Measurement of and Factors Relating to Variation in Cataract Surgery Waiting Times in Manitoba

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A Thesis Submitted to the Faculty of Graduate Studies in
Partial Fulfilment of the Requirements for the Degree of

Doctor of Philosophy

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To RJ, with love

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES
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Measurement of and Factors Relating to Variation in

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BY

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Abstract

This research focuses on waiting times for elective surgery in Manitoba, particularly cataract surgery. Claims data maintained at the Manitoba Centre for Health Policy were analyzed for eleven elective surgical procedures from 1992/93 through 1998/99. A pre-operative visit to the surgeon was flagged as the beginning of the wait. To validate this method, data from a second source, the Cataract Surgery Waiting List Registry (CSWLR) were linked with claims data from November 1998 until March 2000. Estimates between the two were compared, using Spearman's rank order correlation and ANOVA (of the logged wait times). Generalized and hierarchical linear models were developed to explain the variation in waiting times. The outcome was the natural log of the CSWLR wait time.

For all except cataract surgery, elective surgery median waiting times were found to be relatively short, under 60 days, but became significantly longer over time. Waits were similar by age, sex and neighbourhood income level; waits were longer in Winnipeg and Brandon compared to other areas of Manitoba. Cataract surgery waiting times were 18 weeks from 1996/97 through 1998/99.

The wait time estimates using the CSWLR and claims matched for 75.9% of patients ($r = 0.58$, $p < .0001$). A modification to the claims method, using the second closest pre-operative visit as the beginning of the wait if there was more than one visit and the closest occurred with 70 days of surgery, improved the match rate to 83.4%, ($r = 0.80$, $p < .0001$). ANOVA found no significant difference between the CSWLR and claims with this modification. In the regression models, longer waits were associated with being female, older age, being hospitalized while waiting, and surgeon, with higher-volume surgeons having longer waits. The models explained approximately 33% of the variation, and surgeon comprised almost all of that (29.5%).

The research demonstrates that (1) claims data can be used to monitor waiting times; (2) choice of surgeon has a major impact on waiting times (3) increasing the volume of surgery does not shorten waiting times, and (4) a parallel private sector does not reduce waits in the public sector.

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There are many people without whom this thesis would not have been possible. I list them here and I apologize in advance to anybody that I might have missed. Their help pointed me in the right direction; any errors that remain are my own.

I thank the members of my committee, especially my advisor, Noralou Roos, who has been not only my advisor, but my mentor and role model for the last ten years. Much of what I know about research has been achieved through her patient guidance. I also thank the members of my committee, Brian Postl and Norman Frohlich, for their ideas and suggestions.

I thank Lorne Bellan for his advice and for his willingness to share the data from the Cataract Surgery Waiting List Registry with me. I appreciate the time that he took to expedite the use of the data in this research, to explain the components of the Registry, and to assemble the data for my use. I also thank Julie Garofolo for spending a morning with me to show me how the data for the Registry were collected and managed.

I thank Natalia Dik who did the programming to compare the claims and Registry data. Natalia not only programmed, but also helped me in thinking about how to do the analyses to validate the claims data method. I also thank Dan Chateau for his help in developing and interpreting the hierarchical linear models. And I thank my colleagues at the Manitoba Centre for Health Policy who assisted in the two deliverable reports that form part of this work: Leonard MacWilliam, KC Carrière, Sandra Peterson, Randy Walld and Shannon Lussier.

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INTRODUCTION

This thesis describes a body of work that began six years ago, in 1996. It focuses on the area of waiting times for elective surgery, and it takes the form of a pyramid: beginning with broad, contextual issues, going on to discuss measurement and my previous work on measuring waiting times for a variety of surgical procedures in Manitoba, then narrowing to the research that is new to this thesis, waiting times for cataract surgery in Winnipeg. Here, I explored the difference between two different data sources on waiting times, the Cataract Surgery Waiting List Registry and claims data, and explored factors that affect waiting times for cataract surgery. This introductory section describes how this body of research was generated.

I first started to work in the area of waiting times for surgery six years ago, in 1996. There had been ongoing concerns in the media about long waits for a variety of health care procedures: specialist visits, diagnostic tests like MRI and ultrasound, and surgical procedures like coronary artery bypass surgery, hip and knee replacement and cataract surgery. The Manitoba Centre for Health Policy (MCHP), where I am a researcher, had a contract with Manitoba Health to conduct six research projects per year, the subjects of which were to be mutually agreed-upon between the Director of MCHP and the Deputy Minister of Health. The mandate of MCHP is to describe and explain patterns of care and profiles of health and illness through analysis of the unique Population Health Research Data Repository. Although Manitoba Health had expressed interest in our doing a deliverable project on waiting times, we had always felt that the claims data, which comprises much of the Repository, was not suitable for this purpose. Three things came together to persuade us to give it a try.

First, for years David Naylor and his colleagues had been grappling with the issue of waiting times for coronary artery bypass surgery (CABS) in Ontario. His work led to the development of the Cardiac Care Network, a registry for all patients having CABS in Ontario. Through consultation with an expert panel, consensus had been reached on prioritization criteria for patients with coronary symptoms, and recommended maximum wait times were established. One of his papers found that patients' names were entered into the Registry on average three days after angiogram. In Manitoba, while we did not have a cardiac registry, we did have data on angiograms. His research demonstrated that it would be reasonable to use an angiogram as a marker to identify the wait for CABS.

Second, the Nova Scotia Department of Health published a report on waiting times for a large variety of surgical procedures over a number of years. In that study, claims data were used. Surgery date was identified in the hospital file, then the data were searched retrospectively for a pre-operative visit to the surgeon which was flagged as the beginning of the wait time. This was something that could be quite easily replicated in Manitoba.

Finally, Noralou Roos, MCHP's Co-Director, discovered in a casual conversation with Ross Brown, then Medical Vice-President of St. Boniface General Hospital, a large teaching hospital in Winnipeg, that there had been an attempt to collect waiting time data for knee and hip replacement surgery. Surgeons submitted the relevant information to St.

Boniface Hospital, and Manitoba Health agreed to provide the hospital with surgery dates for the patients listed so that waiting times could be estimated. For various reasons, Manitoba Health had fallen behind in supplying the procedure data, and Dr Brown hoped that MCHP could help out.

These three circumstances led to MCHP agreeing to do a deliverable on waiting times. I was just winding up another project, and Noralou Roos asked if I was interested in this area. I agreed. Thus, almost by chance, a window opened on what I have since found to be a fascinating field of inquiry.

At the time, I naïvely thought that waits for surgery were a simple problem of supply and demand—if supply was less than demand, then some people would have to wait. I was ignorant of the complexity, and of the political sensitivity involved. I came to learn a lot more about the intricacy of this issue as I delved into the literature and spoke to people who dealt with it on a daily basis. I remember a conversation I had with somebody about the waiting lists for ultrasound. These waiting lists included people who were scheduled several months in advance for ultrasound as a follow-up to some other intervening procedure, such as radiotherapy, a fact which made the ultrasound waits look longer than they were. This one anecdote brought home to me some of the political dimensions of waiting lists: politicians and policy-makers view waiting lists with some scepticism, but are forced to respond to media and stakeholder pressure in the absence of reliable data; on the other hand, providers have an incentive to keep waiting lists long in order to argue for more resources. The first chapter of this thesis therefore deals with some of the contextual issues surrounding waiting times. It defines rationing, describes some of the policy options for managing waiting times, points out the gap in existing information on waiting times, and identifies the main stakeholders and some of their motivations.

One of the difficulties in assessing whether or not there is a problem with waiting times is that there are very little data available. Most of the 'data' are anecdotal—the catastrophic experience that grabs media headlines. If you think about the key questions that a good news story is supposed to cover—who? what? where? when? why? how?—we don't have good answers to any of those with respect to waiting times. We don't know how many people are waiting, their characteristics, the level of illness they are suffering, when they started to wait, and what they are waiting for. There have been some concerted efforts to develop standardized criteria for and manage waiting times for coronary artery bypass surgery, as well as a few scattered efforts to measure waits for cataract surgery, MRI and total joint replacement—all procedures that have been highlighted as problem areas. But for the most part, there is no co-ordinated waiting list for the bulk of procedures, surgical or diagnostic, with standardized criteria, regular monitoring and management.

Measurement is the topic of the second chapter in this thesis; it includes three appendices which are papers that I authored or co-authored. One of the papers is about different methods of measuring waiting times, their strengths and limitations, and what an ideal system would look like. The other two papers are about waiting time studies conducted at MCHP; in both studies I was the principal investigator and lead author. Following the method first used in Nova Scotia, I used claims data to estimate waiting times for 11 procedures in Manitoba over time. Specific surgical procedures were identified using hospital claims data, then physician claims were searched to identify a pre-operative visit to the surgeon. The pre-operative visit closest in time to the date of surgery was designated as the beginning of the wait for surgery. I reported median wait times and, with the help of a statistician at MCHP, used confidence intervals to determine if there were statistically significant differences over time for each procedure. Comparisons were also made within procedures between sexes, older/younger patients, different neighbourhood income levels and region of residence.

One of the drawbacks of using claims data is that the marker used for the beginning of the wait time is a 'proxy' measure: there is nothing in the claim itself to indicate that a decision was made to proceed with surgery. If independent data sources confirmed the use of a pre-operative visit as the beginning of the wait time, this would lend support to the claims method of estimating waits. That is the topic of Chapter Three. One of the advantages of being able to use claims data to monitor waits is that claims are readily available and can be monitored at less expense than, say, setting up a registry for each procedure. Furthermore, claims can monitor the entire population, whereas Registries are often hospital- or city-specific. In this chapter, data from a Cataract Surgery Waiting List Registry maintained in Winnipeg, Manitoba were first merged with data from the Population Health Research Data Repository. Then the start of the waiting time in the Registry was compared with the pre-operative visit to the surgeon used to mark the beginning of the wait in the claims method. As part of this analysis, the claims method was modified, and I assessed its accuracy with respect to the Registry before and after the modifications.

Another issue that is important in understanding waiting times is to understand what factors affect waiting times. Most people would agree that people who are in greater 'need' (however that is defined) should have surgery before people in less need. But one also hears that people sometimes receive special treatment for reasons other than clinical need, such as, social status, gender, age or region of residence. Chapter Four comprises a literature review of some of the factors that have been found to be related to waiting times. From the literature review came a set of independent variables to be explored in more detail, again with cataract surgery data. Modelling of these factors against waiting times for cataract surgery constitutes the fifth chapter of this thesis.

The sixth chapter in this thesis is a concluding chapter. It is not a rewording of the findings of the previous chapters, but focuses on the main messages that I had learned through doing this research, in an attempt to tie the disparate pieces together. It ends with a summary of policy-relevant findings.

Waiting times are an issue that publicly financed health care systems are struggling with throughout the developed world. Many people have thought and written on this subject, and yet, there is still much that we do not understand. I hope that I can shed at least some small light on this obstinate issue.

CHAPTER ONE: WAITING FOR HEALTH CARE: OVERVIEW

The last century has witnessed remarkable gains in our ability to treat disease. Think of all the things we take for granted now that have changed the way we live: pharmaceuticals like insulin, antibiotics, antihypertensives, statins; diagnostic tests like ultrasound, CT scan and angiography; surgical procedures like coronary artery bypass, transplants, joint replacements, and cataract removal; therapies like dialysis, and neonatal intensive care. Genomics and nanites hold unimaginable promise for longer life and management of what are now terminal illnesses. But these many successes have created problems too, in placing pressure on the limited pool of health care resources. Furthermore, in developed countries, there is a population of baby-boomers and their offspring who have been accustomed to getting whatever it is they want. These are people—my generation—who are educated and informed, and what information they do not have, they will search out in libraries or the Internet. Add to this the fact that this generation is aging, and are therefore likely to be suffering more health problems, and the result is a virtually unlimited capacity for demands on the health care system (Evans and Barer 1999).

Forces like these—advances in technology, an aging population, a generation of 'baby-boomers' who expect gratification—have made demands on the health care systems in all developed countries. Many of them, therefore, are struggling with the issue of how to allocate health care resources in a manner that reflects both societal values and economic realities. In some countries, allocation is based on price. In others, like Canada, one of the mechanisms used to allocate scarce resources are waits to access care. While waits have always existed in publicly funded health care systems, this issue has taken on growing significance of late.

This chapter will review some of the policy issues with respect to waiting for care. First, there will be a discussion of rationing and its relation to waiting. This will be followed by a description of some of the options available to policy-makers to manage waiting lists. Last there will be a discussion of the motivations behind some of the players in the debates about waiting times.

Rationing health care services

The inability of demand to keep up with supply results in a need to find a method of rationing health care.[1] There are two principles by which rationing can occur: explicit/specific or implicit/abstract (Mechanic 1997; Glazer and Rothenberg 1999). In specific or explicit rationing, a service is denied to someone who knows the service is denied, why it has been denied, and can identify an authority who is responsible for the decision. In implicit/abstract rationing, capacity constraints are set such that services are delayed or denied to some people, but the people who will be denied are unknown at the time the constraint is set. Governments constrain access to health care services by using the blunt tool of budget limitations. In this way, the government has some control over

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1 Light opposes this premise, stating that instead of the economics-derived word, 'rationing', we should use the word 'choice', which creates a different framework for thinking about the issue (Light 1999).

costs, yet the day-to-day decisions about who gets access and who has priority falls to the physician (Light 1999).

Arguments can be made regarding either form of rationing. Mechanic (1997) argues that explicit rationing is rigid and inflexible, and allows for neither patient differences nor clinical expertise and judgement. He states that implicit rationing can respond more easily to complexity and changing information and builds on the patient/doctor relationship. Glazer et al. argue that implicit rationing might in fact be more efficient and less costly than explicit rationing: "Delays in providing medical service may be a hallmark of successful rationing (since the capacity constraints needed to limit service can impose waits for all but emergency treatment) rather than a reflection of inefficiency, poor management, or misguided cost savings" (Glazer and Rothenberg 1999). They point out that excess capacity in the United States results in more unnecessary and futile therapies. On the other hand, implicit rationing contravenes the ethical principles of justice and autonomy, since implicit rationing results in inequities, and since patients are not fully informed (Evans and Barer 1999).

Queuing can be either explicit or implicit. Most queues for health care in Canada are implicit, since there are no criteria by which to prioritize patients or allocate resources. Implicit rationing results in inequity because literally millions of decisions are made by independent practitioners in an uncoordinated, and frequently unscientific, fashion. Loss of autonomy results because patients often do not know when they will receive surgery, or if they might have had a shorter wait if they had been referred to a different surgeon, or even if surgery was required at all. Rather than behaving like an ordered line, the so-called queue is more like a pool from which patients are chosen according to vague and inconsistent criteria (Light 1999; Hughes and Griffiths 1997). When queues are managed through standardized criteria that are applied to all patients, criteria which are available both to patients and to providers, queuing is explicit. Few examples of explicit queuing exist in Canada; one of the most well-known is the Cardiac Care Network of Ontario.

Resource allocation

If queues are a method of rationing, which Webster defines as distributing resources equitably, it follows that one of the purposes of queues is to allocate resources. In a survey of provincial/territorial health ministries across Canada, most respondents viewed waiting lists as a mechanism to allocate scarce resources (Shortt et al. 1998). Health care managers thought waiting lists could be used not only to allocate resources within and between departments, but also to argue for more resources (McDonald et al. 1998).

The view that increased resources will reduce waiting times is a commonly held, intuitive belief. Newspaper headlines and accounts illustrate:

- "Day surgeries to double at clinic; Pan Am deal takes pressure off hospitals" (*Winnipeg Free Press*, 2001, September 20)
- "Tories pledge to double MRI tests; $29 million targeted to cut waiting lists for diagnostic procedures" (*Winnipeg Free Press,* 1999, May 13)
- "The Alberta government will spend $54-million this year to cut wait times for joint replacements, cancer treatments and heart surgeries" (*Globe and Mail*, 2000, May 19)
- "Government funding increases earlier this year brought the wait list for an MRI to about three months. This was down from last year's 13 months, then the longest in Canada" (*Times Colonist* [Victoria], 1999, August 24).

In these examples, the extra resources come from provincial governments. Some believe that the additional resources should come from private spending. This is often expressed as the sentiment that people should be permitted to obtain faster care privately, and that furthermore, this will make publicly-financed services more available for others. Cullis argued that the United Kingdom's National Health Service (NHS) should subsidize patients to use the private sector and permit it to expand until NHS wait lists begin to decrease (Cullis and Jones 1985). An interesting twist on this notion was found in a review of public and private hospital use in Australia (O'Hara and Brook 1996). There, even patients who had private insurance preferred to go to the public hospital for some of their care, for example, cardiac investigations, cataract surgery, and rehabilitation services. Thus the public system was feeling extra pressures because of the unexpected demands of privately insured patients.

Recent polls in Canada report different findings on the percentage of respondents that believe people should be able to pay to access care more quickly. The *National Post* reported that a PriceWaterhouseCoopers poll found that 61% of Canadians support the concept of private health care so long as the public system is not jeopardized (*Winnipeg Sun*, 2001, 14 July), whereas an NDP-sponsored poll found that only 10% of Manitobans agreed that people should be able to pay for faster service (*Winnipeg Free Press*, 2000, 09 Dec). These different findings might well relate to how the questions are posed (and the political leanings of the sponsor), but it is noteworthy that it is a question that is posed time and time again as a way to 'cure' Canada's ailing health care system.

The research evidence is equivocal on the effectiveness of adding resources (whether public or private) to shorten waits. There are examples of targeted infusions of public funds reducing the wait list (Edwards 1997; Parmar 1993; Rao and Burd 1997). There are also examples in which an increase in the procedure rate was associated with an increase in the wait list (Goldacre et al. 1987; Hanning and Lundstrom 1998; Williams 1990; Sheldon 2000). In the United Kingdom, when there were major government-funded initiatives to reduce waiting lists, the number of people waiting increased, prompting some people to claim that the government was focussing on the wrong target (Hamblin et al. 1998; Green 1999).

Part of the reason for this paradoxical finding is that as more capacity is seen to be available, more referrals may be made for the service (Williams 1990). The MRI news item quoted previously goes on to say "More doctors and patients are opting for the test since the waiting time has reached a reasonable level. 'It's beginning to creep back up again,' said [Dr. Robert] Koopmans [Capital Health Region section head for MRI.]"

There is also some evidence that the health system is dynamic, and adapts to change by finding its equilibrium. In the UK, where there were huge funding initiatives intended to reduce waiting lists, the *size* of the wait list increased, but the average wait *time* stayed around the same in the 1990s as it was in the 1960s. While the number of GP referrals increased, the rate at which referred patients went on to elective surgery stayed quite constant (Hamblin et al. 1998; Harley 2001). In Manitoba, the number of cataract surgery procedures increased by 32% from 1992/93 to 1996/97. This was accompanied by a U-shape in the median waits: an initial decrease from 16 to 11 weeks, followed by an increase back to 18 weeks (DeCoster et al. 1998).

Increased resources may also contribute to a change in the criteria for surgery, causing more patients to be assessed as surgical candidates. That would be one explanation for the constant proportion of referred patients going on to surgery, despite an increase in referrals. However, this raises a question about appropriateness. In a review of the appropriateness of bypass surgery in areas with different surgical rates, there were more low-benefit cases performed in higher-rate areas (Hux et al. 1995). After an increase in cataract surgery funding in Sweden, patients were found to come to surgery with better visual acuity, and a higher proportion of patients were classified as needing surgery for social reasons (Hanning and Lundstrom 1998).

That an infusion of funds will help assumes that there are additional human and capital resources that can be put to use, but there is little excess capacity in the Canadian health care system. One of the reasons for an increase in the queue for coronary artery bypass surgery (CABS) in British Columbia was the shortage of hospital space, heart-lung bypass perfusionists and critical care nurses (Katz et al. 1991). Recent newspaper stories have highlighted the need for radiation therapists and oncologists for the treatment of cancer patients.[2] A temporary infusion of funds may not work because surgeons, nurses and other support staff may not want to be hired for only four or six months (Newton et al. 1995). On the other hand, the permanent addition of new surgeons may help to reduce waiting lists temporarily, but as the new surgeons build up their own caseload, and compete for resources, the list may begin to increase again (Frost 1980; Harley 2001).

Nor does the availability of additional resources in a parallel private market reduce the waiting times in the public sector. In the Manitoba study, cataract surgery was available both publicly and privately over the time period of the study, yet waits in the public sector grew. Similar evidence comes from the UK where there has always been a private system alongside the National Health System (NHS). There, areas with the longest waits for NHS surgery are those with the most private beds, and the long-wait procedures are those where there is the most private practice (Williams 1990; Light 1996; Richmond 1996).

The above examples refer to privately-funded privately-owned health care providers. Even when health care is publicly funded but is privately provided, differences in waits can result. The Consumers Association of Canada (Alberta) found that in three urban areas with three different delivery models for publicly-insured cataract surgery, average waiting times varied substantially (table 1.1) (Armstrong 2000). In Lethbridge, where cataract surgery took place in a public hospital, the waiting times were 4 to 7 weeks, whereas in Calgary, where cataract surgery was contracted out to privately-owned clinics, the waiting time was 16 to 24 weeks. Nor are longer waits related to physician supply: in

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[2] Priest L, Cash used to lure cancer-centre staff, *Globe and Mail,* 2000 June 15; Paul A, Cancer clinic waits too long, *Winnipeg Free Press,* 2000 January 26; Lett D, Bidding war for health pros 'like the NHL,' *Winnipeg Free Press,* 2000 June 16; McKie P, Pharmacist shortage closes HSC drug store, *Winnipeg Free Press,* 2000 April 12.

Edmonton, there was one ophthalmic surgeon per 51,000 persons, yet the waiting time was 5 to 7 weeks, compared with Calgary, which had a much richer surgeon supply at 1 per 37,000 persons, yet the wait was approximately three times longer.

Table 1.1: Publicly-funded cataract surgery in Alberta, 1998; impact of different delivery models

City	Surgeon/population ratio	Average wait after decision to proceed	Location of service delivery
Lethbridge	1/49,000	4 to 7 weeks	100% in hospital
Edmonton	1/51,000	5 to 7 weeks	80% hospital, 20% private clinic
Calgary	1/37,000	16 to 24 weeks	100% in private clinics

Management

David Naylor has stated several times that waiting lists are a mark of supply/demand mismatch (Naylor 1991; Naylor et al. 1993a; Naylor 1999). Adding resources affects the supply side of the equation. There are also activities that can affect the demand side, such as: information sharing, list audit, and prioritization or scoring systems.

Information sharing

One of the drawbacks that exists currently is that most waiting time information is not available to referring doctors or the public. What this means is that patients with similar levels of illness will wait differing lengths of time depending on the surgeon to which they are referred. However, if information were available on individual surgeon's waiting times, a surgeon with a shorter wait might have been chosen. The most notable exception to this general rule is in British Columbia. There, hospitals report waiting time data to the Ministry of Health which posts it on the Internet. Data are available by procedure, hospital and doctor and cover 95% of scheduled surgery (http://www.health.gov.bc.ca/

waitlist).[3] Similar data have been available in the UK for years (Lee et al. 1987). UK wait time data are categorized by region, specialty and quarter; both the wait to see a specialist and the wait for surgery are available on the Internet (see http://www.doh.gov.uk/waitingtimes/booklist.htm). Notwithstanding some legitimate concerns about the accuracy of the data, they are a step in the right direction of informing both patients and providers.

List audit

Where lists do exist, regular audits are necessary to ensure that everybody who is on the list still requires the procedure. Many patients may no longer be surgical candidates, for a variety of reasons: their condition improved, they changed their minds, they moved, their general health deteriorated so that they are now poor surgical candidates, or they died. Studies have documented the degree of list inflation to be in the order of 25 to 50 per cent (Barham et al. 1993; Tomlinson and Cullen 1992; Lee et al. 1987; Fraser 1991; Elwyn et al. 1996; Woolford et al. 2000). Waiting time will be overestimated if patients who should be removed from the list are included.

Priority Scoring Systems

The purpose of priority scoring systems is to make waiting list management more transparent and equitable. Priority systems generally use research evidence and some form of clinical consensus-building to develop criteria by which patients can be assigned a rela-

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3 There is also cardiac surgery waiting list/time information available on the WWW for the Cardiac Care Network of Ontario (http://www.ccn.on.ca) and for the Central Montreal Regional Health Authority (http://www.rrsss06.gouv.qc.ca/evaluation/chirurgie).

tive priority for surgery (Naylor et al. 1990; Lack et al. 2000; Hadorn 1997). Having physician buy-in appears to be critical in the successful implementation of a prioritization system. Canadian examples of priority scoring systems are the Cardiac Care Network (CCN) of Ontario, Manitoba's Cataract Surgery Waiting List Registry, and the Western Canada Waiting List project.

Examples

The Cardiac Care Network (CCN) is one of the first and probably the best-known prioritized registry in Canada. All patients in Ontario scheduled to received coronary bypass surgery are entered into the database. A prioritization system, developed by a consensus panel of experts based on a literature review and their own experience (Naylor et al. 1990) uses seven clinical factors to determine an urgency rating score and Recommended Maximum Wait Time (RMWT). CCN's Web site has quarterly reports showing for each hospital the average number of procedures, patients waiting, median waits and percentage of procedures performed within the RMWT. The registry was expanded in 2000 to include cardiac catheterization, angioplasty and stent procedures (Cardiac Care Network 2001). Cardiac surgery registries exist in most other provinces across Canada; Manitoba became a satellite of the CCN in 1999, but as yet no data are publicly available for Manitoba (January 27, 2002).

The Cataract Surgery Waiting List Registry (CSWLR) in Manitoba prioritizes patients based on their visual impairment and length of time waiting. (It is described more fully in Chapter 3 of this thesis.) All members of the Department of Ophthalmology were involved in the planning for this system, and they submit all patients booked for cataract surgery in Winnipeg to the CSWLR. The priority scores are returned to the surgeons who are under no obligation to schedule patients according to priority. However a before-and-after comparison demonstrated that physicians were responding to the priority information in their scheduling decisions (Bellan and Mathen 2001). Unfortunately, data from the waiting list have not been shared with referring clinicians, patients or funders.

The Western Canada Waiting List (WCWL) project, a consortium of 19 members including research organizations, medical associations, RHAs, and provincial ministries of health, was a research project funded by Health Canada, the purpose of which was to develop prioritization criteria. Its final report was released on March 31, 2001. Interdisciplinary professional panels were struck to establish point-count priority scoring tools in five areas: total hip/knee replacement, MRI, cataract surgery, general surgery and children's mental health services. Each tool was pilot-tested in one of the member RHAs. Test-retest reliability was strongest for general surgery and hip/knee replacement and weakest for MRI. A series of focus groups brought together members of the public, who showed general support for the tools (Western Canada Waiting List Project 2001). The WCWL is now planning a second phase to implement the tools and develop benchmark waiting times.

In New Zealand, the government acknowledged that rationing did occur, and that on ethical grounds, prioritization for surgery should be more transparent. Criteria were set up for a number of procedures, including cataract extraction, CABS, hip and knee replacement, cholecystectomy, and middle ear tubes (Hadorn 1997). The criteria were developed by professional advisory panels using a two-step Delphi process, followed by pilot testing. Criticisms of the criteria have included concern about inter-rater reliability (Halliwell 1998), and about their ability to accurately prioritize patients (Dennett and Parry 1998; Dennett et al. 1998). The New Zealand prioritization criteria were used not only to establish clinical thresholds, but even more contentious, financial thresholds, i.e., the thresholds that could be sustained by government funds. For CABS, 125 patients who met clinical criteria were removed from the waiting list at one hospital because they fell below the financial threshold (Channer et al. 2000). Of these, five died, for a mortality rate of 4%, considerably higher than the 1% or less reported by Naylor (Naylor et al. 1993b; Naylor et al. 1995). Furthermore, 59 of the 125 patients had CABS because of deterioration, 24 of them as emergencies, which are often more costly. Thus the financial thresholds appeared to result in extra morbidity and mortality and perhaps even extra costs.

Lack described the development of a priority scoring system and iso-resource groups (IRGs) in Salisbury, England (Lack et al. 2000). The scoring system used an algorithm that gave various weights to disease progress, pain and distress, disability, dependence on others, loss of usual occupation, and time in the queue. IRGs are used for planning purposes only, as patients in each IRG are expected to require the same number of bed-days and O.R. time. It would seem possible that IRGs could be used to maximize the number of higher priority patients treated within budgeted resources, although this is not one of their intended uses.

Issues

One of the issues with respect to priority scoring systems is that of the guiding principles to be used. Common guiding principles are: need, ability to benefit, and time in the queue. However, the language on this issue is often unclear. A New Zealand report recommended that "priority should be assigned according to need, and to those with the most ability to benefit" (Fraser et al. 1993). A paper by Lewis et al. stated: "Assuming that a health care intervention offers a reasonable probability of tangible benefit, those with the greatest need for the intervention should be served first" (Lewis et al. 2000). The problem is that the concepts of need and ability to benefit may be in conflict: there will be people who are in very great pain or disability but whose capacity to benefit may be limited, whereas there will be others suffering only minor inconvenience but who, with treatment, would return to normal, productive lives (Meddings et al. 1999). Which should take priority: the person with the greatest need or the one with the most capacity to benefit?.

Length of time in the queue, another potential criterion, may also prove contentious and difficult (Hadorn 1997). In the CSWLR, the priority score is weighted by time spent waiting, as it was felt that this constituted a burden to the patient (Bellan and Mathen 2001). Indeed, aside from physical dysfunction, waiting is associated with anxiety, depression, fatigue, social isolation and economic hardship, all of which affect not only the patient but also family members (Naylor and Slaughter 1994; Petrie et al. 1996; Derrett et al. 1999; Pieper et al. 1985). On the other hand, if length of time waiting is used as a criterion, then it can create distortions in the provision of services, with sicker patients being deferred in favour of those with longer waits who may have a lower level of illness or dysfunction (NHS Consultants' Association 2000).

Also relevant for prioritizing patients is the question as to what pool of patients the prioritization criteria apply: within each surgeon's individual list, between surgeons but within one surgical specialty, or between specialties? For each surgeon to prioritize within his or her individual list does not overcome the problem of patients coming to surgery at different levels of priority as a result of surgeons having different list lengths. Where prioritization systems are in place, it is more common to apply them to one surgical procedure or service within a hospital or region. The Cardiac Care Network of Ontario assigns patients in an area to the first available surgeon, although they can request a particular surgeon if they prefer (Naylor 1991). Using priority schemes to allocate resources across specialties is more rare; rather, Heads of Surgery are more likely to make reallocation decisions in response to a combination of more strident vocalization from the surgeons, funding, pressures from hospital administrators, or the history of Operating Room regular and emergency hours used by each specialty. It seems that prioritizing within specialties is difficult enough, without trying to address the even thornier issue of prioritizing across specialties.

Related to priority schemes is the issue of appropriateness. In the UK, much of the waiting list has been found to comprise patients who are waiting for discretionary procedures, that is, procedures about which there is disagreement as to the appropriate treatment (Davidge et al. 1987; Bloom and Fendrick 1987; Gudex et al. 1990; Donaldson et al.

1989). If patients who do not need the procedure could be safely removed from waiting lists, then potentially there would be shorter waits for patients who do need the procedure. Even when priority scoring systems do exist, there has been little attempt to address the issue of appropriateness. In the Western Canada Waiting List panel discussions for General Surgery, when the issue of appropriateness arose, it was deemed not to be one of the objectives that the criteria were attempting to address, although it was suggested that patients who were not appropriate would not meet the criteria.

Guaranteed maximum waiting times

One method of trying to limit the waiting time is to issue regulations about maximum allowable waiting times. A guaranteed wait is a promise by government designed to prevent patients from languishing on a waiting list, thus effectively being denied care. In the United Kingdom, the patient's charter provides for Guaranteed Maximum Waiting Times of 18 months for inpatient surgery (Edwards 1997). In Sweden, in 1992, patients were guaranteed a maximum wait of three months for cataract surgery if their visual acuity was below a specified threshold or they had special social conditions (Hanning and Lundstrom 1998). The advantage of a guarantee is that it ensures care. A disadvantage is that it creates distortions, because patients with a lower priority who are near their GMWT may take precedence over patients who are in more urgent need of surgery (NHS Consultants' Association 2000). Another potential drawback, from the funder's point of view, is that such a guarantee will certainly be used to argue for extra funding if the current level of resources is insufficient to meet the required targets.

Key players and their roles

Given the stated purpose of using waiting lists as a means of allocating scarce resources, and the potential to reduce, or at least manage waiting times more equitably if better information systems were in place, it is astounding that so little standardized information is available in Canada on waiting times. In September 2000, the First Minister of Canada agreed to develop and report on a comprehensive set of indicators, one of which was waiting times for key diagnostic and treatment services (First Ministers 2000). That the Ministers would have to name waiting times as an indicator in need of development underscores how limited the data are in this area. The next two chapters of this thesis will discuss issues relating to measurement of waiting times in greater detail.

If hospitals, RHAs, physicians and consumer groups apply pressure on governments to increase funding because of long waits, then governments should be demanding more complete and accurate data on the extent and impact of existing waits. Why has this been so slow in coming? Are there any reasons that the government might not want such data? A cynical viewpoint is put forth by Edwards (1997, p14): "One way to conceal a problem is not to collect and publish information about it." Without clear information that large numbers of Canadians are waiting long periods of time for routine procedures, the government can try to ignore the problem. The risk in this course of action is that other groups, notably care-providers, may also benefit from equivocal information, and use unsubstantiated claims of long waits to press for more resources.

Media impact

The following item illustrates how a lack of solid data can be used by all sides in the debate about waiting lists. In November 2001, the Canadian Orthopaedic Association and the Arthritis Society held a news conference in Winnipeg to press for a national strategy to reduce waiting times for knee and hip replacement. At the news conference was a patient who had had to wait eight months, and expected to wait at least two months more. One of Winnipeg's orthopaedic surgeons spoke at the news conference, threatening to leave the province because of growing waiting lists and a lack of resources. Interviewed separately, the Minister of Health countered by saying the province was paying for 300 more hip and knee surgeries than it did two years ago.[4, 5] The media reported opinion and anecdote; there was no evidence available on the actual number of patients waiting, for which procedures or for how long.

In discussing the role of the media in the fate of the Medicare Catastrophic Extension Act in the United States, Fan noted that when actual knowledge about an issue is low, then opinions are more flexible and "persuasability" is high (Fan and Norem 1992). This is the situation with waiting times. In the absence of information, the media will seize on the identifiable "outlier", thus provoking a sense of crisis (Naylor, 1991). Hence the usual focus in the media is on what Mechanic calls the "tragic-choice" situation:

- "I'm a time bomb; Woman with cyst on brain fears long wait for surgery" *Winnipeg Free Press* 2001, December 13

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4 Paul A, Patients, surgeons want waiting lists cut, *Winnipeg Free Press*, 2001 Nov 27; Brodbeck T, Doctor crisis critical, *Winnipeg Sun*, 2001 Nov 27.

5 The Minister also said that Manitoba's waiting times were shorter than elsewhere in Canada, according to the Fraser Institute survey, an irony given that the Minister is NDP, and the Fraser Institute is a right-wing think tank, and furthermore, its annual survey has been criticized and dismissed by scientists for its flawed methodology.

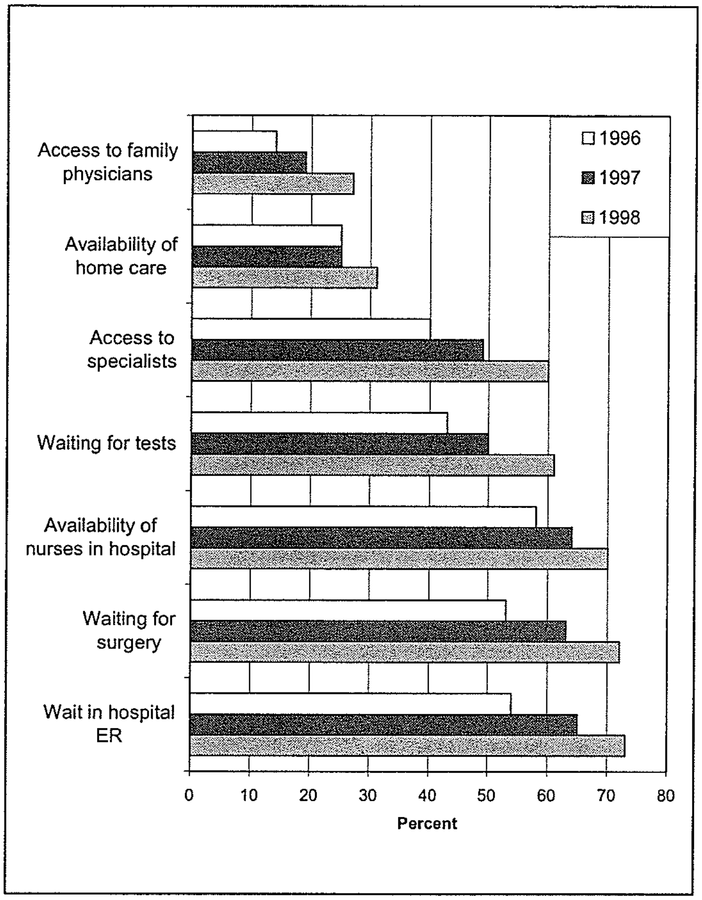
- "Heart patients wait, die" *Winnipeg Free Press* 1996; February 26
- "Kids forced to wait for surgery" *Winnipeg Free Press* 1997; December 9
- "Patients dying on wait lists: Alberta MDs" *Winnipeg Free Press* 1998; July 29

Repeated messages of this nature can be very effective in influencing public opinion. In the late 1990s, the issue of waiting for health care seemed to be receiving increasing play in the media. Using the terms "waiting" AND "health", I searched the Canadian Business and Current Affairs (CBCA) database from 1982 to 2001.[6] There were very few citations in the early years, possibly related to limits of the database itself. Since 1993, the number of citations rose dramatically: 159 in 1993, 290 in 1995, 851 in 1998, and 1174 in 2001, the last year available. Over the same time, several public opinion polls have measured concern about this issue.

- The Canadian Medical Association hired Angus Reid Group to conduct polls in 1996, 1997 and 1998 to measure Canadians' perceived access to a variety of health care services: family physicians, home care, specialists, tests, nurses in hospital, surgery, and hospital Emergency Rooms. In every area, the percentage who believed that access was deteriorating increased over time, just as the number of media items did (see figure 1.1).

6 The CBCA directory provides indexing to more than 220,000 articles per year appearing in nearly 200 Canadian business periodicals, 300 popular magazines and 10 newspapers.

Figure 1.1: CMA/Angus Reid Poll, 1998: Percent of Canadians reporting deteriorating access in the last few years



- A 1998 poll by Prairie Research Associates found that while over 80% of people in Manitoba and Saskatchewan were satisfied with their most recent experience with the health care system, 60% said that waiting lists for any sort of medical treatment were unacceptable (*Winnipeg Free Press* 1998; July 11).[7]

- A 2001 poll by POLLARA research reported that 62% of Canadians felt the health care system needed major repairs or a complete rebuilding, and that these repairs

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7 This article included a statement that "Waiting lists are one of the biggest problem's in Manitoba's health care system," a persuasive and inflammatory sentence, but with no evidence to support it.

should focus on long waiting periods, accessibility and lack of personnel (POLLARA Research 2001).

- The Canadian Medical Association published a National Report Card in 2001. In this poll, Canadians were asked to give the health care system a grade of A, B, C or F along several dimensions (Canadian Medical Association 2001). The overall quality of health care services available was graded A or B by 65% of respondents. In terms of access, defined as the ability to get prompt health care, a grade of A or B was given by 66% for access to a family doctor, but only by 42% for access to specialists, and by 37% for access to modern diagnostic equipment such as MRIs and CT scans. When asked an open-ended question about the most important thing that could be done to improve the system, the highest percentage, 14%, said more funding was needed, followed by 11% who said more timely access to treatment.

While these examples do not comprise a systematic review, it suggests that there is a relationship between media reporting and public opinion. Public opinion can be further swayed when physicians—who, after all, should be in a position to know—are reported as saying that waiting times are too long. Even though there is limited evidence to support their claims, physicians know that politicians react to public perception.

In sum, lack of information can be an advantage to both the government and the care providers. Governments can argue that there is no evidence to support the claims that waiting lists are too long and providers can play the trump card of 'unnecessary patient suffering' to encourage public sympathy.

Role of physicians

Yet another factor underlying the lack of quality information in this area is the historical relationship in Canada between government and physicians. Since the advent of government-insured physician services, there has been an accommodation between government and physicians in the form of an agency relationship: "the government, as principal, established budgetary parameters; organized medicine, as agent, determined within those parameters, how resources were to be allocated" (Tuohy 1999). Physicians gave up control of their fees, but in exchange, demanded clinical autonomy. (One cannot help but notice that clinical autonomy translates into the right to control the volume and mix of services provided, and thus in a fee-for-service system, billings and income.) Whenever governments or other authorities have infringed on the clinical autonomy of physicians, conflict has been the result. When British Columbia passed legislation in 1983 that restricted billing numbers in order to control the number and distribution of physicians, the Medical Association protested vigorously and supported a legal challenge to the legislation. When Ontario banned extra-billing after the passage of the Canada Health Act, the ensuing conflict resulted in a four-week strike in 1986 (Tuohy, 1999, page 208-209). Efforts to collect data on, monitor, and manage waiting lists might be viewed as an infringement of clinical autonomy, which helps to explain why physicians have generally resisted these efforts.

When cataract surgery was amalgamated into one hospital in Winnipeg, the ophthalmic surgeons agreed to establish a waiting list registry in exchange for more funding. The registry uses a measure of self-rated visual dysfunction, and length of time in the queue, to assign a priority for each patient. At a meeting where the planned registry was discussed with the ophthalmic surgeons, a surprising degree of hostility and resistance was expressed to the plan (personal observation). When registry data on waits were presented to optometrists, who are a large referral source for ophthalmic surgeons, the director of the cataract surgery registry (himself an ophthalmic surgeon) was taken aback at the outcry he received from the ophthalmic surgeons who did not want their wait list information shared. To date, this information is still not available to the funders, to referring physicians or to the public.

Other efforts in Winnipeg and elsewhere have had similar problems: when a registry was first initiated for cardiac surgery, some surgeons were very slow to send in their patients' data. In a voluntary hip and knee replacement registry which ran from 1994/95 to 1996/97, only 27% of patients were registered, and the highest physician compliance rate was only 56% (DeCoster, 1998). A more recent implementation of a total-joint-replacement registry in Winnipeg was not made mandatory because surgeons feared the Regional Health Authority would start to manage the waiting list, in other words, to reassign patients to surgeons with shorter waiting times.

The introduction of the BC Waiting List Web site sparked a great deal of discussion and controversy, as a sample of headlines illustrates:

- Medical Website allows patients to search for shorter waiting lists: The health minister is to introduce the new service and its 1-800 number today (*Vancouver Sun*, 1999, May 7)
- Surgery Web site will take months to fix, hospitals say: Variations in the way waiting list information is collected have led to the inaccuracies (*Vancouver Sun*, 1999, May 12)
- BC gov't puts wait list info on the Internet: But is it an idea whose time has come, or just a waste of time? (*Medical Post*, 1999, May 25)
- Posting surgery wait lists a start for health-care accountability (*Vancouver Province*, 1999, June 9)
- Why the vaunted Internet wait lists do not work: A comprehensive system of managing waiting times and lists for surgery is needed, says a Canadian Medical Association official, but the province's method is unwieldy and wrong. (*Vancouver Sun*, 1999, July 16)

It must be emphasized that not all physicians are uncooperative or resistant to efforts to manage waiting lists. Four of the nineteen partners in the Western Canada Waiting List project were Medical Associations: the provincial associations from British Columbia, Alberta and Saskatchewan and the Canadian Medical Association. (The Manitoba Medical Association declined an invitation to partner in the project.) The WCWL also enlisted the help of many physicians across Western Canada to sit on their five clinical panels and to assist in the development and pilot-testing of prioritization tools. The Canadian Medical Association was one of the partners in that project, and has developed Operational Principles for the Measurement and Management of Waiting Lists (Canadian Medical Association 2000). These arose, at least in part, in response to a 1997 challenge issued by federal Health Minister Allan Rock to provide evidence that funding shortfalls have caused problems in access (Borsellino 1998).

In recent years, the CMA has seemed to soften its tone in its polls and communications—further evidence of a willingness to help shape the reform of the health care system—instead of resisting attempts to do so. An Angus Reid poll was released by the CMA on August 13, 2000. In this poll, pairs of choices were presented to elicit preferences for reforming the system. The most preferred option (83%) was for increased public funding, while second choices were: limiting the range of services provided (58%) or accepting longer waiting times for some health care services (57%). The CMA emphasized that respondents thought the top three stakeholders that should be involved in shaping health care reforms were health professionals such as doctors and nurses, provincial governments and federal governments. The CMA's 2001 National Report card includes similar data. These examples illustrate that the tone of the public communications from the CMA has softened of late, emphasizing cooperation and consultation over confrontation.

Conclusion

Waiting times are a fact of Canada's publicly funded health care system. Queues have some benefits: they permit time for patients to consider their decision, to test out a medical therapy and perhaps change their minds about undergoing a surgical procedure. They also permit efficient scheduling of Operating Room and hospital resources (Edwards, 1997). But unduly long waits can cause patients unnecessary pain, suffering, anxiety and even death.

Data needs are great in this area. The remainder of this thesis will focus on two main themes: measurement of waiting times for surgery, and factors that affect waiting times with a focus on the wait for cataract surgery. It will contribute some evidence about how long people wait for selected surgical procedures and whether these waits have been changing in recent years. It will also look into some of the nonclinical characteristics—such as age, sex, region of residence, and surgeon—that may be associated with differences in waiting times. Without evidence such as this, the whole issue becomes a political debate, filled with rhetoric, in which patients often come last.

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CHAPTER TWO: MEASUREMENT OF WAITING TIMES

In Canada, information on waits to obtain health care is limited. For most procedures and in most parts of the country, waiting lists are maintained by individual physicians, and the data are not shared among referring physicians, patients or funding authorities. Nor are there definitions to determine when a waiting time begins. It has been said that you can't manage what you can't measure; if any attempt is to be made to modify waiting times, surely one would first need a standardized method of measuring waiting times.

This chapter focuses on issues surrounding the measurement of waiting times to access elective, or scheduled, surgery. It incorporates two papers that I have written. The first, *Measuring and managing waiting times: What's to be done,* describes several different methods of measuring waiting times, assesses their advantages and disadvantages, and describes the characteristics of an ideal data collection system (Appendix A). (DeCoster 2002). This paper was accepted as submitted by the journal *Healthcare Management FORUM*, and will be published in their May 2002 issue.

The second paper, *Waiting times for surgical procedures*, describes a method that I used to measure waiting times in Manitoba (DeCoster et al. 1999).[1] This method relies on claims data and defines a pre-operative visit to the surgeon as the beginning of the waiting time (Appendix B). The paper used data from 1992/93 to 1996/97; an update report, which added two more years of data, is also included in this chapter (Appendix

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[1] This paper was originally published in a supplement to the journal *Medical Care* 1999; 37(6): JS187-JS205. It is reprinted here with the permission of Lippincott Williams & Wilkins.

C). For both of these studies, I was the principal investigator. I managed the project, which included such tasks as designing the study, directing and coordinating the data analysis, interpreting the results, liasing with Working Group members and other experts, communicating the findings to stakeholders, and writing the report.

These papers will be introduced again later in this chapter. A few issues and constructs not specifically covered in the papers, but relevant to the measurement of waiting times, will be discussed in the rest of this chapter.

Waiting time: Definition

What is a wait for surgery? When does it begin? The answer to that question influences how waits are measured. Arguably, the wait for surgery does not begin until the patient decides to proceed with surgery. But the pathway to surgery involves several prior steps, as illustrated in Figure 2.1, and there may be delays at each of them.

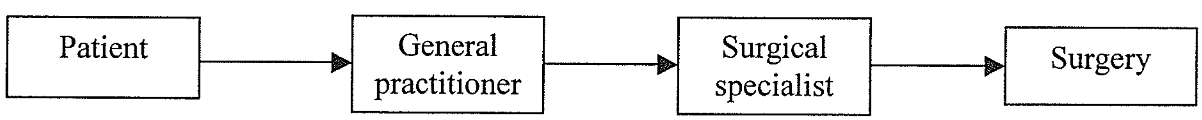

Figure 2.1: Simplified scheme of steps in coming to elective surgery

Patient

Patients may be responsible for some treatment delay either accidentally or intentionally. For instance, a woman may not be aware of the importance of regular Pap smears, thus missing the opportunity for early detection and treatment of cervical cancer. In this case, a public education program or a system of mailed reminders might help to avoid such a delay. On the other hand, a patient with symptoms of rectal bleeding might delay visiting a physician out of fear of a diagnosis of colon cancer, a delay which might affect the outcome of treatment. In the latter case, public education would not help since the patient was already aware of the risk and delayed treatment. Nor is the health care system itself to blame.

General Practitioner

At the general practitioner (GP) step, delays may arise in the time it takes to see the GP, and in the way that the GP manages the problem. Waits to see GPs have not generally been flagged as a big problem in either the literature or the popular press. In the Canadian Medical Association's National Report Card, 66% of respondents rated access to family physicians as good to excellent, but only 42% felt that way about access to specialists (Canadian Medical Association 2001). However, this may be an emerging issue. A call to the Manitoba College of Family Practitioners in October 2001 revealed that only ten family physicians in the city of Winnipeg were accepting new patients. On January 8, 2002, a news release from Manitoba Health and the Manitoba College of Family Physicians announced a new phone line established to "connect Winnipeggers with family physicians accepting new patients." Shortages of family physicians may be related to lower medical school enrolments,[2] an increase in the medicalization of care

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2 Universities across Canada cut medical school enrolments by 10% in 1992. (Guttormson K , McKie P: "Wanted: More med school students" Winnipeg Free Press, 2000, August 14)

(Black et al. 1995) (Moynihan and Smith 2002), low fee schedules, and recruitment of general physicians by the United States.

General practitioners have differing referral thresholds (Earwicker and Whynes 1998). That is, different GPs faced with patients with the same complaints or symptoms will manage the patient differently. Some will try to investigate the complaint themselves more thoroughly to arrive at a diagnosis before referring a patient on; others will refer more quickly. Some will try to manage a patient medically, before opting for a surgical opinion. Some may be more easily influenced by the "squeaky-wheel" patient than others. In Manitoba, there is evidence of the different referral thresholds exhibited by doctors: the consult rate in 1995/96 ranged from 153 per 1000 population in Central Regional Health Authority to 242 in Winnipeg; residents of both of these regions have similar and relatively good health status (Roos et al. 1997).

Once a referral is made to a surgical specialist, if the specialist deems the patient's problem to be non-surgical, he or she will refer the patient back to the referring doctor, who then has to run more tests, and/or perhaps refer to a different specialist. A family physician, interviewed about waiting times, said:

> Surgeons, basically, operate on the premise of. . . if the problem fits into something that they can operate on, then they will operate on the patient. If the patient has a non-operable problem, they won't even suggest what a diagnosis is, they won't suggest what you should do with the patient, they will just say, They don't have an operable problem, end of story.

Surgical specialist

Once there is a referral to a surgical specialist there may be a wait to see the specialist, and once seen, there may be more steps necessary that will add to the time the patient waits for surgery. Anecdotally, patients have claimed they had to wait six, eight, or even twelve months to see an ophthalmologist or orthopaedic specialist. If data were available on the waiting times to see surgeons in Manitoba, family doctors and patients might choose a different specialist with a shorter waiting list. Studies of general practitioners in the United Kingdom found that waiting time, while not the only relevant factor, did influence choice of referral destination (Earwicker and Whynes 1998; French et al. 1990; Mahon et al. 1993).

A specialist may order diagnostic tests, often requiring another wait, or may wish the patient to see another specialist to assess and stabilize a concurrent condition prior to surgery. Surgeons may also monitor a chronic condition for a time prior to surgery. For example, a gynaecologist will often monitor a woman with heavy or frequent non-malignant bleeding for a period of time before performing hysterectomy. Or an orthopaedic surgeon will delay knee or hip replacement in younger patients hoping to avoid a reoperation to replace the prostheses later (Naylor and Williams 1996; Imamura et al. 1996). If a patient has a condition for which there are a number of risks as well as benefits, there may be a time delay until these issues are discussed and a decision is made.

Just as general practitioners have different referral thresholds, surgeons have different surgical thresholds. This helps to explain the significant variation in rates of surgery between populations that have similar risk and incidence profiles. Some patients too will be more eager for a surgical solution than others. Research suggests that patients' desire for a surgical solution is often not as great as one might think; 32 of 107 (30%) patients on a waiting list for prostatectomy decided against surgery after reassurance about the natural history of benign prostatism (Barham et al. 1993). Research by Wennberg on models of medical decision-making suggest that decision-making should include fully informing patients and taking into account their preferences (Flood et al. 1996; Barry et al. 1995; Fleming et al. 1993).

The preceding discussion assumes that a visit to a surgical specialist must always precede surgery. Some researchers have wondered if this was so, that is, is the letter of referral from the family practitioner all that is required to schedule surgery, or is it necessary for the specialist to see the patient? While the evidence is limited, it appears that a visit to the specialist is not required for minor surgical procedures performed under a local anaesthetic (Johnson et al. 1996), but that tonsillectomy or cataract extraction should not be scheduled on the basis of a referral letter alone since one-quarter to one-third of patients were not appropriate for surgery (Kumar et al. 1998; Prasad et al. 1998).

Surgery

When the patient and surgeon agree that surgery is the preferred course of action, there will be a waiting period until that can take place. The only way to avoid some waiting is to have unused, excess capacity. In most publicly-funded health care systems, there are capacity constraints which limit operating room, staff and hospital ward availability. Therefore, patients must wait.[3] In most cases, in Canada, surgeons maintain individual waiting lists in their own offices. Information on waits for individual surgeons is not readily available to referring doctors or patients. Nor are there any standardized criteria for entering patients onto a waiting list, or prioritizing them once there.

Much of the literature on waits has focussed on this last part of the wait: the wait between the decision to proceed and the date of the surgery itself. This is defensible because the wait for surgery does not actually begin until there is a decision made to have surgery; the other waits are not the wait for surgery itself, but for a test or a consultation. But one can readily see that, if gallbladder surgery is the end-point of a visit to the GP for episodes of abdominal pain and vomiting, then the wait from the patient's perspective would seem much longer. The rest of this paper will focus on that last portion of the wait: the wait between the decision to have surgery and the surgery itself.

Measuring waiting times

There are several methods of measuring waiting times, including surveys, administrative data analysis, hospital booking systems, registries and priority scoring systems. These are discussed in my paper, *Measuring and managing waiting times: What's to be done?* (Appendix A). One of the methods that have been used to measure waiting times is administrative data analysis, a method which I used previously to measure waiting times for a set of elective surgical procedures in Manitoba (DeCoster et al. 1998) (see

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[3] Chapter One provides a discussion of some of the issues surrounding waiting lists.

Appendix B and C)(DeCoster et al. 2000; DeCoster et al. 1999). In this method, a pre-operative visit to the surgeon is flagged as the beginning of the waiting period, and the date of surgery is the end of the waiting period. Administrative data arise from the claims made for insured health services; in Manitoba, all medically necessary hospital and medical services are publicly funded with no premiums, deductibles or co-payments. In this case, the data are contained in the Population Health Research Data Repository at the Manitoba Centre for Health Policy.

The Population Health Research Data Repository (the "Repository") is a comprehensive data base which records all patient contacts with physicians, hospitals and nursing homes. It is managed by the Manitoba Centre for Health Policy (MCHP) at the University of Manitoba. All records deposited in the Repository have been processed by Manitoba Health to remove names and addresses while preserving the capacity to link records together to form individual histories of health care use.

The procedures that I studied were: cholecystectomy, hernia repair, excision of breast tumours, stripping/ligation of varicose veins, carpal tunnel release, transurethral resection of prostate (TURP), tonsillectomy, carotid endarterectomy, cataract extraction, coronary artery bypass surgery (CABS), and percutaneous transluminal coronary angioplasty (PTCA). A Working Group comprising physicians, hospital managers, and consumers helped to select the procedures that were studied. These procedures were selected based on a number of criteria. The group felt it would be desirable to have:

1. A mix of procedures, from those that were more pressing, e.g., carotid endarterectomy, CABS, excision of breast tumours, to those that were highly discretionary, e.g., varicose vein repair, tonsillectomy. If wait times were getting longer—as was the popular perception—it was expected that the more discretionary procedures would be more likely to have lengthening waits.

2. Procedures that usually had only one pre-operative visit. In the first study, for the first eight procedures listed, 67.3% of patients had only one pre-operative visit. This criterion was especially relevant for surgery to alleviate chronic or long-standing conditions. For instance, the Working Group felt that hysterectomy for benign disease would not be appropriate in this study because women with this condition often made several visits to a gynaecologist prior to the decision to have surgery. A second example concerns hip and knee replacement, for which there was an opportunity to analyze some data from a Registry that was maintained in 1994 and 1995.[4] The visit closest to surgery often did not correspond with the beginning of the wait in the Registry. Therefore, even though hip and knee replacement was an area where waiting times were a concern, it was not analyzed in these studies.
3. Some procedures for which wait times were a growing public concern, such as cataract surgery, coronary bypass and coronary angioplasty.

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[4] The registry was maintained at St. Boniface General Hospital and was entirely voluntary, with the result that only 27% of procedures were registered. There were several flaws in the registry which made it unreliable for analytical purposes, but instructive as to potential pitfalls in developing a Registry.

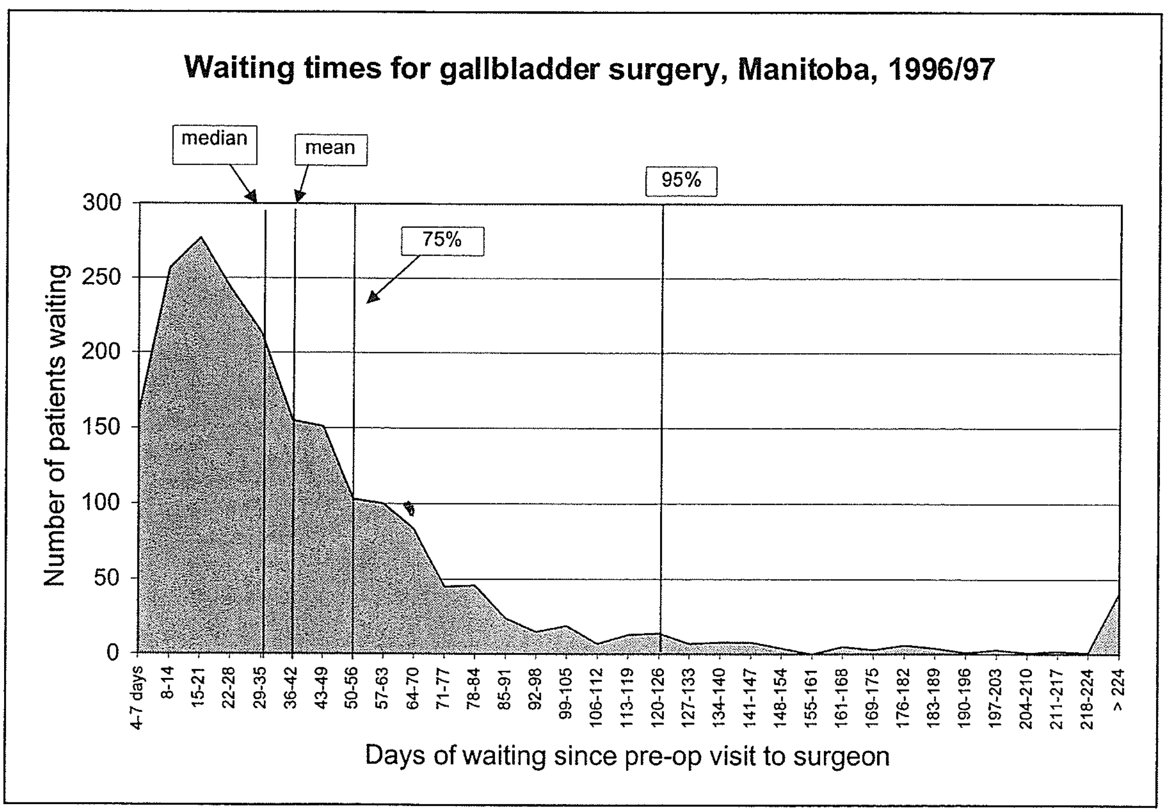
4. Procedures of which a large enough number was performed to permit sub-category analyses, e.g., year, age, sex, region of residence, neighbourhood income level.

5. A limited number of procedures so it was manageable to interpret and report.

Statistical Analyses

One of the difficulties in measuring wait times is that the data are usually skewed to the right (Shortt 2000; Shaw and Shortt 2000; Ortega-Benito 1991; Shaw et al. 1999; Parmar 1993; Goddard and Tavakoli 1998). To illustrate, in 1996/97, over 75% of patients received gallbladder surgery within eight weeks of a pre-operative visit to the surgeon, but about 5% of patients waited longer than four months (figure 2.2).

Figure 2.2: Waiting times for cholecystectomy in Manitoba demonstrate a positively-skewed distribution



Because the distribution of waiting times is often skewed, the mean is influenced by outliers. This raises another issue and that is, the variety of ways that waiting times are reported, compounding the difficulty of making comparisons between studies. Perhaps the most easily understood is the **mean** waiting time. However, since wait-time distributions are usually skewed, the mean is affected by outliers. The **median** is often used to overcome this problem, but the median is less well understood by users. Some studies report the **number** of patients waiting at time n which, in and of itself, is quite meaningless. However cross-sectional data may be combined with other data to yield a new measure. For instance, Moon divided the number of patients waiting at the time of a census (cross-sectional measure) by the mean number of patients cleared (admitted and removed) from the waiting list per month to yield a measure of **clearance time**, or length of time it would take to clear all patients from the wait list (Moon 1996).

Donaldson reported a **standardized waiting list ratio**, a measure of the observed number of patients waiting in a district compared to the expected number based on the region as a whole (Donaldson et al. 1989). This measure permits adjustment for population characteristics like age and sex. Hanning and Lundstrom developed a **waiting list ratio**; it related the waiting list at the end of the year to production, i.e., the number of procedures performed during the year (Hanning and Lundstrom 1998). Several authors have reported the **percentage** of patients waiting specified periods of times, for example, 3 months, or longer than one year. (Bloom and Fendrick 1987; Bishop 1990; Davidge et al. 1987; Hanning & Lundstrom, 1998). Finally, some authors have recommended different methods of graphing the data to illustrate waits over time: **cumulative**

percentage graphs (Shaw and Shortt 2000) and **estimated probabilities** of undergoing surgery as a result of waiting time (Sobolev et al. 2000).

In the Manitoba studies, the median was reported in all analyses, because it is less influenced by outliers. This then raised the problem of conducting tests of statistical significance, since a 'median' is a nonparametric measure. With the advice of a biostatistical consultant, 95% confidence intervals were constructed; however, because the construction of 95% confidence intervals for median values is unusual, it is therefore described more fully here.

Essentially, to calculate the confidence intervals for the median, one must calculate the confidence intervals for the rank-ordered values, assuming that they follow a binomial distribution. One recalls from basic statistics that a binomial distribution shows the probability of x number of subjects experiencing a certain outcome when only two outcomes are possible—in this case, the probability of experiencing a wait that is longer or shorter than the median wait. One must also recall that with a large sample, the binomial distribution approximates a normal distribution. The 95% confidence interval is calculated in the usual manner (i.e., estimated value ± 1.96 * Standard Error). This yields the rank order of the upper and lower confidence limits, and it is then necessary to identify which values occupy these positions. When multiple comparisons were made, a Bonferroni correction was applied to reduce the risk of Type I error (Hassard 1991).

Special modifications to methods

As described, for most of the procedures studied, the beginning of the wait time was defined as the date of a pre-operative visit to the surgeon. This method was modified for coronary revascularization procedures and for cataract surgery.

Coronary Procedures

Patients undergoing coronary artery bypass surgery (CABS) must have a diagnostic procedure called a coronary angiogram to confirm the presence and extent of vascular disease, a procedure which is captured in the administrative data. David Naylor and his colleagues in Ontario compared the dates of coronary angiography and acceptance for surgery, and found them to be a median of three days apart (Naylor et al. 1995). Therefore it seemed feasible to use a coronary angiography as a marker for the waiting time for cardiac surgery. However, since both an angiogram and a consult are routine prior to surgery, both were included: the waiting time was the time between the angiogram *or* the surgical consult, whichever occurred later, and the date of surgery. In the 10% of patients for which there was more than one consult/angio association, the pair closest to surgery was used for the calculation of the waiting time, as this seemed more relevant from a clinical perspective.

It was also necessary to use an angiogram as the marker for coronary angioplasty; because angioplasty is not a surgical procedure, there is no pre-operative consultation, so an angiogram was used instead. Finally, for both coronary bypass and coronary angioplasty, in keeping with much of the literature, waiting times for emergency procedures were also explored, whereas for all other procedures studied only scheduled procedures were studied.

Cataract Surgery

Cataract surgery was also treated differently. Cataract surgery rates have increased remarkably in the last ten years, due to an improvement in surgical techniques along with an aging population. The age-sex adjusted rate of cataract surgery almost doubled in Manitoba, from 3.8 per 1000 population in 1991/92 to 7.5 in 2001/01 (table 2.1). The total number of procedures more than doubled, from 4257 to 8987. Yet cataract surgery is often flagged as one of the trouble-spots when the issue of waiting times is raised.

Table 2.1: Frequencies and age/sex adjusted rates of cataract surgery per 1000 persons in Manitoba

	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01
Number	4257	4842	5226	5551	6741	6742	7397	8518	8520	8987
Rate	3.80	4.28	4.56	4.81	5.79	5.76	6.27	7.20	7.14	7.48

The method used to measure cataract surgery waiting times was modified on the advice of one of Winnipeg's ophthalmic surgeons. His view on seeing preliminary results were that the waiting time estimates were too short. It was common practice when waits were long for surgeons to have their cataract patients see them again shortly before surgery for an ultrasound measurement of the axial length of the eye. Therefore, the method was modified so that if there was more than one visit and the visit closest to surgery was for an ultrasound measurement, then the second closest visit was used.

Another reason that cataract surgery was particularly interesting was the opportunity to analyze the effects of a natural experiment. Cataract surgery is offered at both public hospitals and private clinics in Manitoba. Up until January 1999, patients who opted for surgery in a private clinic were charged a facility or tray fee of approximately $1000. During this time, the surgeon's fee was paid by Manitoba Health; therefore, there was a claim from the surgeon for the procedure, so that the total number of cataract surgery procedures could be identified regardless of whether they were performed in a hospital or clinic. Therefore, a comparison of waiting times between the public and private sector was possible.

The findings with respect to cataract surgery were interesting and controversial. For the first report, the number of public-sector procedures increased, and waiting times initially fell, but then rose back up again, illustrating that an increase in availability does not guarantee that waiting times will decrease. The median wait for cataract surgery was 16 weeks in 1992/93, fell to 11 weeks in 94/95 during which time the rate increased by 11.2%, then rose to 18 weeks in 1996/97 while rates increased by another 12%.

The second finding that was significant was the difference between wait times in the public and private sector. The wait times were shorter in the private sector than the public sector. This was not a surprise since one of the main reasons that people choose private surgery is to have faster access. What *was* surprising was the difference in public-sector waiting times between surgeons who operated both publicly and privately, and those who operated entirely in the public sector. (None of the surgeons operated entirely in the private sector.) The public sector waiting times were considerably longer for the surgeons who operated in both sectors (Appendix B, page JS 196 and table 4; Appendix C, page 21 and figure 4). Waits in the private sector were four to five weeks from 1992/93 to 1998/99 inclusive. Waits in the public sector were as mentioned above: 16 weeks in 1992/93, falling to 11 weeks in 1994/95, then rising to 18 weeks from 1996/97 through 1998/99. However, surgeons who operated in both the public and private sector had waits that were considerably longer for their public-sector patients compared to surgeons who operated only in the public sector (table 2.2). In 1992/93, the difference between the two was only 4 weeks, but by 1995/96 it was 12 weeks and in 1998/99, 16 weeks. Put another way, from 1995/96 through 1998/99, patients having cataract surgery in the public sector might wait three to four months longer if their surgeon also operated in the private sector. Findings like these have been found elsewhere (Light 1996; Richmond 1996; Armstrong 2000)

Table 2.2 : Median waiting times (in weeks) for cataract surgery by practice type

	92/93	93/94	94/95	95/96	96/97	97/98	98/99
Private	4.0	4.3	4.4	4.0	4.1	5.0	5.4
Public – all	15.7	12.3	10.9	11.9	17.9	17.1	17.9
Public - surgeon operates in both sectors (*both*)	17.7	14.3	14.1	19.1	22.9	20.6	26.1
Public – surgeon operates in public sector only (*only*)	13.7	7.7	6.6	6.7	10.4	10.1	10.0
Difference between *both* & *only*	4.0	6.6	7.5	12.4	12.5	10.5	16.1

These projects were performed as part of the work of the Manitoba Centre for Health Policy and Evaluation (MCHPE) for a contract with Manitoba Health.[5] It was customary for MCHPE to disseminate the findings of its deliverables as widely as possible. The findings with respect to cataract surgery were not well-received by the ophthalmic surgeons. First, they felt that the reported waiting times underestimated the real waiting time, despite the adjustment made to our method (Bellan and Mathen 2001). Second, the findings with respect to the much longer waits for public-sector surgery for those

[5] The Centre has since changed its name to the Manitoba Centre for Health Policy (MCHP).

surgeons with a private practice received notice in the media, as well as by the policy makers and other research groups. The implication was that surgeons who worked in both sectors put their patients on waiting lists very early so that their lists were longer and patients would have an incentive to go private. The head of the Department of Ophthalmology, on the other hand, felt that the longer waiting times in the public sector for these surgeons was related to the fact that they had much higher volumes of patients, and not to the type of practice they had.

Around the same time as the Update report on waiting times was being done, the Department of Ophthalmology established a Cataract Surgery Waiting List Registry for patients having cataract surgery in Winnipeg. This Registry created an opportunity to compare waiting times between the Registry and the claims data, in order to assess the validity of the claims data method. Because the Registry also incorporated a measure of visual dysfunction, it would also help to assess whether certain surgeons (particularly the ones with the longest waits) entered their patients onto the Registry at lower levels of dysfunction than others. The next chapter will discuss the comparison of waiting times estimated with administrative data with waiting times from the Cataract Surgery Waiting List Registry.

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Appendix 2: A

Measuring and managing waiting times: What's to be done?

By Carolyn DeCoster

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Measuring and Managing Waiting Times:

What's to Be Done?

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Abstract

On September 11, 2000, the First Ministers of Canada issued a communiqué which, among other things, pledged to develop and report on waiting times for key diagnostic and treatment services. Reporting is to begin by September 2002. Given this commitment, what are the ideal characteristics of such a data collection system? This paper defines and evaluates methods of measuring waiting times, and recommends a prioritized waiting time information system to permit both measurement and management.

WORD COUNT: 75

Measuring and Managing Waiting Times: What's to be done?

On September 11, 2000, a communiqué was issued by the First Ministers of Canada on their meeting about health. Essentially, the federal government agreed to inject funds into health care, in exchange for the provinces' commitment to strengthen and renew Canada's publicly funded health care system. One of the items in the agreement was recognition of the need for accountability, including the need for developing and reporting on a comprehensive set of indicators, for example: " waiting times for key diagnostic and treatment services." Reporting on these indicators is to begin by September 2002.

Long waits to access health care services are usually viewed as a failure of the system to provide care. Media citations provide some evidence of the increasing public awareness and concern about this issue. Using the terms " waiting" and " health" , the Canadian Business and Current Affairs (CBCA) database was searched from 1982 to 2000. Since 1993, the number of citations rose dramatically: 159 in 1993, 290 in 1995, 851 in 1998, and 956 in 2000 (figure 1). However, despite the publicity, there is little reliable evidence that waiting times are dangerously long or growing. In fact, very little is actually known about how long patients wait for surgery - or any other health service - in Canada. As a recent report funded by Health Canada stated: " With rare exceptions, wait lists in Canada, as in most countries, are non-standardized, capriciously organized, poorly monitored, and in grave need of retooling." [1]

This paper will review several methods of measuring waiting times. It can be assumed that the reasons for measuring waiting times is not only to understand where the greatest bottlenecks are, but also to be able to manage waiting times. Hence, in addition to defining and evaluating methods of measuring waiting times, this paper suggests characteristics of a system to permit both measurement and management.

Measurement methods

Methods of measuring waiting times include surveys, administrative data analysis, hospital booking systems, registries, and priority scoring systems. In this section, each of these methods will be defined and discussed briefly.

Surveys: Surveys ask health care providers (usually physicians) to report on their patients' expected waiting times. The best-known of these in Canada is that of the Fraser Institute, but similar surveys have been carried out by both the British Columbia and Alberta Medical Associations. The Fraser Institute combines information from their annual, national survey with data from Statistics Canada to estimate the number of people who are waiting for treatment in each province.

Patients or the public may also be surveyed. The Canadian Medical Association conducted polls in 1996, 1997 and 1998 to measure Canadians perceived access to various health care services, such as family physicians, specialist and surgery. In every area, the percentage who believed that access was deteriorating increased over time.

Surveys are relatively easy to do, and can provide a valuable indication of perceptions, as well as the degree of satisfaction or dissatisfaction with the system. But surveys have several drawbacks. Response rate has been a concern with the Fraser Institute surveys. A good response rate in survey research is 75%; the response rate in the Fraser Institute survey has generally been less than 30%: in 1998 it was 23% and in 1999, it was 25%.[2,3] Another problem with health care provider surveys is that they give no measure of the waiting time for individual patients.

Administrative data analysis: Administrative data, arising from the administration of publicly insured health services, contain hospital abstracts for all surgical procedures. Through record linkage, a date of the last pre-operative visit to the surgeon can be identified and used to flag the beginning of the waiting period. Such data have been used in Nova Scotia and Manitoba.[4-6] A potential disadvantage of the administrative data method is its assumption that the last pre-op visit marks the beginning of the waiting period; however, a recent study comparing British Columbia's hospital booking system with administrative data supported the validity of this method.[7]

Hospital Booking Systems: Hospital booking systems track the number of patients waiting for each elective surgical procedure. Hospital systems usually include some demographic data, the procedure patients are waiting for, the date they were entered into the system, and the date of the procedure itself. Generally no clinical information is included, although some hospital systems do have an indication of patient urgency. Hospital booking systems have been used to report on waiting times in British Columbia, the United Kingdom, Australia and New Zealand.[8-13]

Registries: Registries are similar to hospital booking systems in that they both keep track of all patients waiting for a procedure, but registries are usually disease- or procedure-specific, rather than hospital-specific. In addition to demographic information, registries often include some measure of disease severity and length of time in the queue, both of which can be used to assist with prioritization. Ideally, patients in the registry are monitored so that they can be reassessed if their condition changes, or removed from the registry if appropriate. Examples of registries include the Cardiac Care Network (CCN) of Ontario and Manitoba's Cataract Surgery Waiting List Registry.

Priority Scoring Systems: Priority systems generally use research evidence and some form of clinical consensus-building to develop criteria by which patients can be assigned a relative priority for surgery.[9,14,15] Frequently, registries include a method of prioritization, as do the CCN and the Manitoba Cataract Registry. The Western Canada Waiting List project, a consortium of 19 research, government and provider organizations, has developed and is currently pilot-testing priority tools for cataract, knee and hip replacement, general surgery, MRI and children's mental health.[16]

Priority systems make waiting list management more transparent and equitable. However, this assumes that the guiding principles for the prioritization criteria accurately reflect societal values. Common guiding principles are: need, ability to benefit, and time in the queue. However, there is a potential conflict if both " need" and " ability to benefit" are criteria. Some patients may be in very great need, in terms of pain or suffering, but have limited capacity to benefit. On the other hand, patients with the maximum capacity to benefit, that is, to have complete recovery with surgery, may have only minor problems, hence, less need.[17,18] Length of time in the queue, another potential criterion, may also prove contentious and difficult: should patients who have waited a longer time receive priority over patients with short waits but greater symptom severity?[15]

Assessing data collection methods

The ideal method for collecting data on waiting times depends on the relative importance one places on various criteria. Figure 2 illustrates potential data collection methods as well as the dimensions upon which they may be assessed: development time, system maintenance, potential to prioritize (hence, manage waits), and transparency of decision-making. The data collection methods are arranged from the lowest (bottom) to highest (top) in terms of these dimensions.

Provider survey methods are not included in this figure since they do not permit an assessment of individual patient waiting times.

Administrative data

The advantage of administrative data analysis is that the data collection systems, i.e., for hospital and physician claims, already exist and could theoretically be modified fairly rapidly for use. This method can provide a retrospective measure of how long patients waited for specific procedures, but no indication of how many patients are on the list at any given point, and no measure of clinical severity or prioritization. Furthermore, administrative data cannot be used for any procedures, such as diagnostic procedures, that do not generate a separate record. Administrative data analysis is valuable for monitoring changes in waiting times, but cannot be used to manage them.

Hospital booking systems

Hospital booking systems could also be implemented readily and they have an additional advantage of being able to provide a cross-sectional measure of the number of patients waiting and for how long. Hospital booking systems should be audited from time to time to ensure that patients who are on the waiting lists are indeed still waiting for surgery. Like administrative data, they can be used to monitor how long patients waited for specified procedures. They could provide some measure of priority if an urgency rating were included in the booking request - for instance, within one month, within three months, more than three months - thus permitting some management of patient waiting times.

Priority Scoring:

The next level of data collection includes a measure of priority. A scoring system would need to be developed for each procedure, and could include considerations such as symptom severity, capacity to benefit, threat to social role, and time in the queue. It may be possible to have a scoring system that could be used across procedures, for example, in general surgery, or even across specialties. Each patient in the waiting list would have a score, thus permitting some measure of prioritization between patients. It would be necessary to monitor the patients in the queue regularly to assess whether their circumstances, and thus their priority, had changed. Priority scoring systems provide more transparency, that is, there would be a measure of why some patients should or did receive surgery earlier than others.

Priority Scoring with Thresholds

At the next step, a clinical threshold would be established, below which patients would not be candidates for surgery. The clinical threshold would reflect evidence as well as expert opinion, and as such would make explicit the criteria that surgeons currently use implicitly when recommending surgery. The clinical threshold would not deny care to patients who could benefit from it, since patients whose priority score was lower than the threshold would not be appropriate for surgery. Nevertheless, clinicians would need support in these decisions by hospital managers and politicians for this type of system to be effective.

At the next step, financial thresholds could be introduced, to indicate what level of surgery could be provided within the available financial resources. In New Zealand, data for patients waiting for CABS in four regions were used to develop a distribution of priority scores, which were then used to calculate the costs to provide CABS to all patients at different possible thresholds.[19] The available financial threshold was 10 points higher than the clinical threshold. When that happens, there are a number of possible policy options: allocate more resources to close the gap; deny care to the people whose priority scores fall into the gap; or change the clinical standard. The first option is a societal decision and reflects how much money society wants to direct towards health care. The second would contravene the goals of our publicly insured system, one of which is to provide appropriate care on the basis of need, not ability to pay. The third option sounds like sleight of hand, but has the merit of being equitable and transparent, whereas, without priority scoring systems, the denial of care is irrational and inconsistent. The government may in this case consider permitting a private system to provide care that falls below the clinical-financial threshold.

Following the New Zealand model, money would be earmarked for each type of program or procedure in each province. Alternatively, financial allocations could be decided within each hospital or health authority. In Salisbury, United Kingdom, iso-resource groups (IRGs) have been developed for all elective procedures. Each procedure within an IRG requires the same number of pre- and post-operative bed days and operating room time.[9,20] IRGs were designed for planning purposes, however, they could potentially be used for resource allocation decisions. Hospital or health authority managers could opt to maximize resources within each IRG by focusing on the lower IRG procedures for each priority score. This would maximize value, but would discriminate against patients with similar need, as measured by priority score, but higher resource requirements.

Cost was not entered into the diagram as a dimension for assessment of each method. As for the other dimensions, the cost to operate the waiting time data collection system would be lowest at the bottom and highest at the top. However, the overall costs to the health care system are unknown. For instance, having clinical thresholds might prove to be cost-saving if it was found that surgery is currently being provided to patients who do not meet the clinical threshold.

What's the ideal?

Given the First Ministers' agreement to measure and report waiting times for selected diagnostic and surgical procedures in a consistent manner, what should the data collection system look like? What characteristics should it ideally have?

First, any waiting time measurement system should include a measure of priority, and for the procedures selected, each patient would require a priority score. As stated previously, several examples of priority scoring systems already exist. Provinces must agree to adopt the same priority scoring system for each procedure to ensure comparability between provinces.

Information about the number of patients on each surgeon's waiting list should be publicly available. This would allow patients and referring doctors to select a surgeon with a shorter waiting list if they choose. The patients in the system would also need to be monitored to ensure that their priority had not changed, either for better or worse. Periodic list audits would be necessary to determine if patients who are still in the system are indeed still waiting, and to avoid patients' being on more than one list.

Knowing that patients with a higher priority will undergo surgery sooner could induce some surgeons and patients to game the system. Average priority scores should be fed back to section or department heads so that surgeons could compare themselves to their peers. This method has been shown to be useful in modifying variation in surgical rates in an area.[21] These data could also be shared with referring physicians. It would seem that having higher-than-average priority scores would only work to the surgeon's advantage in the short-term because (i) giving a higher priority score would mislead the patient and would therefore not constitute good care; and (ii) section heads and operating room managers would become sceptical when these surgeons truly have high-priority patients. As a final resort (because it would be more intrusive and expensive), a sample of the higher-than-average surgeon's patients could be re-examined by a second clinician.

Along with the prioritization score, there should be some benchmark, a way to identify whether a patient is a surgical candidate or not. Patients who do not meet this threshold would not be offered surgery. Ideally, there would also be a scoring system, perhaps a simpler one, available for family physicians to use, to assist them in determining when a patient should be referred to a specialist. Studies have found that guidelines like these can make the referral process more efficient.[22,23]

After the clinical tools have been accepted and adopted, there could be a determination of financial implications. Whereas clinicians would be the main decision-makers in determining clinical thresholds, managers would be heavily involved in assessing financial implications. This could be a staggering job if priority scores were used for a large variety of procedures. Possibly procedures could be grouped according to some criteria such as need or expected benefit. For instance, Oregon developed groupings of conditions to prioritize services to be covered (or not covered) by its Medicaid system.[24]

When all is said and done, the decision of how much care the public system could afford would ultimately be a political, hence societal decision. The setting of financial thresholds will no doubt be fraught with controversy. In today's system, governments control costs, yet the day-to-day decisions about who gets access and who has priority falls on physicians' shoulders. Since countless decision are made by independent practitioners in an uncoordinated, and frequently unscientific fashion, inequity results. Having transparent criteria and information on how many patients are waiting, for what, at what level of priority and at what anticipated cost will help to ensure that society's decisions are informed ones.

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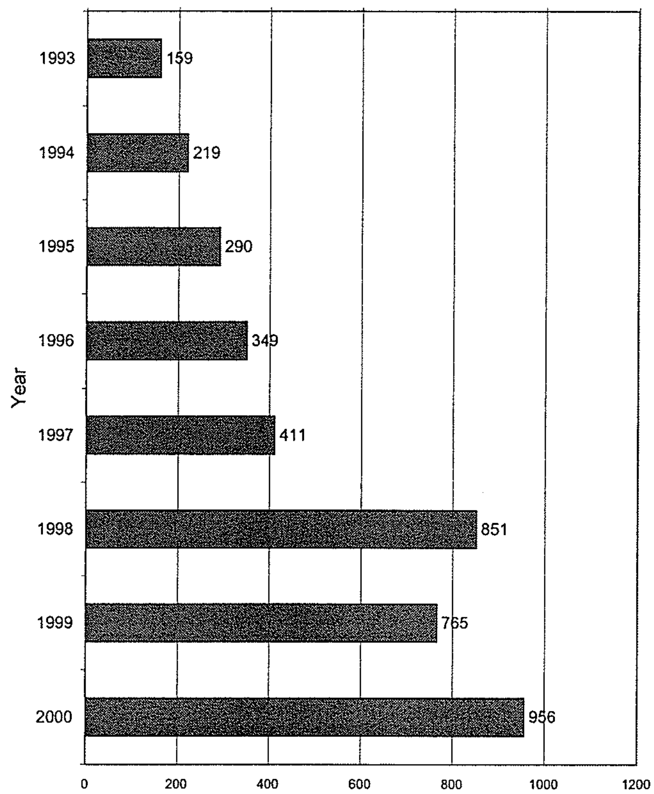
Figure 1: CBCA cites for "waiting" AND "health", 1993 to 2000



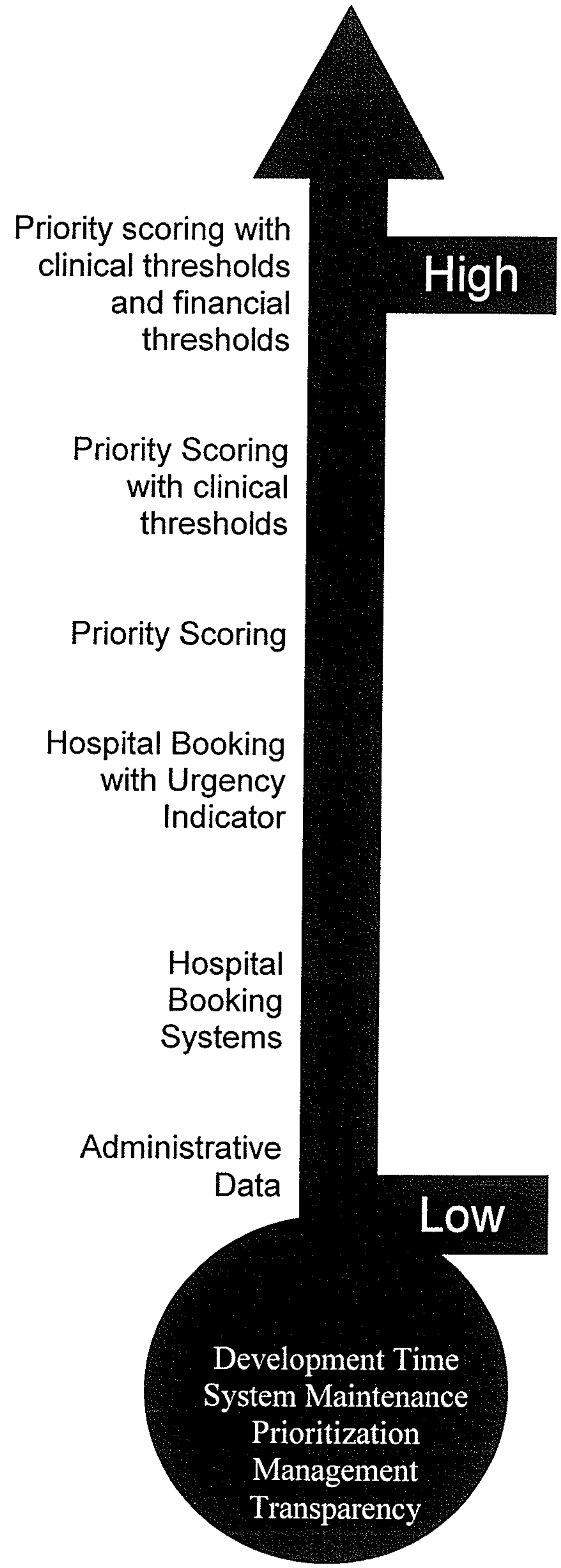


Figure 2: Waiting time data collection: Methods for collecting data and dimensions for assessing their characteristics

Appendix 2: B

Waiting times for surgical procedures

By Carolyn DeCoster, KC Carriere, Sandra Peterson, Randy Walld, Leonard MacWilliam

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Waiting Times for Surgical Procedures

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OBJECTIVES. Polls show that nearly two thirds of Canadians believe that waiting times prior to surgery have increased in recent years. A study was undertaken in Manitoba to determine whether public perceptions about long and increasing waits were valid.

RESEARCH DESIGN. Using administrative data, waiting times for 10 types of surgery—ranging from coronary artery bypass surgery and mastectomy to cataract surgery and hernia repairs—were studied over a 5-year period.

RESULTS. Using each patient's preoperative visit to the surgeon as the beginning of the waiting time, median waiting times for most of the procedures studied were found to have, in fact, remained stable or fallen slightly over the period studied.

CONCLUSIONS. Further, an examination of waiting times for cataract surgery demonstrated that allowing surgeons to practice in both public and private arenas seems to be counterproductive to providing good public service.

Key words: waiting times; waiting lists; surgery; public/private. (Med Care 1999;37: JS187–JS205)

Foreword by the Editors

"Heart patients wait, die." "Need surgery, medical tests? Go to the end of the line."

These headlines capture one of the major complaints leveled at the Canadian health care system: that constraints on resources force long waits for service. The Canadian Medical Association reported that a 1997 opinion poll found nearly two thirds of Canadians felt that waiting times for emergency room treatment and for surgery had worsened over the past few years. This is not a recent phenomenon. The first of the above headlines comes from the *Winnipeg Free Press*, February 26, 1997. The second was written almost 10 years ago, in Canada's national newspaper, the *Globe and Mail*, on May 24, 1989.

Waiting for treatment is described by some as a characteristic, by others as a failure, of publicly supported health care systems. Perhaps Canadians' perception of the unduly long waits for surgery is influenced by rhetoric from south of the border. American critics of a publicly funded health care system are quick to point to the long waits in Canada and label them as rationing. What they often fail to acknowledge is that health care is

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The full report "Waiting Times for Surgical Treatment" on which this paper is based is available ($10.00 Canadian for Canadian orders, $12.00 U.S. for orders from outside Canada) from the Manitoba Centre for Health Policy and Evaluation, University of Manitoba, S101-750 Bannatyne Avenue, Winnipeg, MB Canada R3E 0W3.

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The results and conclusions are those of the authors, and no official endorsement by Manitoba Health or our reviewers was intended or should be implied.

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rationed in the United States, too, based on price. Uwe Reinhardt, James Madison Professor of Political Economy at Princeton University, states that the United States Congress has officially embraced "an income-based health system that will ration health care quite severely for Americans assigned to the bottom tier and not at all for Americans in the upper tier."[1] Health care is readily available for those who can pay; excess capacity guarantees rapid service.

Queues are not necessarily a bad thing. In a discussion of waiting times in the United Kingdom, Edwards[2] notes that some surgeons argue that waiting lists and waiting times can serve a useful purpose. A period of delay allows some conditions to improve spontaneously, and some patients to take time to consider whether they really want an elective procedure, which is never without at least some risk. Waiting lists also enable the optimum scheduling of surgical resources for a mix of long, complex cases with shorter ones. Thus, waiting lists and waiting times can serve a useful purpose as part of patient management.

Policymakers and politicians are sensitive to the issue of waiting times. They are often called to respond to the complaints of patients, clinicians, and opposition members about "excessive" waits. Almost everybody knows someone who has waited for a surgical procedure. Others insist that waits can be manipulated, suggesting that if you try another surgeon or go elsewhere, openings occur. Because of the ongoing concerns about waiting times, Manitoba Health had been interested for some time in having the Manitoba Centre for Health Policy and Evaluation (MCHPE) investigate the issue. We delayed until several new pieces of evidence converged, convincing us we could use administrative data to credibly explore this issue. This paper explores some of the conceptual issues with respect to waiting times, analyzes administrative data to estimate the wait for specific surgical procedures in Manitoba, and explores criteria that might be considered in establishing a centralized registry to monitor waiting times.

Introduction

Although newspaper headlines frequently express concerns about waiting times and access to necessary treatment, waiting time data are not generally collected in Canada, except in the area of cardiac surgery. To obtain a more accurate perspective on this issue, in November 1997, Health Canada commissioned a report, to be completed in 1998, to synthesize information about the nature, extent, scope, and effect of waiting lists, including a literature review as well as a list of waiting lists currently being used.

One reason that data on waiting times are not collected is the complexity of what, on the surface, seems to be a fairly straightforward issue. Waiting lists can be compared to a pool of water in which the rate of inflow and outflow are imperfectly related, and are influenced by different factors. It is often assumed that more money for surgery will shorten the long waits. However, it is difficult to determine the effect of an increased rate of surgery on the size of the waiting list. A study in the United Kingdom found that as surgical admissions from the waiting list increased, paradoxically so did the size of the waiting list.[3] In Ontario, despite a 15% increase in the number of coronary bypass procedures performed from 1992/93 to 1995/96, the median waiting time for surgery increased from 17 to 23 days.[4]

Reasons for this paradoxical finding are uncertain. It may be that some patients and physicians do not seek surgical treatment if they believe waits to be impossibly long. Availability affects the therapy the physician prescribes; comparisons between England and the United States have found that the threshold for treatment was higher in England. For example, British physicians would advise elderly patients who would be considered dialysis candidates in the United States that nothing could be done to help them.[5] Similarly, when asked to assess hypothetical case histories for appropriateness for angiography or for bypass surgery, physicians in the United States judged more indications to be appropriate than did British physicians.[6] Also, the development of new technology, for instance hip replacement and cardiac surgery, permits surgical intervention where none had been possible before, thus increasing the total number of people waiting for surgery. These procedures and many others are more commonly performed on the older population; as that portion of the population increases, so might the demand for surgery. Also, criteria for acceptance for surgery change as experience and technical safety increase, so that people who were not previously surgical candidates may now be accepted for surgery. This may be the case for coronary artery surgery in the 1980s in Ontario; the proportion of bypass procedures in the over-65 population rose from 12.8% in 1979 to 27.4% by 1985, despite a falling incidence of coronary artery disease.[7]

Waiting Lists Versus Waiting Times

There are different ways of viewing queuing data. The number of patients on a waiting list is not very helpful, except perhaps to monitor changes over time. Whether a waiting list contains 100 or 1000 names tells us little about the wait or patients' experiences during the wait. Knowing the average waiting time is more helpful: how long after entry onto a waiting list did patients wait for their surgery?

Surgical Variations

It is well established that surgical rates vary from physician to physician and from country to country. Variations in rates of surgery in populations that are similar to each other suggest that criteria for surgery are not standardized.[8–13] Some surgeons and some patients are more prone to seek a surgical solution than are others. The threshold for surgical intervention varies, thus affecting the size of the waiting list. Not only the rate of surgical intervention, but also the rate of diagnostic testing that influences the rate of surgery, varies. Wennberg et al. found a strong and direct relationship between the degree of stress testing, angiography, and coronary artery bypass surgery.[14]

Patient Factors

Yet another factor to consider is the effect of patient preference, particularly for elective surgical procedures. Anecdotal evidence abounds of patients postponing their surgery until a time that is more convenient for them. Students wait until the end of the semester to have a hernia repaired, and working people wait until their vacations for varicose vein stripping (or perhaps until their vacations are over, depending on their sick benefits and how much they like their jobs!). Seniors, especially in Manitoba, postpone cataract surgery until after they return from spending the winter months in a warmer climate.

Another patient factor affecting waiting time is the presence of chronic conditions. Patients with heart or renal disease might have to have those conditions stabilized before surgery can proceed. At the very least, these concurrent conditions might add to the overall wait simply because the surgeon wants a referral to another specialist to assess the condition before going ahead.

Patients' acceptance of waiting for surgery may be greater than we imagine. Persons who had been placed on waiting lists for cataract surgery in Manitoba, Spain, and Denmark were interviewed to determine their willingness to pay to shorten the wait.[15] The majority were unwilling either to pay higher taxes or pay out of pocket to reduce the wait; however, as the length of the anticipated wait increased, there was a greater willingness to pay.

Trigger Point

Another complexity is determining the "trigger point" for entry to the waiting list. In the United Kingdom and Australia waiting lists are kept for elective patients. Entry to the list is made by the surgeon, who submits the patient's name to a hospital when the decision to have surgery is taken. Before that time, however, patients may have seen their family practitioners one or more times for the problem, undergone diagnostic tests and procedures, and then been referred to a surgeon. The surgeon may order more tests, or monitor the problem for a time (e.g., a gynecologist often will monitor a woman with heavy or frequent nonmalignant bleeding for a period of time before performing a hysterectomy), or send the patient to another specialist to stabilize a chronic condition before surgery. Meanwhile, patients wait between each of these steps, and may feel that they have been waiting much longer than the time period officially recorded.

Once a patient is on a waiting list—whatever the trigger point—what criteria should be used to determine priority for surgery? Is length of time in the queue the only factor? One can immediately see problems with using time as the only criterion. Surely patients whose conditions are more urgent should take priority over those in less need. But how does one define need? In Ontario, a delphic method and consensus panel were used to develop prioritization criteria for coronary bypass surgery[16] and hip and knee replacement,[17] but for the vast majority of procedures, no such formal priority-assignment model exists.

When one is put on a waiting list—and bear in mind that formalized waiting lists do not generally exist in Manitoba—depends not only on the surgical threshold, but also on the way in which surgeons submit names for the list. In the United Kingdom, some ophthalmologic surgeons enter their patients onto the waiting list for cataract surgery at an earlier stage of impairment than others, in anticipation of a long wait. Thus, they would have very long lists and very long waits. Other ophthalmologists wait until the patient's vision has deteriorated before placement on the list; therefore, they have shorter lists and waiting times. In fact, patients of both types of surgeons come to surgery with about the same level of symptoms and impairment.[18]

Waiting List Management

Managing waiting lists is challenging. There is little incentive for surgeons or hospitals to "clean up" their lists. It is tedious work, and long waiting lists can be used to put pressure on governments to provide more resources. Reviews of patients on waiting lists have demonstrated substantial inaccuracies. Reasons that patients should be removed from waiting lists include improvement in symptoms, completion of the surgery, inability to locate, out-migration, or death. In one British study in the Oxford area, comparisons of two data sources over a period of 10 years revealed that 28% of patients on the waiting list never came to surgery at hospitals in the region.[19] In New Zealand, after a questionnaire and clinical reassessment, it was found that half the patients on an orthopaedic waiting list did not require surgery.[20] An audit of surgical waiting lists at Dunedin Hospital in New Zealand found that nearly 25% of patients should be removed from the list.[21] In the Dunedin audit, 6% of the patients on the list felt that they no longer needed or wanted the surgery. A reassessment of 107 patients waiting for transurethral prostatectomy for benign disease found that 51 (48%) could be removed from follow-up; 19 were found to have normal urinary flow rates; and 32 with minimal symptoms decided against surgery themselves after reassurance about the course of their disease.[22]

The only way to eliminate queues is to have excess capacity. To avoid any waiting means having equipped operating rooms and suitably trained staff standing by as well as vacant hospital beds for postoperative care. Excess capacity will encourage higher rates of surgery, increasing the rate of unnecessary surgery, as well as the rate of postsurgical complications and deaths. In a review of the appropriateness of coronary bypass surgery in areas with different surgical rates, there were more low-benefit cases performed in higher-rate areas.[23] In the waiting list reviews noted earlier, a percentage of patients did not require surgery (6% in the Dunedin audit, 48% in the transurethral prostatectomy [TURP] review, and 16% in the orthopaedic review).

Unquestionably, excessive waits for necessary surgery increase pain, suffering, disability, and perhaps even the risk of death. Yet there also are indications that too much surgery leads to a higher level of unnecessary surgery, more surgical complications, and more deaths. Finding the balance is a challenging task, especially since patient preferences and medical decision-making are variable.

Methods and Results

Working Group

A Working Group was established to advise on the project. Its role was to review and suggest improvements to the project methodology; provide feedback on the analysis and interpretation of findings; review and comment on draft reports; and provide input to recommendations to Manitoba Health based on the study findings. The members of the Working Group for the waiting times study included the CEO of a rural hospital, the head of surgery in the medical faculty and the teaching hospitals, a cardiac surgeon, a board member of the Consumers' Association of Canada, a past president of the Manitoba Society of Seniors, a family physician, an individual who had worked with establishing a surgical registry, and a key administrator from Manitoba Health.

Elective Surgical Procedures

Administrative data contain a history of contacts in the period before surgery between the patient, the patient's family physician, and the surgeon, (as well as documenting referrals and some diagnostic tests). Although we thought we could convince ourselves of the robustness of a definition using various approaches, we needed some evidence of a gold standard from primary data collection to convince others who were skeptical, particularly in this highly politicized area. This project became a possibility when we received a working paper from a sister organization in Toronto, the Institute for Clinical Evaluative Sciences. Using data collected prospectively as part of the organization's Cardiac Care Network registry, the paper documented waiting times for more than 8000 consecutive coronary artery bypass patients. The median time between angiography and submission of the patient's name to the registry waiting list for bypass surgery was 3 days.[24] Because our database contained dates of angiography and dates of bypass surgery, we felt we could propose a waiting times project at least for this procedure.

At about the same time, we met with a medical vice president at one of the teaching hospitals. He had worked with orthopaedic surgeons at his hospital and others in the province to develop a waiting list for hip and knee replacement surgery. By using his data to test waiting time algorithms we might develop from administrative data, or by analyzing his data directly, we could potentially add two additional key procedures to a waiting times project.

Thus, we initially intended to use administrative data to explore the waits for coronary artery bypass surgery (CABS) and percutaneous transluminal coronary angioplasty (PTCA), as well as data from the provincial hip/knee replacement registry. After our initial analyses and on the advice of the Working Group, we analyzed selected elective surgical procedures and cardiac procedures. Regrettably, the hip/knee replacement registry was found to have serious flaws, which were instructive in terms of developing criteria for setting up a registry, but limited the registry's usefulness as a guide.

Because there is no field in the administrative data to indicate when each patient and physician made the decision to proceed with surgery and, hence, began to wait for a surgical booking, a marker had to be found to flag the beginning of the wait for surgery. The marker had to be present in a high proportion of cases, and it had to make sense to clinicians. We chose the preoperative visit to the operating surgeon as the marker for when waiting time began. Our method is similar to one used by the Nova Scotia Department of Health.[25] Our method assumes that for the elective surgical procedures we analyzed, the family physician refers the patient to a surgeon, and the decision is made to have surgery, after which the patient is not seen again by the surgeon until surgery. Any problems that arise in the meantime are handled by the family physician. We did not analyze the wait between referral from the family physician and the preoperative visit to the surgeon. Although this is an important component of patient waiting, it was outside the scope of this study.

Issues of waiting times for surgical procedures usually are treated separately from issues of population-based surgical rates. However, we had just finished a project on specialist physicians in the province,[26] and information on the access of Manitobans to procedures such as coronary artery bypass surgery compared to access by residents of other provinces was relevant and available. Therefore, this information also was incorporated into this report.

Validity and Sensitivity of Results

The physicians in our Working Group emphasized that all decisions to have elective surgery were made jointly by surgeon and patient; therefore, they generally accepted our method of using a preoperative visit to the surgeon as the beginning of the waiting period. However, the group was careful to select procedures for analysis that fit our assumptions. For instance, our method is not appropriate for long-term or chronic problems, which is why we decided to exclude hysterectomy for benign disease from the study. The group, when asked, wanted the median wait used rather than the mean (since the mean was affected by outliers) but also wanted some measure of statistical significance. This was not a small request, because the existing program to calculate confidence intervals was not applicable for medians with a skewed distribution.

We presented to the Working Group the effect of certain exclusions—for example, limiting the analysis to elective patients, and limiting the analysis to the first procedure over the time period. This careful presentation of the effect of each limitation seemed to make the group more comfortable with the validity of the results as a tool for monitoring waiting times for selected procedures over time. Nevertheless, group members were still concerned about what was missing from administrative data: the clinical and social factors that often affected the length of the wait or surgery, as well as information about patients who are still waiting to have their surgery.

Procedures Investigated

We selected eight surgical procedures that are commonly performed and represent a variety of conditions. We applied certain diagnostic limitations, as follows:

Cholecystectomy (abdominal or laparoscopic). We excluded patients who had surgery for malignancies or for pancreatitis. The main diagnoses that we included were gallstones, cholecystitis, or abdominal pain.

Hernia repair. We included inguinal and femoral hernia without gangrene.

Excision of breast lesions. The diagnostic codes included benign and malignant tumors of the breast. We excluded breast biopsies, but included lumpectomies and mastectomies.

Stripping/ligation of varicose veins. We considered this procedure only when performed for varicosities of the lower extremities, not esophageal or gastric problems.

Carpal tunnel release. We considered this procedure when performed for carpal tunnel syndrome.

Transurethral prostatectomy (TURP). We included TURP performed for benign hyperplasia, but excluded all malignancies.

Tonsillectomy. We included tonsillectomy performed for tonsillitis or hypertrophy, but not for middle ear infections.

Carotid endarterectomy. There were no diagnostic restrictions.

Estimating Waiting Times for Elective Surgery

As stated previously, we applied diagnostic restrictions to the surgical procedures under consideration. Hospital abstracts permit up to 12 procedure codes and 16 diagnoses; the procedures and diagnostic codes that we included had to be in the first position, indicating that they were the primary reason the patient came to hospital. We searched the Data Repository for patients with the eight procedures defined above, from 1991/92 to 1995/96. The result was 52,213 records.

The hospital abstract includes an admission status code: urgent, emergent, elective, or day. We included only elective or day procedures for this analysis. After this step there were 47,368 records (4845 records [9.3%] were removed).

In cases where an individual had more than one of the procedures over the time span of the study, we included only the first procedure. Also, we searched the 2 years before 1991/92 to exclude patients who had had any of the procedures prior to the study period. To simplify the analysis, we included only the first procedure. (We found that among the patients with more than one procedure, many of them (65%) were potentially bilateral procedures: carpal tunnel, varicose veins, hernia repair, carotid endarterectomy. We noted that often patients did not have a visit recorded to the operating surgeon between procedures, so we had no trigger point to flag the beginning of the wait for the second procedure.) After this step, there were 44,086 records (3282 records [6.9% of 47,368] were eliminated).

We merged hospital records with physician claims and looked for a preoperative visit to the operating surgeon. Patients who did not have a preoperative visit with the operating surgeon were excluded. If there was more than one preoperative visit, we used the last of those prior to surgery. Most patients (67.3%) had one preoperative visit with the surgeon, 17.8% had two visits, 5.7% had three visits, and 9.2% had four or more visits. (In the Nova Scotia study, more than 75% of cases had only a single visit prior to surgery.) After this step, there were 41,969 records (2117 records [4.8% of 44,086][25] were eliminated).

We excluded patients who had a preoperative visit within 3 days of surgery, assuming that these patients were more urgent. Like the exclusion of urgent and emergent patients, the 3-day rule was used to give us a more conservative estimate; when we removed this restriction, the mean and median waiting times were between 5 and 20 days shorter. After this step, there were 40,814 records (1155 records [2.8% of 41,969] were eliminated).

We analyzed the results for each year, by gender, by region of residence, and by socioeconomic status. The 1991 Canadian census has information on average household income in each enumeration area. We used these data to rank Winnipeg neighborhoods into five income quintiles. An urban enumeration area is defined by Statistics Canada as having a population density greater than 400 persons per square kilometer. Average income is less applicable in rural areas; therefore, only Winnipeg residents are included in this analysis.

We report the median in all tables. The median is the midpoint, the length of time at which half the people over a given time period have already received their surgery. The median has the advantage of being uninfluenced by outliers, unlike the mean. We calculated 95% confidence intervals for all medians. For ease of presentation we have not included all of the interval values, but indicated only statistically significant differences.

Rates of Procedures

We looked at the rate of the eight procedures listed above over five years of data (Table 1). This was relevant because if the number or rate of a particular procedure changed substantially, then we might expect the waiting times to change also. If more procedures are done, then the waiting time might be shorter. On the other hand, even if more procedures are done to compensate for increased demand, it is possible that demand still exceeds supply, so that waiting times might, in fact, increase. Annual rates were calculated from 1991/92 to 1995/96, directly standardized to the 1992 population. Procedure rates remained quite stable over the time period except for cholecystectomy and carotid endarterectomy. Although the rate of carotid endarterectomy doubled, it is still an infrequently performed procedure, at only 0.3 procedures per 1000 population. Cholecystectomy rates increased in 1992/93 and then remained stable.

Waiting Times for Elective Surgical Procedures

Waiting Times by Year. Table 2 gives the median waits by procedure for each year. Values that are significantly different from the 5-year median are indicated with an asterisk. Note that even where there is a significant difference statistically, it may not be significant clinically. For instance, although the 28-day median wait for hernia repair in 1994/95 was found to be statistically different from the 5-year median of 30 days, it is doubtful whether a 2-day difference is clinically meaningful.

In general, median waits tended to be getting shorter or remaining stable. Median waiting times for cholecystectomy declined significantly over time. Between 1991/92 and 1993/94, there was a big shift from abdominal cholecystectomy to laparoscopic cholecystectomy, a procedure that is less invasive and requires shorter postoperative stays. This shift might account for the shorter waiting times as well as the nearly 10% increase in cholecystectomy procedure rates between 1991/92 and 1995/96.

The only procedure that demonstrated a trend to increased waiting times is carpal tunnel release; waiting times in both 1994/95 and 1995/96 were significantly higher than the 5-year median. Carpal tunnel syndrome is a computer-related illness and, not surprisingly, the rate of performing this procedure increased 15.1% from 1991/92 to 1994/95; in 1995/96, the rate fell somewhat, but the waiting times increased. One possible interpretation is that waiting times increased in 1995/96 because fewer procedures were performed.

Waiting Times by Region of Residence. Are there differences in the wait for surgery depending on where people live? Do residents of Winnipeg or Brandon—where most of the surgical specialists live—wait for less time than residents of other regions of the province?

Manitoba is divided into 10 rural Regional Health Authorities, the Brandon Regional Health Authority, and two authorities in Winnipeg. To compare waiting times for all procedures for each RHA was not feasible because of the small numbers of some procedures performed in some regions. Therefore, for this analysis, we grouped RHAs into five areas according to two criteria: geographic proximity and where their residents received most of their surgery. Surprisingly, residents of Winnipeg and the West, where Brandon is situated, often had longer waiting times (up to 11 days longer) than the provincial median, even though one would think that these residents would have easier access to specialists. The South consistently had significantly shorter median waits. Rates of surgery were compared between regions; no region consistently had higher or lower rates of surgery.

The median wait for TURP (for benign disease) was notably higher in the West (69 days) than the provincial median (29 days). The median wait for TURP for Western Manitoba residents was very high for 1991/92 and 1992/93, fell to the provincial median in 1993/94 and 1994/95, then rose somewhat—although not significantly—in 1995/96. The rate of TURP was somewhat lower in the West compared to the rest of Manitoba.

Waiting Times by Neighborhood Income. Table 3 demonstrates the median waiting times for each procedure for residents from neighborhoods with dif-

TABLE 1. Rates of Surgical Procedures Per 1,000 Population, Directly Standardized to the 1992 Population

	91/92	92/93	93/94	94/95	95/96	Change 91/92 to 95/96
Cholecystectomy	2.33	2.61	2.60	2.58	2.55	9.4%
Hernia repair	2.26	2.29	2.30	2.16	2.17	−4.0%
Excision breast lesions	2.38	2.19	2.17	2.30	2.42	1.7%
Varicose veins	0.36	0.35	0.31	0.40	0.37	2.8%
Carpal tunnel release	1.06	.94	1.06	1.22	1.08	2.0%
TURP	2.59	2.18	1.58	1.38	1.52	−41.3%
Tonsillectomy	2.02	2.08	1.99	2.13	2.02	0.0%
Carotid endarterectomy	0.14	0.14	0.12	0.19	0.28	100.0%

ferent levels of income; the asterisks indicate significant difference from the overall Winnipeg median.

Table 3 shows that generally there were no differences in waiting times for surgery based on income status, although the lowest-income neighborhoods tended to have shorter waits than the Winnipeg median. For hernia repair, residents of the poorest neighborhoods had significantly shorter waits than the Winnipeg median, and for carpal tunnel release, patients from the wealthiest neighborhoods waited significantly longer than the Winnipeg median.

Waiting Times by Gender. There were no differences in the median wait based on gender.

Waiting Times by Age. We examined whether people who were younger came to surgery more quickly. Our hypothesis was that people under the age of 65 were more likely to be in the workforce and would perhaps receive surgical treatment more quickly so that they would be subject to fewer interruptions at work. We therefore divided patients into two categories: younger than 65 years and 65 years or older. Because there are almost no tonsillectomies performed on older adults, that procedure was excluded from this analysis. Contrary to expectations, patients who were under 65 years had longer waiting times than those aged 65 or older. For every year except 1992/93, the waiting time for patients aged 65 or older was significantly shorter than the provincial median.

Analysis of Mean Waiting Times

Our analysis of medians indicated that there were no real fluctuations in waiting times over the last 5

TABLE 2. Median Waiting Times (Days) Between Pre-Operative Visit to Surgeon and Surgery Date, Manitoba

	91/92	92/93	93/94	94/95	95/96	91/92 to 95/96
Cholecystectomy	36*	35*	32	30	28*	32
Hernia repair	36*	29	29	28*	30	30
Excision breast lesions	16	16	14*	16	16	16
Varicose veins	43	35	34	43	40	39
Carpal tunnel release	34	29*	29*	38*	42*	34
TURP	45*	30	24*	26	24	29
Tonsillectomy	62*	55	49*	51	57	54
Carotid endarterectomy	33*	24	23	24	29	27

*$P < 0.05$ compared with 91/96 median.

TABLE 3. Median Waiting Times (Days) for Winnipeg residents by Average Neighborhood Income for Each Procedure, 1991/92 to 1995/96

Median Waiting Times	Lowest 20%	Second Lowest	Middle 20%	Second Highest	Highest 20%	Winnipeg Median
Cholecystectomy	32	34	36	35	33	34
Hernia repair	29*	31	32	32	34	32
Excision breast lesions	17	18	17	16	16	17
Varicose veins	40	43	37	42	47	42
Carpal tunnel	34	33	34	42	48*	39
TURP	23	25	28	32	25	27
Tonsillectomy	64	62	63	69	68	65
Carotid Endarterectomy	25	30	20	29	28	27

*$P < 0.05$ compared with Winnipeg median.

years. Nonetheless, 95% confidence intervals often resulted in very narrow estimates in median times. This indicated a high concentration of patients around the median. Since comparing median waiting times does not convey any information about variability, we also explored mean waiting times to consider the face values of waiting times beyond the midpoint of all observed data. The findings of this analysis were consistent with the analysis of medians, and offered statistical reinforcement for our findings.

Cataract Surgery

In recent years, the growth in cataract surgery rates has been remarkable. Whereas cataract surgery formerly required strict bed rest for several days and thick distorting glasses that limited patients' mobility, technological improvements have made it possible to perform cataract surgery quickly and safely on an outpatient basis. Lens replacement allows vast improvements in vision, and hence in quality of life. The volume of cataract surgery increased 60% in Manitoba from 1991/92 to 1995/96, from 3882 to 6200 procedures, and the rate increased 53%, from 3.46 to 5.29 per 1000 population.

Cataract surgery is available privately as well as publicly in Manitoba. It is offered in two hospitals—in Winnipeg and Brandon—as well as two private clinics in the same two cities. In both a public hospital and a private clinic, the surgeon's fee is paid by Manitoba Health; however, patients who opt to attend a privately run clinic must pay a "facility" or "tray" fee for overhead and support services. The fee in 1997 was $1000 in the Winnipeg clinic and $1200 in Brandon. (In 1994, the fee ranged from a low of $510 plus the price of the lens in one clinic, to a high $1273, including the lens; at that time there were three clinics.)

One of the arguments used to support the need for private surgery is expediency; rather than wait many months with impaired vision, a private clinic can offer surgery in a matter of weeks. In 1994, the Consumers' Association of Canada, Alberta branch, conducted a telephone survey to assess the waiting time for cataract surgery.[27] The Association found intriguing differences in the waiting times depending on whether the surgeon operated both publicly and privately or only publicly. The wait for surgery in a private clinic was from 1 day to 4 weeks. To receive surgery in the public system, the wait was from 2 to 8 weeks if the surgeon's practice was entirely in the public system. However, if the surgeon operated both publicly and privately, the wait for surgery in the public system was up to a year. We wanted to know if this was true in Manitoba also.

Methods

We identified cataract surgery in hospital claims, including only patients who were coded as elective or day surgery patients. Patients who received surgery in private clinics were identified using physician claims (for this we look for a tariff or billing number, since we do not have procedure codes in the physician claims). We included only the first cataract procedure for each patient. Thus, if a patient had one eye operated on in a private clinic and one in the public hospital, we included only the one that took place first. As before, we used a visit to the operating surgeon as the marker for when waiting time began. However, we did not use the "3-day" rule for this comparison, because private clinics are supposed to offer faster service, and cataract surgery is rarely urgent.

When we used the visit immediately preceding surgery, we calculated median waiting times for patients in the public sector ranging from 6 to 9 weeks. Feedback from one of Winnipeg's ophthalmologists was that these waits did not seem to square with his experience or that of his colleagues; his experience was that waits were longer than that. He also noted that some ophthalmologists call patients back to their offices just before surgery if they have had a long wait, to perform ultrasound to measure the axial length of the eye. Using this advice we re-examined our data. We found that for patients with more than one preoperative visit, the visit closest to surgery was coded for ultrasound measurement in 52% of the patients. Therefore, we modified our method. For patients with one preoperative visit, we used that visit to calculate the waiting time. For patients with more than one preoperative visit, if the visit closest to surgery was coded as an ultrasound measurement, we used the visit before that for calculating the waiting time.

Results

As anticipated, patients who received their cataract surgery in a private clinic had shorter median waiting times than those who received surgery in the public hospital. The median wait for surgery in a private clinic was about 4 weeks, and this remained stable from 1991/92 through 1995/96. The median wait for surgery in the public system was 18 weeks in 1991/92, falling to 12 weeks in 1993/94 and remaining there. (Ophthalmology surgery in Winnipeg was consolidated at one hospital in 1993/94.)

When we grouped patients according to their surgeons' practice, a different picture emerged. We separated surgeons into those who operated only publicly and those who operated both publicly and privately. *Private surgery* was defined as procedures performed by surgeons who performed at least 100 procedures privately over the 5-year period. Using this limitation, we excluded 134, or 6.8%, of private clinic patients over the period. (None of the surgeons operated in the private sector only.)

By far the majority of cases (approximately 90%) were performed in the public hospital. Surgeons who operated only in the public sector performed from 38.2% to 46.9% of all cataract procedures. The group of surgeons who operated both publicly and privately consistently used the public system for more than 75% of their patients.

Table 4 shows the different median waiting times for public sector patients according to whether or not their surgeon also operated privately. The median wait for surgery in the public sector was different depending on the surgeon's practice. For surgeons who operated only in the public sector, the wait was 7 to 8 weeks for 1993/94 through 1995/96. For surgeons who operated in both the public and private sector, the waits were 15, 14.4, and 20 weeks for the same three years, a difference of 7 to 13 weeks. As the Consumers' Association discovered in Alberta, cataract surgery in the public sector entailed much longer waits if the surgeon also had a private practice. One might wonder about the availability of operating room time—that is, if surgeons who operate in both sectors had less operating time time in the public sector, that would explain the longer waits. Discussions with one ophthalmologic surgeon in Winnipeg revealed that a policy has been put into place in Winnipeg to allocate operating room time equally for all surgeons.

Results by Income Category. Interestingly, not all of the Winnipeg patients who had surgery in a private clinic came from the wealthier neighborhoods. In fact, over the period of the study, 40% of private clinic patients lived in the two neighborhoods with the lowest average incomes. Hence, the option of private surgery is not used only by the well-to-do.

More people living in low-income neighborhoods receive cataract surgery than do those in high-income neighborhoods. There is some research evidence that cataract formation is an indicator of generalized tissue aging, and that the formation of a cataract at an earlier age (50 to 65 years) may be related to lower socioeconomic status.[28] Over the 5-year period, 2598 and 1963 patients who lived in the two lowest-income neighborhoods and 1482 and 1368 patients from the two highest-income neighborhoods received surgery. We found no difference in the median waits (in either the public or private sector) for patients living in different income neighborhoods.

TABLE 4. Median Waiting Times (Weeks) for Cataract Surgery in Public Sector, Depending on Whether Surgeon Operated Privately or Not

	91/92	92/93	93/94	94/95	95/96
Surgeon operated in public sector only	13.7	13.7	8.2	6.9	7.4
Surgeon operated both publicly and privately	22.1	18.6	15.0	14.4	20.0

Cardiac Procedures: Coronary Artery Bypass Surgery and Percutaneous Transluminal Coronary Angioplasty

Waiting times for isolated coronary artery bypass surgery (CABS), that is, CABS without a valve replacement or other heart procedure, were examined. Both an angiogram and a surgical consult are routinely required before CABS. Therefore, our marker for calculating the wait for CABS included both an angiogram and a surgical consult. The waiting time was the time between the angiogram *or* the surgical consult, whichever occurred second, and the surgical procedure date. If there was more than one consult/angio association (as was the case in about 10% of patients), we used the pair closest to surgery for the calculation of the waiting time, again using the later of the two events in the pair. Using the earliest angio/consult made no difference to the median waits for urgent/emergent patients, but increased the median waits for scheduled patients by about 10 days in each year. We chose, however, to use the latest angio/consult because it was more relevant from a clinical perspective. Our definition captures about 95% (2919) of all procedures when the denominator is procedures having at least one angio or one cardiac surgeon consult (n = 3075).

Percutaneous transluminal coronary angioplasty (PTCA) is a procedure that is undertaken in the angiography suite, not the operating room, and there usually is no surgical consult before the procedure. Therefore, the marker for waiting time for PTCA is the date of the last angiogram prior to angioplasty.

Because much of the literature on coronary procedures includes the waiting times for urgent or emergent cases, we did not initially exclude these patients from the analysis. Therefore, at the first "cut" we looked at waiting times by whether a patient was coded on admission as urgent/emergent or elective. (The term "elective" is commonly accepted to mean scheduled surgery. However, since nobody "elects" to have open heart surgery, we use the term non-urgent or scheduled instead of elective.) Then, as for the elective surgery analysis, we excluded patients who were coded as urgent/emergent, and also patients who had waits of 3 days or less. We examined 6 years of data, from 1990/91 through 1995/96.

Results

Coronary Artery Bypass Surgery

In Manitoba, the rates of cardiac procedures increased substantially over the 6 years. In 1990/91, the rate of CABS per 1000 population was 0.404, while in 1995/96, the rate was 0.615, an increase of 52.2%. (Rates are directly adjusted to a standard Manitoba population.) Manitoba appeared to be well served in this area, relative to other provinces. Data from Statistics Canada showed that Manitoba's rate of CABS was equal to or higher than that of most other provinces; the only province with a substantially higher rate was Nova Scotia.[26] These rates, however, may still be lower than the optimum. An estimate of the benefits of CABS in Ontario found that patients continued to benefit from the procedure up to a rate of 0.9 CABS per 1,000 population; beyond that rate, the benefits to the patient began to decline.[23]

The number of cases analyzed rose from year to year, from 391 cases in 1990/91 to 655 in 1995/96. Over the 6-year period, the median waiting times for all patients fell slightly, from a median wait of 11 days (95% CI: 9, 15) in 1990/91 to a median wait of seven days (95% CI: 6, 8) in 1995/96. In each year, approximately two thirds of patients had surgery within 1 month of having an angiogram and consult (range, 63.3% to 74.7%). However, the picture changes when one separates patients coded as urgent/emergent from those coded as non-urgent.

In every year, approximately half of patients having CABS were coded on admission as urgent or emergent. For these patients, the median waiting time was from 3 to 5 days. For patients coded as elective, i.e., scheduled, the median waiting times fluctuated between 24 and 48 days and the confidence intervals were quite wide.

Did the waits for scheduled surgery increase in the years when there was a higher proportion of urgent/emergent surgery? One might guess that the use of additional resources for urgent patients would mean that non-urgent patients would have to wait longer. This was not found to be the case, however. The median waits for scheduled surgery actually were shorter in the years during which there was a higher proportion of urgent cases. This may be possible if urgent/emergent patients are operated on outside of normally scheduled operating room hours, and the patients can be discharged from intensive care or recovery room care soon enough to permit scheduled cases to continue.

We looked at patients who had a heart attack—or acute myocardial infarction (AMI)—before CABS, thinking that these patients might have had shorter waiting times than those who did not infarct. We searched hospital claims for one year prior to the surgery date; we did not include any patients who had an AMI during the same admission as their CABS. Twenty-four percent of the patients in our data set had an AMI in the year prior to surgery. Most of these (95%) had the AMI before being put on the waiting list. That is, if they had an AMI in the year prior to CABS—and not during the same admission as the surgery—the usual course was to have the AMI, then be put on the waiting list for CABS, and then have the CABS. Very few had an AMI after the wait list date (8 patients) or both before and after (25 patients). There was no difference in the waiting times for these 2 groups of patients: for both groups of patients, 49% had surgery within 7 days.

Scheduled Coronary Artery Bypass Surgery. As described, we next focused on scheduled patients, excluding those who waited 3 days or less. Waiting times for the remaining patients were analyzed with respect to year, gender, region of residence, and neighborhood income quintile. The overall 6-year median wait for scheduled patients (excluding those who waited 3 or fewer days) was 52 days, or almost 2 months.

Surgery may be considered to be delayed when patients wait more than 3 months.[16,29] Over time, there has been some decrease in the proportion of patients waiting more than 3 months for CABS. In 1990/91 and 1991/92, between 39% and 40% of the patients waited 3 months or more for surgery, whereas by 1994/95 and 1995/96, 32% to 33% of the patients were waiting 3 months or more. A proportion of patients, ranging from 10.2% in 1992/93 to 25.0% in 1993/94, waited more than 6 months for their surgery. In the last 2 years of analysis, the proportion that waited more than 6 months was 13%.

We found no differences in the median waits by gender or by region of residence. We found somewhat longer waits for residents of the poorest neighborhoods. That is, when waiting times for Winnipeg residents were analyzed according to neighborhood income quintile, patients living in the lowest-income neighborhoods had median waits of 66 days compared to the Winnipeg median of 52 days. The waiting time for residents of all other neighborhood income categories ranged from 48 to 58 days.

Percutaneous Transluminal Coronary Angioplasty

The rate of PTCA in Manitoba increased 31.1%, from 0.395 per 1000 population in 1990/91 to 0.518 per 1000 in 1995/96. The number of PTCA cases for analysis in each year increased from 326 cases in 1990/91 to 409 in 1995/96. Over the 6-year period, the median waiting times for all patients have fallen, from 13 days (95% CI: 11, 16) in 1990/91 to six days (95% CI: 5, 7) in 1995/96. The proportion of patients receiving PTCA within 1 month of their most recent angiogram increased over time, from 68.7% in 1990 to 84.3% in 1995/96.

The proportion of cases performed on a day surgery basis increased over the 6-year period, from 1.5% in 1990/91 to 22.7% in 1995/96, likely reflecting the move toward more day surgery as hospitals closed beds. At the same time, a higher proportion of patients were coded as urgent/emergent over time: 45% in 1990/91 and near 60% for the last 3 years of analysis. It is not known if this increase in urgent procedures reflected a change in the criteria for performing urgent PTCA or, perhaps, insufficient resources to schedule patients electively.

For patients who were coded as urgent or emergent, the median waits for PTCA were from 4 to 7 days. For scheduled inpatient or day patients, the median waits exhibited a downward pattern, from 32 days (95% CI: 25,40) in 1990/91 to 19 days (95% CI: 12, 23) in 1995/96.

Scheduled Percutaneous Transluminal Coronary Angioplasty. As described, urgent/emergent patients and patients who waited 3 days or less were excluded from the analysis of scheduled PTCA. Waiting times for the remaining patients were analyzed with respect to year, gender, region of residence, and average neighborhood income quintile. The median waits have fluctuated from year to year, with no clear trend emerging (Table 5). The proportion of patients waiting fewer than 90 days has fluctuated from year to year, but has remained under 20%, and the proportion who waited less than 30 days stayed close to 50%, ranging from 41% to 63%.

We found no differences in the median waits by gender, by region of residence, or by neighborhood income quintile. Unlike the longer waits for CABS in the low-income neighborhoods, the residents of lowest-income neighborhoods had slightly shorter waits for PTCA than the Winnipeg median (23 vs. 29 days, not statistically significant). These findings suggest that all groups were served equally for PTCA.

Discussion

Elective Surgery

Perhaps the most startling finding in the analysis of waiting times for elective surgery is the absence of startling findings. We analyzed certain elective procedures because one might expect them to be the most subject to long waits. People who need their varicose veins stripped or their hernias repaired generally are in some discomfort but are able to carry out most of their daily tasks. United Kingdom literature documents very long waits for some of these elective procedures, yet we found the median waits in Manitoba to be around 4 weeks for hernia repair and 6 weeks for varicose veins. For most of the elective procedures examined, the waiting times were stable or falling slightly. The strength of our method is that it includes the entire population of patients, and measures the waiting time from the patient's, rather than from a surgeon's or hospital's, perspective. Our measure for estimating waiting times—using a preoperative visit with the surgeon as a starting point—while it lacks an assessment of clinical factors that would affect the prioritization for surgery, makes it possible to monitor changes and trends over time and point out areas that may need to be examined more closely. For example, the waiting time for carpal tunnel release increased; it was 29 days in 1992/93 and 1993/94, but rose to 38 days in 1994/95 and 42 days in 1995/96. Carpal tunnel syndrome is a work-related injury, and lengthy waits for surgery may translate to lost productivity in the workplace. Carotid endarterectomy waits are 3 to 4 weeks and seem to be increasing. Carotid endarterectomy is effective in reducing the incidence of stroke,[30] and, therefore, long waiting times for this potentially life-saving procedure should be avoided.

It is somewhat surprising that the longest waits for elective surgery were found in Winnipeg and western Manitoba (the West), where the supply of surgical specialists is highest. In general, these longer waits were not clinically significant, but did suggest that residents of the urban areas were not getting preferential treatment. Despite a concentration of surgeons and surgical facilities in Winnipeg and Brandon, and the problems that distance poses to the delivery of health care across the province, the system worked well, providing good access to most surgical procedures across the province.

In each year, the waiting times for patients who were 65 years or older were shorter than those for patients younger than 65 years. People who are over 65 are more likely to be retired and may therefore be more available on short notice to have surgery.

We found only small differences in waiting times by residents of different income neighborhoods in Winnipeg. If anything, residents of low-income neighborhoods tended to have shorter waiting times than those of high-income neighborhoods. Residents of low-income neighborhoods have higher rates of premature mortality, death due to chronic disease, cancer and injuries, and hospital and physician use.[31] Therefore, the pattern of shorter waiting times for residents of low-income neighborhoods may be related to higher need in these patients.

Cataract Surgery

The case of cataract surgery affords a unique opportunity to compare waiting times between publicly available hospital surgery and private clinic surgery. One of the most persuasive argu-

TABLE 5. Median Waiting Times in Days for Scheduled PTCA, Excluding Waits of 0 to 3 Days, With 95% Confidence Intervals (inpatient and day patients combined)

	1990	1991	1992	1993	1994	1995
Median	35	39	21	34	26	26
(95% CI)	(28, 43)	(31, 46)	(18, 27)	(22, 49)	(21, 32)	(21, 39)

ments in favor of private health care for those who can afford it is that the private system can provide faster service. Patients are advised that if they opt to pay $1000, they can shorten the wait for surgery significantly. Our data show that indeed, when public and private cataract surgery were compared, the median waits were shorter in the private clinics: 4 weeks, compared to a median wait of 13 weeks in the public sector (mean waits for 1994/95 and 1995/96 are about 6 and 14 weeks, respectively, in the private and public sectors).

Anecdotes abound of patients being told that they will have to wait 6 to 8 months to have surgery in the hospital. Where is the discrepancy coming from? When we divided patients into 3 different categories according to where their surgeon practiced, an intriguing picture emerged, one that parallels the telephone survey results by the Consumers' Association of Canada in Alberta.[27] Median waits for surgery in a hospital were 7 to 13 weeks longer if the patient's surgeon also operated in the private sector.

British researchers provide insight on the possible effects of private health care on a public system.[32] There have always been a few private clinics and user-pay beds in the United Kingdom, ever since the National Health Service (NHS) began in 1948. Since the 1970s, though, there has been a boom in private practice as queues lengthened. From 1981 to 1995, the number of private beds increased 66%, to 11,681.

In the United Kingdom, private hospitals have no intensive care units, few diagnostic capabilities, and no 24-hour in-house doctors; if there are complications, patients must be transferred to an NHS facility. Coincidentally, most private facilities are conveniently located within 1 mile of an NHS facility. People with expensive, long-term chronic illness rely on the public NHS; private clinics are said to depend on "the three Hs"—hips, hernias, and hemorrhoids.

There seems to be a lesson in the experiences of the United Kingdom, Alberta, and Manitoba. If surgeons are allowed to operate in both sectors, there is an incentive for them to encourage long waits in the public sector; the longer the wait for surgery in the public sector, the more likely is the patient to seek private care. It has been reported that in the United Kingdom, areas with the longest waits for NHS surgery are those with the most private beds, and that the long-wait specialties are the main private-practice specialties.[32,33] Our research on cataract surgery demonstrates what can happen when surgeons have two options: their public patients waited much longer than did patients whose physicians operated only in the public sector.

It is prudent in the discussion of private versus public health care to remember that it is not only the wealthy, the people who can afford it, who pay for private surgery; 40% of patients who had their cataract surgery in a private clinic lived in the two lowest-income neighborhoods.

Cardiac Procedures

Patients waiting for coronary artery bypass surgery often are headlined in the local newspapers, as the following selection from the *Winnipeg Free Press* demonstrates:

"Cardiac patients on hold" (June 28, 1995).

"No bed for HSC heart patient" (August 20, 1996).

"Heart patients wait, die" (February 26, 1997).

Concerns about the availability of open heart surgery are common across Canada. Many provinces have set up a registry for open heart surgery, in the absence of any other waiting time registry. Since November 1996, Manitoba has collected data on waiting times for elective open heart surgery. The surgeon is asked to submit a patient information form that includes demographic and clinical data, as well as the planned procedure, the date placed on a waiting list, and the priority scale (2 to 6 weeks; more than 6 weeks). All data are captured by the cardiac surgery utilization analyst. Although the completion of these forms is said to be mandatory, physician compliance has been reluctant. Although data from this registry were not available for this analysis, mean waits for all open heart surgical procedures were said to be 14 to 15 weeks in 1997. (V. Tribula, personal communication, December 1997). These results are very similar to ours: we found the mean wait for CABS in 1995/96, the most recent year available, was 13.3 weeks for elective surgery excluding waits of 3 days or less.

About 50% of CABS procedures in Manitoba were coded as elective. This proportion may seem quite low, but it is similar to reports from British Columbia,[34] Nova Scotia,[35] and Ontario.[36] Our results indicate stable—perhaps slightly decreasing—waiting times for both CABS and PTCA. The proportion of non-urgent patients who receive their CABS surgery within the recommended 3-month period seems to be increasing; it was 60% in 1990/91 and 68% in 1995/96. There were still some patients, about 13%, who waited more than 6 months for non-urgent CABS. According to one Finnish study, patients who have been on sick leave for more than 6 months before bypass surgery were less likely to return to work.[37] However, given the limits of our data, we do not know the reason for these long waits. Was the patient "bumped" by more urgent patients? Did the patient's symptoms improve spontaneously for a period of time? Was there another health problem that required stabilization prior to cardiac surgery? Did the patient delay for personal reasons? Further detailed investigation is required to answer these questions.

We note an increase in the proportion of PTCA patients having the procedure on an urgent or emergent basis; this may indicate either a change in indications, a change in coding practices, or a lack of resources to manage scheduled patients. However, between 80% and 90% of scheduled patients received their PTCA within 3 months.

As for the elective procedures that we reviewed, the system appears to be serving patients equally for coronary procedures regardless of where they live in Manitoba. We found no difference in the waiting time for CABS or PTCA by region of residence. There was also no difference by waiting time by gender. Although not statistically significant, patients living in the lowest-income neighborhoods waited 2 weeks longer for elective CABS compared to the Winnipeg median.

Our data lack information about the wait for angiography; verbal accounts suggest that there is a bottleneck in the treatment of patients with coronary artery disease while they wait for coronary angiogram. Any program that is developed to monitor the wait for heart surgery should include a method of monitoring the wait for angiography and angioplasty as well as for surgery.

Strengths and Limitations

The benefit of using administrative data is that they include the entire population of relevant patients, and therefore are not dependent on the physician or the physician's office staff remembering to complete a form and submit it to a registry. The method we used is a relatively simple way to monitor patterns and trends over time.

The major limitation of this analysis of waiting times is that, of necessity, it must rely on proxy measures to calculate the waiting time. We do not have a registry of waiting times in Manitoba. There is no field in hospital abstracts or physician claims that indicates when a patient started to wait for surgery. We have chosen a preoperative visit to the surgeon or, in the case of cardiac procedures, an angiogram, as the best available marker for the procedures that we studied. There is some evidence that administrative data are reliable for this purpose. This method was used previously by the province of Nova Scotia to provide an estimate of waiting times for a wide variety of procedures.[25] In Ontario, records of 8517 patients who had CABS and were registered in the Cardiac Care Network database were reviewed.[24] The median time between angiography and submission of the patient's name to the registry was 3 days.

We chose conditions that often require only one preoperative visit to the surgeon. Our method is not appropriate for procedures performed for chronic conditions, such as hysterectomy for benign tumors, hip replacement, or knee replacement, for which several visits to the surgeon preoperatively are customary. For instance, in analyzing preoperative visits for knee and hip replacement patients, we found that 31.2% of the patients had one preoperative claim, 27.5% had two, 13.7% had three, and 26.3% had four or more. We have no way of knowing at which of these visits the decision to undergo surgery was made. In comparison, for the elective procedures that we analyzed, 67.3% had one preoperative visit, 17.8% had two visits, 5.7% had three visits, and 9.2% had four or more visits.

Using the preoperative visit closest to surgery may understate the wait experienced by the patient. The episode of care usually will involve a visit to the family physician, diagnostic tests, and possibly more than one referral. The patient must wait at each of these points, a scenario illustrated by a personal anecdote. It took nearly 6 months between the time a relative of one of the authors (DeCoster) first saw his doctor for abdominal pain until he had a cholecystectomy, yet our median waiting time is about 4 weeks. On the other hand, this method may overstate the actual wait if the surgery has been delayed for personal reasons, such as vacation, school, or work. In that case, the surgery may have been offered to a patient who put it off until it could be scheduled more conveniently.

Administrative data are always limited in their lack of clinical information. We have no data describing pain, functional limitation, or severity of symptoms. These are factors that physicians must take into consideration when they prioritize patients for surgery. It would be useful to have these data to determine if the sickest patients are operated on first. However, the focus of this study was not to determine if patients were appropriately prioritized, but to provide more general estimates of waiting times and to look for systematic differences in those waiting times. Given the constraints of administrative data, we have been successful in meeting our objective.

Discussion From the Editors

Role of Data

One of the objectives of the study was to outline some of the issues and concepts that surround waiting times. Another was to suggest some criteria for the development of a central registry in the province of Manitoba. It became clear in meeting the former objective that it would be difficult to meet the latter, because this is a complex and multilayered issue. In setting out criteria for consideration in establishing a registry, there was the danger that two assumptions would be made: (1) that the decision to establish a registry was a *fait accompli*; and (2) that the criteria presented were exhaustive. The decision was made therefore to rephrase the suggested criteria into "pitfalls" to consider, thus avoiding sounding either prescriptive or exhaustive.

One of the things that surprised some members of the Working Group—and, indeed, is not well known by many Canadians—is that there are no routinely collected, standardized data on waiting times. Because the media often trumpet the inexcusably long waits for surgery, it is generally thought that hospitals, physicians, and governments know how many people are waiting for surgery and for how long. This omission is especially surprising in Manitoba, where other data collection is so well done. One of the recommendations to come out of the study is that a field should be added to the physician claim indicating when the decision was made to proceed with surgery. Although it was recognized that such a field would not include data that would assist in prioritization, it would be a simple method to at least begin to collect data in this area.

Interacting at the Top Policy Level

Three years before we undertook this study, the Director of MCHPE was given a report by the Fraser Institute* on hospital waiting lists in Canada that was about to be released. Manitoba's Deputy Minister asked that it be reviewed. Fraser Institute reports, which are released once a year, generally receive front-page coverage across the country. We were therefore surprised at the poor science involved in this study, in the form of very low response rates from doctors concerning waiting times.

Clearly, a systematic method of tracking waiting lists was needed, to remove the issue from the anecdotal, front-page, letter-to-the-editor context and allow it to be analyzed on the basis of fact. Over the next months after the Fraser report, the Deputy Minister funded at least three attempts to establish formal waiting list systems. Two concerted efforts to develop such lists for cardiac surgery foundered on a

*The Fraser Institute is an independent Canadian economic and social research and educational organization. Its objective is the redirection of public attention to the role of competitive markets in providing for the well-being of Canadians.[38] In other words, it is philosophically in favor of free enterprise and opposed to government intervention. Every year, the Institute conducts a survey of physicians asking how long their patients wait for medical treatment. The Fraser Institute describes the survey as measuring "the extent of health care rationing in the provinces from year to year," a curious presumption of guilt in a publication that is presented as an objective assessment of the reality of the Canadian system.

lack of interest or cooperation from the surgeons; it was not until a requirement to establish a waiting list was written into the recruiting package for a new head of cardiac surgery that a system was finally established.

A second system—for tracking waiting times for hip and knee replacement surgery—was implemented at least in part because orthopaedic surgeons have never received the media attention cardiac surgeons garner and hence have had problems making a case for expanded prosthesis budgets. A registry (voluntary on the part of surgeons) was seen as one way of making a case for such increased funding.

Challenging Basic Assumptions

These data directly challenge public perceptions surrounding waiting times in Manitoba, which have been shaped over the past several years by sensational headlines and the annual reports of the influential, partisan Fraser Institute. As we prepared the report for public release, we chose to highlight the fact that for most scheduled procedures studied the waiting periods were remarkably short—under 6 weeks—and that in the recent past waiting times have decreased or remained stable. Also, we emphasized that patients do not wait for urgent heart procedures.

This paper counters additional assumptions, including the idea that rural residents wait longer for surgery than their urban counterparts and that those with pull, the wealthy, go to the front of the line, even in the public system. For the procedures we studied, the waits for residents living in rural areas often were shorter than for urban residents. Although these differences generally were not significant, the findings suggest that access is similar across the province. Waits for those from middle- and lower-income neighborhoods were in general no longer than those from the wealthiest areas.

The analysis of cataract surgery also shed some new light on the public/private debate ongoing in Canada. Two items stand out. It was not only residents of well-to-do neighborhoods who paid for cataract surgery; 40% of patients who had surgery privately lived in the poorest 40% of neighborhoods. Secondly, waiting times were very different in the public sector depending on the practice type of the surgeons. Surgeons with both public and private practice patients had longer waits for their public patients compared to surgeons who operated only in the public sector. Discussions with one Winnipeg ophthalmologist indicated that this finding was not a result of less operating room time for the public/private group, since operating room time has now been allocated evenly to all surgeons. However, we note that the public/private surgeons seem to have more patients and longer public waits. Would publicly available information on waiting times by surgeon help alleviate these discrepancies?

Our study on cataract surgery also makes it clear that simple solutions such as funding more surgery are not necessarily going to "solve" the waiting times issue. Recent data on rates of surgery over time illustrate how during a period in which the number of publicly funded cataract surgeries increased markedly every year, waiting times initially fell, then leveled off and began to increase.[39]

Our experience in releasing this report demonstrates the critical nature of timing. It was released 2 days before the national right-wing Fraser Institute report was released. Our report received national coverage (having finally established a link with a health reporter who says "Press releases don't do it—I get 150 coming across every day—you have to pick up the phone and tell me to look for it"). Both nationally, and particularly locally, for the first time in 5 years, there were a minimum number of headlines screaming over waiting list scandals. Our local paper, after carrying our op-ed on waiting lists, in striking contrast to previous years, published nothing about the Fraser Institute Manitoba results (obtained from mail surveys of surgeons). Instead, they ran a thoughtful editorial suggesting that reaction to a topic as important as waiting lists needed to be based on more than opinions. The importance of our arm's-length role in this cannot be overstated. In British Columbia, a report was released by government (which does collect systematic data on waiting times), showing that waiting lists for most surgical procedures had remained stable (and reasonably short) for many procedures, despite a rapidly growing and aging population. The opposition health critic, a former nurse, attacked it as a "whitewash."[40]

Acknowledgment

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Appendix 2: C

Waiting Times for Surgery: 1997/98 and 1998/99 Update

By Carolyn DeCoster, Leonard MacWilliam, Randy Walld

Winnipeg, MB: Manitoba Centre for Health Policy and Evalution; November 2000

Waiting Times for Surgery: 1997/98 and 1998/99 Update

November 2000

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We acknowledge the Faculty of Medicine Research Ethics Board, and the Access and Confidentiality Committee of Manitoba Health for their thoughtful review of this project. Strict policies and procedures to protect the privacy and security of the data have been followed in producing this report.

This report was prepared as part of the contract between the University of Manitoba and Manitoba Health. The results and conclusions are those of the authors, and no official endorsement by Manitoba Health was intended nor should be inferred.

THE MANITOBA CENTRE FOR HEATH POLICY AND EVALUATION

The Manitoba Centre for Health Policy and Evaluation (MCHPE) is a unit within the Department of Community Health Sciences, Faculty of Medicine, University of Manitoba. MCHPE is active in health services research, evaluation and policy analysis, concentrating on using the Manitoba Health database to describe and explain patterns of care and profiles of health and illness.

Manitoba has one of the most complete, well-organized and useful databases in North America. The database provides a comprehensive, longitudinal, population-based administrative record of health care use in the province.

Members of MCHPE consult extensively with government officials, health care administrators, and clinicians to develop a research agenda that is topical and relevant. This strength, along with its rigorous academic standards and its exceptional database, uniquely position MCHPE to contribute to improvements in the health policy process.

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Executive Summary

The objective of this document is to update the waiting times analysis that the Manitoba Centre for Health Policy and Evaluation first published in 1998: *Surgical Waiting Times in Manitoba*, by DeCoster, Carriere, Peterson, Walld, and MacWilliam. Since its publication, interest in waiting times for health care has if anything increased, yet the rhetoric far outweighs the data. This research provides one of the few examples of actual measurement of a waiting period, using data derived from the experience of all patients who underwent surgery in a specified time period.

Administrative data were used to estimate waiting times for selected elective surgical procedures; a pre-operative visit to the surgeon was the marker for the beginning of the wait. The original paper used data for five years from 1992/93 to 1996/97 (except coronary procedures which used 1990/91 to 1996/97); this report adds data for 1997/98 and 1998/99, and makes comparisons with the earlier findings. As in the original report, the procedures studied have been grouped into three areas: coronary procedures, cataract surgery, and eight routinely-performed elective procedures.

Waits that were statistically different are marked with an asterisk. However, what is *statistically* significant may not be *clinically* significant. The clinical relevance of shorter or longer waits is a subject of great controversy. Little is known about the impact of a delay for discretionary surgery; some patients will improve or decide they do not want surgery, whereas others will suffer continual pain, dysfunction or anxiety. The evidence in this area is inconclusive: a systematic literature review of the effect of delay on breast cancer outcome was performed for the General Surgery panel of the Western Canada Waiting List project; of the 30 papers reviewed, delay was found to have a negative impact on survival in 14 papers, and no impact on survival in 16 papers. Therefore, the clinical significance of a change in waiting times is uncertain. Despite this uncertainty, because waiting times have assumed such significance in the discussions on our health care system, we have emphasized changes that were seven or more days.

We also made no assessment as to the appropriateness of these procedures. Several of the elective procedures reviewed may be considered highly discretionary, meaning that there is no general agreement about when surgery is indicated. Discretionary procedures include, for example, tonsillectomy, and varicose vein repair.

Coronary procedures – key findings

- Coronary procedures studied were coronary artery bypass surgery (CABS) and percutaneous transluminal angioplasty (PTCA).
- Between 1996/97 and 1998/99, the standardized rate of CABS increased 16% and the rate of PTCA increased 6%.
- Median waits for scheduled (elective) CABS were 15 and 22 days shorter in 1997/98 and 1998/99, respectively, compared with the previous seven-year median of 48 days.
- A previously reported trend to a higher proportion of scheduled patients receiving surgery within 90 days continued.
- The median wait for scheduled PTCA was not significantly different from the 90/91-96/97 median. The wait for 90/91-96/97 was 32 days, for 97/98 it was 37 days, and for 98/99 it was 31 days.

Cataract surgery – key findings

- Cataract surgery is performed in both public hospitals and privately-owned clinics. Until January 1999, patients who had cataract surgery in a private clinic were required to pay a tray or facility fee of approximately $1000; since then, Manitoba Health has covered all costs.
- There was a 12 week difference in waits between public- and private-sector surgery for 97/98 and 98/99. The public-sector waiting time was 17 weeks, and the private-sector 5 weeks. These were both significantly longer than the previous five-year medians of 13 and 4 weeks.
- Public-sector waits for 97/98 and 98/99 did not increase compared to 96/97. The rate of performing public-sector cataract surgery increased 13% since 96/97.

- About 75% of cataract surgery was in the public sector, and about two-thirds of public-sector cataract surgery was performed by surgeons who practised in both sectors.
- There continued to be a difference in waits in the public sector according to surgeon practice-type. Waits for public-sector surgery if the surgeon operated *only* in the public sector were 10 weeks in both 97/98 and 98/99; waits for public-sector surgery for surgeons who had *both* public and private practices were 21 and 26 weeks in 97/98 and 98/99, respectively.
- Median waits were similar according to region of residence and by neighbourhood income level.
- Almost 65% of cataract surgery is performed on women, and women had median waits about three weeks longer than men.
- About 20% of patients from the lowest and lower-middle income neighbourhoods had surgery privately, compared to 32% of patients from the highest-income neighbourhoods.

Selected routine procedures – key findings

- We studied eight routinely-performed elective procedures: excision of breast lesions, carotid endarterectomy, cholecystectomy, carpal tunnel release, trans-urethral resection of prostate (TURP) (for benign disease), tonsillectomy, hernia repair, and stripping and ligation of varicose veins. Although all of these procedures are "elective" in the sense of being scheduled, they range in the degree to which indications for surgery are clear and undisputed, with excision of breast lesions and carotid endarterectomy being less discretionary, and tonsillectomy and varicose vein repair being more discretionary.
- Since 96/97, standardized rates for three of these procedures increased (excision of breast lesions (+29.7%), cholecystectomy (+8.6%), and tonsillectomy (+16.2%)), two decreased (carpal tunnel release (-7.3%), varicose vein repair (-5.6%)) and three stayed about the same.

- In 1998/99, waits for seven of the eight procedures were significantly longer compared to 92/93-96/97; only cholecystectomy was not significantly different.
- For five of the procedures, the wait was four to six days longer, for carpal tunnel release it was 17 days longer and for varicose vein repair it was 19 days longer in 98/99 compared to 92/93-96/97.
- For seven of the eight procedures (all except carotid endarterectomy), patients from either Winnipeg or the West (South Westman, North Westman and Brandon RHAs) had a significantly longer wait than the Manitoba median. Patients in the South (Central and South Eastman RHAs) had a shorter wait than the Manitoba median for four procedures. Patients living in other RHAs had waits similar to the Manitoba median.
- Median waits were similar by age, gender and neighbourhood income level. Whereas previously, older patients tended to have shorter waits than younger, in 97/98-98/99, there was no difference according to age.

Discussion

This report provides a measure of the actual time that patients wait for a variety of surgical procedures. There is good news. For instance, the waits for coronary artery bypass surgery are decreasing and a bigger proportion of patients receive their surgery within 90 days. Also reassuring is that, whether male or female, wealthy or poor, young or old—Manitobans experience similar waiting times. For all procedures studied, except cataract surgery, waits were less than 60 days, and for several of them, the wait was around 30 days. Shortening waits more than this may in fact be inappropriate, since patients should have sufficient time to weigh carefully the risks and benefits that accompany any surgical procedure.

However our report raises some concerns also. There was a general pattern of increasing waiting times for elective surgery. For instance, the median wait for breast tumour surgery increased 25% in 98/99 compared to the 92/93-96/97 median, and the median wait for carotid endarterectomy increased 23%. Even though the median waits are generally less than 60 days, and the absolute increases are not large—4 days for breast tumour surgery and 6 days for carotid endarterectomy—it is the trend towards increasing waits that is of concern. Do they indicate that access to care is decreasing?

One of the usual, and indeed intuitive, responses to this kind of finding, is that we need more resources. It seems logical that if waits are increasing, then it must mean that supply is inadequate. But an increase in resources is not necessarily the answer. While an increase in the rate of coronary artery bypass was accompanied by a decrease in median waiting time, there is also conflicting evidence: increasing rates of cataract and prostate surgery were accompanied by increases in median waiting times.

The presence of a parallel private system also does not result in shorter waits in the public sector. Manitoba Health's decision to ban extra fees for private clinic cataract surgery reflects the recognition of this fact. We found that waiting times for cataract surgery in the public sector were longest for surgeons who also had a private practice. The reasons for this finding are unclear. It is not the case here that surgeons who operated in both sectors devoted less time to their public sector patients, since they made maximum use of the public-sector operating room time available to them. There is, however, an incentive for surgeons who operated in both sectors to have long public-sector waiting lists, and these surgeons might place their patients on waiting lists earlier than others, knowing that with the anticipated wait, patients will be ready for surgery when called. The potential discrepancies in dysfunction between patients waiting for the same procedure point to the need for better information.

What is needed to manage waits is a system that prioritizes patients based on defined criteria, such as severity of illness, activity limitation, urgency, and expected benefit. In addition, information on waiting times for individual surgeons should be readily available, to assist patients and primary care physicians when making referrals to specialists. A waiting list information system should flag patients whose waits seem excessively long, reprioritize patients based on their changing conditions, and remove patients from the list who are no longer waiting, either because they have moved, or their condition improved, or they decided against surgery. Finally, better information systems can contribute to research on outcomes, which can then feed back into improved management of waiting times.

In closing, while this research monitors waiting times, it cannot assist with managing them. The causes of waiting times—a complete discussion of which is beyond the scope of this report—are complex. Consequently, their solutions are often elusive. But one thing seems clear—in order to have some impact on waiting times, more and more accurate information is needed.

Introduction and Objectives

The objective of this document is to update the waiting times analysis that the Manitoba Centre for Health Policy and Evaluation first published in 1998: *Surgical Waiting Times in Manitoba* by (DeCoster C, Carriere KC, Peterson S, et al.). Since its publication, interest in waiting times for health care has if anything increased, yet the rhetoric far outweighs the data. This research provides one of the few examples of actual measurement of a waiting period, using data derived from the experience of all patients who underwent surgery in a specified time period.

As in the first report, administrative data were used to estimate waiting times for selected elective surgical procedures; a pre-operative visit to the surgeon was the marker for the beginning of the wait. The original paper used data from 1992/93 to 1996/97 inclusive (except coronary procedures which used 1990/91 to 1996/97); this report adds data for 1997/98 and 1998/99, and makes comparisons with the earlier findings. In this report, there will be a brief review of the methods, followed by updated results.

As for the original report, the procedures studied have been grouped into three areas:

1. Coronary procedures: coronary artery bypass surgery (CABS) and percutaneous transluminal angioplasty (PTCA)
2. Cataract surgery: this procedure is discussed separately because it has been performed both publicly and privately. Until January 1999, patients who had cataract surgery in a private clinic were required to pay a tray or facility fee of approximately $1000; since January 1999, Manitoba Health covers all costs.
3. Selected routinely-performed elective procedures: excision of breast lesions, carotid endarterectomy, cholecystectomy, carpal tunnel release, trans-urethral retropubic prostatectomy (TURP) (for benign disease), hernia repair, tonsillectomy, and stripping and ligation of varicose veins. Although all of these procedures are "elective" in the sense of being scheduled, they range in the degree to which indications for surgery are clear and undisputed, with excision of breast lesions and carotid endarterectomy being less discretionary, and tonsillectomy and varicose vein repair being more discretionary (Gentleman, Vayda Parson, et al., 1996).

Methods

The methods we used were described in detail in the original report. To recap, patients who had one of the procedures were selected from anonymous records in the Population Health Research Data Repository for the years 1997/98 and 1998/99. We restricted the analysis to elective (scheduled) procedures. When the procedures had been identified, we searched the physician claims for a pre-operative visit to the surgeon who performed the surgery. If there were several visits, we used the one closest to the procedure. The estimated waiting time was the time between the pre-operative visit and the date of surgery.

There were a few exceptions to the above method:

- For cataract surgery patients, if there was more than one visit, and the visit closest to surgery was coded as an ultrasound measurement, we used the visit prior to that for calculating the waiting time.
- For the coronary procedures, we analyzed both scheduled and urgent cases.[1]
- For CABS, we looked not only for a pre-op visit to the surgeon, but also for a pre-operative angiogram. For PTCA, an angiogram flagged the beginning of the waiting period.
- For the routine elective procedures, we required that the pre-op visit to the surgeon be more than three days prior to surgery; we did this to exclude patients who were possibly more urgent.

Diagnostic restrictions applied to some of the procedures. For cholecystectomy and TURP, we excluded malignancies. Hernia repair referred only to inguinal or femoral hernia without gangrene. Excision of breast lesions did not include simple biopsies. Stripping and ligation of varicose veins referred to lower limb surgery and excluded oesophageal or gastric varices.

[1] The hospital abstract includes an admission status code: urgent, emergent, elective or day. For elective, or scheduled, patients, we included elective or day codes. Cases coded as urgent or emergent were grouped as urgent.

It was noted during the course of this analysis that in the first waiting times report, patients having coronary artery bypass surgery included those having concomitant valve replacements. Since patients having both procedures might represent sicker and hence more urgent patients, we have now excluded patients having concomitant valve replacement from all analyses. We found it made very little difference to the results.

How comparisons were made

The purpose of this update is to monitor whether waiting times changed in 1997/98 and 1998/99 compared with the earlier report, which used data from 1992/93 to 1996/97 inclusive. Therefore, for most of the tables and charts following, we compare data for 97/98 and 98/99 with the previous five-year median waits (seven years for coronary procedures).

As in the previous report, we calculated 95% confidence intervals, adjusting for multiple comparisons. The confidence interval (CI) is a statistical measure, giving us a range within which we are 95% confident that the true value lies. The CI is significantly different in a statistical sense from the previous five-year median when the interval does not overlap the five-year value.[2] For instance, the five-year (92/93-96/97) median wait for hernia repair was 29 days. In 1997/98, it was 35 days, with a 95% CI of 33, 36. That means that we are 95% confident that the true median for 97/98 is between 33 and 36 days, a range which does not overlap the previous median of 29 days. Therefore, the wait was significantly longer in 97/98 compared to the 92/93-96/97 median.

Waits that were statistically different are marked with an asterisk. However, what is *statistically* significant may not be *clinically* significant. The clinical relevance of shorter or longer waits is a subject of great controversy. Little is known about the impact of a delay for discretionary surgery: some patients will improve or decide they do not want surgery, whereas others will suffer continual pain, dysfunction or anxiety. The evidence in this area is inconclusive: a systematic literature review of the effect of delay on breast cancer outcome was performed for the General Surgery panel of the Western Canada

[2] There are no confidence intervals for the five-year median; since so many procedures are included, the confidence interval is so small as to be non-existent.

Waiting List project; of the 30 papers reviewed, delay was found to have a negative impact on survival in 14 papers, and no impact on survival in 16 papers (Martin, Roman-Smith and Hadorn, 2000). Therefore, the clinical significance of a change in waiting times is uncertain. Despite this uncertainty, because waiting times have assumed such significance in the discussions on our health care system, we have emphasized changes that were seven days or more.

We report on the median waiting time, the time it took for half of all patients to obtain their surgery. To illustrate, if the median waiting time for cholecystectomy in 1997/98 was 30 days, it means that half of all patients who had cholecystectomy in 1997/98 had surgery within 30 days of seeing their surgeon, and half waited longer. We report the median rather than the mean because the median is uninfluenced by extreme values. (Mean values are reported in Appendix A.)

Analyses were conducted not only by year of surgery, but also by various sub-groups: region of residence, gender, age, and by neighbourhood income quintile. For sub-group analyses, the 97/98 and 98/99 data were combined. In analyzing waits according to the region in which the patient lived, we noted that in some Regional Health Authorities (RHAs), there were small numbers of procedures; hence, the eleven Manitoba RHAs were combined into five areas as follows:

- Winnipeg
- West: Brandon, South Westman, Marquette
- South: South Eastman, Central
- Mid-North: Parkland, Interlake, North Eastman
- Far North: Burntwood, Norman, Churchill

Age was categorized into two groups—younger than 65 years, or 65 years or older—at the time of surgery. Neighbourhood income quintile applied to residents of Winnipeg only; Statistics Canada data on average income in an enumeration area were used to rank neighbourhoods into five income quintiles, labelled: lowest, lower-middle, middle, upper middle, and highest.

Coronary Procedures

KEY POINTS

- Between 1996/97 and 1998/99, the standardized rate of CABS increased 16% and the rate of PTCA increased 6%.
- Median waits for scheduled (elective) CABS were 15 and 22 days shorter in 1997/98 and 1998/99, respectively, compared with the previous seven-year median of 48 days.
- A previously reported trend to a higher proportion of scheduled patients receiving surgery within 90 days continued.
- The median wait for scheduled PTCA was not significantly different from the 90/91-96/97 median. The wait for 90/91-96/97 was 32 days, for 97/98 it was 37 days, and for 98/99 it was 31 days.

Coronary Artery Bypass Surgery

As mentioned in the Methods section, it was noted during the course of this analysis that in the first waiting times report, patients having coronary artery bypass surgery included those having concomitant valve replacements. Patients having both procedures might be sicker and therefore more urgent, so for this analysis, we excluded patients having concomitant valve replacement, both for the original seven years and the most recent two. This resulted in excluding about 7.5% of all cases and 8.5% of scheduled cases, but did not change the median waits appreciably.

Our initial analysis included all patients, those who were urgent/emergent, and those who were elective, that is, scheduled. The rate of CABS increased by 15.7% between 96/97 and 98/99, from 0.66 to 0.76 per 1000 population.[3] For urgent/emergent cases, waiting times were not significantly different in 97/98 or 98/99 from the previous seven-year median: all were 3 or 4 days (Table 1).[4] For scheduled patients, waiting times in 1997/98 and 1998/99 were significantly shorter than previously, that is, the confidence intervals for 1997/98 and 1998/99 did not overlap the 90/91-96/97 median value. The median wait for 90/91-96/97

[3] All rates were age- and sex-adjusted to the 1992 Manitoba population using the direct method of adjustment.

[4] For coronary procedures, the earlier report used seven years of data, 90/91-96/97, whereas for all other procedures, the comparator years are 92/93-96/97.

was 29 days, and the waits for 97/98 and 98/99 were 19 and 15 days, respectively—10 and 14 days shorter.

Table 1: Median waits in days (with 95% confidence intervals) for CABS, 97/98 and 98/99 compared with 90/91-96/97, excluding patients with concomitant valve replacement

	90/91-96/97	97/98	98/99
Urgent/Emergent	4	3 (3, 4)	4 (3, 4)
Scheduled, all patients	29	19* (13, 22)	15* (13, 20)
Scheduled, excluding waits under 4 days	48	33* (23, 39)	26* (20, 32)

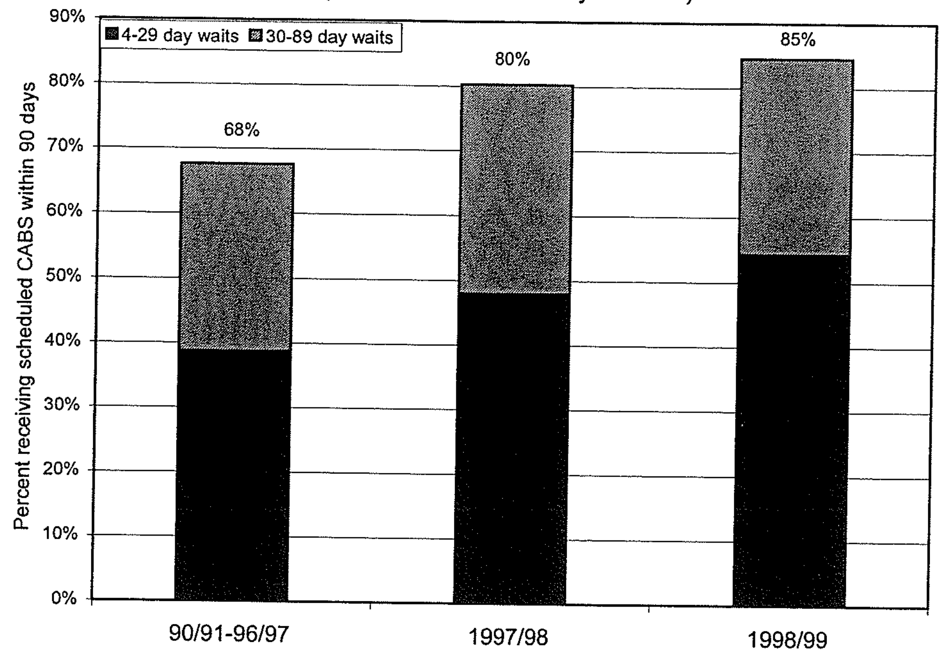
Scheduled CABS

For the next set of analyses, we excluded urgent/emergent patients, as well as scheduled patients who had a pre-op visit or angiogram within three days of surgery.[5] The median waits for these patients in 97/98 and 98/99 were 33 and 26 days, respectively (Table 1); both medians were significantly shorter than the 90/91-96/97 median of 48 days.

One of the indicators used previously was the proportion of scheduled patients who had their CABS within 90 days; patients who waited more than 90 days for elective CABS were considered delayed (Carroll, Horn, Soderfeldt, et al., 1995). We had found a trend towards a higher proportion of patients undergoing surgery within 90 days: in 90/91, 60% of scheduled patients had CABS within 90 days, and in 96/97, 76%. This trend continued in 97/98 and 98/99 when 80% and 85% of patients, respectively, received their CABS within 90 days (Figure 1).

[5] Approximately 20% of scheduled patients had an angiogram or pre-op visit within three days of surgery.

Figure 1: Scheduled coronary artery bypass surgery Manitoba, 90/91-96/97 vs 97/98-98/99 Percent of patients receiving surgery within 90 days
(excludes waits of 3 days or less)



Gender, region, income

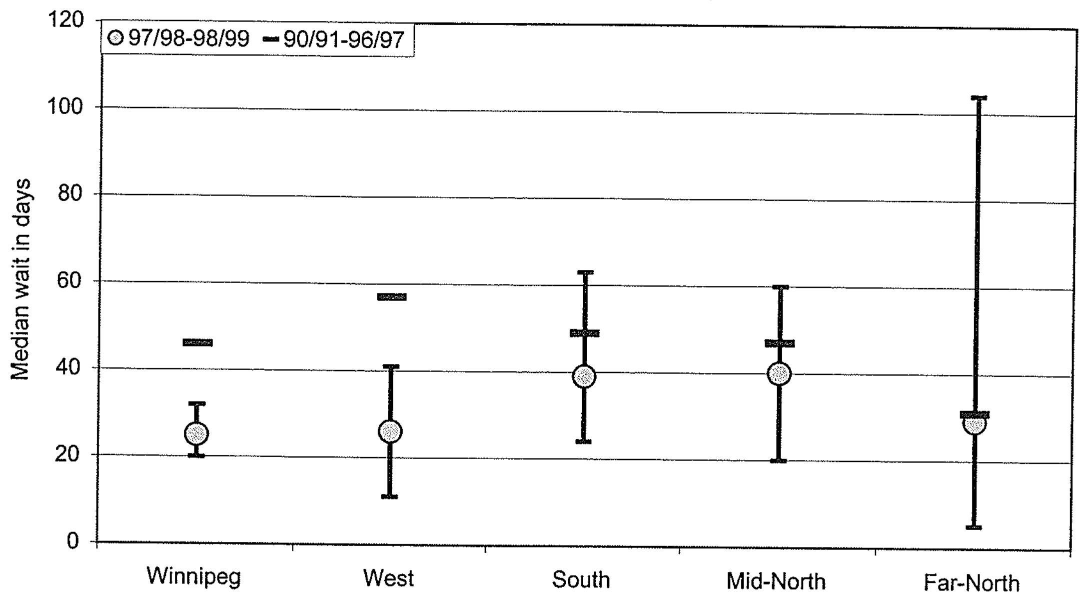
About 3½ times the number of males than females had CABS in both time periods. Compared to 90/91-96/97, waiting times were shorter for both males and females in 97/98-98/99.[6] In 90/91-96/97, males waited 50 days, compared to 30 days (95%CI: 26, 34) for 97/98-98/99. For females the waits were 47 days and 26 days (95% CI: 20, 37), respectively.

Residents of every area of the province experienced generally shorter median waits in 97/98 and 98/99 compared with the 90/91-96/97 median. However, the only areas that had statistically significant shorter waits were Winnipeg and the West (for definitions of regions, see page 109), as can be seen in Figure 2. In this chart, the horizontal bar represents the median wait from 92/93-96/97, and the dot is the median wait for 97/98-

[6] For sll subgroup analyses, 97/98 and 98/99 were combined.

98/99. The whiskers on either side of the dot illustrate the 95% confidence interval. When the whiskers do not
overlap the bar, then the 97/98-98/99 median is significantly different than the 92/93-96/97 median. Winnipeg residents waited 21 days less and Brandon residents 31 days less in 97/98-98/99 compared to 90/91-96/97. Having shorter waits in the West is good news, since residents of the West had noticeably longer waits compared to the rest of the province in 90/91-96/97. Wait times were not significantly different between regions for 97/98-98/99.

Figure 2: Median wait in days for scheduled CABS, by region of residence Manitoba 90/91-96/97 to 97/98-98/99
(excluding waits of 3 days or less)



The trend to shorter median waits for scheduled CABS was evident in the waits for patients living in different income neighbourhoods in Winnipeg. Median waits were statistically shorter in 97/98-98/99 for patients from the middle- and highest-income neighbourhoods (Table 2), however waits generally decreased across all income groups. Remember that this is in comparison to the *90/91-96/97* median. Compared to the *Winnipeg* median for 97/98 and 98/99, which was 25 days, none of the neighbourhoods were significantly different (data not shown); in other words, regardless of neighbourhood income level, all Winnipeg patients had similar waits for scheduled coronary bypass surgery.

Table 2: Median waits in days (with 95% confidence intervals) for CABS scheduled procedures, Winnipeg, by neighbourhood income level, 97/98-98/99 compared with 90/91-96/97 (asterisk shows significant difference from 90/91-96/97 median)

	90/91-96/97	97/98-98/99
Lowest	48	29 (15, 56)
Lower middle	48	24 (14, 48)
Middle	43	29* (14, 42)
Upper middle	53	30 (13, 60)
Highest	43	24* (13, 39)

Percutaneous transluminal coronary angioplasty

The standardized rate of coronary angioplasty increased 6.4% between 1996/97 and 1998/99, from 0.61 to 0.65 per 1000 persons. Looking at all scheduled patients, including those who had an angiogram within three days of PTCA, median waits were shorter in 97/98 and 98/99, significantly so in 98/99, compared with the 90/91-96/97 median (Table 3). The dramatically shorter waits in 98/99—10 days shorter than for 97/98—for scheduled PTCA were explored further. We noted that the proportion of scheduled patients that received a pre-op angiogram within three days of surgery had been increasing over time: in 90/91, 4% of scheduled patients received an angiogram within three days of surgery, for the years 1995/96 through 1997/98, it was about 25%, but in 1998/99, it was 43%. This change in practice may help to account for the shorter median waits for all scheduled patients as shown in Table 3. It also means that there are fewer scheduled patients each year in the bottom row of Table 3, i.e., scheduled patients who waited more than three days, which contributes to some instability in the median.

Table 3: Median waits in days (with 95% confidence intervals) for PTCA (asterisk shows significant difference from 90/91-96/97 median)

	90/91-96/97	97/98	98/99
Urgent/Emergent	5	4 (2,5)	0* (0,1)
Scheduled, all patients	24	17 (10, 31)	7* (4, 9)
Scheduled, excluding waits under 4 days	32	37 (22, 49)	31 (19, 40)

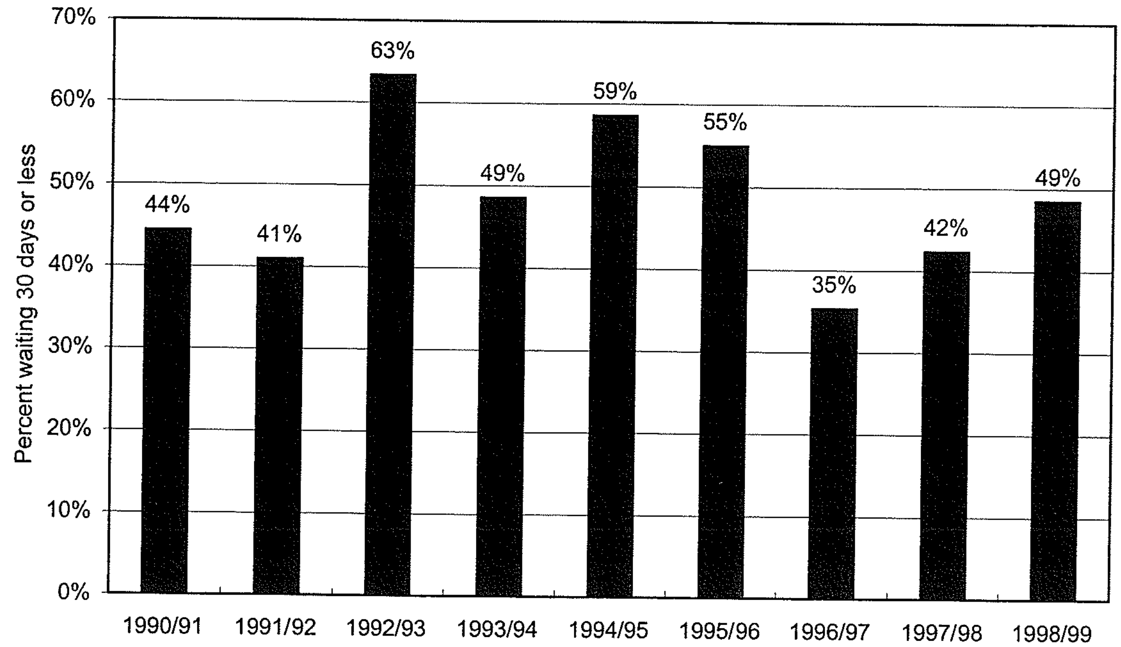
In the first report it was noted that the proportion of patients having PTCA that were coded as urgent/emergent rather than scheduled was increasing over time; however, there was no increase in 97/98 and 98/99. The proportion that were urgent/emergent from 90/91 to 92/93 inclusive was around 45%, and from 93/94 to 96/97, it was around 60%. For 97/98 and 98/99, that proportion remained the same at about 60% of patients being coded as urgent/emergent and 40% being coded as scheduled PTCA patients.

Scheduled PTCA

Next, patients who were coded as urgent/emergent were excluded, as well as those who had an angiogram within three days of PTCA. As previously noted, the proportion of scheduled patients who had an angiogram four or more days prior to PTCA declined in 1998/99. Once waits of three days or less were excluded, the median waits in the most recent two years for scheduled PTCA were not significantly different from the 90/91-96/97 median (Table 3). The median wait time for 90/91-96/97 was 32 days; for 1997/98, it was 37 days (95% CI: 22, 49) and for 1998/99, 31 days (95% CI: 19, 40).

In the first report, the proportion of scheduled patients who received angioplasty within 30 days seemed to be decreasing, and this was raised as a possible concern. However, in the most recent two years, this proportion increased (Figure 3). In 1996/97, only 35% of scheduled PTCA patients received the procedure within 30 days, but in 1997/98, it was 42% and in 1998/99, it was 49%.

Figure 3: Scheduled PTCA - proportion of patients waiting 30 days or less (excluding waits of 3 days or less) Manitoba, 1990/91 to 1998/99



The median wait for scheduled PTCA for 97/98 and 98/99 did not differ from the 90/91-96/97 median by gender, neighbourhood income level or region of residence. Also, there were no differences in waits between gender, between income levels or between region of residence.

Cataract Surgery

KEY POINTS

- Cataract surgery is performed in both public hospitals and privately-owned clinics. Until January 1999, patients who had cataract surgery in a private clinic were required to pay a tray or facility fee of approximately $1000; since then, Manitoba Health has covered all costs.
- There was a 12 week difference in waits between public and private-sector surgery for 97/98 and 98/99. The public-sector wait was 17 weeks, and the private-sector wait was 5 weeks. These were both significantly longer than the previous five-year medians of 13 and 4 weeks.
- Public-sector waits for 97/98 and 98/99 did not increase compared to 96/97. The rate of performing public-sector cataract surgery increased 13% since 96/97.
- About 75% of cataract surgery was in the public sector, and about two-thirds of public-sector cataract surgery was performed by surgeons who practised in both sectors.
- There continued to be a difference in waits by the surgeon's practice-type. Waits for public-sector surgery if the surgeon operated *only* in the public sector were 10 weeks in both 97/98 and 98/99; waits for public-sector surgery for surgeons who had *both* public and private practices were 21 and 26 weeks in 97/98 and 98/99, respectively.
- Median waits were similar according to region of residence and by neighbourhood income level.
- Almost 65% of cataract surgery was performed on women, and women had median waits about three weeks longer than men.
- About 20% of patients from the lowest and lower-middle income neighbourhoods had surgery privately, compared to 32% of patients from the highest-income neighbourhoods.

As stated earlier, for the analysis of cataract surgery, we were interested in comparing waits between the public and private sectors.[7] For most of this study period, patients who had cataract surgery in a private clinic were required to pay a tray or facility fee of approximately $1000; since January 1999, Manitoba Health has covered all costs, agreeing to fund 2000 additional procedures annually in the public sector. In other words, all cataract surgery is now publicly funded. Exploring the differences in waiting times for public and private cataract surgery may seem moot now; however, it seemed to be relevant in terms of its policy implications.

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[7] Cataract surgery at the Gimbal Clinic in Calgary was not included. Data from Manitoba Health show that the number of procedures performed at the Gimbal Clinic for calendar years 1997 and 1998 were 148 and 82, respectively.

It should be noted that the rate of performing cataract surgery in the public sector has increased 43% between 1992/93 and 1998/99; 12.6% between 1996/97 and 1998/99. An additional 2000 procedures would represent a doubling of the number of procedures performed in 1992/93.

In our previous report, we found that waits were longer in the public sector: the median public-sector wait for 92/93-96/97 was 13.1 weeks and the private-sector wait was 4.1 weeks. By the final year of analysis, the wait in the public sector was 17.9 weeks, compared with 4.1 weeks in the private sector.[8] This pattern held for 1997/98 and 1998/99: the public-sector waits were 17.1 and 17.9 weeks, respectively, whereas the private-sector waits were 5.0 and 5.4 weeks for those years. When compared to the previous five-year median, waits in both sectors were significantly longer. When compared to 96/97 only, the public-sector wait remained stable despite a 12.6% increase in the rate of surgery.

We also found in our previous report that there was a difference in the public-sector wait depending on whether the surgeon also had a private practice. We divided ophthalmic surgeons according to whether they operated entirely in the public sector, or in both public and private sectors. We defined surgeons as having both a public and private practice if they performed at least 20 procedures per year in a private clinic.[9] Most cataract surgery, about 75% in 97/98 and 98/99, was in the public sector (Table 4). Furthermore, about two-thirds of public-sector cataract surgery was performed by surgeons who have both a public and private practice. These high-volume surgeons focus most of their practise on cataract surgery, and make maximum use of the public-sector operating room resources available to them. Low-volume surgeons often have sub-specialties, and consequently have limited capacity to increase the number of cataract operations they do.

[8] Note that when talking about waits for cataract surgery, we use "weeks" whereas for all other procedures we talk of waits in terms of "days."
[9] All surgeons operate in the public sector, but some operated both publicly and privately.

Table 4: Number of patients receiving cataract surgery in private clinics and public hospitals, according to surgeon's practice type[10] (% of annual total)

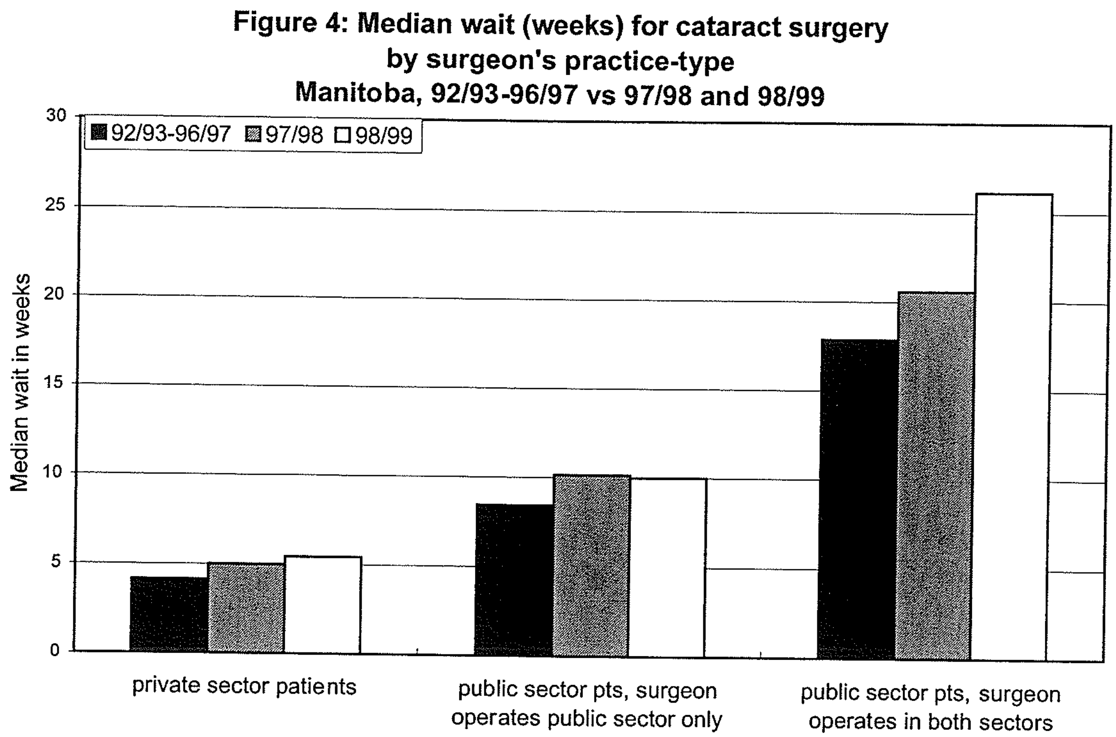
	92/93-96/97	1997/98	1998/99
Surgeon operates in public hospital only*	6811 (38.0%)	1133 (25.8%)	1154 (23.4%)
Public hospital, surgeon operates both publicly and privately**	8830 (49.2%)	2353 (53.6%)	2424 (49.2%)
Private clinic, surgeon operates both publicly and privately**	2292 (12.8%)	903 (20.6%)	1351 (27.4%)
Total procedures	17933	4389	4929

* number of surgeons = 27 for 92/93-96/97, 13 for 97/98, 18 for 98/99

** number of surgeons = 9 for all years

There continued to be a difference in waits by type of surgeon practice (Figure 4). Waits for public-sector surgery, if the surgeon operated only in the public sector, were 10 weeks in both 97/98 and 98/99; waits for public-sector surgery for surgeons who had both public and private practices were 21 and 26 weeks in 97/98 and 98/99, respectively. For both types of practices, public-sector waits were significantly longer compared to the previous five-year median.

[10] These numbers will not compare with other MCHPE reports, because for this study, if the patient had more than one cataract procedure over the study period, we included only the first procedure.



Region of residence, gender, income

Waits for public-sector cataract surgery were similar for residents living in different regions of the province, with residents from every region except the Far North waiting between 17 and 19 weeks. Residents of the Far North had shorter waits: 12.5 weeks.

There were differences between genders with respect to public-sector cataract surgery. The majority of patients, 63.5%, were female, and women waited longer than men. Using two years of data, 97/98-98/99, women waited 18.6 weeks (95% CI: 17.9, 19.3) and men waited 15.9 weeks (95% CI: 14.9, 16.7). In other words, women waited on average nearly three weeks (19 days) longer than men. This difference was statistically significant. From 92/93-96/97, women waited 11 days longer than men.

There was no difference in the median wait for cataract surgery according to neighbourhood income category. People in the highest-income neighbourhoods had similar waits to people from the lowest-income neighbourhoods. Proportionately more cataract procedures were performed on residents of the lowest-income neighbourhoods:

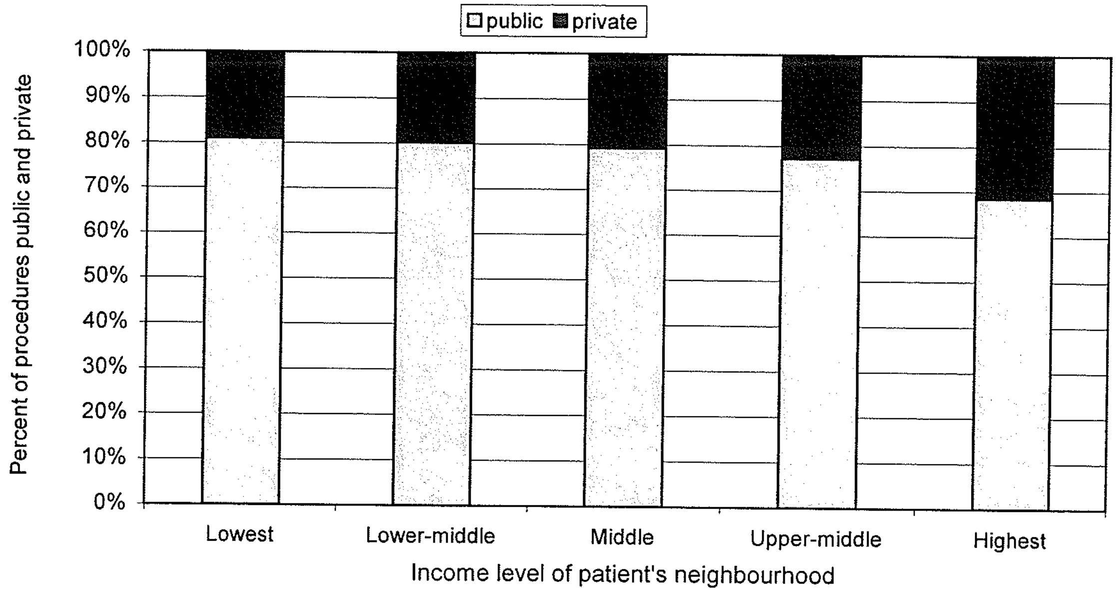
23% of all cataract surgery recipients in 97/98-98/99 were from the lowest-income neighbourhoods, and 18% were from the highest-income neighbourhoods (Table 5). Despite the fees charged for private-clinic cataract surgery for most of the study period, a substantial proportion, 38%, of private-clinic procedures were performed on patients from the two lowest-income neighbourhoods.

Table 5: Proportion of cataract surgery performed in public versus private sector, 97/98 and 98/99, by neighbourhood income, Winnipeg residents only

Neighbourhood income level	Lowest	Lower-middle	Middle	Upper-middle	Highest
Public (n = 4242)	24.0%	21.2%	20.4%	18.1%	16.3%
Private (n = 1235)	19.4%	18.1%	18.4%	18.4%	25.7%
Total (n = 5477)	23.0%	20.5%	20.0%	18.1%	18.4%

In Table 5, the *rows* total 100%, showing how the number of cataract surgery procedures are distributed according to patients' neighbourhood income level. Another way to look at the distribution is according to the proportion in each income category that are performed privately and publicly, i.e., having each *column* total 100%. When looked at in this way, one can see that there is a gradient between low- and high-income neighbourhoods, with proportionately more of the high-neighbourhood-income patients having their cataract surgery done privately (Figure 5).

Figure 5: Cataract surgery, percent of procedures public and private by patients' neighbourhood income level, Winnipeg, 97/98-98/99



Selected routine procedures

KEY POINTS

- We studied eight routinely-performed elective procedures: excision of breast lesions, carotid endarterectomy, cholecystectomy, carpal tunnel release, trans-urethral resection of prostate (TURP) (for benign disease), hernia repair, tonsillectomy, and stripping and ligation of varicose veins. Although all of these procedures are "elective" in the sense of being scheduled, they range in the degree to which indications for surgery are clear and unequivocal, with excision of breast lesions and carotid endarterectomy being less discretionary, and tonsillectomy and varicose vein repair being more discretionary.
- Since 96/97, standardized rates for three of these procedures increased (excision of breast lesions (+29.7%), cholecystectomy (+8.4%), and tonsillectomy (+16.2%)), two decreased (carpal tunnel release (-7.3%), varicose vein repair (-5.6%)) and three stayed about the same.
- In 1998/99, waits for seven of the eight procedures were significantly longer compared to 92/93-96/97; only cholecystectomy was not significantly different.
- For five of the procedures, the wait was four to six days longer, for carpal tunnel release it was 17 days longer and for varicose vein repair it was 19 days longer in 98/99 compared to 92/93-96/97.
- For seven of the eight procedures (all except carotid endarterectomy), patients from either Winnipeg or the West (South Westman, North Westman and Brandon RHAs) had a significantly longer wait than the Manitoba median. Patients in the South (Central and South Eastman RHAs) had a shorter wait than the Manitoba median for four procedures. Patients living in other RHAs had waits similar to the Manitoba median.
- Median waits were similar by age, gender and neighbourhood income level. Whereas previously, older patients tended to have shorter waits than younger, in 97/98-98/99, there was no difference according to age.

Procedure rates

Rates of all procedures studied were calculated (Table 6). All rates were age- and sex-adjusted to the 1992 Manitoba population, using the direct method of adjustment. The procedure with the biggest change since 1996/97 was excision of breast lesions (excluding simple biopsies), increasing 29.4%. The tonsillectomy rate increased 16.2%. Several procedure rates decreased in 97/98 compared to 96/97, then increased in 98/99 to a rate similar to or higher than the 96/97 rate: carotid endarterectomy, cholecystectomy, TURP, and varicose veins. The rate for carpal tunnel release showed the opposite pattern, increasing in 97/98 and then falling below the 96/97 rate in 98/99. The rate of hernia repair stayed fairly stable over the three years.

Table 6: Rates of selected surgical procedures, 1996/97 to 1998/99, Manitoba, directly adjusted to the 1992 population

	1996/97	1997/98	1998/99	Percent increase (decrease)
Excision Breast Lesions	2.29	2.68	2.97	29.7%
Carotid Endarterectomy	0.33	0.29	0.32	(2.1%)
Cholecystectomy	2.45	2.38	2.66	8.4%
Carpal Tunnel Release	1.10	1.14	1.02	(7.0%)
TURP	1.54	1.47	1.56	1.2%
Hernia Repair	2.01	1.98	1.99	(1.1%)
Tonsillectomy	1.54	1.65	1.79	16.2%
Varicose Veins	0.36	0.29	0.34	(6.6%)

Overall findings

Table 7 shows the median waiting time for eight common elective procedures for 1997/98 and 1998/99, comparing them to the median for the previous five years. In 1997/98, four procedures showed a significantly longer wait compared to the 92/93-96/97 median: excision of breast lesions, carotid endarterectomy, carpal tunnel release and hernia repair. In 1998/99, seven of the eight procedures had significantly longer waits compared to 92/93-96/97; only cholecystectomy was not significantly different. Most of the increases were less than seven days compared to 92/93-96/97, the exceptions being carotid endarterectomy for 97/98 (7 days), carpal tunnel release for both years (8 and 17 days), and varicose vein surgery for 98/99 (19 days).

Table 7: Median waiting times in days between pre-operative visit to surgeon and surgery date, Manitoba, (with 95% confidence intervals) (asterisks indicate significantly different from 92/93-96/97 median)

	92/93 to 96/97	1997/98	1998/99
Excision Breast Lesions	16	19* (17, 20)	20* (19, 21)
Carotid Endarterectomy	26	33* (27, 38)	32* (29, 38)
Cholecystectomy	31	30 (29, 33)	33 (31, 34)
Carpal Tunnel Release	35	43* (40, 49)	52* (47, 56)
TURP	25	27 (23, 30)	30* (27, 33)
Hernia Repair	29	35* (33, 36)	35* (34, 37)
Tonsillectomy	51	51 (48, 54)	55* (52, 58)
Varicose Veins	40	43 (38, 50)	59* (51, 71)

Region of residence

Table 8 provides the median waits according to the area of the province in which patients live. In Table 8, there are two columns for each region. The median wait for 92/93-96/97 is on the left for each region and the two-year median for 97/98-98/99 is on the right. The asterisk indicates a statistically significant difference from the 92/93-96/97 median value.[11] For instance, in the South, the carotid endarterectomy median wait for 92/93-96/97 was 22 days, and for 97/98-98/99, it was 29 days, an increase which was not statistically significant.

Table 8: Median waits (days) by region of residence for each procedure, 97/98-98/99 median compared with 92/93-96/97 median (* indicates significantly longer than 92/93-96/97 median; ** significantly shorter)

Region of residence	Winnipeg		West		South		Mid-North		Far North	
	92/93 - 96/97	97/98 - 98/99	92/93 - 96/97	97/98 - 98/99	92/93 - 96/97	97/98 - 98/99	92/93 - 96/97	97/98 - 98/99	92/93 - 96/97	97/98 - 98/99
Excision Breast Lesions	17	20*	15	24*	14	17*	15	19	13	21*
Carotid Endarterectomy	27	32*	35	37	22	29	25	31	26	31
Cholecystectomy	33	33	37	43	26	26	29	31	26	33*
Carpal Tunnel	41	61*	33	43*	27	30	31	42*	33	35
TURP	23	25*	47	38**	25	29	27	29	27	30
Hernia Repair	30	36*	35	40*	26	33*	28	32	25	25
Tonsillectomy	61	58	38	52*	42	40	48	50	39	47
Varicose Veins	41	59*	42	53	36	34	42	48	28	49

[11] It may seem peculiar that a difference of 11 days in the waits for varicose vein repair was not found to be significant in the West, whereas a difference of six days in the waits for hernia repair is significant for Manitoba. Confidence intervals are wider when there are fewer procedures and/or more variation in the waits.

Every procedure showed a significant difference in at least one area of the province. Most of the time, this meant that the more recent waits were longer than the earlier waits, with the exception of TURP for the West, where the wait became shorter. Residents of every area except the Mid-North had a statistically significant increase in the wait for excision of breast lesions; in the West and Far North the increase was greater than one week. Waits for carotid endarterectomy were significantly increased only for Winnipeg, with the 97/98-98/99 median being five days longer than the 92/93-96/97 median. Cholecystectomy waits did not change significantly except for residents of the Far North where the wait increased by seven days. Three areas showed increased waits for carpal tunnel repair, Winnipeg, the West and Mid-North, and all of the increases were 10 or more days. Waits for hernia repair were from five to seven days longer in Winnipeg, the West and the South. The wait for tonsillectomy increased by two weeks for residents of the West. The wait for varicose vein surgery was 18 days longer for Winnipeg residents, which was statistically significant.

Because the confidence intervals are not shown in Table 8, there is also a series of charts, one for each area, that show the median wait for both 92/93-96/97 and 97/98-98/99 for each procedure (Figures 6, 7, 8, 9, and 10). In these charts, the horizontal bar represents the median wait from 92/93-96/97, and the dot is the median wait for 97/98-98/99. The whiskers on either side of the dot illustrate the confidence intervals. When the whiskers do not overlap the bar, then the 97/98-98/99 median is significantly different than the 92/93-96/97 median.

Figure 6: Median wait (days) for elective procedures with 95% confidence intervals, Winnipeg: 97/98-98/99 compared with 92/93-96/97 median

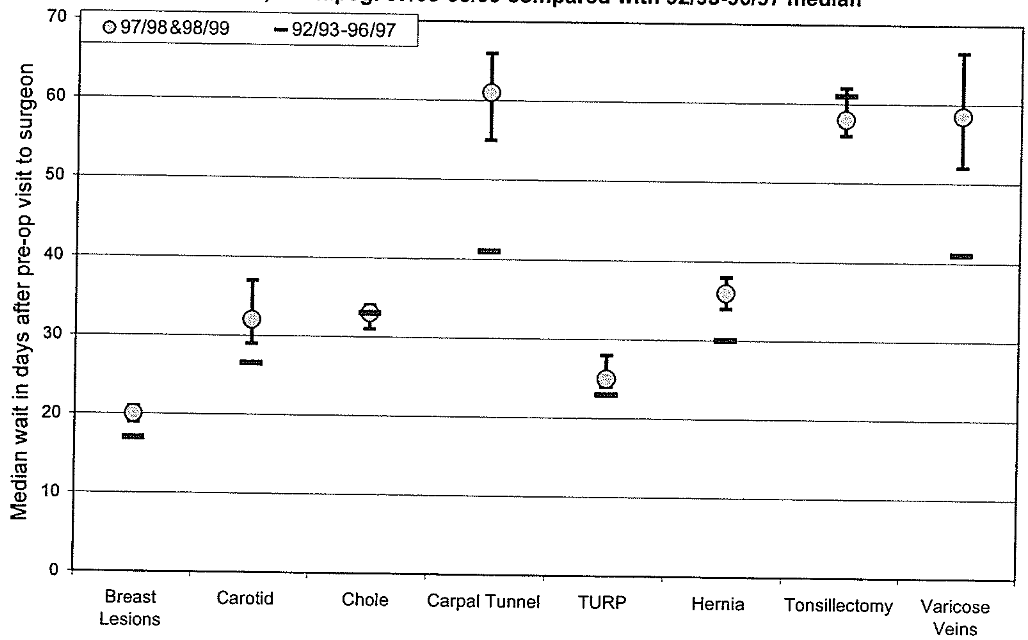


Figure 7: Median wait (days) for elective procedures with 95% confidence intervals, West: 97/98-98/99 compared with 92/93-96/97 median

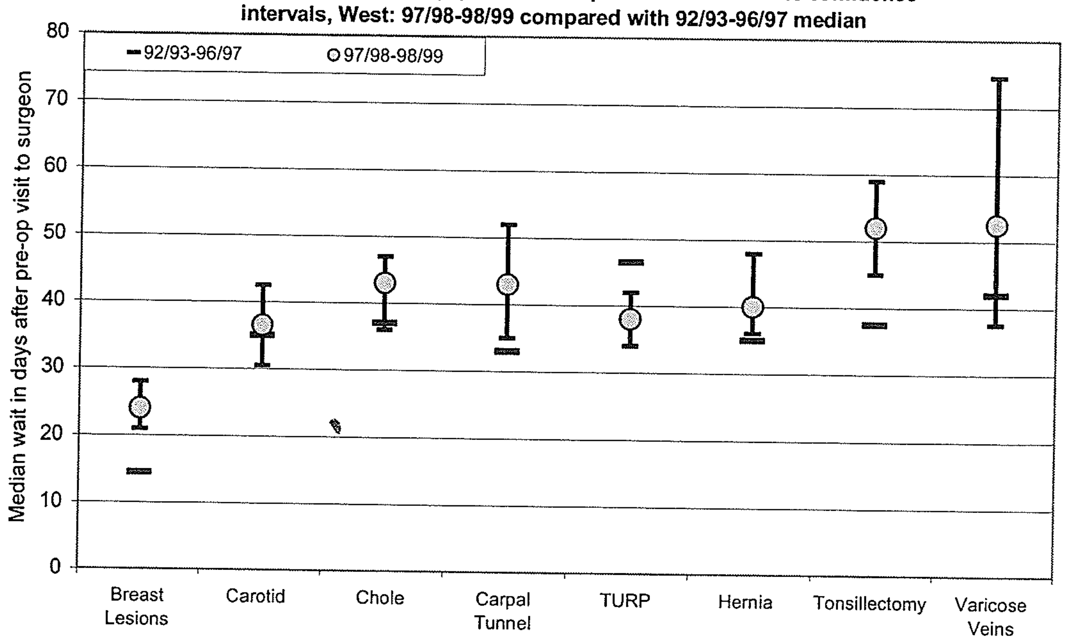


Figure 8: Median wait (days) for elective procedures with 95% confidence intervals, South: 97/98-98/99 compared with 92/93-96/97 median

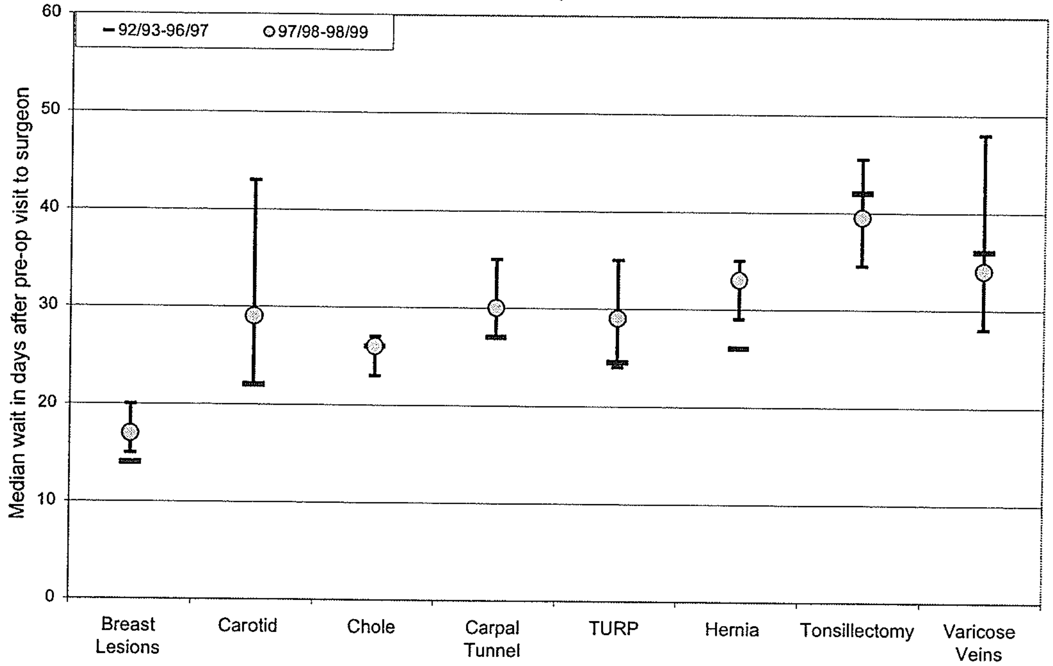


Figure 9: Median wait (days) for elective procedures with 95% confidence intervals, Mid-North: 97/98-98/99 compared with 92/93-96/97 median

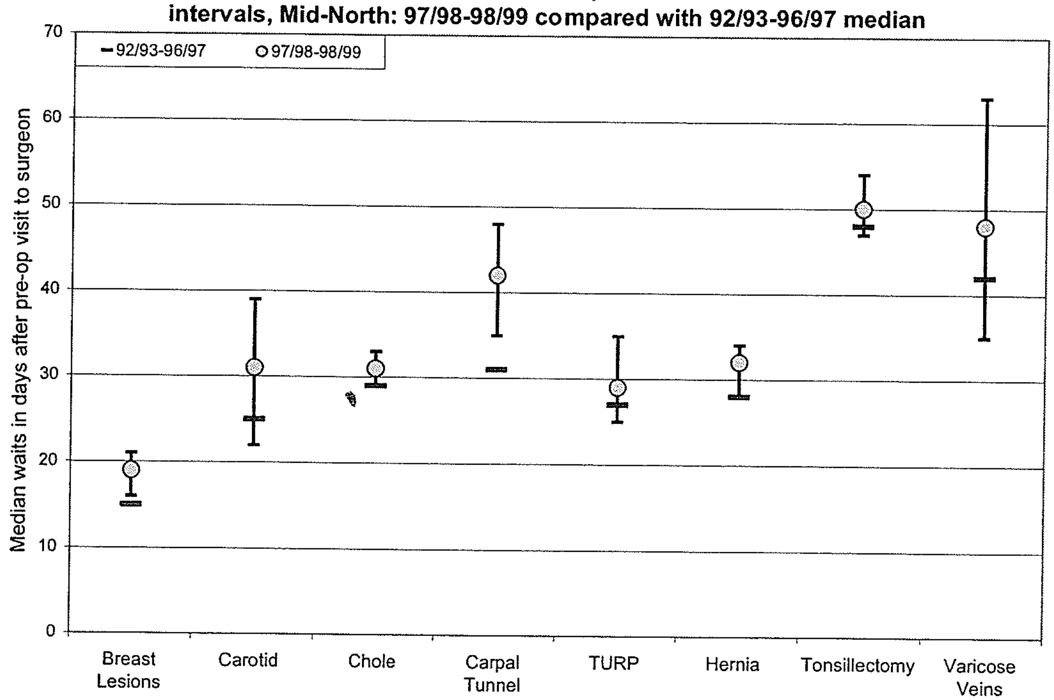
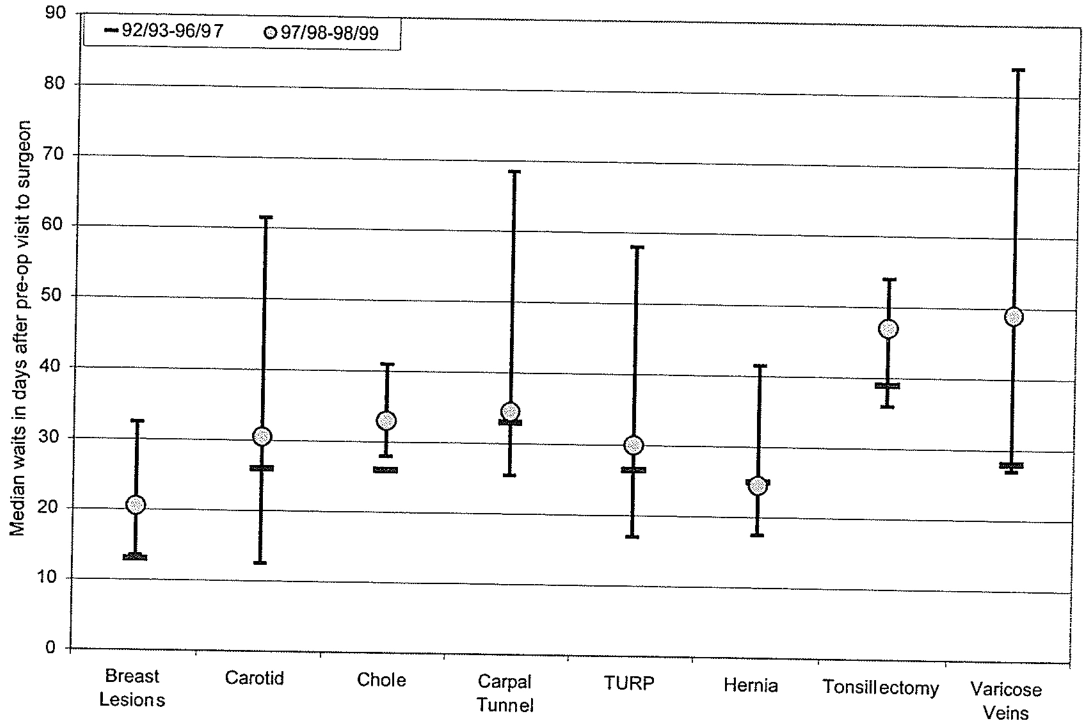


Figure 10: Median wait (days) for elective procedures with 95% confidence intervals, Far North: 97/98-98/99 compared with 92/93-96/97 median



Comparisons between regions

For every procedure, the longest waits were either in the West, where Brandon is located, or Winnipeg. For six of the eight procedures, waits were shortest in the South. Because of these patterns, we also made a comparison *between* regions for 97/98-98/99. For this comparison, each region's two-year median was compared to the Manitoba two-year median (Table 9). For seven of the eight procedures (all except carotid endarterectomy), patients from either Winnipeg or the West had a significantly longer wait than the Manitoba median. Patients in the South had a shorter wait than the Manitoba median for four procedures: cholecystectomy, carpal tunnel, tonsillectomy, and varicose veins. The Mid-North and Far North had similar median waits as the Manitoba median.

Table 9: Median waits (days) by region of residence for each procedure, 97/98-98/99, compared to the Manitoba median for 97/98-98/99 (* indicates significantly longer than Manitoba median; ** significantly shorter)

	Winnipeg	West	South	Mid-North	Far North	Manitoba
Excision Breast Lesions	20	24*	17	19	21	20
Carotid endarterectomy	32	37	29	31	31	33
Cholecystectomy	33	43*	26**	31	33	32
Carpal Tunnel	61*	43	30**	42	35	48
TURP	25	38*	29	29	30	28
Hernia Repair	36	40*	33	32**	25	35
Tonsillectomy	58*	52	40**	50	47	53
Varicose Veins	59*	53	34**	48	49	51

Winnipeg residents waited 61 days for carpal tunnel release compared to the Manitoba median of 48 days, 58 days for tonsillectomy compared to 53 for Manitoba, and 59 days for varicose vein surgery compared to 51 days for Manitoba. For cholecystectomy, residents of the West waited 11 days longer than the Manitoba median of 32 days, and residents of the South waited six days less than the Manitoba median. Southern Manitoba residents waited 18 days less than the Manitoba median for carpal tunnel release, 13 days less for tonsillectomy and 17 days less for varicose vein surgery. In our earlier report, patients living in the West waited 47 days for TURP compared with the Manitoba median of 25 days; despite the fact that waits for TURP have shortened in the West, they are still longer (38 days) than the rest of the province (28 days).

Age

We looked at median waits for age, categorized as younger than 65 years and 65 years or older. Patients having tonsillectomy were excluded from this analysis since they are predominantly younger. In the previous report, it was noted that persons aged 65 years or older had shorter waits on average compared to people younger than 65. However, this was not evident for 97/98-98/99, where the waits for these age groups was similar. The median waits were within three days of each other for all procedures except carotid endarterectomy and carpal tunnel release; only the wait for carpal tunnel release was significantly different with people under 65 waiting longer than those aged 65 or older.

Table 10 shows the median waits for both age groups for both time periods. In the younger age group, waits increased significantly for excision of breast lesions, carpal tunnel release, hernia repair, and varicose veins, but did not change significantly for carotid endarterectomy, cholecystectomy, and TURP. For carpal tunnel release and varicose vein surgery the increases were 14 and 9 days, respectively. For older patients, waits were significantly longer in 97/98-98/99 compared to 92/93-96/97 for every procedure except cholecystectomy; for carotid endarterectomy, carpal tunnel repair and varicose vein surgery, the difference was ten or more days.

Table 10: Median waits (days) by age category 92/93-96/97 and 97/98-98/99 (* indicates significantly longer than 92/93-96/97 median)

	Age younger than 65 years		Age 65 years or older	
	92/93-96/97	97/98-98/99	92/93-96/97	97/98-98/99
Excision Breast Lesions	16	20*	15	20*
Carotid endarterectomy	28	28	26	36*
Cholecystectomy	30	32	31	32
Carpal Tunnel	38	52*	28	38*
TURP	31	29	24	28*
Hernia Repair	30	35*	28	35*
Varicose Veins	42	51*	30	51*

Gender

Median waits according to gender for 97/98-98/99 combined were compared to the Manitoba median for the two years. For the most part, there were no differences in median waits by gender, except for tonsillectomy, where males waited longer than females. Males waited 56 days (95%CI: 54, 59) and females waited 50 days (95%CI: 48, 53). The Manitoba median for tonsillectomy for 97/98-98/99 was 53 days.

Neighbourhood Income

Table 11 shows the median waits for Winnipeg residents according to neighbourhood income level. Similar to Table 8, the left column for each income level shows the 92/93-96/97 median value and the right, the 97/98-98/99 value. The asterisk denotes a significant difference from the 92/93-96/97 median value for that income category.

Table 11: Median waits (days) by neighbourhood income for each procedure, Winnipeg residents only, 97/98-98/99 compared to 92/93-96/97 (* indicates significantly longer than 92/93-96/97 median)

Neighbourhood income level	Lowest income		Lower Middle		Middle		Upper Middle		Highest Income	
	92/93 - 96/97	97/98 - 98/99	92/93 - 96/97	97/98 - 98/99	92/93 - 96/97	97/98 - 98/99	92/93 - 96/97	97/98 - 98/99	92/93 - 96/97	97/98 - 98/99
Excision Breast Lesions	17	21*	18	19	16	18*	17	20*	16	19*
Carotid endarterectomy	26	38*	25	31	24	39*	26	38*	26	22
Cholecystectomy	30	30	32	31	35	35	33	34	32	32
Carpal Tunnel	38	56	35	54*	37	62*	44	68*	52	59
TURP	21	24	22	32*	25	27	29	23	22	25
Hernia Repair	29	32	29	34*	31	40*	31	39*	32	37*
Tonsillectomy	56	52	59	56	60	56	64	59	62	63
Varicose Veins	40	60	43	70*	39	69*	39	57	45	57

Although some neighbourhoods waited longer for some procedures, there seems to be no pattern of longer or shorter waits by neighbourhood income level. Patients in all but lower-middle income neighbourhoods waited significantly longer for breast surgery, but only by two to four days. Residents of lowest, middle and upper-middle income neighbourhoods waited from 12 to 15 days longer for carotid endarterectomy in 97/98-98/99 compared to 92/93-96/97. Waits for carpal tunnel were from 19 to 25 days longer in the three middle-income neighbourhoods. Lower-middle income residents waited 10 days longer for TURP and 27 days longer for varicose vein surgery in 97/98-98/99 compared to 92/93-96/97. The wait for varicose vein surgery was also significantly longer for middle-income residents, going from a median of 39 days in 92/93-96/97 to 69 days in 97/98-98/99. Residents of all but the lowest income neighbourhoods waited from five to nine days longer for hernia surgery in 97/98-98/99 compared to 92/93-96/97.

Comparisons were also made between neighbourhoods in the different income quintiles, to see if there were patterns of differences between them. For this comparison, each neighbourhood was compared with the Winnipeg median. No significant differences in the median waits were found. In other words, regardless of income level, patients throughout Winnipeg had similar waits for these commonly performed elective procedures.

Limitations

1. We used the most recent pre-op visit to estimate the median wait time, except for cataract surgery. For the eight routinely performed procedures, 70% of patients had only one pre-op visit to the surgeon. However, for some procedures, the percent of patients with only one visit was lower. For excision of breast lesions and TURP, only about 50% of patients had one visit, and for carotid endarterectomy, only 39% of patients had one visit. It seems reasonable that patients with these conditions would require more than one visit, and that the most recent visit is the one where the decision was made to proceed. For example, patients with TURP for benign disease might have a period of watchful waiting before deciding to have surgery, and patients with breast disease or carotid stenosis would likely have some diagnostic tests after the preliminary visit to the surgeon. It had been mentioned in the earlier report that this method was not suitable for procedures for chronic conditions. Given that restriction, perhaps TURP should be excluded from future analyses.

2. It was discovered during the course of this analysis that proportionally more procedures were excluded in patients from the lowest-income neighbourhoods compared to others. For instance, 35% of tonsillectomies were excluded in patients in the lowest-income neighbourhoods, compared to 20% for the middle, upper-middle and highest-income neighbourhoods. Recall that all urgent/emergent procedures were excluded, and we only counted the initial procedure performed over the time period. Reasons for this discrepancy are unknown. Possibly more low-income patients see surgeons in out-patient clinics where claims are not filed, or low-income people may be more likely to receive more than one procedure and we only counted the first one over the time period.

3. Our method can only estimate waits for people who had surgery. For patients who had decided to have surgery but did not, we have no data. Therefore, this method could underestimate the true waiting time. However, registries that collect data on all patients waiting can overestimate the wait because of list inflation, that is, the tendency for waiting lists to contain the names of patients who should be removed

from the list because they have improved, changed their minds, moved or died. Studies have documented the degree of list inflation to be in the order of 25 to 50 per cent (Barham, Pocock and James, 1993; Elwyn, Williams, Barry, et al., 1996; Lee, Don and Goldacre, 1987; Tomlinson and Cullen, 1992). The method used in this report does not have to contend with this problem, since it measures the wait for all patients who did have surgery.

Discussion

This report provides a measure of the actual time that patients wait for a variety of surgical procedures. There is good news. For instance, the waits for coronary artery bypass surgery are decreasing and a bigger proportion of patients receive their surgery within 90 days. Also reassuring is that, whether male or female, wealthy or poor, young or old—Manitobans experience similar waiting times. For all procedures, except cataract surgery, waits were less than 60 days, and for many of them, the wait was around 30 days. Shortening waits more than this may in fact be inappropriate, since patients should have sufficient time to weigh carefully the risks and benefits that accompany any surgical procedure.

However our report raises some concerns also. There was a general pattern of increasing waiting times for elective surgery. For instance, the median wait for breast tumour surgery increased 25% in 98/99 compared to the 92/93-96/97 median, and the median wait for carotid endarterectomy increased 23%. Even though the median waits for every procedure except cataract surgery are less than 60 days, and the absolute increases are not large—four days for breast tumour surgery and six days for carotid endarterectomy—it is the trend towards increasing waits that is of concern. Do they indicate that access to care is decreasing?

One of the usual, and indeed intuitive, responses to this kind of finding, is that we need more resources. It seems logical that if waits are increasing, then it must mean that supply is inadequate, and that more resources will reduce waits. A supporting example can be found in coronary bypass surgery, in which both the rate and the frequency increased over the past five years, and the median waiting time declined. But there is contradictory evidence as well. The number of public-sector cataract surgery operations increased 52% between 1992/93 and 1998/99, and the age-sex adjusted rate increased 43% over that period. As the resources devoted to cataract surgery were increasing, the median waiting time at first fell, but then increased again. TURP shows yet a different pattern: the number of procedures fell from 1223 in 1992/93 to 786 in 1994/95 and this was accompanied by a fall in the waiting time from 30 to 25 days. Since 1994/95, the number of procedures has increased to 928 and the waiting time has also risen back up to 30 days. So, for TURP and cataract surgery, an increase in resources has been accompanied by an increase in waiting times. Increasing resources is clearly not the only answer in trying to manage waiting times.

The presence of a parallel private system also does not result in shorter waits in the public sector. Manitoba Health's decision to ban extra fees for private clinic cataract surgery reflects the recognition of this fact. During most of this study period, cataract surgery was available both publicly and privately, with patients being required to pay a fee if they opted for surgery in a private clinic. We found that waiting times for cataract surgery in the public sector were the longest for surgeons who also had a private practice. This pattern has been noted in the United Kingdom as well, where areas with the longest waits for public-sector surgery are those with the most private beds, and the long-wait procedures are those where there is the most private practice (Williams, West, Hagard et al., 1983; Light, 1996; Richmond, 1996). The reasons for this finding are not clear. One possibility is that where more human and capital resources are devoted to private practice, they are unavailable for the public sector. However, that does not seem to be the answer in Manitoba, where the surgeons who operated both publicly and privately made maximum use of their public-sector operating room time.

Another theory is that surgeons with private clinics have an incentive to have long public-sector waiting lists. That is not to say that these surgeons would try to "pad" their public-sector waiting lists by recommending surgery unnecessarily, but they might recommend it sooner than other surgeons, knowing that with the anticipated wait, the patient would be ready for surgery when called. Therefore, patients waiting for the same surgical procedure will have varying levels of dysfunction, depending on the way each surgeon manages his or her waiting list. This is true not only of cataract surgery, but of elective surgery generally, and points to the need for more information in order to manage waits.

What is needed is a system that prioritizes patients based on defined criteria, such as severity of illness, activity limitation, urgency, and expected benefit (Hadorn, 2000). In addition, information on waiting times for individual surgeons should be readily available, to assist patients and primary care physicians when making referrals to specialists. A waiting list information system should flag patients whose waits seem excessively long, reprioritize patients based on their changing conditions, and remove patients from the list who are no longer waiting, either because they have moved, or their condition improved, or they decided against surgery (Lewis, Barer, Sanmartin et al., 2000). Finally, better information systems can contribute to research on outcomes, which can then feed back into improved management of waiting times.

In closing, while this research monitors waiting times, it cannot assist with managing them. The causes of waiting times—a complete discussion of which is beyond the scope of this report—are complex. Consequently, their solutions are often elusive. But one thing seems clear—in order to have some impact on waiting times, more and more accurate information is needed.

APPENDIX 1: MEAN WAITING TIMES

The major drawback of using the mean is that it is sensitive to outliers. Therefore, for the calculation of mean waiting times as given in table 1A below, it was necessary to consider excluding a few extremely unusual waiting times based on Tukey's robust outlier detection method. Under this method, we calculated the difference between the 25th and 75th percentile, called the interquartile range (IQR). An outlier was defined as being longer than [3*IQR] + the 75th percentile, or shorter than the 25th percentile – [3*IQR]. Note that we used the conservative [3*IQR] instead of the conventional [1.5*IQR] to define outliers. This resulted in excluding 3.6% of the eight routinely-performed procedures, and 2.5% of all procedures.

Table 1a: Mean waiting times for 92/93-96/97, 97/98 and 98/99

	92/93 to 96/97	1997/98	1998/99
Excision Breast Lesions	20.0	23.6	24.5
Carotid Endarterectomy	34.8	39.3	42.2
Cholecystectomy	41.3	38.2	39.5
Carpal Tunnel Release	52.1	69.3	70.7
TURP	36.4	33.1	35.2
Tonsillectomy	61.7	56.7	61.3
Hernia Repair	38.1	43.5	45.7
Varicose Veins	49.4	52.0	69.9
Cataract surgery (public sector only)	115.2	138.1	149.2
CABS (scheduled)	78.7 (90/91-96/97)	46.8	42.1
PTCA (scheduled)	44.1 (90/91-96/97)	45.4	37.8

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CHAPTER THREE: COMPARISON OF WAITING TIMES BETWEEN CATARACT SURGERY WAITING LIST REGISTRY AND CLAIMS DATA

Introduction

Chapter 2 described a method of measuring waiting times using claims data from the Population Health Research Data Repository. Briefly, the beginning of the wait was defined as the date of the pre-operative visit to the surgeon and the end of the wait was defined as the date of surgery. If there was more than one pre-op visit, then the visit closest to surgery was used.

The validity of using claims data to measure waiting times has been questioned, since the beginning of the wait—a pre-op visit to the surgeon—is a proxy measure. Comparisons of estimates between this method and other data sources are lacking. For the project described above, there was a working group on which there were several physician representatives (DeCoster et al. 1998). They advised the use of the last pre-operative visit, as they felt that it best represented physician practice patterns in which the decision to proceed with surgery was generally made at the last pre-op visit. However, they cautioned that this method was best used for acute, short-lived conditions where only one or two visits were required. Procedures to alleviate chronic or long-standing conditions, and for which several specialist visits were made, for example, hysterectomy for benign disease or total joint replacement, were not appropriate for this method.

Empirical support for the claims method comes from two recent studies (Sanmartin 2000; Shaw and Shortt 2000). Sanmartin compared data from the hospital booking system with claims data in British Columbia. In that study, the date that the hospital was booked was compared with a visit to the surgeon for four procedures, knee replacement, hip replacement, coronary artery bypass surgery (CABS) and cataract. The majority of the procedures were booked after the last (if more than one visit occurred), or only visit prior to surgery. The proportion of patients booked after their last visit or only visit was 63.7% for knee replacement, 68.4% for hip replacement, 77.9% for CABS, and 54.7% for cataract.

In Kingston, Shaw and Shortt analyzed chart data for over 30,000 surgeries that took place from July 1, 1992 to June 30, 1996. Four items were recorded: (1) the date the patient was placed on a waiting list as recorded in the chart, usually in the form of a letter from the surgeon to the referring physician; (2) the date of the patient's last visit to the surgeon before the procedure; (3) the date the procedure took place; (4) the type of procedure. The types of surgery represented were cardiac, general, neurosurgery, orthopaedic, thoracic, vascular, ophthalmology, gynaecology and urology. For general, neuro-, ophthalmic, thoracic, vascular and urologic surgery, the difference between the decision date (1) and the last visit (2) was negligible, from 0.1 day for ophthalmology to 1.5 days for neurosurgery. For cardiac, orthopaedic and gynaecologic surgery there was a significant difference between the decision date and the last visit pre-operatively, with the last visit date being closer to the surgery date than the decision date. In other words, using the last visit date would significantly underestimate the waiting time for these categories of surgery. Although this study did not compare claims data with data from the patient's record *per se*, it does offer support for the use of a physician visit in certain procedures as a proxy for the decision-date for surgery, and hence the beginning of the wait time.

In Manitoba all patients who are scheduled for cataract surgery in Winnipeg are entered into the Cataract Surgery Waiting List Registry (CSWLR) maintained at Misericordia hospital. The CSWLR provides a measure of waiting time as well as other data including demographic data, prioritization scores, surgery information and explanations for unusual circumstances. If wait times from the CSWLR correspond to wait times using claims data, this would further support the use of claims data for estimating waiting times.

Objective

The objective of this study is to merge anonymized data from the CSWLR with data in the Repository to compare waiting times between methods. One of the limitations of the administrative data method of estimating waits is that it uses a proxy measure, the pre-operative visit to the physician, as the beginning of the wait, and it is not known how closely this corresponds to patients' actual waiting times. Furthermore many patients having cataract surgery have more than one pre-operative visit to the surgeon. A comparison between the two data sources would show whether they yield similar results, and if not, where the differences are. This may suggest ways to modify the claims method to approximate more closely the CSWLR estimate. This research is important because the administrative data method is generally less resource-intensive than establishing and maintaining a Registry, but if it is to be used in a policy context, its strengths and limitations must be understood.

This research project has been submitted to and approved by the Health Research Ethics Board at the University of Manitoba (H2001:054), and the Health Information Privacy Committee of Manitoba Health (2000/2001–48).

Data Sources

Cataract Surgery Waiting List Registry

The Cataract Surgery Waiting List Registry (CSWLR) is well-described in a paper authored by Drs Lorne Bellan and Mathen Mathen, who are members of the Department of Ophthalmology (Bellan and Mathen 2001). Much of this description borrows from that paper, as well as conversations with Dr Bellan, and a site visit with the clerks who maintain the Registry.

The CSWLR went into effect in 1998. It is maintained at Misericordia Health Centre (MHC) in Winnipeg. MHC agreed with Manitoba Health to establish the registry for cataract surgery when all Winnipeg adult ophthalmological surgery was consolidated at MHC in 1993. (Approximately 5% of cataract surgery in Manitoba is performed in Brandon, the rest in Winnipeg.) All members of the Department of Ophthalmology were invited to a series of planning meetings in 1997, one of which included a presentation and discussion by a medical ethicist. The Department agreed to a scoring system that would prioritize patients on the waiting list, and that the scoring system should be heavily weighted towards visual impairment related to the cataract. Although the Registry is maintained at MHC, the determination of the sequence in which patients are operated is under the control of the individual ophthalmologist.

Scoring system

The instrument used to measure visual impairment is the VF-14 with additional questions related to problems with employment or driving. The VF-14 asks patients questions about the degree of difficulty they experience in carrying out 14 specified activities that may be affected by vision problems, e.g., reading small print, watching TV, recognizing people (Castells et al. 2000). The VF-14 score has "been shown to be the best preoperative predictor of gain in patient satisfaction, and to have a high degree of reliability and interobserver scoring consistency" (Bellan and Mathen 2001). Time spent on the waiting list also contributes to the patient's prioritization score. Although there is some disagreement about whether time-waiting should be a factor in prioritization, the consensus of the Department was that waiting constituted a burden and thus should be factored into the score.

The scoring system consists of five factors: (1) functional impairment according to VF-14 (2) length of wait in months (3) work impairment (4) work driving impairment (5) potential loss of driver's licence. Table 3.1 illustrates the scoring algorithm. Because a higher score on VF-14 indicates better functioning, the score in the algorithm is entered as 100 minus the VF-14 score, thus giving more points to poorer function. The questions on work and driving contribute a maximum of 60 points to the overall score.

Table 3.1: Scoring system for the CSWLR (Bellan and Mathen 2001)

Factor	Score
Functional impairment	100 – VF14 score
Length of wait	No of months waiting for surgery * 5
Work impairment	None = 0; mild = 10; severe = 25
Work driving impairment	No = 0; yes = 20
Potential loss of driver's licence	No = 0; yes = 15
Total score	Sum of factor scores

Process

Surgeons' offices submit patients' names to the CSWLR office when the decision is made to proceed with surgery. Registry staff then contact the patient by telephone to administer the questionnaire, using translators if necessary. If patients cannot be reached after three attempts, a questionnaire is mailed. The staff realize that if patients have a great deal of visual impairment, they may not be able to complete a written survey, but have found that often a family member will assist, or patients themselves will phone the Registry office upon receipt of the paper questionnaire. Ophthalmologists are asked to complete the questionnaire if patients cannot be reached or cannot answer the questions, for example, due to deafness. The results of the questionnaire are entered into a database to create the prioritization score. Having the questionnaire independently administered helps to avoid gaming of the scoring system. If both eyes are booked at the same time, the interview is conducted once and the same score is used for both eyes.

Each ophthalmologist receives a monthly report listing all patients and their priority scores. The surgeons then decide which patients to operate on for their surgical slates three months hence. Ophthalmologists can also override the score if a patient's condition changes or there are other factors affecting urgency.[1]

The archive contains patients who have been removed from the active registry. A list of patients who have had cataract surgery at MHC is transmitted to the Registry daily so that

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1 The CSWLR clerk told me only one surgeon ever uses the override score, and this surgeon always gives threatened loss of driver's license as the reason for the override and assigns a score of 250. When there is an override, the clerks do not try to contact the patient for an interview.

the patients can be moved from the active list to the archive. Lists from the two private clinics are provided biweekly. Also, patients who are cancelled are moved to the archive; however, patients who are postponed are maintained in the active Registry.

Data collected

The CSWLR includes about 95% of all cataract surgery patients in Manitoba.[2] In the CSWLR are:

- *demographic data*: patient surname, given name, gender, Manitoba Health family number, Personal Health Information Number (PHIN), date of birth, city of residence, postal code, language;
- *relevant dates*: date booked for surgery, date of interview, surgery date, removal date from CSWLR;
- *prioritization information*: calculated VF-14, combined work/driving score, individual scores for questions on work and driving, wait factor, total priority score;
- *surgery information*: surgery done (yes/no), surgeon number, surgeon name, first or second eye, left or right eye, surgery location (Misericordia Health Centre, Western Surgery Centre or Pan-Am Clinic); and
- *explanations for unusual circumstances*: removal reasons if other than surgery, priority reasons if moved up by surgeon, cancellation reasons if scheduled then cancelled.

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2 About 5% of procedures in 97/98 and 98/99 were performed in Brandon; and the number of patients going to the Gimbel clinic in Calgary, according to Manitoba Health is negligible: 82 in 1998, 111 in 1999.

Population Health Research Data Repository

The Population Health Research Data Repository (the "Repository") is a comprehensive data base which records all patient contacts with physicians, hospitals and nursing homes. It is managed by the Manitoba Centre for Health Policy (MCHP) at the University of Manitoba. All records deposited in the Repository have been processed by Manitoba Health to remove names and addresses while preserving the capacity to link records together to form individual histories of health care use.

The Repository contains anonymized encounter-based records of individuals' interactions with the provincial health care system. It is derived from information contained in the Manitoba Health insurance population registry, and from health insurance claims routinely filed by physicians and health care facilities with Manitoba Health. Manitoba Health provides MCHP with copies of several files which have been identified as necessary to carry out MCHP deliverables, including the hospital file, medical claims file, personal care home file and the registry. In addition, data from other sources such as the Manitoba Cancer Registry, Vital Statistics and Statistics Canada Census data (aggregate data only) have been incorporated into the Repository. As well, over the years, special subfiles have been created, incorporating anonymized data from other research, for example, the Aging in Manitoba Study.

Claims method of estimating waiting times

The method used to estimate waiting times using claims data has been described in detail in an earlier chapter. In general terms, the method involves identifying a specified surgical procedure in the hospital claims, then searching for a claim for a pre-operative visit to the surgeon as a marker for the beginning of the wait time. In cases where more than one pre-operative visit occurred, the visit closest to surgery was used as the index visit. Out-of-province patients were excluded from all analyses.

Because cataract surgery can occur at either a hospital or a privately-owned clinic, the method had to be modified somewhat. To identify cataract surgery in the hospital claims, hospital files were searched for one of the following procedures codes: 1311, 1319, 132, 133, 1341, 1343, 1351, and 1359. The procedure code had to be in the first position, indicating that it was the primary reason for hospitalization.

To identify patients who received cataract surgery at a private clinic, medical claims were used since there is no hospital abstract filed from the privately-owned clinics. Tariff 5611 or 5612 indicates a surgical claim for cataract extraction. For all patients with these tariffs, if the physician claim indicated a known clinic number or if the facility number was missing, the record was kept. If a record was found in the hospital file that corresponded with respect to dates and other information, then the claim was attributed to the hospital. If there was no hospital claim, then it was attributed to one of the clinics.

A variety of tariffs were used to identify pre-operative visits by the patient to the operating surgeon. The list of tariffs is found in Table 3.2 and was intended to be as complete as possible. The method for determining the start of the wait was modified for cataract surgery, after consultation with an ophthalmologist. For patients with more than one pre-op visit, if the visit closest to surgery was coded for ultrasonography to determine axial length for cataract surgery (tariff 9890 or 9891), the visit before that was used. If that visit was also coded for ultrasonography the third closest visit was used.

Table 3.2: Tariffs used to identify pre-op visit claims to the operating surgeon

Tariff	Definition
8550	consultation
8540	complete history and physical
8501	regional history and examination.
8507	Subsequent Visits (office)
8509	Regional or subsequent visit or well-baby care
8543	Complete History and ocular exam
8556	Consultation including refraction and other necessary tests (ophthalmology)
9847	Gonioscopy or 3-mirror exam (ocular test)
9890	Ultrasonography of eye to determine axial length (for cataract surgery)
9891	as above, professional component only

Methods

Data from the CSWLR were received on May 25, 2001. The data included all patients who had been "archived", that is, they had been removed from the active waiting list either due to surgery or due to cancellation for some other reason, between November 1998 and May 24, 2001. The data received included waiting time information (date on the waiting list and date of surgery), and some identifiers, for example, sex and birth date; other data, such as priority scores, were not made available.

Since the claims method of estimating waiting times relies on identifying a date of surgery, then looking retrospectively for a pre-operative visit to the surgeon, the check between the claims method and the CSWLR method relied on having a date of surgery. In other words, only patients who had already received surgery could be identified in the claims data and therefore compared with the CSWLR. Claims data were available only until March 31, 2000.

The process for comparing the two data sets involved, first, a record linkage between the two, and second, a comparison of waiting times in both data sets. First, the data from the CSWLR were examined and cleaned, to remove files with missing information. Second, common variables between the CSWLR and claims were identified, and linkage was attempted. Once linkage was successful, match rates were compared, i.e., to what extent did the beginning of the wait time using the CSWLR as the 'gold standard' match the beginning of the wait time using claims data. Efforts were then made to identify sources of discrepancy between the two.

Linkage methods

Linkage methods can be of two general types: deterministic or probabilistic (Roos and Wajda 1991). Deterministic linkage requires agreement on a set of individual identifiers believed to be highly accurate. Probabilistic linkage is more complex and is used in cases where there are numerous coding errors, missing fields, lack of unique identifiers or few matching variables with which to carry out a deterministic linkage. If deterministic linkage results in numerous ties, probabilistic methods should be used. The probabilistic method applies weights in decreasing order to all variables; the weight is an estimate of the odds that the two records under consideration do in fact refer to the same individual. Though probabilistic methods have the benefit of using more of the available data, their disadvantage is their added complexity. A linkage strategy that uses deterministic linking first, and then, if necessary, probabilistic techniques to resolve ties is the most efficient in terms of time and computing resources (Wajda et al. 1991; Roos et al. 1986).

Validation of claims method

Validity can be defined as the extent to which any measuring instrument measures what it is intended to measure (Carmines and Zeller 1979). There are different types of validity, including face, criterion and construct. Face validity refers to a subjective belief among experts that a measure appears to make sense (Zikmund 1988). Criterion validity is a measure of the degree to which a measure corresponds to other measures of the same thing; it is generally measured by the use of correlation. Construct validity refers to the degree to which the measure conforms to its theoretical underpinnings. Construct validity is comprised of convergent and discriminant validity. Convergent validity, similar to criterion validity, is the degree to which measures that should be similar are similar; discriminant validity is the degree to which measures that should not be similar are not. (Zikmund 1988; Trochim 2001). In this study, the objective was to compare the measures of waiting times using two different methods, which fit the definition of criterion or convergent validity. Correlation was used to measure this degree of convergence. According to Carmines (p. 17), "The operational indicator of the degree of correspondence between the test and the criterion is usually established by the size of the correlation." In this study, Spearman's rank order correlation was used rather than Pearson's product-moment correlation because the data were not normally distributed (Hassard 1991).

One of the identified problems in comparing wait times is that the data are frequently skewed to the right. Because of this, the usual parametric tests cannot be used since the assumption of normality is violated. However, by taking the natural log of the values, they can be normalized, thus permitting parametric statistical tests (Ortega-Benito 1991; Hassard 1991). Shaw and Shortt recommend the use of ANOVA to compare the log-transformed waiting times (Shaw and Shortt 2000). Multiple t-tests could also be used with a Bonferroni correction to maintain an overall p-value of 0.05. However, since ANOVA can handle several comparisons simultaneously, it was used to compare the different methods of estimating the wait time, followed by a Tukey's multiple-comparison test to determine which methods differed from each other.

Findings

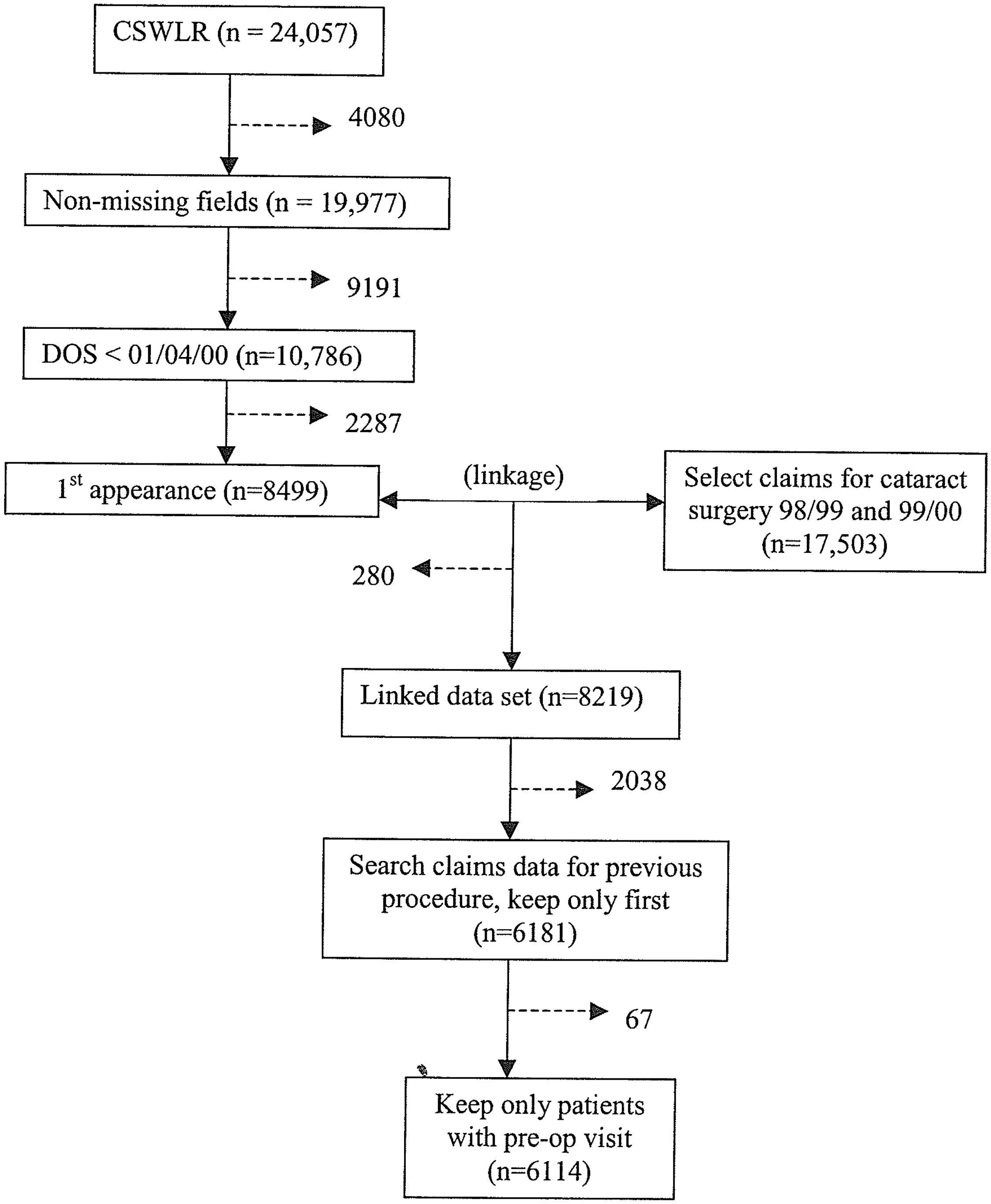
Linkage

The CSWLR contained 24,057 entries. In the initial sort, records with missing fields were excluded, leaving 19,977 records (Figure 3.1). (Of note, 11.7% of records were missing a date of surgery, indicating that patients had been removed from the active Registry and archived without having received surgery, a possible indication of inflation of the Registry.) Then only records with a date of surgery (DOS) prior to April 1, 2000 were kept (n = 10,786), and only the first appearance in the Registry (n = 8499). Claims data for cataract surgery for the entire province for 1998/1999 and 1999/2000 were selected, yielding 17,503 records.

There were four possible fields on which to match records between the CSWLR and claims data: sex, birth date, date of surgery and an internal ordering number. A deterministic linkage using all four fields provided only a 26.7% match, but using three of those four fields yielded a match rate of 96.7% (n = 8219). Because the deterministic linkage yielded a match rate in excess of 95%, probabilistic methods were not attempted.

My previous work on waiting times had demonstrated that frequently, when patients were having bilateral procedures, there was no record of a pre-operative visit between the first and second procedure. In some early analyses (unpublished), for procedures that were potentially bilateral, e.g. cataract, carpal tunnel release, 72% of patients did not have a visit to the surgeon between the first and second procedure. Furthermore, only the first appearance in the CSWLR was selected for analysis, the same rule was applied to the claims data, to make the comparison between claims and CSWLR as similar as possible. Therefore, for the patients that were linked (n = 8219), claims data for the three years prior to the date of surgery were searched for a previous claim for cataract surgery, and people with a prior claim were excluded. This step left 6181 linked cases, of which 6114 (98.9%) had a claim for a visit pre-operatively to the surgeon. Therefore, the final cohort for analysis was 6114 individuals who had first-eye cataract surgery between November 1999 and March 2000.

Figure 3.1: steps in linkage process between CSWLR and claims data



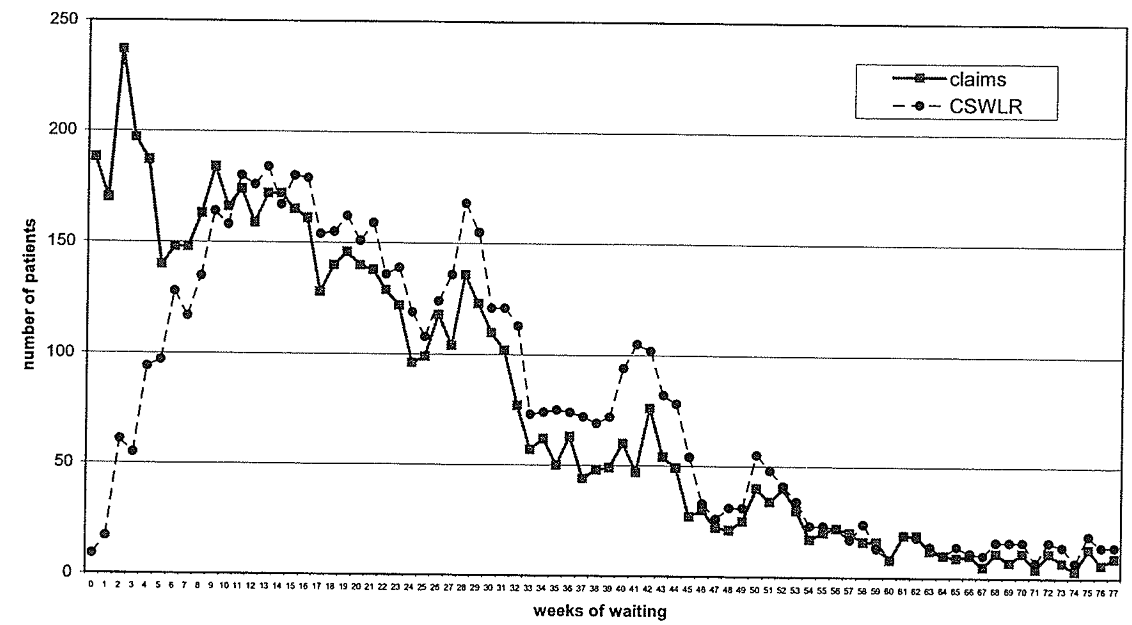
Comparing wait times using Claims and Wait List data

The next step was to compare the wait times using claims and CSWLR data. In the CSWLR, "date on the wait list" is provided by the ophthalmic surgeon's office when the booking request is forwarded to Misericordia Health Centre. (Even patients who are having surgery at one of the two private clinics have a booking request submitted to MHC, so that they can be entered into the CSWLR.)

For the 6114 linked patients who also had at least one pre-operative visit to the surgeon, the beginning of the wait time was exactly the same in both datasets for 4318 (70.6%). If differences of up to 30 days were permitted, then 4640 (75.9%) records matched. Both the mean and the median waiting time were much shorter using the claims methods compared to the CSWLR. The mean wait was 36 days shorter in the claims method (154.2 days) versus the CSWLR (190.1 days); similarly the median wait was 37 days shorter using claims (126 days) versus CSWLR (163 days).

A graphic display of the distribution of waiting times sheds further light on this issue (Figure 3.2). The chart illustrates the number of people waiting from 0 to 78 weeks (1½ years) using both methods. The two lines track each other remarkably well, except for the first six to ten weeks. The claims data method suggests that 1762 (28.8%) of patients have waits of less than ten weeks, whereas the CSWLR indicates only 1035 (16.9%) had surgery within ten weeks, a difference of 727.

Figure 3.2: Distribution of wait times CSWLR and claims, Nov 98-Mar 00
note: pts waiting 78+ weeks: CSWLR 104; Claims 62



The plot of the data indicated that the claims method was accurate at estimating waiting times except for shorter waiting periods. Recall that the date entered in the CSWLR was the date indicated by the surgeon on the booking request. The claims method assigned the closest visit to surgery as the beginning of the wait unless it had been coded as an ultrasound measurement; the plot suggested that this assignment did not reflect physician practice. Many patients saw their surgeon more than once prior to surgery. Searching through three years of physician claims data prior to the date of surgery, 2541 (41.6%) patients saw the surgeon only once pre-operatively, 2138 (35.0%) twice, and 1435 (23.5%) three or more times. The chart suggests that for many patients, the closest pre-op visit was not the beginning of the wait, at least for dates within ten weeks of surgery.

Based on these findings, the method for estimating the beginning of the wait was modified. If there was more than one visit, and the closest visit was less than a specified number of days pre-operatively or it was coded as a measurement, then the second closest visit was used. Three different time periods were used as cut-off points for the first visit: 42, 56 and 70 days. All three modifications improved the congruence between the claims and CSWLR estimates of waiting times.

Table 3.3 indicates the mean and median waiting times for the CSWLR, the original claims method and the three new algorithms. The column '% perfect' indicates the proportion of perfect matches between the CSWLR and the claims methods. The '% ± 30 days' column shows the proportion of matches between CSWLR and claims if a margin of up to 30 days in either direction is permitted as a match. The last column indicates the Spearman's rank-order correlation coefficients between the two methods.

Table 3.3: Comparison between Cataract Surgery Wait List Registry and Claims data for estimating waiting times for surgery

Method	Mean	Median	% perfect	% ± 30 days	Spearman's r*
CSWLR	190	163			
Claims – original	154	126	70.6%	75.9%	0.58
Claims – 42-days	184	153	77.4%	83.4%	0.80
Claims – 56-days	188	155	77.7%	83.7%	0.80
Claims – 70-days	192	160	77.5%	83.4%	0.80

* All correlation coefficients were significant at $p < .0001$.

The mean and median waiting times in the CSWLR were 190 and 163 days respectively. The median is noticeably shorter than the mean because the data are skewed to the right, as illustrated in Figure 3.2. The original claims method estimated shorter mean and median waiting times of 154 and 126 days respectively. All three modifications to the claims method (labelled 42-days, 56-days and 70-days), have mean and median waiting times that are closer to that of the CSWLR. For 70.6% of patients, the original claims method matches the CSWLR. This proportion increases to about 77.5% for the three modifications to the claims method. The proportion of matches within ± 30 days also increases about 7% between the original method (75.9%) and the three modifications (83.4% to 83.7%). Spearman's correlation between the CSWLR and original claims method was 0.58 and for the three modifications was 0.80; all correlations were significant at $p < 0.0001$.

The wait time distributions for each modification were charted for comparison to the CSWLR. Figure 3.3 illustrates that all of the modified methods converge with the CSWLR after about 10 weeks, after which they all track fairly closely together. Figure 3.4 tracks looks at only the first ten weeks since that was the period of interest. In figure 3.4, the modification that consistently tracks the closest to the CSWLR is the 70-day method. In other words, for patients who had more than one pre-op visit to the ophthalmic surgeon, and whose closest visit was within 70 days (or ten weeks), the second closest visit was used. While all three of the modifications (42-day, 56-day, and 70-day) improved the comparison between the claims and CSWLR (table 3.3), the differences between the three were marginal, but the visual comparison suggests that the 70-day method is the closest.[3]

[3] Several other modifications were also tried to see if they matched any better. These included using the third visit if the second visit occurred within the time-restriction of 42, 56 or 70 days but this did not improve the match rate or correlation. Also, for 70-day method, the tariff restriction was relaxed, but that decreased the match rate.

Fig 3.3: Distribution of wait times from CSWLR and claims, Nov 98-Mar 00
CSWLR and three modified claims methods

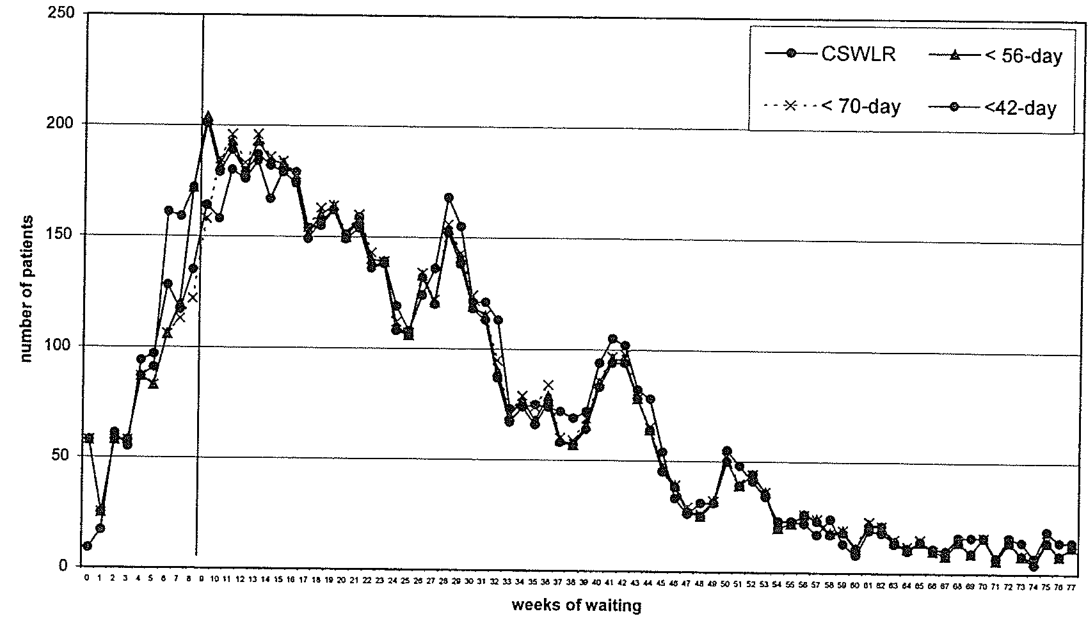
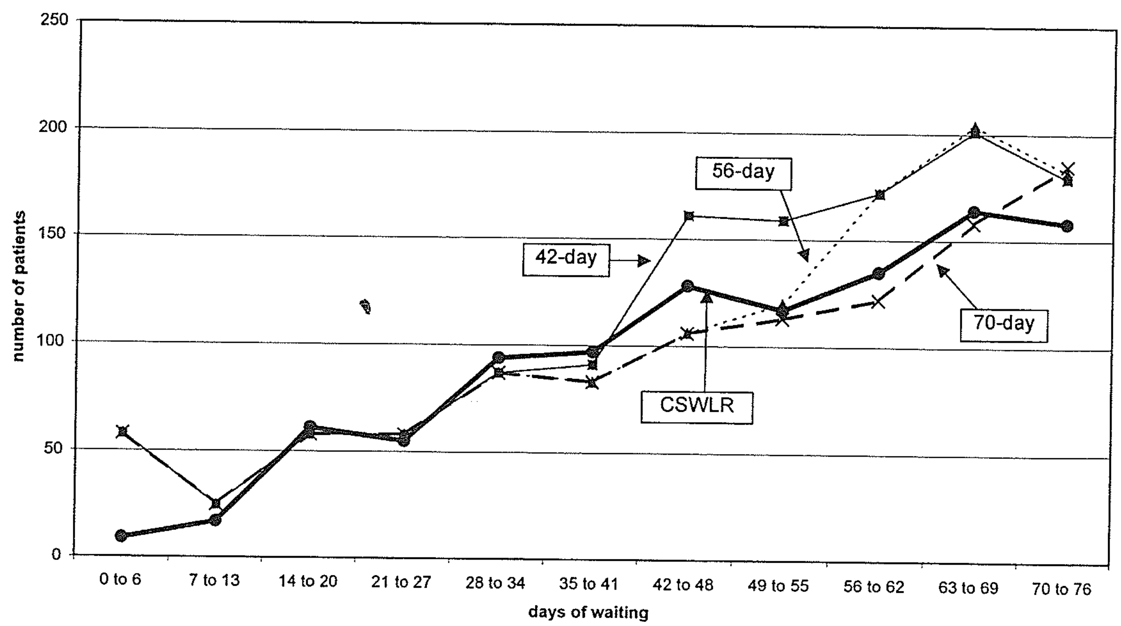


Fig 3.4: Distribution of wait times from CSWLR and claims, Nov 98-Mar 00
comparing only waits of up to 76 days (< 11 weeks)



Analysis of Variance

Wait times were next log-transformed, and analysis of variance (ANOVA) was used to compare the log-transformed wait times between the CSWLR, and four claims methods: original, 42-day, 56-day and 70-day. In order to compare the log-transformed mean values, Tukey's multiple comparison test was used. This test is a follow-up to a significant ANOVA to determine which of the comparison groups is significantly different from one another, and adjusts for the higher risk of Type I error resulting from multiple comparisons. The ANOVA table is reproduced below (table 3.4). The F-value is 211.25, and the critical F-value is 2.37 for a p-value that is much less than 0.001.

Table 3.4: ANOVA table for log-transformed waiting times, comparing CSLWR and four claims methods.

Source of Variation	Sum of squares	df	Mean squares	F-value	P-value	F critical
Between Groups	624.35	4	156.09	211.26	4.11E-179	2.37
Within Groups	22583.57	30565	0.74			
Total	23207.92	30569				

The calculated Tukey's is 0.042, which means that mean values that differ by less than 0.042 are not significantly different. The means of the log-transformed data are: CSWLR, 5.025; Original claims method, 4.632; 42-day method, 4.946; 56-day method, 4.970; 70-day method, 4.993. Table 3.5 uses a matrix to illustrate the differences between the means. Values greater than 0.042 indicate a significant difference between groups, and are indicated in bold. The key finding is in the top row: the Registry method is significantly different from the original, 42-day and 56-day methods, but it is not significantly different from the 70-day method. In other words, the 70-day method of estimating waits using claims data provides wait time estimates that are similar to those of the CSWLR.

Table 3.5: Differences between mean values; significant differences using Tukey's multiple comparison test are in bold

	CSWLR	original	42-day	56-day	70-day
CSWLR	0	**0.392707**	**0.079466**	**0.054747**	0.031736
original		0	**0.31324**	**0.33796**	**0.360971**
42-day			0	0.024719	**0.04773**
56-day				0	0.023011
70-day					0

Potential sources of difference between CSWLR and Claims methods

Are there any systematic differences between the CSWLR and the claims method for estimating waiting times? There is no theoretical reason to suppose that the match rate, say, between women and men, or between Winnipeg and non-Winnipeg residents, would be different. If there were differences, that would suggest that, for instance, men's names are entered into the CSWLR close to the time of an office visit, but women's names are not. Nevertheless, χ^2 analyses were conducted for both the proportion of perfect matches and the proportion of matches within ± 30 days for the following categories (Yates' correction was applied with 1 degree of freedom):

- sex
- age (0-50 yrs, 51-64, 65-84, 85+)
- individual surgeon
- surgery group: four group practices identified from billing data

- High volume vs. low volume surgeons: high volume surgeons were defined three ways
    1. surgeons performing more than the mean number of cases (n = 8)
    2. surgeons doing > 75th percentile of cases (n = 5; these surgeons performed 52.7% of all surgery in the cohort)
    3. surgeons who performed more than 500 cases (n = 7)
- Site of surgery: Misericordia vs. clinic
- Hospitalized during wait, yes/no
- Hospitalized for > 6 days while waiting
- Winnipeg vs. non-Winnipeg residence
- Neighbourhood income quintile (Winnipeg residents only)
- Resident of personal care home or chronic care vs. community

The only significant χ^2 was for match rates by individual surgeon using the original claims method; when using the 70-day method, this difference disappeared. Using the original claims method, the χ^2 for individual MDs was 134.67 and was significant at the 0.001 level. The χ^2 for individual MD using the 70-day method was 28.15, and just missed being statistically significant at the 0.05 level. There were two MDs who had very low match rates (i.e., 12.4% and 15.3%) with the original method, but when using the 70-day method, these two surgeons had a match rate of 77.8% and 69.9%, much closer to the overall match rate of 77.5%. On the other hand, there were three surgeons whose match rate was better with the original method versus the 70-day method; however the magnitude of the difference was much less.

Discussion

The purpose of this project was to compare estimated waiting times between two methods: one that relied on a Cataract Surgery Wait List Registry and the second that relied on analysis of claims data. The first challenge was to link the two datasets; this was achieved with a high success rate. The second challenge was to see how closely the two methods matched each other, and whether it was possible to adjust the claims method to improve the match rate. This too was successful.

The findings demonstrate that claims data can be used to estimate waiting times. The original method performs quite well, matching the Registry on roughly three-quarters of patients, however it underestimated the mean and median waiting times. This discrepancy appears to be related to the misclassification of the beginning of the wait time for some patients, in which the visit closest to surgery was not an accurate measure of the beginning of the wait time. This is consistent with Sanmartin's finding that 42% of cataract surgery patients were entered onto the wait list after a visit other than the one closest to surgery (Sanmartin 2000). The restriction to the claims method of assigning the beginning of the wait to the second-closest pre-op visit if the first occurred within 70 days (or 42 or 56) improved the proportion of matches by about 7%, but more importantly, increased the Spearman rank-order correlation from 0.56 to 0.80 and resulted in an estimate of mean and median waiting times that more closely matched the CSWLR. ANOVA analysis demonstrated that the Registry wait times were not significantly different from the 70-day claims method, but did differ from the original, 42-day and 56-day claims methods.

These findings suggest that to estimate waiting times using claims data for long-wait procedures, pre-operative visits that occur close to the surgery date may not indicate the beginning of the wait. While this modification was discovered through a comparison of data, it may not be necessary to have a Registry with which a comparison can be made. A similar modification could be discovered by interviewing surgeons or their office staff to find out physician practice patterns. For example, questions could be asked about whether a surgeon routinely schedules a follow-up visit closer to surgery if the wait is longer than a specified period of time. While a questionnaire may not be feasible for long-wait procedures in which many surgeons are involved, there were only 19 ophthalmic surgeons so the task would not be overwhelming. Thus, claims data could still be used to estimate waiting times without the need for the more expensive and resource-intensive registry, but incorporating feedback from surgeons to modify the method appropriately.

There may be several reasons for the finding that the closest pre-op visit was often not the best estimate of the beginning of the wait time. If a patient has had a long wait, it would seem prudent for the surgeon to see him or her again closer to the surgery date. In fact, the guideline of the American Academy of Ophthalmologists recommends that an examination take place no more than three months preoperatively (Lee 1998). However, this practice should be questioned. A study from the United Kingdom looked at the routine practice of having patients listed for cataract surgery attend a pre-assessment clinic shortly before surgery. It found that the pre-assessment clinic added little new information and could have been avoided if the initial consultation included a decision on lens implant power (Prasad et al. 1998).

Long waits for cataract surgery contribute to the need to see patients again closer to surgery. Part of the long lead time may be mechanical: the Registry office asks surgeons to schedule their patients three months in advance, so there is some incentive to have a wait list of at least three months in duration—a period which may be long enough for at least some surgeons to schedule a repeat visit closer to surgery. Some surgeons may put their patients on the wait list sooner than others, in anticipation of a long waiting time. This may indicate some 'gaming' of the system, that is, surgeons may want to have long waiting lists for political reasons so that they can argue for more resources from the government or the Regional Health Authority. Alternately, it may simply reflect innocent differences in practice styles.

In order to assess whether there were any characteristics that were systematically related to the observed differences in the wait times using the CSWLR and claims methods, χ^2 were calculated. The only groupings which showed a significant χ^2 were those related to the surgeons providing the service. That is, individual surgeons have different practice styles and enter their patient's names at different times into the CSWLR. This significant difference disappeared when I incorporated the 70-day rule. This supports the suggestion that some surgeons enter their names into the CSWLR earlier and then, if a period of time has passed, arrange to see their patients again closer to surgery. In fact, I observed that two of the surgeons had very low match rates with the original claims method of estimating waits, which improved markedly with the 70-day method. On the other hand, while in general the 70-day method improved the match rate by individual surgeons, for three surgeons the original method was superior, however the magnitude of the change was less.

Given the differences in practice, one wonders if patients whose surgeons enter their names into the CSWLR earlier have higher levels of visual function. From my interview with the CSWLR staff, I know that it is not uncommon for patients to report that they are having no difficulties in any of the items of the VF-14. Furthermore, the staff confirmed that some surgeons enter their patients at lower levels of dysfunction than others, although in their view, this did not appear to be related to the length of their waiting list, that is, it did not seem that surgeons with the longest waits entered their patients at lower levels of dysfunction. It would have been enlightening to be able to compare the visual function scores for patients of these earlier-placement surgeons with others who enter their patients' names closer to surgery. The absence of this measure is a drawback for assessing differences between patients when placed on the waiting list.

Throughout this chapter, there has been an implicit assumption that the CSWLR is the 'gold standard.' However, it is clear that it is not a perfect standard, as demonstrated by the different practice patterns already mentioned. Occasionally, patients will be contacted by the Registry office who are not aware that their names are on a waiting list or that they are going to be having surgery. Because of the way the priority scores are calculated, it is possible that the points due to time spent waiting could be higher than points due to visual function. So surgeons may have an incentive to enter patients onto the list earlier than is warranted, so that they could use the data to argue for more resources. Despite these unresolved problems, the CSWLR does generally reflect physician practice in terms of when the decision is made to proceed with surgery and can therefore be used as a data source for comparison purposes.

One more limitation of this or any Registry concerns the extent to which it may be inflated. Research in other jurisdictions has found that waiting lists are consistently inflated by as much as 25 to 50 per cent. (Barham et al. 1993; Tomlinson and Cullen 1992; Lee et al. 1987; Fraser 1991) Reasons for this inflation include patients not being available for surgery, double-booking, and patients no longer requiring surgery. The active Cataract Surgery Wait List Registry contains the names of patients who have been postponed, but not cancelled. In other words, those names go into the calculation of mean waiting times, but those patients may not in fact be available for surgery. Although this would not affect the archived data that were used in this study, it does affect any wait times reported using the active Registry.

Another contribution to inflation is the extent to which patients are listed for both eyes simultaneously. In this case, the second eye listing would be included in the calculation of mean waiting times, yet the patient is not actually waiting for the second eye until after the first eye is operated on. One estimate was that simultaneous listing of both eyes happened about 10% of the time (Bellan and Mathen 2001). On the other hand, when I was interviewing the Registry staff, I was told that this happens "most of the time." A check of the archive data showed that 35% of patients had two procedures, and the second-eye surgery represented 26% of the records in the archive. Of the patients who had two cataract procedures, 61% of them had both eyes listed at the same time. Put another way, at least 16% of the records in the archives were for procedures (second-eye surgery) that patients were not waiting for at the time of entry into the Registry because the first eye had not yet been operated on. Since the waiting time would be calculated from the beginning of the wait for the first eye, this would also tend to drive up the mean waiting times in the Registry.

Another source of list inflation is double-listing: patients will sometimes try to be on more than one waiting list at a time. That cannot happen with the CSWLR because the software automatically checks for repeat listings. Finally, some patients listed for surgery are removed without ever having had the procedure. In the archived data from the CSWLR, from November 1998 to May 2001, 2821 patients out of 24,057, or 11.7%, were removed from the CSWLR without having had surgery. While these list inflation factors would not affect the current study, it is important for policy-makers to recognize that estimates of waiting times using cross-sectional data will tend to overestimate the number of people waiting and the mean waiting times.

Conclusion

This study linked data from the Cataract Surgery Wait List Registry with data in the Population Health Research Data Repository in order to compare waiting times between two data sources. My earlier research underestimated the wait for cataract surgery. Nevertheless, the findings provide evidence that claims data can be used to estimate waiting times, but may need to be modified for long-wait procedures. The original claims method used the closest pre-op visit to the surgeon as the marker for the beginning of the wait time (unless it was for ultrasonography), and it was found that in general, this accurately represented physician practice patterns. However, the claims method was improved somewhat by modifying it so that the second closest visit was used if the first visit was within 70 days of surgery. With this modification, the mean and median wait time values were virtually identical. Although this study relied on comparing data from a cataract registry with claims data, it may be possible to discover the need to modify the claims method through physician surveys or feedback.

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CHAPTER FOUR: FACTORS AFFECTING WAITING TIMES: BUILDING A CONCEPTUAL FRAMEWORK

Introduction

The purpose of this chapter is to describe characteristics that have been found in the literature to be related to the waiting time for elective surgery. The Canada Health Act promises that hospital and medical care is to be accessible to all citizens based on medical necessity. In a statement issued in September 2000, Canada's First Ministers reaffirmed that one of the goals of our health care system is to "ensure that Canadians have reasonably timely access to a . . . range of health services anywhere in Canada, based on their need, not their ability to pay." (First Ministers 2000). This statement embodies the value that patients with greater need for care should receive higher priority, and therefore have shorter waits. It also implies that Canadians should be treated equitably. In other words, characteristics like socioeconomic status, age, or region of residence should not be associated with differences in access, assuming that one measure of access is waiting times.

The purpose of trying to describe the factors associated with waiting times is to inform the next stage of the analysis. I have spent some time describing the measurement of waiting times; the next step is to identify and test characteristics that may be associated with variation in waiting times. What are some of the factors that have been noted in the literature to affect waiting times? How can the evidence in the literature be built into a theory about characteristics that might affect waiting times? What comprises a theory? These are the questions that this chapter will attempt to address.

Theory construction

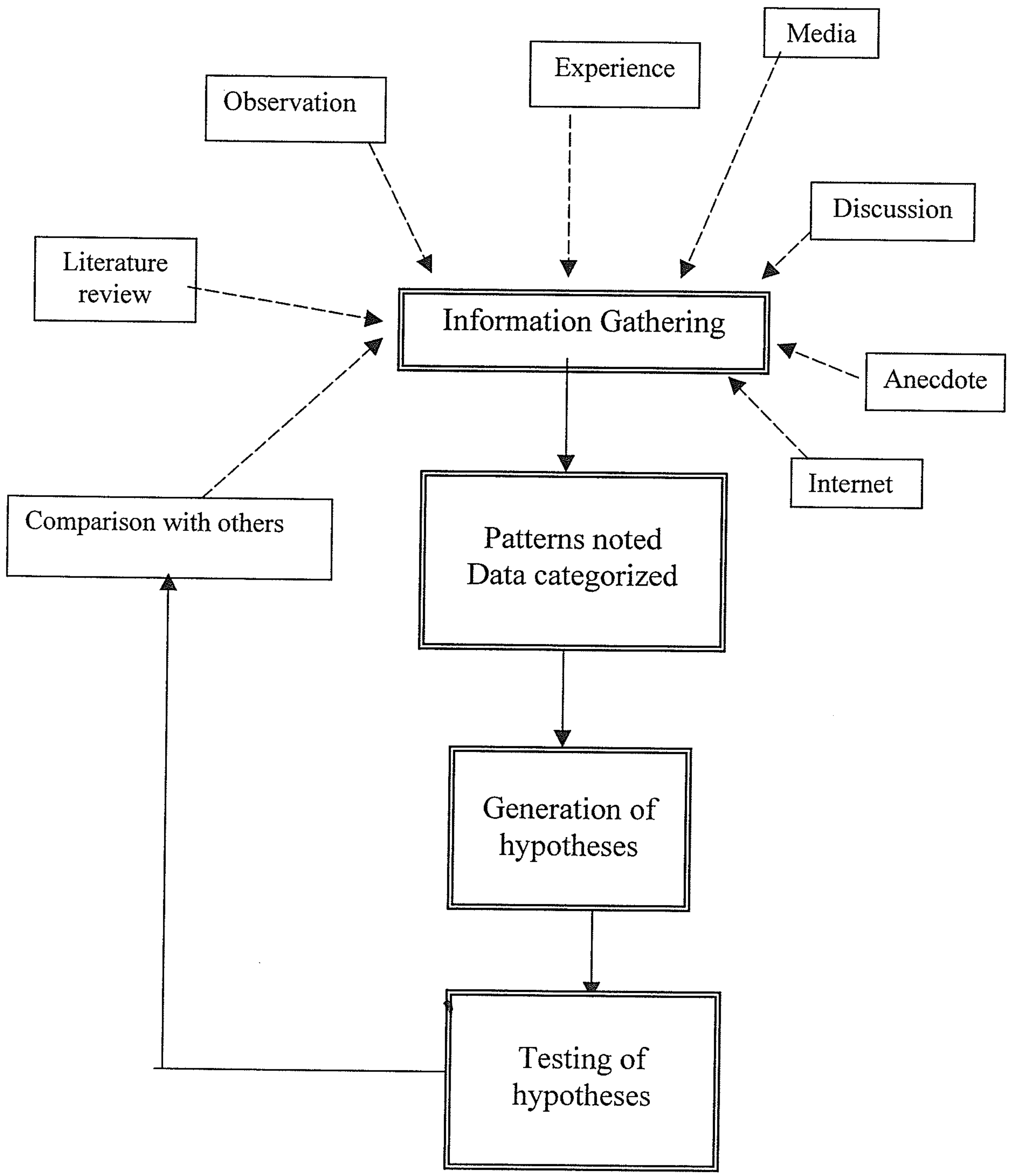
Many scientists and scientific philosophers have grappled with the complexities of defining a theory and how to test it. This section is an attempt to pull together some of these perspectives into a personalized view of theory construction.

Theory construction is iterative and evolutionary. The building blocks of scientific theories are testable hypotheses, which are in turn built from observations. Sometimes the observed phenomena are naturally occurring, and sometimes the observations are a result of experiments to test a hypothesis. I developed an example to illustrate.

My spouse was watching Olympic speed-skating on television, and after a few heats, he observed that the person skating the extra half lap on the inside-track always seemed to win (there were two skaters per heat). Then he started to keep count, and in all of the subsequent races, the person finishing on the inside track won; he saw a pattern in what he observed. Suppose that he was able to investigate this finding further. He might first hypothesize that the staggered starting points did not compensate for the shorter diameter of the inside track. That could be tested by measuring the two tracks. If the measurements were exactly equal, then that hypothesis, i.e., that the two tracks were not equal, would be falsified. He would have to think of different possible explanations, possibly relating to ice conditions, the degree of bank in the turns, or obstacles to visibility. He could test each of these and gradually determine what, if any, differences existed between the two tracks that might account for the results that he observed. In his search for information, he might have to borrow theories from other disciplines, for example, the physics of surface tension and flow dynamics. He might find out that more than one factor, or hypothesis, explained the results. Gradually he would come to some conclusions—or develop a theory—about what characteristics are necessary to permit the fairest contest. The theory may still be modified by future events or it may be brought down altogether if one of the basic tenets is false.

This example, while somewhat limited, illustrates some of the important points about theory development (see figure 4.1). Observations are one form of information gathering. Others are literature review, experience, discussion and so on. As information accumulates, patterns are noticed and data are grouped according to these patterns. These in turn engender hypotheses, which can be tested and if not proved false, built into frameworks. This is induction, building from the particular to the general. But deduction is also used, from the general to the specific, for instance when theories of flow or surface dynamics are applied to the specific case of creating a competitive speed skating track. Continued experiments generate more observations which lead to modifications of hypotheses and of the theories that they support.

Figure 4.1: How scientific evidence is built. (Adapted from Hart 1998)



Experimentation may falsify or not falsify hypotheses; but experimentation can not confirm hypotheses. Why? Theories take the form of generalizations or universal statements ('For every "x," "y" is true'), and universal statements are impossible to confirm. According to Popper (Popper 1959)

> I consider it both useful and fruitful to regard natural laws as synthetic and strictly universal statements ('all-statements'). This is to regard them as non-verifiable statements which can be put in the form: 'Of all points in space and time (or in all regions of space and time) it is true that. . . .' (63)

Take, for example, the statement: 'All ravens are black.' Unless every single raven from the beginning of time could be observed—which is clearly impossible—there can be no "proof" of this statement. However, if one non-black raven is seen, then the statement has been falsified. A similar situation holds for scientific theories. That is why scientists test the 'null' hypothesis, or a hypothesis in the form of: 'all ravens are not black,' or 'There is no relationship between ravens and being black.' After enough data have been gathered to conduct statistical tests, the null hypothesis can be rejected, but its alternative can never be confirmed, i.e., the universal statement that 'all ravens are black.'

Another issue requiring elaboration is the relationship between hypothesis development and testing. Testing the hypothesis through experimentation, and reporting the observations from the experiment sound like an objective process. However, several authors have noted that a strictly objective observation is an impossibility. Popper wrote: 'All observations are theory-impregnated: There is no pure, disinterested, theory-free observation' (Popper 1997). And Hanson stated: 'There is a sense, then, in which seeing is a "theory-laden" undertaking. Observation of x is shaped by prior knowledge of x' (Hanson 1997). Our observations are informed by previous experience which is organized into a perceptual framework. Pickering's case study of the discovery of the weak neutral current in particle physics is a compelling example of how theory informed observation; here, scientists interpreted what was virtually the same data very differently because of the development of a new theory (Pickering 1997). The point is that there is a constant interplay between hypothesis- or theory-development and observation, and that one must be aware that scientific experiments have to be constructed carefully to avoid the accusation of seeing only what one wants or expects to see.

This chapter reviews the literature on characteristics related to differences in waiting times for cataract surgery. As will become evident, the literature tends to reflect different stages of theory development, moving through descriptive research, to hypothesis generation and testing, towards the construction of theories based on evidence. Furthermore, different types of procedures are in different stages along this cycle—procedures which are perceived to be life- or limb-saving, e.g., coronary artery bypass surgery, vascular surgery, have a better-developed evidence base than procedures which affect quality of life, or procedures which correct minor inconveniences.

Objectives

The purpose of this literature review were:

1. To find characteristics that have been associated with variation in waiting times for elective surgical procedures.
2. To assess the strength of the evidence that supports these characteristics.
3. To propose hypotheses that can be tested with respect to factors that affect waiting times for cataract surgery.

Search strategy

Search criteria

1. wait*
2. time*
3. list*
4. #1 and #2
5. #1 and #3
6. #4 or #5
7. LA = "ENGLISH"
8. #6 and (LA = "ENGLISH")
9. surgery
10. transplant*
11. surger*
12. surgical*
13. #11 or #12
14. #13 not #10
15. LA = "ENGLISH"
16. #14 and (LA = "ENGLISH")
17. "Angioplasty-Transluminal,-Percutaneous-Coronary"/ all subheadings
18. LA = "ENGLISH"
19. dialys*
20. dentist*
21. #8 and #16
22. #21 not #17
23. #21 not #19
24. #21 not #20
25. #21 not #19 not #20
26. queue*
27. LA = "ENGLISH"
28. #26 and (LA = "ENGLISH")
29. #16 and #28
30. #25 or #29

The literature on waiting times is considerable, although a limited amount of it comes from Canada. Much of it arises from the United Kingdom. Systematic search techniques were applied to locate as many papers as possible that described characteristics associated with waiting times for elective surgical procedures. MEDLINE® Advanced was searched using the search terms wait*, time*, list*, queue*, and surgery. Terms that were excluded from the search results were: transplant, dialysis, coronary angioplasty, and dentistry. The search was restricted to papers published since 1985 in English (see box).

The search yielded 1029 papers. All titles and abstracts were reviewed to determine if papers should be retrieved. Some papers clearly did not deal with factors relating to wait times in elective surgery. If there was uncertainty, they were kept at this stage. Admittedly, decision-making at this time might have been somewhat arbitrary, but every effort was made to be as broadly inclusive as possible. Known grey literature papers and reports were also included in the review. After this initial winnowing process, 263 titles remained, and these were obtained. Upon review, more papers were excluded as they were not on topic, leaving 111 papers.

Assessment of papers

At this point, some guidelines were developed to help not only to determine which papers were appropriate to keep, but also to assess the category into which it could be placed. Three categories were developed. Group III studies provided the most convincing evidence, as these were the papers that I assessed as being satisfactory in all of the areas described below. Papers in Group II provided more 'moderate' evidence, and had a 'not satisfactory' answer to at least one of the last four questions below. Group I studies were descriptive papers—reports or brief papers that described waiting list characteristics with no statistical testing.

1. Did the paper describe characteristics that were associated with variations in waiting times for elective surgery? If yes, go on to next questions.
2. Were the objectives, measures, methods and analysis described in enough detail to understand what was done?
3. Was the study designed in a way that I believed would yield credible results?
    - What was the study design?
    - Was it prospective or retrospective?
    - If retrospective, was the analysis based on registry data, on administrative data available at the individual level, or on published aggregate data?
    - If prospective, how were the data collected?

- If a survey design, how was the sample selected? Was a sample of the survey questions included in the study? Was the response rate satisfactory?

4. Was the relationship between the explanatory factor(s) and waiting time tested for statistical significance?
   - What tests were performed?
   - Were the statistical tests univariate or multivariate?
   - Were the explanatory and outcome variables clearly described?
5. Did the findings support the conclusions? Were limitations discussed?

Categorization

After the guidelines were applied, there were 62 papers: 23 descriptive, 23 hypothesis-testing moderate and 16 hypothesis-testing strong. The relevant findings for each of these studies were listed on spreadsheets (see Appendix 4.A). Then every characteristic that was suggested as having an impact on waiting times was written down, and whether there was any evidence to support this view. Some characteristics were pure conjecture with no testing to back them up; others had a considerable amount of testing. Looking at the written list of characteristics, four categories seemed apparent:

1. level of illness: urgency and symptoms, dysfunction
2. patient sociodemographic: age, sex, employment, smoking, living arrangements, socioeconomic status, region of residence
3. provider: specific hospital, type of hospital, available resources, emergency cases, length of stay, day surgery, specific surgeon, number of patients surgeon sees.

4. system: rate of surgery including targeted initiatives, presence of competition, year, type of surgery

In a publicly-funded health care system, one of the values underlying the allocation of resources is that prioritization in the queue should be based on level of illness as described by urgency, symptoms or dysfunction. It was useful to separate level of illness characteristics from other patient characteristics for several reasons. First, there has been more work done in measuring level of illness and its impact on waiting times, at least in the area of life-saving procedures; this statement is less true for other types of procedures. Secondly, while one would expect level of illness to have an impact on waiting time, one would not expect that to be the case for most other patient characteristics. Other patient characteristics which have been identified as being related to waiting times include, age, gender, socioeconomic status, employment status, risk factors such as obesity, smoking or family history, living alone or with dependants, and region of residence.

A variety of provider characteristics have been associated with variation in waiting times. Broadly these can be broken into two categories: hospital and surgeon. The hospital factors include type of hospital, the resources available in terms of operating room sessions, beds, staff, and specialized diagnostic equipment like angiography, the proportion of emergency cases (which uses resources that would otherwise have been available for elective surgery), and measures of efficiency like length of stay, and throughput. The degree to which cases can be done as day surgery procedures with no overnight stay has also been identified as an explanatory variable. Different surgeons have different waiting list lengths. These differences could relate to the number of patients a surgeon sees, the surgical threshold, and differences in ways surgeons manage their waiting lists.

The last category has been titled 'system' characteristics, because they relate to how the system of health care is organized and funded more generally. The rate of surgery may affect waiting times, including funds targeted towards reducing waiting lists. How the system is organized can also have an effect. For instance, the presence of a competitive environment by way of a parallel private sector, or by the internal market created in the United Kingdom, may affect waiting times in the public sector. 'Year' was included as a system variable, since changes to the system might show up as changes in waiting list over time.

'Type of surgery' at first glance may seem out of place in the 'System' category, but it was slotted here because it relates to how surgical resources are allocated within the overall system. For instance, the number of hip and knee replacements or cataract procedures performed is related to the funding available. Differences in waiting times for different types of surgery is quite common. Partly, this is related to urgency, in which a patient with a life- or limb-threatening condition tends to take precedence over a patient with an annoying or irritating condition. However, looking beyond life-saving procedures, there still exists variation in waits for similar categories of procedures, i.e., procedures that affect quality of life or that are highly discretionary.

Level of illness

Twenty papers were located in which the relationship between level of illness and variation in waiting times for elective surgery was explored. The degree to which 'level of illness' has been defined and measured varies. Explicit criteria have been better developed and tested in the area of advanced cardiac or vascular interventions.

Three papers used 'urgency,' categorized into two or four levels, the assignment of which was left to the discretion of the surgeon. Two papers from Australia used urgency as an explanatory variable for a variety of surgical procedures. One of these was a description of waiting lists based on a hospital survey and found patients with a higher urgency category (out of two choices) generally had shorter waits (Moon 1996). The other used survival analysis to model hospital and patient survey data in New South Wales, and found that waiting time was related to urgency rating (two categories), as well as type of surgery, employment and having private health insurance (Clover et al. 1998). 'Urgency' was also used as a variable in an analysis of general and orthopaedic surgery waiting times in a London hospital (Pope and Roberts 1991). In this study there were four urgency ratings and greater urgency was significantly and inversely related to length of wait using chi-square tests.

Four studies were associated with procedures that have an impact on quality of life, two of which looked at cataract surgery. Churchill surveyed 67 cataract patients in New Zealand, collecting data on visual acuity, coexisting visual comorbidity, threat to independent living, additional disabilities, and visual impairment. Length of waiting time was shorter with high overall scores (Churchill et al. 2000). A study of cataract patients in Regina found that visual acuity, cataract symptomotology and visual function were *not* predictive of waiting times (Hadjistavropoulos et al. 1998). These two studies that are pertinent to cataract surgery specifically both failed to demonstrate a relationship between waiting time and measures of visual problems.

Two studies examined the effect of level of illness on waiting times for knee and hip replacement. One of these used a Delphi technique with an expert panel to come to convergence on factors that should be used to judge appropriateness and urgency for knee or hip replacement (Naylor and Williams 1996). The panel reached 93% convergence on the use of function, level of pain, anticipated prosthesis survival, and age as factors to consider in rating the appropriateness of surgery. They reached 74% convergence on factors that affected urgency: level of pain, problems at work, functional class. Note that this study relied on expert opinion to develop criteria but did not test these criteria on 'real' patients. A comparison of knee replacement between Ontario and the United States analyzed the relationship between a number of factors and the outcomes of waiting times and patient satisfaction; it found the condition of the knee pre-operatively was a significant predictor of a shorter waiting time in the United States but not in Canada (Coyte et al. 1994).

The remaining studies that explored the effect of level of illness on waiting time dealt with life-threatening conditions. One of these looked at breast cancer surgery, three at vascular surgery and eleven at coronary revascularization procedures.[1] The higher number of papers in the area of coronary revascularization likely reflects two things: people who are waiting for bypass surgery are at risk of death, and it is more easy to measure the degree of impairment—hence the risk of death—via coronary angiography and other sophisticated diagnostic tests.

A retrospective cohort study in Quebec, found that waiting time for breast cancer surgery was significantly related to cancer stage. In this study linear regression was used and other variables included age, number of diagnostic procedures, type of surgery and year (Mayo et al. 2001). Sobolev has published several papers in which he has analyzed prospective cohort data for 1084 patients entered to the waiting list for vascular surgery in Kingston, Ontario between 1994 and 1998 (Sobolev et al. 2000; Sobolev et al. 2001b; Sobolev et al. 2001a). The types of surgery were abdominal aortic aneurysm repair, carotid endarterectomy, surgery for peripheral vascular disease, and arteriovenous fistula for long-term access in patients with renal failure. Recommended maximum waiting times (RMWT) were assigned based on consensus within the surgical group. All studies used sophisticated analytical techniques and found that waiting time was inversely related to urgency. The proportion of patients that were admitted within their RMWT varied by type of surgery.

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[1] Papers that dealt only with coronary angioplasty were excluded from the search, otherwise this number would have been higher. Papers that looked at both angioplasty and bypass were included.

Of the papers that examined the relationship between level of illness and coronary revascularization, one was in the descriptive category, four were in the moderate category and six were in the strongest evidence category. A review article of factors associated with the waiting time for cardiac surgery noted that multiple risk factors, number of diseased vessels, angina stability, left main coronary disease and recent angioplasty all affected the waiting time for cardiac surgery, whereas, age, sex, reoperative status did not (Cohen et al. 1996). This paper did not present any new evidence but was a narrative review.

David Naylor and his colleagues have published a number of papers concerning prioritization of patients awaiting coronary artery bypass surgery (CABS). A panel of experts rated 438 fictitious case histories on a seven-point scale and these ratings were used to develop recommended maximum waiting times for bypass (Naylor et al. 1990). The three most important characteristics were severity and stability of angina symptoms, coronary anatomy from angiographic studies, and results of non-invasive tests for risk of ischaemia. The RMWTs have been used in the Cardiac Care Network of Ontario, which registers all patients waiting for bypass surgery and assigns an RMWT to each patient once accepted for surgery. (Manitoba is a satellite of the CCN.) A follow-up mail survey of clinicians assessed the extent of agreement between respondents' ratings of 49 hypothetical cases using the expert panel's criteria and the ratings of the expert panel (Naylor et al. 1992a). This study validated the expert panel's criteria, since 90% of the responses were within one scale point. A retrospective medical record review not only validated the criteria, but demonstrated that clinicians made appropriate assessments of urgency even in the absence of formalized criteria (Naylor et al. 1993a). In this study, waiting times were compared with the RMWT that would have been assigned had the criteria been available, and found that waiting times did correlate with urgency ratings ($r = 0.42$, $p < 0.0001$).

After the RMWT had been formally established, Naylor looked at a consecutive case series of patients; he found that patients whose RMWT was two weeks or more were more likely to receive surgery within their RMWT (Naylor et al. 1993b). This study also found that mortality on the waiting list was low (1.0%) , suggesting that the prioritization criteria were working well. A subsequent review of over 8,000 patients found that mortality on the waiting list was 0.4% (Naylor et al. 1995).

There are three more studies that associated level of illness with waiting time for cardiac surgery. Fox found evidence of prioritization in Nova Scotia for CABS patients in a retrospective chart review, i.e., Class IV angina patients were operated on sooner (Fox et al. 1998). Kee reported on a retrospective chart review of 141 patients in Ireland who had had angiography, 88 of whom had surgery. Using Cox's proportional hazards modelling, he found that waiting time was related to symptoms as well as age, smoking status and family history (Kee and Gaffney 1995). A second paper by Kee reported on the results of an expert opinion survey in which clinicians were asked to prioritize 50 hypothetical patients (Kee et al. 1997). The purpose of this paper was to assess the extent to which clinicians were influenced by clinical and non-clinical factors. Models which incorporated perceptions of benefit and the cases' clinical and non-clinical characteristics had high explanatory power for prioritization (R^2, 0.86); however, lifestyle and demographic variables had much less impact on the doctors' judgements than the major clinical cues of angina severity and left main-stem stenosis.

In summary, many studies have found that level of illness is directly related to the waiting time for elective surgery. However, much of the attention in this area focuses on procedures which are perceived to be life- or limb-saving. Limited research has been carried out for procedures that improve quality of life such as cataract surgery. The development of standardized and acceptable prioritization criteria are more difficult in this area, but progress is being made. The Western Canada Waiting List project has developed and pilot-tested prioritization tools in five areas including cataract, knee/hip replacement, general surgery, MRI and children's mental health (Western Canada Waiting List Project 2001). As it moves into its next phase of research, further testing and implementation will demonstrate the usefulness of these tools in a practice setting.

Patient Sociodemographic Characteristics

A variety of patient characteristics have been studied to see if they have any relationship with variations in waiting times. These characteristics include age, gender, employment status, smoking and other risk factors, socioeconomic status, region of residence and whether the patient delayed surgery.

Age

Two earlier, descriptive studies noted that, except for ophthalmology, the majority of patients waiting for surgery were less than 65 years of age (Davidge et al. 1987; Donaldson et al. 1989). In my first study on waiting times, I found that patients who were aged 65 and older were more likely to have shorter waiting times for a number of elective surgical procedures, including varicose vein repair, carpal tunnel release and transurethral prostatectomy for benign disease; however in my second study, that difference had disappeared (DeCoster et al. 1998; DeCoster et al. 2000; DeCoster et al. 1999). In these studies, age was dichotomized into less than 65 versus 65 years and older. Age differences for cataract patients were not examined since most patients were older than 65 years. A different age categorization for cataract surgery patients might have been more appropriate.

In studies categorized as the strongest evidence, age was not usually one of the characteristics of interest, although it was a variable that was controlled for in multivariate analyses (Clover et al. 1998; Coyte et al. 1994; Gaffney and Kee 1995; Hadjistavropoulos et al. 1998; Mayo et al. 2001; Naylor and Levinton 1993; Naylor et al. 1995; Pell et al. 2000; Sobolev et al. 2000; Sobolev et al. 2001b; Sobolev et al. 2001a). In a retrospective record review, Kee found that patients who were older than 65 were 2.2 times as likely to have had coronary bypass surgery at follow-up compared to patients younger than 50 years, even after adjusting for disease severity. In this study, follow-up occurred in the summer of 1993, for patients who had received an angiogram in 1991; the data were analyzed using Cox's proportional hazards modelling (Kee and Gaffney 1995).

Several studies did not actually provide any *evidence*; instead they surveyed the opinions of patients and providers. In a survey of health care provider, administrator, and consumer groups across Canada, elderly patients were perceived to be disadvantaged in the queue, being more likely to be affected by conditions for which there were queues (Shortt and Ford 1998). Two studies investigated patients' perspectives on who should be given priority in the queue (Kee et al. 1997; Mariotto et al. 1999) and one explored clinicians' perspectives (Naylor et al. 1992b). In both of the patient surveys, respondents said that priority should be given to younger patients. Similarly, clinicians said they would give higher priority for bypass surgery to a younger patient employed in manual labour, compared to a same-age patient with a desk job, compared to a retiree; in this survey, the symptoms of all three hypothetical patients were the same.

In conclusion, age is not generally found to be associated with variation in waiting times, especially after other characteristics, like employment or urgency, have been taken into consideration.

Gender

Sex, like age, is often not the characteristic of interest, but is included as a covariate in multivariate analyses. In a univariate analysis of waiting time for a variety of elective surgical procedures, I found that sex was not associated with differences in waiting times, except for cataract surgery in which females waited significantly longer than males (DeCoster et al. 2000). In a retrospective review of patients who had bypass surgery in London in 1992 or 1993, more females were found to have received surgery within the maximum recommended waiting time (Langham et al. 1997). Naylor focussed on gender differences in accessing advanced coronary revascularization services, both bypass and angioplasty (Naylor and Levinton 1993). This prospective cohort study found that women had significantly shorter waits for bypass surgery compared to men, but that was because their symptoms were often worse. Women were less likely to be referred and accepted for bypass surgery than men, even after adjusting for symptom status.

The evidence, therefore, on variation in waiting times by gender is slim. There appears to be some difference with respect to cardiac revascularization, but this seems to be related to urgency. The difference I found in the waiting times for cataract surgery is directly relevant to my research.

Socioeconomic Status

In the survey of provider, administrative and consumer groups, it was felt that poor patients were more likely to suffer long waits because they lacked the skills to navigate the system (Shortt and Ford 1998). Two studies appeared to support that notion. Pope interviewed people in the admitting office who were responsible for managing the waiting lists (Pope 1991), and found that patient characteristics influenced the admitting office staff:

> Angela went on to reassure the patient that he would not be moved to the bottom of the list—she remembered this patient, explaining that he "was a bank manger or something like that". Soon after another patient telephoned. He had been seen last week by a consultant who had offered two possible dates for surgery. Unusually, the consultant had given details of when he personally would be available, so that the patient could choose an admission date. This patient could expect preferential treatment because he was a local GP: the clerks adopted an extremely polite manner, using the consultant's diary to find a mutually suitable day. (page 202)

Similarly, Ontario cardiologists, cardiac surgeons, hospital CEOs, internists, and family physicians were asked whether they had been involved in preferential access to treatment; 80% of physicians and 53% of CEOs said yes. Factors associated with preferential access were personal ties to the physician, high-profile public figures, politicians, hospital board members, donors to hospital foundations, own family or friends, and other health care professionals (Alter et al. 1998). Thus social status may explain differences in access.

Two of the stronger-evidence studies investigated the effect of socioeconomic status (SES) on waiting time, and found that people with lower SES were disadvantaged. A retrospective cohort study in Ontario found that shorter waiting times for invasive cardiac procedures were associated with higher neighbourhood incomes (Alter et al. 1999). A Scottish study also concluded patients of low socioeconomic status were less likely to be investigated and offered coronary bypass surgery (despite higher rates of ischaemic heart disease), less likely to be categorized as urgent, and more likely to wait longer, compared to the wealthiest patients (Pell et al. 2000).

In contrast, two studies found that SES had little effect on waiting times, although they were both in the moderate-evidence category. Harley used a composite measure of SES in an analysis of waits in England, and found that it explained only 1% of the variance in the proportion of patients waiting longer than one year (Harley 1988). In Manitoba, I found no difference in wait times between residents in different-income neighbourhoods (DeCoster et al. 1998).

All of these four papers used an ecological measure of socioeconomic status yet came to different conclusions. The two that found a disadvantage related to SES were looking at advanced cardiac interventions, whereas the two that did not were looking at several procedures. However, these two did not use multivariate analyses. (When looking specifically at bypass and angioplasty, I still found no difference by neighbourhood income.) The difference may not be related to procedure studied but to the use of multivariate analyses in the first two studies, thereby adjusting for other possible effects.

Employment

If patients are missing time from work because of the condition that requires surgery, one might expect surgeons to prioritize them. According to one Finnish study, patients who were on sick leave for more than six months prior to CABS were less likely to return to work (Konttinen and Merikallio 1990). Gehring reported similar findings on a study of 447 German patients in the early 1980s (Gehring et al. 1988). Nord estimated that from 5% to 10% of all patients on waiting lists were on sick leave from their employment (Nord 1990). The impact of this lost labour on the economy is difficult to estimate, but one Canadian study estimates the lost productivity to be in the same range as that due to labour disputes (Globerman 1991).

The three studies described previously that explored patients' and providers' attitudes towards prioritization, looked not only at age, but also employment. These three studies concurred in that employed patients were perceived to have higher priority than unemployed or retired people (Kee et al. 1997; Mariotto et al. 1999; Naylor et al. 1992b). A fourth paper that described the development of urgency and appropriateness criteria for knee/hip replacement noted that interference with employment was a criterion used by experts to determine urgency (Naylor and Williams 1996).

Churchill (2000) found that the threat to loss of employment or independence was one of the strongest factors predicting a shorter wait for cataract surgery. Australian patients were found to have shorter waits if they were employed (Clover et al. 1998). In that study other factors that were considered but found not to be significant included age, hospital, gender, aboriginality, education, and marital status. My finding that older patients had shorter waiting times for elective surgery may, paradoxically, be related to employment: older patients are more likely retired and may therefore be more available for surgery, whereas younger, employed patients may put off the surgery until a time when it is more convenient.

The evidence therefore suggests that employment status has been associated with variation in waiting time. Arguably, this is defensible since employed persons make a greater contribution to societal well-being. However, the use of employment as a prioritization criterion is contentious. I was a member of the clinical panel for general surgery for the Western Canada Waiting List project. There was a great deal of discussion about whether this should be a criterion. Furthermore, it was felt that if 'interference with employment' was a criterion, it should be broadened to include interference with activities carried out by unemployed people as well. In the end the criterion was stated as: 'Degree of impairment in usual activities due to surgical condition' with a choice of four responses; it received a maximum of 15% of the total score. The Cataract Surgery priority tool allocated a possible 19% of the total score to the criterion: 'Ability to work or live independently or care for dependants.' The Hip/Knee Replacement tool gave a maximum of 20% of the total to: 'Threat to patient role and independence in society.' Therefore, all of the

WCWL tools that were developed to prioritize patients for surgery included some weight for the effect the surgical condition had on the patient's occupation.

Region of residence

Several studies have found that waiting times vary according to where the patient lives. If this is so, then a health system promising equity of access is failing to meet this goal. In the Shortt survey, it was believed that rural patients would have longer waits than urban because of the distribution of services. The British Columbia Medical Association in a survey of physicians found considerable variation in wait times according to the region where patients lived (British Columbia Medical Association 1998a; British Columbia Medical Association 1998b). For example, waits for cataract surgery ranged from seven to thirty-five weeks, and waits for total joint replacement ranged from eight to fifty-two weeks. There was no pattern of more or less populous regions having consistently longer waits. The Fraser Institute, located in Vancouver, British Columbia, conducts an annual survey of physicians to obtain waiting times across Canada. In their most recent survey, waits for some procedures were similar across Canada, e.g., four to six weeks for a Dilatation and Curretage, two to three weeks for mastectomy; for others, the range of reported waits was quite wide: six to seventy-eight weeks for rhinoplasty, seven to thirty-nine weeks for cataract surgery, and three to forty weeks for gallbladder surgery. It should be pointed out that the Fraser Institute survey suffers from low response rates, in the range of 25% to 30%, a response rate that is too low to be treated as representative. Despite this limitation, the range in reported waiting times for some procedures is noteworthy.

A number of studies or reports have described large differences in waiting times between regions, although there has been very little attempt to try and explain why these differences exist. Often it is not clear if 'region' refers to the region where the patient lives or the region in which the service is being offered, but implicit in many of these studies is the assumption that patients will generally have elective surgery in their local hospital. Regional differences have been noted in the United Kingdom (1988; Bloom and Fendrick 1987; Donaldson et al. 1989; Williams et al. 1983; Harley 1988), Australia (Moon 1996), Sweden (Hanning and Lundstrom 1998), and between European countries (Sheldon 2001).

Bloom found that wide regional disparities did not depend on whether the patient lived in an area that was rural vs. urban, large city vs. small, or inner city vs. suburb (Bloom and Fendrick 1987). A few papers reported on efforts to reduce waiting times by encouraging patients to travel out of district for their surgery. In one of these, 484 patients who had waited longer than one year for minor elective surgery were contacted and asked if they would be willing to travel to another district for surgery, with travel costs paid for by the home district; 356 agreed (Stewart and Donaldson 1991). Another noted that patients in the Netherlands were offered the chance to go to Spain to reduce their waiting times for orthopaedic surgery. Surgeons went with the patients and all arrangements were made by private health insurance companies. Patients were able to reduce their waiting times from 32 weeks to a wait of four to twelve weeks (Sheldon 2001).

Two Canadian papers mentioned regional differences specifically. In Ontario, Naylor noted significant differences in rates of revascularization and in waiting times after acceptance for bypass surgery between Ontario regions. In Manitoba, waits for elective surgery tended to be longer in the more populous regions of Manitoba: out of eight elective surgical procedures, waits were significantly longer in 1997/98-1998/99 for six of them in Winnipeg or Brandon, and significantly shorter for four of them in the rural South (DeCoster et al. 2000).

Given the pervasiveness of regional disparities in waiting times, and the research pointing to patients' willingness to travel, patients should be offered the opportunity to have surgery more quickly in another region if possible. This would require co-operation from surgeons because if patients are offered surgery elsewhere, then it means not only loss of a patient to the original surgeon, but also loss of income.

Smoking, risk factors, personal behaviour

When deciding to allocate scarce resources, decision criteria can be of two types: those that 'rule in' and those that 'rule out' (Pope 1991; Hughes and Griffiths 1997). Personal behaviour is sometimes used as a criterion to rule out surgery. Hughes described a regular conference to decide on candidates for bypass surgery. The cardiologist presented the angiographic findings, but sometimes added information about lifestyle, such as obesity or smoking. Some patients were 'ruled out' based on these lifestyle factors. On the other hand, in deciding which patients out of a pool of candidates to accept for rehabilitation therapy, patient behaviour—positive attitude, willingness to work hard—was used as a ruling-in criterion (Hughes and Griffiths 1997). Similarly, Imamura found that clinicians were apt to use obesity as a 'list-limiting' factor for hip replacement surgery (Imamura et al. 1996).

Langham, in a retrospective record review, found that smokers were less likely to receive bypass surgery within their maximum recommended waiting time (Langham et al. 1997). Kee found a similar relationship between smoking and wait times, but that a positive family history for coronary disease predicted a shorter wait for bypass surgery (Kee and Gaffney 1995). Kee also found that patients may be accepting of lifestyle factors as a criterion for prioritization. Patients who were waiting for angioplasty were asked questions about who should take priority for bypass surgery (Kee et al. 1997). Patients who were smokers were more likely to say that non-smokers should take priority.

Pope in her work with hospital admissions clerks noted that patient behaviour was a criterion that the clerks used. If a patient went on holiday or did not accept a date offered, this was perceived as undesirable behaviour.

> 'The fireman was typical. This man rings up and says that his condition was affecting work, he might lose his job. So we rushed round arranging everything and then when we phoned him up and said to come in he said, "oh well I can't do that I'm going on holiday."' (page 202)

Two studies investigated the effect of scheduling delay on waiting times. Both of these were in the stronger-evidence category. Hadjistavropoulos found that a patient's own delay of cataract surgery was one of only two significant predictors of a longer wait, the other being the surgeon's waiting list length (Hadjistavropoulos et al. 1998). Sobolev modelled the effect of scheduling delays, either patient- or surgeon-initiated, on the proportion of patients admitted for vascular surgery within the recommended time, and concluded that these delays needed to be accounted for in measuring access to care (Sobolev et al. 2001a). While this seems patently obvious, many waiting time measures are not designed to take that factor into consideration.

Provider characteristics

Hospital characteristics

Choice of hospital can influence the length of the wait, although this may be related to choice of surgeon, since many surgeons operate in only one or two hospitals. When Katz reviewed long waiting lists for bypass surgery in Vancouver, he noted that three of the fourteen cardiac surgeons had 2/3 of the waiting list and they practised at the two longest wait hospitals (Katz et al. 1991). Several characteristics of hospitals have been explored as potentially affecting waiting times. Descriptive studies have suggested a number of characteristics that are associated with differences in waiting times by hospital: number of operating room sessions (Aiono et al. 2000), number of hospital beds (Aiono et al. 2000), occupancy (Pope 1991), availability of surgeons, nursing and support staff (Katz et al. 1991; Harley 2001; Sheldon 2001), length of stay (Ellis 1991; Martin 1995), and number of emergency surgeries (Pope 1991; Ellis 1991). Few of these have been explored further.

Harley noted that higher throughput per bed, lower average length of stay and lower occupancy explained 3%, 7% and 6%, respectively, of the variation in waiting times between hospital districts. (Harley 1988). Several studies have noted that the availability of specific resources on site can affect waiting times for advanced cardiac interventions. Having a cardiologist, a catheterization lab, or surgical services on site appears to be related to a shorter wait than not having these resources (Singh et al. 1999; Naylor et al. 1993a). Coyte found that waiting times for knee replacement in Ontario were longer for teaching hospitals compared to non-teaching hospitals.

In summary, while there are recognized differences in waiting times between hospital, little has been done to investigate the reasons for these differences.

Surgeon

Choice of surgeon often affects the wait since different surgeons have different waiting lists and times. Yet often the size of the discrepancy is unknown. In most of Canada, for most surgical procedures, waiting lists are maintained—and kept secret—by individual surgeons. In a survey of 17 British Columbia hospitals in 1992, it was found that individual surgeons maintained their lists in 59% (n = 10) of cases, surgical departments in 24% (n = 4) and admissions/operating room departments in 18% (n = 3) (Amoko et al. 1992). There is no evidence to suggest that the practice in BC is atypical in Canada. Sharing of information on waiting list size with general practitioners and with patients can help to effect a redistribution of patients (French et al. 1990; Earwicker and Whynes 1998). Patients and their referring doctors can experience shorter waits if they refer to a different doctor, or if waiting lists are centrally managed and patients are referred to the first available slot (Naylor 1991).

Long wait lists are perceived as a status symbol, a sign of surgical excellence. The very existence of a wait list proves that there is a demand for that surgeon's services. Pope quotes a GP defending a consultant colleague, saying: 'He hasn't got a waiting list . . . it's not that he's no good, but he hasn't got a waiting list. (Pope and Roberts 1991). Or, as a family doctor I interviewed stated:

> About the differences in surgeons' [waiting times] and that sort of thing, there's a reason for that. I mean, there's a reason why some surgeons attract people, and some surgeons don't. And some of it may be bedside manner and some of it may be competency. And some of it, like, there are surgeons who I won't refer to, I wouldn't refer my dog to, cuz I know, I've been in the operating room when they're operating and I just refuse to send somebody there, because I don't trust them. And the ones I do trust, I send people to, but then, everybody else does too.

This raises the issue of quality. The size or length of a surgeon's waiting list should not be a reflection of surgical excellence. Other, more objective, measures should be used to monitor surgical outcomes. If these more objective reviews demonstrate poorer outcomes, then appropriate actions, such as retraining or removal, should be taken.

Long wait lists can also be used as bargaining tools for more resources (Pope and Roberts 1991; McDonald et al. 1998). Despite this advantage, surgeons are often reluctant to share these data, or to cooperate voluntarily in efforts to centralize and monitor wait times. A case in point: Winnipeg's attempts to centralize cardiac, cataract and knee/hip replacement waiting times. All ophthalmic surgeons in Winnipeg submit their patients' names to a Cataract Surgery Waiting List Registry, but the data have not been shared with funders, referring clinicians or the public. The Cardiac Surgery and the Total Joint Replacement Registries, managed by the Winnipeg Regional Health Authority, are voluntary; registries had not been mandated because surgeons feared that the WRHA would then redistribute workload. The result is incomplete data in both of these registries.

There may be several reasons for this reluctance to participate. For one, as long as surgeons are paid in a fee-for-service system, there is no incentive for Surgeon A to cooperate with Surgeon B, if doing so will decrease Surgeon A's income. Also, surgeons may view their waiting lists as belonging to them, and the mandate to centralize and publicize average waiting times can be perceived as an infringement on physicians' autonomy. Furthermore, long lists can be used by surgeons to encourage patients to have the surgery privately where such an option exists (Pope and Roberts 1991; Bloom and Fendrick 1987; Light 1996; Armstrong 2000; DeCoster et al. 1998).

As with the variation in waiting times between specific hospitals, the reasons for variation in waiting times between surgeons has not been explored in depth. Yet it seems a widely prevalent characteristic. Unfortunately, patients are often not provided with information about differences in waiting times between surgeons, so that they could choose to go to a surgeon with a shorter wait.

System Characteristics

Rate of surgery

It is a common belief that waiting times are influenced by the rate of surgery, and that if more surgery is performed, waiting times will decrease. The evidence in this regard is equivocal and has already been discussed in the first chapter of this thesis. To summarize, there are examples of infusions of public funds reducing the wait list (Edwards 1997; Naylor et al. 1993b; Parmar 1993; Rao and Burd 1997). There are also examples in which an increase in the procedure rate was associated with an increase in the wait list (Goldacre et al. 1987; Hanning and Lundstrom 1998; Williams 1990; Sheldon 2000; Nordberg et al. 1994). Goddard used NHS data from Scotland to empirically test a model of the demand function for surgery, and found evidence that waiting times varied inversely with surgery rates (Goddard and Tavakoli 1998). (Interestingly, he noted that there was more inter-regional variation than variation over time.) The drawback of this study was the limited amount of data available. In Manitoba, the number of cataract surgery procedures increased by 32% from 1992/93 to 1996/97. This was accompanied by a U-shape in the median waits: an initial decrease from 16 to 11 weeks, followed by an increase back to 18 weeks (DeCoster et al. 1998). In the United Kingdom, when there were major government-funded initiatives to reduce waiting lists, the number of people waiting increased, even though the average wait time remained the same (Green 1999; Hamblin et al. 1998).

Increased resources may also contribute to a change in the criteria for surgery, causing more patients to be assessed as surgical candidates. That would be one explanation for the fact that when the surgery rate increased in the UK, a constant proportion of referred patients went on to surgery, despite an increase in referrals (Hamblin et al. 1998). However, this raises a question about appropriateness. In a review of the appropriateness of coronary bypass surgery in areas with different surgical rates, there were more low-benefit cases performed in higher-rate areas (Hux et al. 1995). After an increase in cataract surgery funding in Sweden, patients were found to come to surgery with better visual acuity, and a higher proportion of patients were classified as needing surgery for social reasons (Hanning and Lundstrom 1998).

Presence of competition

There has been a great deal of debate lately in Canada about the desirability of a parallel private sector in health care. The proponents of such a system argue that increased competition will guarantee more efficiency and thus an improvement in access to health care for all. Another argument is that the private sector would act as an escape valve, reducing pressure on the public system. (These two arguments seem to be in contradiction to one another. Having a private sector would increase pressure to become more efficient, but would supposedly decrease pressure by taking away some of the patients, yet the patients that the private sector would 'take away' would likely be the low-risk, low-cost patients, not the chronic, complicated, high-cost patients.)

The available data indicate that, while having competition is beneficial to those who can take advantage of it, i.e., those who can pay for private insurance, it does not appear to lead to shorter waiting times in the public sector (DeCoster et al. 2000; Marber et al. 1991; Dowling 1997). Even if the surgery is publicly financed, the presence of a competitive market appears to drive up waiting times. Waiting times for cataract surgery in Alberta were longest where all of the surgery was contracted out to the private sector, even though it was publicly financed (Armstrong 2000).

Type of surgery

Anecdotal evidence points to concerns about waiting times for certain procedures and services in Canada: cardiac surgery, cataract surgery, total knee/hip replacement and MRI being the ones that are most frequently mentioned in the media coverage. A number of studies confirm that different kinds of elective surgery are subject to different waits. General surgeons in Winnipeg state that patients who need hernia repairs can be scheduled at the patients' preference. However, the same is not true for ophthalmic surgeons and cataract surgery. Manitoba data show that the median wait after a visit to the operating surgeon for hernia repair or cholecystectomy was 33 *days* in 1998/99, but for cataract surgery, it was 18 *weeks*. Nova Scotia data reveal a similar pattern: mean cholecystectomy and cataract surgery waits of 39 and 120 days, respectively, in 1995/96 (Nova Scotia Department of Health 1996). Studies in UK and Australia have also found that certain types of surgery—often cataract, total joint replacement, and some general surgical procedures—comprise most of the long waits. (Clover et al. 1998; Gudex et al. 1990; Davidge et al. 1987). This issue is important in terms of reallocating health care dollars between types of health care services.

Year of surgery

The health care system is a dynamic one. There are changes in techniques, in diagnostic capabilities, in technology, in patient preferences, and in how the system is funded and organized over time. Looking at changes in wait times may capture the effect of some of these changes. Two Canadian studies noted increases in waits over time (DeCoster et al. 2000; Mayo et al. 2001). In comparing 1997/98 and 1998/99 with the previous five years, I found that median wait times for seven of eight elective surgical procedures had shown statistically significant increases. Mayo looked at changes in wait times for breast cancer surgery in Quebec. In multivariate analysis, wait times were found to increase significantly from 29 days in 1992 to 42 days in 1998, after adjusting for age and cancer stage.

Hypotheses generation

The last stage of this paper is to use the literature to guide the generation of hypotheses, which will be used to guide the selection of variables to be modelled in the next chapter. The literature review highlighted several characteristics associated with variation in waiting times for elective surgery. Even though most of the papers reviewed did not pertain to cataract surgery, they will be used as guides. I will also include other information in this discussion since:

> In most deductive research, hypotheses are generated from the researcher's previous research, from library research and the results of other's work, and from intuitive knowledge of the phenomena. This information is used to generate hypotheses by demonstrating relationships and testing the predictive value of specific variables. (Morse and Field 1995) (p.7)

Although the characteristic with the most evidence was urgency, i.e., higher urgency was associated with shorter waiting times, only one of the papers focussed on cataract specifically (Churchill et al. 2000). In that study, several prioritization criteria were correlated with actual waiting times for cataract: visual acuity, coexisting visual comorbidity, threat to independent living or employment, any additional disabilities, visual impairment perceived by patient. The five criteria were generated based on interviews with ophthalmologists. Only the third criterion—threat to independent living or employment—was significantly correlated with waiting time, and the overall score was weakly negatively correlated, suggesting that clinicians prioritize based on clinical factors.

It has been found that visual acuity alone is not a good indicator of the need for cataract surgery, since visual acuity does not correlate well with dysfunction (Norregaard et al. 1998b). Guidelines emphasize the patient's subjective assessment of interference with the ability to carry out daily activities, rather than measures of visual acuity alone (BC Council on Clinical Practice Guidelines 2000; Cataract Guideline Management Panel 1993). Consequently, the Cataract Surgery Waiting List Registry uses a measure of visual function in its prioritization score, and does not include measures of visual acuity. Unfortunately these data were not made available to me.

Other patient characteristics that were explored include age, sex, socioeconomic status, employment status, region of residence, and patient behaviour. Age was generally not related to variation in waiting time, although a couple of descriptive papers stated that in ophthalmology, there was a high proportion of people on the waiting list who were older than 65. There is some research evidence that points to poorer outcomes of cataract surgery with increasing age (Mangione et al. 1995; Norregaard et al. 1998b; Wong 2001), however that does not mean that older individuals receive no benefit. The CSWLR does not consider age in its prioritization score because 'it was felt that it would be socially unacceptable to penalize older patients' (Bellan and Mathen 2001). I believe that age is related to the wait for cataract surgery, with younger patients receiving higher priority, although that may be related to other factors such as work or driving impairment, for which I have no measure.

With respect to gender, in univariate analysis, I found that female patients had significantly longer waiting times for cataract than males. No other study found this relationship for cataract surgery in particular, or for non-life-saving surgical procedures in general. (Even if age and sex were not thought to explain some of the variation in waiting times, they would be included in any multivariate model because it is standard practice to adjust for them.)

There is some evidence to suggest that patients living in lower socioeconomic status areas may be disadvantaged in access to cardiac surgery; however, there is little evidence to support this relationship for other types of surgery. In Canada's publicly financed health care system, there should be no difference in wait times according to SES. In my earlier work, I found no relationship between neighbourhood income level and waiting times over a variety of procedures. However, this analysis was limited in several ways: it included only Winnipeg residents, it used neighbourhood income, an ecologic variable, as the measure of SES, and it did not control for other variables. These limitations will be addressed in the next chapter.

There is some evidence that clinicians consider employment when prioritizing patients. Churchill's study, described earlier, found this. Furthermore, threat to employment is a criterion in the Cataract Surgery Waiting List Registry, so one would expect it to be related to shorter waiting times. Unfortunately, once again, I was not allowed to access this information.

Two studies found that a scheduling delay predicted a longer wait time for surgery. While there is a field in the CSWLR that pertains to postponement, that field is not available to me. Delays are not always patient-initiated; sometimes they are related to other health problems. Therefore, I am incorporating several measures that might indicate a 'sicker' patient: being hospitalized while waiting, an ambulatory care case-mix grouper, number of different drugs and living in a nursing home. Another reason to include measures of health status is that, while not associated with waiting times, poorer general health status has been associated with poorer outcomes of cataract surgery (Norregaard et al. 1998a), which argues that surgeons may consider this factor when prioritizing patients.

Related to the issue of general health status is that of ocular comorbidity. There are three recognized ocular comorbidities that predict poorer outcomes of cataract surgery: glaucoma, age-related macular degeneration, and diabetic retinopathy (Desai 1993; Norregaard et al. 1998b; Mangione et al. 1995). I would hypothesize that patients with these conditions would have longer waiting times. However, there are problems with the accuracy and completeness of the claims data that prevent me from using these ocular comorbidities.

The last patient variable to be considered was region of residence. At least twelve studies noted that waiting times vary between regions. Therefore, I will include that as a potential predictor. I noted that in some studies, it was unclear whether 'region' referred to where patients lived or where they had surgery. In my study, the location of surgery is Winnipeg for all patients, but they come from all over the province. Therefore, region will refer to region of residence, and this will be defined several ways.

I will also include the site of surgery, and the specific surgeon as explanatory variables, since these were also commonly noted in the literature. Hadjistavropoulos found that one of the strongest predictors of cataract surgery waiting times was the length of the individual surgeon's waiting list. Therefore, volume of surgery may be a relevant indicator. Another reason to enter this variable is that when I found differences in public-sector waiting times according to whether or not a surgeon also has a private practice, members of the Department of Ophthalmology advised me that this was more likely because the surgeons with a private practice were the high-volume surgeons.

In the literature review, rate of surgery, presence of competition and year of surgery were identified as possible predictors of waiting times. My hypotheses would be that rate of surgery, presence of competition and year would all be related to longer waiting times. However, only one of these will be relevant for this study: presence of competition. While all of the surgery is funded publicly, some of it is performed at one of two privately owned clinics.[2] The time span is too short to consider changes in rate of surgery or in year of surgery.

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2 One of the two clinics is the Pan Am Clinic, which was purchased by Government of Manitoba in April 2001. However, for the time period of this study (Nov 1998 to Mar 2000), it was privately owned.

Conclusion

Based on the review of the literature, experience and anecdotal information from informed sources, a variety of characteristics have been identified that may be associated with variations in waiting times. The characteristics which appear to be relevant, but for which there are no data available in this study are: visual dysfunction, ocular comorbidity, and employment. The characteristics which appear to be relevant but are not applicable to this study include rate and year of surgery. The remaining characteristics that appear to be relevant and will be entered into the next stage of the analysis are: age, sex, socioeconomic status, general health, region of residence, surgery location, surgeon, and volume of surgery by specific surgeon.

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Appendix 4.A:

Lists of papers

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables	Comments
Aiono 696/id	2000	secondary data	I	general surgery	none	WL size	number of hosp beds theatre sessions WL initiative	-limitations in beds and theatre sessions led to increase in number of people on WL - WL initiative reduced WL temporarily
anon 114/id	1985	health district survey	I	6 spclties	none	% >1 year	district	-data on WT by district published & pts used the info to ask for referral elsewhere after waiting years in own district
Armstrong 305/id	2000	telephone survey	I	cataract	none	wait times	mix of private/public	Fully insured cataract surgery: longer waits where sourced out to private sector - Data reported may not be accurate
Bloom 9/id	1987	Secondary data Physician survey	I	various	none	median wait	surgical specialty region of surgery population age population sex hospital bed size hospital location private practice	longer waits for neuro, ophth, ortho, plastic regional variations showed no identifiable pattern private care shorter waits poorly described methods
Cohen 801/id	1996	review paper	I	cardiac surgery	none	WT	age, sex, reoperative status multiple risk factors # diseased vessels angina stability lt main coronary recent angioplasty	- authors state that the last five factors influence WT for patients in the queue - also say that waiting hasn't affected operative mortality - no new evidence, a review paper
Davidge 24/id	1987	Retrospective data analysis	I	various	none	patients on waiting lists	surgical specialty type of surgery age of patients district of residence waits > 1 year	pts waiting for 7 procedures comprise 50% of list % >65 not high except Ophth
Donaldson 29/id	1989	Retrospective data analysis	I	various	none	standardized waiting list ratio waiting prevalence	outpt vs inpt surgery age surgical specialty district of residence type of surgery	in each specialty, small # procs comprise most of pts waiting considerable inter-district variation most pts <65, except ophth

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables	Comments
Drummond 251/id	1991	review paper	I	cataract	none	# waiting	rate of surgery, bed supply, # of surgeons, efficiency, out/inpt	- not evidence but suggesting reasons for growing WL in cataract surgery
Ellis 631/id	1991	dynamic model	I	gen surg	none	MLOS, # occ beds, costs, OR use, WT	mode of admission complexity of surg length of stay	-model effect of more Emerg admits, fewer admits and shorter LOS; cuts in beds affects routine elective most
Fraser 38/id	1991	descriptive	I	various	none	WT	surgery rate, surgeon, referral/surg threshold service availability patient's behaviour new technology def'ns and mgnt of WL	A review paper - no statistical testing, but good as providing context for some of the important issues.
Hamblin 768/id	1998	public use hosp data (?)	I	various	no	# waiting wait time	# pts seen by GP, % referred, # pts seen by spclst, % put on WL	-altho # of pts referred inc, % having surgery constant; people change behaviour in response to change in capacity
Harley 678/id	2001	secondary data anal	I	ortho surgery	no	various	WT, WL	Orthopods up 57% since 1990 but referrals up 38% & WL 37%, but #pts per WL staying same -seems demand grows to meet supply
Harvey 254/id	1993	admin data Pt survey	I	hernia varicose v	no	WL, pt satis throughput	# proc performed district of residence	-evaln of 3 a specialty centre, WL fell only a bit, substitution seemed to occur for hernia
Katz 51/id	1991	Secondary data analysis	I	Cardiac surgery	none	wait list size wait time	Procedures performed Patients referred Surgeon Hospital of surgery	3/14 surgeons had 2/3 of wait list two of those surgeons were ar the hospital with longest wait Notes shortage of perfusionists, ICU nurses
Martin 813/id	1995	descriptive	I	various	not approp	WT	-9 procs: 80% of cases to be moved to day surg incl hernia, vv, cataract	-describes government policy to have more day surgery and PACs - assumption that shorter LOS will reduce WL
McGregor 798/id	1996	descriptive	I	plastic surgery	none	WL	10 factors suggested as NB: # of outpt clinics, ratio of new/returning pts; OR & bed avlblty; # of OR sessions; MD's special interests; having case-mix for teaching; prestige of long WL; WL initiatives, WT guarantees; decisions not to accept certain cases	

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables	Comments
Moon 69/id	1996	retro-spective analysis	I	various	none	clearance time	-surgical specialty -hospital type - surgical procedure -urgency category - region (state)	Not much variation by hospital type Wide variation between states Shorter clearance time w. higher urgency Accuracy of dat? Health authorities provided from wait lists and hospital records
Nord 84/id	1990	cost-benefit analysis	I	elective surg	no	sick leave	WT	Argues that pts on sick leave should get priority, resulting inc in productivity should pay for extra surgery; 5-10% of pts on WL are on sick leave -Tons of assumptions (econimists!)
Nova Scotia 85/id	1996	Secondary data	I	various	none	wait time	type of surgery year	-wide variation by type of surgery -uses proxy measure (phys visit) as start of wait, may not be valid
Pope 92/id	1991	informant interviews	I	various	not approp	WT	Social status How MD manages pts Pt behaviour External, e.g, emerg-encies or occupancy	Qualitative study interviewing people in the admissions department who are responsible for the WL - they used a lot of discretion -interesting view of how WL 'really' work
Sheldon 438/id	2000	descriptive	I	elective surg	no	WT WL	increase in funding	funding to reduce WL led to increase in demand WT long a problem in Dutch medicine
Sheldon 675/id	2001	descriptive	I	ortho surg	no	WT	shortages in beds shortages staff travel to other countries	surgeons traveled to Spain with pts, from Netherlands, paid by insurance WT 4-12 weeks vs normal WT of 32 wks
Williams 109/id	1983	retrospec & Secondary data	I	various	none	throughput	additions to list number remaining at end of time period	Methodological paper Wide regional variation in number waiting more than one year.

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables (* = statistically sig)	Comments
Alter I/id	1998	Survey	II	specialized cardiovasc care	Chi-square Fisher's t	preferential access	patient knows phys high-profile pt pt is litigious pt/family make specific requests	Opinion survey only Most physicians and CEOS had been involved in preferential access
Churchill 268/id	2000	Prospective cohort	II	cataract	Spearman's rank correlation	waiting time	age, sex first eye/second eye overall score 1: visual acuity 2: clinical modifiers 3: independence* 4: other disabilities 5: visual impairment	Small sample (n = 67) Overall scores also correlated but not significant Survey developed from physicians' beliefs about relevant prioritization criteria, yet was not well-supported by the evidence
De Coster 463/id	2000	Seconday data	II	various	conf interv	median	-year* -region* -type of surgery -age -sex* -private/public* -neighbourhood income	-sex sig only for cataract - in 1998 report, >65yrs waited less time - large sample size - phys visit used as proxy for start of wait, may not be valid
Dowling 168/id	1997	pt info database anal	II	various	ANOVA	mean WT	fundholding* by hospital & year (92/93-95/96)	- only checked data against 40 records - questionable accuracy of data source -mean WT not log transformed
Fox 32/id	1998	Retrospective cohort	II	Coronary artery bypass	none	wait times	urgency rating optimal waiting time	Pts with higher urgency waited less Clinicians prioritize well even with no criteria May not be generalizable
Goddard 152/id	1998	test demand f'n surgery	II	6 spclties	don't know	average WT	surgery rates region year	Only 88 to 154 obs for each specialty -more inter-regional var than var'n over time WT varied inversely w surgery rates
Goldacre 42/id	1987	retrospec & Secondary data	II	various	time series	size of wait list	admissions from list seasonal trends month & year	wait list size increased when number of admissions from the list increased Data may contain many errors,altho lists

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables (* = statistically sig)	Comments
Groothoff 289/id	1995	retrospect. survey	II	cataract knee arthro total hip	none	WT satisfaction	age, gender, educ'n occupation, form of insurance, urgency Hospital of surgery	- not much difference noted by demo-graphic vars, but big diff betw hosp -despite long waits, only 15% dissatis.
Hanning 160/id	1998	Retro-spective & Survey	II	Cataract	correlation	degree of guarantee performance	% of guarantee pts volume of surgery surgical rate	Out of 33 units, large range in degree to which pts w 3 month guarantee actually waited 3 months: 35% to 95% guarantee performance Large regional rate variation Paper is hard to understand
Harley 253/id	1988	retrospec & Secondary data	II	various	correlation	clearance time	regions (in UK) net pt flow, Jarman*, throughput*, unit size, beds, OP clinics, senior MDs, LOS*, % day cases,	Analysis of 30 worst districts showed no pattern of resource availability, resource use or socio-demographic characteristics Methods and data sources inadequately described
Kee 542/id	1996	survey	II	CABS	Chi-square	who should get priority	age, gender, obesity, smokers, employed, dependents, symptoms	-priority to younger, w/dependents, non-smoke, non-obese, employed - older pts and smokers more likely to give place to younger pts and non-smokers resp.ly
Kee 537/id A87	1997	expert opinion survey	II	CABS	regression	priority safe WT	benefit non-clinical charac clinical status	-lifestyle and demographic var much less impact on doctors' judgements than major clinical cues
Langham 787/id	1997	retrospective cohort	II	CABS	none	surgery in RMWT def. w. CCN system	clinical status sex, age, smoking, high BP, diabetes, obesity	N = 1594, 1992 & 93, 3 London hosp -only 38% treated in approp time, 34% earlier - sex & smoking assoc'd w actual waits -recommend using priority criteria
Marber 574/id	1991	Prospective pt registry	II	advanced cardiac	means, SD with CI	wait time	NHS versus private	waits were sig longer in NHS waits increased in NHS but not in private fewer unstable pts in private (1% vs 20%)
Mariotto 721/id	1999	pt interviews	II	card surg outpt visit	Chi-square logistic regr	give up place in queue?	age, sex, marital st, educ'n, employmt, med-ical histo, ADL, IADL, Mini mental, depression, desire for approval	-4 queus posed & asked about giving up place -would give up place to younger, self-employed but delay would only be 15 days -used a 10% random sample of age 65+ in Padona, Italy

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables (* = statistically sig)	Comments
Naylor 78/id	1992	Mail survey	II	CABS PTCA		% agreement betw surveyed MDs and criteria	numerous clinical factors used by respondents to rate 49 hypothetical cases re acceptable wait	More than 90% of responses were within one scale point of the panel rating Only 60% response rate: respondent bias?
Naylor 567/id	1992	Mail survey	II	CABS PTCA	t-test	appropriateness RMWT	age occupation	Shifts in willingness to intervene and recomm max wait in favour of laborer facing job loss vs civil servant vs retiree Raises issue of societal values in prioritization
Naylor 82/id	1996	Delphi tech expert panel	II	knee/hip replacemnt	recursive partitioning	appropriateness, urgency agrmnt	app: function, pain, prosthesis suvival, age urg: pain, problems in work, func'nal class	-93% convergence on appropriateness & 74% for urgency 120 cases rated for appropriateness; 42 for priority
Nordberg 475/id	1994	hosp disch hosp survey	II	various	correlation Kruskal-Wallis	wait list size	-surgery rate* -hosp surgery rate	-positive correlation betw list size and surgery rate, weighted for population size, except for cataract surgery -accuracy of hospital data?
Pope 90/id	1991	Retrospective data analysis	II	general & orthopedic surgery	Chi-square logistic regression	wait time clearance	urgency rating* type of surgery Surgeon	Urgency related overall to waiting time, but there were discrepancies. Surgeons varied widely in % waiting > 1 yr & in clearance time (no statistical test) Distribution skewed, data transformed? Few procs comprised most of long waits
Shortt 376/id	1998	survey	II	various	none	WT	poor elderly rural socially disadvantaged	Survey of consumers, administrator provider grps Asked one open-ended question about groups most afffected by waiting lists
Singh 520/id	1999	Prospective log data	II	advanced cardiac	Student's t-test	wait time adv events	month of year hosp resources: 1) cath lab on site 2) cardiologists on site 3) neither 1 or 2	No adjustment for multiple comparisons No objective assessment of severity n = 1203, 7 community hosp in Toronto, 01-May-97 to 30-Apr-98 Sig diff in waits betw 1 < 2 < 3
Stewart 863/id	1991	prospective cohort	II	general surgery	none	% travelling satisfaction	length of wait type of surgery anticipated LOS region (indirectly)	484 pts waiting >1 year asked if they'd travel to another region for faster surgery, 356 agreed - noted list inaccuracies esp w the longest waits - MDs had to agree: they 'lost' some cases

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables (** = statistically sig)*	Comments
Alter 133/id	1999	retrospec-tive data	III	advanced cardiac	weighted linear regression	waiting time	-income quintile*	Controlled for age, sex, disease severity, physician specialty, case volume, teaching status, on-site facility to operate, geographic prox of admit hosp to tertiary hosp -45% shorter wait highest:lowest income -n = 41,191 Apr 1994 to Mar 1997
Clover 154/id	1998	Prospective cohort	III	various	survival analysis	waiting time	surgical specialty* age hospital (3) urgency category (2)* sex Australian/ not aboriginality education marital status employment status* health insurance* SF-35 health survey	n = 689 note health status not sig. may not generalize to other hosp/areas pt entry period only 5 weeks
Coyte 22/id	1994	retrospect. pt survey	III	knee replacemnt	all sorts	WT consult WT surgery satisfaction	country, age, year race (U.S.) sex income, education volume of surgery* C teaching status* C # of beds * C coexisting conditions type of arthritis cond'n knee pre-op* U urban/rural res* U	-used admin data from US Medicare 85-89 and Ontario HMRI 85-89 plus pt mail survey -C = sig in Canada; U = sig in United States - factors affecting acceptability of WT: WT, inability to use stairs, older age, dissatisfaction w surgical outcome - Ont WT lower than expected and several letters to editor questioned that.

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables (* = statistically sig)	Comments
Hadjistavropoulos 279/id	1998	prospective cohort	III	cataract	multiple regression	WT visual func'n visual acuity	age, sex, educ'n, income, living alone cataract symptoms, VA VF-14, comorbidities anxiety*, coping Pt's own delay* list length of surgeon*	-216 pts invited, 98 agreed - generalizability? - found pts perceptions of actual WT very close to the wait times in the information system -pts not concerned about WT but it was shorter here than in MB, about 75 days -wait had no effect on outcomes
Kee 256/id	1995	retrospect record rev	III	CABS	Chi-square Cox's	WT	age*, BMI, gender, marital status, emplmnt, smoking*, referral hosp, distance, depriv'n, family hist*, comorbid, angina grade, # vessls treadmill test, left main* unstable angina*	Smokers waited longer 141 who had angio, and 88 who had surgery
Mayo 615/id	2001	admin data	III	breast ca surgery	linear regr	WT	age cancer stage* # diagnostic procs* type of surgery year*	-addresses completeness, accuracy Quebec data, n = 29606, 1992 to 1998
Naylor 79/id	1993	Retrospec-tive study	III	CABS	correlation	wait time	clinical status Hospital of surgery age Hosp diff than angio-graphy site	Significant correlation between actual wait & recommended wait according to criteria, even though criteria went into effect AFTER these cases. Notes inter-hospital variation in wait times, & discrimination against hosp with no surgery
Naylor 77/id	1993	prospective cohort	III	advanced cardiac	lots lots	type of Tx WT willingness to intervene	sex, age symptom status coronary anatomy procedure risk ischemia, recent MI	- F more serious symptoms but turned down more often even after adj't for symptoms, risk -WT shorter for women (related to symptoms) -CABS more in M than F -Tx: CABS, PTCA, medical Tx
Naylor 635/id	1993	consecutive case series	III	CABS or PTCA	univariate	WT others	urgency rating scale specific surgeon req time (quarterly anal)	-pts w higher urgency more likely beyond RMWT -request for specific surgeon inc WT -expansion of capacity dec WT

Report or study	year	Design	Study Group	Procedures	Statistical Analysis	Outcome var	Explanatory variables (* = *statistically sig)*	Comments
Naylor 81/id	1995	consecutive case series	III	CABS	lots lots	WT	site of surgery*, age angina class*, acuity score*, recent MI, anatomy*, LV grade*, sex	-sex was stat sig in one type of analysis only -median time betw cath and CABS 3 days more than time from acceptance to surgery N = 8517 Oct 1991 to July 1993
Naylor 944/id	1995	consecutive case series	III	CABS or PTCA	chi-square Kruskal-Wallis anova	rates WT	region of residence*	Significant diff in rates of revascularization and in time between MI and revasc'n by region of residence therefore increases in $$ should pro-rated
Pell 89/id	2000	Retrospective data analysis	III	cardiac surgery	multiple regression	wait time	age sex type of surgery* deprivation category*	When urgent/routine cases separated, wait shortest for most & least dep'd: U-shape Least deprived more likely to be urgent No clinical data included in the analysis
Sobolev 691/id	2000	prospective cohort	III	vascular	survival curve	Time-to-Tx admit rates	sex, age, year priority* type of surgery* date on WL	-priority did influence wait time but still pts w same urgency but diff surgery not all treated equitably, ie. Among least urgen there were sig diff by procedure
Sobolev 924/id	2001	prospective cohort	III	vascular	logistic regr	WT % in RMWT	% of emergency cases* enrolment period urgency type of surgery* age, sex	- Registry data from '1994' to '1998', n = 1173 - only 45% had surgery in RWT, varied by proc - weeks w more emerg had fewer cases in RWT
Sobolev 913/id	2001	prospective cohort	III	vascular	Cox regression	WT	enrolment period scheduling delay* age, sex urgency type of surgery	- noted that scheduling delays - either by MD or by pt - need to be accounted for in WT measure
Williams 170/id	1997	prospective cohort	III	hip/knee replace	princ.comp correlation ANOVA	WT	level of pain dysfunction physical health mental health	None of the factors seemed ass'd w WT but one would expect things like pain and dysfunc'n to be ass'd with WT Long waits did not affect outcomes

CHAPTER FIVE: CHARACTERISTICS RELATED TO VARIATION IN WAITING TIMES FOR CATARACT SURGERY IN MANITOBA

Introduction

The last chapter closed with the following paragraph:

> Based on the review of the literature, experience and anecdotal information from informed sources, a variety of characteristics have been identified that may be associated with variations in waiting times. The characteristics which appear to be relevant, but for which there are no data available in this study are: visual dysfunction, ocular comorbidity, and employment. The characteristics which appear to be relevant but are not applicable to this study include rate and year of surgery. The remaining characteristics that appear to be relevant and will be entered into the next stage of the analysis are: age, sex, socioeconomic status, general health, region of residence, surgery location, surgeon, and volume of surgery by specific surgeon.

The purpose of this chapter is to discuss work carried out to analyze the effect of various characteristics on the waiting time for cataract surgery for 6114 patients receiving surgery in Winnipeg between November 1998 and March 2000, i.e., the cohort that was defined in Chapter Three.

According to the principles underlying the Canada Health Act, medically necessary care is to be universal, accessible, and publicly administered. In Manitoba, there are no co-payments, premiums or deductibles. Because of these characteristics of the health care system, one would expect that differences in access would relate primarily to need and not to other factors, such as age, socioeconomic status or region of residence. Therefore, the principle research question to be explored in this paper is: Are there variations in wait times that can be explained by characteristics other than need?

Methods

In Chapter 3, a cohort was identified of 6114 individuals having first-eye cataract surgery between the dates of November 1, 1998 and March 31, 2000 in Winnipeg. This same cohort will be analyzed here. In brief, the method used was to split the sample in two, develop generalized and hierarchical models for half of the sample, then test them on the second half of the sample.

A random sample of 50% of the patients was selected in order to develop the models; the remaining 50% of the cohort was used to test how well the models predicted actual waiting times. The distributions of several characteristics in the two samples were compared using both Chi-square analysis and Fisher's exact test (on NCSS) to see if the samples were similar. Both Fisher's and Chi-square can be used to compare two proportions, but Fisher's provides an exact probability measure whereas Chi-squares are approximate (NCSS software, version 2000 release April 15, 1999). The difference between the two is minor unless the frequency of the expected value is less than five, when Fisher's is recommended (Dawson and Trapp 2001). None of the expected frequencies was less than five with these datasets). Bonferroni correction was made for multiple comparisons (Hassard 1991).

The outcome variable was the wait time calculated from the Cataract Surgery Waiting List Registry. Explanatory variables were selected based on the conclusions reached at the end of the preceding chapter. The variables were: age, sex, socioeconomic status using the socioeconomic factor index (SEFI), measures of general health status, region of residence, specific surgeon and surgeon characteristics, and location of surgery. The rationale for using these variables was described in Chapter Four. Table 5.1 lists and defines each of the variables.

Table 5.1: Explanatory variables used in regression models

Variable	Definition
age	age at date of surgery
sex	
SEFI	socioeconomic factor index*
number of ADGs	number of Ambulatory Diagnostic Groups in year of surgery*
number of drugs	number of different drugs prescribed in year of surgery*
residence in LTC	individuals residing in either a nursing home or a chronic care facility at the date of surgery
hospitalization	patients who had at least one hospitalization with LOS > 1 day between beginning of waiting time and date of surgery
region of residence	where patient lived at date of surgery, three definitions:* 1)Winnipeg/non-Winnipeg 2) residence by non-Winnipeg RHAs and 12 Community Areas in Winnipeg 3) residence in non-Winnipeg RHA and 25 Neighbourhoods in Winnipeg
individual MD	surgeon who performed the surgery
clinic/hospital	surgery site: public hospital or a clinic
volume*	surgeons who performed more than 500 procedures in the total cohort were defined as high volume
practice location	whether MD did surgery at public hospital only, or both public hospital and clinic (all surgeons operate in public hospital)*

* described further in text

Socioeconomic Factor Index: The Socioeconomic Factor Index (SEFI) was developed at MCHP using factor analysis on public-use data taken from the 1996 Canadian census. In constructing the SEFI, 12 variables that were available in the 1986, 1991 and 1996 censuses were analyzed. Various models were tested with a previously constructed index measure of poor health[1] as the outcome variable. From the factor analysis, six socioeconomic characteristics were chosen. These variables are:

1. the age dependency ratio: the population aged 65 or older over the population aged 15- 64;
2. Unemployment rates: the unemployed divided by the total labour force for that age group (four age groups were used: 15-24, 25-34, 35-44, 45-54);
3. Single parent households: per cent of single parent households among households with children aged 0-14 years;
4. Single parent female households: per cent of single female parent households among households with children aged 0-14 years;
5. Labour force participation female: women working or seeking work on census day over all women aged 15 or older; and
6. Education: per cent of residents who reported attaining at least high school diploma level education (three age groups were used, 25-34, 35-44, 45-54).

SEFIs have been estimated for various geographic aggregations. Two of these were available for this study: SEFI_12 which provides the SEFI for each non-Winnipeg Regional Health Authority (RHA) and 12 Community Areas of Winnipeg, and SEFI_25 which provides the SEFI for each non-Winnipeg RHA and 25 Neighbourhoods of Winnipeg. These geographical divisions of Winnipeg were defined by the Winnipeg Regional

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[1] The prototype poor health status index includes hospitalizations for injury, hospitalizations for acute respiratory infection for young children and seniors, and fertility.

Health Authority. SEFI has been demonstrated to be highly correlated to premature mortality, a measure of general health status (Frohlich et al. 2001).

Ambulatory Diagnostic Groups: The Johns Hopkins Adjusted Clinical Group (ACG) system quantifies morbidity by grouping individuals based on their age, gender and constellations of diagnoses assigned by their health care providers over a defined time period (Reid et al. 1999).[2] The ACG system quantifies morbidity by grouping individuals based on their age and gender and all known medical diagnoses assigned over a defined period of time, typically one year. The first step in assigning ACGs is to assign patients into Ambulatory Diagnostic Groups (ADGs) based on all diagnoses over the time period; only unique codes are used, i.e., if the same diagnosis appears more than once in the time period, it is counted only once. There are 32 ADGs and patients can be in none or all of them. Using the number of ADGs, age and sex, each patient is then assigned to one of 92 mutually exclusive ACGs. By converting the categorical ACG into an ACG index, it has been found to be significantly and highly correlated with other population health status measures such as premature mortality rates, chronic disease mortality rates, and diabetes prevalence in Manitoba (Reid et al. 1999). Since the ACG is a categorical variable, the number of ADGs were used as a measure of health status, since individuals with a higher number of ADGs can be expected to have more health problems.

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[2] Some of the information in the description of ACGs, SEFI, and drugs is from MCHP's concept index at: http://www.umanitoba.ca/centres/mchp/concepts.

Number of different drugs: The Drug Program Information Network (DPIN) contains pharmaceutical information for the entire province from retail pharmacies and nursing homes. Missing from the database are pharmaceuticals dispensed to hospital inpatients and to Status First Nations from Nursing Stations. In an assessment of data quality, prescriptions dispensed for a one-week period from a sample of pharmacies were compared to entries in the database. Overall, 93.0% (95% CI, 92.4%-93.6%) of prescriptions were entered into the database, although the correspondence between prescriptions and entries for Status First Nations was lower at 79.7% (95% CI, 78.0%-81.4%) (Metge et al. 1999a). Several different concepts have been developed at MCHP to measure the population's use of pharmaceuticals; one of these is 'Number of different drugs dispensed'[3] over a specified time period (Metge et al. 1999b). In this analysis, it was defined as the number of different drugs dispensed to the patient during the same fiscal year as the date of surgery. For this cohort, the number of different drugs correlated highly with number of ADGs; the correlation coefficient was 0.58 ($p < 0.0001$).

Region of residence: This was defined in several different ways. First was a dichotomous variable for whether a patient lived in Winnipeg or not. In the second and third method, persons living outside of Winnipeg were classified according to the Regional Health Authority (RHA) in which they lived. Manitoba is divided into 12 RHAs. Winnipeg is one RHA, but it contains roughly 60% of the population. Therefore, Winnipeg has been divided by the Winnipeg Regional Health Authority into 12 Community Areas, and sub-divided into 25 Neighbourhoods.

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[3] Drugs are defined at the 4th level of the Anatomical Therapeutic Chemical (ATC) classification system.

Volume: Responses by the Department of Ophthalmology to previous work on waiting times suggested that volume of surgery might be an important characteristic with respect to waiting times. In exploring this characteristic, high-volume surgeons were characterized in several different ways: surgeons performing more than the mean number of cases (n = 8), surgeons performing more than the 75th percentile of cases (n = 5), surgeons who performed more than 500 cases (n = 7). It was not immediately clear which definition to use. Volume was also categorized into five groups: < 100 procedures, 100-299, 300-499, 500-599 and 600+ procedures. Table 5.2 illustrates the number of patients, mean and median waiting times (from the Registry) using these different categories. A big jump in median waiting times occurs when the number of procedures goes to 500 or more. Based on this analysis, high-volume surgeons were defined as those who performed 500 or more procedures.

Table 5.2: Wait times in days (from Cataract Surgery Waiting List Registry) according to volume of surgery performed

Volume of procedures	Number of patients	Mean waiting time	Median waiting time
< 100	418	92.6	80
101 to 199*	477	117.6	104
300 to 399*	992	148.0	105
500 to 599	2199	238.0	209
600+	2028	196.0	175

*There were no surgeons in the 200-299 or 400-499 range, so the labels are correct. The number of surgeons in each volume category was not included to ensure privacy.

Practice location: In my earlier research, surgeons who operated both in the public hospital and in a private clinic were found to have the longest public-sector waiting times (DeCoster et al. 1998; DeCoster et al. 2000). At the time of that research, patients who opted for surgery at a private clinic were charged a facility or tray fee of approximately $1000. That is no longer the case; since January 1999 Manitoba Health pays all costs whether the surgery is performed at the public hospital or a private clinic. Therefore, one would anticipate that there would no longer be a difference in waiting times between a clinic or the hospital for surgeons who operate in both settings. This variable was entered in order to test that hypothesis.

Modelling

Several characteristics of the data are worth mentioning here. First, the distribution of the data is not normal but is positively skewed. Several researchers have overcome this obstacle by log-transforming the outcome prior to analysis so that parametric tests can be used (Coulter and McPherson 1987; Goddard and Tavakoli 1998; Shaw and Shortt 2000). Accordingly, the outcome, waiting time from the Cataract Surgery Waiting List Registry, was log-transformed for all regression models.

The other characteristic of the data is that they exhibited a nested, or multi-level, structure. While some of the characteristics of interest described patients, e.g., age, sex, some described surgeons, e.g., volume of surgery. Furthermore, each patient had one, and only one surgeon, making it relatively easy to define surgeon as the second level of the multi-level hierarchy. These factors suggest the use of hierarchical linear modelling (HLM) techniques. HLM assumes that the data are not independent of one another. The clearest example of non-independence would be in the case of repeated measurements on the same individual. For instance two blood pressure measurements on Individual M will likely be more similar than a blood pressure measurement on Individual M compared to a blood pressure measurement on Individual K. Whether or not observations are independent of one another is often not so clear-cut. If patients of different family practitioners were measured on several health characteristics, these measures might not be independent because of the continuing relationship between patient and family practitioner and the influence the physician has on the patient. This argument loses strength for the patients in this study who see ophthalmologists on a referral basis for a specific surgical procedure. In other words, the argument for independence between patients is stronger for specialist surgeons.

Two methods were used to develop the models, so that comparisons could be made between them: Hierarchical Linear Modelling (HLM) and Generalized Linear Models (GLM). Generalized Linear Models were generated using SAS software, Version 8.2 of the SAS System for Sun or Solaris Operating Systems, Copyright 1999-2001, SAS Institute Inc. Hierarchical Linear Models were generated using HLM5 software, Version 5.00 for UNIX, Copyright 2000.

To develop the GLMs, first the regression equation for each individual variable was estimated and those with a p-value of ≤ 0.10 were kept. Next, to develop the multivariate model, each variable was entered in turn, depending on the proportion of the variation it explained (R^2) in the univariate analyses. As each variable was added, if the proportion of the variation explained improved significantly, then it was kept in the multivariate model. The only exceptions to this general rule were age, sex and SEFI, which were kept as control variables, regardless of significance.

HLM is a relatively new technique of analysis and consequently the process for its use and interpretation are still evolving. The first step was to run a null model, after which groups of variables were added in the following fashion:

1. age, sex, SEFI (level 1)
2. region coded by RHA and 12 CAs in Winnipeg (level 1)
3. region (Winnipeg/non-Winnipeg), number of ADGs, number of different drugs (level 1)
4. clinic, hospitalization while waiting, residence in a nursing home or chronic care facility (level 1)
5. volume of surgery, practice location (level 2)

As each level 1 model was run, the output was examined to see if the variable was significant at approximately 0.10 or less, and if there was significant variation between level 2 variables in this characteristic. To illustrate, age was found to be significant with a p-value of 0.025 and therefore explained variation between patients, but in the 'final estimate of variance components' section, the p-value was > 0.5, which means that age did not explain the variation in wait times between surgeons.

As the final models were reached, the resulting regression equations were tested against the observed outcomes using the second half of the dataset. The correlation between the predicted values and observed values was calculated to evaluate how well the generated model worked (by finding the R^2) . One of the problems with the HLM output is that there is no statistic available to tell how much of the variance is explained by the model, a statistic which is provided automatically for the GLM with the SAS output. In order to be able to compare models, it was necessary to use the model parameters from HLM on the same dataset that was used to generate the model in order to measure the proportion of the variation explained.

Results

An examination of the mean and median waiting times for the entire cohort of 6114 patients suggests which characteristics might be important for explaining variation in waiting times. Table 5.3 shows the distribution as well as the mean and median waiting time according to age, gender, number of ADGs, number of different drugs, region of residence (RHAs and Community Areas of Winnipeg), hospitalized while waiting, residence in long-term-care (LTC) facility, site of surgery (hospital/clinic), surgeon, surgeon's volume (high/low), and practice location. SEFI is not shown since the index is assigned according to region of residence and therefore the distribution and wait times are the same as the relevant region of residence.

Women have waiting times somewhat longer than men, and patients aged 65 and older appear to wait longer than younger patients. There do not appear to be differences in waits according to number of ADGs or number of different drugs. Patients having their surgery in a hospital rather than a clinic appear to have slightly longer waits. Having a hospitalization while waiting seems to be associated with a longer wait, while persons living in a LTC facility had a slightly shorter wait. Although there is variation in wait times according to region of residence, no clear patterns emerge. Winnipeg residents and non-Winnipeg residents have similar median waiting times, 164 and 161 days, respectively (not shown).

Mean and median waiting times vary considerably by surgeon. Mean waiting times range from a low of 67 days (MD11) to a high of 359 days (MD19). Median waits range from a low of 61 (MD11) to a high of 399 days (MD19).[4] High-volume surgeons had longer waits, as did surgeons who operated in both hospital and clinic. There is considerable overlap between practice location and volume: all high-volume surgeons operate at both the hospital and clinic; eight of the eleven low-volume surgeons operate only at the hospital.

[4] It may be noticed that the median wait time for MD19 is longer than the mean; this is correct. For this surgeon, 17% of patients had very long waits, over one-and-a-half years.

Table 5.3: Descriptive data for 6114 cataract surgery patients

		Waiting time				*Waiting time*	
Characteristic	*Number*	*Mean*	*Median*	*Characteristic*	*Number*	*Mean*	*Median*
Gender				**Surgeon**			
females	3860	198	173	MD1	651	257	272
males	2254	177	147	MD2	179	134	109
Age				MD3	552	205	212
0-50	227	160	128	MD4	575	173	191
51-64	752	167	144	MD5	40	105	117
65-84	4320	195	169	MD6	751	171	161
85+	810	196	168	MD7	78	71	73
No of ADGs				MD8	76	75	64
1–3 ADGs	1029	186	161	MD9	81	114	109
4-7 ADGs	459	189	162	MD10	304	80	76
8-10 ADGs	3313	193	167	MD11	150	67	61
11+ ADGs	1191	190	160	MD12	372	242	280
unassigned	122	166	133	MD13	148	149	154
No of drugs				MD14	316	103	97
1-4 drugs	1572	189	170	MD15	82	75	62
5-9 drugs	2747	193	164	MD16	61	130	86
10+ drugs	1795	186	156	MD17	626	163	151
Site				MD18	511	215	205
Hospital	4902	191	167	MD19	561	359	399
Clinic	1212	186	155				
Hospitalized during wait				**Practice Location**			
yes	542	269	258	hospital	1123	101	87
no	5566	182	156	hosp + clinic	4991	210	191
Resided in LTC				**Volume**			
yes	127	181	154	High	4227	218	197
no	5987	190	163	Low	1887	128	99
Residence				**Residence (continued)**			
Winnipeg CAs				*RHAs*			
St James-Assin	456	184	161	Central	484	205	172
Assiniboine S	190	200	168	N Eastman	150	170	153
Fort Garry	301	195	178	S Eastman	261	169	121
St Vital	388	195	161	Interlake	423	179	149
St Boniface	286	196	159	Nor-Man	57	185	167
Transcona	131	193	194	Parkland	170	236	229
River East	618	179	149	Burntwood/ Churchill	69	184	163
Seven Oaks	404	193	178	Brandon	95	162	142
Inkster	138	170	155	Marquette	87	196	162
Pt Douglas	311	177	166	S Westman	158	217	197
Downtown	470	190	168				
River Heights	459	201	174				

Comparing the distribution between the split dataset

The cohort for study consisted of 6114 patients. A random sample of 50% of these patients was drawn, and this 'first-half' sample was used to develop all models. Table 5.4 shows the distribution of certain characteristics between the two datasets, and also the results of the Fisher's exact test (the chi-square tests produced very similar p-values). Although the proportion of patients for two of the surgeons (MD1 and MD10) appears to be significantly different between the halves because the p-values are < 0.05, because of multiple comparisons the critical p-value was set to 0.0001. Therefore, there were no significant differences in the distributions between the first-half and second-half datasets.

Table 5.4: Comparison of distribution of split-sample dataset.

Characteristic	Per cent in first-half	Per cent in second half	Fisher's exact test p-value	Characteristic	Per cent in first-half	Per cent in second half	Fisher's exact test p-value
Gender				**Surgeon**			
females	63.7%	62.6%	0.68	MD1	11.6%	9.8%	0.04
males	36.3%	37.4%		MD2	3.2%	2.7%	0.29
				MD3	8.8%	9.2%	0.63
Age				MD4	9.6%	9.2%	0.63
0-50	3.4%	4.1%	0.17	MD5	0.7%	0.7%	1.00
51-64	11.9%	12.7%	0.91	MD6	12.4%	12.2%	0.88
65-84	71.6%	69.8%	0.54	MD7	1.3%	1.2%	0.91
85+	13.1%	13.4%	0.79	MD8	1.1%	1.4%	0.30
				MD9	1.4%	1.2%	0.65
Location				MD10	4.2%	5.8%	0.01
clinic	20.6%	19.1%	0.23	MD11	2.3%	2.7%	0.36
hospital	79.4%	80.9%		MD12	5.6%	6.5%	0.17
				MD13	2.2%	2.6%	0.36
Residence				MD14	4.9%	5.5%	0.33
Wpg	67.9%	67.7%	0.97	MD15	1.4%	1.3%	0.74
non-Wpg	32.1%	32.3%		MD16	1.0%	1.0%	1.00
				MD17	10.6%	9.9%	0.45
				MD18	8.7%	8.0%	0.38
				MD19	9.2%	9.1%	0.93

Developing the Generalized Linear Models

Univariate linear models were developed for each variable, to determine if it explained a significant proportion of the variation in wait times. Variables that were found to be significant at the 0.10 level are listed in table 5.5 along with the proportion of the variation (R^2) in logged waiting times each explained. None of the 'health status' measures (number of ADGs, number of different drugs, residence in long term care) were found to be significant. Neither was the location of surgery, i.e., clinic or hospital. When region of residence was taken to the level of neighbourhoods, none of the Winnipeg neighbourhoods were found to be significant.

Table 5.5: Variables that were significant in the univariate models

Variable	variation explained
Sex	0.7%
Age	0.7%
Region of residence (RHA and 12 CAs of Winnipeg)	1.6%
Region (Winnipeg vs. non-Winnipeg)	0.1%
SEFI (for RHA and 12 CAs of Winnipeg)	0.1%
Hospitalized during wait	3.1%
Volume (high vs. low)	13.3%
Practice location	13.1%
Surgeon	29.7%

In developing the multivariate GLMs, age, sex and SEFI were entered initially since a previous decision had been made to include them as control variables. Then each variable that had been significant in the univariate model was entered in decreasing order of its impact on explaining the variance.

The following tables (5.6A to D) illustrate the additional explanatory value attributable to each variable. In each table the variables that were in the previous model are in the first row, then the additional variation that was attributable to the new variable alone was tested to determine if it significantly improved the model. Individual MD is the predictor that contributed the most to the model: when it was added to age, sex and SEFI, the explained variance increased from 1.3% to 30.8%, and the F-statistic was 73.44 with 18 degrees of freedom, which was highly significant. The only additional variable to improve the model was being hospitalized during waiting. Although volume and practice location were significant in the univariate models, they were not included in the final model because they were highly correlated with MD.

Tables 5.6.A to C.: Impact of each additional variable in the multivariate linear model

Table 5.6.A: Age, sex, SEFI, MD; $R^2 = 0.3075$

Variables	d.f.	SS	MS	F	p
Age, sex, SEFI	3	20.17			
MDs	18	462.65	25.7	73.44	< 0.001
Error	3028	1087.26	0.35		
Total	3049	1570.1			

Table 5.6.B: Age, sex, SEFI, MD, hosp; $R^2 = 0.3251$

Variables	d.f.	SS	MS	F	p
Age, sex, SEFI, MD	21	482.82			
hosp	1	27.70	27.7	79.1	<0.001
Error	3027	1059.57	0.35		
Total	3049	1570.08			

Table 5.6.C: Age, sex, SEFI, MD, hosp, residence by RHA/CA; $R^2 = 0.3284$

Variables	d.f.	SS	MS	F	p
Age, sex, SEFI, MD, hosp	22	510.52			
residence by RHA/CA	21	5.16	0.246	0.70	NS
Error	3007	1054.4	0.35		
Total	3049				

Table 5.6.D: Age, sex, SEFI, MD, hosp, Wpg/non-Wpg residence; $R^2 = 0.3255$

Variables	d.f.	SS	MS	F	p
Age, sex, SEFI, MD, hosp	22	510.52			
residence by Wpg/non-Wpg	1	0.46	0.46	1.30	NS
Error	3026	1059.1	0.35		
Total	3049				

The final GLM included age, sex, SEFI, MD and hospitalization, and it explained 32.5% of the variation in waiting times. All first-order interactions were tested and none were significant. The parameter estimates are in Table 5.7 below. The model was tested against the second-half sample where it explained 34.3% of the variance.

Table 5.7: Parameter estimates from generalized linear model

Parameter	Estimate	Standard error	t- Value	Pr > |t|
Intercept	5.0002	0.0823	60.73	< 0.001
Age	0.0039	0.0010	3.72	0.002
Sex	0.1041	0.0225	4.62	< 0.001
SEFI_12	-0.0108	0.0113	-0.96	0.3369
hosp	0.3382	0.0380	8.90	< 0.001
MDI	-0.7014	0.0680	-10.33	< 0.001
MD2	-0.2929	0.0479	-6.11	< 0.001
MD3	-0.3837	0.0470	-8.17	< 0.001
MD4	-0.9060	0.1361	-6.66	< 0.001
MD5	-0.3626	0.0440	-8.24	< 0.001
MD6	-1.1811	0.0989	-11.95	< 0.001
MD7	-1.2337	0.1093	-11.28	< 0.001
MD8	-0.7071	0.0958	-7.38	< 0.001
MD9	-1.1068	0.0613	-18.05	< 0.001
MD10	-1.2218	0.0780	-15.67	< 0.001
MD11	-0.0958	0.0551	-1.74	0.0819
MD12	-0.3608	0.0792	-4.55	< 0.001
MD13	-0.8879	0.0580	-15.32	< 0.001
MD14	-1.3215	0.0957	-13.81	< 0.001
MD15	-0.6312	0.1126	-5.61	< 0.001
MD16	-0.3546	0.0456	-7.77	< 0.001
MD17	-0.1759	0.0481	-3.66	0.003
MD18	0.2380	0.0474	5.02	< 0.001

Development of Hierarchical Linear Models

The dataset for the Hierarchical Linear Models was organized into two files. In the Level 1 file, the patient-specific variables were included: age, sex, SEFI, number of ADGs, number of different drugs, whether hospitalized while waiting, whether resident of a long term care facility, region of residence (RHA/CA) and surgery location (clinic or hospital). The second file included the level 2 units: specific MD, volume of surgery (high/low) and practice location (hospital vs. hospital and clinic). As noted previously, there is considerable overlap between practice location and volume.

The process for adding variables was described previously. The null model showed that there was significant variance between Level 2 units, meaning that there was significant variation in waiting times between surgeons. Based on the significance of the correlation coefficients and the variable's ability to predict variation between surgeons, the initial 'final' model included volume (high/low), sex, age, hospitalized while waiting, residence in a LTC facility, and SEFI. (SEFI was not significant but was kept as a control variable.) Four of the Level 1 variables: age, sex, hospitalized while waiting, and SEFI, were found not to vary between surgeons. That is, they did nothing to explain the variation between surgeons. Residence in a LTC facility was somewhat puzzling. On its own, it was not significant, however both volume and practice location had a significant effect on this variable: if a LTC resident had a high-volume surgeon, that increased waiting time, but if the surgeon operated in both hospital and clinic, that had the effect of decreasing waiting time. Since most high-volume surgeons also practised in both settings, the effect was almost neutral. However, for a low-volume surgeon who operated in both settings, the wait would be significantly shortened. Volume was found to be significant in explaining variation between surgeons, but practice location was not.

The regression equation from the hierarchical linear model was:

log (wait) = [4.535150 + (0.676349*volume)] +
(.067568 * sex) +
(.003287 * age) +
(0.236709 * hosp1) +
[(0.241668 + (1.087010 * volume) + (-1.461243 * pracloc)) * resid] +
(-0.013682 * SEFI)

This equation was tested on both the first-half and the second-half of the sample to assess how much of the variation was explained by this model. The model explained 32.3% of the variation in waiting times for the first half of the cohort, similar to the 32.5% of the variation explained by the generalized linear model. When used to predict waiting times for the second half of the cohort, the calculated R-square was 34.1%.

Volume had been dichotomized previously. Since it did significantly predict some of the variation between MDs, volume was redefined as the actual number of patients each surgeon had. With that, residence in a LTC facility dropped out of the model, but age, sex, and hospitalization while waiting remained significant Level 1 predictors. The HLM regression equation became:

log (wait) = [4.914874 + (0.002743) * cases] +
(.067583 * sex) +
(.003065 * age) +
(0.234497 * hosp1) +
(-0.013927 * SEFI)

This model suggests that there is significant variation between MDs which can be partially explained by volume. However, there was still significant unexplained variation between surgeons. That the level 1 predictors do not vary between MD suggests that, although the intercept for each MD is different, the slopes are parallel. In other words, the variation in waiting times that is explained by sex, age and hospitalization while waiting is not different between doctors, a finding that could not be explained by GLM.

Tested against the observed CSWLR waiting times (logged), this model performed about the same. For the first-half of the sample, it explained 31.9% of the variance, and 33.2% for the second-half. By way of comparison, a GLM using the same variables (age, sex, SEFI, hospitalization while waiting, and cases) had an R-square of 0.164, and when tested on the second-half sample, predicted 17.7% of the variation in waiting times. Although there is little additional benefit gained by coding volume as a continuous variable, rather than simply dichotomized into high versus low, it does make the HLM easier to interpret since the LTC variable now drops out of the model.

To summarize the findings of the modelling procedures, both the generalized linear model and hierarchical model explained about the same proportion of the variation in waiting times as measured in the Cataract Surgery Waiting List Registry. The GLM variables were age, sex, SEFI, surgeon and hospitalized while waiting. It explained 32.5% of the variation in waiting times. The HLM independent variables were age, sex, SEFI, hospitalized while waiting, and volume of cases, and it explained 31.9% of the variation. Both models performed similarly in predicting waiting time for the second-half of the cohort: the R-square for GLM was 34.3% and for HLM was 33.2%

Discussion

This chapter describes an exploration of the relationship between waiting times for cataract surgery and a variety of potential explanatory variables. By far, the most important variable was specific surgeon. This mirrors a finding that seems to be common knowledge, i.e., that different surgeons have different waiting times, but has not often been noted in the research literature. Of relevance, a study of patients having cataract surgery in Saskatchewan found that one of the most significant predictors of a long waiting time was if the surgeon had a long list (Hadjistavropoulos et al. 1998). Similarly, in the current study, the use of hierarchical linear modelling demonstrated that the volume of surgery significantly predicted the length of waiting time: surgeons with a higher volume of surgery had longer waiting times.

This finding suggests that if caseload were more evenly distributed among surgeons, waiting time variation would be less, and average waiting times might be lower: even though the average wait for what are currently low-volume surgeons would likely increase, the average wait for what are currently high-volume surgeons would decrease. Indeed, in Ontario, Naylor found that for patients referred to a regional co-ordinating office for coronary artery bypass surgery, waits were 22.7 days if the referral office was allowed to find a surgeon or interventional cardiologist, and 35.3 days if one was requested ($p = 0.002$ after adjustment for urgency scores) (Naylor et al. 1993). This argues for the sharing of waiting time information with referring physicians and patients so that they can choose a surgeon with a shorter wait.

It is not certain that surgeons with shorter waiting times would agree to take on more cataract surgery patients. Previously, members of the Department of Ophthalmology have stated that surgeons with shorter waiting times often have sub-specialty surgical interests and they try to keep Operating Room time open to accommodate these interests. These open slots, if not used for specialized surgery, could expedite waits for cataract patients; conversely, the use of O.R. time for sub-specialized types of surgery may prolong the waits for cataract patients. Further work to identify sub-specialties as an independent predictor might prove fruitful.

The mechanics of the Registry may contribute to longer waits for some surgeons. Surgeons are requested to book patients three months in advance of surgery. High-volume surgeons therefore need more patients on their waiting lists to keep a sufficient backlog. For the cohort analyzed in this study, the average number of procedures over a three-month period ranged from 11 to 133. The surgeon who averaged 133 procedures in three months requires more patients on his or her waiting list to make sure that all available Operating Room time is filled.

More research is necessary to understand the characteristics that explain variation among surgeons. Subspecialization is one possible explanatory variable. The comparison between CSWLR and claims data showed that physician style varies in terms of visit patterns and listing in the Registry. This could be explored further, for example surgeons could be described according to their patients' average number of pre-operative visits. Another characteristic might be average visual dysfunction score. One somewhat dated study in the United Kingdom found that ophthalmologists listed patients for surgery with differing degrees of impairment; some had longer lists of less-impaired patients and some had shorter lists of more-impaired patients. Yet patients of both types of surgeons came to surgery with about the same level of symptoms and impairment (Sanderson 1982). Other possible relevant factors are outcomes and referral patterns. Maybe surgeons with high volumes have better outcomes and consequently more clinicians refer to them. Other important surgeon characteristics might be age, gender, or even some psychosocial variables like desire for status (long waiting lists are seen as a status symbol), or need for security.

Being hospitalized during the wait was also found to predict a longer waiting time. Only 8.9% of patients were hospitalized while waiting, and of these, three-quarters were hospitalized only once. Less than 1% of patients were hospitalized three or more times. Given the long waiting times, it is somewhat surprising that the relatively rare occurrence of a hospitalization while waiting could have a significant impact, yet it explained about 2% of the variation in waiting times in the multivariate linear model. Other studies have found that a scheduling delay was associated with longer waiting times (Hadjistavropoulos et al. 1998; Sobolev et al. 2001). That may explain why a hospitalization while waiting predicted longer waiting times. The CSWLR contains data on the reason for a postponement of surgery; it would be instructive to be able to use these data to confirm if hospitalization did result in a scheduling delay.

Age and sex were also found to be significant, with females and older individuals waiting longer. This is an unusual finding. A Swedish study that explored visual problems before and after cataract surgery found that fewer problem areas were reported with increasing age (Lundstrom et al. 1994). If that were true for this cohort of patients, then they would have better visual function, hence lower priority and possibly longer waits. There is some evidence that age is a predictor for poorer outcomes in cataract surgery, even after adjusting for other risk factors (Wong 2001; Norregaard et al. 1998). This might be reflected in longer waits for older patients. The Cataract Surgery Waiting List Registry specifically excluded age as a prioritization criterion, because it was felt that it would be 'socially unacceptable to penalize older patients;' but points are given for threatened loss of employment, which may lead to shorter waits for younger patients who are more likely to be employed (Bellan and Mathen 2001). Having the scores from the visual function questions would permit testing of this hypothesis.

In my previous research, longer waiting times were found for women than for men, however this was a univariate analysis (DeCoster et al. 2000). In this analysis, that relationship remained significant even after adjusting for other factors. Why might this be? It seems unlikely that males would systematically be entered into the Registry at higher levels of dysfunction than females. On the contrary, the Swedish study cited above found that women reported more problem areas than men (Lundstrom et al. 1994). The VF-14 questionnaire has been tested internationally and has been found to have a high degree of reliability (Cassard et al. 1995; Alonso et al. 1997). Therefore, it is unlikely that the VF-14 is biased in favour of males. However, the prioritization score gives weight to the threatened loss of a driving license. In older patients, it may be that women are less likely to drive, so this criterion may have the effect of favouring men over women.

Also interesting in this study are the characteristics that were found not to be significant. In my previous research, patients who had surgery in a clinic were required to pay a fee of approximately $1000. Public-sector waiting times were longest for surgeons who also had a private practice. Now that the government pays all costs, regardless of site, there is no difference in waiting times between the two types of surgery sites. That is, waiting times are no different if the surgery is at a clinic versus the hospital. This could be viewed as evidence in support of the ophthalmologists' contention that the previous difference in public-sector waiting times reflected volume of surgery, not having a private practice.

However, one might interpret this finding from a different perspective if one looks at the incentives in play. Previously, there was an incentive to have long public-sector waits to encourage patients to have surgery privately. Now, the incentive is to have the private clinics fully booked since the physician/owners still profit. A difference in waiting time is not relevant anymore. What is relevant is to make it so that patients are indifferent to which site they have surgery, since waits are the same. In this way, surgeons can be sure that they can make full use of the Operating Room time in the clinics. Anecdotal support for this reading of the data is that the fee per case at the Pan-Am Clinic has been negotiated down from $1000 to $700 since the Clinic is now publicly owned.

Measures of general health status also had no relationship to differences in waiting time. Number of ADGs, a measure which is based on the number of unique diagnoses in a year, and number of different drugs, were not related to differences in waiting times. There is evidence that poorer general health status is related to poorer outcomes of cataract surgery (Norregaard et al. 1998). Thus, it might be expected that patients with poorer general health might wait longer. Also, since cataract surgery is a quality-of-life procedure, it would not be surprising if patients who were in poorer health were at a disadvantage in waiting for surgery. On the other hand, one might argue that patients who have a number of other conditions are in greater need of having their cataracts operated on, so that they are not further hampered in their activities of daily living by poor vision.

Other characteristics found not to be significant were region of residence and SEFI. This finding is reassuring, and suggests that the publicly financed health care system is working the way it should. In the univariate analysis, SEFI had a p-value of 0.06 and was negative. In other words, patients who had higher socioeconomic risk tended to have shorter waiting times, but this was not statistically significant. It has been suggested that cataract indicates poor health status and is more prevalent in those with lower socioeconomic status (Meddings et al. 1998; Minassian et al. 1992). Possibly cataracts not only occur earlier in individuals with lower socioeconomic status, but also they might be more severe, which would explain why these patients had slightly shorter waits.

This analysis was limited by lack of clinical data on visual dysfunction, visual acuity and ocular comorbidity. Having these additional indicators might increase the strength of the models. Alternatively, some of the explained variation might disappear with the addition of these clinically meaningful variables. However, given the large sample size, it is plausible to assume that these clinical factors are homogeneously distributed among patients.

In summary, individual surgeon explained a large proportion of the explained variation between waiting times. The generalized linear model explained 32.5% of the variation between waiting times; specific surgeon explained 29.5% of the variation. The hierarchical linear model explained a similar amount of the variation. The benefits of HLM are that it more clearly reflects the organization of the data, and accounts for non-independence, if any, between observations. HLM demonstrated that the significant patient predictors did not vary by surgeon. The disadvantage of HLM is that the software, process and interpretation of using HLM is currently less well understood and less accessible than that of GLM, which in this case performed equivalently. Mean and median waits vary substantially between surgeons: the lowest mean wait was 67 days and the highest 359 days; the medians were 61 and 399, respectively. The big differences that patients can expect to wait, depending on the surgeon that they see, is a subject that merits further investigation.

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CHAPTER SIX: CONCLUSIONS AND KEY MESSAGES

This thesis has been about waiting times for elective surgery, particularly cataract surgery. It opened with a chapter on the context in which this issue is played out in Canada, emphasizing the roles of key players, especially government, physicians and the media. The next two chapters focussed on how waiting times are measured. Chapter Two described general issues to consider, what an ideal system might look like, and two research projects which used administrative data to measure waiting times for eleven elective surgical procedures in Manitoba, from 1992/93 to 1998/99 inclusive. Chapter Three linked data from the Cataract Surgery Waiting List Registry with the Population Health Research Data Repository. The claims method of estimating wait times was then compared to the waiting times in the CSWLR. The next two chapters looked at factors that are associated with differences in waiting times, using a literature review to identify relevant characteristics, and then modelling the relationship between specific predictors and waiting times.

As a concluding chapter, this chapter is meant not to reiterate the conclusions from previous chapters, but to bring them together into messages that arise from the work as a whole. It will focus on five key messages that have arisen as a result of this work, and it will list several policy-relevant suggestions. The five key messages are:

1. Choice of surgeon can have a major impact on waiting times;
2. Claims data can be used to monitor waiting times for surgery.
3. Waiting times are incredibly complex, and as a result, difficult to measure and to manage;

4. The process of the advancement of scientific knowledge occurs in a variety of ways.
5. The health care system is dynamic, yet it seeks a level of equilibrium.

1. Impact of specific surgeon

This research has demonstrated that surgeons have a major impact on waiting times. Physicians are the gatekeepers to the system and how they manage their patient and their practice influences how many patients are waiting for a procedure and when that wait begins. Furthermore, in our system, physicians practice with a great deal of freedom; within budget parameters specified by government, they decide how resources are to be allocated. Many people (this seems to be more often true of older patients who are the ones primarily having cataract surgery) accept without question the advice their physician gives them. Patients and public tend to believe that physicians practice in objective, standard ways based on scientific evidence. Academics involved in health services research may be more sceptical; for instance, the evidence for small-area variation in procedure rates suggests that a great deal of discretion is common in medical care. Nevertheless, the influence of physician practice style on waiting times has seldom been researched, and the findings of this study were therefore surprising.

In the generalized regression models, choice of surgeon explained 29.5% of the variation in waiting times. In social sciences research this is a very strong association. The hierarchical model showed that volume of cases was responsible for some of that variation, yet significant variation between surgeons remained. Older age, female gender and being hospitalized while waiting predicted a longer wait but these did not vary between surgeons. Other factors need to be considered.

Evidence of different practice-styles was seen in the comparison of waiting times between the Cataract Surgery Waiting List Registry (CSWLR) and claims data. Recall that in the original claims method the pre-op visit closest to surgery was flagged as the beginning of the wait (unless it was for an axial measurement). The waiting-time dates matched in 70.6% of patients using the original claims method. For seven surgeons, the match rate was over 80%; for five it was less than 60%, and for two of these, the match rate was only 12.4% and 15.3%. It might be assumed that surgeons with a lower match rate were more likely to be the high-volume surgeons, since these surgeons had longer mean wait times, and might therefore be more likely to have patients revisit them prior to surgery. This was not the pattern: of the seven high-volume surgeons, four had match rates of 85% or higher, which means that the visit closest to surgery was the one where patients were entered to the Registry. To put it simply, physicians manage their patients differently.

Most of the literature reviewed focussed on patient characteristics that were associated with waiting time differences. Although it is widely acknowledged that surgeons have different wait times, this is an avenue of very little inquiry thus far. This study demonstrated that volume of surgery was a significant predictor of variation in waiting times. Other surgeon characteristics also need to be explored, for instance, pre-operative visit patterns, sub-specialization, and sociodemographic characteristics. In addition, it may be important to reframe other characteristics previously described as patient- related. Specifically, how do patient characteristics influence physician behaviour? For example, how does socioeconomic status or employment influence physician decision making? Alter found that many clinicians admitted to expediting access if the patient was a high-profile public figure (Alter et al. 1998), and Naylor found that clinicians prioritized hypothetical patients for cardiac surgery depending on type of employment (Naylor et al. 1992). Perhaps other patient characteristics also need to be viewed in this way. It is a different framework for viewing the waiting time issue and suggests a different avenue of inquiry.

From a policy-perspective, the impact of physicians in waiting time variation stresses the importance of including physicians in any plan to manage waiting times. This concept was understood by the participants of the Western Canada Waiting List project. The Research Director was a physician, and the clinical panels charged with developing the prioritization tools were comprised mostly of physicians. Physician buy-in is critical to any initiative to manage waiting times, but it is often difficult to obtain. When the Medical Care Act came into effect in Manitoba in 1969, physicians essentially gave up the right to control their fees for the right to control clinical decision-making. Efforts to measure waiting times can be viewed as an infringement on their clinical autonomy, more so if the measure includes a system of prioritization, and physicians perceive that the measure will lead to patient management, i.e., a redistribution of their patients, or a questioning of the appropriateness of surgery. This may explain why physicians in Winnipeg have resisted efforts of the Winnipeg Regional Health Authority to establish registries for cardiac and total joint replacement surgery.

The next logical question is, How does one go about obtaining physician involvement? It would be useful to have a primer on what works and what does not. This could incorporate a review of the literature as a starting point. Relevant fields to consult for the literature review would include the fields of research/knowledge transfer, organizational behaviour and change management. It could also incorporate initiatives or models that have been successful elsewhere. These might be identified in the literature (both academic and popular), and might be enhanced by interviews with key individuals involved with such successes.

2. Use of claims data to monitor waiting times

This research has demonstrated that claims data can be used to estimate waiting times for surgery. The claims method of estimating waits performed quite well, matching the Registry on roughly three-quarters of patients, however it underestimated the mean and median waiting times. This discrepancy appears to be related to the misclassification of the beginning of the wait time for some patients, in which the visit closest to surgery was not an accurate measure of the beginning of the wait time. Modification of the claims method to assign the beginning of the waiting time to the second closest visit if the first visit was within 70 days (or 42 or 56 days) improved the match rate by about 7% and predicted mean and median waiting times that were closer to those of the CSWLR. It is likely that a modification like this would not be necessary for shorter-wait procedures.

Analysis of the data permitted the modification to the claims method to match more closely the CSWLR. It may not be necessary to have two data sources to achieve this. Surveys of physician offices could determine whether surgeons routinely schedule another pre-operative visit if they have not seen their patients for a period of time, and that period of time could also be ascertained. Surveys such as these need not involve all types of surgeons, but could focus on areas which appear to be a problem. Given the influence of physician practice patterns on waiting times, and the importance of physician involvement, feedback such as this makes sense.

It should be noted that although the claims method may underestimate waits, especially for long-wait procedures, Registries my over-estimate the waits. Possible sources of over-estimation in the CSWLR are inclusion of second-eye surgery in the estimation of waiting time when both eyes are listed simultaneously, and the inclusion of patients who have postponed surgery. Reports of average waiting times using data from any patient registry may be distorted for reasons like this.

Use of the last pre-op visit before surgery as the beginning of the waiting time was supported by Shaw and Shortt's analysis of over 30,000 surgeries that took place in Kingston (Shaw and Shortt 2000). They too found that for some procedures (although not cataract surgery), the last pre-op visit underestimated the true waiting time. Using claims data to estimate waits in this way affords a relatively easy method for Ministries of Health to monitor waiting times without the need to establish the more resource-intensive registries. This is especially relevant in Manitoba, where data from the existing Registries are either incomplete or inaccessible.

3. Complexity of waiting times

Waiting times are often perceived as relatively straightforward: If there is a long wait for a procedure, you just need to do more of them, and the waits will go down. However, the reality is much more complex, making them a difficult problem to manage. Evidence is limited and rhetoric abounds. Below are some (not all) of the common beliefs about waiting times and a brief presentation of the evidence concerning each.

"I'm on the waiting list for . . ."

For the most part, there is no centrally co-ordinated master list of how many patients are waiting, for how long, for what procedures and who their physician is. A personal example will illustrate my introduction to this issue: During my studies for my Master's degree, one of my courses was on dynamic modelling. I thought it would be interesting to model the events that affect waiting times for cardiac surgery. I spoke to the Cardiac Surgery Nurse whose responsibility it was to schedule and contact patients for the coming week. I was surprised to learn that there was no waiting list, and that the nurse spoke to each of the six cardiac surgeons each week to find out which patient to contact for the coming week. That situation has changed for cardiac surgery now, but for most other types of surgery, it has not. The notion of a 'list' is comforting, denoting an orderly queue where patients are served in a systematic fashion, but as Light put it: '[S]o-called waiting lists are *pools*. Patients swim around in them, treading water until someone fishes them out.' (Light 1999)

Even where waiting lists do exist, there are inconsistencies across them that can distort the meaning of the measured waiting time. For example, in the CSWLR, there was inconsistency in when surgeons put their patients on the list. Overestimates can occur if patients who should be removed from the estimate are not. Regular list audits are necessary to identify patients who should be removed because they have moved, died, no longer need or want surgery, or had surgery elsewhere. One of the advantages of using claims data to estimate waiting times is that they include only patients who had the procedure, so there is no issue of list inflation.

"Waiting times are long and getting longer."

Since waiting times are not generally measured, the waiting times are for most types of health care are unknown. Because of this lack of information, much of this thesis focuses on measurement. An ideal method of measuring waiting times would include not just measurement of the wait, but a method of prioritizing patients so that sicker patients receive treatment first (DeCoster 2002). Furthermore, information about surgeons' average waiting times would be shared so that referring physicians and patients could request a specialist with a shorter waiting time if they chose. Without standardized, universal data collection systems, we do not know how long waits are, or if they are getting shorter or longer.

"Waiting times are growing because of cutbacks, and more resources would reduce waits."

Cataract surgery can be used as an example to refute this statement. In Manitoba, the number of cataract procedures in the public sector increased 52% from 4040 in 1992/93 to 6121 in 1998/99, and the age-sex standardized rate increased 45%, from 3.57 to 5.18 per 1000 population. The public-sector median waiting time was 16 weeks in 92/93, fell to 12 weeks in 1994/95 then increased to 18 weeks where it stayed from 1996/97 through 1998/99. In 99/00, the number of publicly funded procedures was 8520, for a rate of 7.14 per 1000. For the patients who formed the cohort analyzed in this study, the wait times were again 18 weeks in 1999/2000.[1] These data demonstrate two things. First, the number of cataract surgery procedures has not been cut back; publicly funded procedures have more than doubled in less than ten years.[2] Second while the number of procedures has been growing, the waiting times have not decreased.

Other types of surgery also provide evidence contrary to this perception (DeCoster et al. 2000). In Manitoba, data from 1992/93 through 1998/99 showed the rate of coronary artery bypass surgery increased and the waiting time decreased. For prostate surgery, the rate decreased as did the waiting time. Breast tumour surgery and tonsillectomy rates both increased, and so did their median waiting times. Thus the relationship between additional resources and reduced waiting times is unpredictable.

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[1] Waiting times were calculated with the original claims method across all years to provide a fair comparison.

[2] I overheard a senior remark in a coffee-shop: 'When I was a kid, we all had our tonsils out. Next it was our gallbladders. Now, we're all having our cataracts done.'

"Waiting times are too long and it's unsafe for patients."

Anecdotal evidence suggests that waits are quite long for some procedures, notably cataract surgery, and knee/hip replacement. My research demonstrated that for most procedures, waiting times were not very long (DeCoster et al. 2000). With the exception of cataract surgery, the waiting times for eleven elective procedures studied were under sixty days, and for six of them the median waits were around thirty days in 1998/99. Although these waits do not seem to be excessive, it is important to realize that there are few established benchmarks to support that statement. More work is required in this area to measure the burden of illness while waiting, as well as outcomes of surgery, the impact of waiting on outcomes, and the outcomes of non-surgical alternatives as well.

Although there are few benchmarks, for two of the eleven procedures studied there is some literature on recommended maximum waiting times (RMWT). For carotid endarterectomy, there were two papers: one used a benchmark of 21 days for symptomatic disease and 90 days for non-symptomatic (Sobolev et al. 2001); the other used a RMWT of two weeks for symptomatic disease and four week for non-symptomatic (Turnbull et al. 2000). Manitoba patients waited a median of 32 days in 1998/99 for carotid endarterectomy, within both guidelines (there was no information on whether the disease was symptomatic or not). For coronary bypass surgery, patients who wait more than 90 days are considered delayed (Carroll et al. 1995). In 1998/99, 85% of patients received their surgery within 90 days.[3] This evidence using Manitoba data suggests that patient waiting times were not unsafe.

"The presence of a parallel private system reduces waiting times in the public sector."

The available data indicate that, while having competition is beneficial to those who can take advantage of it, i.e., those who can pay for private insurance, it does not appear to lead to shorter waiting times in the public sector (DeCoster et al. 2000; Marber et al. 1991; Dowling 1997). Even if the surgery is publicly financed, the presence of a competitive market appears to drive up waiting times. Waiting times for cataract surgery in Alberta were longest where all of the surgery was contracted out to the private sector, even though it was publicly financed (Armstrong 2000).

So what can be done?

Given their complexity, what can be done about managing waiting lists? Surely, the first step should be accurate measurement. In a paper included in this thesis, the merits and drawbacks of different measurement systems were discussed, and a recommendation was made for a system that included prioritization criteria to permit both measurement and management (DeCoster 2002). While such a system would not do away with waiting times, it would permit a fairer assessment of the issue, drawing the debate away from rhetoric and anecdotes towards evidence and objectivity. Also important would be research into the burden of illness patients experience while waiting, as well as outcomes of

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[3] The Cardiac Care Network of Ontario has seven different urgency categories with RMWT for each. Now that Manitoba is a node of the network, those data may soon be available for analysis.

surgery with the view to establishing guidelines with respect to maximum waiting times for more procedures. Maximum waiting times should not be guaranteed but should be guidelines: steps could be taken to try and expedite the patients who are near the maximum (for example, they might be asked if they would like to switch surgeons if that would shorten the wait), but having a guarantee leads to distortions as patients who are near their 'time-limit' are given precedence over more urgent patients who have waited less time (NHS Consultants' Association 2000).

4. Building scientific evidence

Chapter Four contained a diagram (Figure 4.1) to illustrate how scientific evidence accumulates. A diagram like this is perhaps unusual in a doctoral thesis as it speaks to my personal viewpoint. The paradigm of scientific research as it is presented in peer-reviewed publications and scientific meetings is to cite evidence pertinent to the research question, describe methods and findings, and interpret them in the discussion. The style of writing is formal, objective and employs the passive voice and the third person. During the course of this thesis, I have devoted some thought to the scientific process; one result of the body of work presented here is to reach some insights into the scientific process. Because this viewpoint is personal, this section must also be perhaps more personal than is customary.

The steps illustrated in Figure 4.1 were: (1) information gathering (2) noting patterns (3) generation of hypotheses (4) testing of hypotheses. These steps are not necessarily linear, and are always iterative. Gathering information comprises several activities: literature review is the principal one, but science is also informed by anecdotes and news accounts, popular media, discussion with others, and experience.

The next step is noting patterns and grouping of data. The most *obvious* example of grouping was in Chapter Four when the research papers were grouped into three categories of evidence, and the factors thought to be associated with variation in waiting times into four categories. The most *significant* example of noting patterns was the pattern seen when I plotted the waiting time distributions for the CSWLR and the claims data on one chart. That experience made concrete a previously heard piece of advice: Graph your data. The chart suggested how to go about modifying the claims method to match more closely the CSWLR data; the spreadsheet could not yield that insight.

One other note about categorization: it is very difficult once information has been grouped not to be constricted by that categorization. In other words, once a grouping scheme has been developed and information is slotted into a group, there is a risk of becoming blinkered, and not seeing an alternative organizing principle. Predictors were grouped into four categories, one was labelled 'Patient Characteristics,' and another, 'Provider Characteristics.' What I did not see because of that grouping was the possible interaction between the two, i.e. that physicians respond to patient characteristics and may treat patients differently because of them.

Hypotheses grow out of the patterns observed. I developed hypotheses for modifying the method of using claims data to estimate waiting times; these I tested by using correlation and ANOVA. I also developed a number of hypotheses with respect to the characteristics that seemed to be related to waiting times for surgery. These were tested with two types of linear regression models, hierarchical and generalized. The finding that volume explained some of the variation in physician waiting times is a new contribution, suggesting the need to rethink the significance of surgeon characteristics in explaining waiting time variation—a potential area for further research.

5. Dynamic health care system

The last message is a theory that I have been developing not only from this research, but also from other work with which I have been involved. The developing theory is this: Although the health care system is a dynamic one, it seeks an 'equilibrium' level.

This phenomenon first became evident during a different project, one that looked at long-term patients, i.e., those staying more than 30 days, in an acute care hospital (DeCoster and Kozyrskyj 2000). Even though the number of hospital beds had decreased and the number of nursing home beds had increased in Winnipeg, the proportion of acute-hospital patients that were long-stay was remarkably stable. In every year, approximately 5% of medical-surgical patients were long-stay patients and these patients consumed about 39% of the days. This was quite surprising. It suggested that despite all the changes in resources, the hospital system was 'comfortable' with having a certain level of long-stay patients.

With the waiting time data, there was also some evidence of this tendency. For four years in a row, the median waiting time for cataract surgery was 18 weeks (using the original claims method), even though the volume of procedures was steadily increasing. Given that the overall average remained at 18 weeks, this could mean that individual surgeons keep their waiting lists at a certain length. It may be that surgeons become accustomed to having a waiting time that is a certain length, even if it is quite long, and try to maintain it. This is a testable hypothesis.

Two papers from the United Kingdom also suggested this tendency. In the UK, where there were huge funding initiatives intended to reduce waiting lists, the *size* of the wait list increased, but the average wait *time* stayed around the same in the 1990s as it was in the 1960s. More patients were referred by general practitioners to specialists, and more patients actually underwent surgery, but the *proportion* of referred patients that went on to have elective surgery stayed quite constant (Hamblin et al. 1998; Harley 2001). Because of funding increases, the number of available surgery 'slots' increased, and more patients could be accommodated, but the waiting time remained the same.

These examples illustrate that the health care system, while dynamic, seeks an equilibrium level. Pessimistically, that can be interpreted to mean that nothing can ever change. A more optimistic view is that change is possible, but it is incremental as the fluctuations move slowly one way or another over time.

Policy implications

Several of the findings of this thesis have policy relevance, and in closing, these are listed below.

1. Better measurement of waits—how many people are waiting, for what procedures, for how long, at what level of dysfunction or disability—are required in order to manage waits. Physicians must be involved in any plan to measure and manage waits. Since running a Registry is expensive, focussing on long-wait procedures (as the WRHA is doing) may be a good first step.

2. In an examination of waiting times for eleven elective surgical procedures, for all except cataract, the waits were under sixty days. However, waiting times for most procedures appeared to be getting longer over the last two years of study (1997/98 and 1998/99) compared to earlier years (1992/93 to 1996/97).

3. A high proportion of records, 97%, were linked between the Cataract Surgery Waiting List Registry and claims data. Of the linked patients, 99% were found to have a pre-operative visit to the operating surgeon, suggesting that the claims data method captures the waiting time for most patients.

4. Using claims data to estimate waiting times may underestimate actual waiting times for long wait procedures, such as cataract. An understanding of physician practice patterns is necessary to modify the claims method appropriately.

5. Procedure-specific registries may overestimate the wait if they are not audited regularly to remove patients no longer waiting for surgery. In the Cataract Surgery Waiting List Registry, sources of overestimation are the inclusion of patients who have

delayed their surgery, and the inclusion of waits for second eye surgery when both eyes are listed simultaneously. Also, patients whose surgery has been delayed, for example, because of a hospitalization or for personal reasons, should not be part of the calculation of average waiting times.

6. Choice of surgeon contributes a significant amount of the variation between waiting times. Surgeon-specific average waiting times should be available to funders, referring physicians and the public.

7. Volume of surgery was one of the significant predictors of variation in waiting times between surgeons. More research is necessary to understand the reasons for this finding, and to determine other reasons for variation between surgeons.

8. Management of waiting times is difficult. Two 'solutions' that do not work are: increasing the resources available and having a parallel private sector.

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