Developing an Objective, Efficient, and Cost-Effective Approach to Managing the Waiting List for Cardiac Catheterization

June 2005

Dr. Madhu K. Natarajan
Dr. Heather Arthur
Dr. Amiram Gafni
Dr. Douglas Holder
Dr. Diwakar Gupta
Dr. Salim Yusuf

Funding Provided by:
Canadian Health Services Research Foundation
Principal Investigator:

Dr. Madhu K. Natarajan  
Associate Professor,  
Division of Cardiology  
Hamilton General Hospital  
Room 260, McMaster Clinic  
237 Barton Street East  
Hamilton, ON L8L 2X2

Telephone: 905-527-6241  
Fax: 905-527-2337

Primary e-mail: natarajm@ccc.mcmaster.ca  
Secondary e-mail: nataraja@mcmaster.ca

This document is available on the Canadian Health Services Research Foundation web site (www.chrsf.ca).

For more information on the Canadian Health Services Research Foundation, contact the foundation at:  
1565 Carling Avenue, Suite 700  
Ottawa, Ontario  
K1Z 8R1  
E-mail: communications@chsrf.ca  
Telephone: 613-728-2238  
Fax: 613-728-3527

Ce document est disponible sur le site Web de la Fondation canadienne de la recherche sur les services de santé (www.fcrss.ca).

Pour obtenir de plus amples renseignements sur la Fondation canadienne de la recherche sur les services de santé, communiquez avec la Fondation :  
1565, avenue Carling, bureau 700  
Ottawa (Ontario)  
K1Z 8R1  
Courriel : communications@fcrss.ca  
Téléphone : 613-728-2238  
Télécopieur : 613-728-3527
Developing an Objective, Efficient, and Cost-Effective Approach to Managing the Waiting List for Cardiac Catheterization

June 2005

Dr. Madhu K. Natarajan
Dr. Heather Arthur
Dr. Amiram Gafni
Dr. Douglas Holder
Dr. Diwakar Gupta
Dr. Salim Yusuf

Acknowledgements:
I would like to thank 1) the co-investigators: Dr. Heather Arthur, Dr. Amiram Gafni, Dr. Diwakar Gupta, Dr. Douglas Holder, Mr. Donald Shilton, and Dr. Salim Yusuf for their support on the various aspects of this grant; 2) Cheryl Christmas, Kirsten Kachmar, Corinne Tartaglia, and Deborah Weber for co-ordinating the data management of the registry; 3) Rizwan Afzal for statistical assistance; 4) the referring physicians for completing referral forms; 5) the invasive cardiologists for completing preliminary report forms; 6) the Heart Investigations Unit staff for help in data and forms collections; and 7) Vivek Krishnamurthy for reviewing the final report and his insightful comments. I would also like to thank the Hamilton Health Sciences Cardiac and Vascular Programme for co-sponsorship of this grant.

The SORT Registry and work on this grant has provided background data for other successful grant applications:

“The Hamilton Region Primary PCI Initiative Project” awarded by the Change Foundation of Ontario, Principal Investigator — Dr. M.K. Natarajan

“The Effect of Early Education on Patient Anxiety While Waiting for Elective Cardiac Catheterization” awarded by the Heart and Stroke Foundation of Ontario, Principal Investigator — Dr. H. Arthur
# Table of Contents

Key Implications for Decision Makers ........................................................................................................i 

Executive Summary........................................................................................................................................ii 

Context.........................................................................................................................................................1 

Objectives ....................................................................................................................................................1 

Approach......................................................................................................................................................1 

*What is Cardiac Catheterization?* ..............................................................................................................2 

*The Prospective Registry* ..........................................................................................................................2 

Catheterization Registry Simulations ...........................................................................................................4 

Strategies for Prioritizing Waiting Lists ......................................................................................................8 

Epilogue .......................................................................................................................................................10 

Conclusions..................................................................................................................................................11 

References...................................................................................................................................................12 

Appendix.....................................................................................................................................................13
Key Implications for Decision Makers

Cardiac catheterization is a surgical diagnostic procedure for heart patients. Waiting lists at Hamilton Health Sciences were studied to determine the best way to reduce waiting times to acceptable levels (between 1998 and 2000, only 37 percent of procedures were completed within the recommended waiting times).

- It is more expensive to keep patients in the hospital on a waiting list than to perform a cardiac catheterization. Keeping 900 inpatients in the hospital for more than the average seven-day wait was associated with excess costs per year of $2,025,000 for procedures done during normal hours and $1,705,500 for procedures done after hours.

- One-time increases in capacity to reduce or clear existing backlogs are ineffective, as waiting times will rise back to unacceptable levels once the one-time increase is withdrawn.

- Simulations on the effect of a SARS-like crisis showed that waiting times for urgent inpatients took weeks to return to their pre-crisis levels, nearly three years for urgent outpatients, and more than 10 years for less-urgent outpatients.

- Allowing patients and/or referring physicians to choose a particular specialist did not have an effect on waiting times.

- Waiting times are associated with many adverse effects for patients: hospitalization, heart attack, congestive heart failure, death, lower quality of life, higher anxiety, and more physical pain.

- Simple process changes could allow more patients to be treated:
  - having the same physician perform the same kind of procedure in the same lab consecutively;
  - moving most pre-surgical preparation from the catheterization lab to a pre-operative staging area;
  - allocating less time in the schedule to each procedure (as most procedures finish early); and
  - scheduling some diagnostic sessions as possible treatment sessions (since about 70 percent of treatments are done on an ad hoc basis at the same time as the diagnostic).

- Improved primary diagnosis could reduce the number of minimally ill or disease-free patients undergoing catheterization. Approximately one-third of patients have minimally diseased or normal arteries, and even a one-fifth reduction in the number of healthy patients would have the same effect as opening three new catheterization labs in Ontario.
Executive Summary

Cardiac or heart catheterization is a procedure that involves inserting a catheter through a vein or artery into the heart to measure pressures, inject dye, and take X-ray images. This procedure plays a pivotal role in managing patients with heart disease. Long waiting times for cardiac catheterization are common in any publicly-funded health system such as Canada’s. We found that waiting for catheterization is associated with major adverse cardiac events such as hospitalization for unstable angina (chest pain), myocardial infarction (heart attack), congestive heart failure, and death. These event rates are higher in outpatients, who wait for the procedure for a significantly longer average period of time than inpatients. A significant proportion of these events may be preventable if patients receive their procedure in a timely manner.

Waiting is also associated with a worsening of other aspects of a patient’s health. Patients on the waiting list for cardiac catheterization have a lower quality of life and higher anxiety levels compared to the overall population, adjusted by age and gender. Excessive waiting times are associated with a further worsening of these indices, including anxiety and physical pain.
Simple interventions, such as having a nurse available for telephone consultations with patients who are waiting for catheterization, result in less anxiety for patients on the waiting list.

Long waiting times, especially for inpatient procedures, represent a misallocation of healthcare dollars towards maintaining patients in hospital beds that could be better used to provide patients with the treatments for which they are waiting.

Simulation models developed for this study demonstrate a severe lack of cardiac catheterization capacity in Hamilton during the study period, which can potentially be alleviated by expanding available capacity from three labs to four, as well as by extending working hours. Severe capacity limitations also confer a potential risk of significant strain when subjected to an adverse shock, such as the SARS crisis of 2003, or rapid changes in technology or practice patterns, such as direct angioplasty for myocardial infarction.
However, increasing capacity is not the only solution to the problem of long waiting lists.

A comprehensive approach is required that a) incorporates initiatives such as improving the efficiency of procedures (for example, reducing variability of service provision and increasing unplanned angioplasty with diagnostic catheterization); b) the methods by which patients are triaged (such as prioritizing high-risk patients for earlier access); and c) continuous prospective monitoring of these implementations in the form of a registry. These strategies will be potentially effective in improving throughput, reducing burden of the wait (such as reducing morbidity, hospitalizations, and anxiety), and increasing cost-efficiency. These initiatives are required both at the provincial level (such as through the Cardiac Care Network of Ontario) and the regional and institutional levels.
Context
The problem of long waiting times for essential medical services under Canada’s publicly funded healthcare system has emerged as a leading public issue in the last decade. It has attracted the attention of academics, editorialists, physicians, and politicians who are sensitive to the electorate’s concern over this issue. On the face of it, both the problem and its solution appear to be a simple matter of a mismatch between the demands for certain kinds of medical services and the capacity of the healthcare system to provide them. As a result, most of the public debate on the issue of waiting times has centered around various proposals to boost the capacity of the system to provide services that are in high demand, usually accompanied by commitments from governments to reduce waiting times for given procedures to below certain arbitrary thresholds.

While increasing capacity certainly plays an important role in bringing waiting times down to acceptable levels, the purpose of this paper is to show that the ultimate success of any strategy to reduce waiting times requires a better understanding of how waiting lists form, behave, and respond to a number of different circumstances. Between the years 2000 and 2003, the Canadian Health Services Research Foundation funded a unique interdisciplinary research project at Hamilton Health Sciences/McMaster University that generated just such a systematic understanding of the dynamics of waiting lists. This research is yielding a number of innovative new techniques for the superior management of waiting lists for a particular procedure (cardiac catheterization), which has the potential to be generalized and applied to other areas of the healthcare system that experience similar waiting list issues.

Objectives
Our purpose in launching the project was threefold: 1) to develop an understanding of the burden to patients and to the healthcare system of excessively long waits for cardiac catheterization; 2) to develop a rational method for prioritizing patients waiting for catheterization that reduces the morbidity and the mortality of the wait; and 3) to generate an understanding of waiting lists as dynamic systems that respond in often unexpected ways to changes in demand, supply, and changes in the state of medical science.

Approach
The ongoing project has three interrelated components. The first is the creation of a prospective registry containing the demographic and medical details of every patient treated at the Heart Investigations Unit at Hamilton Health Sciences, Hamilton, Ontario. The registry documents the length of the wait endured by patients in need of cardiac catheterization and the consequences of the wait on their health. The second component is a simulation project that uses the data from the prospective registry to understand the dynamics of the waiting list, identify inefficiencies in
the treatment of patients, and model changes in procedures and new capital investments that hold the promise of reducing waiting times. The third component of the project uses the prospective registry data to develop better indicators of the severity of a patient’s condition to prioritize them better and improve patient outcomes.

The rest of the paper will summarize the findings of the three components.

What is Cardiac Catheterization?
Cardiac (heart) catheterization (or angiography) is an X-ray-based procedure generally performed at specialized cardiac centers across Canada. For patients with coronary artery disease, catheterization provides information for best management with coronary angioplasty/stents or coronary bypass surgery. For patients with other heart conditions such as cardiomyopathy, valvular conditions, and congenital conditions, catheterization assists in choice of further surgical and medical interventions.

The Prospective Registry
Catheterization is not usually a primary diagnostic procedure; thus, patients are usually sent for catheterization only after undergoing more routine, non-invasive tests such as an electrocardiogram, echocardiogram, or treadmill stress test. Making a virtue out of the necessity that our patients are formally referred to the Heart Investigations Unit by their physician after primary diagnostic procedures are carried out, in 1998 we decided to create a prospective registry (Study Of Registry and Triage (SORT) Registry) of all catheterization referrals to address the lack of data needed to answer such basic questions about the waiting list for the procedure for catheterization such as who waits and for how long. Data in the registry reflect information supplied to the Heart Investigations Unit by a patient’s physician at the time a referral is made, and they include information on the patients’ socio-demographic profiles, their medical conditions and history, and the referring physician’s assessment of the urgency of the procedure.

The first phase of the registry operated from April 1, 1998 to March 31, 2000, during which time 8,030 patients were referred to Hamilton Health Sciences for cardiac catheterization. Of the 8,030 patients, 4,725 were outpatient referrals, with a mean age of 63.3 years, while the remaining 3,305 were inpatient referrals with a mean age of 64.4 years. The data were reported in the *Canadian Medical Association Journal* and quantified the length of the wait for cardiac catheterization in Hamilton and the effects of these waits on patient health. The study found that only 37 percent of procedures were completed within “recommended” target waiting times and that the median waiting times of six days for inpatients and 60 days for outpatients were significantly worse than the target times of two days for inpatients and either seven or 30 days.
for outpatients, depending on the urgency of their case. Overall, 109 patients suffered an adverse cardiac event while waiting for catheterization, of which 33 were inpatients (one percent of the inpatient population) and 76 were outpatients (1.6 percent of the outpatient population). Fifty patients died, 32 suffered myocardial infraction, and 41 experienced congestive heart failure while on the waiting list. The median time to a major cardiac event was two days among inpatients and 35 days among outpatients.

In a second analysis, Natarajan and Arthur sent questionnaires to 1,500 outpatients waiting for catheterization that generated scores measuring their anxiety levels, the severity of any angina (chest pains), and their quality of life during a waiting period that averaged between 13 and 16 weeks. Nearly 1,000 questionnaires were returned, with 286 having both baseline and follow-up time-points and included in the final analysis. Self-reported quality of life of patients waiting for cardiac catheterization was approximately 40 percent worse than that of the general population, controlling for age, gender, and other socio-demographic factors. There was also a marked decline in perceptions of health and an increase in the severity of reported angina as waiting times increased.

Subsequently, a randomized study reported by Harkness et al conducted on the catheterization registry patients found that simple measures such as a one-hour intervention by a cardiology nurse at the beginning of the waiting period, consisting of viewing a video about catheterization followed by a question and answer session, can reduce patient anxiety. Although anxiety increased during the waiting period for catheterization in both groups, patients receiving the nurse intervention reported a 23-percent reduction in perceived anxiety as compared to the control group. The finding is significant not only because anxiety is associated with patient’s quality of life but also because anxiety may result in the further deterioration of the physical health of patients, increasing the urgency level of their cases and the burden on healthcare system dollars.

Subsequent analyses conducted using data generated from the registry sought to better understand the costs associated with waiting in terms of healthcare expenditure and patient quality of life. Natarajan and Gafni compared the costs of providing accelerated access to catheterization (within seven days of admission) to all inpatients with the cost of having inpatients occupy hospital beds while they wait to be catheterized. During the study period, the average inpatient waiting time was seven days, with a range between one and 22 days. Among those who waited more than seven days, the average waiting time was 10 days. Given that the average cost in Ontario of keeping a person in hospital at the time was approximately $1,000 per day, the total cost to
the healthcare system of maintaining the 900 inpatients who waited more than seven days for cardiac catheterization was $2.7 million. By contrast, the average cost of performing a cardiac catheterization at Hamilton Health Sciences during normal working hours was approximately $750 per procedure, rising to $1,105 for procedures performed after hours. Thus, if sufficient capacity existed in the Heart Investigations Unit to catheterize all inpatients within seven days of referral, the total cost of all 900 procedures would have been $675,000 during normal hours and $994,500 during overtime hours, representing savings of $2,025,000 and $1,705,500 per annum over having patients wait an additional three days. If sufficient capacity within the Heart Investigations Unit did not exist, then capital costs to expand capacity would need to be factored in. In general, building and equipping a new catheterization lab costs approximately $2-3 million. The conclusion is that waiting is not only costly in terms of the toll it takes on the physical health of patients, it also represents a poor allocation of healthcare dollars.

In summary, the data collected from the registry show that waiting for cardiac catheterization is costly in three ways: 1) it can be physically taxing on patients to the point of morbidity or mortality; 2) it is often emotionally draining; and 3) it represents an inefficient use of healthcare resources, for it costs more to maintain patients on the waiting list than it actually costs to perform the procedures for which they are waiting.

Catheterization Registry Simulations
The next step in our project was to take data available from the registry and determine using computer simulation methods what actions could be taken to alleviate waiting times for catheterization within the existing capacity. Is extra capacity really the necessary and sufficient solution to the problem of long waiting lists? Are there better ways that existing capacity can be used to reduce waiting times? And can such improvements in the utilization of existing capacity bring waiting times down to acceptable levels by themselves?

These analyses were undertaken in collaboration with Diwakar Gupta, adopting techniques from the industrial engineering perspective to carry out dynamic modelling and simulate patient flow through the catheterization labs. To carry out the analyses, we combined the data from the registry, which contains clinical variables and the hospital procedural booking data base.8-10 To our knowledge, systematic studies using these techniques to model patient flows and plan for resource utilization is still not common in the healthcare field. During the period September 2000 through December 2001, 6,215 patients referred for catheterization were categorized based on clinical need for the purposes of the modelling into one of the following three streams: 1) urgency 1 patients, which are inpatients who should be catheterized within two days; 2) urgency
2 patients, which are outpatients who should be catheterized within seven days; and 3) urgency
3 patients, which are outpatients who should be catheterized within 30 days.

Prior to modelling patient flow through the Heart Investigations Unit, however, a simple statistical
analysis conducted on the data revealed a significant deterioration in the condition of the waiting
list during the study period. Whereas in 1998-2000 the average waiting time for urgency
1 inpatients was six days, by 2000-2001 it had increased to nine days. The early phases of the
registry did not distinguish between urgent and less urgent outpatients, but registry data from
2000-2001 nevertheless revealed average waiting times for these groups of 45 and 100 days
respectively, compared to “target” times of seven and 30 days.

We generated a computer model of patient flow through the Heart Investigations Unit, which
was used to simulate what effects different changes in unit procedures would have on the waiting
list for cardiac catheterization and to draw inferences as to what would happen to waiting times
under a number of different scenarios. Two interesting and unexpected findings occurred early
in the analyses. We hypothesized that patients and/or referring physicians being allowed to
express a preference for a specific angiographer versus being assigned to the “first available”
angiographer with the shortest list was resulting in waiting list delays. However, our analyses
showed that allowing patients and/or referring physicians to express a preference for a particular
angiographer on the referral form hardly had an effect on waiting times and that waiting times
actually increased when patients were sent to the angiographer with the shortest waiting list
rather than when an attempt was made to send them to their preferred angiographer. These findings
may be the result of different angiographers having different operating styles, which suit certain
patients better than others, and relationships between certain angiographers and certain referring
physicians allowing certain angiographers to treat certain patients more efficiently and effectively
than if they were simply assigned to the angiographer with the shortest waiting list.

Our simulations were also able to quantify the necessary capacity planning for catheterization in
the Hamilton area. Our analyses showed that if the population continued to grow and age, and if
the current trend of increasing referrals of heart patients for catheterization also continued, average
waiting times for catheterization in Hamilton may reach as high as 16 days for urgent inpatients,
85 days for urgent outpatients, and 230 days for less-urgent outpatients in just three years.
One-time injections of extra capacity to reduce or clear existing backlogs were found to be
ineffective in dealing with the problem of long waiting lists, for even if the waiting list was
reduced to zero, there was insufficient capacity in the system to prevent waiting times from
rising back to unacceptable levels once the one-time capacity injection was withdrawn.
One particularly effective demonstration of severe capacity limitation came from a simulation of the effect of an exogenous shock resulting in a large number of urgent inpatients flooding the waiting list for catheterization, similar to the outbreak of Sudden Acute Respiratory Syndrome (SARS) in March/April 2003 that resulted in the cancellation of most elective surgeries and cardiac catheterization procedures in Toronto hospitals. Our aim in simulating such an event was to discover how long such a shock could be seen to affect the system after the shock itself ends. While waiting times for urgent inpatients in our simulation recovered to pre-shock levels within weeks, waiting times for urgent outpatients took nearly three years to return to their pre-shock levels and waiting times for less-urgent outpatients failed to recover completely in the 10-year window of our simulations. The inability of the system to deal with such shocks when they occur is perhaps the clearest indicator of the acute shortage of capacity.

Finally, the model was used to determine what additional level of capacity was required in Hamilton to reduce waiting times down to “target times” of two days for inpatients, seven days for urgent outpatients, and 30 days for less-urgent outpatients. According to our simulations, the construction of an additional catheterization lab, which would allow an additional seven patients to be treated each day, would be a minimal necessity, when added to the three labs already operating in Hamilton. This finding from our modelling and simulation exercise was partly helpful in getting the Ontario Ministry of Health and Long-Term Care to fund the construction of a fourth catheterization lab in Hamilton, which is currently under construction and scheduled to open in March 2005.

The simulations also provided some insights into simple process changes that could be implemented to reduce the time individual procedures take, thus allowing more patients to be treated given current facilities. The first efficiency improvement identified pertains to reducing the changeover time between procedures. Four different kinds of procedures are generally performed by angiographers in the Heart Investigations Unit: left heart angiography; left and right heart angiography; booked angioplasty; and angiography with unplanned angioplasty. We discovered that changeover times are faster when the same physician performs the same kind of procedure in the same lab consecutively rather than if the physician and/or the kind of procedure performed changes. The time saved by scheduling one physician to perform many of the same kind of procedures all at once allows many more procedures to be performed within a given block of time than under the previous arrangement. Borrowing a technique from industrial production, where parts are prepared as assemblies away from the main assembly line before being brought there, changeovers between procedures could also be made faster by moving as much of the pre-surgical preparation as possible outside of the actual catheterization lab into a
Another way in which existing facilities can be used more efficiently is by changing the amount of time assigned to each different kind of procedure when they are scheduled. Analysis of the frequency distribution of the length of procedures shows that most procedures end significantly early, whereas a much smaller number of procedures last longer than their scheduled length of time. By shortening the blocks of time allocated in the schedule to each procedure, more procedures could take place within a given block of time, with only a minimum of extra cost owing to some procedures extending beyond their allotted time and thus resulting in the billing of overtime hours.

A related way of increasing the efficiency of the use of existing facilities identified by the simulation models is to schedule a proportion of diagnostic angiography sessions as left heart combined with possible angioplasties instead. Whereas in the past most angioplasties were performed at a separate appointment following a diagnostic angiography session, today some 70 percent of angioplasties at Hamilton Health Sciences are performed on patients who initially were just booked for a diagnostic angiography. Clinical reasons prevent this number from approaching 100 percent, as patients with more complex cases may not be suitable candidates for immediate angioplasty. However substantial efficiency improvements have already been realized with this new system. Changes in the composition of the clinicians working in the Heart Investigations Unit have also made it easier to move towards performing more ad hoc angioplasties. Whereas in 2001 only 62 percent of the angiographers were interventional cardiologists capable of performing both angiography and angioplasty, 83 percent of the angiographers are now capable of performing both procedures.

The incorporation of some techniques borrowed from the industrial engineering field provides insight into capacity planning and efficiency of process in our labs. While many of these changes will potentially funnel healthcare dollars to where they were initially allocated and reduce cost per case, the increase in throughput may actually increase overall costs to the institution, at least in the short term. Therefore competing agendas, such as the need for overall cost containment by administrators of catheterization laboratories, may make these efficiency exercises seem futile. Unlike privately funded hospitals in the U.S. where decisions are based on market forces, demographics, and compensation rates, funding in Canada is based on advice from planning bodies at the provincial level determining the target utilization rates (number of procedures per 100,000) to best serve the population. Health officials translate those decisions into overall funding levels, which percolate down to a regional and/or institutional level. Local health bureaucrats take this aggregate funding and invest it in a mix of capital and labour yielding a level of “realized output” in a given healthcare field. Realized output depends on a whole
series of decisions administrators make: dealing with urgent cases; the number of procedures to schedule in a given amount of time; what average time per procedure it uses in scheduling; the operating styles of physicians; and the surgical facilities available for performing the procedure. For example, Hamilton Health Sciences receives an envelope of funding to perform a certain number of catheterization, angioplasty, and bypass procedures per fiscal year based on a pre-specified target rate per 100,000 population. However, the actual number of procedures required in any particular year and the cost per case may vary significantly from the predetermined targets based on how many are referred and how sick the patients are during that particular 12-month period. There is always a balancing act by the administrators towards the end of fiscal year to meet the needs of the patients requiring the services versus the needs of the institution to arrive within “target” of the pre-specified budget. Furthermore, it is not always possible to free funding from other areas of a hospital’s budget so that more procedures can be performed if necessary and therefore efficiency savings that might have allowed for increased throughput and reduced waiting lists in one area may in fact be needed to offset additional expenses elsewhere.

Strategies for Prioritizing Waiting Lists

Queuing for procedures is a fact of life in a supply-managed healthcare system like we have in Canada. Queues are to be expected, as they are in any publicly funded system where there are multiple demands on the public purse. Indeed, in the case of catheterization, queuing is a medical necessity, as often a waiting period is required between an initial consultation and the performance of the catheterization procedure to assess the suitability of the patient for what is after all an invasive procedure. The questions we need to answer, therefore, are not whether queues ought to exist but rather whether someone should be in the queue or not, and how long he should remain in the queue before being treated. In other words, the challenge is to prioritize queues rather than to seek their outright elimination.

Regarding the first question of whether someone should be in the queue or not, data from the registry shows that there is room for improvement. Registry statistics from 1998 to 2000 show that 23.3 percent of patients who underwent catheterization had normal coronary arteries, and a further 10.2 percent had only mild coronary artery disease. Given that angiography is a secondary or even a tertiary diagnostic procedure, the fact that more than one-third of patients are minimally ill or disease-free suggests that there is room to improve primary diagnostic techniques to reduce the number of indeterminate or “false positive” results suggesting the presence of coronary artery disease when a patient is in fact healthy. While it is inevitable that some proportion of individuals undergoing a diagnostic procedure will be found to be healthy, even a modest one-fifth reduction in the number of healthy patients who are sent for angiography would have the same effect as opening three new catheterization labs across the province of Ontario.
The second question, of how long people should remain in the queue, is far more difficult to answer given that queues are as complex as the medical needs of the individual patients that populate them. The first problem is that there are multiple queues rather than a single queue. Patients whose needs are more urgent need to be seen more quickly than patients whose cases are somewhat less urgent. As such, we will always face the challenge of managing multiple queues, and of individuals moving between queues as their condition improves or worsens while they await treatment.

More significant than the fact that there are multiple queues, however, is that there is a lack of agreement on what constitutes a safe waiting time for different categories of patients awaiting treatment. For catheterization, there are one or two scales available for prioritizing patients which are neither simple nor comprehensive enough to be useful in a clinical setting.12

However, better and more useful scales can be developed by correlating baseline clinical and demographic variables of patients with clinical events during the waiting period and their anatomy at the time of catheterization. Such is the philosophy behind the ongoing development of the McMaster Urgency Ranking Score for Cardiac Angiography scale, which has evolved from a scale encompassing more than 22 variables in its first iteration to a simple scale with eight variables. The eight variables are all predictors of both certain kinds of anatomical features (such as three-vessel disease or left-main disease) and of adverse cardiac events. These variables can eventually be used to triage patients for catheterization into low-, medium-, and high-risk categories. Patients on the registry were divided into a developmental group, which consists of two-thirds of the population, and an experimental group, consisting of the remaining one-third. Data from the developmental group were used to generate the predictor variables in the scale, which were then validated using the data from the experimental group. The scale is currently being validated in a prospective cohort of catheterization patients and will be discussed in further detail once it is ready for clinical use.

An additional level of complexity in developing scales like the McMaster one is that they must remain a dynamic, ongoing process keeping up with changes in medical knowledge and technology rather than a finite event. For example, new clinical evidence shows that catheterization, and particularly angioplasty with stent placement, is a highly effective treatment for certain types of myocardial infarction (heart attacks) when administered within the first few hours of symptom onset.13 Likewise, there is also increasing evidence that there are age and gender differences in developing, identifying, and managing cardiovascular disease. That these developments are increasing the number of patients who urgently require catheterization imposes new strains on
both waiting lists and on the tools used by hospitals to triage patients and manage waiting lists. As more and more patients are deemed to be in urgent need of catheterization, should some patients who were formerly ranked as urgency 1 patients be downgraded to urgency 2? Should others be upgraded to an emergent status based on the strength of new clinical evidence? Should institutions that offer catheterization be specialized to preferentially serve one group of patients over another? These problems are not trivial, for if with every new discovery more and more individuals join the ranks of the urgent patients, triage loses its effectiveness as a tool by which to manage waiting lists.

Epilogue
As long as medical science continues to advance, there can be no one-time fixes to the problem of queuing anywhere in the healthcare system. The only way the problem of queuing can be managed is by ongoing data collection to identify trends, obstacles to providing service, and opportunities to embrace new technologies and new diagnostic procedures to reduce waits for procedures like catheterization.

Finally, there must be recognition that the problem of queuing is not simply one for physicians and health bureaucrats to solve on their own. Investing in a public healthcare system is ultimately about choosing between different social priorities, of deciding how much a society is ready to invest in order to save a life, or to improve the quality of a life, rather than educate its young, house its poor, or defend its territory. Some countries have made these implicit tradeoffs explicit by bringing non-medical factors into account when deciding whether to place patients in a queue for expensive and complex medical procedures, including cardiac surgery. However, these countries maintain parallel private systems where individuals who fall outside these categories may seek treatment, which blunts some of the sharpness of these ethical choices as compared to Canada, where the public healthcare system is the only game in town. Nevertheless, given that the Canadian population is aging and that today’s seniors demand more aggressive interventions against disease to allow them to live more active and independent lives, Canadian society can no longer avoid asking the tough questions about how much it is willing to spend on ever more complex and costly procedures to prolong life, and to what extent investments in health should be allowed to take priority over other forms of social investment.

It is for this reason that capacity expansion alone is not the answer to the problem of long waiting times for certain kinds of medical procedures, for just as newly expanded roads soon fill up with traffic, newly expanded medical facilities attract greater and greater numbers of patients whose genuine need for medical treatment is not always clear. Just as important as identifying more
efficient ways of using healthcare dollars and developing better triage techniques in solving the problem of excessively long waiting lists is a public debate on just what kind of healthcare system Canadians want.

Conclusions
The results of our research can be summarized in a few succinct points.

- Our studies show that waiting times above and beyond the generally recognized target waiting times for patients requiring cardiac catheterization in each of our three urgency categories carry physical and emotional costs which are borne by patients and economic costs which are borne by the public purse. This happens because of the misallocation of resources towards paying for people to wait in hospital rather than to provide them with the procedures they need.

- We have shown that, at least for the Heart Investigations Unit at Hamilton Health Sciences, there is a severe and chronic shortage of capacity to deal with our catheterization case load. When stresses are applied to the system, this shortage of capacity can result in outpatients facing waiting times of several months for a procedure which ideally should be performed in a matter of days. Both these issues are reflective of the current status of waiting lists for procedures such as catheterization across Canada.15

- There are low-hanging fruits which can be plucked to yield efficiency improvements that can allow more patients to be treated using existing capacity. The current funding model, however, makes it difficult for many hospital administrators to capitalize on such opportunities.

- Developing techniques to prioritize waiting lists is of real importance and must be an ongoing process to reflect rapid changes in medical knowledge and patient composition.

- Finally the debate about waiting lists is not simply a technical conversation about improving efficiency or patient throughput through the healthcare system. Fundamentally, it is a conversation about vision and social values in which every Canadian deserves a say, for it is too important to be left in the hands of the academics, the commentators, the physicians, and the politicians.
References
2) Hamilton Spectator. March 23, 2002. General hospital gets $7m; Ministry pays $7.1m of $12m crucial project that cuts wait times for life-saving heart work... Joanna Frketich.
6) Arthur HM et al. Psychological and Health-Related Quality of Life Implications of Waiting for Elective Coronary Angiography. (manuscript in preparation)
10) Gupta D et al. Capacity Planning for Cardiac Catheterization: A Case Study. (manuscript in preparation)
15) Ezekowitz JA and Armstrong PW. The waiting game: facing the consequences. CMAJ. 2002; 167:11
A new study shows that patients in Canada are waiting longer than their doctors recommend for a specialized heart procedure. The delays are resulting in more complications and patient deaths, doctors found.

A team of doctors in Hamilton, Ont. followed 8,030 patients over a two-year period between 1998 and 2000. All the patients were waiting for a procedure called cardiac catheterization, a diagnostic test that reveals heart damage, blockages, and leaks in coronary arteries.

Of those patients, only 37 per cent received the procedure during the six-week time frame recommended by their doctor, according to the study published this week in the Canadian Medical Association Journal. On average, patients waited two months for the test, while some had to wait as long as six months.

For in-patients, those who have already been admitted to hospital seeking tests for heart attack symptoms, many wait six days for an angiogram that should be done within 48 hours. Heart patient Garnet Earle knows exactly what waiting is like.

“You start to work your way up the list and all of a sudden, three or four emergencies come in. You are bumped right down to the bottom of the list again. I could have gone on until who knows?” he told CTV.

Even after waiting on one list for diagnosis, there’s sometimes another for treatment. “It could be easily a year before they are actually evaluated by a specialist, have a procedure done if necessary and then if they need an operation, it can easily be even longer,” said Earle’s cardiologist, Dr. Emilio Raimondo.

Patients who waited for cardiac catheterization were more likely to face serious consequences, doctors found.
Of the 8,030 patients involved in the study, 109 suffered heart attacks or heart failure and 50 of those died while they were still on the waiting list. Those numbers are disproportionately higher than in patients who were catheterized within the recommended time frame.

“There has to be a reasonable wait. And when I see patients waiting five or six months, it makes you feel bad,” said the study’s author, Dr. Madhu Natarajan, of the Hamilton Health Sciences Centre.

Ontario is considered a leader in tracking cardiac diagnostic waits due to this study. Delays could be worse in other parts of the country.

“The province-wide effort was modeled after what was done in Hamilton a few years back... because this is an issue in the rest of Ontario and this is an issue elsewhere in Canada,” said Eric Cohen, the chair of the Cardiac Care Network.

Doctors say the findings underscore the necessity for speedy medical care for cardiac patients, along with a tracking mechanism to insure people are getting the care they need — when they need it.

“This experience again signals the need for national surveillance and standards,” concluded the study.

A recent Ipsos-Reid poll, conducted for CTV and The Globe and Mail, found that a majority of Canadians think Roy Romanow should make reducing waiting lists for diagnostic testing his No. 1 spending priority when he releases his much-anticipated report on the future of Canada’s health-care system.

The poll found that 63 per cent of respondents believe that reducing waiting lists for diagnostic services should be a top priority when it comes to prioritizing new health-care spending.

The Romanow commission report is scheduled for release Thursday. It follows a year of hearings and is expected to call for a large injection of cash into the health-care system.

With a report from CTV’s Scott Laurie