Centre universitaire de santé McGill
McGill University Health Centre

**FINAL**

**Report Number 32**

# Wait times at the MUHC. No.4

## Diagnostic Imaging Revisited
## Adult Hospitals of the MUHC

**Has there been progress?**
**Where are the bottlenecks?**
**How can they be removed?**

**Feb 29, 2008**

***Report prepared for the Technology Assessment Unit (TAU)***

***of the McGill University Health Centre (MUHC)***

**by**

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**Approved by the Committee of the TAU on Feb 21, 2008**

**TAU Committee**

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## *Invitation.*

***This document was developed to assist decision-making in the McGill University Health Centre. All are welcome to make use of it. However, to help us estimate its impact, it would be deeply appreciated if potential users could inform us whether it has influenced policy decisions in any way.***

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## Glossary

| | |
|---|---|
| CHUM | Centre universitaire de l'université de Montréal |
| MUHC | McGill University Health Centre |
| MGH | Montréal General Hospital |
| MCH | Montréal Children's Hospital |
| MNH | Montréal Neurological Hospital |
| MNI | Montréal Neurological Institute |
| PREM | Programme régionale d'effectifs médicaux |
| RVH | Royal Victoria Hospital |
| TAU | Technology Assessment Unit |
| WTA | Wait Times Alliance |

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## EXECUTIVE SUMMARY

This report is one of a series prepared in response to the request of Dr. Arthur Porter that the Technology Assessment Unit (TAU) should study patient wait times at the MUHC, identify bottlenecks in patient flow, and recommend measures necessary to eliminate them. The present report concerns wait times for imaging in the adult hospitals of the MUHC.

# PART 1. Present status of wait times

The overall wait time consists of two components, the *request to procedure time (*interval between receipt of a request and its execution), and the *turnaround time* (completion of procedure to dictation of report, *plus* dictation of report to transcription, *plus* transcription to signature). The status of wait times at the MUHC can be summarized as follows:

### CT Scan

- For *elective* procedures the Wait Times Alliance (WTA) benchmark of 30 days is routinely and grossly exceeded at both the MGH and the RVH for all CT studies requiring contrast.
- There has been no improvement over the past year.
- Wait times for *emergency, urgent and all inpatient* care are within WTA benchmarks.

### MRI

- For almost all *elective* MRI procedures wait times at all three adult hospitals are more than double the WTA standard of 30 days. They are 10 to 12 times above the WTA Standard for several procedures.
- At the MGH there has been improvement for some *elective* procedures as a result of the installation of a new MRI at the RVH in 2006.
- At the MNH wait times for *elective* procedures have been increasing, and are currently approximately 1 year.
- At all three adult hospitals *emergency, urgent* and all *inpatient* care MRI wait times are well within WTA benchmarks

## Ultrasound

There are no WTA standards for ultrasound.

- At the RVH and MGH wait times for *elective* non-cardiac ultrasound exams exceed 10 weeks. Abdominal ultrasound, excluding gynecological studies, exceeds 20 weeks.
- At MGH and RVH *elective* wait-times have more than doubled in the past year.
- At the MNH, wait times for carotid ultrasound have increased from 2-3 days to approximately 6 weeks.

## Other Radiographic Procedures

For GI Barium studies, mammography, angiography, radiography of chest, skeleton, and abdomen no WTA standards are available.

- At the MGH wait times for barium procedures (upper and lower GI) are >13 weeks.
- At MGH and RVH wait times for outpatient angiography and interventional procedures (non-cardiac) have increased from 2 to approximately 6 weeks.

## Nuclear Medicine

In nuclear medicine there are no excessive wait times.

# Causes of Wait Time delay

## Request to procedure time.

CT. MRI. The principal reason that the demand for CT and MRI exceeds capacity at all three adult hospitals is inability to operate equipment for the maximum number of potential hours at all sites. This is principally because of lack of budgeted technology posts and sometimes because of inability to fill budgeted positions
Ultrasound. At all three adult hospitals ultrasound productivity is limited due to lack of budget to hire technologists and cover operational expenses. At the RVH availability of radiologists is also a significant cause.

Upper and lower GI Barium series. The delay in these procedures at the MGH (>14 weeks) is due both to shortage of technologists and radiologists.

## Turnaround time

Urgent cases and all cases referred from the Emergency Room are reported <24 hours. However, turnaround times for *elective* cases were prolonged at RVH (22 days), and MNH (12 days). In both it is due to frequent absence of transcriptionists and at the RVH an additional reason is an inadequate infrastructure. Outsourcing has started to improve this situation. At the RVH prolonged signoff time is partly due to shortage of radiologists.

# PART 2. Corrective Measures

In spite of major efforts, the Imaging Departments are unable to meet the increasing demand. The result is an increasing backlog, stressed personnel, and in some areas rapid staff turnover and difficult recruitment. To correct this cycle urgent assistance is necessary.

The backlog of patients is the consequence of a continuing *small* excess of demand over capacity. Elimination of backlog requires a substantial increase in productivity of *short duration*. This will require the following interventions.

## Recommendations

### 1). Radiologists.

A major reason for excessive wait times for imaging at the MUHC is shortage of radiologists. Over recent years their workload has increased and their numbers have been reduced.

Over the past four years the total number of technical units reported by the three adult hospitals of the MUHC has ***increased by 65%*** .

Over the past five years, as estimated in the report, there has been an ***increase in workload at the MGH and the RVH of 25%.*** **A** similar increase at the MNH was not quantitated.

In fiscal year 2006/07 comparison of the ratio of radiologists to technical units indicates that the workload of radiologists at the MUHC was ***approximately 46% higher*** than at the neighboring institution, the CHUM.

In 2002 there were 32 radiologists at the three adult hospitals. Assuming an increased workload of 25%, the addition of 8 radiologists would restore the average workload per radiologist to the 2002 level.

However, over the same time interval there has been a reduction of three radiology PREMs (Programmes régonale d'éffectifs médicaux).

To *merely restore* the workload at the three adult hospitals to the 2002 level would require the addition of *at least 11 PREM positions*. (Even with this addition the ratio of technical units per PREM would be 5% higher at the MUHC than at the CHUM).

- ***The MUHC should urgently make representations to the authorities at the highest level to increase the number of radiology PREMs by at least 11, in order to restore the radiologist workload at the three adult hospitals to the 2001 level.***

## 2). <u>Technologists.</u>

A second cause of prolonged wait times was the shortage of technologists, due in some instances to lack of budgeted posts and in others to unfilled posts. Because the department is currently reviewing staffing levels and initiating measures to address shortages the extent of this need was not quantitated, but in some areas any increase in productivity will require additional budgeted positions. In addition, in some sites productivity of technologists might be increased by increased use of technical assistants and by more prompt and reliable transportation services.

- ***Although the exact need for technologists is currently under review by the department, it is clear that wait times will not be eliminated without some additional personnel. The MUHC should open sufficient full time positions to operate equipment, when necessary, from 7:30 a.m. to midnight 7 days per week..***

- ***At RVH technologist productivity could be increased by the creation of a patient transportation unit within the department, answering only to departmental needs.***

- ***When technologists cannot be recruited, the MUHC should consider increasing the use of technical assistants to increase the productivity of existing staff.***

**3). Transcription.**

Apart from emergency and urgent cases, delay in typing reports is common and loss of reports not uncommon.

A recently approved voice recognition dictation system will substantially correct this situation. However, its installation will take time and additional resources. Elimination of the present prolonged turnaround times with loss of reports **must not be allowed to await the installation of the new system.**

- ***The MUHC must give the department the resources necessary to install the voice recognition technology as rapidly as possible.***
- ***Elimination of excessive turn-around-time must not be allowed to wait until the new system is functioning. Every effort must be made to maintain the full number of transcriptionists and outsourcing used when necessary.***

**4). Information system.**

The recently approved Radiology Information System (RIS) will play a major part in reducing wait times and eliminating the loss of reports. However, its installation will take time and resources. **Elimination of excessive wait times can not be put off until this is achieved.**

- ***The MUHC should give the department the necessary resources to achieve the installation of the RIS with the minimum delay.***
- ***In the meantime the measures necessary to correct wait times outlined in this report must not be delayed.***

**5). Additional Short term Measures.**

Elimination of backlog will require a considerable increase in productivity for a relatively short period. To achieve this the following temporary measures should be considered.

General radiology. There are private facilities in Montréal with PACS systems connected to the MUHC at which outpatients can undergo imaging studies (other than ultrasound, CT, and MRI) without additional cost to the patients or the MUHC. All outpatients could be encouraged to use these facilities.

- ***In order to diminish the departmental workload and allow more time to be allocated to the reduction of backlogs, the MUHC should temporarily divert outpatients requiring general radiological examinations to private laboratories***, ***when this can be done without cost or inconvenience to patients.***

MRI. CT.US The most cost effective way to increase productivity for these modalities would be to recruit sufficient staff to run equipment from 7 a.m. to midnight, seven days per week, as recommended above. However, as a short-term measure to eliminate backlog consideration should also be given to temporarily operating equipment 24 hours per day and/or outsourcing patients to the Montréal Neurological Institute.

- ***To eliminate backlog the MUHC should consider budgeting a sufficient number of technologist posts to operate equipment 24 hours per day, seven days per week, and/or temporarily outsourcing MRI to the Montréal Neurological Institute.***

# Diagnostic Imaging Revisited.
# MUHC Adult Hospitals

## CONTEXT

This document is one of a series of reports developed by the Technology Assessment Unit (TAU) in response to the request of Dr. Arthur Porter, Director General and CEO of the McGill University Health Centre (MUHC) that the TAU should conduct an investigation into wait times with the following objectives:

- To determine wait times at the MUHC in the five priority areas identified by the Provincial First Ministers (diagnostic imaging, joint replacement, cancer care, sight restoration, and cardiac care).
- To study patient internal wait times at the MUHC (appointments, tests, procedures) with the object of identifying bottlenecks in patient flow.
- To identify the measures necessary to reduce excessive wait times.

The first report on wait times [Wait times at the MUHC. 1. TAU report No 26, Sept 2006], concluded that *Emergency* and *urgent* imaging requests were satisfactorily carried out well within the recommended benchmarks . However, for *elective* studies the time lapse from initiating a request to completion of the signed report exceeded accepted benchmarks for many procedures to an extent that was inconsistent with the standards of good medical care.

The present report considers whether there has been improvement or deterioration since that time, addresses the bottlenecks in patient flow, and the measures necessary to eliminate them in the departments of diagnostic imaging.

## PRESENTATION

In the present study we consider only the adult hospitals of the MUHC, namely the Montréal Neurological Hospital (MNH), the Montréal General Hospital (MGH), and the Royal Victoria Hospital (RVH) with which the Montréal Chest Hospital is affiliated. Wait times at the Montréal Children's Hospital (MCH) were not considered here.

This report consists of two parts. In **Part 1,** we consider whether the wait time situation is improving or deteriorating, and identify those procedures in which wait times are excessive. First, we review the average annual wait times since 2002-3, to explore how wait times have been changing over the past 4 years (Figures 1-4). Next, to identify the changes that have occurred over the past year in more detail we compare the wait times for each procedure carried out during period 11 alone, in 2006 and in 2007(Tables 1-5). Some changes since the latter date are noted in "updates" to the text.

In **Part 2**, we consider the specific reasons for each hold up and the remedial measures necessary to eliminate them.

## METHOD

There are two differences in the methodology used in identifying wait times and the methodology used in a previous report on wait time imaging [Wait times at the MUHC. 1. TAU report No 26]. In that report which was carried out from the point of view of the patient, the time taken to receive an appointment with the specialist responsible for ordering the examination was included in the definition of wait time. The present report focuses on the delays taking place within the imaging departments with the objective of identifying corrective measures. It therefore considers the wait time to start with the receipt of a request in the imaging department.

Furthermore, unlike the previous report in which information on wait times was obtained from the departmental booking clerks, in this report data from all departments except nuclear medicine were derived from the Department of Radiology's QI Dashboard internal

tracking system  (Appendix 2). For nuclear medicine studies, which are not included on the Dashboard, wait times reflect the delay experienced by patients as reported by the departmental administration.

The causes of excessive wait times for each procedure were explored in discussions with departmental heads, booking clerks, and administrators.

# Part 1.
# Present status of wait times.

## 1. CT Scan.

### a). Are wait times for CT changing ? Are they excessive?

Average Wait time / Fiscal Year

**Note: Wait times for CT and MRI studies that use contrast are longer than those that do not because the former require the presence of a medical doctor. In the following graphs and tables they are reported separately. Note the different ordinates in Figures 1a and 1b.**

**Figure 1a: CT without contrast**

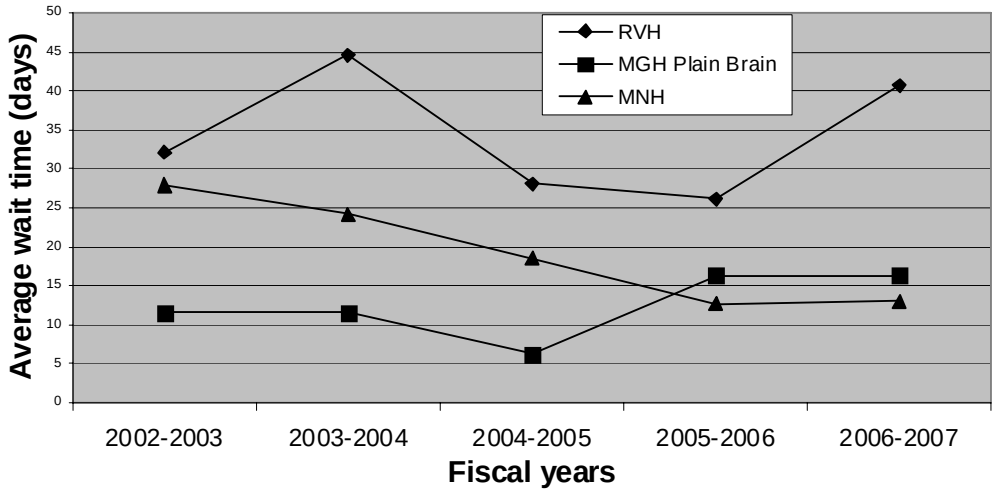
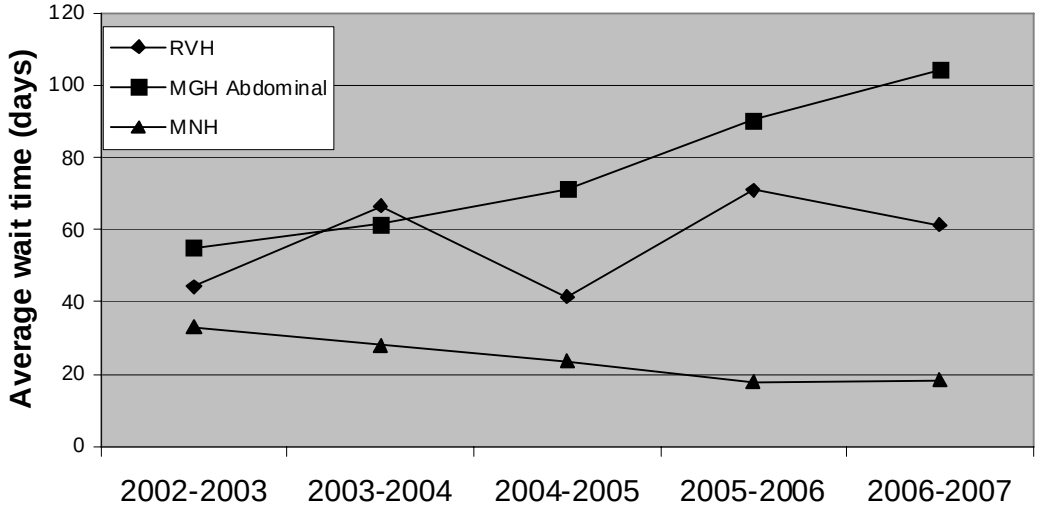



**Figure 1b: CT with contrast**




**Wait times at the MGH are tracked separately for different types of exam within the same modality. Non-contrast brain scans and abdominal contrast exams represent the highest volume procedures, and thus are used as the official tracking indicators.**

# Table 1: CT Scan

Comparison of Wait Times (Calendar days) in Period 11. 2006 , **2007**

**Scheduled Cases**

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| **Site** Procedure | Time to Test | | Time to Report* | | Total Time | | Change |
|---|---|---|---|---|---|---|---|
| | 2006 | **2007** | 2006 | **2007** | 2006 | **2007** | |
| **RVH** | | | | | | | |
| C - | 20 | **55** | 21.6 | **21.6** | 42 | **77** | **+35** |
| C+ | 70 | **63** | " | **"** | 92 | **85** | -7 |
| **MGH** | | | | | | | |
| Brain C - | 21 | **7** | 6 | **5** | *27* | ***12*** | -15 |
| Abd C+ | 85 | **91** | " | **"** | 91 | **96** | **+5** |
| ENT C+ | 69 | **48** | " | **"** | 75 | **53** | -22 |
| Chest C+/- | 85 | **106** | " | **"** | 91 | **111** | **+20** |
| Body C+/- | 111 | **91** | " | **"** | 117 | **96** | -21 |
| Head C+/- | 11 | **10** | " | **"** | *17* | ***15*** | -2 |
| Bones | 62 | **46** | " | **"** | 68 | **51** | -17 |
| **MNH** | | | | | | | |
| All CT | 10 | **10** | 9.1 | **12.3** | *19* | ***22*** | **+3** |

NOTE : *C+ = With Contrast infusion. C- = No Contrast used.*
*C+/- = Data including both contrast and non-contrast studies.*

*WTA Standard. Time to test (all CT scans) < 30 days*
*Wait times more than twice the WTA Standard are underlined.*

**Emergency and Urgent Cases**

RVH and MGH: Emergency cases < 12 hours,
MNH: <3 hours.

RVH and MGH :Urgent cases <3 days. All inpatients are given priority.
MNH: <12 hours.

WTA Standard emergency <1 day. urgent <7 days

Findings.

- Wait times for *elective* CT studies not requiring contrast are mostly below the WTA benchmark of 30 days (Fig 1a). An exception is the recent increase to 77 days for wait-times for non-contrast CT procedures at the RVH.
- For *elective* CT studies requiring contrast the 30-day WTA benchmark is routinely and grossly exceeded at both the MGH and the RVH .
- Comparison of wait-times during period 11 (Table 1) shows no improvement over the past year. For most studies the wait time is more than double the WTA benchmark of 30 days (underlined)
- Wait times for *emergency* and *urgent* care are within WTA benchmarks

## b). Causes of CT delay?

Delay between the receipt of a request for an imaging study and delivery of the signed report consists of two components, the *request to procedure time*, and the *turnaround time*.

**Request to procedure time.**
The time between the receipt of a request and the carrying out of the test procedure is the greater component of the overall wait time experienced by patients. Potential causes are lack of equipment, underuse of equipment due to shortage of technologists, or shortage of radiologists.

At the RVH the CT unit is used from 8 a.m. to midnight five days per week and from 8 a.m. to 8 p.m. over weekends. Extension of weekend work hours would require additional technologists. Any further increase in productivity would require an additional CT unit. (However, an additional unit could not be operated without a further increase of radiologists and technologists).

At the RVH there are no technical assistants to help technologists with the workflow. In some situations their use would allow an

increase in the through-put of the scanners. It is estimated that the RVH could dedicate one scanner to out-patients and double the through-put with the help of technology assistants. [L Stein].

At the MNH where there is no significant wait time for CT, equipment is used from 8 a.m. to 5 p.m. five days each week, and is available on call after 5pm on Monday to Friday and 24-hour/day on weekends.

At the MGH one CT unit serves the Emergency Room (ER), 24/24 and 7/7. However, the two other CT units only function from 8 a.m. to 4 p.m. 5/7 because of the unavailability of technologists.
*Update, In January 2008 10 positions are unfilled at the MGH.*

Turnaround time.
The turnaround time consists of three components:

- the time from completing the examination to dictating the report,(a time determined by Radiologist availability).
- the time from dictation to transcription of the report, (a time determined by transcriptionist availability).
- the time taken from transcription to signature of the report by the responsible radiologist, (a time determined by Radiologist availability).

Average turnaround times for all imaging procedures are shown in Table 6.

At the RVH the turnaround time for CT scans in period 11 was 22 days. Of these 2 days were taken up by dictation of the report (radiologist), 5 by transcription (typist), and >14 days for signing of the typed report (radiologist). (The latter cannot be attributed to the holiday season since it is comparable in other periods examined).

The 14-day delay in signing off typed reports at the RVH is partly due to the involvement of Residents who must dictate and sign reports before they are verified and countersigned by the radiologist.

However, a major source of delay in signing off reports at the RVH is attributable to an infrastructure that is inadequate for the present high turnover, without any reliable method for auditing non-finalized reports. (This results in the anomaly that the same radiologists and residents working at the RVH and the MGH generate less signature delay at the MGH where there is an efficient web-based system. See Table 6). As a result, many RVH reports are mislaid for long periods and some are permanently lost. (E.g. On January 29, 2008, 20 reports of one radiologist, dictated and typed before September 30, 2007, had still not been signed off and mailed 4 months later).

A second major source of transcription delay is because the number of transcriptionists frequently falls to levels that are incapable of keeping up with demand.

A contributory source of delay at the RVH is the shortage of radiologists who, when needed to sign off reports, are frequently absent elsewhere in the McGill RUIS, at congresses, etc. The typed report then has to await the return of the radiologist for signature. Poor morale can also play a part in prolonging the delay. (If the system takes a week to get the report typed why should I hurry to sign it?).

At the MNH total turnaround time was 12.3 days, 7 of which were dictation to transcription time. This was principally due to the fact that of 4 FTE transcription positions, one is currently empty, one individual is on maternity leave and no replacements are available.

Another cause of delay is an outdated transcription system (dictation to tape, transcription from tape, signature of hard copy, mailing of signed report), with frequent temporary and sometimes permanent losses of reports. Inefficiency is increased by location of the departmental typists outside the MNH [D.Tampieri].
*Update. On January 28, 2008, turn around time at the MNH had increased to eight weeks.*

At the MGH, turnaround time for CT was five days. This hospital has a superior system that allows reports to be signed off electronically at the time they are read, via remote access.

*<u>Update</u> (November 2007): Subsequent to Period 11 an acute shortage of typists resulted in prolonged transcription times. However, due to outsourcing of transcription services to an outside firm typing of current reports at the MGH is now reported to be on a "next day basis ". The department aims to eliminate typing backlog, which consists mostly of films already seen by the orthopedic surgeons and plain chest films, by mid-April 2008.*

It can be argued that it is not urgent to shorten turnaround times because referring doctors are not completely deprived of the necessary information until the typed report is received, because the dictated report can be accessed by phone. Furthermore, whenever a lesion is found the radiologist will normally phone the referring doctor.

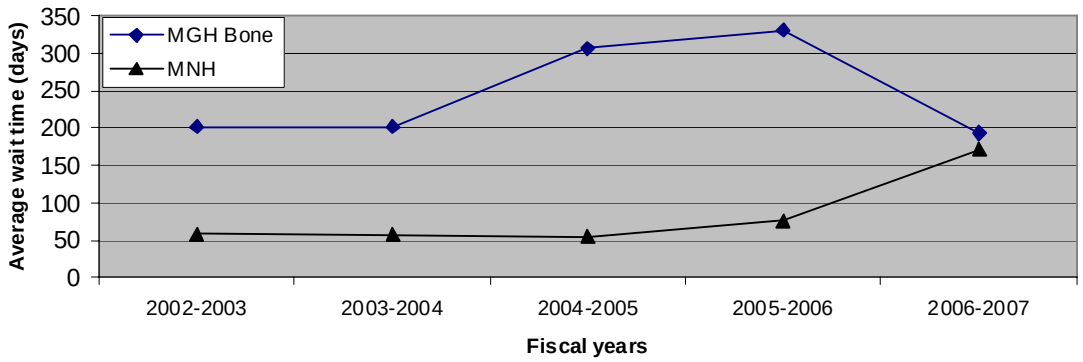
However these are hardly efficient solutions. To access the typed report requires: a 5 digit telephone access code, a 5 digit ID, a 4 digit password, and an 8 digit requisition number, after having signed in to the PACS (ID, password), and searched for the case (7 digit MRN or 8 digit requisition number). Likewise, for the radiologist to personally phone the referring doctor whenever there are positive findings is time-consuming and inefficient, and lacks the reliability of a written report.

# 2. MRI

## a). Are wait times for MRI changing? Are they excessive?

Average Wait time / Fiscal Year

**Figure 2a: MRI without contrast**




Note: Wait times for MRI at the MNH are still increasing. Wait times in August 2007 were estimated to be approximately 9 months for non-contrast studies and 12 months for studies requiring contrast.

**Figure 2b: MRI with contrast**

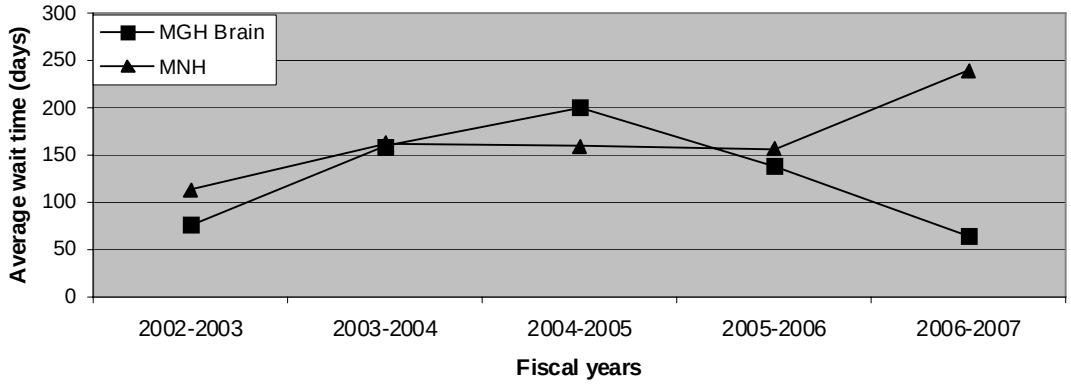


**Figure 2c: MRI variation (non-contrast) in wait times by period 2002-2007**

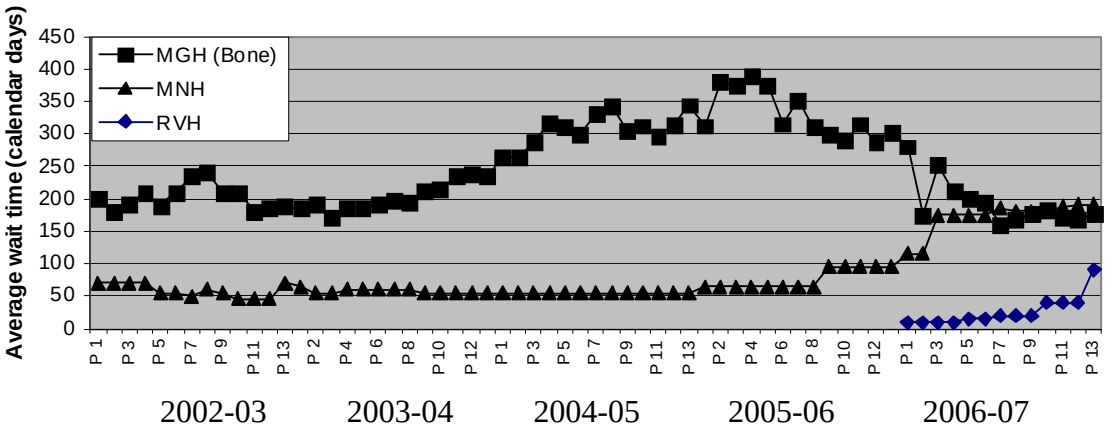



Figure 2c, based on the same data as figure 2b, demonstrates the variation in wait times from period to period. Note the impact on MGH wait times of opening an MRI unit at the RVH in early 2007.

# Table 2: MRI

Comparison of Wait Times (Calendar days) in Period 11. 2006 , **2007**

## Scheduled Cases

| Site / Procedure | Time to Test 2006 | Time to Test **2007** | Time to Report 2006 | Time to Report **2007** | Total Time 2006 | Total Time **2007** | Change |
|---|---|---|---|---|---|---|---|
| **RVH** | | | | | | | |
| All tests | N/A | **N/A** | N/A | **18.8** | N/A | N/A | N/A |
| **MGH** | | | | | | | |
| bone C- | 315 | **171** | 16 | **5** | 331 | **176** | -155 |
| E.N.T C- | 34 | **50** | " | **"** | 50 | **55** | **+5** |
| neuro-spine C- | 30 | **70** | " | **"** | 46 | **75** | **+29** |
| ortho C- | 250 | **62** | " | **"** | 266 | **67** | -199 |
| neuro-brain C- | 30 | **70** | " | **"** | 46 | **75** | **+29** |
| **MGH** | | | | | | | |
| neuro-spine C+ | 70 | **63** | 16 | **5** | 86 | **68** | -18 |
| neuro-brain C+ | 42 | **70** | " | **"** | 58 | **75** | **+17** |
| E.N.T | 53 | **112** | " | **"** | 69 | **117** | **+48** |
| orthopedic | 553 | **381** | " | **"** | 569 | **386** | -183 |
| pelvis/Abd/Gyn | 496 | **294** | " | **"** | 512 | **299** | -213 |
| Abdomen | N/A | **90** | " | **"** | N/A | **95** | N/A |
| Breast | N/A | **274** | " | **"** | N/A | **279** | N/A |
| Bone | N/A | **129** | " | **"** | N/A | **134** | N/A |
| Arthro gram | N/A | **381** | " | **"** | N/A | **386** | N/A |
| **MNH** | | | | | | | |
| All scans C- | 95 | **187** | 10.3 | **12.1** | 105 | **199** | **+94** |
| C+ | 151 | **262** | " | **"** | 161 | **274** | **+113** |

*WTA Standard Time to test* *< 30 days.*
*Wait times in excess of twice WTA standard are underlined..*

## Emergency and Urgent Cases

Emergency, MGH, MNH 1-2 days
*WTA Standard (Time to test)* *<1 day*

Urgent MGH (except breast cancer) <7 days
MGH Breast cancer 21 days

*WTA Standard (Time to test)* *<7 days*
*Urgent patients are prioritized by OR date, etc., but may be delayed past recommended guidelines. Extra sessions or overtime are used to ensure that exams are performed prior to hard deadlines.*
Non-emergency *inpatients* are treated as urgent (<2 days).

Findings

- *Elective* MRI wait times at all three adult hospitals are more than double the WTA standard of 30 days for almost all studies and 10 to 12 times the WTA Standard for several procedures. (Fig 2a,b and Table 2).
- For *elective* MRIs, wait times in the current year at the MNH are increasing.
  *Update. In Jan 2008 the wait time at MNH was approximately 1 year.*
- Improvement for some *elective* MRI procedures at RVH and MGH (E.g. Bone, orthopedic, pelvic and gynecological studies (Fig 2c, and Table 2) is related to the installation of a new MRI machine at the RVH in late 2006.
- Wait times for *emergency* studies are within WTA standards with the exception of breast cancer studies at the MGH (21 days).

## b). Causes of prolonged wait times for MRI?

**Request to procedure time.**
At the RVH the MRI unit is used only from 8 a.m. to 4 p.m. seven days per week. Budget is not available to operate it in the late shifts.

In addition, making reservations for this type of examination (as well as some of the CT and ultrasound exams) is a more complex procedure than for many simpler investigations. The department believes that this situation could be remedied by the addition of two booking clerks at an intermediate or senior-level. [L. Stein. J. Arnoldo]

At the MNH the MRI unit is almost fully used (7:30 a.m. to 12:00 p.m. 7/7) but only on an on call basis over holidays. Of the six available technologists one or more is frequently absent due to illness or pregnancy. [D.Tampieri].

Increased demand at the MNH is attributed to interaction of the following factors: increased emergencies from the RVH emergency-room, increased number of practicing neurosurgeons, the need for neuro-navigation MRI prior to all surgical procedures, early

postoperative MRI after all brain cancer surgery as required by Canadian Guidelines, time consuming performance of MRIs under general anaesthesia, and the engagement of the MNH in brain tumor/epilepsy treatment which involves frequent MRIs [D. Tampieri].

At the MGH, except for the evening weekend shift for which no staff are budgeted, the MRI unit operates from 7 a.m. to midnight 5/7, and from 7 a.m. to 3 p.m. at weekends. No increased productivity can be expected without increasing the budget for technologists to cover the weekend shift.

*Note. It is reported that the Agence is considering the installation of 4 additional MRI's on the island of Montreal in hospitals that at present have no MRI experience. In view of the existence of idle hours for the very expensive equipment already installed, the Agence might be better served adding additional MRI capacity in experienced centres (with both technologist and MD experience) where necessary.*

**Turnaround time**

As with CT, turnaround times for MRI are long, at the RVH (19 days), and the MNH (12 days)(Table 6). The reasons for this are the same as for CT, discussed above.

# 3. Ultrasound.

## a). Are wait times for ultrasound changing? Are they excessive?

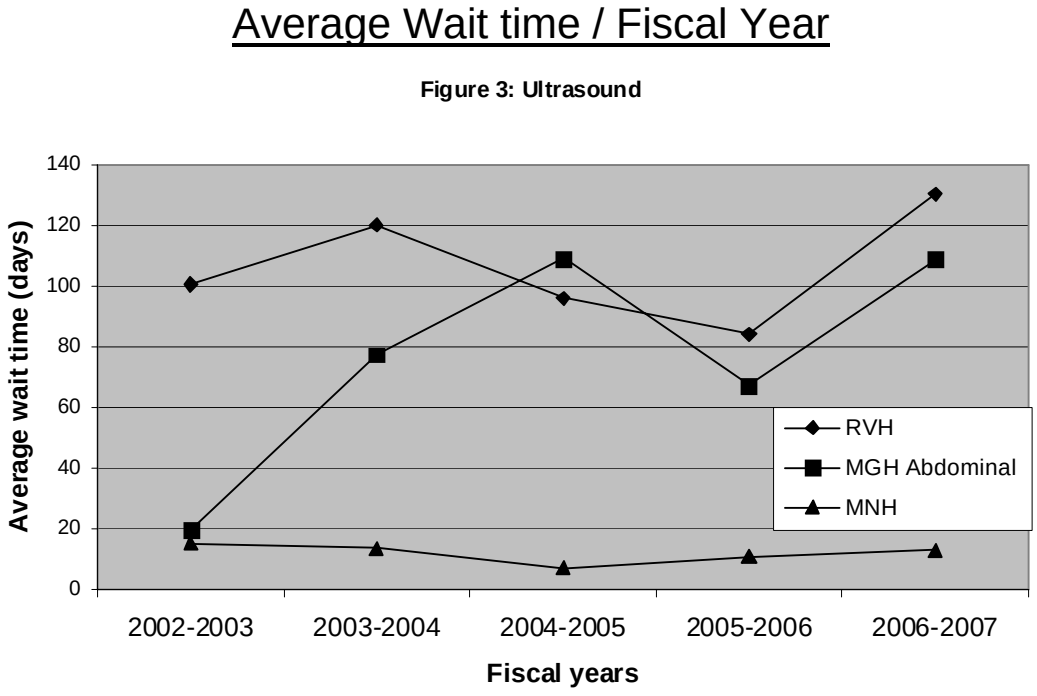



**Figure 3: Ultrasound**

# Table 3
# Ultrasound

Comparison of Wait Times (days) in Period 11. 2006 and **2007.**

**Scheduled Cases**

| Site<br>Procedure | Time to Test<br>2006 | <br>**2007** | Time to Report<br>2006 | <br>**2007** | Total Time<br>2006 | <br>**2007** | Change<br>06 to 07 |
|---|---|---|---|---|---|---|---|
| **RVH** | | | | | | | |
| Non-cardiac | 70 | **154** | 19.1 | **5.9** | 89 | **160** | **+71** |
| Breast * | N/A | **183** | " | **"** | N/A | **189** | N/A |
| **MGH** | | | | | | | |
| Pelvis | 29 | **73** | 12 | **5** | 41 | **78** | **+37** |
| Abdomen | 29 | **143** | " | **"** | 41 | **148** | **+107** |
| Small parts | 29 | **73** | " | **"** | 41 | **78** | **+37** |
| Carotid | 3 | **41** | " | **"** | *15* | **46** | **+31** |
| Prostate | 29 | **71** | " | **"** | 41 | **76** | **+35** |
| Bone | 73 | **74** | " | **"** | 85 | **79** | -6 |
| **MNH** | | | | | | | |
| Carotid Dopp | 7 | **14** | 8.4 | **13.2** | *15* | ***27*** | **+12** |

*WTA Standards. None defined. Wait times over 70 days are underlined.*

**Emergency and Urgent Cases**
At both RVH and MGH emergency cases: < 1 day: urgent cases <2 days.
*No WTA Standards defined.*

*In the Breast Clinic a new prioritization policy is in place: "Patients seen for a clinical exam by a surgeon in the Breast Clinic who subsequently need an ultrasound, receive it on the same day. Outpatients' ultrasound requests are triaged. Urgent requests wait a maximum of two weeks. Non-urgent requests wait up to six weeks."[Kim Martire. Executive Assistant to the Director of the Breast Center]

## Findings

- At both the RVH and the MGH wait times for *elective* (non-cardiac) ultrasound exams are ***currently more than 10 weeks,*** while abdominal ultrasound (non-GYN/OB) now takes **over 20 weeks.** (There are no WTA standards for ultrasound).

- In both the MGH and the RVH wait-times for *elective* ultrasound studies has ***more than doubled*** in the past year. At the MNH, delay for carotid ultrasounds has increased from 2-3 days to approximately 6 weeks.

## b). Causes of ultrasound delay.

**Request to procedure time**

At the RVH excessive wait times for ultrasound are due to shortage of both technologists and radiologists.
Rapid turnover of technologists is a major problem. Of the five positions four are filled but because of rapid turnover, most are in training with substantially reduced output.
One staff position is currently unfilled, but even with all positions filled there would be delays due to lack of radiologists.

At the MNH the only procedures currently carried out are carotid Doppler studies and US guided nerve blocks. The two weeks wait time is mainly the result of shortage of technologists with ultrasound training, with the result that the Chief Radiologist frequently has to act as a technologist in order to maintain the current level of service. In addition, shared space with angiography severely limits ability to carry out US directed nerve blocks [D Tampieri]

**Turnaround time**

Turnaround times for ultrasound examinations tend to be shorter than for other procedures, except at the MNH where sign off time averages seven days (Table 6).

# 4. Other Radiographic Procedures.

**Barium upper GI, Barium lower GI, Mammography, Angiography, Routine radiography of chest, skeleton, abdomen.**

## a). Are wait times changing? Are they excessive?

Average Wait Time by Fiscal Year

**Figure 4a: Upper GI**

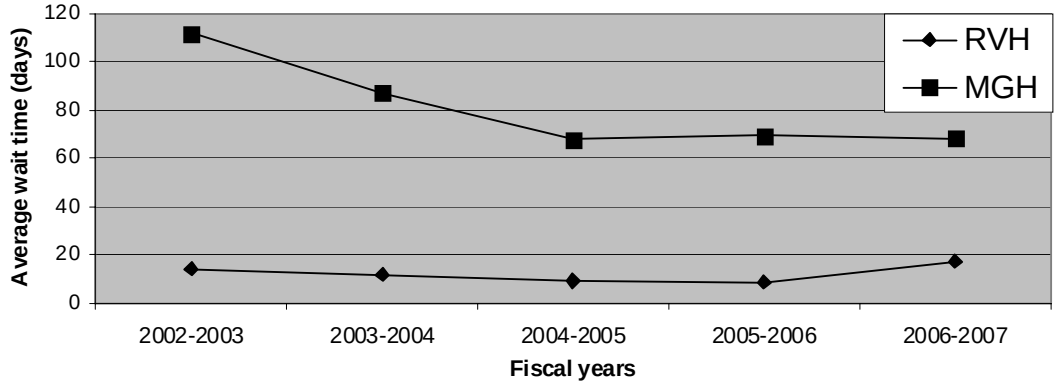



**Figure 4b: Barium Enema**

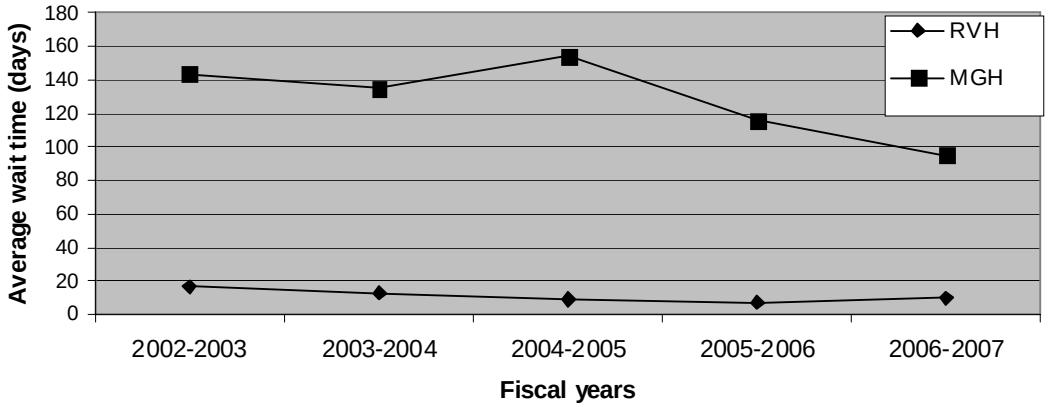


**Figure 4c: Mammography**

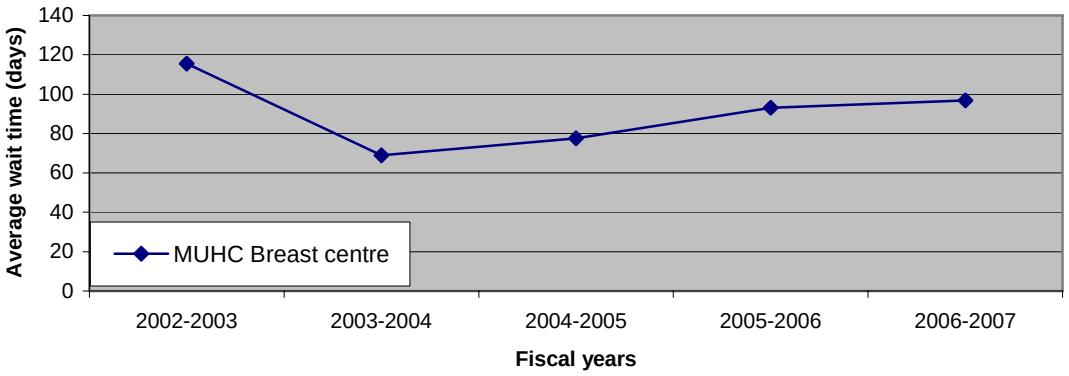
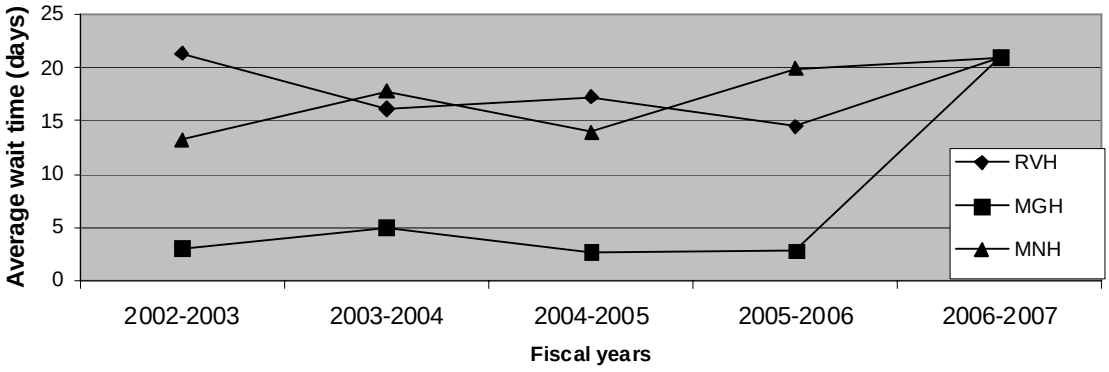



**Figure 4d: Angio/Interventional**



# Table 4 :
# Barium upper GI, Barium lower GI, Mammography, Angiography, and Routine radiography of chest, skeleton, abdomen. RVH and MGH

Comparison of Wait Times (days) in Period 11. 2006 and **2007**

**Scheduled Cases**

| Site Procedure | Time to Test 2006 | **2007** | Time to Report 2006 | **2007** | Total Time 2006 | **2007** | Change 06 to 07 |
|---|---|---|---|---|---|---|---|
| **RVH** | | | | | | | |
| Ba Upper GI | 7 | **14** | 22.4 | **14.3** | *29* | ***28*** | -1 |
| Ba Lower GI | 7 | **14** | " | **"** | *29* | ***28*** | -1 |
| Mammography | 35 | **65** | 17.6 | **22.4** | 67 | **113** | +47 |
| Angiography | 7 | **21** | 12.4 | **25** | *19* | **46** | +27 |
| **MGH** | | | | | | | |
| Ba Upper GI | 108 | **73** | 36 | **18** | 144 | **91** | -53 |
| Ba Lower GI | 174 | **87** | " | **"** | 210 | **105** | -105 |
| Arthrogram | 11 | **11** | " | **"** | 47 | ***29*** | -18 |
| Myelogram | 11 | **11** | " | **"** | 47 | ***29*** | -18 |
| Angiography | 3 | **21** | 9 | **20** | *12* | **41** | +29 |
| **MNH** | | | | | | | |
| Angiography | 28 | **21** | 14.8 | **15** | 43 | **36** | -7 |
| Chest* | < 1 hour | | 22 | **14** | *23* | ***15*** | -8 |
| Abdomen* | Same day | | 22 | **14** | *23* | ***15*** | -8 |
| Skeleton* | Same day | | 22 | **14** | *23* | ***15*** | -8 |

Note: Nearly all general radiology tests can be done on the same day. The only exceptions are the Special series for Scoliosis, Metastasis, and Hyperparathyroid.

- Routine Radiography is not tracked through the QI-Dashboard. This information was obtained from the booking clerks.

*No WTA Standards defined. Wait times over 60 days are underlined.*

**Emergency and Urgent Cases**

Emergency and urgent cases, < 12 hours.

## Findings

- Wait times for barium procedures (upper and lower GI) at the MGH are >13 weeks.
- The wait time for outpatient angiography and interventional procedures (non-cardiac) at both the MGH and the RVH has increased from approximately 2 to 6 weeks.

## b). Causes of delay of these procedures

**Request to procedure time**

The principal source of excessive wait times for upper and lower GI procedures is shortage of radiologists. For angiography and interventional radiology productivity is limited by both equipment and technologist shortage.

**Turnaround Time.**

The turnaround time for most procedures approx, 2-3 wks (Table 6).

At the RVH, for angiographic and general radiographic procedures, the greater part of this time is delay in dictating the report (approximately 1 week). However, most of these procedures are therapeutic rather than diagnostic, and the time to delivery of a report is relatively unimportant.

At the MGH current plain films are dealt with expeditiously but at least 10,000 are unread. This is caused by unavailability of Radiologists. [R. del Carpio]. Although not reflected in these data, in September 2007 there were approximately 75,000 lines of dictated reports untyped at the MGH.

*Update Nov. 2007: Due to support from the RVH, and outsourcing of transcription services to an outside firm, MGH typing is now on a " next day" basis. It is predicted that the typing backlog, which consists mostly of films already seen by the Orthopedic Surgeons and plain chest films will be eliminated by mid-April.*

At the MNH, there is a 7-day transcription delay, due to the fact that of 4 FTE transcription positions, one is currently unfilled, one individual is on maternity leave, and no replacements are available to fill these positions.

# 5. Nuclear medicine

## a). Are wait times changing? Are they excessive?

### Table 5: Nuclear Medicine

Comparison of Wait Times (days) in Period 11. 2006 , **2007**

**Scheduled Cases**

| **Site** Procedure | Exams /year* 2007 | Time to Test 2006 | Time to Test **2007** | Time to Report* 2006 | Time to Report* **2007** | Total Time 2006 | Total Time **2007** | Change |
|---|---|---|---|---|---|---|---|---|
| **RVH** | | | | | | | | |
| Bone Dens. | 5844 | 3 | **1** | 7 | **4** | *10* | ***5*** | -5 |
| Bone | # | 13 | **4** | " | **"** | *20* | ***8*** | -12 |
| Brain | 79 | 27 | **25** | " | **"** | 34 | ***29*** | -5 |
| Dip Mibi | 3196 | 46 | **16** | " | **"** | 53 | ***20*** | -33 |
| Exercise Mibi | 1588 | 6 | **30** | " | **"** | *13* | **34** | **+21** |
| Hida | 143 | 11 | **30** | " | **"** | *18* | **34** | **+16** |
| Liver | 169 | 5 | **16** | " | **"** | *12* | ***20*** | **+8** |
| Lung | 1069 | 3 | **1** | " | **"** | *10* | ***5*** | -5 |
| Muga | 528 | 3 | **22** | " | **"** | *10* | ***26*** | **+16** |
| Parathyroid | 117 | 14 | **11** | " | **"** | *21* | ***15*** | -6 |
| Renal | 2126 | 4 | **9** | " | **"** | *11* | ***13*** | **+2** |
| Thyroid | 1691 | 17 | **7** | " | **"** | *24* | ***11*** | -13 |
| Joints | # | 28 | **21** | " | **"** | 35 | ***25*** | -10 |
| C14 | 836 | 55 | **39** | " | **"** | 62 | **43** | -19 |
| OCTREOS | 114 | 47 | **38** | " | **"** | 54 | **42** | -12 |
| **MGH** | | | | " | **"** | | | |
| Bone Dens. | 3715 | 5 | **44** | " | **"** | *12* | **48** | **+36** |
| Bone | 2893 | 10 | **4** | " | **"** | *17* | ***8*** | -9 |
| Muga | 88 | 4 | **9** | " | **"** | *11* | ***13*** | **+2** |
| Dip Mibi | 99 | 3 | **7** | " | **"** | *10* | ***11*** | **+1** |
| Exercise Mibi | 102 | 3 | **7** | " | **"** | *10* | ***11*** | **+1** |
| Hida | 14 | 4 | **8** | " | **"** | *11* | ***12*** | **+1** |
| Liver | 13 | 4 | **8** | " | **"** | *11* | ***12*** | **+1** |
| Lung | 1257 | 3 | **1** | " | **"** | *10* | ***5*** | -5 |

*There are no WTA standards for scheduled tests*
PET not included in dashboard. All urgent studies and all inpatient studies are carried out < 24 hours. Elective studies (other than follow up following therapy), < 6weeks.[L.Proulx].

The time to report is a year round average estimate of the administrator of the department. The frequency of these procedures varies greatly. See column 1 above.

# At the RVH the number of exams for joints and bones are recorded together as a single figure (2921). However, wait times for each procedure are recorded separately. (Bones 8 days, Joints 25)

**Definitions:**
MUGA (Multiple Gated Acquisition) heart examination
Myocardial perfusion scan (cardiac stress test) aka. MIBI (2-methoxy isobutyl isonitrile) test. Offered as either an exercise stress test, or as a pharmacological stress test (Dip MIBI)
Liver scan (Liver/spleen) HIDA scan (Hepatobiliary scan, or liver/gallbladder)
C-14 Urea breath test (detection of *H. Pylori)*
OCTREOS. Octreotide scan (detects neuroendocrine tumors)

Ref: http://www.wramc.army.mil/departments/Nuclear/PatientInfo/Hpylori%20test.htm

**Emergency and Urgent Cases**

| | |
|---|---|
| Emergency cases | < 1 day |
| *WTA Standard* | *< 1 day* |
| | |
| Urgent cases | < 2 days |
| *WTA Standard (cardiac nuclear imaging*)* | < 3 days |
| *WTA Standard (FDG-PET,bone scan)* | < 7 days |

***Note**: At RVH and MGH inpatients are given priority over outpatients.*
** perfusion; viability, LV function (SPECT or PET)*

## Findings

Excessive wait times for nuclear medicine tests are uncommon.

**Table 6 : Detailed breakdown of Turnaround time (Radiology):** **Time from exam to completed report (days)**

| Period 11 | ER | | General Radiography | | Ultrasound | | CT | | MRI | | Angiography | | Mammography | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RVH | '06 | **'07** | '06 | **'07** | '06 | **'07** | '06 | **'07** | '06 | **'07** | '06 | **'07** | '06 | **'07** |
| Exam to Dictation | 1.1 | **0.8** | 8.4 | **7.7** | 0.1 | **0.3** | 5.5 | **2.1** | | **2.4** | 1.7 | **7.5** | 0 | **0.6** |
| Dictation to Transcription | 0.5 | **0.8** | 10.5 | **2** | 15.9 | **1.2** | 11 | **5.1** | | **9.4** | 7.7 | **13** | 13.7 | **9** |
| Transcription to Signature | 6.6 | **2** | 3.5 | **4.6** | 3.1 | **4.4** | 5.1 | **14.4** | | **7** | 3 | **4.5** | 3.9 | **12.8** |
| *Total time* | *8.2* | ***3.6*** | *22.4* | ***14.3*** | *19.1* | ***5.9*** | *21.6* | ***21.6*** | *0* | ***18.8*** | *12.4* | ***25*** | *17.6* | ***22.4*** |
| MGH | | | | | | | | | | | | | | |
| Exam to Dictation | 0 | **0** | 26 | **13** | 4 | **0** | 1 | **1** | 8 | **1** | 2 | **11** | | |
| Dictation to Transcription | 1 | **0** | 5 | **2** | 4 | **2** | 3 | **2** | 3 | **2** | 5 | **3** | | |
| Transcription to Signature | 1 | **2** | 5 | **3** | 4 | **3** | 2 | **2** | 5 | **2** | 2 | **6** | | |
| *Total time* | *2* | ***2*** | *36* | ***18*** | *12* | ***5*** | *6* | ***5*** | *16* | ***5*** | *9* | ***20*** | *0* | |
| MNH | | | | | | | | | | | | | | |
| Exam to Dictation | | | 2.7 | **3.8** | 1.6 | **3.7** | 2.1 | **3.3** | 3.8 | **3.5** | 7.6 | **7.6** | | |
| Dictation to Transcription | | | 3.4 | **6.9** | 5.1 | **7.1** | 5.3 | **7** | 4.5 | **6.7** | 4.5 | **6.1** | | |
| Transcription to Signature | | | 1 | **1.4** | 1.7 | **2.4** | 1.7 | **2** | 2 | **1.9** | 2.7 | **1.5** | | |
| *Total time* | *0* | | *7.1* | ***12.1*** | *8.4* | ***13.2*** | *9.1* | ***12.3*** | *10.3* | ***12.1*** | *14.8* | ***15.2*** | *0* | |

'06 = Last year, 2005-2006, period 11
'07 = Current year, 2006-2007, period 11
Times listed in days of calendar time.

# Part 2.
# Corrective Measures

Before considering corrective measures it is necessary to bear in mind three factors that can profoundly influence wait times.

Elimination of Backlog. **Reduction of wait times requires two steps requiring very different levels of productivity, elimination of backlog, and prevention of its recurrence.**
In general the elimination of a long wait time does not require a sustained major increase of productivity. For example, with a maximum capacity of 100 procedures per week and a demand of 101, within five years there will be a wait list of 260 individuals. While elimination of this backlog may require a temporary increase in productivity of, say 10% for six months, thereafter, as long as demand remains constant, it will require a sustained increase of only 1% to avoid further backlog. However, in the case of imaging, the elimination of wait times may eventually cause an increase in demand.

Effect of wait time on demand. **In the case of imaging the elimination of a wait time may result in a *sustained* increase in demand.**
In the case of interventions such as fracture management or cancer treatment the elimination of wait times will have no effect on demand, (the number of patients will be the same whether there is a wait time or not). This is also largely true for most surgical interventions (few individuals demand unnecessary operations). However, in the case of imaging procedures the existence of a wait time may reduce demand because therapeutic decisions often have to be taken without the information provided by the imaging study, or the examination may be carried out elsewhere. As a result, the elimination of an imaging wait time can be expected to increase demand.

Acceptance of wait times. **There is a danger that the existence of excessive wait times can become accepted as the norm.**
With the passage of time the department, the hospital, and the whole health care system becomes accustomed to long waiting times and

accepts them as "normal". When this has happened, to reduce wait times requires a modification of behavior, an awareness that excessive wait times constitute bad medical care and cannot be tolerated.

Reduced demand. The departments of medical imaging have no control over demand. The MUHC could theoretically diminish overall caseload through negotiation with the Agence to divert cases elsewhere. In addition, demand on imaging services might be reduced by physician and patient education or by modification of request procedures. However, departments are already making considerable efforts to triage requests and exclude inappropriate investigations, a process that will be facilitated with the introduction of a Radiology Information System (RIS). In the present report we will not consider such initiatives that might reduce demand, but will focus on those initiatives that could reduce waiting times by increasing productivity.

**Increased productivity**. As noted above, there are areas where substantial increase in productivity cannot be achieved without the replacement of aging equipment, or the addition of new apparatus. Increased productivity of existing equipment can be achieved by one or all of the following interventions:

## 1. Additional radiologists.

**A major reason for most of the logjams encountered is shortage of radiologists. How has this come about?**

The number of radiologists is limited by the number of PREMS (Programme règional d'effectifs médicaux) allowed to the MUHC.

It has been suggested that the shortage of radiologists in the MUHC is because some radiolgists also work in a private imaging facility. This is a perfectly legal and long-standing practice in Québec, that has only come under scrutiny because the PREM system considers every radiologist on the staff as "full-time". Because of this the hours worked in other hospitals, in research laboratories, in teaching, or in a

private facility are hours lost to the institution in which the PREM's are counted. However, at the MUHC no full-time radiologists work less than 40 hours per week and the majority work more than 50 hours [L Stein].

Over the past five years the number of PREM positions allowed at the adult hospitals of the MUHC (MGH, RVH/Chest Hosp, MNH) has been ***reduced by three*** positions (32 to 29) [R Lisbona]. Has the reduction in PREM numbers been associated with any reduction in workload?

Precise estimation of workload is not easy. However, *change* in workload can be roughly estimated by relating it to the change in the number of technical units reported by the departments. These units are based on technologist time commitment, and a change in the number of units reported each year presumably bears a relationship to the change in radiological workload. Data for the last four years (2003/4 to 2006/7) show that the *technical units reported* by the three adult hospitals *have* ***increased by 65%*** (503,308, to 831,169).

A more direct method of estimating change in radiologist workload is based on the numbers of studies carried out for each test modality in the three adult hospitals (see Appendix 3, Tables A1 to A10). The cumulative results are shown in Table 7. Over the past five years there has been an increase of 1.7% in non-interventional procedures and an increase of 13.5% in interventional procedures.

However, this does not adequately reflect the change in workload because different examinations require different amounts of radiologist time commitment and the complexity of studies has been increasing. In order to estimate the change in the demand on radiologists' time it is necessary to know the time they spend on each type of test. No estimates of this nature are available.

Accordingly, MUHC radiologists were asked to estimate the time required for the procedures that they themselves carry out by responding to a questionnaire (Appendix 4). This time includes direct involvement in the procedure, and reporting and signing of the report, but does not include time in which the radiologist is only required to be on-site while the procedure is being done.

The estimated time commitment of radiologists for each test are shown in Table 8. Because the procedures carried out at the MNH differ considerably from the other adult hospitals, this site has been excluded from this estimate. (However, the workload here has also increased substantially. Since 1990 the number of neurosurgeons has increased approximately threefold, there has been increased demand from the ER, and referrals from other hospitals in the newly created RUIS (Réseau universitaire integrés en santé) structure have increased the MRI and CT load by an estimated 30% [D.Tampieri]).

In order to estimate the radiologist hours involved each year at the MGH and RVH, the number of examinations for each procedure was multiplied by the estimated average time taken for that procedure. (See Appendix 3, Tables A8 to A10).

The sum of the products, that is the estimated total hours spent on all types of examination by all radiologists at the MGH and RVH each year, is shown in Table 9. (The total hours estimated in this way are slightly more than the time that the radiologists could have spent on the job, which may be due to over-estimation of the times involved, or because the *average* estimated time per test does not accurately reflect the time actually taken. Nevertheless, for the purpose of comparing *change* in workload over time this is unimportant since the same estimate of time per act is applied to each year).

Based on these estimates, in the MGH and the RVH over the last five years the radiologists work hours committed to *direct service* (performing and reporting procedures only) ***increased by 25%.*** *(*46,941 in 2001-02 to 58,828 in 2006-07). For present purposes we will assume that the increase in workload at the MNH was comparable. (According to an alternative method of estimation set out in Appendix 5 the increase over this time period was 27.5%).

An additional burden on radiology manpower ***not reflected*** in the above estimates results from the recent development of RUIS responsibilities. These include the daily interpretation of electronically transmitted studies from Northern Quebec at the MGH and MCH sites, the transfer of patients from other hospitals in the McGill RUIS to the MNH for MRI studies, 8 weeks of radiology

coverage on site at Val D'Or , regular provision of help at St-Mary's Hospital for approximately 6 weeks per year, and regular referral of complex imaging and interventional cases from the RUIS periphery to the MUHC for management.

Aside from the RUIS commitment, to restore the radiologists workload to what was in 2001/02 would require an increase in staff of (25% of 32 ), or eight radiologists. However, the number of radiologists in the adult hospitals has been reduced since that time by 3 PREMS. **Thus, to merely restore the radiologist workload in the adult hospitals to the 2001-02 level, would require the addition of 3 plus 25% of 32, or 11 additional radiologists** (MCH not included).

Furthermore, there is no reason to assume that the level of staffing at the MUHC in 2001 was appropriate for the load. Precise comparison with other hospitals would require more detailed study. However, assuming that the radiologist workload bears a relationship to the technological units reported in hospitals with a comparable case-mix, the MUHC appears to be understaffed in comparison with its immediate neighbour the CHUM. Considering adult hospitals only, at the MUHC there are currently 29 PREM positions compared to 46 at the CHUM [B Lisbona], while the units reported from these hospitals were 8,850,817 and 9,647,027 respectively [SOFI, AQESS, 2006/07] **Thus the number of technical units per PREM was 46% higher at the MUHC.**

**In summary, it will not be possible to significantly reduce wait times at the MUHC without a substantial increase in the number of PREM positions. Unless this can be achieved wait times will continue to increase, morale will continue to deteriorate, and recruiting will become more difficult.**

The intention behind PREM allocation, namely to divert radiologists from theoretically over-served urban areas to underserved rural areas is valid and should be respected. However, an increase of workload (over which the department has no control), combined with a reduction in the number of PREM positions has resulted in an increasingly dysfunctional department in spite of the extraordinary efforts of all members to maintain services.

In view of Government's commitment to the reduction of wait times, it is inconceivable that they would not be open to increasing the PREM allocation, at least to the extent necessary to restore the workload of radiologists to the 2002 level.

- ***The MUHC should urgently make representations to the authorities at the highest level to increase the number of radiology PREMs, at least in numbers sufficient to restore the radiologist workload to the 2001 level. Excluding the needs at the MCH, this would require at least 11 additional PREMs.***

## 2). Additional Technologists

An additional major cause of prolonged wait times was the shortage of technologists. Since a review of manpower needs is currently under review by the department, and additional full-time float positions are being created, no attempt was made to quantitate the extent of the technology shortage. However, in the process of identifying the causes of bottlenecks it became clear that unavailability of technologists was a major cause of excessive wait times in all the adult hospitals. **Wait times cannot be eliminated without some increase in technologist staff.**

In addition, the productivity of the available technologists might be increased in some sites. At the RVH productivity could be increased through improvement of the patient transport system where it is reported that equipment is often idle up to 90-120 minutes per day because of delays in delivery of inpatients to the department. It is reported that transportation staffing has been reduced from six to three in recent years and that of the three allocated personnel one is absent, without replacement, for approximately 80% of the time. Clearly more transportation personnel are required, answering only to the needs of the department and situated, between calls, in the department.

Productivity of technologists could also be increased in certain areas by addition of technical assistants to help technologists in carrying out CT, MRI, US, and angiography procedures. It is estimated that in the RVH the addition of only one technical assistant would permit a sufficient increase in the use of the scanners to allow the hospital to dedicate one scanner to out-patients and to double the departmental through-put [L. Stein].

- ***Although the exact need for technologists is currently under review by the department, it is clear that wait times will not be eliminated without some additional personnel. The MUHC should open sufficient full time positions to operate equipment, when necessary, from 7:30 a.m. to midnight, 7 days per week..***

- ***At RVH a patient transportation unit, larger than the present three staff, should be situated within the department, answering only to its needs.***

- ***When technologists can not be recruited, the MUHC should consider increasing the use of technical assistants to increase the productivity of existing staff.***

## 3). Additional Transcription Capacity. Voice recognition

To be able to deliver competent patient care and avoid possible legal action, it is necessary that the reports of imaging tests should not get lost and should be made available to referring physicians in a timely manner (within 1 hour for emergency cases, on the same day for urgent cases and same-day/next day for all other cases).

In the case of elective reports this target is generally not achieved. Furthermore, the delay in typing frequently causes a second delay in signing off. (It is easier for a radiologist to proofread and sign a report she has just dictated than one she dictated 3 weeks ago). In addition, long typing delays increase the probability that when the report is ready for signature the radiologist will be absent from the department.

The failure to have promptly typed reports is primarily due to shortage of transcriptionists.

Recent progress in reduction of backlog typing through outsourcing is encouraging but will not alone diminish the turn-around-time of current work. The level of staffing appears to be capable of meeting demands *only* when *all staff members* are present and the absence of even one typist results in significant backlog. Historically, it has often been difficult or impossible to replace absentees, resulting in massive typing backlogs.

The recently approved voice recognition dictation system will resolve these problems and eliminate the present excessive turnaround times. However, its installation will take time and resources**. The present high turn-around-time and high loss rate must not be permitted to continue until the new system is functional.**

Accordingly it will be essential to continue to make every effort to maintain staffing levels and to continue to eliminate typing backlog through outsourcing of transcription services. This benefit should be extended (indirectly) to the RVH and the MNH.

- ***The MUHC must give the department the resources necessary to install the voice recognition technology as rapidly as possible.***
- ***Elimination of excessive turn-around-time must not be allowed to await the new system. Every effort must be made to maintain the full number of transcriptionists.***
- ***The elimination of backlog through outsourcing should be maintained and extended until all backlog is eliminated.***

## 4). Information system.

The present inefficiencies in scheduling, reporting, with occasional loss of reports, constitutes an inacceptable level of health care with a danger of legal damages. These inefficiencies will be greatly reduced or eliminated with the introduction of the recently approved Radiology Information System (RIS). However, the installation of this system will take resources and time. The elimination of excessive wait times must not be put off until the RIS is functional.

- ***The MUHC should consider the initiation of an RIS to be urgent and make sure that the resources are available to make it functional as rapidly as possible.***
- ***The measures necessary to eliminate wait times must not be delayed until the RIS is functional.***

## 5). Additional Short term Measures.

As discussed above reduction of wait times requires two steps, elimination of current backlog and prevention of its re-accumulation. To eliminate the existing backlog there are several temporary possibilities that should be considered in addition to the above recommendations.

General radiology. There are private facilities in Montréal with PACS systems connected to the MUHC at which outpatients could undergo imaging studies (other than ultrasound, CT, and MRI) without additional cost to the patients or the MUHC.

- ***In order to diminish the departmental workload and allow more time to be allocated to the reduction of the backlog, the MUHC should temporarily divert outpatients requiring general radiological examinations to private laboratories***, ***when this can be done without cost or inconvenience to patients.***

MRI. CT.US The most cost effective way to increase productivity for these modalities would be to recruit sufficient staff to run equipment from 7 a.m. to midnight, seven days per week. However, as a short-term measure to eliminate backlog consideration should also be given to temporarily operating equipment 24 hours a day and/or outsourcing patients to the Montréal Neurological Institute.

- ***To eliminate backlog the MUHC should also consider budgeting a sufficient number of technologist posts to temporarily operate equipment 24 hours per day, seven days per week, and/or temporarily outsourcing MRI to the Montreal Neurological Institute.***

## Table 7 : Total number of exams in MUHC in adult sites

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 159,585 | 161,965 | 155,501 | 161,292 | 158,964 | 162,702 |
| RVH | 141,680 | 147,548 | 154,995 | 150,310 | 144,502 | 148,853 |
| MNH | 30,319 | 31,320 | 26,856 | 24,755 | 25,799 | 25,848** |
| MUHC | 331,584 | 340,833 | 337,352 | 336,357 | 329,265 | 337,403 |
| **Interventional** | | | | | | |
| MGH | 3,924 | 3,907 | 3,400 | 3,959 | 4,693 | 5,912 |
| RVH | 6,624 | 6,380 | 4,745 | 4,681 | 6,217 | 7,122 |
| MNH | 251 | 220 | 312 | 541 | 832 | 872 |
| MUHC | 10,799 | 10,507 | 8,457 | 9,181 | 11,742 | 13,906 |
| **Total** | | | | | | |
| MGH | 163,509 | 165,872 | 158,901 | 165,251 | 163,657 | 168,614 |
| RVH | 148,304 | 153,928 | 159,740 | 154,991 | 150,719 | 155,975 |
| MNH | 30,570 | 31,540 | 27,168 | 25,296 | 26,631 | 26,720 |
| **MUHC** | **342,383** | **351,340** | **345,809** | **345,538** | **341,007** | **351,309** |

Data for Montréal Chest Institute included with RVH.

*Lithotripsy exams have been excluded, as they do not normally require radiologist time

**The drop in exam numbers at the MNH is due entirely to a reduction in Doppler exams. This has been the result of the loss of the 3 technologists who were trained in this procedure. There is currently a single trained technologist available, which has made it necessary for a radiologist to conduct some of these exams in addition to her normal duties. Attempts to recruit additional technologists are on-going. [D. Tampieri]

## Table 8:Estimated time of radiologist commitment for each procedure

| Procedure | Type | Mean time (min) | No of Radiol. | Procedure | Type | Mean time (min) | No of Radiol. |
|---|---|---|---|---|---|---|---|
| Gen. X-Ray | Shortest | 1.89 | 14 | CT | Shortest | 7.87 | 7 |
| | Longest | 17.36 | 14 | | Longest | 36.33 | 15 |
| | Average | 4.70 | 14 | | Average | 29.64 | 15 |
| Mammography | Shortest | 3.25 | 4 | Int. CT | Shortest | 15.60 | 15 |
| | Longest | 25.50 | 4 | | Longest | 104.17 | 12 |
| | Average | 10.25 | 4 | | Average | 28.33 | 12 |
| Int. Mammo. | Shortest | 26.67 | 3 | MRI | Shortest | 16.00 | 12 |
| | Longest | 75.00 | 3 | | Longest | 64.00 | 10 |
| | Average | 40.00 | 3 | | Average | 47.08 | 10 |
| Barium GI | Shortest | 10.71 | 7 | Angio. | Shortest | 16.25 | 10 |
| | Longest | 36.43 | 7 | | Longest | 138.75 | 4 |
| | Average | 19.29 | 7 | | Average | 28.55 | 4 |
| Ultrasound | Shortest | 7.50 | 12 | Int Angio. | Shortest | 22.50 | 4 |
| | Longest | 38.33 | 12 | | Longest | 165.00 | 4 |
| | Average | 15.00 | 12 | | Average | 45.00 | 4 |
| Int. U/S | Shortest | 17.50 | 8 | | | | |
| | Longest | 63.13 | 8 | | | | |
| | Average | 1.89 | 14 | | | | |

# Table 9
## Estimated time commitment (number of acts X hours/act) for all radiological procedures carried out in the MGH, RVH, and MCI

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | % Change |
|---|---|---|---|---|---|---|---|
| **Non-Interventional** | | | | | | | |
| MGH | 25300 | 26116 | 25465 | 26558 | 26367 | 27296 | **107.9%** |
| RVH | 15814 | 16767 | 18287 | 18301 | 19381 | 21325 | **134.9%** |
| MCI | 1108 | 1195 | 1213 | 1176 | 1223 | 1272 | **114.7%** |
| *Main adult sites* | *42223* | *44078* | *44965* | *46036* | *46971* | *49893* | ***108.1%*** |
| | | | | | | | |
| **Interventional** | | | | | | | |
| MGH | 1853 | 1720 | 2348 | 2689 | 3119 | 3929 | **212.0%** |
| RVH | 2866 | 3058 | 3423 | 3487 | 4595 | 5006 | **174.7%** |
| MCI | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** |
| *Main adult sites* | *4718* | *4778* | *5771* | *6176* | *7714* | *8935* | ***189.6%*** |
| | | | | | | | |
| **All exams** | | | | | | | |
| MGH | 27153 | 27836 | 27813 | 29247 | 29485 | 31225 | **115.0%** |
| RVH | 18680 | 19824 | 21709 | 21788 | 23976 | 26331 | **141.0%** |
| MCI | 1108 | 1195 | 1213 | 1176 | 1223 | 1272 | **114.7%** |
| *Main adult sites* | *46941* | *48855* | *50736* | *52211* | *54685* | *58828* | ***125.3%*** |

Data for Montréal Chest Institute included with RVH.

## APPENDIX 1

# Definitions

**Wait times**
The wait time is generally considered to be the time elapsed between the initiation of a request for a service by the appropriate physician and the time that elapses before the service is received. Unless specifically noted wait time in the present report includes the period from the initiation of the request to the completion of the report.

**Benchmarks**
Benchmarks are intended to be *evidence-based* intervals that express the longest time that it is appropriate to wait for a particular procedure or diagnostic test. Theoretically, because they are based on evidence, they are applicable across different jurisdictions[3]. In practice the "evidence" is often weak, and published benchmarks are variably dependent on expert opinion.

**Targets**
Targets are performance goals set by health authorities. They may be influenced by numerous factors including the pain and distress experienced by waiting patients, and are thus partly determined subjectively.

**WTA Standard**
Target determined as appropriate by the Canadian Wait Times Alliance[4].

**Priority**
Unless otherwise specified the definition of priority is that used by the Canadian Wait Time Alliance[4]:

| | |
|---|---|
| 1 Emergency | Immediate danger to life, limb or organ. |
| 2 Urgent | A situation that is unstable and has the potential to deteriorate quickly and result in an emergency situation. |
| 3 Scheduled | A situation involving minimal pain, dysfunction or disability (also called "routine" or "elective"). |

## APPENDIX 2

*Methods:* The current wait times for all departments except nuclear medicine were obtained from Radiology's QI Dashboard internal tracking system, and Dashboard source documents such as backlog reports (kindly supplied by the Departments administration).

The Dashboard methodology depends on estimation of the potential capacity to carry out each type of investigation, compared to the number of requisitions awaiting processing at that time, from which it can be predicted how long it would take to complete all waiting requisitions.

Results are based on Period 11 of each fiscal year. At the MNH and the RVH, reservations are made for each modality as a whole (e.g., CT or MRI). At the MGH, reservations are made separately for each specific test (e.g., CT-abdomen or CT-bone) and the wait time for one test type is chosen to represent wait times for that modality. At the MGH, the QI Dashboard figures represent the averages of weekly backlog reports for each test type. The backlog data for the last week of Period 11 (January 29th) were used for those procedures within a modality that are not specifically tracked in the QI-Dashboard (CT: Chest, Body, Head, Bones, ENT; MRI: Neuro-spine, Pelvis/Abdominal/Gyn, ENT, Abdomen, Breast, Bone, Arthrogram; Ultrasound: Pelvis, Small parts, Carotid, Prostate, Bone). At the RVH and MNH, the wait times data are averaged for all tests in that modality.

For those test types not listed on the Dashboard or supporting documents, we obtained the data in the same manner as in Wait Times Report #1 (report # 26), by asking the relevant booking clerks what the delay before a non-urgent test would be.

Time to test = time from booking procedure to time of procedure.
*Time to report = Time to interpret (by Radiologist) + time to inscribe (by Typist) + time to sign (by Radiologist). These are averages calculated from randomly selected patient files, and do not reflect individual variation between physicians or official or un-official differences in priority levels.

Time to test for exams listed as C+ or C+/- (Except MNH-MRI) was calculated based on a 5-day workweek. Wait times for non-contrast exams may be slightly shorter. Times for the MNH-MRI are based on a seven-day week since it operates 7 days/week.
For all departments except nuclear medicine, calendar wait times were calculated based on a 5-day workweek (except where specified above) and times were rounded to the nearest whole day. An exception is time to report, which is recorded in calendar days. Each adult site has its own method of tracking this information (See the QI Dashboard files).

## APPENDIX 3

### Radiologist hours:

The total number of examinations of each type performed in each hospital each year is shown in tables A1 to A7 and the total of all examinations performed each year in the text in table 7. Since the radiologist time involved in each examination varies with the test performed, and the numbers of each examination vary from year to year, it is not possible to estimate the change in workload from Table 7.

To adjust the number of examinations performed so as to reflect the change in radiologists' workload it was necessary to estimate the average time spent by the radiologist on each examination. Since no such estimates are available, radiologists working at the MGH and RVH were given a questionnaire in which they were asked to estimate the average, longest, and shortest time they would normally spend on any particular examination. Radiologists at the MNH were not asked to participate. A sample of the questionnaire may be found in Appendix 4. The number of participating radiologists and their average estimates are shown in Table 8 above.

A mean procedure time was calculated from the radiologists' estimate of the average time taken for each test. Since the sum of the product of the number of acts times the number of acts performed slightly exceeds the time that the available radiologists could have spent on the job, there is obviously some upward skewing. This could either be due to upward rounding by the radiologists estimating the time spent on some or all of these procedures, or lack of information of the number of short, long, and average-length procedures carried out. However, for the purpose of comparing *change* in workload over time this is unimportant since the same estimate of time per act is applied to each year.

## Radiology workload

### Table A 1. Overall - Number of exams

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 159,585 | 161,965 | 155,501 | 161,292 | 158,964 | 162,702 |
| RVH/MCI | 141,680 | 147,548 | 154,995 | 150,310 | 144,502 | 148,853 |
| MNH | 30,319 | 31,320 | 26,856 | 24,755 | 25,799 | 25,848 |
| MUHC | 331,584 | 340,833 | 337,352 | 336,357 | 329,265 | 337,403 |
| **Interventional** | | | | | | |
| MGH | 3,924 | 3,907 | 3,400 | 3,959 | 4,693 | 5,912 |
| RVH/MCI | 6,624 | 6,380 | 4,745 | 4,681 | 6,217 | 7,122 |
| MNH | 251 | 220 | 312 | 541 | 832 | 872 |
| MUHC | 10,799 | 10,507 | 8,457 | 9,181 | 11,742 | 13,906 |
| **Total** | | | | | | |
| MGH | 163,509 | 165,872 | 158,901 | 165,251 | 163,657 | 168,614 |
| RVH/MCI | 148,304 | 153,928 | 159,740 | 154,991 | 150,719 | 155,975 |
| MNH | 30,570 | 31,540 | 27,168 | 25,296 | 26,631 | 26,720 |
| MUHC | 342,383 | 351,340 | 345,809 | 345,538 | 341,007 | 351,309 |

*Lithotripsy exams have been excluded, as they do not normally require radiologist time

## Radiology workload

### Table A 2. CT - Number of exams

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 19,867 | 21,030 | 23,035 | 25,150 | 27,812 | 31,570 |
| RVH/MCI | 12,604 | 13,334 | 14,796 | 15,206 | 16,523 | 17,850 |
| MNH | 9,663 | 9,855 | 9,538 | 8,533 | 8,265 | 7,942 |
| MUHC | 42,134 | 44,219 | 47,369 | 48,889 | 52,600 | 57,362 |
| **Interventional** | | | | | | |
| MGH | 291 | 209 | 177 | 226 | 262 | 211 |
| RVH/MCI | 248 | 164 | 190 | 219 | 554 | 560 |
| MNH | 0 | 0 | 7 | 2 | 5 | 9 |
| MUHC | 539 | 373 | 374 | 447 | 821 | 780 |
| **Total** | | | | | | |
| MGH | 20158 | 21239 | 23212 | 25376 | 28074 | 31781 |
| RVH/MCI | 12852 | 13498 | 14986 | 15425 | 17077 | 18410 |
| MNH | 9663 | 9855 | 9545 | 8535 | 8270 | 7951 |
| MUHC | 42673 | 44592 | 47743 | 49336 | 53421 | 58142 |

## Radiology workload

### Table A 3. General Angiography and Interventional procedures - Number of exams

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 1,194 | 919 | 639 | 602 | 1,117 | 1,093 |
| RVH/MCI | 4,126 | 4,384 | 4,589 | 4,571 | 4,563 | 5,194 |
| MNH | 2,340 | 2,404 | 1,679 | 1,812 | 2,220 | 1,808 |
| MUHC | 7,660 | 7,707 | 6,907 | 6,985 | 8,044 | 8,095 |
| **Interventional** | | | | | | |
| MGH | 1141 | 1130 | 1719 | 1928 | 2087 | 2707 |
| RVH/MCI | 1740 | 1871 | 2231 | 2339 | 2771 | 2812 |
| MNH | 205 | 183 | 178 | 209 | 327 | 190 |
| MUHC | 3086 | 3184 | 4128 | 4476 | 5185 | 5709 |
| **Total** | | | | | | |
| MGH | 2335 | 2049 | 2358 | 2530 | 3204 | 3800 |
| RVH/MCI | 5866 | 6255 | 6820 | 6910 | 7334 | 8006 |
| MNH | 2545 | 2587 | 1857 | 2021 | 2547 | 1998 |
| MUHC | 10746 | 10891 | 11035 | 11461 | 13229 | 13804 |

## Radiology workload

### Table A 4. General Radiography - Number of exams

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 99,663 | 98,571 | 90,530 | 91,931 | 91,947 | 91,753 |
| RVH | 60,224 | 58,271 | 55,633 | 55,010 | 52,750 | 51,667 |
| MCI | 14,160 | 15,263 | 15,497 | 15,027 | 15,627 | 16,245 |
| MNH | 3,934 | 3,896 | 3,878 | 4,159 | 4,428 | 4,521 |
| MUHC | 177,981 | 176,001 | 165,538 | 166,127 | 164,752 | 164,186 |
| **Interventional** | | | | | | |
| MGH | 410 | 492 | 633 | 855 | 916 | 1,144 |
| RVH/MCI | 750 | 457 | 413 | 412 | 494 | 918 |
| MNH | 46 | 30 | 127 | 330 | 500 | 673 |
| MUHC | 1,206 | 979 | 1,173 | 1,597 | 1,910 | 2,735 |
| **Total** | | | | | | |
| MGH | 100073 | 99063 | 91163 | 92786 | 92863 | 92897 |
| RVH | 60974 | 58728 | 56046 | 55422 | 53244 | 52585 |
| MCI | 14160 | 15263 | 15497 | 15027 | 15627 | 16245 |
| MNH | 3980 | 3926 | 4005 | 4489 | 4928 | 5194 |
| MUHC | 179187 | 176980 | 166711 | 167724 | 166662 | 166921 |

## Radiology workload

### Table A 5. MRI - Number of exams

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 6,836 | 6,848 | 7,024 | 6,508 | 7,031 | 6,707 |
| RVH | 0 | 0 | 0 | 0 | 290 | 2,727 |
| MNH | 6,507 | 7,399 | 7,757 | 7,879 | 8,958 | 9,807 |
| MUHC | 13,343 | 14,247 | 14,781 | 14,532 | 16,401 | 19,241 |
| **Interventional** | Interventional procedures not performed at this time | | | | | |
| MGH | | | | | | |
| RVH/MCI | | | | | | |
| MNH | | | | | | |
| MUHC | | | | | | |
| **Total** | | | | | | |
| MGH | 6836 | 6848 | 7024 | 6508 | 7031 | 6707 |
| RVH/MCI | 0 | 0 | 0 | 0 | 290 | 2727 |
| MNH | 6507 | 7399 | 7757 | 7879 | 8958 | 9807 |
| MUHC | 13343 | 14247 | 14781 | 14532 | 16401 | 19241 |

## Radiology workload

### Table A 6. Mammography - Number of exams

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 1,669 | 0 | 0 | 0 | 0 | 0 |
| RVH/MCI | 7,303 | 12,882 | 14,062 | 15,296 | 18,124 | 19,291 |
| MNH | 0 | 0 | 0 | 0 | 0 | 0 |
| MUHC | 8,972 | 12,882 | 14,062 | 15,296 | 18,124 | 19,291 |
| **Interventional** | | | | | | |
| MGH | 193 | 0 | 0 | 0 | 0 | 0 |
| RVH/MCI | 217 | 786 | 879 | 1081 | 1605 | 1708 |
| MNH | 0 | 0 | 0 | 0 | 0 | 0 |
| MUHC | 410 | 786 | 879 | 1081 | 1605 | 1708 |
| **Total** | | | | | | |
| MGH | 1,862 | 0 | 0 | 0 | 0 | 0 |
| RVH/MCI | 7,520 | 13,668 | 14,941 | 16,377 | 19,729 | 20,999 |
| MNH | 0 | 0 | 0 | 0 | 0 | 0 |
| MUHC | 9,382 | 13,668 | 14,941 | 16,377 | 19,729 | 20,999 |

## Radiology workload

### Table A 7. Ultrasound - Number of exams

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 31,601 | 35,940 | 34,273 | 37,101 | 31,021 | 31,579 |
| RVH/MCI | 13,924 | 13,001 | 16,964 | 16,002 | 17,197 | 16,606 |
| Woman's Pav. | 27,100 | 29,606 | 32,743 | 31,212 | 18,408 | 18,379 |
| MNH | 7,875 | 7,766 | 4,004 | 2,227 | 1,928 | 1,770 |
| MUHC | 80,500 | 86,313 | 87,984 | 86,542 | 68,554 | 68,334 |
| **Interventional** | | | | | | |
| MGH | 644 | 733 | 871 | 950 | 1428 | 1850 |
| RVH/MCI | 1397 | 1099 | 1032 | 643 | 793 | 1124 |
| MNH | 0 | 7 | 0 | 0 | 0 | 0 |
| MUHC | 2041 | 1839 | 1903 | 1593 | 2221 | 2974 |
| **Total** | | | | | | |
| MGH | 32245 | 36673 | 35144 | 38051 | 32449 | 33429 |
| RVH/MCI | 15321 | 14100 | 17996 | 16645 | 17990 | 17730 |
| Woman's Pav. | 27100 | 29606 | 32743 | 31212 | 18408 | 18379 |
| MNH | 7875 | 7773 | 4004 | 2227 | 1928 | 1770 |
| MUHC | 82541 | 88152 | 89887 | 88135 | 70775 | 71308 |

# Table A 8
## Radiologist-hours per year - Non-Interventional

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | |
|---|---|---|---|---|---|---|---|
| **All exams** | | | | | | | |
| MGH | 25300 | 26116 | 25465 | 26558 | 26367 | 27296 | 107.9% |
| RVH/MCI | 15814 | 16767 | 18287 | 18301 | 19381 | 21325 | 134.9% |
| MCI | 1108 | 1195 | 1213 | 1176 | 1223 | 1272 | 114.7% |
| *Main adult sites* | *42223* | *44078* | *44965* | *46036* | *46971* | *49893* | *108.1%* |
| | | | | | | | |
| **CT** | | | | | | | |
| MGH | 5165 | 5468 | 5989 | 6539 | 7231 | 8208 | 158.9% |
| RVH/MCI | 3277 | 3467 | 3847 | 3954 | 4296 | 4641 | 141.6% |
| *Main adult sites* | *8442* | *8935* | *9836* | *10493* | *11527* | *12849* | *136.1%* |
| | | | | | | | |
| **General Angio.** | | | | | | | |
| MGH | 896 | 689 | 479 | 452 | 838 | 820 | 91.5% |
| RVH/MCI | 3095 | 3288 | 3442 | 3428 | 3422 | 3896 | 125.9% |
| *Main adult sites* | *3990* | *3977* | *3921* | *3880* | *4260* | *4715* | *105.7%* |
| | | | | | | | |
| **General Radiography** | | | | | | | |
| MGH | 7801 | 7716 | 7086 | 7196 | 7197 | 7182 | 92.1% |
| RVH | 4714 | 4561 | 4355 | 4306 | 4129 | 4044 | 85.8% |
| MCI | 1108 | 1195 | 1213 | 1176 | 1223 | 1272 | 114.7% |
| *Main adult sites* | *13623* | *13471* | *12654* | *12678* | *12549* | *12498* | *92.2%* |
| | | | | | | | |
| **MRI** | | | | | | | |
| MGH | 3253 | 3259 | 3342 | 3097 | 3346 | 3191 | 98.1% |
| RVH/MCI | 0 | 0 | 0 | 0 | 138 | 1298 | N/A |
| *Main adult sites* | *3253* | *3259* | *3342* | *3097* | *3484* | *4489* | *144.2%* |
| | | | | | | | |
| **Mammography** | | | | | | | |
| MGH | 285 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| RVH/MCI | 1248 | 2201 | 2402 | 2613 | 3096 | 3296 | 264.2% |
| *Main adult sites* | *1533* | *2201* | *2402* | *2613* | *3096* | *3296* | *215.0%* |
| | | | | | | | |
| **Ultrasound*** | | | | | | | |
| MGH | 7900 | 8985 | 8568 | 9275 | 7755 | 7895 | 99.9% |
| RVH/MCI | 3481 | 3250 | 4241 | 4001 | 4299 | 4152 | 119.3% |
| *Main adult sites* | *11381* | *12235* | *12809* | *13276* | *12055* | *12046* | *84.9%* |

***Ultrasound performed at the Woman's Pavillion is excluded as per Methods.**

# Table A 9
## Radiologist-hours per year - Interventional

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | |
|---|---|---|---|---|---|---|---|
| **All exams** | | | | | | | |
| MGH | 1853 | 1720 | 2348 | 2689 | 3119 | 3929 | 212.0% |
| RVH/MCI | 2866 | 3058 | 3423 | 3487 | 4595 | 5006 | 174.7% |
| MCI | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| *Main adult sites* | *4718* | *4778* | *5771* | *6176* | *7714* | *8935* | *189.6%* |
| | | | | | | | |
| **Interventional CT** | | | | | | | |
| MGH | 228 | 164 | 139 | 177 | 206 | 166 | 72.5% |
| RVH/MCI | 195 | 129 | 149 | 172 | 435 | 439 | 225.8% |
| *Main adult sites* | *423* | *293* | *288* | *349* | *640* | *605* | *144.7%* |
| | | | | | | | |
| **Angio/ Interventional** | | | | | | | |
| MGH | 1046 | 1036 | 1576 | 1767 | 1913 | 2481 | 237.2% |
| RVH/MCI | 1595 | 1715 | 2045 | 2144 | 2540 | 2578 | 161.6% |
| *Main adult sites* | *2641* | *2751* | *3621* | *3911* | *4453* | *5059* | *185.0%* |
| | | | | | | | |
| **Interventional Radiography** | | | | | | | |
| MGH | 132 | 158 | 203 | 275 | 294 | 368 | 279.0% |
| RVH | 241 | 147 | 133 | 132 | 159 | 295 | 122.4% |
| MCI | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| *Main adult sites* | *373* | *305* | *336* | *407* | *453* | *663* | *226.8%* |
| | | | | | | | |
| **Interventional MRI** | | | | | | | |
| MGH | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| RVH/MCI | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| *Main adult sites* | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | | | | | | | |
| **Interventional Mammography** | | | | | | | |
| MGH | 129 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| RVH/MCI | 145 | 524 | 586 | 721 | 1070 | 1139 | 2247.4% |
| *Main adult sites* | *273* | *524* | *586* | *721* | *1070* | *1139* | *400.9%* |
| | | | | | | | |
| **Interventional Ultrasound** | | | | | | | |
| MGH | 318 | 362 | 430 | 469 | 706 | 914 | 248.0% |
| RVH/MCI | 690 | 543 | 510 | 318 | 392 | 555 | 86.3% |
| *Main adult sites* | *1008* | *905* | *940* | *787* | *1097* | *1469* | *145.0%* |

# Table A 10

## Radiologist-hours per year - All exams performed

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | |
|---|---|---|---|---|---|---|---|
| **All exams** | | | | | | | |
| MGH | 27153 | 27836 | 27813 | 29247 | 29485 | 31225 | 115.0% |
| RVH/MCI | 18680 | 19824 | 21709 | 21788 | 23976 | 26331 | 141.0% |
| MCI | 1108 | 1195 | 1213 | 1176 | 1223 | 1272 | 114.7% |
| *Main adult sites* | *46941* | *48855* | *50736* | *52211* | *54685* | *58828* | *125.3%* |
| | | | | | | | |
| **CT** | | | | | | | |
| MGH | 5394 | 5632 | 6128 | 6716 | 7437 | 8374 | 155.2% |
| RVH/MCI | 3472 | 3596 | 3996 | 4125 | 4731 | 5080 | 146.3% |
| *Main adult sites* | *8865* | *9227* | *10124* | *10842* | *12167* | *13454* | *151.8%* |
| | | | | | | | |
| **General Angio.** | | | | | | | |
| MGH | 1941 | 1725 | 2055 | 2219 | 2751 | 3301 | 170.0% |
| RVH/MCI | 4690 | 5003 | 5487 | 5572 | 5962 | 6473 | 138.0% |
| *Main adult sites* | *6631* | *6728* | *7542* | *7791* | *8713* | *9774* | *147.4%* |
| | | | | | | | |
| **General Radiography** | | | | | | | |
| MGH | 7933 | 7874 | 7290 | 7471 | 7491 | 7550 | 95.2% |
| RVH | 4955 | 4708 | 4487 | 4438 | 4288 | 4339 | 87.6% |
| MCI | 1108 | 1195 | 1213 | 1176 | 1223 | 1272 | 114.7% |
| *Main adult sites* | *13996* | *13776* | *12990* | *13085* | *13002* | *13160* | *94.0%* |
| | | | | | | | |
| **MRI** | | | | | | | |
| MGH | 3253 | 3259 | 3342 | 3097 | 3346 | 3191 | 98.1% |
| RVH/MCI | 0 | 0 | 0 | 0 | 138 | 1298 | N/A |
| *Main adult sites* | *3253* | *3259* | *3342* | *3097* | *3484* | *4489* | *138.0%* |
| | | | | | | | |
| **Mammography** | | | | | | | |
| MGH | 414 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| RVH/MCI | 1392 | 2725 | 2988 | 3334 | 4166 | 4434 | 318.5% |
| *Main adult sites* | *1806* | *2725* | *2988* | *3334* | *4166* | *4434* | *245.5%* |
| | | | | | | | |
| **Ultrasound*** | | | | | | | |
| MGH | 8218 | 9347 | 8999 | 9745 | 8461 | 8809 | 107.2% |
| RVH/MCI | 4171 | 3793 | 4751 | 4318 | 4691 | 4707 | 112.8% |
| *Main adult sites* | *12390* | *13140* | *13749* | *14063* | *13152* | *13516* | *109.1%* |

*Ultrasound performed at the Woman's Pavillion is excluded as per Methods.

# APPENDIX 4

## Example Quiz on Radiologist workload

**DIAGNOSTIC IMAGING**
**Royal Victoria Hospital**

**Assessment of increase in workload**

**Background**. The Technology Assessment Unit of the MUHC is reviewing the length of wait times, and trying to identify what steps are necessary to reduce them. In the Radiology department there has clearly been an increase in the number of procedures carried out each year. However, different procedures require different amounts of radiologists' professional time. To gain some idea of the increase in workload it is necessary to roughly estimate the time taken for each procedure.

**Request**. Could you please help us by making a ***rough*** estimate of the shortest time, the longest time, and the average time that YOU spend on each of the following tests that YOU carry out. This includes where relevant, involvement in the procedure, reporting, and signing out the report, but not time during which you are required to stay in the building while a test is being done. Any help you can give will be greatly appreciated.

| **Procedure** | **Time** | | **Comment** |
|---|---|---|---|
| | Shortest | Longest | **Average** |
| General x-ray (chest, fracture) | | | |
| Mammography | | | |
| Mammography + intervention | | | |
| G. I Barium | | | |
| Ultrasound | | | |
| Ultrasound + intervention | | | |
| CT | | | |
| CT + intervention | | | |
| MRI | | | |
| Angiography | | | |
| Angiography + intervention | | | |

# APPENDIX 5

Although not included in the text of this report we have used a second approach to crosscheck the change in radiologist time commitment over the past five years.

Given that the radiologist/hour estimates presented in Tables A8-10 are higher than the actual hours worked, a method of reducing these estimates to realistic levels was developed. This takes into account not only issues where the base estimates have potentially generated an overestimate, but also workload components e.g, teaching, research, etc., that were not included in the primary calculations.

Workload is calculated for PREM-holding radiologists only (residents and retirees excluded). As the radiologists at the MNH were not polled, the workload for the MNH was excluded from the calculations.

Given that the MUHC is a teaching centre, some times taken may be longer than would be the case at a community hospital due to case complexity or additional time needed during resident observation or teaching sessions. On the other hand, in general radiology the time per test may be shortened due to the assistance of radiology residents, particularly those near the end of their training. It is estimated that in general radiology the residents permit a 30% increase in efficiency (L.Stein) , Accordingly the contribution of general radiography (non-interventional) to the overall workload was reduced by this amount.

In addition, orthopaedic surgeons are able to make initial diagnoses prior to the official reports for general radiology films, and as a result a backlog of musclo-skeletal (MSK) cases has been building up at a rate of approximately 1000/year. Accordingly, the MSK radiologists were identified, the average time taken by them to read an average case was calculated, and the overall workload was appropriately reduced.

Finally, these workload calculations reflect only the time actually spent carrying out and interpreting procedures. The time spent on administrative duties and teaching was estimated as 15% of the

radiologists work hours (Dr. L. Stein). Accordingly, 15% was added to the estimated work hours of all radiologists.

The final calculated workloads were still slightly higher than the known working hours. There are many possible causes for this from the very human tendency to round time estimates upward, to lack of information on the proportion of short, long and average cases. Thus, it was necessary to develop a method of further adjusting the workload calculations appropriately.

To determine the final relative workloads over the years, the number of hours worked by a full-time radiologist was calculated with the assistance of Dr. L. Stein. These included all time spent on-site, as well as on-call and consultation workloads. A 30-minute lunch break was excluded for each nominal working day, resulting in a time of 50 hours per week spent by a full time radiologist at the two main adult hospitals in the 2006-2007 fiscal year.

The calculated workload was reduced by a factor of 27.5% to match this known time, and this same factor was applied to all previous years. The final result of these corrections is presented in Tables B1-B7, below. Table B1 represents the sum of the times presented in Tables B2-B7

Once the final workloads were worked out, the number of FTE radiologists needed to permit the radiology staff to work a standard 40-hour workweek, with no time for teaching or administrative duties, was calculated for each site (excluding MNH and MCH). In addition, the relative workload per 40-hour FTE was calculated using 2001-2002 as a comparison year, as the MUHC's allotment of 38 PREMs in 2001 was reduced to 34 in 2002.

**Conclusion.** It can be seen from Table B1 that the estimated radiologist hours per week has increased from 779 in 2001-02 to 993 in 2006-07, an increase of 27.5%. This compares to an estimated increase of 25% arrived at using the previous approach.

## Table B 1. Overall - Estimated radiologist hours/week

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 418.78 | 434.13 | 425.70 | 445.04 | 441.54 | 458.58 |
| RVH | 262.65 | 280.87 | 309.72 | 310.25 | 330.91 | 366.84 |
| MCI | 14.15 | 15.25 | 15.49 | 15.02 | 15.62 | 16.24 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 695.59 | 730.26 | 750.91 | 771.57 | 791.10 | 841.65 |
| **Interventional** | | | | | | |
| MGH | 32.47 | 31.37 | 42.83 | 49.04 | 56.88 | 71.66 |
| RVH/MCI | 50.77 | 50.36 | 56.38 | 56.16 | 72.77 | 79.55 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 83.24 | 81.74 | 99.22 | 105.20 | 129.65 | 151.21 |
| **Total** | | | | | | |
| MGH | 451.25 | 465.51 | 468.54 | 494.09 | 498.43 | 530.23 |
| RVH | 313.43 | 331.23 | 366.10 | 366.41 | 403.68 | 446.40 |
| MCI | 14.15 | 15.25 | 15.49 | 15.02 | 15.62 | 16.24 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 778.83 | 811.99 | 850.12 | 876.77 | 920.75 | 992.87 |

*Estimated radiologist hours *do not* include Lithotripsy exams, as these numbers are calculated based on the data below.

**MCI data are incorporated with RVH data for most modalities.

Due to the complex nature of neuroradiologist work carried out at the MNH, an estimate of radiologist hours was not made at this time. The number of exams carried out, however, has been included to show the changing pattern towards increasing numbers of lengthy interventional exams.

## Table B 2. CT - Estimated radiologist hours/week

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 94.22 | 99.73 | 109.24 | 119.27 | 131.89 | 149.72 |
| RVH/MCI | 59.77 | 63.23 | 70.17 | 72.11 | 78.36 | 84.65 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 153.99 | 162.97 | 179.41 | 191.38 | 210.25 | 234.37 |
| **Interventional** | | | | | | |
| MGH | 4.17 | 2.99 | 2.53 | 3.23 | 3.75 | 3.02 |
| RVH/MCI | 3.55 | 2.35 | 2.72 | 3.13 | 7.93 | 8.02 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 8.02 | 7.80 | 7.71 | 5.34 | 5.25 | 6.37 |
| **Total** | | | | | | |
| MGH | 98.38 | 102.72 | 111.77 | 122.51 | 135.64 | 152.74 |
| RVH/MCI | 63.32 | 65.58 | 72.89 | 75.25 | 86.29 | 92.67 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 161.70 | 168.31 | 184.66 | 197.75 | 221.93 | 245.40 |

## Table B 3. General Angiography and Interventional procedures - Estimated radiologist hours/week

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 16.33 | 12.57 | 8.74 | 8.24 | 15.28 | 14.95 |
| RVH/MCI | 56.44 | 59.97 | 62.78 | 62.53 | 62.42 | 71.05 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 72.78 | 72.54 | 71.52 | 70.77 | 79.67 | 86.01 |
| **Interventional** | | | | | | |
| MGH | 19.08 | 18.89 | 28.74 | 32.24 | 34.89 | 45.26 |
| RVH/MCI | 29.09 | 31.28 | 37.30 | 39.11 | 46.33 | 47.02 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 48.17 | 50.18 | 66.04 | 71.34 | 81.23 | 92.28 |
| **Total** | | | | | | |
| MGH | 35.41 | 31.47 | 37.48 | 40.47 | 50.17 | 60.21 |
| RVH/MCI | 85.54 | 91.26 | 100.08 | 101.64 | 108.75 | 118.07 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 120.95 | 122.72 | 137.56 | 142.11 | 160.90 | 178.28 |

## Table B 4. General Radiography - Estimated radiologist hours/week

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 99.60 | 98.51 | 90.47 | 91.88 | 91.89 | 91.70 |
| RVH | 60.19 | 58.24 | 55.60 | 54.98 | 52.72 | 51.64 |
| MCI | 14.15 | 15.25 | 15.49 | 15.02 | 15.62 | 16.24 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 173.94 | 172.00 | 161.56 | 161.87 | 160.23 | 159.57 |
| **Interventional** | | | | | | |
| MGH | 2.40 | 2.88 | 3.71 | 5.01 | 5.37 | 6.71 |
| RVH | 4.40 | 2.68 | 2.42 | 2.42 | 2.90 | 5.38 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 6.80 | 5.56 | 6.13 | 7.43 | 8.27 | 12.09 |
| **Total** | | | | | | |
| MGH | 144.69 | 143.61 | 132.96 | 136.26 | 136.64 | 137.70 |
| RVH | 90.38 | 85.87 | 81.85 | 80.95 | 78.21 | 79.15 |
| MCI | 20.22 | 21.79 | 22.13 | 21.45 | 22.31 | 23.19 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 255.29 | 251.28 | 236.93 | 238.67 | 237.16 | 240.04 |

*Includes 30% increase in efficiency due to resident contribution.

## Table B 5. MRI - Estimated radiologist hours/week

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 59.33 | 59.43 | 60.96 | 56.48 | 61.02 | 58.21 |
| RVH/MCI | 0.00 | 0.00 | 0.00 | 0.00 | 2.52 | 23.67 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 59.33 | 59.43 | 60.96 | 57.74 | 64.60 | 81.88 |
| **Interventional** | Interventional procedures not performed at this time | | | | | |
| MGH | | | | | | |
| RVH/MCI | | | | | | |
| MNH | | | | | | |
| MUHC(w/o MNH) | | | | | | |
| **Total** | | | | | | |
| MGH | 59.33 | 59.43 | 60.96 | 56.48 | 61.02 | 58.21 |
| RVH/MCI | 0.00 | 0.00 | 0.00 | 0.00 | 2.52 | 23.67 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 59.33 | 59.43 | 60.96 | 57.74 | 64.60 | 81.88 |

## Table B 6. Mammography - Estimated radiologist hours/week

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 5.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RVH/MCI | 22.76 | 40.14 | 43.82 | 47.66 | 56.47 | 60.11 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 27.96 | 40.14 | 43.82 | 47.66 | 56.47 | 60.11 |
| **Interventional** | | | | | | |
| MGH | 1.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RVH/MCI | 1.15 | 4.15 | 4.64 | 5.70 | 8.47 | 9.01 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 2.16 | 4.15 | 4.64 | 5.70 | 8.47 | 9.01 |
| **Total** | | | | | | |
| MGH | 6.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RVH/MCI | 23.90 | 44.29 | 48.45 | 53.37 | 64.94 | 69.12 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 30.12 | 44.29 | 48.45 | 53.37 | 64.94 | 69.12 |

## Table B 7. Ultrasound - Estimated radiologist hours/week

| | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|
| **Non-interventional** | | | | | | |
| MGH | 144.10 | 163.89 | 156.28 | 169.18 | 141.45 | 144.00 |
| RVH/MCI | 63.49 | 59.28 | 77.36 | 72.97 | 78.42 | 75.72 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 207.59 | 223.17 | 233.64 | 242.15 | 219.87 | 219.72 |
| **Interventional** | | | | | | |
| MGH | 5.80 | 6.61 | 7.85 | 8.56 | 12.87 | 16.67 |
| RVH/MCI | 12.59 | 9.90 | 9.30 | 5.79 | 7.15 | 10.13 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 18.39 | 16.51 | 17.15 | 14.36 | 20.01 | 26.80 |
| **Total** | | | | | | |
| MGH | 149.90 | 170.49 | 164.13 | 177.74 | 154.32 | 160.67 |
| RVH/MCI | 76.08 | 69.19 | 86.65 | 78.76 | 85.56 | 85.85 |
| MNH | N/A | N/A | N/A | N/A | N/A | N/A |
| MUHC(w/o MNH) | 225.98 | 239.68 | 250.79 | 256.50 | 239.89 | 246.52 |

*Data for Woman's pavilion excluded as this is covered by the OB/GYN staff.