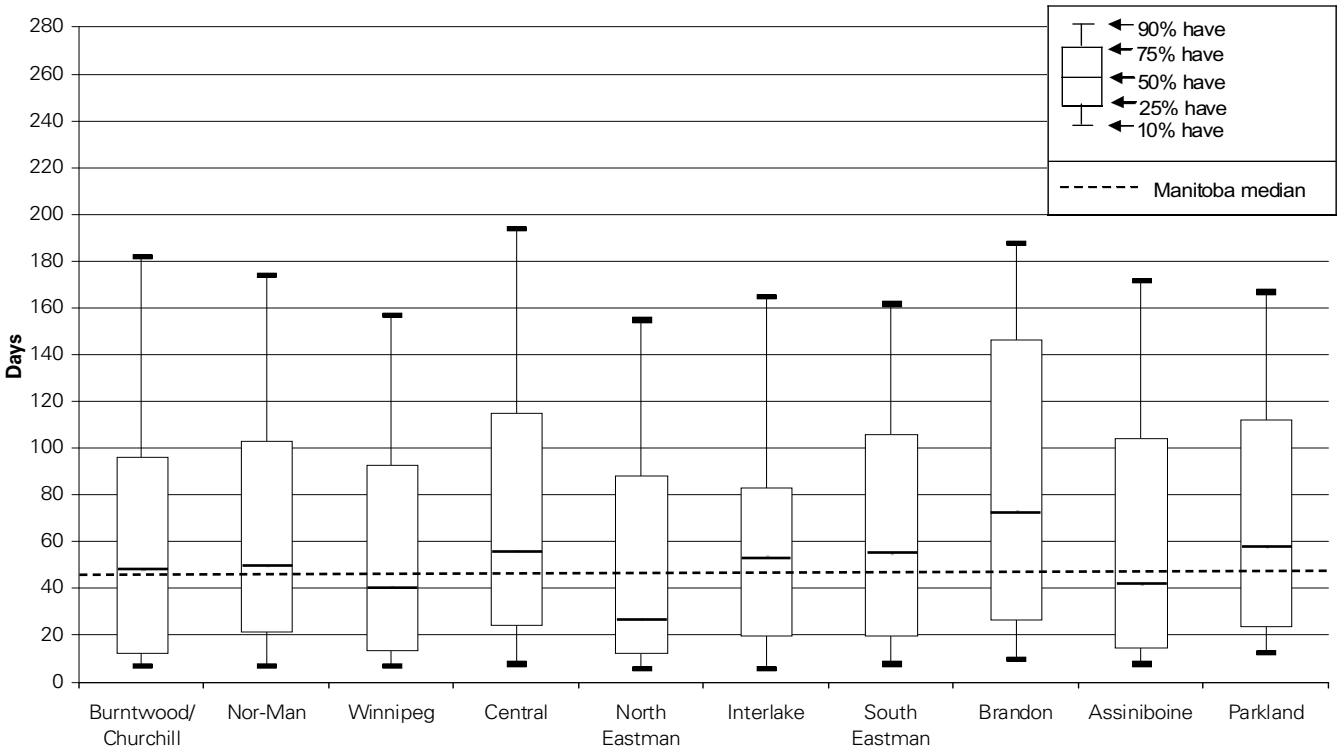



| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 768 | 701 | 712 | 709 | 803 |
| Total Procedures Analyzed | 317 | 337 | 285 | 344 | 405 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 36: Coronary Artery Bypass Graft (Elective) Waits by RHA, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (days)



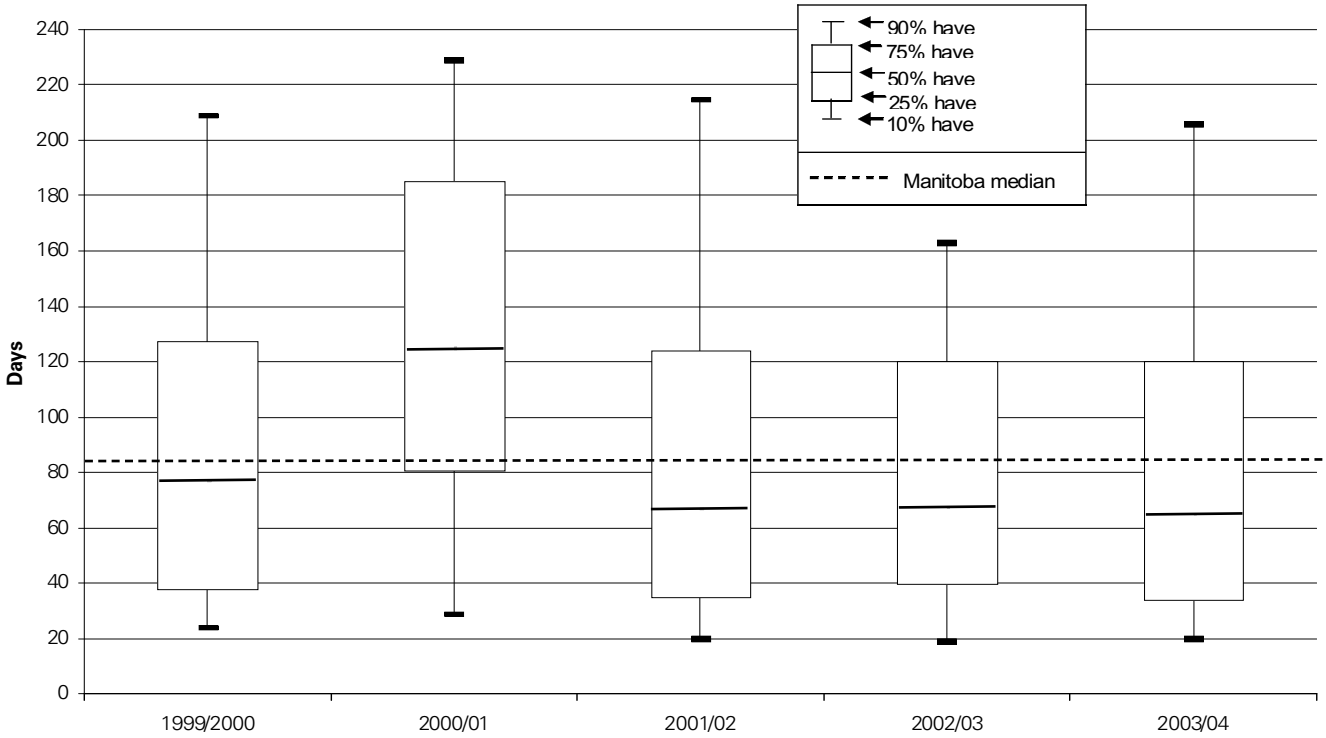

Source: Manitoba Centre for Health Policy, 2007

database to assess urgency level. For elective CABG, the median wait times were 58 days at the beginning of the study period, rose to 70 days in 2000/01 and then decreased for the remainder of the study period. Residents of North Eastman had the shortest median wait at 27 days, and residents of Brandon had the longest median wait (73 days).

For heart valve replacement (elective only), the median wait times were 77 days at the beginning of the study period, rose to 125 days in 2000/01 and then decreased to between 65 and 68 days for the remainder of the study period. The median waits were 84 days for Winnipeg residents, 100 days for residents of Brandon, 71 days for Rural South, and 97 days for residents of the North. There were few patients from Brandon (n = 14) and the North (n = 15) so these waits must be interpreted with some caution.

**Figure 37: Heart Valve (Elective) Surgery by Fiscal Year, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (days)



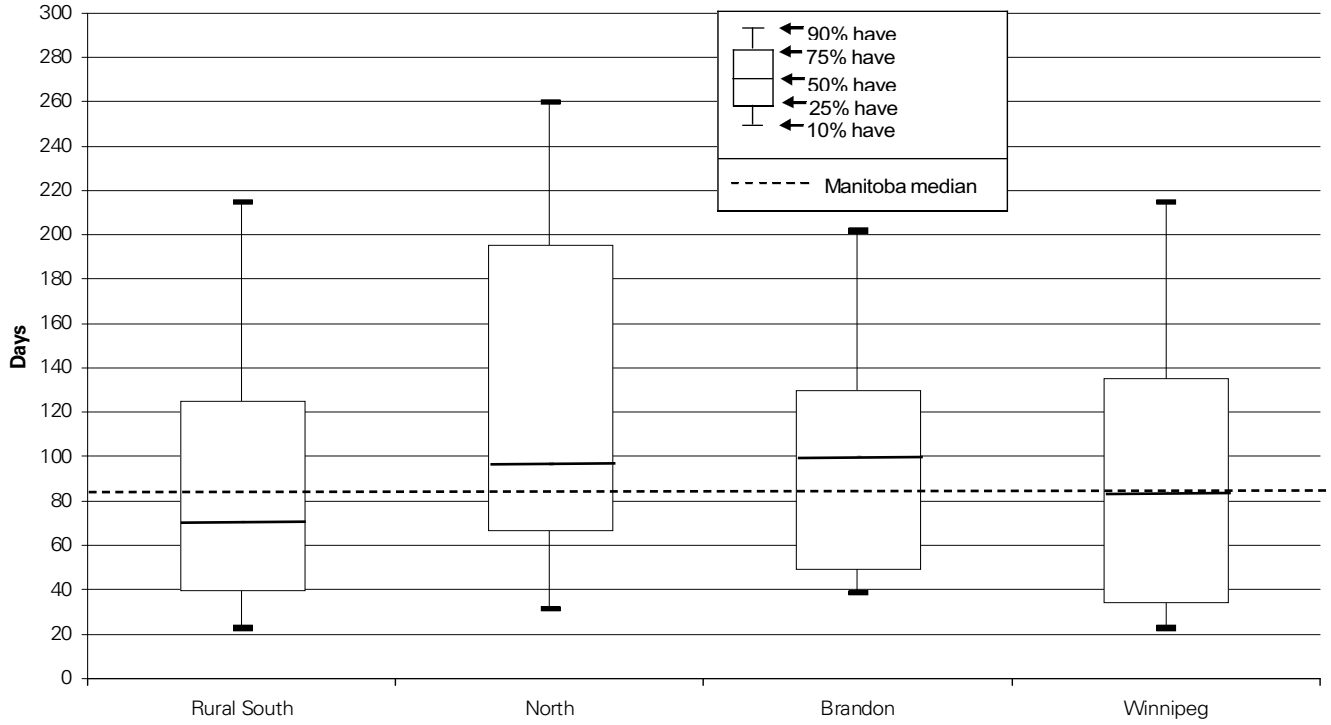

**Heart Valve (Elective & Urgent/Emergent) Surgery by Year**

| | 1999/2000 | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|---|
| Total Procedures Performed | 139 | 123 | 137 | 144 | 121 |
| Total Procedures Analyzed | 77 | 73 | 84 | 88 | 81 |

Source: Manitoba Centre for Health Policy, 2007

**Figure 38: Heart Valve (Elective) Surgery Waits by Region, Manitoba, 1999/2000 - 2003/04**

Unadjusted wait times (days)

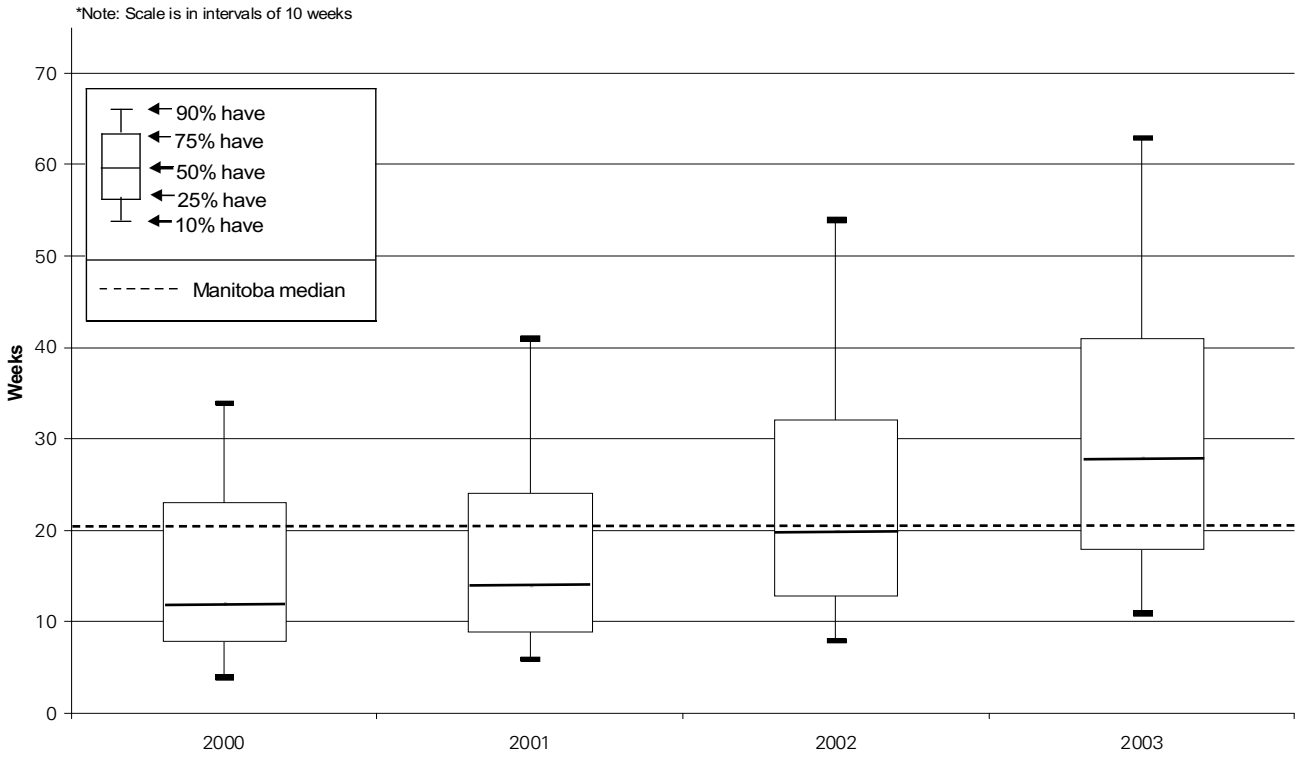



Source: Manitoba Centre for Health Policy, 2007

## Hip/Knee Replacement

The benchmark wait time announced by the FPT Ministers of Health for hip or knee replacement is 26 weeks (FPT Ministers of Health, 2005). The median wait times for primary hip replacements as reported in the registry were 12 weeks in 2000/01 increasing steadily to 28 weeks in 2003/04. Some of this increase may be due to differences in reporting: more surgeons participated in the later years and office staff may have improved their recording practices over time. Residents of Interlake experienced the shortest wait times at 18 weeks and Burntwood/Churchill had the longest waits at 30 weeks. Several RHAs had waits of around 21 weeks: Central, Winnipeg, Nor-Man, Assiniboine and North Eastman.

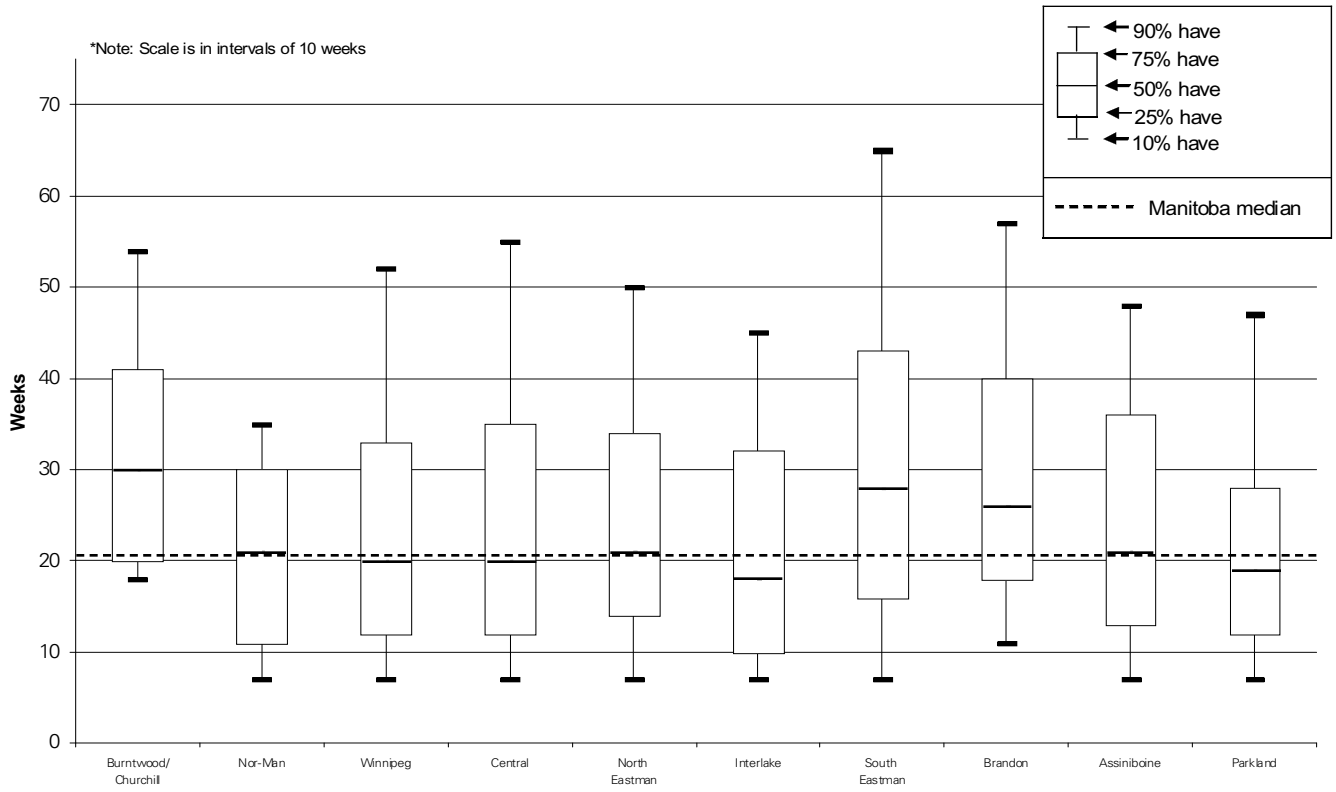
**Figure 39: Hip Replacement Waits by Year, Manitoba, 2000/01 - 2003/04**
Unadjusted wait times (weeks)




| | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|
| Total Procedures Performed | 690 | 656 | 719 | 742 |
| Total Procedures Analyzed | 62 | 368 | 482 | 485 |

**Figure 40: Hip Replacement Waits by RHA, Manitoba, 2000/01 - 2003/04**

Unadjusted wait times (weeks)

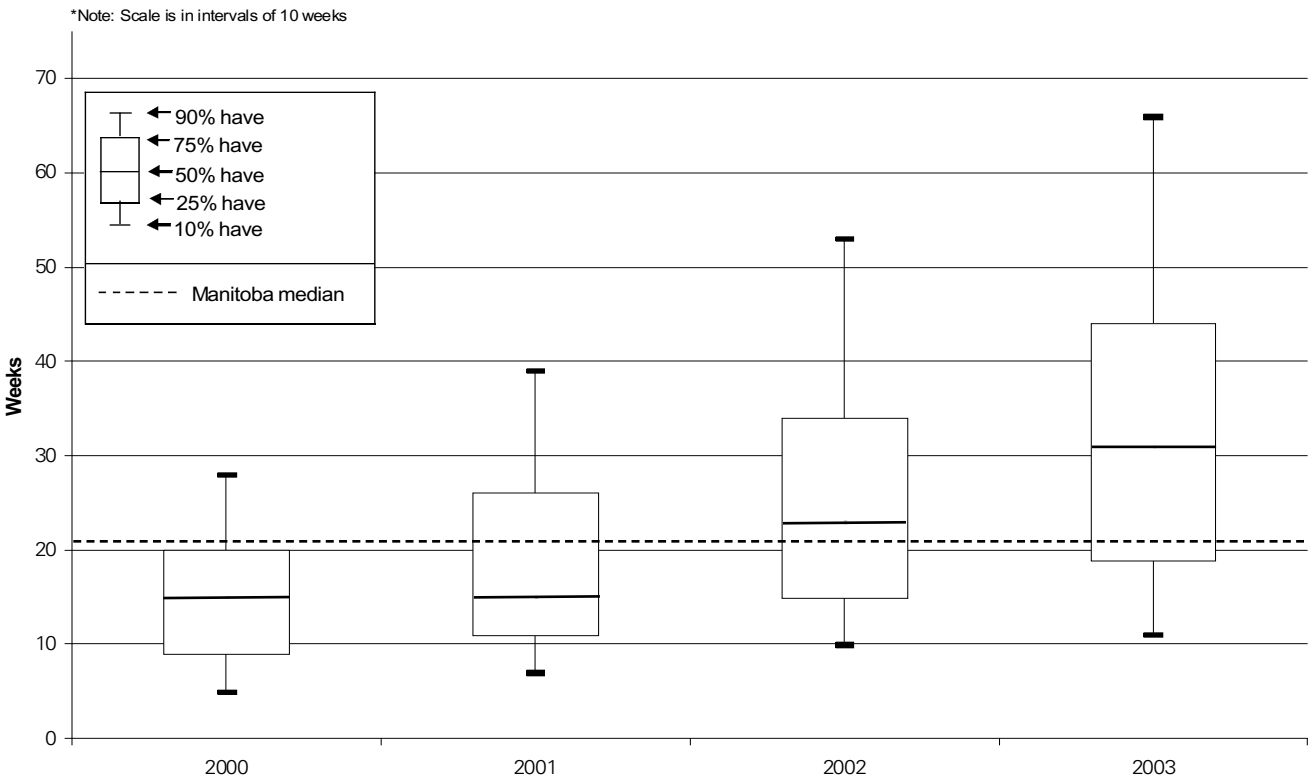



Source: Manitoba Centre for Health Policy, 2007

The median wait times for primary knee replacements as reported in the registry increased over time from 15 weeks in 2000/01 to 31 weeks in 2003/04. Some of this increase may be due to differences in reporting: more surgeons participated in the later years and office staff may have improved their recording practices over time. By RHA, residents of North Eastman had the shortest waits at 18 weeks, and Burntwood/Churchill waited the longest at 31 weeks. Three RHAs had waits near 21 weeks: Brandon, Interlake and Winnipeg.

**Figure 41: Knee Replacement Waits by Year, Manitoba, 2000/01 - 2003/04**

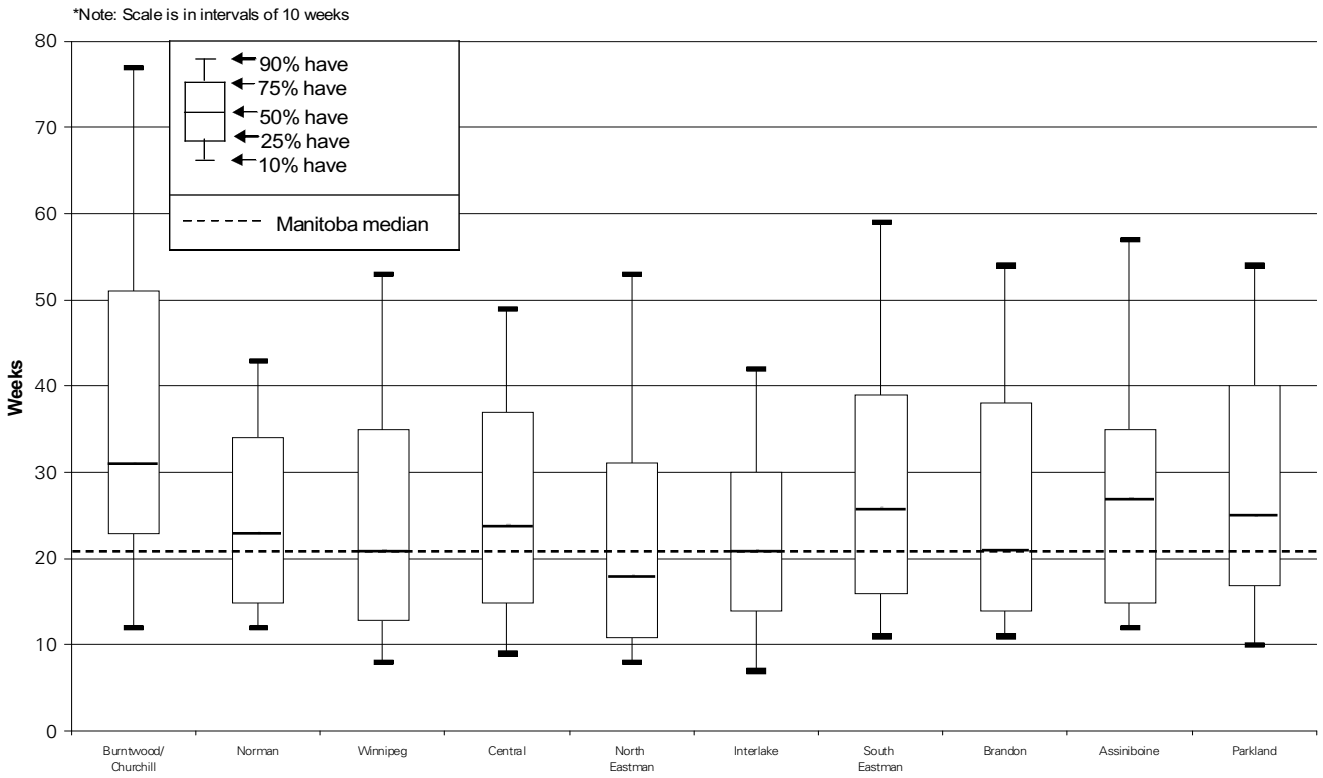
Unadjusted wait times (weeks)




| | 2000/01 | 2001/02 | 2002/03 | 2003/04 |
|---|---|---|---|---|
| Total Procedures Performed | 1,069 | 1,064 | 1,180 | 1,147 |
| Total Procedures Analyzed | 117 | 634 | 803 | 762 |

**Figure 42: Knee Replacement Waits by RHA, Manitoba, 2000/01 - 2003/04**

Unadjusted wait times (weeks)




Source: Manitoba Centre for Health Policy, 2007

## 3.2.2 Multivariate Models for Cataract, Cardiac and Hip/Knee Replacement

### Variables available and used

One of the advantages of linking administrative and registry data is the opportunity to include variables from both data sources. Registry data are potentially rich in information about clinical signs and symptoms, test results or measure of dysfunction and pain, all of which are absent from administrative data. On the other hand, administrative data can provide additional information about precursors or outcomes not available on the registry.

*Cataract*

Variables of interest in the cataract registry include VF-14 (a test of visual function), three questions on whether the cataract threatens the ability to drive or to work, wait factor (a score that reflects the total wait time in months multiplied by 5) and total priority score. Data in the cataract registry were virtually 100% complete.

*Cardiac*

There are a number of clinical and comorbidity measures in the cardiac registry data that could help to explain the variation in wait times. For patients having CABG surgery, the specific diseased vessels are noted. Also available are the Canadian Cardiovascular Society (CCS) classification at acceptance, the urgency categorization and recommended maximum wait time (RMWT) at acceptance. For the urgency scores, a lower score indicates a higher urgency. For patients having valve replacement, there are fields to note the degree of regurgitation and stenosis in each of the involved valves. Urgency and RMWT are not provided for valve patients. For all patients, there are fields to indicate the presence of **congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD)**, **exercise electrocardiogram (ECG)** risk, history of smoking, left ventricular function, and previous **myocardial infarction (MI)**.

For most patients having CABG, there was information about which vessel was diseased; only 2.9% had no data in this field. In contrast, for patients having valve replacement, 41.2% had no information in any of the eight fields that indicated the degree of regurgitation or stenosis. For CABG patients, fewer than 1% were missing the information on CCS, urgency categorization and RMWT (see Table 3). For patients having CABG combined with valve replacements, 53.1% were missing CCS at acceptance. For the other variables, about 16% of cases were missing data on CHF, 17% missing data on COPD, 8% missing data on exercise ECG risk, 23% missing data on history of smoking, 24% missing data on LV Function (not unexpectedly, a higher proportion of valve patients were missing this information than CABG patients), and 15% missing data on previous MI.

We kept registry variables for which we had the most amount of data. For CABG, we kept CHF, COPD, previous MI, CCS at acceptance, and urgency score. We ran separate models for elective and urgent CABG. For valve replacements, we modelled elective cases only and the registry variables we kept in the models were CHF and COPD.

**Table 3: Variables of interest from the Cardiac Registry and per cent missing by procedure**

| | CABG | HV | HV+CABG | TOTAL |
|---|---|---|---|---|
| **Total n** | 2,780 | 503 | 288 | 3,571 |
| **Canadian Cardiovascular Society Category** | | | | |
| | **s** | **457** | **153** | **610** |
| (per cent) | | 90.9% | 53.1% | 17.1% |
| **Congestive Heart Failure** | | | | |
| | **446** | **78** | **45** | **569** |
| (per cent) | 16.0% | 15.5% | 15.6% | 15.9% |
| **Chronic Obstructive Pulmonary Disease** | | | | |
| | **462** | **89** | **51** | **602** |
| (per cent) | 16.6% | 17.7% | 17.7% | 16.9% |
| **Exercise ECG Risk** | | | | |
| | **225** | **40** | **16** | **282** |
| (per cent) | 8.1% | 8.0% | 5.6% | 7.9% |
| **History of Smoking** | | | | |
| | **577** | **181** | **76** | **834** |
| (per cent) | 20.8% | 36.0% | 26.4% | 23.4% |
| **Urgency Rating** | | | | |
| | **s** | **---** | **284** | **284** |
| (per cent) | | | 98.6% | 8.0% |
| **Left Ventricular Function** | | | | |
| | **533** | **237** | **95** | **865** |
| (per cent) | 19.2% | 47.2% | 33.0% | 24.2% |
| **Myocardial Infarction** | | | | |
| | **384** | **95** | **48** | **527** |
| (per cent) | 13.8% | 18.9% | 16.7% | 14.8% |
| **Recommended Maximum Wait Time** | | | | |
| | **s** | **---** | **276** | **276** |
| (per cent) | | | 96% | 7.6% |

s = Data suppressed due to cell counts of < 5.

Source: Manitoba Centre for Health Policy, 2007

*Hip/Knee Replacement*

A large proportion of patients were missing data on walking, pain, overall health, height and weight (see Table 4). Almost half of all patients were missing these data. Most of the patients who were missing at least one of the data points were missing all of the data points. This is not surprising, since these data are collected from patients in a mail survey. We determined that walking distance and walking help were highly intercorrelated, as were pain by day and pain by night; therefore we kept only one of each of those pairs (walking distance and pain at night).

**Table 4: Variables of interest in hip/knee replacement registry and per cent missing by procedure.**

| | Hip Replacement | Knee Replacement | Combined |
|---|---|---|---|
| **Total n** | 1,377 | 2,305 | 3,682 |
| **Walking help** | | | |
| | **602** | **994** | **1,596** |
| (per cent) | 43.7% | 43.1% | 43.3% |
| **Walking distance** | | | |
| | **610** | **1,016** | **1,626** |
| (per cent) | 44.3% | 44.1% | 44.2% |
| **Pain day** | | | |
| | **613** | **1,026** | **1,639** |
| (per cent) | 44.5% | 44.5% | 44.5% |
| **Pain night** | | | |
| | **655** | **1,177** | **1,832** |
| (per cent) | 47.6% | 51.1% | 49.8% |
| **Overall health** | | | |
| | **639** | **1,096** | **1,735** |
| (per cent) | 46.4% | 47.5% | 47.1% |
| **Height** | | | |
| | **644** | **1,099** | **1,743** |
| (per cent) | 46.8% | 47.7% | 47.3% |
| **Weight** | | | |
| | **654** | **1,127** | **1,781** |
| (per cent) | 47.5% | 48.9% | 48.4% |

Source: Manitoba Centre for Health Policy, 2007

### 3.2.3 Multivariate Models and Wait Times

For all models discussed in this section, the variables that were used in the different steps are listed in Table 5. Full model results with $\chi^2$ and p-values are available from the principal author on request.

**Table 5: Variables used in models for cataract, cardiac and HKR surgery.**

| Procedure | Variables |
|---|---|
| **Cataract** (only one step in this model) | Age, sex, RHA, year, income quintile, hospitalized while waiting, mean surgical volume while waiting, ACG score, Visual Function (VF-14), three questions on whether the cataract threatens the ability to drive or to work, wait factor, surgeon and surgery location |
| **CABG (urgent)** | **1st step**: age, sex, year, RHA of residence, income quintile, hospitalized during the wait, mean surgical volume while waiting, and ACG score<br><br>**2nd step**: age, sex, year*, RHA of residence, income quintile, hospitalized during the wait, mean surgical volume while waiting, ACG score, CHF, COPD, recent MI, CCS at acceptance and urgency score |
| **CABG (elective)** | **1st step**: age, sex, year, RHA of residence, income quintile, hospitalized during the wait, mean surgical volume while waiting, and ACG score<br><br>**2nd step**: age, sex, year*, RHA of residence, income quintile, hospitalized during the wait*, mean surgical volume while waiting, ACG score, CHF, COPD, recent MI, CCS at acceptance and urgency score |
| **Heart valve replacement** | **1st step**: age, sex, year, RHA of residence, income quintile, hospitalized during the wait, mean surgical volume while waiting, and ACG score<br><br>**2nd step**: age, sex, year*, RHA of residence, income quintile, hospitalized during the wait*, mean surgical volume while waiting, ACG score, CHF and COPD |
| **Hip replacement** | **1st step**: age, sex, surgeon, year, RHA of residence, income quintile, hospitalized during the wait, mean surgical volume while waiting, ACG score<br><br>**2nd step**: age, sex*, surgeon*, year*, RHA of residence, income quintile, hospitalized during the wait, mean surgical volume while waiting, ACG score, side, overall health status, pain at night, walking distance, height and weight |
| **Knee replacement** | **1st step**: age, sex, surgeon, year, RHA of residence, income quintile, hospitalized during the wait, mean surgical volume while waiting, ACG score<br><br>**2nd step**: age*, sex, surgeon*, year*, RHA of residence, income quintile, hospitalized during the wait, mean surgical volume while waiting, ACG score, side, overall health status, pain at night, walking distance, height and weight |

* indicates variables that must be interpreted with caution in the second-step models as they are systematically associated with missing registry data.

Notes:

- The outcome for all models is wait time according to the respective registry
- First-step models include only administrative variables
- Second-step models include administrative and registry variables.

Source: Manitoba Centre for Health Policy, 2007

*Cataract*

Nearly all of the variables were significant in predicting variation in wait times. When models have a large number of observations (we had over 20,000 observations in our cataract models), it is possible for nearly everything to be significant statistically, although the association might be relatively weak. We will focus on the variables that explained the greatest amount of the variation, as determined by the $\chi^2$ and p-values.

For cataract surgery, the variables that explained the greatest amount of the variation were: year, being hospitalized during the wait, surgeon and wait factor. Five years of data were included in the analyses from 1999/2000 to 2003/04 with 2003/04 used as the referent year. The adjusted cataract wait times were shorter in the earlier years of the study compared to 2003/04. Being hospitalized during the wait predicted a longer waiting time. The specific surgeon was associated with a large amount of the variation in the wait time. It was expected that wait factor would explain a large amount of the variability associated with cataract wait times—and it did.[5] Importantly though, the VF-14 and the questions on work and driving explained part of the variation even after accounting for the wait factor; furthermore, they worked in the expected direction, that is, shorter wait times were associated with higher (i.e., greater dysfunction) scores. Mean volume of surgery during the wait was significant and negative, indicating that a higher volume of surgery was associated with a shorter wait time, although it explained a relatively small amount of the variation.

**Cardiac[6]**

*Urgent or Emergent CABG*

Four years of data were included in the analyses from 2000/01 to 2003/04. The first-step models demonstrated that sex and being hospitalized during the wait were significantly associated with variation in the wait time for urgent CABG. The adjusted wait times for urgent CABG were shorter for males than females, and longer for patients hospitalized during the wait. There were 1,271 observations in this model.

There were 1,034 observations for the second-step model since people with missing values were excluded from the analyses. Being hospitalized during the wait and having a higher URS (less urgent) were associated with longer adjusted wait times. Sex was no longer significant in the full model; it is possible that males are more urgent, and so when measures of urgency are included in the model, sex is no longer significant.

---

[5] Wait factor was kept in the model even though it is almost the same as the outcome: since both wait factor and visual function comprise the priority score, we kept wait factor in the models to test whether visual function is associated with wait time even after accounting for the wait factor.

[6] Surgeon was not included in the cardiac models because the models became unstable when surgeon was included.

*Elective CABG*

The first-step model, which included only administrative data, demonstrated that age, being hospitalized during the wait, volume of surgery during the wait time and ACG score were significantly associated with variation in the wait time for elective CABG. Four years of data were included in the analyses from 2000/2001 to 2003/2004. The adjusted wait times for scheduled CABG were longer for older patients and for patients hospitalized during the wait. Shorter waits were associated with higher volumes of surgery and higher ACG scores indicating a higher level of illness. There were 1,373 observations in this model.

There were 1,086 observations for the second-step model since people with missing values were excluded from the analyses. Shorter waits were associated with a higher ACG score, not having CHF, having an MI, having a higher (more severe) CCS score, or a lower Urgent Referral Score (URS) (more urgent).

*Elective Heart Valve Replacement*

Four years of data were included in the analyses from 2000/01 to 2003/04. The first-step model demonstrated that region of residence, year and being hospitalized during the wait were significantly associated with variation in the wait time for heart valve replacement. The adjusted wait times for heart valve replacement were shorter in 2003/04 compared to 2000/01. Residents of Interlake and Assiniboine RHAs experienced shorter wait times than residents of Winnipeg. Waits were longer for patients hospitalized during the wait. There were 327 observations in this model.

There were 264 observations for the second-step model since people with missing values were excluded from the analyses. A higher mean volume of surgery was associated with a shorter wait for valve replacement surgery.

**Hip/Knee Replacement**

*Hip Replacement*

Four years of data were included in the analyses from 2000/01 to 2003/04. The first-step model for hip replacement, which included only administrative data, showed that year, being hospitalized during the wait, surgeon, mean surgical volume, and ACG score were significantly associated with variation in wait time for knee replacement. The adjusted hip replacement wait times were shorter in the earlier years of the study compared to 2003/04. Being hospitalized during the wait predicted a longer wait time. Mean volume of surgery during the wait was significant and negative, indicating that a higher volume of surgery was associated with a shorter wait time. Having a higher ACG score, that is higher level of illness, was also associated with a shorter wait. Surgeon explained a large amount of the variation in hip replacement wait times. There were 1,340 observations for this model.

There were 604 observations for the second-step model since people with missing values were excluded from the analyses. Being hospitalized during the wait was associated with longer wait times. Shorter waits were associated with a higher volume of surgery during the wait, and good overall health (compared to poor).

***Knee Replacement***

Four years of data were included in the analyses of primary knee replacement from 2000/01 to 2003/04. The first-step model for knee replacement, which included only administrative data, showed that year, RHA, being hospitalized during the wait, surgeon, ACG score and mean surgical volume during the wait time were significantly associated with variation in wait time for knee replacement. The adjusted knee replacement wait times were shorter in the earlier years of the study compared to 2003/04. Being hospitalized during the wait predicted a longer wait time. Residents of Burntwood/Churchill had significantly longer waits compared to residents of Winnipeg, which was the referent. A higher ACG score, meaning a higher level of illness, predicted a shorter wait time. Mean volume of surgery during the wait was significant and negative, indicating that a higher volume of surgery was associated with a shorter wait time. Surgeon explained a large amount of the variation in hip replacement wait times. There were 2,207 observations for this model.

There were 902 observations for the second-step model since people with missing values were excluded from the analyses. Being hospitalized during the wait and the ability to walk a longer distance were associated with longer wait times. Shorter waits were associated with a higher volume of surgery during the wait and higher ACG score. Pain at night was significant but difficult to interpret since it did not show a consistent pattern from least to most pain at night. This finding might be explained by the fact that these data come from a questionnaire but are not designed to be used as a measure of urgency or priority.

## 3.3 Events While Waiting for Surgery

### 3.3.1 Methods

One of the questions that is often raised in the discussion of wait times is, does it make a difference? Are long waits unsafe? Are outcomes affected by long waits? Answering these questions has been the topic of much discussion, debate and, more recently, research. In 2003, CIHR funded several synthesis projects to review the evidence for the effects of long waits on outcomes. These research projects were commissioned by the FPT Ministers of Health in order to develop benchmark wait times in five key areas: cancer screening, cancer care, cataract surgery, HKR, and cardiac surgery. Researchers found that little evidence exists on the impact of a delay in surgery especially in non life-threatening conditions, such as cataract or hip/knee osteoarthritis.

In the current project, we wanted to know whether patients who are waiting have a higher risk of a negative outcome, such as death, during the wait. There are other possible negative outcomes. For instance, patients waiting for HKR may be unable to work or to enjoy their normal family and social activities, and they may use high amounts of pain medication. However these are things that are not captured, or are captured only incompletely in the administrative data. Persons waiting for cardiac surgery seem to be the most obviously at-risk of dying of their condition while waiting. The nature of the illness is such that some sudden deaths are inevitable; death rates while waiting for CABG with or without concomitant valve surgery have been reported ranging from 0.7% to 2.5% (Sobolev et al., 2006; Legare et al., 2005; Rexius et al., 2004b; Rexius et al., 2004a; Cesena et al., 2004; Koomen et al., 2001; Ray et al., 2001). By linking **Vital Statistics** data and registry data, from 2000/01 to 2003/04, we found records of eight deaths in CABG patients and five deaths in heart valve patients while waiting, for a combined death rate of 0.6%. Thus, we identified too few deaths to analyze. On the advice of the Working Group, we selected hospitalizations for **acute coronary syndrome (ACS)** to investigate a non-fatal outcome that might plausibly be associated with longer waits for CABG.

We used a **case-control** analysis. Cases were patients who had CABG surgery between 2000/01 and 2003/04. Cases had to be included in both the registry and the administrative data. Controls were matched on age and sex; individuals who had cardiac surgery during the case's wait time or for a year before or after the wait time were excluded from the pool of controls. We aimed for a 3:1 match between controls and cases; our dataset consisted of 2,784 cases and 7,873 controls. For both cases and controls we identified hospitalizations for ACS during the wait period.[7]

[7] ACS: ICD-9-CM codes 410 (Acute MI) and 411 (other acute and subacute forms of ischemic heart disease); most responsible diagnosis only in hospital claims.

A logistic gold regression model with ACS as the outcome was employed to adjust for age, sex, ACG score, income quintile, and RHA of residence. Additional models were created for the cases only to explore the impact of wait time and urgency. Wait time was defined in two ways: (1) actual wait time according to the registry, and (2) actual wait time minus the recommended maximum wait time.

Additionally, we wanted to know if the frequency of ACS hospitalizations changed after surgery. Therefore we looked at the frequency of hospitalization one year before and one year after surgery for patients who received surgery in 2002/03, and compared cases and controls using $\chi^2$.

## 3.4 Findings

There were 2,784 cases and 7,873 age-sex matched controls. After adjusting for age, sex, income level, level of illness (ACG score) and RHA of residence, people waiting for CABG had much higher odds of being hospitalized for acute coronary syndrome than controls (OR 43.6, 95% CI 17.6, 108.5). The wait time was not significantly associated with ACS.

Finally, we looked at the frequency of hospitalization for ACS in the year before and the year after surgery. For this analysis there were fewer individuals because they had to be present in Manitoba for one full year before and one full year after the date of surgery. There were 633 cases and 1,899 controls. For controls, hospitalizations for ACS did not change over the time period; however for cases there were 132 hospitalizations in the year before surgery and 15 in the year after surgery ($\chi^2$ 105.4, $p < .0001$, 1 d.f.).

# 4.0 DISCUSSION

## 4.1 Eight Common Elective Procedures

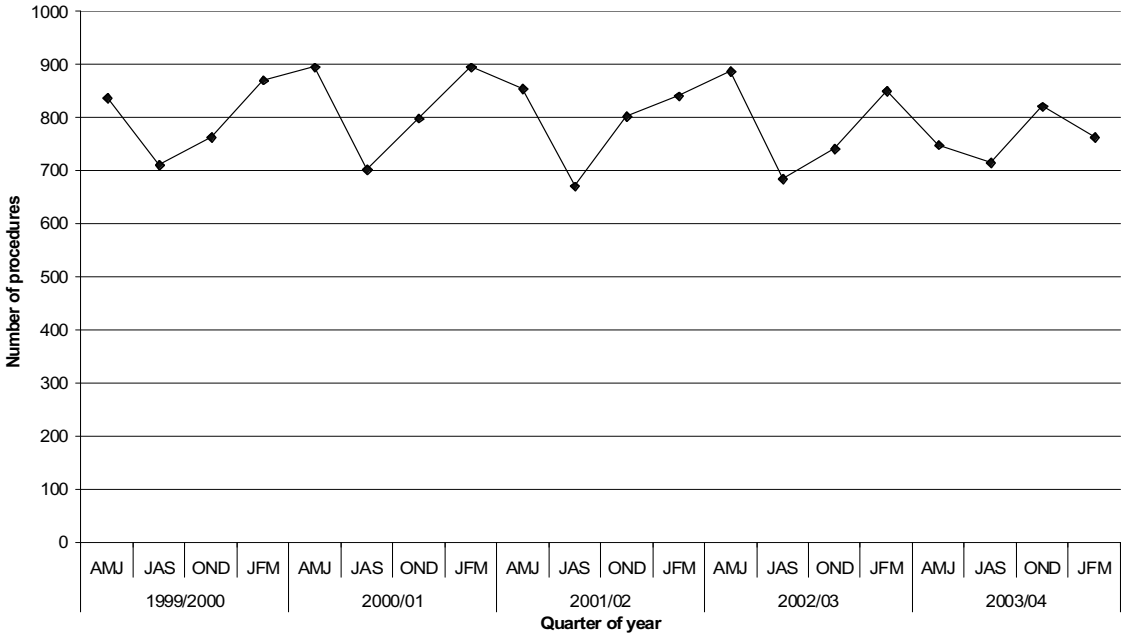
Our analyses of the eight common elective procedures suggests that median wait times from decision-date to surgery are increasing over time. We have presented both unadjusted wait times, using box plots, and adjusted wait times. The use of box plots provide a richer understanding of the data, with information not only on the median wait but also the time it took for 75% or 90% of people to receive their surgery. The use of parametric **survival analysis** models to adjust median wait times is something that has not previously been reported in the literature and permits an all-things-being-equal comparison. The increase in wait times over time though is evident with both methods of analysis. The median waits are significantly longer for carpal tunnel release, TURP, hernia repair, T&A, and varicose vein repair. There is no significant change in waits for breast lesions, carotid endarterectomy and cholecystectomy.

The reasons for the increase in wait times for the eight common procedures are not clear. When presented with information about an increase in wait times, the immediate question that most people ask is: Did the rate of surgery change? There is a strongly held belief that if wait times increased, then the available resources probably decreased. Table 1 (page 9) demonstrates the rate of surgery decreased for most of these procedures over the study period. Decreases may be due to a variety of reasons, including less availability of resources, changes in the health of the population, and changes in clinical practice which might reduce the need for surgery.

The relationship between volume of surgery and wait time is not direct and consistent. Wait times may increase or decrease irrespective of the volume. For instance, we found that both the rate and the wait time for carpal tunnel surgery increased in this time period, while both the rate and wait time for carotid endarterectomy decreased. When we constructed the multivariate models, we used a measure of volume as one of the independent variables: the volume of surgery averaged over each quarter of that individual's wait time. For the eight common procedures, volume was significant (and negative) only for cholecystectomy, carpal tunnel release, and hernia repair that is, for these procedures a higher volume of surgery over the individual's wait time was associated with a shorter wait. Thus the relationship between the wait time and the volume of surgery is complex.

We charted the quarterly volumes of surgery and discovered a noticeable drop in volume over the summer months, illustrated here for three procedures: cholecystectomy, T&A and surgery for breast tumours. One can see a pronounced dip in the volume of surgery during the summer quarter (JAS) for cholecystectomy and T&A. Not surprisingly, the summer dip is not as noticeable for excision of breast lesion surgery.

**Figure 43: Cholecystectomy, Number of Procedures by Quarter, Manitoba, 1999/2000 - 2003/04**



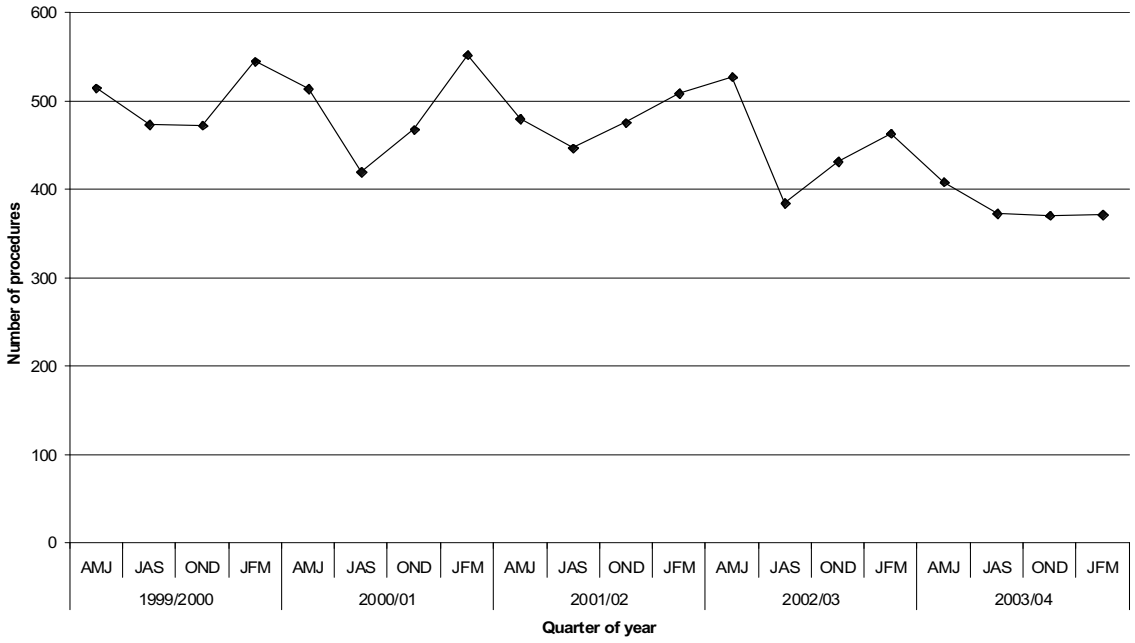

**AMJ**: April, May, June; **JAS**: July, August, September; **OND**: October, November, December; **JFM**: January, February, March

Source: Manitoba Centre for Health Policy, 2007

The summer decrease in volume may be partly patient-driven, but is likely also due to summer vacation by hospital staff in both the Operating Rooms and the surgical nursing wards. (It is less likely that this is due to surgeons' vacations since generally speaking, if one surgeon is away, another will use his/her time.) The science of operations research, which can be defined simply as the science of determining the most efficient way to do something in an organization, would suggest that these fluctuations in supply may be contributing to the increased wait times. Even if the average supply and average demand over a year are similar, if there are times when capacity is constrained, then queues can develop or grow. More research is required on this issue.

We also saw that there are differences in wait times according to the RHA in which people live. Residents of Nor-Man and Central often experienced shorter waits and residents of Brandon and South Eastman tended towards longer waits. The findings demonstrate that living in an urban area such as Brandon does not guarantee shorter waits, and living in a more remote region, such as Nor-Man, does not predict longer waits to access surgery. This may be counter-intuitive to beliefs that access to care is worse in more remote areas and better in urban centres.

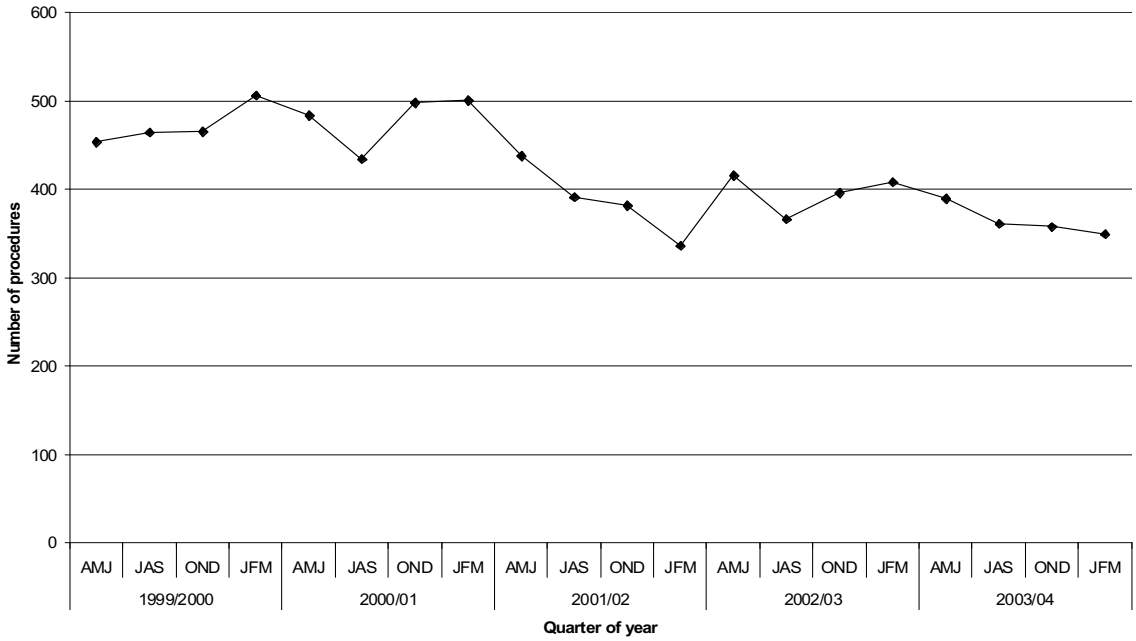
**Figure 44: Tonsillectomy and Adenoidectomy, Number of Procedures by Quarter, Manitoba, 1999/2000 to 2003/04**




**AMJ**: April, May, June; **JAS**: July, August, September; **OND**: October, November, December; **JFM**: January, February, March

Source: Manitoba Centre for Health Policy, 2007

**Figure 45: Excision of Breast Lesions, Number of Procedures by Quarter, Manitoba, 1999/2000 - 2003/04**




**AMJ**: April, May, June; **JAS**: July, August, September; **OND**: October, November, December; **JFM**: January, February, March

Source: Manitoba Centre for Health Policy, 2007

In order to explore the differences in waits by region of residence, we looked at where people received their surgery. For the general surgical procedures (cholecystectomy, hernia repair, breast lesions and varicose veins), residents of Central, South Eastman, and Nor-Man receive about 60% to 70% of their surgery in their own region, Burntwood about 50% and Parkland about 90%. Residents of Interlake and North Eastman receive most of their surgery in Winnipeg and residents of Assiniboine in Brandon. Nor-Man residents experienced generally shorter wait times and South Eastman residents experienced a pattern of longer wait times, yet both regions appear to have about the same proportion of surgery available in region. Thus in-region service availability does not seem to explain shorter or longer waits.

Also significant in most of the multivariate models was being hospitalized for some other reason during the wait, which was associated with a longer wait. Age, sex, and income generally were not significant, meaning that individuals did not wait different lengths of time based on these characteristics, which demonstrates that access is equivalent regardless of these characteristics.

## 4.2 Cataract, Cardiac and HKR Surgery: Registry and Administrative Data

### 4.2.1 Algorithm Development

We merged registry and administrative data in order to develop or validate algorithms using administrative data to estimate wait times. At first blush, this may seem unnecessary: why develop an administrative data measure when we have the registry wait times? But the advantage of being able to estimate wait times using administrative data is that, except for cardiac surgery, not all patients are included in the registry. We were able to develop or modify accurate measures of wait times from the administrative data for cataract and cardiac procedures but not for HKR surgery.

### 4.2.2 Descriptive

Evidence-informed benchmarks for cataract, cardiac and HKR surgery were announced by the FPT ministers of health in December 2005. The benchmark for cataract surgery is 16 weeks for high-risk procedures. The median wait time for cataract in 2003/04 was 16 weeks, but this was for all patients, not just high-risk patients. The 90$^{th}$ percentile wait, the time it took for most people to receive their cataract surgery was 42 weeks, but showing a downward trend since 2001/02. Data in more recent years may show a continued decrease in the wait times. Data from Manitoba Health's website showed that as of December 2006, median waits for cataract in Winnipeg were 13 weeks, and outside of Winnipeg they were 7 to 10 weeks (Manitoba Health, c).

The benchmark for CABG surgery varied by level of urgency: 2 weeks for Level I, 6 weeks for Level II and 26 weeks for Level III. Here the news is good. The 90th percentile wait for elective CABG was 20 weeks in 2003/04 and for urgent cases it was 3 weeks. Again, more recent data may show different results. Data from Manitoba Health's website showed that as of December 2006, the median wait for Level I patients was 5 days, for Level II patients was 13 days and for Level III patients 46 days (Manitoba Health, c).

The benchmark wait for HKR surgery is 26 weeks. In 2003/04, we fell short of that mark according to the HKR registry. It took 62 and 65 weeks for 90% of patients to have their HKR surgery, respectively. In October 2005, it was announced that Manitoba would receive $155 million from the federal Wait Time Reduction Fund; roughly $55 million of that has been directed to HKR surgery. Additional procedures have been funded. Pre-hab clinics have been developed at some hospitals to make sure that patients are as fit as possible for their surgery, so that they will not experience delays due to poorly controlled medical problems. Work has also been done to focus on the 'long-waiters' defined as patients waiting more than 41 weeks. Surprisingly, some of these long-waiters are in fact patients who are on the wait list but in fact are not ready for surgery yet; their surgeons placed them on the list in anticipation of the lengthy wait. The median wait time for hip replacement surgery in December 2006 according to Manitoba Health's website was 22 weeks for Winnipeg hospitals and 18 weeks at Boundary Trails Hospital. For knee replacement the median wait was 35 weeks in Winnipeg hospitals, 35 weeks for Brandon hospitals and 30 weeks in Boundary Trails (Manitoba Health, c).

### 4.2.3 Multivariate Models

It was anticipated that by being able to link administrative and registry data, additional variables would be available for the survival models. Registries typically include data not available in administrative data, such as clinical measures or measures of dysfunction and overall health. Our ability to use these additional variables from the registries was mixed. For cataract surgery, the data are virtually 100% complete, likely because of the way the data are collected: registry staff try several times to contact the patient to administer the questionnaire and enter the data directly onto the computer. Data were less complete for the other two registries. The hip/knee registry is dependent on patients completing and returning a mail questionnaire, and many patients apparently choose not to do it. The cardiac registry requires the coordinators to review the patients' medical charts to obtain the data, and the charts may not contain information on all of the variables. There was however evidence for both of these registries that data were more complete over time; perhaps at the start-up of the registries there were some difficulties in obtaining data that were overcome with time.

We found that average volume during the wait and being hospitalized during the wait were consistently associated with variation in wait times for these procedures. A higher volume of surgery was found to be associated with shorter wait times, suggesting that the great efforts being made to provide more of these procedures does work to reduce wait times. It shouldn't be a surprise that being hospitalized during the wait is associated with a longer wait: obviously if a patient is in the hospital, he or she is not available for surgery. What is important though is that registries should keep track of times when the patient is not available, whether it's through illness or choice, and treat those patients differently when calculating average wait times.

Shorter waits for cataract and CABG surgery were associated with greater dysfunction or urgency. The specific surgeon was also found to be associated with a great deal of the variation in wait times.

### 4.2.4 Events While Waiting

We analyzed events associated with waiting for scheduled CABG. We could identify only eight patients who died while waiting for CABG—well within what has been reported in the literature for death rates while waiting for CABG—which was too few to model. On the advice of the working group, we looked at hospitalizations for acute coronary syndrome. Patients waiting for CABG were found to be at a much higher risk of being hospitalized for ACS while waiting, however there was no relationship between the length of time waiting and the risk of being hospitalized for ACS. The rate of being hospitalized for ACS decreased significantly in the year after CABG surgery, demonstrating the benefits of the procedure.

### 4.2.5 Limitations

Questions of validity may apply to the use of a proxy measure to mark the beginning of the wait time, as we did for the eight common procedures. This method has been used by other provinces, which suggests its acceptability (Nova Scotia Department of Health, 1996; Tu et al., 2006; Nova Scotia Department of Health, 2007). A chart abstraction study was performed in one general surgery practice in Winnipeg in which the decision date to have surgery was noted and compared with the visit date available in the administrative data (De Coster et al., 2007). This study showed that the mean and median wait times were not significantly different. This study was small and perhaps not generalizable to other types of surgical conditions. Shortt and colleagues analyzed chart data for over 30,000 surgeries that took place from July 1, 1992 to June 30, 1996 in Kingston (Shortt et al., 2004). They compared the date the patient was placed on a waiting list with the date of the patient's last visit to the surgeon. For general, neuro-ophthalmic, thoracic, vascular and urologic surgery, the

difference between the decision date and the last visit was negligible, from 0.1 day for ophthalmology to 1.5 days for neurosurgery.

Less compelling evidence comes from a study of British Columbia data in which data from the hospital booking system were compared with administrative data for four procedures, knee replacement, hip replacement, CABG and cataract surgery (Sanmartin, 2000). About 70% of procedures were booked after the last visit prior to surgery, except for cataracts where it was only 55%. The findings of this latter study suggest that the last visit before surgery may be less reliable as a measure of wait times for those procedures. Hence the need to explore data from the registries for these procedures to develop and validate algorithms using administrative data.

The limitation in the use of administrative data to estimate wait times is the determination of the beginning of the wait. Despite the evidence that this method is valid, there will no doubt still be times when we either over-estimate or under-estimate the wait. An under-estimate may occur if a patient has agreed to surgery, but then suddenly experiences a worsening of symptoms, sees the surgeon again and gets prioritized for earlier surgery. And over-estimate could occur if the decision to have surgery is actually made some time after a patient visit, perhaps over the phone. We also miss any occasions where the patient saw a different surgeon than the one who did the surgery. These situations will contribute to errors in the wait time estimate.

Registries also have their limitations. They are often found to be inflated by around 25 to 30% ("Surgical waiting lists," 1991; Elwyn et al., 1996; Fraser, 1991; Rao and Burd, 1997; Tomlinson and Cullen,1992). We also found many instances of incomplete data though there was evidence data quality improved over time with less missing data in later years. A registry that is voluntary, like the HKR registry was for this time period, will be biased because only some surgeons will contribute and even those will likely not contribute all of the time. As with administrative data, the start of the wait time may also be a question with registry data.

### 4.2.6 Key Messages

**Eight Common Procedures**

1. Waits for eight common elective surgical procedures were studied: Excision of breast lesions; carotid endarterectomy, cholecystectomy, carpal tunnel release, transurethral prostatectomy (TURP) (for benign disease), hernia repair, tonsillectomy and adenoidectomy (T&A), and stripping/ligation of varicose veins.
2. A visit to the surgeon prior to surgery was used as a marker for the beginning of the wait time. There is evidence to support the validity of using this method, and it is a relatively easy and inexpensive way to track wait times especially for procedures for which there is no surgical registry.
3. Wait times for cholecystectomy, hernia repair, excision of breast lesions, and carotid endarterectomy did not show a clinically relevant change. Waits did however increase for varicose veins, carpal tunnel release, T&A and TURP. The longest median wait was for varicose vein surgery at 93 days in 2003/04.
4. Adjusted waits tended to be shorter for residents of Nor-Man and Central; longer for residents of Brandon and South Eastman.
5. An individual's age, sex or neighbourhood income level generally did not influence their wait times.

**Cataract, Cardiac and Hip/Knee Replacement**

6. Linking of administrative and registry data can be used to develop or validate the estimation of wait times with administrative data. We were able to develop valid algorithms to estimate waits for cataract and cardiac surgery, but not for HKR.
7. Median waits increased over the time period of the study for HKR, and decreased for cataract and cardiac surgery.
8. For cataract, CABG, and HKR, a higher average volume of surgery was associated with shorter wait times.
9. Patients waiting for elective CABG have an increased risk of being hospitalized for acute coronary syndrome. The risk decreases after CABG surgery.

**More Research**

10. There has been a great deal of attention focussed on reducing wait times for surgical procedures that were prioritized by the FPT First Ministers: cataract, cardiac and HKR surgery. There are now concerns that concentration in these areas may squeeze out other services. Our method of tracking wait times for commonly performed non-emergency surgery could be used to explore this issue and would be worth looking at again in future.
11. Longer wait times might be related to seasonal fluctuations in the volume of surgery performed. More research is necessary to confirm this.
12. The evidence supporting benchmark wait times is limited, therefore additional research on the outcomes of waiting is required.

# REFERENCE LIST

Abrami PC, Cholmsky P, Gordon R. *Statistical Analysis for the Social Sciences: An Interactive Approach*. Available from URL: http://www.ablongman.com/html/abrami/index.html. Accessed on: February 27, 2007.

AUA Guidelines on Management of Benign Prostatic Hyperplasia. Chapter 1: Diagnosis and Treatment Recommendations. *The Journal of Urology* 2003;170(2 Part1):530-547.

Barnett HJ, Meldrum HE, Eliasziw M. The appropriate use of carotid endarterectomy. *Can Med Assoc J* 2002;166(9):1169-1179.

Cesena FHY, Favarato D, Ce'sar LAM, de Oliveira SA, da Luz PL. Cardiac complications during waiting for elective coronary artery bypass graft surgery: Incidence, temporal distribution and predictive factors. *Eur J Cardiothorac Surg* 2004;25:196-202.

De Coster C. Measurement and Factors Relating to Variation in Cataract Surgery Waiting Times in Manitoba [dissertation]. Winnipeg, MB: University of Manitoba; 2002.

De Coster C, Carrière KC, Peterson S, Walld R, MacWilliam L. *Surgical Waiting Times in Manitoba*. Winnipeg, MB: Manitoba Centre for Health Policy and Evaluation, 1998.

De Coster C, Luis A, Taylor M. Do administrative databases accurately measure waiting times for medical care? Evidence from general surgery. *CJS 2007*;(In press).

De Coster C, MacWilliam L, Walld R. *Waiting Times for Surgery: 1997/98 and 1998/99 Update*. Winnipeg: Manitoba Centre for Health Policy and Evaluation, 2000.

de la Rosette JJMC, Alivizatos G, Madersbacher S, Perachino M, Thomas D, Desgrandchamps F, De Wildt M. EAU guidelines on benign prostatic hyperplasia (BPH). *European Urology* 2001;40(3):256-263.

Elwyn GJ, Williams LA, Barry S, Kinnersley P. Waiting list management in general practice: a review of orthopaedic patients. *BMJ* 1996;312(7035):887-888.

Findlay JM, Tucker WS, Ferguson GG, Holness RO, Wallace MC, Wong JH. Guidelines for the use of carotid endarterectomy: current recommendations from the Canadian Neurosurgical Society. *Can Med Assoc J* 1997;157(6):653-659.

Federal/Provincial/Territorial Ministers of Health. *First ever common benchmarks will allow Canadians to measure progress in reducing wait times*. December 12, 2005, Ministry of Health and Long-Term Care.

Fraser GG. An audit of surgical waiting lists. *NZMJ* 1991;104:385-386.

Health Canda. First Minister's Meeting on the Future Health Care 2004: *A 10-year plan to strengthen health care 2004*. Available from: http://www.hc-sc.gc.ca/hcs-sss/delivery-prestation/fptcollab/2004-fmm-rpm/index_e.html. Accessed on: April 10, 2007.

Health Canada. *Wait times in Canada*. Available from URL: http://www hc-sc gc ca/hcs-sss/qual/acces/wait-attente/index_e html. (Updated April 4, 2006; accessed on November 8, 2006.)

Hospital Abstract Users Manual. Manitoba Health Services Commission, 1987.

Koomen EM, Hutten BA, Kelder JC, Redekop WK, Tijssen JG, Kingma JH. Morbidity and mortality in patients waiting for coronary artery bypass surgery. *Eur J Cardiothorac Surg* 2001;19(3):260-265.

Legare J, MacLean A, Buth KJ, Sullivan JA. Assessing the risk of waiting for coronary artery bypass graft surgery among patients with stenosis of the left main coronary artery. *Can Med Assoc J* 2005;173(4):371-375.

Manitoba Health, a. Manitoba Wait Time Information: Taking Action on Wait Times. Available from URL: http://www.gov.mb.ca/health/waitlist/plan.html. Accessed on: February 24, 2007.

Manitoba Health, b. Manitoba Physician's Manual, 2006.

Manitoba Health, c. Manitoba Wait Time Information: Surgical Services. Available from URL: http://www.gov.mb.ca/health/waitlist/surgical/index.html. Accessed on: February 28, 2007.

Naylor CD, Baigrie RS, Goldman BS, Basinski A. Assessment of priority for coronary revascularization procedures. *Lancet* 1990;335:1070-1073.

Nickel JC, Herschorn S, Corcos J, Donnelly B, Drover D, Elhilali M, Goldenberg L, Grantmyre J, Laroche B, Norman R, Piercy B, Psooy K, Steinhoff G, Trachtenberg J, Saad F, Tanguy S. Canadiain guidelines for the management of benign prostatic hyperplasia. *Canadiain Journal of Urology* 2005; 12(3):2677-2683.

Nova Scotia Department of Health. *Reporting Health Performance: Elective Procedure Waiting Times in Nova Scotia*. Halifax, NS. 1996.

Nova Scotia Department of Health. Nova Scotia Wait Times. Available from URL: http://www gov ns ca/health/waittimes/ Accessed on: February 28, 2007.

Rao GS , Burd DA. Problems and priorities of plastic surgical waiting list initiative schemes: an audit. *J R Coll Surg Edinb* 1997;42(2):128-130.

Ray AA, Buth KJ, Sullivan JA, Johnstone DE, Hirsch GM. Waiting for cardiac surgery - Results of a risk-stratified queuing process. *Circulation* 2001;104(12):I92-I98.

Rexius H, Brandrup-Wognsen G, Ode'n A, Jeppsson A. Gender and mortality risk on the waiting list for coronary artery bypass grafting. *Eur J Cardiothorac Surg* 2004a;26:521-527.

Rexius H, Brandrup-Wognsen G, Ode'n A, Jeppsson A. Mortality on the waiting list for coronary artery bypass grafting: Incidence and risk factors. *Ann Thorac Surg* 2004b;77:769-775.

Sanmartin C. *Study of Surgical Waiting Lists and Waiting Times for Selected Procedures in British Columbia*. University of British Columbia; 2000.

Shortt SED, Shaw RA, Elliott D, Mackillop WJ. Monitoring trends in waiting periods in Canada for elective surgery: Validation of a method using administrative data. *CJS* 2004;47(3):173-178.

Sobolev B, Levy A, Hayden R, Kuramoto L. Does wait-list size at registration influence time to surgery? Analysis of a population-based cardiac surgery registry. *Health Services Research* 2006;41(1):23-39.

Statistics Canada. "dissemination area (DA)", "enumeration area (EA)." Available from URL: http://www12.statcan.ca/english/census01/Products/Reference/dict/geo021.htm and geo024.htm). Accessed on: February 27, 2007.

Surgical waiting lists in Victorian hospitals. The Standards Sub-Committee of the Victorian State Committee of the Royal Australasian College of Surgeons. *Med J Aust* 1991;154(5):326-328.

Tomlinson M , Cullen J. A clinical audit of patients on an orthopaedic waiting list for greater than two years. *NZMJ* 1992;July 8:266-268.

Tu JV, Pinfold SP, McColgan P, Laupacis A, [eds.]. *Access to Health Services in Ontario: ICES Atlas 2nd Edition*. Toronto, ON. Institute for Clinical Evaluative Sciences, 2006.

# GLOSSARY

Acronyms used in this report:

**ACG** – Adjusted Clinical Group

**ACS** – Acute Coronary Syndrome

**CABG** - Coronary Artery Bypass Graft

**CCS** – Canadian Cardiovascular Society

**CIHR** – Canadian Institute for Health Research

**CHF** - Congestive Heart Failure

**COPD** – Chronic Obstructive Pulmonary Disease

**DA** – Dissemination Area

**EA** – Enumeration Area

**ECG** – Electrocardiogram

**FPT** – Federal/Provincial/Territorial

**HKR** – Hip/knee Replacement

**ICD-9-CM** - International Classification of Disease, 9th version with clinical modifications

**ICU** – Intensive Care Unit

**MI** – Myocardial Infarction

**PHIN** – Personal Health Identification Number

**RHA** – Regional Health Authority

**RMWT** – Recommended Maximum Wait Time

**T & A** – Tonsillectomy and Adenoidectomy

**TURP** – Transurethral Prostatectomy

**URS** – Urgency Referral Score

**WRHA** – Winnipeg Regional Health Authority

### Acute Coronary Syndrome (ACS)

An acute clinical syndrome due to inadequate supply of oxygen to the heart muscle, including unstable angina, non ST segment elevation myocardial infarction and ST segment elevation infarction.

### Adjusted Clinical Group (ACG) Case-Mix 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 all known diagnoses assigned by their health care providers over a defined time period (typically, one year).

### Administrative Data

Information collected usually by government, primarily for administrative purposes such as reimbursing physicians or hospitals; this data may also be used for research or surveillance purposes. MCHP's research uses administrative data from hospital discharge summaries, physician billing claims, claims for prescription drugs, and other health related data. Using these data, researchers can study the utilization of health resources over time and the variations in rates within and across the provinces.

### Cardiac Care Network of Ontario

Formerly called the Provincial Adult Cardiac Care Network, it oversees the provision of adult cardiac services in Ontario using a centralized, computerized information system. It also advises the provincial health ministry on all matters related to these services.

### Cardiaccess Registry
The wait time and access database of the **Cardiac Care Network of Ontario.**

### Carotid Endarterectomy
Also called carotid artery surgery, it is the surgical removal of plaque from the carotid artery, to improve blood flow to the brain. See Appendix Table 1.2 for codes used to identify this procedure.

### Carpal Tunnel Release
Surgical release of pressure on the nerve in the carpal tunnel in the wrist. See Appendix Table 1.2 for codes used to identify this procedure.

### Case-Control
Studies in which individuals who already have a certain condition are compared with individuals who do not. They compare study subjects retrospectively .

### Cataract
Clouding of the normally clear lens of the eye, thereby preventing light from passing through. This results in blurred and distorted vision, sensitivity to light and glare, and increasing nearsightedness. Surgery involves replacing the lens of the eye with an artificial lens. See Appendix Table 1.2 for codes used to identify this procedure.

### Cholecystectomy
Surgical removal of the gallbladder. It can be done through an abdominal incision (open cholecystectomy) or through smaller incisions using a small video camera on a tube called a laparoscope (laparoscopic cholecystectomy). See Appendix Table 1.2 for codes used to identify this procedure.

### Chronic Obstructive Pulmonary Disease (COPD)
A group of lung diseases characterized by limited airflow to, and destruction of, lung tissue. Emphysema and chronic bronchitis are the most common forms of COPD. See Appendix Table 1.2 for codes used to identify this procedure.

### Congestive Heart Failure (CHF)
Also called congestive cardiac failure or just heart failure, it is the inability of the heart to pump a sufficient amount of blood throughout the body.

### Coronary Artery Bypass Graft (CABG)
Surgical procedure that reroutes blood around a blocked coronary artery using a healthy blood vessel from another part of the body, thereby improving oxygen and blood flow to the heart. See Appendix Table 1.2 for codes used to identify this procedure.

### Correlation Coefficient, r
An indicator of the strength and direction of a linear relationship between two variables. Its absolute value can range from 0 (no relationship) to 1 (a perfect relationship). The sign of the coefficient indicates the direction of the relationship. In this study we used **Spearman's rank-order correlation** to compare median wait times calculated using the registry versus administrative data.

### Day Procedure
A "same day" **elective** surgical procedure.

### Dissemination Area (DA)
"A small, relatively stable geographic unit composed of one or more blocks. It is the smallest standard geographic area for which all census data are disseminated. DAs cover all the territory of Canada" (http://www12.statcan.ca/english/census01/Products/Reference/dict/geo021.htm). The DA replaces the **enumeration area** as a basic unit for dissemination.

### Elective Procedure
Surgical procedure for a patient admitted to hospital through the admitting department and listed on a slate for treatment prior to admission.

### Electrocardiogram (ECG)
Test that records the electrical activity of the heartbeat. In this study the cardaic registry data included exercise ECG risk. An exercise ECG tests the effect of exercise on your heart.

### Emergent Procedure
"Surgical procedure for a patient with a hospital admission status of emergent (i.e. patients who have a life threatening condition requiring immediate assessment and treatment. Delay is harmful to the patient)" (Hospital Abstract Users Manual, 1987).

### Enumeration Area
"The geographic area canvassed by one census representative. An EA is composed of one or more adjacent blocks. EAs cover all the territory of Canada. Enumeration areas are only used for census data collection. The **dissemination area** (DA) replaces the EA as a basic unit for dissemination" (Statistics Canada).

### Hernia Repair
Surgical repair of a hernia (i.e., protrusion of underlying tissue through a weakness in a muscular wall (usually of the lower abdomen)). See Appendix Table 1.2 for codes used to identify this procedure.

### Hospital Discharge Abstract
A computerized record containing information taken from a person's medical chart that is created at the time the person is discharged from an acute care hospital. Also called "Hospital Discharge Abstract" or "Hospital Separation Abstract." The Hospital Abstract User Manual (HAUM) contains the appropriate coding rules and processing details.

### 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 Quintile
A method to measure the average (mean) household income of residents, ranking them from poorest to wealthiest, and then grouping them into 5 income quintiles (1 being poorest and 5 being wealthiest), each quintile containing approximately 20% of the population. The income quintile measure is derived from Statistics Canada Census data by aggregating household income to the enumeration area and then ranking neighbourhoods by income quintile. Income quintiles are available for both urban and rural populations. Income quintiles are often used as a proxy measure of socioeconomic status.

### Logistic Regression
Statistical technique for estimating the probability of an event based on two or more variables.

### Manitoba Cataract Surgery Waiting List Program (MCWLP)
Created in 1993, this provincial program monitors cataract surgery waiting lists and prioritizes patients using a centralized database.

### Median
The middle of an ordered set of scores. It is a more appropriate measure than the mean when analyzing highly skewed distributions because it is less influenced by extreme outliers.

### Morbidity
Any deviation from a state of physiological or psychological well-being. In this study, morbidity for each individual was measured using the Adjusted Clinical Group (ACG) value which reflects the person's consumption of health services over a certain time period (in this case, the year prior to the date of surgery).

### Myocardial Infarction (MI)
A heart attack; it occurs when an area of heart muscle dies or is permanently damaged because of an inadequate supply of oxygen-rich blood to that area.

### Osteoarthritis
Also known as degenerative arthritis or degenerative joint disease, and sometimes referred to as "arthrosis" or "osteoarthrosis"), is a condition in which low-grade inflammation results in pain in the joints, caused by wearing of the cartilage that covers and acts as a cushion inside joints. As the bone surfaces become less well protected by cartilage, the patient experiences pain upon weight bearing, including walking and standing. Due to decreased movement because of the pain, regional muscles may atrophy, and ligaments may become more lax. OA is the most common form of arthritis.

### Pattern Mixture Model
A statistical model that takes into account the relationship between predictors and missing data points, allowing for unbiased estimates of the effects of predictors on the outcome variable.

### Personal Health Identification Number (PHIN)
A unique numeric identifier assigned by Manitoba Health to every person registered for health insurance in Manitoba, and to non-residents who are treated at facilities which submit claims

electronically. Introduced as a linkage key in 1984, it was issued to the public in 1994 as the basic access identifier for the Pharmacare/Drug Programs Information Network (DPIN). At MCHP, PHIN is either a scrambled version of the Manitoba Health PHIN or an alphanumeric identifier assigned via the Research Registry to individuals who do not have scrambled numeric PHINs.

### 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 physicians on alternate payment plans (APP) are for administrative purposes only. The physician claims data file is part of the **Population Health Research Data Repository** (**Repository**).

### Physician Resource Database

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

### Population Health Research Data Repository (Repository)

A comprehensive collection of administrative, registry, survey and other databases primarily comprising residents of Manitoba housed at the Manitoba Centre for Health Policy (MCHP). It was developed to describe and explain patterns of health care and profiles of health and illness, facilitating inter-sectoral research in areas such as health care, education, and social services. The administrative health database, for example, holds records for virtually all contacts with the provincial health care system, the Manitoba Health Services Insurance Plan (including physicians, hospitals, personal care homes, home care, and pharmaceutical prescriptions) of all registered individuals. MCHP acts as a steward of the information in the Repository for agencies such as Manitoba Health.

### Regional Health Authorities (RHAs)

Regional governance structures set up by the province to be responsible for the delivery and administration of health services in specified areas. In Manitoba, as of 2002, there are 11 RHAs.

### Research Registry

A population-based database that contains longitudinal demographic histories for every individual who has registered for the Manitoba Health Services Insurance Plan since 1970. The data are organized by family registration numbers and includes information on dates of coverage, age, sex, marital status and place of residence (by postal code and municipal code only; no addresses are contained in the file).

### Rural South

An aggregate geography which includes all of the **Regional Health Authorities** (**RHAs**) in the south and the mid-province of Manitoba except the two urban centres of Winnipeg and Brandon. Those RHAs include: South Eastman, Central, Assiniboine, Interlake, North Eastman, and Parkland.

### Spearman's Rank-Order Correlation

A **correlation coefficient** used to describe the degree of relationship between a predictor and outcome variable when they have both been measured on ordinal scales (Abrami et al., 2007).

### Survival Analysis

Analysis of data that deals with time until the occurrence of any well-defined event. In this study, it was used to analyze the length of time patients waited for surgery.

### Tariff Code

A specific code used to identify each service provided by physicians or nurse practitioners, as defined in the tariff manual.

### Tariff Manual

A manual defining the specific services and fee schedule for which a physician may bill Manitoba Health. This is updated on a regular basis.

### Tonsillectomy & Adenoidectomy

The surgical removal of tonsils and/or adenoid glands.

### Transurethral Prostatectomy (TURP)

The surgical removal of the prostate gland via the urethra (the tube through which urine is discharged from the bladder), that is, not requiring an incision into the abdomen.

### Urgent Procedure

In this study, any procedure that was associated with an urgent hospital admission i.e., patients whose condition requires immediate assessment but for whom delayed action would be threatening to life. Proper treatment should commence within a few hours.

### Vital Statistics

A Manitoba government department responsible for keeping records and registries of all births, deaths, marriages and stillbirths that take place in Manitoba.

### Wait Time (surgical)

The time from when the decision for surgery has been made to the date of the surgery.

# APPENDIX 1

## Appendix Table 1.1: Tariff Codes Used

| Tariff Codes | Tariff Description | 8 Common Procedures | Cataract | Cardiac |
|---|---|---|---|---|
| 8403 | Regional history and examination or subsequent visit | ✓ | ✓ | ✓ |
| 8500 | Visits complete history physical exam for pts aged 75+ | ✓ | ✓ | ✓ |
| 8501 | Office visits, regional history and | ✓ | ✓ | ✓ |
| 8505 | Office visits, regional history and | | ✓ | |
| 8507 | Office visits, subsequent visit | ✓ | ✓ | ✓ |
| 8509 | Office visits, regional or subsequent visit or well baby care | ✓ | ✓ | ✓ |
| 8510 | Regional history & exam in hospital | ✓ | ✓ | ✓ |
| 8513 | Visits regional or sub visit for patients aged 75+ | ✓ | ✓ | ✓ |
| 8529 | Office visits, regional intermediate visit or subsequent visit or well-baby | ✓ | ✓ | ✓ |
| 8530 | Office visits, subsequent visit | ✓ | ✓ | ✓ |
| 8540 | Office visits, complete history and physical examination, new patient | ✓ | ✓ | ✓ |
| 8543 | Office visits, complete history & ocular exam incl refraction & other necessary tests | | ✓ | |
| 8548 | Office visits, regional history and examination, otorhinolaryngology | ✓ | | |
| 8549 | Office visits, subsequent visit, otorhinolaryngology | ✓ | | |
| 8550 | Consultation | ✓ | ✓ | ✓ |
| 8556 | Ophthalmology - consultation, incl. Refraction & other necessary tests(dr or | | ✓ | |
| 8557 | Otorhinolaryngology, consultation | ✓ | ✓ | ✓ |
| 8594 | Complete history and physical exam, unassigned pt. | ✓ | ✓ | ✓ |
| 8595 | Consultation, unassigned patient | ✓ | ✓ | ✓ |
| 9847 | Special diagnostic ocular tests, gonioscopy or 3 mirror examination, bilateral | | ✓ | |
| 9890 | Ultrasonography of eye to determine axial length (re cataract surgery)-total | | ✓ | |
| 9891 | Ultrasonography of eye re cataract surgery-prof | | ✓ | |

## Appendix Table 1.2: Procedure & Diagnosis Codes Used

| Procedure Names | Procedure Codes | Diagnosis Names | Diagnosis Codes |
|---|---|---|---|
| **Cholecystectomy** | | | |
| Total Cholecystectomy | 5122 | Calculus of gallbladder with acute cholecystitis | 5740 |
| Laparoscopic Cholecystectomy | 5123 | Calculus of gallbladder with other cholecystitis | 5741 |
| | | Calculus of bile duct with acute cholecystitis | 5743 |
| | | Calculus of bile duct with other cholecystitis | 5744 |
| | | Acute cholecystitis | 5750 |
| | | Other cholecystitis | 5751 |
| | | Calculus of gallbladder without mention of cholecystitis | 5742 |
| | | Calculus of bile duct without mention of cholecystitis | 5745 |
| | | Cholangitis | 5761 |
| | | Abdominal pain | 7890 |
| **Hernia Repair** | | | |
| Bilateral repair inguinal hernia, NOS | 5310 | Inguinal hernia with obstruction, without mention of gangrene | 5501 |
| Bilateral repair direct ing hernia | 5311 | Inguinal hernia, without mention of obstruction or gangrene | 5509 |
| Bilateral repair indirect ing hernia | 5312 | Femoral hernia | 5530 |
| Bilateral repair ing hernia, one direct and one indirect | 5313 | Femoral hernia with obstruction | 5520 |
| Bilateral repair direct ing hernia with graft or prosthesis | 5314 | | |
| Bilateral repair indirect ing hernia with graft or prosthesis | 5315 | | |
| Bilateral repair of ing hernia, one direct, one indirect with graft or pros | 5316 | | |
| Bilateral ing hernia repair with graft or prosthesis, NOS | 5317 | | |
| Other bilateral femoral herniorrhaphy | 5339 | | |
| Bilateral repair of femoral hernia with graft or prosthesis | 5331 | | |
| Unilateral repair ing. hernia NOS | 5300 | | |
| Uni repair direct ing. hernia | 5301 | | |
| Uni repair of indirect ing. hernia | 5302 | | |
| Uni repair of direct with graft or prosthesis | 5303 | | |

| Procedure Names | Procedure Codes | Diagnosis Names | Diagnosis Codes |
|---|---|---|---|
| Uni repair of femoral hernia with graft or prosthesis | 5321 | | |
| Other uni femoral herniorrhaphy | 5329 | | |
| Bilateral repair of femoral hernia with graft or prosthesis | 5331 | | |
| Other bilateral femoral herniorrhaphy | 5339 | | |
| **Excision of Breast Lesions** | | | |
| Lumpectomy | 8521 | Sebaceous cyst | 7062 |
| Resection of quadrant of breast | 8522 | Malignant neoplasms of female breast | 174x |
| Subtotal Mastectomy | 8523 | Carcinoma in situ of breast | 2330<br>2333 |
| Subcutaneous mammectomy with synchronous implant, unilateral | 8533 | Observation for suspected malignant neoplasm | V711 |
| Other subcutaneous mammectomy, unilateral | 8534 | | |
| Subcutaneous mammectomy with synchronous implant, bilateral | 8535 | | |
| Other subcutaneous mammectomy, bilateral | 8536 | | |
| Simple mastectomy, unilateral | 8541 | Benign mammary dysplasias (610, 6101-6109) | 610x |
| Simple mastectomy, bilateral | 8542 | | |
| Extended simple mastectomy, unilateral | 8543 | Lipoma | 214 |
| Extended simple mastectomy, bilaterl | 8544 | | |
| Radical Mastectomy, unilateral | 8545 | Benign neoplasm of breast | 217 |
| Radical mastectomy, bilateral | 8546 | | |
| Extended radical mastectomy, unilaterl | 8547 | Benign neoplasm of skin of trunk, except scrotum | 2165 |
| Extended radical mastectomy, bilateral | 8548 | | |
| **Stripping/Ligation Varicose Vein** | 385x | | |
| | | Varicose veins of lower extremities with ulcer | 4540 |
| | | Varicose veins of lower extremities with inflammation | 4541 |
| | | Varicose veins of lower extremities with ulcer and inflammation | 4542 |

| Procedure Names | Procedure Codes | Diagnosis Names | Diagnosis Codes |
|---|---|---|---|
| | | Varicose veins of lower extremities without mention of ulcer or inflammation | 4549 |
| **Carpal Tunnel Release** | 0443 | Carpal tunnel syndrome | 3540 |
| | | | |
| **Transurethral Prostatectomy** | 602 | Hyperplasia of prostrate | 600 |
| | | | |
| **Tonsillectomy & Adenoidectomy** | | | |
| Tonsillectomy without adenoid | 282 | Chronic tonsillitis | 4740 |
| Tonsillectomy with adenoidectomy | 283 | Hypertrophy of tonsils and adenoids | 4741 |
| Excision of tonsil tag | 284 | Other chronic diseases tonsils and adenoids | 4748 |
| Adenoidectomy without tonsils | 286 | Unspecified chronic disease of tonsils and adenoids | 4749 |
| | | Acute tonsillitis | 463 |
| **Carotid endarterectomy** | 3812 | | |
| **Cataract**[1] | | | |
| Extracapsular extraction of lens by linear extraction technique | 132 | | |
| Extracapsular extraction of lens by simple aspiration & irrigation | 133 | | |
| Intracapsular extraction of lens by temporal inferior route | 1311 | | |
| Other intracapsular extraction of lens | 1319 | | |
| Phacoemulsification and aspiration | 1341 | | |
| Mechanical phacofragmentation and other aspiration of cataract | 1343 | | |
| Extracapsular extraction of lens by temporal inferior route | 1351 | | |
| Other extracapsular extraction of lens | 1359 | | |
| **Cardiac** | | | |
| Aortocoronary bypass not otherwise specified | 3610 | | |
| Aortocoronary bypass of 1 coronary artery | 3611 | | |
| Aortocoronary bypass of 2 coronary arteries | 3612 | | |
| Aortocoronary bypass of 3 coronary arteries | 3613 | | |
| Aortocoronary bypass of 4+ | 3614 | | |

| Procedure Names | Procedure Codes | Diagnosis Names | Diagnosis Codes |
|---|---|---|---|
| coronary arteries | | | |
| Single internal mammary- coronary artery bypass | 3615 | | |
| Double internal mammary-coronary artery bypass | 3616 | | |
| Other bypass anastomosis | 3619 | | |
| **Heart Valve Replacement** | | | |
| Replacement of unspecified heart valve | 3520 | | |
| Replacement of aortic valve with tissue graft | 3521 | | |
| Other replacement of aortic valve | 3522 | | |
| Replacement of mitral valve with tissue graft | 3523 | | |
| Other replacement of mitral valve | 3524 | | |
| Replacement of pulmonary valve with tissue graft | 3525 | | |
| Other replacement of pulmonary valve | 3526 | | |
| Replacement of tricuspid valve with tissue graft | 3527 | | |
| Other replacement of tricuspid valve | 3528 | | |
| **Hip Replacement** | | | |
| Joint replacement of lower extremity | 8150 | | |
| Total hip replacement | 8151 | | |
| **Knee Replacement** | | | |
| Joint replacement of lower extremity | 8150 | | |
| Total knee replacement | 8154 | | |

[1] In order to identify cataract surgeries performed in private clinics, we also used tariffs 5611 (crystalline lens, extraction of lens, intracapsular or extra-capsular, unilateral) and 5612 (crystalline lens, extraction of lens with insertion of intra-ocular implant, unilateral) from the surgeons' claims and ensured they did not also appear in the hospital abstracts.

# APPENDIX 2

# Box Plot Data

**Appendix Table 2.1a: Excision of breast lesions, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 1,181 | 20 | 7 | 11 | 38 | 58 |
| **2000/01** | 1,150 | 21 | 7 | 12 | 36 | 62 |
| **2001/02** | 911 | 19 | 7 | 12 | 31 | 51 |
| **2002/03** | 984 | 21 | 8 | 13 | 35 | 52 |
| **2003/04** | 887 | 22 | 8 | 13 | 35 | 58 |
| 1999/2000- 2003/04 | 5,113 | 20 | 7 | 12 | 35 | 57 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.1b: Excision of breast lesions, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 68 | 30 | 7 | 16 | 44 | 123 |
| **Nor-Man** | 74 | 19 | 6 | 10 | 30 | 44 |
| **Winnipeg** | 3,096 | 21 | 8 | 12 | 36 | 58 |
| **Central** | 347 | 16 | 6 | 9 | 31 | 55 |
| **North Eastman** | 149 | 18 | 6 | 11 | 28 | 46 |
| **Interlake** | 341 | 22 | 8 | 12 | 35 | 54 |
| **South Eastman** | 196 | 20 | 7 | 13 | 33 | 65 |
| **Brandon** | 260 | 21 | 10 | 14 | 28 | 38 |
| **Assiniboine** | 359 | 22 | 10 | 14 | 34 | 60 |
| **Parkland** | 223 | 16 | 6 | 9 | 33 | 50 |
| **Manitoba** | 5,113 | 20 | 7 | 12 | 35 | 57 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.2a: Carotid Endarterectomy, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 235 | 22 | 7 | 10 | 46 | 76 |
| **2000/01** | 200 | 26 | 10 | 14 | 67 | 107 |
| **2001/02** | 214 | 21 | 4 | 10 | 45 | 95 |
| **2002/03** | 143 | 18 | 7 | 10 | 39 | 62 |
| **2003/04** | 125 | 18 | 6 | 10 | 35 | 80 |
| **1999/2000–2003/04** | 917 | 22 | 7 | 11 | 46 | 87 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.2b: Carotid Endarterectomy, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 19 | 31 | 5 | 11 | 49 | 72 |
| **Nor-Man** | 11 | 13 | 5 | 6 | 43 | 55 |
| **Winnipeg** | 521 | 22 | 7 | 11 | 51 | 92 |
| **Central** | 59 | 15 | 6 | 9 | 29 | 64 |
| **North Eastman** | 31 | 19 | 7 | 11 | 62 | 100 |
| **Interlake** | 101 | 26 | 7 | 12 | 45 | 82 |
| **South Eastman** | 37 | 20 | 8 | 12 | 36 | 69 |
| **Brandon** | 50 | 16 | 5 | 8 | 46 | 81 |
| **Assiniboine** | 55 | 23 | 6 | 11 | 45 | 84 |
| **Parkland** | 33 | 21 | 7 | 11 | 58 | 74 |
| **Manitoba** | 917 | 22 | 7 | 11 | 46 | 87 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.3a: Cholecystectomy, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 2,073 | 36 | 11 | 20 | 61 | 104 |
| **2000/01** | 2,196 | 36 | 10 | 20 | 63 | 114 |
| **2001/02** | 2,078 | 36 | 11 | 19 | 68 | 121 |
| **2002/03** | 2,028 | 38 | 11 | 20 | 69 | 120 |
| **2003/04** | 2,070 | 36 | 11 | 19 | 66 | 112 |
| **1999/2000-2003/04** | 10,445 | 36 | 11 | 20 | 65 | 114 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.3b: Cholecystectomy, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 609 | 47 | 8 | 21 | 97 | 179 |
| **Nor-Man** | 271 | 25 | 6 | 12 | 47 | 73 |
| **Winnipeg** | 5,365 | 36 | 11 | 20 | 64 | 111 |
| **Central** | 935 | 26 | 8 | 15 | 45 | 79 |
| **North Eastman** | 481 | 29 | 10 | 17 | 55 | 100 |
| **Interlake** | 804 | 37 | 12 | 20 | 56 | 91 |
| **South Eastman** | 553 | 48 | 14 | 28 | 76 | 124 |
| **Brandon** | 354 | 55 | 18 | 28 | 103 | 182 |
| **Assiniboine** | 580 | 44 | 14 | 22 | 87 | 164 |
| **Parkland** | 493 | 41 | 11 | 22 | 67 | 92 |
| **Manitoba** | 10,445 | 36 | 11 | 20 | 65 | 114 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.4a: Carpal Tunnel Release, unadjusted wait times by fiscal year (days)**

| | Number Analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 835 | 49 | 13 | 24 | 99 | 166 |
| **2000/01** | 879 | 56 | 14 | 28 | 115 | 200 |
| **2001/02** | 733 | 58 | 14 | 28 | 118 | 187 |
| **2002/03** | 750 | 64 | 15 | 29 | 140 | 209 |
| **2003/04** | 932 | 58 | 14 | 26 | 113 | 220 |
| **1999/2000-2003/04** | 4,129 | 56 | 14 | 27 | 117 | 200 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.4b: Carpal Tunnel Release, unadjusted wait times by RHA, 1999/2000 - 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 72 | 75 | 22 | 41 | 122 | 160 |
| **Nor-Man** | 70 | 17 | 5 | 7 | 46 | 115 |
| **Winnipeg** | 1,844 | 77 | 17 | 36 | 151 | 226 |
| **Central** | 406 | 30 | 9 | 17 | 70 | 149 |
| **North Eastman** | 185 | 50 | 14 | 25 | 105 | 193 |
| **Interlake** | 321 | 62 | 17 | 33 | 120 | 200 |
| **South Eastman** | 242 | 63 | 27 | 43 | 112 | 170 |
| **Brandon** | 215 | 48 | 14 | 26 | 101 | 176 |
| **Assiniboine** | 424 | 40 | 14 | 21 | 75 | 145 |
| **Parkland** | 350 | 40 | 12 | 21 | 69 | 110 |
| **Manitoba** | 4,129 | 56 | 14 | 27 | 117 | 200 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.5a: Transurethral Prostatectomy, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 513 | 27 | 9 | 16 | 46 | 76 |
| **2000/01** | 415 | 27 | 10 | 17 | 46 | 72 |
| **2001/02** | 399 | 32 | 11 | 19 | 50 | 76 |
| **2002/03** | 335 | 32 | 13 | 18 | 52 | 80 |
| **2003/04** | 385 | 38 | 14 | 22 | 62 | 88 |
| **1999/2000-2003/04** | 2,047 | 41 | 11 | 18 | 50 | 80 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.5b: Transurethral Prostatectomy, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number Analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 28 | 36 | 9 | 16 | 49 | 80 |
| **Nor-Man** | 19 | 32 | 15 | 20 | 59 | 68 |
| **Winnipeg** | 1,222 | 29 | 10 | 17 | 49 | 79 |
| **Central** | 173 | 29 | 11 | 18 | 48 | 84 |
| **North Eastman** | 70 | 30 | 9 | 16 | 51 | 79 |
| **Interlake** | 154 | 32 | 11 | 19 | 57 | 83 |
| **South Eastman** | 106 | 345 | 14 | 18 | 49 | 73 |
| **Brandon** | 79 | 33 | 16 | 23 | 57 | 76 |
| **Assiniboine** | 129 | 35 | 15 | 24 | 55 | 96 |
| **Parkland** | 67 | 37 | 16 | 24 | 63 | 143 |
| **Manitoba** | 2,047 | 41 | 11 | 18 | 50 | 80 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.6a: Hernia Repair, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 1,763 | 38 | 12 | 22 | 64 | 112 |
| **2000/01** | 1,836 | 42 | 13 | 23 | 70 | 125 |
| **2001/02** | 1,784 | 40 | 13 | 21 | 73 | 137 |
| **2002/03** | 1,733 | 41 | 12 | 21 | 72 | 121 |
| **2003/04** | 1,738 | 42 | 13 | 22 | 72 | 120 |
| **1999/2000-2003/04** | 8854 | 41 | 13 | 22 | 70 | 122 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.6b: Hernia Repair, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 96 | 36 | 8 | 15 | 71 | 117 |
| **Nor-Man** | 108 | 20 | 6 | 11 | 35 | 74 |
| **Winnipeg** | 5,014 | 41 | 13 | 22 | 69 | 119 |
| **Central** | 843 | 32 | 10 | 17 | 58 | 99 |
| **North Eastman** | 311 | 36 | 13 | 21 | 69 | 121 |
| **Interlake** | 578 | 38 | 13 | 21 | 63 | 102 |
| **South Eastman** | 525 | 54 | 20 | 34 | 79 | 131 |
| **Brandon** | 354 | 53 | 15 | 27 | 102 | 200 |
| **Assiniboine** | 612 | 49 | 14 | 26 | 88 | 194 |
| **Parkland** | 413 | 36 | 6 | 15 | 69 | 113 |
| **Manitoba** | 8,854 | 41 | 13 | 22 | 70 | 122 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.7a: Tonsillectomy & Adenoidectomy, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 1,727 | 61 | 18 | 32 | 97 | 144 |
| **2000/01** | 1,658 | 62 | 21 | 36 | 101 | 158 |
| **2001/02** | 1,688 | 79 | 24 | 44 | 139 | 179 |
| **2002/03** | 1,579 | 82 | 24 | 47 | 131 | 183 |
| **2003/04** | 1,326 | 70 | 22 | 37 | 120 | 190 |
| **1999/2000-2003/04** | 7,978 | 69 | 21 | 39 | 116 | 173 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.7b: Tonsillectomy & Adenoidectomy, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 273 | 67 | 22 | 41 | 119 | 201 |
| **Nor-Man** | 210 | 35 | 12 | 20 | 70 | 140 |
| **Winnipeg** | 4,050 | 72 | 24 | 43 | 120 | 176 |
| **Central** | 651 | 61 | 16 | 28 | 112 | 168 |
| **North Eastman** | 306 | 76 | 22 | 43 | 108 | 176 |
| **Interlake** | 489 | 72 | 25 | 44 | 121 | 183 |
| **South Eastman** | 529 | 65 | 20 | 38 | 103 | 174 |
| **Brandon** | 442 | 85 | 19 | 40 | 130 | 181 |
| **Assiniboine** | 651 | 71 | 19 | 36 | 123 | 166 |
| **Parkland** | 377 | 53 | 20 | 34 | 80 | 118 |
| **Manitoba** | 7,978 | 69 | 21 | 39 | 116 | 173 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.8a: Varicose Vein Stripping/Ligation, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 313 | 62 | 16 | 31 | 120 | 211 |
| **2000/01** | 291 | 56 | 15 | 29 | 108 | 200 |
| **2001/02** | 275 | 77 | 24 | 41 | 192 | 394 |
| **2002/03** | 294 | 96 | 14 | 43 | 189 | 356 |
| **2003/04** | 248 | 93 | 22 | 45 | 200 | 333 |
| **1999/2000-2003/04** | 1,421 | 72 | 17 | 36 | 154 | 312 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.8b: Varicose Vein Stripping/Ligation, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 39 | 103 | 12 | 37 | 205 | 447 |
| **Nor-Man** | 20 | 20 | 8 | 11 | 53 | 140 |
| **Winnipeg** | 741 | 76 | 18 | 38 | 174 | 319 |
| **Central** | 162 | 47 | 12 | 21 | 101 | 207 |
| **North Eastman** | 36 | 128 | 28 | 45 | 232 | 377 |
| **Interlake** | 76 | 95 | 24 | 50 | 201 | 382 |
| **South Eastman** | 108 | 73 | 23 | 50 | 130 | 204 |
| **Brandon** | 59 | 102 | 18 | 44 | 231 | 470 |
| **Assiniboine** | 83 | 72 | 20 | 36 | 160 | 283 |
| **Parkland** | 97 | 62 | 12 | 36 | 93 | 135 |
| **Manitoba** | 1,421 | 72 | 17 | 36 | 154 | 312 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.9a: Cataract, unadjusted wait times by fiscal year (weeks)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 5,432 | 22 | 8 | 13 | 37 | 53 |
| **2000/01** | 5,408 | 24 | 9 | 14 | 37 | 52 |
| **2001/02** | 5,333 | 25 | 8 | 14 | 39 | 52 |
| **2002/03** | 5,743 | 21 | 6 | 11 | 35 | 50 |
| **2003/04** | 5,417 | 16 | 6 | 10 | 30 | 42 |
| **1999/2000-2003/04** | 27,333 | 21 | 7 | 12 | 35 | 50 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.9b: Cataract, unadjusted wait times by RHA (in weeks), 1999/2000 – 2003/04 (weeks)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 299 | 18 | 0 | 9 | 34 | 53 |
| **Nor-Man** | 286 | 19 | 8 | 13 | 35 | 48 |
| **Winnipeg** | 16,555 | 22 | 7 | 12 | 35 | 49 |
| **Central** | 765 | 22 | 8 | 13 | 37 | 52 |
| **North Eastman** | 1,992 | 23 | 8 | 13 | 35 | 48 |
| **Interlake** | 1,810 | 24 | 9 | 14 | 37 | 50 |
| **South Eastman** | 1,047 | 19 | 7 | 11 | 33 | 49 |
| **Brandon** | 1,447 | 17 | 7 | 11 | 30 | 54 |
| **Assiniboine** | 2,305 | 17 | 8 | 11 | 31 | 50 |
| **Parkland** | 827 | 29 | 10 | 16 | 43 | 61 |
| **Manitoba** | 27,333 | 21 | 7 | 12 | 35 | 50 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.10a: CABG – Urgent/Emergent, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 421 | 6 | 1 | 2 | 11 | 28 |
| **2000/01** | 343 | 7 | 1 | 4 | 14 | 48 |
| **2001/02** | 405 | 7 | 1 | 3 | 14 | 62 |
| **2002/03** | 337 | 6 | 1 | 2 | 12 | 42 |
| **2003/04** | 372 | 7 | 1 | 3 | 12 | 42 |
| **1999/2000-2003/04** | 1,878 | 7 | 1 | 3 | 13 | 43 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.10b: CABG – Urgent/Emergent, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 51 | 7 | 1 | 4 | 14 | 59 |
| **Nor-Man** | 25 | 7 | 0 | 3 | 10 | 20 |
| **Winnipeg** | 839 | 7 | 1 | 3 | 13 | 48 |
| **Central** | 102 | 6 | 1 | 2 | 8 | 27 |
| **North Eastman** | 57 | 7 | 1 | 3 | 13 | 79 |
| **Interlake** | 106 | 6 | 1 | 3 | 12 | 21 |
| **South Eastman** | 72 | 6 | 1 | 2 | 12 | 34 |
| **Brandon** | 63 | 6 | 1 | 3 | 15 | 34 |
| **Assiniboine** | 73 | 7 | 2 | 4 | 11 | 36 |
| **Parkland** | 69 | 7 | 1 | 2.5 | 11 | 23 |
| **Manitoba** | 1,878 | 7 | 1 | 3 | 13 | 43 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.11a: CABG – Elective, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 317 | 58 | 6 | 15 | 99 | 168 |
| **2000/01** | 337 | 70 | 6 | 14 | 140 | 237 |
| **2001/02** | 285 | 46 | 8 | 19 | 81 | 123 |
| **2002/03** | 344 | 38 | 7 | 13 | 86 | 173 |
| **2003/04** | 405 | 41 | 8 | 20 | 77 | 139 |
| **1999/2000-2003/04** | 1,688 | 46 | 7 | 16 | 97 | 169 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.11b: CABG – Elective, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 35 | 48 | 7 | 13 | 96 | 182 |
| **Nor-Man** | 37 | 50 | 7 | 22 | 103 | 174 |
| **Winnipeg** | 1005 | 41 | 7 | 14 | 93 | 157 |
| **Central** | 131 | 56 | 8 | 25 | 115 | 194 |
| **North Eastman** | 53 | 27 | 6 | 13 | 88 | 155 |
| **Interlake** | 123 | 54 | 6 | 20 | 83 | 165 |
| **South Eastman** | 59 | 55 | 8 | 20 | 106 | 162 |
| **Brandon** | 62 | 73 | 10 | 27 | 146 | 188 |
| **Assiniboine** | 97 | 42 | 8 | 15 | 104 | 172 |
| **Parkland** | 86 | 58 | 13 | 24 | 112 | 167 |
| **Manitoba** | 1,688 | 46 | 7 | 16 | 97 | 169 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.12a: Heart Valve Surgery - Elective, unadjusted wait times by fiscal year (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **1999/2000** | 77 | 77 | 24 | 38 | 127 | 209 |
| **2000/01** | 73 | 125 | 29 | 81 | 185 | 229 |
| **2001/02** | 84 | 67 | 20 | 35 | 124 | 215 |
| **2002/03** | 88 | 68 | 19 | 40 | 120 | 163 |
| **2003/04** | 81 | 65 | 20 | 34 | 120 | 206 |
| **1999/2000-2003/04** | 403 | 83 | 23 | 38 | 134 | 216 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.12b: Heart Valve Surgery - Elective, unadjusted wait times by RHA, 1999/2000 – 2003/04 (days)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Winnipeg** | 223 | 84 | 23 | 35 | 135 | 215 |
| **Brandon** | 14 | 100 | 39 | 50 | 130 | 202 |
| **North** | 15 | 97 | 32 | 67 | 195 | 260 |
| **Rural South** | 151 | 71 | 23 | 40 | 125 | 215 |
| **Manitoba** | 403 | 83 | 23 | 38 | 134 | 216 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.13a: Hip Replacement, unadjusted wait times by fiscal year (weeks)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **2000/01** | 62 | 12 | 4 | 8 | 23 | 34 |
| **2001/02** | 368 | 14 | 6 | 9 | 24 | 41 |
| **2002/03** | 482 | 20 | 8 | 13 | 32 | 54 |
| **2003/04** | 485 | 28 | 11 | 18 | 41 | 63 |
| **2000/01-2003/04** | 1,397 | 12 | 7 | 12 | 34 | 52 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.13b: Hip Replacement, unadjusted wait times by RHA, 2000/01 – 2003/04 (weeks)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 22 | 30 | 18 | 20 | 41 | 54 |
| **Nor-Man** | 18 | 21 | 7 | 11 | 30 | 35 |
| **Winnipeg** | 860 | 20 | 7 | 12 | 33 | 52 |
| **Central** | 143 | 20 | 7 | 12 | 35 | 55 |
| **North Eastman** | 46 | 21 | 7 | 14 | 34 | 50 |
| **Interlake** | 118 | 18 | 7 | 10 | 32 | 45 |
| **South Eastman** | 36 | 28 | 7 | 16 | 43 | 65 |
| **Brandon** | 31 | 26 | 11 | 18 | 40 | 57 |
| **Assiniboine** | 62 | 21 | 7 | 13 | 36 | 48 |
| **Parkland** | 61 | 19 | 7 | 12 | 28 | 47 |
| **Manitoba** | 1,397 | 12 | 7 | 12 | 34 | 52 |

**Source:** Manitoba Centre for Health Policy, 2007

**Appendix Table 2.14a: Knee Replacement, unadjusted wait times by fiscal year (weeks)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **2000/01** | 117 | 15 | 5 | 9 | 20 | 28 |
| **2001/02** | 634 | 15 | 7 | 11 | 26 | 39 |
| **2002/03** | 803 | 23 | 10 | 15 | 34 | 53 |
| **2003/04** | 762 | 31 | 11 | 19 | 44 | 66 |
| **2000/01-2003/04** | 2,316 | 22 | 8 | 14 | 35 | 53 |

Source: Manitoba Centre for Health Policy, 2007

**Appendix Table 2.14b: Knee Replacement, unadjusted wait times by RHA, 2000/01 – 2003/04 (weeks)**

| | Number analyzed | Median | 10th percentile | 25th percentile | 75th percentile | 90th percentile |
|---|---|---|---|---|---|---|
| **Burntwood/Churchill** | 38 | 31 | 12 | 23 | 51 | 77 |
| **Nor-Man** | 34 | 23 | 12 | 15 | 34 | 43 |
| **Winnipeg** | 1,468 | 21 | 8 | 13 | 35 | 53 |
| **Central** | 191 | 24 | 9 | 15 | 37 | 49 |
| **North Eastman** | 99 | 18 | 8 | 11 | 31 | 53 |
| **Interlake** | 196 | 21 | 7 | 14 | 30 | 42 |
| **South Eastman** | 86 | 26 | 11 | 16 | 39 | 59 |
| **Brandon** | 21 | 21 | 11 | 14 | 38 | 54 |
| **Assiniboine** | 74 | 27 | 12 | 15 | 35 | 57 |
| **Parkland** | 109 | 25 | 10 | 17 | 40 | 54 |
| **Manitoba** | 2,316 | 22 | 8 | 14 | 35 | 53 |

Source: Manitoba Centre for Health Policy, 2007

# APPENDIX 3

# TECHNICAL APPENDIX: DEVELOPING ALGORITHMS FOR WAIT TIMES USING ADMINISTRATIVE DATA

## Methods

The three sources of registry data were the Manitoba Cataract Surgery Waiting List Program registry, the Cardiaccess registry and the HKR registry. The de-identified registry files were linked via encrypted **PHIN** to the population registry in the Repository. Registry records with no PHIN were excluded. Records in the registry files were matched with administrative data files based on PHIN, date of surgery and surgical procedure codes. Out-of-province patients were excluded. For cataract and HKR surgery, only elective or day patients as identified in the administrative data were included; both elective and urgent/emergent cases were included for cardiac surgery. Procedure codes used in the administrative data are in Appendix 1.

Checks were made between variables that were in common between the registry and administrative data. These variables included date of birth, sex, procedure performed, and postal code or RHA. Previous linkage work (by the principal author, Carolyn De Coster) has shown that certain fields tend to be more accurate than others: the recording of sex is highly accurate whereas the recording of birth dates and postal code information tends to be less accurate. Therefore one can expect that match rates for the latter two will be somewhat lower.

Where a match was made on the basis of date of surgery, a search was made for pre-operative visits to the surgeon who performed the surgery. In each of the registries, one field identifies the start of the wait time. Wait times were calculated using the registry and administrative data methods for identifying the beginning of the wait time. Comparisons were then made between the mean and median wait times using the different methods, as well as **Spearman's rank order correlation coefficient**. Different algorithms were developed in order to improve the match between the registry and the administrative data.

For cataract surgery, a previously developed algorithm (De Coster, 2002) was applied. In this algorithm, if there was only one pre-op visit to the surgeon, it was used to estimate the wait times. If the closest visit was for an axial measurement of the eye,[1] or if it was within 70 days of surgery, then the second closest visit was used, if there was one. The third closest visit was used only if the second-closest visit was for radiology.

## Findings

### Linkage of Registry Data to Claims Data

Our ability to link administrative data to registry data varied across procedures. For cataract surgery, the proportion of cases found in the registry data for which there was a match within 6 days of the date of surgery in the registry was 93.6% (38,317/40,924).

[1] Tariff codes 9890, 9891.

For cardiac procedures, there were 3,008 CABG cases in the registry, 605 valve replacements, and 320 CABG + valve replacement procedures. We were able to match 92.1% (2,771/3,008) of the CABG, 74.7% (452/605) of the valve replacements and 78.8% (252/320) of the combined CABG + valve replacement cases. These were matches on the date of surgery and the procedure. There were a few discrepancies between the procedure in the administrative data versus that in the registry; when we permitted a match based on any cardiac procedure in the administrative data, then we found a record for a cardiac procedure that matched on the date of surgery with the registry for 92.4%, 82.6% and 90.0% for CABG, valve replacement and combined procedures, respectively.

For HKR surgery, we excluded emergent and urgent procedures. The date of surgery recorded in the registry and the administrative data had to be within 6 days of each other. Of all procedures in the registry, we found a match in the claims data for 90.4% (1,382/1,529) of primary hip replacements, 52.7% (203/385) of hip revisions, 95.4 (2,295/2,406) of primary knee replacements, and 63.8% (150/235) of knee revisions. The rest of our analyses focussed on the primary HKRs because they are the patients who are more likely to be waiting, whereas revision procedures are treated more urgently.

Appendix Table 3.1 shows the degree to which the administrative and registry data matched on a few demographic variables that were common between the two datasets. Birth date and sex matched at nearly 100%, whereas the agreement between postal code or RHA of residence was somewhat lower.

**Appendix Table 3.1**: **Comparison between administrative and Registry data for variables common to both datasets**

| | Hip Replacement | Knee Replacement | Cataract | CABG | Valve Replacement |
|---|---|---|---|---|---|
| **Birthdate** | 99.7% | 99.4% | 99.5% | 96.1% | 96.4% |
| **Sex** | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| **RHA/postal code** | 93.7% | 93.9% | 79.2% | 84.7% | 83.1% |

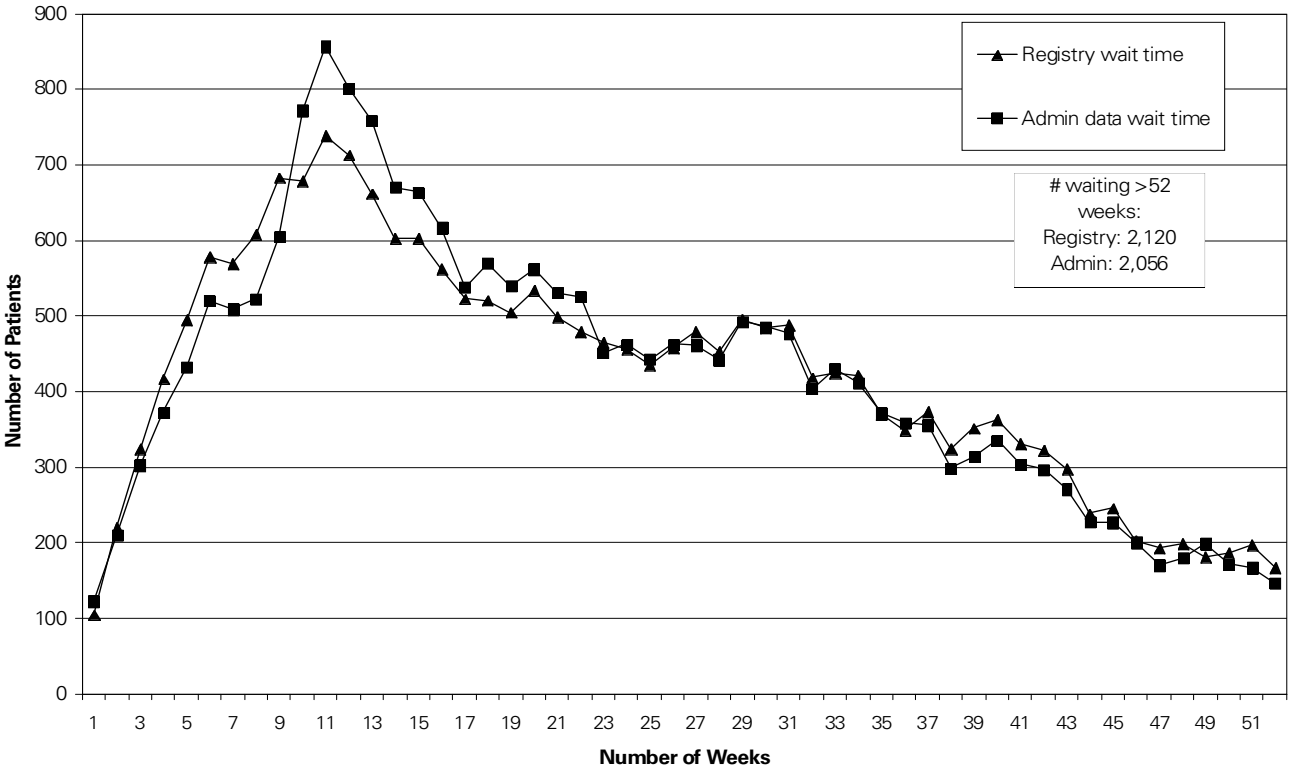
Source: Manitoba Centre for Health Policy, 2007

## Algorithm Development

### Cataract

For cataract surgery, we applied the previously developed algorithm as described above. We restricted the analysis to first-eye cataract surgery only. We found that this algorithm performed as it had done previously. The measure of agreement we used was Spearman's rank-order correlation, and it was 0.79. The median wait times were 23 weeks and 22 weeks for the registry and administrative data, respectively. The mean waiting times were 26.0 weeks for both registry and administrative data. Appendix Figure 3.1 illustrates the comparison between the wait times using registry and administrative data. We were satisfied that this algorithm did not require modification.

**Appendix Figure 3.1: Cataract Wait Times (weeks), Registry vs. Administrative Data**



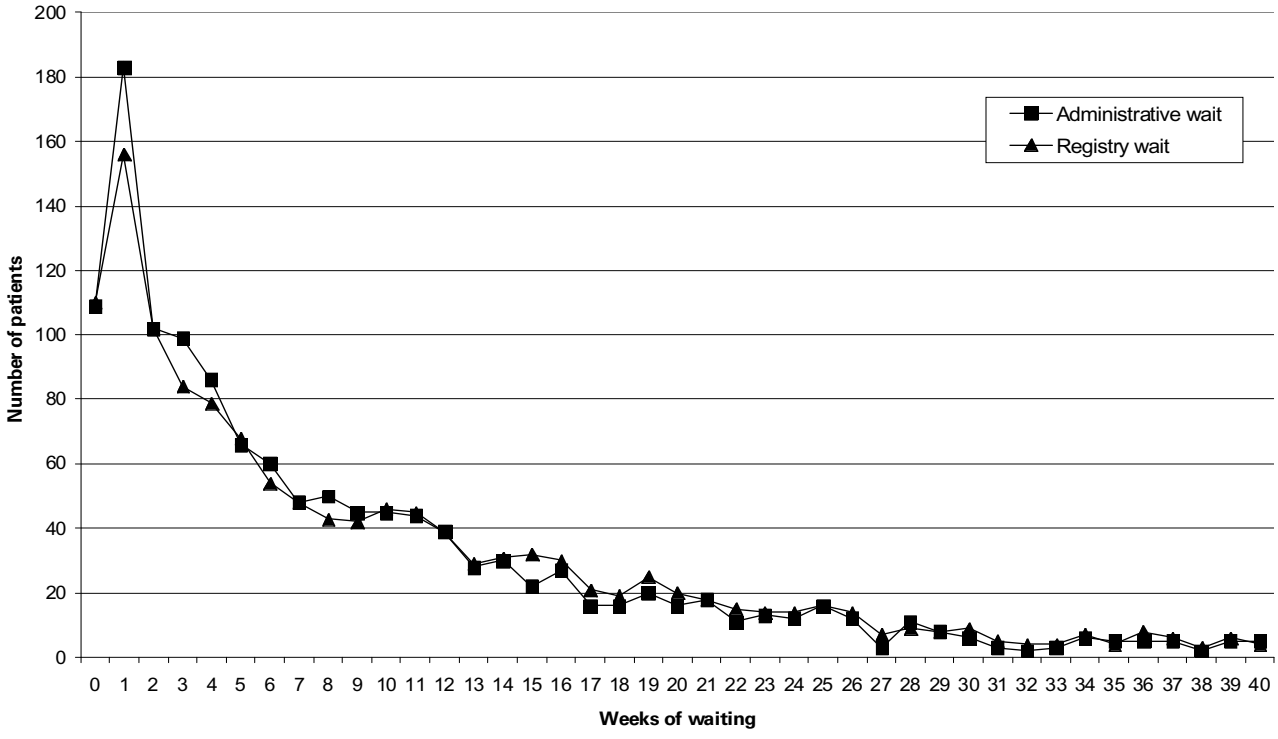

Source: Manitoba Centre for Health Policy, 2007

**Cardiac**

For all cardiac procedures, we defined the beginning of the wait time in different ways, trying to approximate the beginning of the wait time in the registry. We were more successful in developing an algorithm for CABG than for valve replacements. For CABG, we looked at the closest pre-operative visit, the closest angiogram pre-operatively, or an algorithm that required both a pre-op visit and an angiogram, selecting the one with the date closest to surgery as the beginning of the wait time. We separated urgent/emergent cases from elective cases.

For elective cases, the method that provided the closest match to the registry data was to define the date of the closest pre-operative visit (as long as it was at least 4 days before surgery) as the beginning of the wait or, if no visit could be found, the date of the angiogram closest to surgery: the Spearman's correlation was 0.87 using this method, and the median wait for elective CABG was 50 days in the registry compared to 44 days in the administrative data. To estimate the waits using administrative data for urgent/emergent CABG, the date of the closest angiogram was used. The median wait according to the registry was 6 days and according to the administrative data was 7 days with a Spearman's correlation of 0.86. Appendix Figure 3.2 illustrates the comparison between the two sources of data.

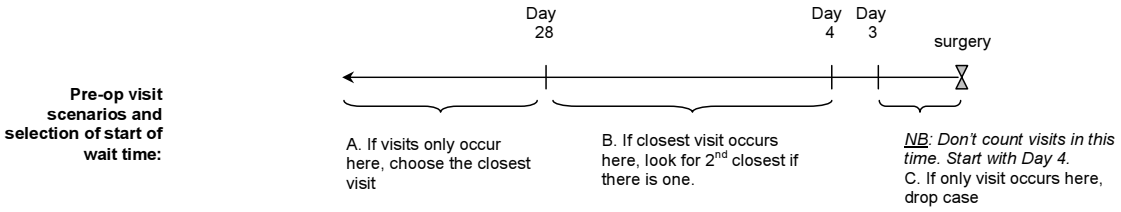
**Appendix Figure 3.2: Elective Coronary Artery Bypass Graft (CABG) Surgery Waits, Comparison of Registry vs. Administrative Data, 2000/01 - 2003/04**




Source: Manitoba Centre for Health Policy, 2007

For valve replacements, we first compared dates for the pre-operative visit closest to surgery and the 'acceptdate' field in the registry. This algorithm underestimated the wait times: median wait time in the administrative data was 3 weeks compared to 7 weeks in the registry (Spearman's r: 0.54). On examining the data, we made several modifications. We selected only elective procedures, excluded visits that occurred 3 or fewer days before surgery, and selected the second closest visit if the closest visit was within 28 days. (See Appendix Figure 3.3, below). With this algorithm, the median wait was 91 days and 84 days for the registry and administrative data respectively. Spearman's correlation was 0.77. (See Appendix Figure 3.4*).*

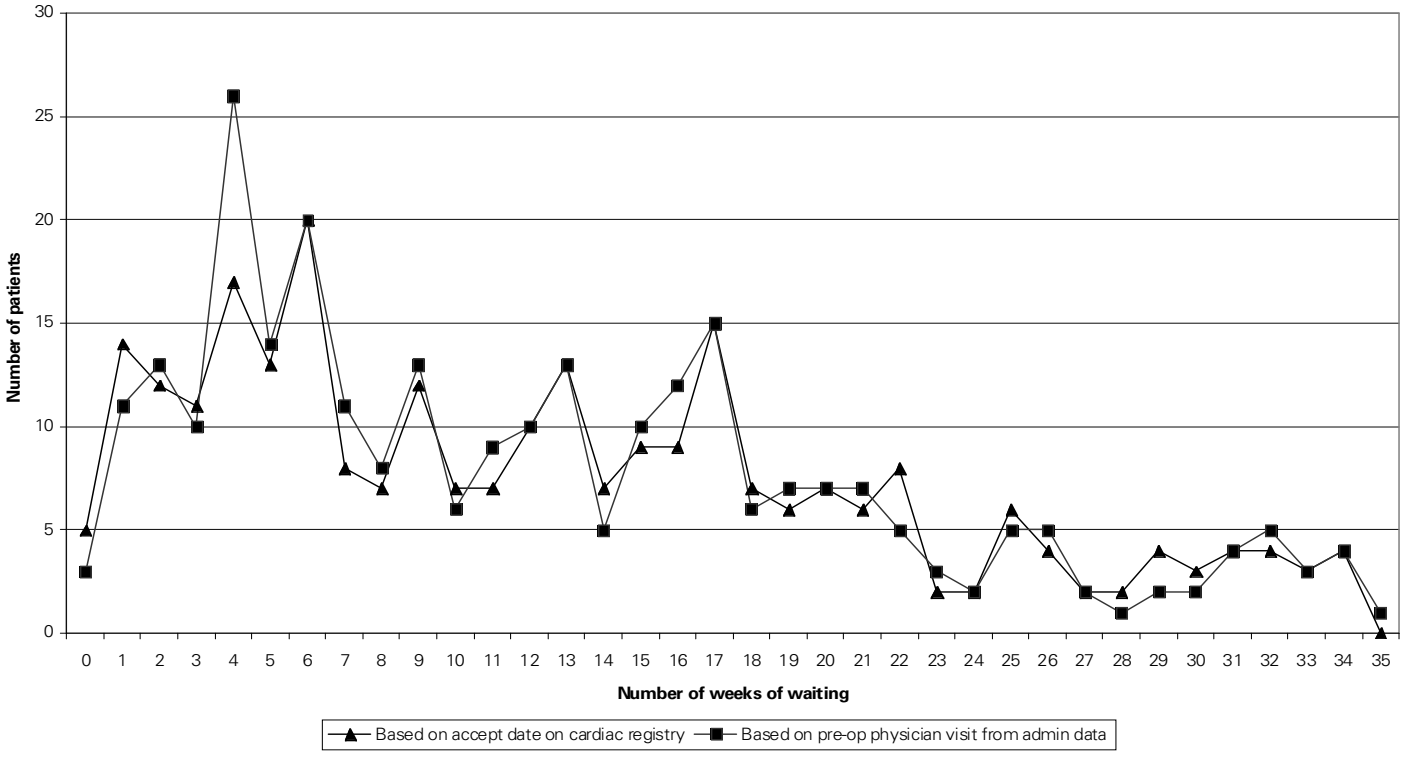
**Appendix Figure 3.3: Heart Valve Replacement: Algorithm Used to Define Start of Wait Time**




Source: Manitoba Centre for Health Policy, 2007

**Appendix Figure 3.4: Waits for Heart Valve Replacement Surgery, Registry vs. Administrative Data, Different Algorithms**

2000/01 to 2003/04 (elective procedures only)




Source: Manitoba Centre for Health Policy, 2007

Looking at year-by-year comparisons between the registry and administrative data, we noticed 2001/02 was an odd year (See Appendix Table 3.2). The registry wait time was considerably longer than the administrative wait time for that year. The four-year median waits for elective CABG were 50 and 44 days for the registry and administrative data, respectively and for elective heart valve replacement, they were 91 and 84 days for registry and administrative data, respectively. When we excluded surgery that took place in 2001/02, the median waits for CABG were 47 and 44 days for the registry and administrative data, respectively and for elective heart valve replacement, they were 88 and 88 days for registry and administrative data, respectively.

**Appendix Table 3.2: Year-by-year comparisons between registry and administrative data median wait times for elective CABG and heart valve replacement**

| | 2000/01 | 2001/02 | 2002/03 | 2003/04 | 2000/01-03/04 | 2000/01-03/04 (excl 2001/02) |
|---|---|---|---|---|---|---|
| **CABG** | | | | | | |
| Registry | 69 | 64 | 41 | 42 | 50 | 47 |
| Administrative | 66 | 46 | 36 | 41 | 44 | 44 |
| **Heart Valve Replacement** | | | | | | |
| Registry | 126 | 103 | 86 | 63 | 91 | 88 |
| Administrative | 125 | 65 | 70 | 67 | 84 | 88 |

Source: Manitoba Centre for Health Policy, 2007

Two surgeons retired and two new surgeons took up practice in 2001/02. This change could explain the longer wait times in the registry: if patients visited one surgeon, agreed to have surgery, but were then transferred to a new surgeon and saw that surgeon closer to surgery, there would be shorter wait times using the administrative data method.

**Hip and Knee Replacement**

When developing the algorithm for HKR, our first decision was to focus on primary HKRs. Using the closest visit as the beginning of the wait time yielded very poor results when comparing median wait times between the registry and administrative data. As for other algorithms, we then excluded visits that occurred less than 4 days before surgery. Another issue was that many patients in the registry had more than one procedure performed. Based on clinician advice, if a patient had both joints operated on within six months of each other, it was assumed to be one episode of care (Personal Communication: E Bohm). If the time between procedures was greater than 180 days, then it was assumed to be two different episodes of care. Therefore we excluded any subsequent procedure that occurred less than 180 days after the initial procedure. We also used different methods to define the beginning of the wait time in the administrative data: closest visit, second closest visit if there was more than one visit, or second closest visit if the closest visit was within 70 days of the procedure. None of the algorithms produced acceptable results. (See Appendix Table 3.3). The best fit was using the second closest pre-op visit if the closest was within 7 weeks (See Appendix Figures 3.5 and 3.6). For this algorithm the median between the registry and administrative data for knee replacement were 22 weeks and 20 weeks, with a Spearman's correlation of 0.56, and for hip replacement the medians were 21 weeks and 18 weeks for the registry and administrative data, respectively, with a Spearman's correlation of 0.59.

**Appendix Table 3.3: Comparison between HKR wait times in Registry vs. various algorithms using administrative data**

| | N | Median (IQR*) | Mean (SD**) | Spearman's r |
|---|---|---|---|---|
| **Hip Replacement** | | | | |
| Registry (1) | 1,324 | 21 (12, 34) | 25.7 (18.9) | |
| Closest Visit (1) | 1,324 | 10 (4, 19) | 13.2 (12.9) | 0.07 |
| Registry (2) | 1,318 | 21 (12, 33) | 25.8 (18.9) | |
| Excluding visits < 4 days | 1,318 | 14 (7,25) | 18.5 (16.3) | 0.51 |
| Second closest visit | 1,318 | 25 (14, 44) | 34.0 (29.2) | 0.49 |
| 7-week rule | 1,318 | 18 (12, 28) | 22.9 (17.3) | 0.59 |
| **Knee Replacement** | | | | |
| Registry (1) | 2,202 | 22 (14, 35) | 27.4 (20.0) | |
| Closest Visit (1) | 2,202 | 12 (5, 25) | 15.9 (15.3) | 0.13 |
| Registry (2) | 2,196 | 22 (14, 35) | 27.3 (20.0) | |
| Excluding visits < 4 days | 2,196 | 16 (7, 28) | 20.5 (18.2) | 0.49 |
| Second closest visit | 2,196 | 30 (17, 52) | 39.3 (31.8) | 0.43 |
| 7-week rule | 2,196 | 20 (13, 31) | 25.1 (18.5) | 0.56 |

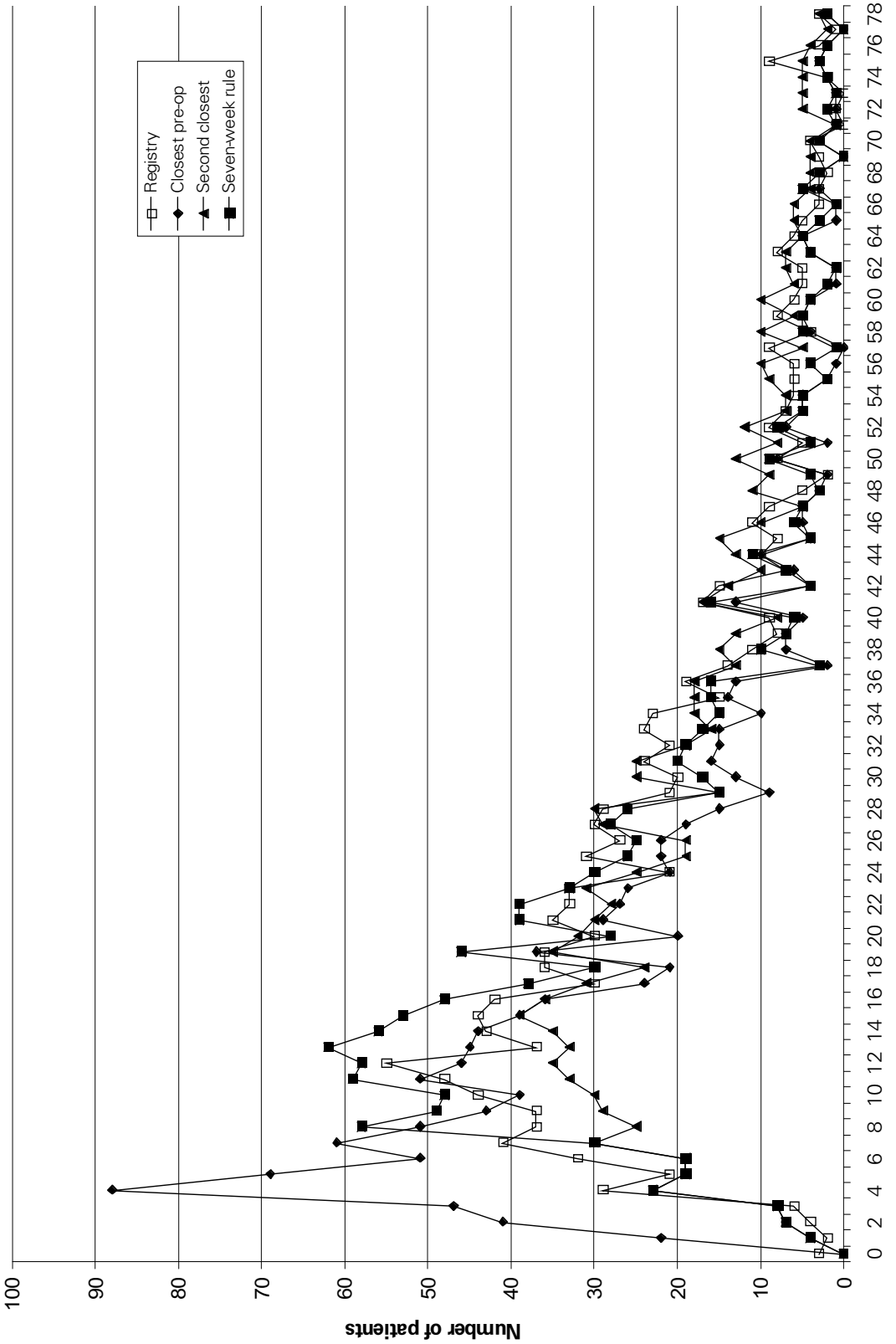
* IQR = interquartile range; **SD = standard deviation

(1) Values using the closest visit including those occurring within 3 days of surgery
(2) Values excluding patients whose only visit was less than 4 days before surgery

Source: Manitoba Centre for Health Policy, 2007

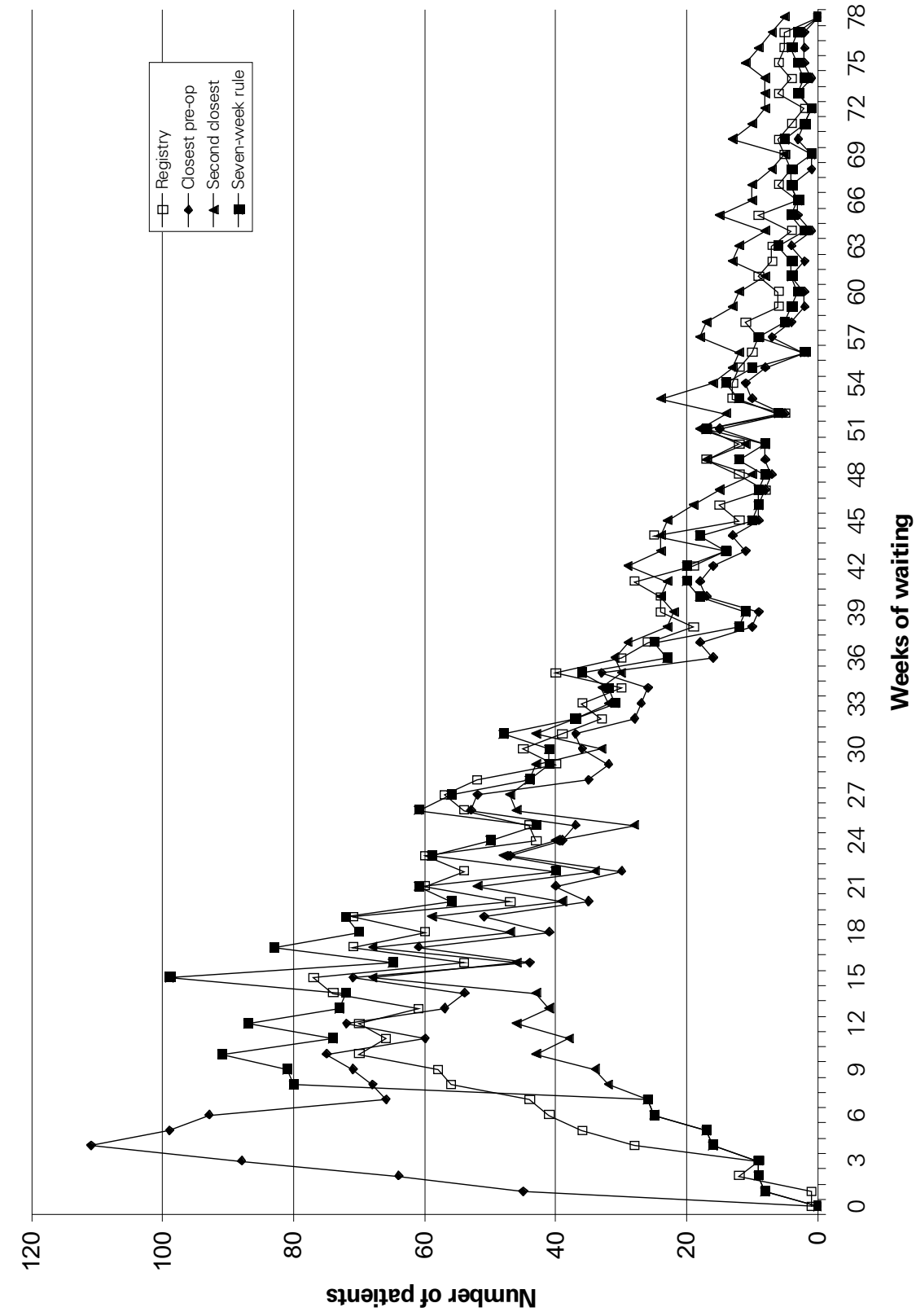
We looked at the records of visits to the surgeon pre-operatively and compared it to the decision date in the registry. Our objective was to see if there was a recognizable pattern between the date of a physician visit and the decision date in the registry: was the decision date usually nearest to the closest visit prior to surgery, the second closest and so on. We found that in only 20% of cases was the decision-date nearest to the date of the closest visit prior to surgery; 35% of the time the decision-date was nearest to the second closest visit; 20% and 10% of the time the decision-date was closest to the third or fourth closest visit, respectively. Because the pattern is so variable, it is difficult to determine an algorithm using administrative data to estimate wait times for HKR surgery.

**Appendix Figure 3.5: Total Hip Replacement Wait Times, Different Methods**




Source: Manitoba Centre for Health Policy, 2007

**Appendix Figure 3.6: Total Knee Replacement Wait Times, Different Methods**



# Recent MCHP Publications

## 2006

*Using Administrative Data to Develop Indicators of Quality Care in Personal Care Homes,* by Malcolm Doupe, Marni Brownell, Anita Kozyrskyj, Natalia Dik, Charles Burchill, Matt Dahl, Dan Chateau, Carolyn De Coster, Aynslie Hinds, and Jennifer Bodnarchuk

*Profiling Primary Care Practice in Manitoba* by Norman Frohlich, Alan Katz, Carolyn De Coster, Natalia Dik, Ruth-Ann Soodeen,Diane Watson and Bogdan Bogdanovic

*Defining and Validating Chronic Diseases: An Administrative Data Approach* by Lisa Lix, Marina Yogendran, Charles Burchill, Colleen Metge, Nancy McKeen, David Moore and Ruth Bond

*Application of Patient Safety Indicators in Manitoba: A First Look* by Sharon Bruce, Heather Prior, Alan Katz, Mark Taylor, Steven Latosinsky, Patricia Martens, Carolyn De Coster, Marni Brownell, Ruth-Ann Soodeen and Carmen Steinbach

## 2005

*Sex Differences in Health Status, Health Care Use, and Quality of Care: A Population-Based Analysis for Manioba's Regional Health Authorities* by Randy Fransoo, Patricia Martens, *The Need to Know* Team (funded through CIHR), Elaine Burland, Heather Prior, Charles Burchill, Dan Chateau, and Randy Walld

*Health and Health Care Use Among Older Adults: Using Population-Based Information Systems to Inform Policy in Manitoba*, Canadian Journal on Aging, Volume 24, Supplement 1, 2005

*High-Cost Users of Pharmaceuticals: Who Are They?* by Anita Kozyrskyj, Lisa Lix, Matthew Dahl and Ruth-Ann Soodeen

*Primary Prevention: An Examination of Data Capabilities in Manitoba,* by Lisa Lix, Greg Finlayson, Marina Yogendran, Ruth Bond, Jennifer Bodnarchuk, and Ruth-Ann Soodeen

*Aboriginal Health Research and Policy: First Nations-University Collaboration in Manitoba,* Canadian Journal of Public Health, Volume 96, Supplement 1, January/February 2005

## 2004

*Patterns of Regional Mental Illness Disorder Diagnoses and Service Use in Manitoba: A Population-Based Study,* by Patricia Martens, Randy Fransoo, Nancy McKeen, *The Need To Know Team* (funded through CIHR), Elaine Burland, Laurel Jebamani, Charles Burchill, Carolyn De Coster, Okechukwu Ekuma, Heather Prior, Dan Chateau, Renée Robinson, and Colleen Metge

*Diagnostic Imaging Data in Manitoba, Assessment and Applications,* by Greg Finlayson, Bill Leslie and Leonard MacWilliam

*How do Educational Outcomes Vary With Socioeconomic Status? Key Findings from the Manitoba Child Health Atlas 2004*, by Marni Brownell, Noralou Roos, Randy Fransoo, Anne Guèvremont, Leonard MacWilliam, Shelley Derksen, Natalia Dik, Bogdan Bogdanovic, and Monica Sirski

*Using Administrative Data to Develop Indicators of Quality in Family Practice*, by Alan Katz, Carolyn De Coster, Bogdan Bogdanovic, Ruth-Ann Soodeen, and Dan Chateau

*Patterns of Health Care Use and Cost at the End of Life*, by Verena Menec, Lisa Lix, Carmen Steinbach, Okechukwu Ekuma, Monica Sirski, Matt Dahl, and Ruth-Ann Soodeen

## 2003

*Pharmaceuticals: Therapeutic Interchange and Pricing*, by Steve Morgan, Anita Kozyrskyj, Colleen Metge, Noralou Roos, and Matt Dahl

*Pharmaceuticals: Focussing on Appropriate Utilization*, by Colleen Metge, Anita Kozyrskyj, Matt Dahl, Marina Yogendran, and Noralou Roos

*Supply, Availability and Use of Family Physicians in Winnipeg*, by Diane Watson, Bogdan Bogdanovic, Petra Heppner, Alan Katz, Robert Reid, and Noralou Roos

*Manitoba RHA Indicators Atlas: Population-Based Comparisons of Health and Health Care Use*, by Patricia J Martens, Randy Fransoo, *The Need to Know Team*, Elaine Burland, Laurel Jebamani, Charles Burchill, and others.

*Why is the Health Status of Some Manitobans Not Improving? The Widening Gap in the Health Status of Manitobans*, by Marni Brownell, Lisa Lix, Okechukwu Ekuma, Shelley Derksen, Suzanne De Haney, and others.

*Discharge Outcomes for Long-Stay Patients in Winnipeg Acute Care Hospitals*, by Anita Kozyrskyj, Charlyn Black, Elaine Dunn, Carmen Steinbach, and Dan Chateau

*Key Events and Dates in the Manitoba Health Care System, 1990 to 2003,* compiled by Fred Toll

## 2002

*Improving Children's Health: How Population-Based Research Can Inform Policy - The Manitoba Experience,* Canadian Journal of Public Health, Volume 93, Supplement 2, November/December 2002

*Monitoring the Acute Care Sector: Key Measures and Trends,* Healthcare Management Forum Supplement, Winter 2002

*Estimating Personal Care Home Bed Requirements*, by Norman Frohlich, Carolyn De Coster, and Natalia Dik

Copies of MCHP publications are available for download free of charge at **http://www.umanitoba.ca/centres/mchp/reports.htm**
Hard copies of our reports are available, free of charge, by contacting us at:

Manitoba Centre for Health Policy
University of Manitoba
4th Floor, Room 408
727 McDermot Avenue
Winnipeg, Manitoba, Canada R3E 3P5
**Email: reports@cpe.umanitoba.ca**
**Phone**: 204-789-3819 **Fax**: 204-789-3910