Chapter 3

Section

3.06 Hospitals—Management and Use of Diagnostic Imaging Equipment

Background

There are 155 public hospital corporations in Ontario, each providing patient services at one or more locations. Public hospitals in the province are generally governed by a board of directors and are, for the most part, incorporated under the *Corporations Act*. The board is responsible for the hospital's operations. As well, each hospital is responsible for determining its own priorities to address patient needs in the communities it serves. The *Public Hospitals Act* and its regulations provide the framework within which hospitals operate.

Hospital boards are also accountable to the Ministry of Health and Long-Term Care (Ministry), which provides approximately 85% of total hospital funding, some of which can only be used for specified purposes. Other funding sources may include internally generated surpluses, such as those from semi-private and private accommodation charges, cafeteria sales, and parking revenues. Donations, which may be restricted to specified purposes, also help fund hospitals. In the 2005/06 fiscal year, the total operating cost of the 155 hospital corporations was approximately $17.5 billion. This excludes most physicians' services that are provided to hospital patients and paid for by the Ministry to physicians through the Ontario Health Insurance Plan (OHIP).

Diagnostic medical imaging includes the use of x-ray, ultrasound, magnetic resonance imaging (MRI), and computed tomography (CT) to provide physicians with important information used in diagnosing and monitoring patients' conditions. According to the World Health Organization, diagnostic imaging is necessary for the appropriate and successful treatment of at least a quarter of all patients. There were about 10.6 million diagnostic imaging tests conducted in Ontario hospitals in the 2005/06 fiscal year, broken down by type of test in Figure 1.

Figure 1: Diagnostic Tests in Ontario Hospitals by Percentage, 2005/06 Fiscal Year

Source of data: Ministry of Health and Long-Term Care

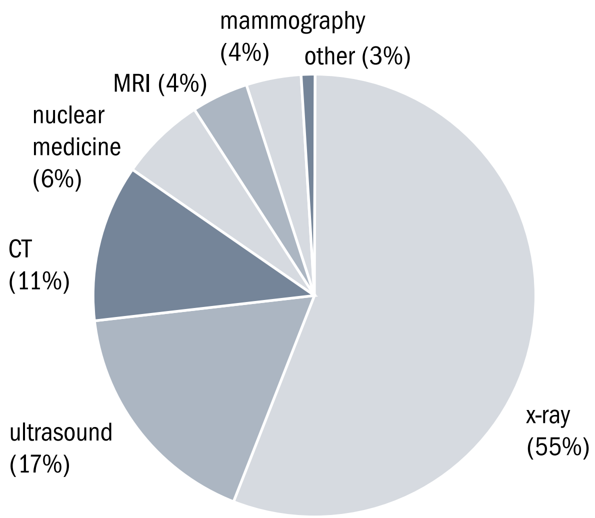
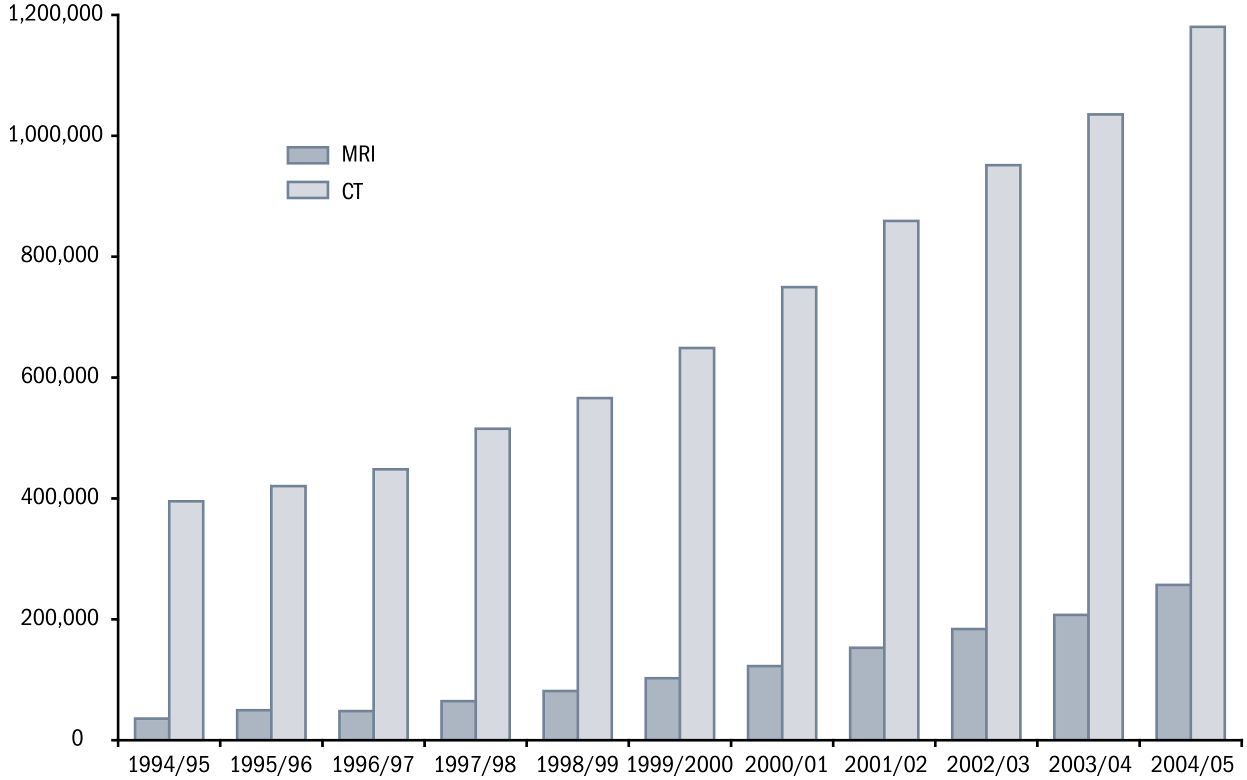


Figure 2: Number of CT and MRI Examinations in Ontario by Fiscal Year

Source of data: Ministry of Health and Long-Term Care



Although CT and MRI examinations are a small percentage of the number of diagnostic imaging procedures performed overall, our audit focused on CTs and MRIs, since the equipment can cost several million dollars, there are health safety risks associated with the examinations, and the use of CT and MRI scanners has been increasing over the years. According to ministry data, between the 1994/95 and 2004/05 fiscal years, the total number of CT examinations increased almost 200%, and MRI outpatient examinations increased over 600%. (See Figure 2.)

In reports issued in April 2005 and May 2006, the Institute for Clinical Evaluative Sciences (ICES) indicated that the reason for such a significant increase in the use of this equipment was not clear. However, it was likely due to a combination of factors including: greater patient and physician demand, the availability of more scanners, longer operating hours for MRI scanners due to increased funding, new indications for use, physician concern about litigation, increased use of scanning to monitor response to therapy, and the capability of new CTs to complete examinations faster. According to *Medical Imaging in Canada, 2005*, a report by the Canadian Institute of Health Information, Ontario has a total of 108 CT and 58 MRI scanners. The numbers of scanners and of scans completed in Ontario relative to other large provinces are shown in Figure 3.

CT, also known as computer assisted tomography (CAT), uses a series of x-rays to create virtual images of slices of a patient's body. A computer then processes the data to create three-dimensional images of the structures within the body. Physicians use CT scans for diagnosing a wide range of conditions, such as head injury, chest trauma, musculoskeletal fractures, and for monitoring cancer. MRI machines use a strong magnetic field (10,000 to 30,000 times stronger than the

Figure 3: CT and MRI Scanners and Examinations, Selected Provinces, 2005

Source of data: *Medical Imaging in Canada, 2005*, Canadian Institute for Health Information

	CT		MRI	
Province	Scanners/ Million (Pop.)	Examinations/ Thousand (Pop.)	Scanners/ Million (Pop.)	Examinations/ Thousand (Pop.)
Ontario	8.7	79.4	4.7	27.4
Alberta	9.3	90.8	7.8	36.6
British Columbia	10.9	78.2	5.5	18.4
Quebec	14.0	90.1	6.5	21.7

earth's magnetic field) and radio waves to generate images of areas inside the body. MRI is especially useful in imaging the brain, spine, abdomen, pelvis, soft tissues of the joints, and the inside of bones.

Audit Objective and Scope

The objective of our audit was to assess whether selected hospitals had adequate policies and procedures in place to ensure that the management and use of medical imaging equipment, particularly MRI and CT equipment, meets patient needs efficiently and is in compliance with applicable legislation, and that test results are accurately reported on a timely basis.

We conducted our audit work at three hospitals of different sizes that provide services to a variety of communities: Grand River Hospital serving the region of Waterloo and area, University Health Network in Toronto comprised of the Toronto General Hospital, the Toronto Western Hospital and the Princess Margaret Hospital, and Peterborough Regional Health Centre serving Peterborough and area. In conducting our audit, we reviewed relevant files and administrative policies and procedures, interviewed appropriate hospital and ministry staff, and reviewed relevant research including that on the delivery of diagnostic imaging services in other jurisdictions. We also conducted preliminary visits at two other hospitals to become familiar with their diagnostic imaging equipment operations. In addition, we discussed the delivery of diagnostic services—in particular MRI and CT examinations—in Ontario with representatives of the Canadian Association of Radiologists, the Ontario Association of Medical Radiation Technologists, the Healing Arts Radiation Protection Commission, and the Ministry's Expert Panel on MRI and CT.

This audit and the audit in Section 3.05 constitute the first value-for-money (VFM) audits conducted of the hospital sector, enabled by an expansion of the mandate of the Office of the Auditor General of Ontario effective April 1, 2005. The expansion allows us to conduct VFM audits of institutions in the broader public sector such as hospitals, children's aid societies (see Section 3.02), community colleges (see Section 3.03), and school boards (see Section 3.11).

Our audit fieldwork was substantially completed in May 2006 and was conducted in accordance with the standards for assurance engagements, encompassing value for money and compliance, established by the Canadian Institute of Chartered Accountants and accordingly included such tests and other procedures as we considered necessary in the circumstances, except as explained in the Scope Limitation section that follows. The criteria used to conclude on our audit objective were discussed with and agreed to by senior hospital management.

We did not rely on the Ministry's Internal Audit Services to reduce the extent of our audit work because they had not recently conducted any audit work on diagnostic services within hospitals. None of the hospitals we visited had an internal audit function.

SCOPE LIMITATION

On November 1, 2004, sections of the *Quality of Care Information Protection Act, 2004* (Act) and related regulations came into force that prohibit the disclosure of information prepared for or by a designated quality-of-care committee unless the committee considers the disclosure necessary to maintain or improve the quality of health care. Similarly, anyone to whom such a committee discloses information may share the information only if it is considered necessary to maintain or improve the quality of health care. We understand that this legislation was designed to encourage health professionals to share information to improve patient care without fear that the information would be used against them.

The Act prevails over all other Ontario statutes, including the *Auditor General Act*, unless specifically exempted. One of the three hospitals that we visited had designated a quality-of-care committee under the Act, and information relating to any analysis and follow-up of critical, severe, and near-miss incidents (for example, unusual occurrences causing injury to patients or hospital employees) associated with diagnostic imaging was prepared for this committee. Due to the Act, our access to such information was prohibited. Therefore, we were unable to determine whether this hospital had an adequate system in place to analyze and follow up on diagnostic imaging incidents and take corrective action, where necessary, to prevent similar incidents in the future.

The other two hospitals we visited did not have a designated quality-of-care committee; therefore, we were able to review their processes to analyze and follow up on incidents.

Our concerns over the scope limitation imposed by the *Quality of Care Information Protection Act, 2004* were also mentioned in our 2005 Annual Report audit of health laboratory services, where we were unable to determine whether the Ontario Medical Association's quality management program for laboratory services was functioning as intended. In fact, we have expressed concerns with the scope limitation since December 2003, when the Act was introduced for first reading in the Legislature. We continue to be concerned about the impact of the Act on our current and future audit work, and the effects it has on our ability to determine whether important systems, which can affect patient safety and treatment, are functioning as intended.

Summary

All of the hospitals we visited were managing and using their medical imaging equipment, specifically CTs and MRIs, well in some areas, such as operating patient appointment-scheduling systems and participating in Ontario's Wait Time Strategy to reduce wait times. Notwithstanding, hospitals can still improve their management and use of CTs and MRIs to better meet patient needs—for instance, by adopting best practices from other jurisdictions. More specifically, we found that the hospitals we visited generally did not use referral guidelines to ensure patients received the most appropriate test, did not always clearly prioritize patients based on their needs, and were not able to fully utilize their equipment despite patient waiting lists. Furthermore, the hospitals needed to do more to ensure the safety of patients and hospital personnel, including ensuring that exposure to radiation is as low as reasonably achievable. In particular, our observations on the operation of MRIs and CTs included:

- The Canadian Association of Radiologists (CAR) has noted that 10% to 20% of diagnostic imaging examinations that physicians order are not the most appropriate test in the circumstances, given the patient's clinical symptoms. Notwithstanding, the hospitals we visited were generally not using referral guidelines (such as CAR's September 2005 guidelines) to help ensure that the most appropriate diagnostic test was ordered.
- Hospitals receive about $1,200 from the Workplace Safety Insurance Board of Ontario (WSIB) for each WSIB out-patient provided with an MRI examination. At two of the hospitals we visited, we noted that WSIB patients received much quicker access to their MRI examination than did non-WSIB patients. For example, at one hospital the WSIB out-patients received their MRI within an average of five days, while other out-patients waited 25 days on average.
- Wait times reported on the Ministry's website combine in-patient and out-patient wait times, even though in-patients generally receive their examination within a day. For example, at one hospital the ministry-reported wait time for a CT was 13 days, but out-patients actually waited about 30 days. As well, the starting point for measuring wait times has not been clearly established. In the sample we tested at one hospital, if all the wait times had been measured from the time the completed referral form was received, rather than from the time it was entered into the system, the reported wait time would have been an average of 13 days longer.
- Most CTs and one MRI at the hospitals we visited did not regularly operate on the weekends. We also noted that most CTs and MRIs were generally in operation for more than 80% of their posted operating hours, but that about half of the CTs at one hospital were scheduled to operate eight hours or less on weekdays. Hospital management indicated that a shortage of technologists and radiologists and a lack of funding prevented them from operating the machines for longer periods of time, even though waiting lists existed for these tests.
- Many referring physicians and staff at the hospitals we visited indicated that they were not aware that CT examinations expose patients to significantly more radiation than conventional x-rays. For example, one CT of an adult's abdomen or pelvis is approximately equivalent to the radiation exposure of 500 chest x-rays. Although other countries, such as Britain and the U.S., have established radiation dose reference levels to guide clinicians in establishing CT radiation exposure levels for patients, Ontario has not. Given that with CTs, better image quality can be obtained by increasing the level of radiation, reference levels are beneficial because they provide guidance on acceptable levels of radiation to produce an adequate diagnostic image. Without such reference levels, patients could receive more radiation at one hospital than at another for the same type of examination.
- Staff at the two hospitals we visited that performed pediatric CT examinations indicated that in close to 50% of the selected cases the appropriate equipment settings for children were not used. As a result, the children were exposed to more radiation than necessary for diagnostic imaging purposes. In addition, a recent survey of referring pediatricians in the Toronto area found that 94% underestimated the radiation exposure for children from CT examinations. Furthermore, since children's organs are more sensitive to radiation than those of adults, the use of an adult setting for one CT examination of a child's abdomen and pelvis was estimated to be equivalent to

over 4,000 x-rays, which is eight times the radiation an adult would be exposed to on the same setting. Using less radiation is particularly important when the patient is a child, since children exposed to radiation are at a greater risk of developing radiation-related cancer later in life.

- None of the hospitals that we visited had analyzed the number of CT examinations by patient or monitored radiation dosages absorbed by patients. At the two hospitals that were able to provide us with information for 2005, 353 patients had at least 10 CT examinations, and several patients had substantially more examinations than that during that year. As well, at the two hospitals that performed pediatric CTs, 58 children received more than one CT examination, including 14 children who had at least three, and one child with six examinations in 2005. In addition, these patients may have received additional CT examinations at other hospitals or in other years, which would also add to their lifetime radiation exposure. The International Commission on Radiological Protection (ICRP) cautions that while many diagnostic procedures with relatively high radiation doses (such as CTs) are very useful medical imaging tools, repeated examinations may expose patients to a level of radiation which evidence shows may cause cancer.
- Radiation protection practices include using protective accessories, such as a lead sheet, to cover a patient's body parts that are sensitive to radiation. At the hospitals we visited, policies on the use of protective accessories for CTs varied from shielding a patient's reproductive organs to shielding other superficial organs outside the area under examination. However, actual shielding practices varied. One hospital informed us that lead sheets were placed over and under a patient's body if doing so did not interfere with the diagnostic image, whereas another hospital provided no similar protection for patients undergoing a CT.
- Individuals who are exposed to radiation as part of their job are required to wear dosimeters, a device used to measure radiation exposure. However, we found that the majority of interventional radiologists at one hospital, who are exposed to higher levels of radiation since they perform procedures close to the radiation source, were not wearing their dosimeters. As a result, the hospital was unable to tell whether these physicians exceeded annual maximum radiation doses established under the *Occupational Health and Safety Act*.
- Unlike x-ray operations, since there are no CT operating standards specified under the *Healing Arts Radiation Protection Act*, the Ministry does not examine CT operations, even though CTs expose patients to significantly more radiation than x-rays.
- None of the hospitals that we visited had a formal quality assurance program in place to periodically ensure that radiologists' analyses of CT and MRI examination images were reasonable and accurate. A 2001 British research article determined that clinically significant or major errors (those that would potentially alter patient management decisions) in radiologists' reports ranged from 2% to 20% for CT examinations and from 6% to 20% for MRI examinations.

We wish to acknowledge the co-operation we received from the hospitals visited as well as from the Ontario Hospital Association in co-ordinating our first audit in this sector. In particular, we wish to thank the hospital management, staff, and physicians for their input and open discussions throughout the audit process.

Detailed Audit Observations

REFERRAL GUIDELINES

A 2003 study done in the United States found that regions with the highest expenditures on health care (including the increased use of diagnostic tests such as CT and MRI) had no better patient outcomes; in fact, somewhat surprisingly, the study indicated there was a trend towards poorer outcomes for patients with similar acuity in higher-expenditure regions. Clinical practice guidelines can help clinicians determine which diagnostic tests are most appropriate and when they should be done. The ICES report *Access to Health Services in Ontario* (April 2005) recommended that evidence-based guidelines for appropriate use of CT and MRI scanning be developed for use in Ontario. ICES also noted that the American College of Radiology had established appropriateness criteria for diagnostic imaging and, at that time, the Canadian Association of Radiologists (CAR) was developing evidence-based guidelines for diagnostic imaging procedures.

In October 2004, the Ministry of Health and Long-Term Care established the Expert Panel on MRI and CT (Panel), with hospital, academic, and ministry representation. In its April 2005 report, the Panel identified the need for MRI and CT referral guidelines, due to a perception that referring physicians–both specialists and non-specialists–are not sufficiently informed about the appropriate clinical use of MRIs and CTs. In addition, the Panel stated that referring physicians need to be better educated about the range of diagnostic tests available. To address these concerns, the Panel recommended that the Ministry assess the CAR guidelines, once developed, and those from other jurisdictions, such as the U.S. and Britain, with the goal of adopting and implementing guidelines for the appropriate use of MRIs and CTs in Ontario.

In September 2005, the Canadian Association of Radiologists published *Diagnostic Imaging Referral Guidelines*, which are based on the British Royal College of Radiologists' guidelines. CAR noted that, according to research from around the world, 10% to 20% of diagnostic imaging examinations that physicians order are not the most appropriate ones, given the patient's clinical symptoms. Therefore, the guidelines were aimed at assisting physicians to choose the most appropriate diagnostic imaging tests for their patients. We were informed that the Panel was assessing these guidelines.

The CAR's guidelines were introduced as a small pilot project at a New Brunswick hospital in 2005. The guidelines were embedded into the hospital's diagnostic imaging order entry system. The system provides feedback to referring physicians on the appropriateness of ordered tests, based on the patient information provided (such as the patient's relevant medical history and symptoms and the examination ordered). Preliminary results indicated that 86% of tests were appropriately ordered. In addition, while the guidelines were not used to restrict the freedom of physicians to order what they believed was the most appropriate test for their patient, the pilot study noted that physicians generally changed the diagnostic test being ordered when the software indicated another test was more appropriate. At the time of our audit, a larger pilot project was under way at the Children's Hospital of the Winnipeg Health Sciences Centre.

Other than a few specific ordering guidelines, such as the Ministry's stroke protocol and Cancer Care Ontario's practice guidelines for certain types of cancer, no other MRI and CT ordering or appropriateness guidelines were formally used by the hospitals that we visited. In fact, in some cases, the referring physicians we spoke with did not know that the CAR guidelines existed. However, all the referring physicians and radiologists we contacted indicated that they were in favour of guidelines of this nature.

In the absence of guidelines, the hospitals indicated that various other approaches were used to help ensure the appropriateness of CT and MRI examinations ordered by referring physicians. At one hospital, the radiologist, chief of emergency, and other key medical personnel indicated that most cases were discussed with the radiologist first to ensure that the most beneficial diagnostic test is performed. At another hospital, we were informed that discussion of the appropriateness of diagnostic tests between radiologists and internal referring physicians occurred occasionally. However, we were told that the radiologists did not proactively pursue these consultations for two reasons: firstly, the radiologists believed that they did not have enough time to consult with physicians; and secondly, they did not want to question the judgment of their colleagues or risk possible confrontation among co-workers. At the third hospital, we were informed that the radiologist would contact the referring physician if there were any concerns about the appropriateness of the ordered test, but that this was seldom necessary due to the physicians' familiarity with the tests. As well, most radiologists we spoke with agreed that physicians who did not work at the hospital and had not specifically discussed a patient's case with the radiologist, usually did not provide sufficient clinical information with the request for a diagnostic test to enable the radiologist to determine whether the requested test was the most appropriate one. In the absence of this clinical information, the requested tests were performed as ordered.

RECOMMENDATION 1

To better ensure that patients receive the most appropriate diagnostic test given their clinical symptoms, and thereby help reduce unnecessary tests, waiting lists, and unnecessary exposure to medical radiation, hospitals should:

- in conjunction with the Ministry, evaluate the benefits of using diagnostic imaging referral guidelines, such as those issued by the Canadian Association of Radiologists, to assist with determining the appropriateness of tests; and
- have a process in place to identify possibly inappropriate diagnostic imaging tests ordered by referring physicians, particularly with respect to CT and MRI referrals.

ACCESS

Appointment Scheduling

At the hospitals we visited, CT and MRI appointments for in-patients and emergency patients were generally booked by hospital staff directly into the hospital's information system. For other patients, such as out-patients, referring physicians completed a hospital form to request either a CT or an MRI appointment. This form generally required the patient's name, address, health card number, and clinical history, as well as the nature of the test to be conducted.

Once an out-patient appointment request form is received by the hospital, it is reviewed to ensure that all of the required information is complete. Incomplete forms are returned to the referring physician.

For completed CT request forms, the hospitals book an appointment and inform the referring physician or the patient directly of the date and time of the appointment. The hospitals we visited generally reserved time each day for in-patient, out-patient, and emergency CT appointments and also conducted emergency CT examinations as required. We were told by hospital management that emergency patients were generally the top priority, followed by in-patients, and then out-patients. As well, we noted that out-patient CT appointments were generally booked on a first-come, first-served basis with the exception of cancer patients and urgent out-patients at two of the hospitals we visited. The hospitals reserved time for cancer patients to provide these patients quicker access, and they reserved or added on time for urgent out-patients. We were informed by hospital management at two of the hospitals we visited that out-patient CT scans are generally not prioritized because not enough information is provided on the appointment request form and, in general, there is little reason to prioritize because there is not a long waiting time for a CT appointment.

Completed MRI request forms are forwarded to a radiologist who prioritizes the requests according to the patient's medical needs. One of the hospitals we visited had defined four priority codes, such as code 1 for immediate threat to life or permanent loss of function, down to code 4 for chronic and stable pathology, routine follow-up, and screening studies. However, at the other two hospitals we visited, the priority levels were not defined, and radiologists generally prioritized MRI examinations as high, medium, or low urgency; or urgent or routine, respectively. Therefore, different radiologists at these hospitals could assign a different priority to patients with similar conditions. As a result, the hospitals could not ensure that patients with similar conditions had the same access to MRI examinations. In December 2005, the Ministry of Health and Long-Term Care announced CT and MRI priority categories with associated wait-time benchmarks, as shown in Figure 4. As discussed more fully in the Wait Times section of this report, the hospitals participating in the Ministry's Wait Time Strategy, which includes the three hospitals we visited, will have to report wait times based on these priority categories by the end of 2006. We were informed that two of the hospitals we visited had adopted the Ministry's priority levels by summer 2006.

Once patients are prioritized, the hospitals then book an appointment and inform the referring physician or the patient of the date and time of the appointment. As with CT appointments, the hospitals we visited generally reserved time each day for in-patient, out-patient, and emergency MRI appointments and also conducted emergency MRI examinations as required.

Figure 4: Ontario Wait-time Benchmarks for CT and MRI Examinations

Source of data: Ministry of Health and Long-Term Care

Priority	Wait-time Target
Priority I – Emergency scan needed	Immediate
Priority II – Potential for deterioration	48 hours
Priority III – Cancer staging	2 to 10 days
Priority IV – Non-urgent scan	4 weeks

We were told by physicians at all three hospitals that there is an informal mechanism in place where MRI and CT appointments can be scheduled sooner, based on a patient's medical needs. In these cases, the referring physician contacts the radiologist to request an earlier appointment. We recognize that these consultations are important to help ensure that patients are appropriately prioritized. However, in the absence of defined patient-priority levels, some physicians could consistently overprioritize their patient's needs and may therefore obtain earlier appointments for them.

Access for Patients Covered By the Workplace Safety and Insurance Board of Ontario

Individuals who are injured at work in Ontario may need various hospital tests, including tests (such as an MRI) to determine whether they are healthy enough to return to work. The Workplace Safety Insurance Board of Ontario pays hospitals directly for conducting these examinations. For example, hospitals are paid about $1,200 for an MRI examination. For patients not injured at work, the costs of their in-patient and out-patient examinations generally must be covered by the hospital's global budget.

The report of the Expert Panel on MRI and CT indicated that "all Ontarians should have timely access to MRI and CT services, with medical need determining the priority of their case." However, in order to earn additional revenues, hospitals may try to provide services to as many WSIB clients as possible, rather than prioritizing patients based on need. At two of the three hospitals we visited, specific appointment time slots were reserved for WSIB out-patients in order to ensure quicker access to service. In addition, one of these hospitals had a policy of providing MRI examinations to WSIB out-patients within two weeks of their referral. We were informed by one hospital's management that WSIB patients received quicker access to MRI examinations because WSIB would have the examinations done elsewhere if there was a longer wait time, which would result in lost revenue for the hospital.

We selected a sample of WSIB-funded out-patients and other out-patients who booked their appointments on the same day for the same type of MRI examination (same body part) and noted the following:

- 81% of WSIB-funded out-patients at one hospital received access to services within two weeks, while only 27% of the other out-patients received access to the same services within two weeks. In addition, we noted that the WSIB-funded out-patients were usually prioritized as "high" in order to receive an examination within two weeks.
- WSIB-funded out-patients at another hospital received their examination within an average of five days, while the other out-patients waited 25 days on average.
- At the third hospital, both WSIB-funded and the other out-patients waited a similar length of time, about 32 days, to receive an MRI examination. This hospital did not allocate specific appointment time slots for WSIB-funded patients.

The provision of quicker access to WSIB-funded out-patients at two of the hospitals we visited appears to have resulted in longer wait times for other out-patients, who may be equally or more medically in need of an MRI examination.

As part of its Wait Time Strategy, Ontario has developed four levels to prioritize patients for an MRI. According to the Ministry, all hospitals participating in the Wait Time Strategy will be required to use these levels when booking patient appointments, including appointments for WSIB patients, and when reporting prioritized wait times. Since all patients, including WSIB patients, should be prioritized based on consistent needs-based standards, this may require policy changes at some Ontario hospitals.

RECOMMENDATION 2

Hospitals should establish policies to ensure that all patients, including Workplace Safety and Insurance Board patients, are prioritized for MRI and CT examinations in a similar manner based on medical need.

Wait Times

In February 2003 and in September 2004, the provincial ministers of health met to discuss health-care renewal and the future of health care, including the need to reduce wait times and improve access to diagnostic services. In September 2004, the First Ministers agreed to achieve reductions in wait times in five areas, including diagnostic imaging, by March 31, 2007.

As a result, Ontario's Wait Time Strategy was announced in November 2004 to reduce wait times by improving access to health-care services for adult Ontarians in five areas, including MRI and CT, by December 2006. This strategy included funding for new and replacement MRI and CT equipment and expanding the hours of operation for MRI services in selected hospitals. In the 2004/05 fiscal year, the federal and provincial funding for medical equipment flowed through several initiatives, including $21 million used to replace aging MRI scanners at seven hospitals and $45.3 million used to replace aging CT scanners at 23 hospitals. As well, the Ministry indicated that an additional 182,700 MRI examinations were to be funded in hospitals and independent health facilities through the Wait Time Strategy at a cost of $47 million between November 2004 and March 2007.

Wait-time Benchmarks

As part of the First Ministers' agreement, the federal, provincial, and territorial ministers of health agreed to establish evidence-based benchmarks for medically acceptable wait times by December 31, 2005, for a number of procedures, including diagnostic imaging procedures. The benchmarks were to express the appropriate amount of time, based on clinical evidence, to wait for a particular procedure. While benchmarks were established for many of the selected procedures, no targets were established for access to CT or MRI examinations.

However, in December 2005, the Ministry of Health and Long-Term Care announced Ontario wait-time benchmarks, developed by clinical experts across the province, including targets for CT and MRI wait times. These benchmarks were based on four priority categories, as shown in Figure 4.

Although all three hospitals we visited participate in the Wait Time Strategy, these benchmarks were relatively new at the time of our audit, and therefore none of these hospitals were reporting wait times based on these priority levels or comparing wait times to these benchmarks. However, one hospital had established its own wait-time targets for certain types of CT and MRI examinations and monitored actual wait times against these targets. We noted that the wait times at this hospital exceeded the hospital's own targets in 43% of the CT and MRI examination categories for the period we reviewed. We were informed that the hospital has a number of initiatives to decrease wait times, such as moving patients between sites or extending CT and MRI operating hours.

Reporting Wait Times

Commencing in July 2005, hospitals participating in the Wait Time Strategy were required to report monthly wait-time information to the Ministry for both MRI and CT examinations to be eligible to receive funding for performing additional MRI examinations. The wait times were to be calculated from the date that the test was ordered to the date that the examination was performed, and hospitals were responsible for ensuring that the data is accurate.

The Ministry uses the data provided by the hospitals to calculate the median and average wait times for each hospital and for the province as a whole. The number of days that it takes 90% of patients to receive their examination is also determined. According to the website, the combined wait times for in-patients and out-patients (excluding wait times for emergency patients) receiving tests from April 1, 2006, to May 31, 2006, for the hospitals participating in the Wait Time Strategy, are as shown in Figure 5. As shown in Figure 6, wait times for CT and MRI examinations since August 2005 have remained somewhat stable.

We reviewed the data submitted to the Ministry by the hospitals we visited and had the following concerns:

- The starting point for measuring the wait time for tests was not sufficiently defined. As a result, the hospitals reported wait times

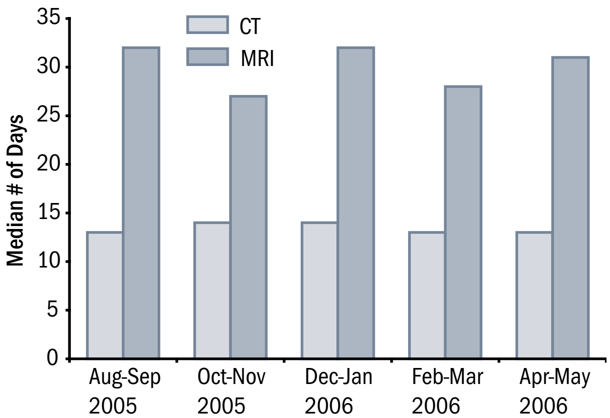
Figure 5: CT and MRI Wait Times for Participating Hospitals, April 2006–May 2006

Source of data: Ministry of Health and Long-Term Care

		Wait Times (Days)		
Type of Exam	# of Hospitals Reporting Wait Times	Median	Average	For 90% of Patients to Receive Scan
CT	38	13	28	71
MRI	41	31	44	91

Figure 6: CT and MRI Wait Times for Participating Hospitals, August 2005–May 2006

Source of data: Ministry of Health and Long-Term Care



differently. Specifically, out-patient wait times were based on one of the following dates:

- the date the hospital initially received the referral form;
- the date when the hospital received a completed referral form; or
- the date when the hospital put the referral information into their system.

For example, one hospital's process was to record wait times based on when the hospital received a completed referral form. However, we noted that this date was not always used—hospital staff indicated that paper referral forms (representing approximately 20% of the hospital's referrals) were manually entered into the system, and therefore errors (such as using the date the referral form was entered into the system, rather than the date it was received), could occur. In our sample of CT and MRI referral forms, if all the wait times had been measured from the time the completed referral form was received rather than from the time it was entered into the system, the reported wait time would have been an average of 13 days longer. Hospital management indicated that it was monitoring the recording of wait times to better ensure compliance with the hospital's process.

- Despite the Ministry's instructions to exclude emergency patients from the wait-time data, one hospital we visited included the wait times for certain emergency patients. These patients had a previously scheduled CT or MRI appointment but then had the test earlier than scheduled after being admitted to the hospital's emergency department. The wait time from the date the appointment was booked until the date of the emergency test was included in the hospital's wait-time data. The hospital was unable to determine the magnitude of the misstatement.
- Wait times for hospitals that have multiple sites are reported as an overall wait time for the hospital, although the wait times may vary significantly among sites. For example, we noted that median wait times for out-patient CT exams ranged from six days to 35 days at different sites of the same hospital, while out-patient MRI examinations ranged from 14 days to 28 days. Hospital management indicated that each hospital site provides services based on its area of specialization (for example, cardiac), and therefore wait times vary by hospital site.

Alberta, Manitoba, and Nova Scotia also report wait times for MRI and CT imaging. However, these times are defined differently from province to province and are not readily comparable to the wait times reported in Ontario.

Limitations of Wait-time Reporting

Although the Ministry's website provides some information on wait times, it does not provide wait times for every hospital in Ontario. For example, 33 hospitals that have MRI and/or CT equipment are not included in the data since they do not receive funding under the Wait Time Strategy and therefore are not required to report this information. As well, wait-time data for an additional five MRI and

Figure 7: CT and MRI Median Wait Times for In-patients versus Out-patients, Fall 2005
Source of data: Hospitals and Ministry of Health and Long-Term Care

	CT Wait Times (Days)			MRI Wait Times (Days)		
Hospital	In-patient	Out-patient	As Reported by Ministry	In-patient	Out-patient	As Reported by Ministry
#1	1	30	16	1	45	40
#2	0	15	10	1	22	20
#3	0	30	13	2	45	44

four CT scanners, operated by independent health facilities, are also not included.

There were also a number of limitations to the wait-time information reported by hospitals to the Ministry at the time of our audit. For example, the information includes follow-up tests purposely scheduled for a future date, which makes the average wait time appear longer, even though the patients can receive their tests at the requested time and therefore have no wait time whatsoever. Also, in-patient and out-patient data are combined, although out-patients normally wait much longer than in-patients. Since combining in-patient data with out-patient data could potentially have a significant impact on reported wait times, we examined the wait times for these two groups for selected months and noted that the median wait for an out-patient CT examination was significantly higher than the median reported by the Ministry. The wait time for MRI out-patients was slightly higher. (See Figure 7.) To provide more meaningful information to the public, one of the hospitals we visited posted both in-patient and out-patient wait times on its own website.

To address some of the limitations detailed above, the Ministry developed the Wait Time Information System (WTIS). According to the Ministry, the WTIS will provide more comprehensive data, for example, waiting time by priority level, waiting time to report test results, and on how long a patient must wait for a test as of a certain date. In addition, WTIS will enable physicians and hospitals to better manage their waiting lists by flagging patients whose wait times are approaching wait-time target benchmarks. This system is being implemented between March 2006 and June 2007 in the hospitals participating in the Wait Time Strategy. We were informed that two of the hospitals we visited had implemented the WTIS by summer 2006.

RECOMMENDATION 3

To help hospitals better manage their MRI and CT waiting lists, and provide the public with more reliable and useful wait-time information, hospitals should:

- seek further guidance from the Ministry to clarify the starting point for the calculation of each patient's wait time, to ensure that wait-time data are being consistently reported across all hospitals; and
- measure and report wait times using the Ministry's new Wait Time Information System, including information on patient priority levels, ability to meet benchmarks, and out-patient wait times.

Patient Cancellations and No-shows

In order to ensure that diagnostic equipment is used efficiently and that waiting lists are minimized, it is important that CTs and MRIs are used to their full potential during operating hours. When patients cancel an MRI or CT appointment with little notice provided to the hospital, or when patients do not show up for their scheduled appointment (patient no-shows), the equipment may not be used until the next patient is available. Since there is a waiting list for both CT and MRI examinations across the province, it is important that appointment cancellations and patient no-shows are kept to a minimum.

All the hospitals we visited recorded MRI and CT appointment cancellations as well as patient no-shows. However, none of the hospitals had summarized this information. For the two hospitals that tracked cancellations in a similar manner, we summarized this data as shown in Figure 8.

The third hospital included rescheduled appointments in their cancellation data, and therefore, they were unable to determine their overall cancellation rate. In addition, while appointments could be rescheduled by the hospital, the referring physician, or the patient, the hospital did not track who had rescheduled the appointment.

Appointments may be cancelled for various reasons, such as a change in the patient's condition, bad weather, or equipment problems at the hospital. All the hospitals we visited had some processes in place to record in some cases the reasons for CT and MRI appointment cancellations. This information enables hospitals to analyze the reasons for cancellations, and take action where appropriate to minimize them, especially last-minute cancellations and no-shows. However, none of the hospitals visited captured the information needed to determine what action to take.

At all of the hospitals we visited, hospital management indicated that cancellations did not affect the efficiency of their operations, since any CT or MRI time that becomes available from an outpatient cancellation is generally filled by an inpatient. However, MRI no-shows involve longer patient appointment times and more hospital administrative time (for example, to ensure patients do not have implanted metal devices). As a result, one hospital phoned patients to determine why they did not show up for their MRI appointment

Figure 8: MRI and CT Appointment Cancellation and No-show Rates, 2005

Source of data: Two of the hospitals visited

	Overall Cancellation Rate (%)*		No-show Rate (%)	
Hospital	MRI	CT	MRI	CT
#1	14	8	4	2
#2	14	7	7	5

*including no-shows and excluding rescheduled appointments

in July 2005. Although the hospital was unable to contact over half of the patients for various reasons, such as wrong phone numbers, the patients they contacted indicated various reasons for missing the appointment, including the patient was unaware of the appointment and the patient forgot about the appointment. In order to address the issue of MRI no-shows, hospital management indicated that they were considering informing the referring physician about the patient's appointment. Referring physicians are likely to have correct patient information such as phone numbers and may help to ensure that patients show up. Hospital management indicated that they plan to conduct telephone reviews of the reasons for MRI no-shows twice a year to help reduce missed appointments.

The same hospital (operating its MRI 24 hours a day, seven days a week) also noted that many patients missed late night or early morning appointments. As a result, the hospital further monitored the percentage of exams cancelled from 11 p.m. to 7:15 a.m., with a view to keeping missed appointments below 5%. For the three months ending December 31, 2005, two of this hospital's sites had exceeded the patient no-show target and had an average no-show rate of almost 12%. To help address this situation, hospital management indicated that they would accept MRI appointments during these hours for other hospitals' patients, who otherwise may have had to wait longer for their appointment.

To help reduce no-shows, all the hospitals indicated that they phoned MRI outpatients prior to their appointment date to remind them of their appointment and to ensure that patients were able to take the MRI examination. However, only one of the three hospitals that we visited phoned CT outpatients to remind them of their appointment date and time. At the other two hospitals, management indicated that they were unable to do this because they had insufficient administrative staff to perform this task.

RECOMMENDATION 4

In order to ensure that hospitals are utilizing their MRI and CT equipment efficiently, hospitals should monitor the reasons for cancellations and take proactive action where possible to minimize the impact of last-minute cancellations and no-shows.

UTILIZATION

Given the large capital and operating expenses associated with MRI and CT scanners, the Expert Panel on MRI and CT indicated that this equipment should operate for extended hours in order to reduce wait times. Specifically, the Panel recommended that MRI and CT equipment should operate 16 hours a day, seven days a week, where human and financial resources permit. The Panel also recommended that ultimately, the operating goal for MRI scanners should be 24 hours a day, seven days a week. Based on a survey of hospitals, the Panel's information indicated that, on average, hospitals were operating their MRI scanners about 11 hours a day, seven days a week, in the 2003/04 fiscal year. As well, the Panel's survey showed that, on average, hospitals were operating their CTs about 8.5 hours a day, including weekends. At one hospital we visited, many of the CTs operated eight hours or less and only on weekdays, while the remaining CTs at this and the other two hospitals operated for extended hours. One hospital operated two CTs 24 hours a day, seven days a week, for emergency patients. In addition, the MRIs at all three hospitals operated for extended hours on weekdays, with four MRIs at one hospital operating 24 hours a day, seven days a week. However, most CTs and one MRI did not regularly operate on the weekend, although technologists and radiologists were generally on call or otherwise available if an emergency CT or MRI examination was needed.

The Panel noted that hospitals reported a number of factors that would impede their expansion of MRI and CT capacity. These include a reported lack of radiologists in 43% of hospitals with MRIs, and in 51% of hospitals with CTs, as well as a shortage of technologists in 41% of hospitals with MRIs, and in 47% of hospitals with CTs. Management at the hospitals we visited indicated (as did the Panel) that a combination of too few technologists and radiologists, as well as a lack of funding, prevented operation of the machines for longer periods even though wait lists existed.

The Panel also developed targets for the time needed to perform each adult MRI and CT examination based on the part of the body being scanned. Efficiency in meeting the targets was based on "worked hours"—that is, the hours that MRI and CT scanners are available to perform clinical procedures—and the Panel recommended an efficiency rate of at least 80%. Using 2003 OHIP data, the Panel applied its recommendation to 71 hospitals that had an MRI and/or a CT scanner and noted that many of the hospitals actually took less time than recommended to perform a CT or MRI examination.

Two of the hospitals we visited did not monitor the utilization of their CTs and MRIs. Therefore, we reviewed patient appointment and imaging data over a two-week period at these two hospitals and noted that the equipment was generally in use for more than 80% of the time available to perform clinical procedures, in accordance with the Panel's recommendation. However, the time to perform clinical procedures does not consider the amount of time the equipment is unavailable for patient use during posted operating hours due to maintenance and repairs. In addition, there was no benchmark for what is a reasonable amount of downtime due to maintenance and repairs. Therefore, we also reviewed the use of CTs and MRIs in comparison to the hospitals' posted operating hours for this equipment. We did note cases where the equipment was being used for less than 80% of the posted operating hours and, at one hospital, that no patients were seen during the last 75 minutes to two hours of the MRI's posted operating hours for the weekend shifts we reviewed. Hospital management indicated that utilization was lower primarily due to unexpected equipment problems, preventive maintenance, staff preparation for the next day, and staff time for meals and other breaks.

The third hospital we visited had generally monitored the use of its CTs and MRIs. Where information was available, hospital reports indicated that CT and MRI equipment was generally in use at least 80% of the time available to perform clinical procedures. As well, on average, the CT scanners were used about 86% of the posted operating hours, with a range of 77% to 90% per CT from July 2005 to February 2006, while most MRIs were used, on average, for 75% of the posted operating hours, with a range of 66% to 79% per machine. This hospital also had three other MRIs whose use includes research. Two of these were also used for patient examinations and, in total, operated for 32% and 77% of the posted operating hours, respectively. The third MRI was dedicated to research work and was only used a few hours a week.

RECOMMENDATION 5

To better provide patients with timely access to required examinations, hospitals, in conjunction with the Ministry, should develop strategies to increase the utilization of MRI and CT equipment, including increasing the time available for performing clinical procedures.

SAFETY

MRI Safety

Since MRIs use a strong magnetic field and radio frequency pulses, there are safety concerns for patients, medical radiation technologists, housekeeping personnel, and other individuals who may need to enter an MRI room. When materials that can be attracted to magnets come near an MRI, they are pulled rapidly toward the MRI's magnet, potentially causing a serious hazard. For example, in July 2001, a fatal accident occurred in the U.S. when an oxygen cylinder pulled by an MRI's magnet crashed into a young boy undergoing an MRI. In another case, while no one was injured, a monitor had been pulled into an MRI at one of the hospitals we visited.

The Ontario Health Technology Advisory Committee (OHTAC), an advisory group to the healthcare system, including the Ministry of Health and Long-Term Care, reviewed MRI patient monitoring systems in December 2003. Their report noted that the U.S. Emergency Care Research Institute has a Health Devices Alerts database that tracks reported instances where objects have been pulled into an MRI. In Ontario, as in other Canadian provinces, there is no similar reporting system. Furthermore, there is no legislation governing or monitoring the use of MRI equipment. There are, however, various sources that promote safe MRI practices. These include the American College of Radiology's White Paper on Magnetic Resonance Safety, Health Canada's guidelines on exposure to electromagnetic fields from MRIs, and advisory notices from Health Canada to hospitals.

We noted that policies on the operation of MRIs varied greatly among the three hospitals we visited.

For example, one hospital had no formally documented MRI policies available, another had some policies and had established an MRI safety committee to develop further policies, and the third had extensively documented policies. According to clinical practice parameters and standards for MRIs for independent health facilities, set by the College of Physicians and Surgeons of Ontario (College), written policies and procedures should be in place. These include policies that provide diagnostic imaging staff with direction on the preparation of patients for MRIs, use of technical settings, and emergency procedures.

The College's clinical practice parameters and standards were developed to assist physicians in developing their own quality management program and to act as a guide for assessing the quality of patient care provided in independent health facilities. According to these standards, items to be addressed in the policies and procedures include when and how to turn off the MRI's magnet in emergencies, how to respond to emergency patient resuscitation in the MRI room, and how to screen non-patients accessing the MRI room. Furthermore, policies and procedures should be available for use by all diagnostic imaging personnel.

Patients who have materials in their body that can be attracted to magnets (metal fillings, defibrillators, clips or pins, for example) generally cannot be imaged. Metal implants or foreign bodies can be twisted and pulled by the MRI's magnet, resulting in cuts or serious damage to surrounding tissues. Patients using pacemakers cannot be imaged because the MRI's strong magnetic field can induce currents in the pacemaker's circuitry that cause it to fail, possibly causing death. Devices such as electrocardiogram (ECG) electrodes and leads also have the potential to become hot enough to cause burns when they are exposed to the MRI's changing magnetic fields and radio frequency currents.

All of the hospitals that we visited required the completion of patient screening forms to help determine if patients had any reasons preventing them from undergoing an MRI examination. We compared the screening forms used by the hospitals to both the College's recommended screening form, used by independent health facilities, and to a screening form created by an American MRI expert. We noted that the hospital screening forms generally covered off most of the key patient risks. However, some of the hospital forms contained a more comprehensive listing of the risks than others. For example, one hospital's form did not include implanted defibrillators, electrodes, or surgical clips.

In February 2004, the Ontario Health Technology Advisory Committee (OHTAC) recommended that to minimize risks to patients and providers, the Ministry of Health and Long-Term Care should conduct a review of all MRI facilities to ensure adherence to best practices, or alternatively, to alert facilities to potential MRI safety hazards. In April 2006, OHTAC assisted the Ministry in addressing this recommendation by commissioning a review by an external research group. The review found that not all MRI facilities in Ontario followed the American College of Radiology's guidelines for MRI environment safety, which are industry-accepted safety standards. In addition, there were several inconsistencies in certain MRI practices across the province. (Some hospitals do not require out-patients to remove their clothing and change into hospital gowns for their MRI exam, for example.) As well, a number of safety issues were noted, including no designated MRI safety officer at each hospital, a lack of access controls to hospital MRI rooms, inconsistent labelling of equipment that is safe to bring into the MRI room, unclear MRI warning signs, and inadequate training for hospital staff, including some MRI personnel.

As a result, the Ontario Health Technology Advisory Committee endorsed a number of recommendations made in the study, including establishing a provincial MRI safety committee to promote consistent MRI safety practices in Ontario. Another recommendation was to appoint an MRI safety officer at each hospital to regularly maintain MRI policies and procedures and oversee staff screening and training. OHTAC also endorsed measures to better control entry to MRI environments and recognized the need for a single, comprehensive patient screening form that would be used by all MRI facilities to ensure patient safety.

RECOMMENDATION 6

To help ensure the safety of patients and hospital staff with regard to the operation of MRIs, hospitals should address the recent recommendations endorsed by the Ontario Health Technology Advisory Committee, which were designed to promote consistent and safe MRI practices in Ontario.

CT Safety

Patient Radiation Exposure

Diagnostic tests that use radiation, including CTs, are an accepted and important part of medical practice because the clinical benefit to a patient can outweigh the potential harmful effect of the radiation exposure. However, unlike regular x-rays where excess radiation exposure results in blackening of the film, better image quality is obtained with higher radiation use in CTs.

According to the Canadian Association of Radiologists, CTs now contribute almost half of the collective radiation exposure from all diagnostic medical examinations. CAR has noted that radiation exposure from CTs, which is measured in millisieverts (mSv), is particularly high, as shown in Figure 9.

At the hospitals we visited, many staff and referring physicians indicated that they were unaware that CTs exposed patients to as much radiation as they do. In addition, hospital staff indicated that patients were not specifically informed about the radiation risks of CT scans. A 2004 U.S. study, conducted at an academic medical centre, also found that patients, emergency department physicians, and radiologists underestimated patients' radiation exposure from CTs, and that patients were not given information about the risks, benefits, and radiation dose. A recent survey of referring pediatricians in the Toronto area found that 94% underestimated the radiation exposure from various pediatric CT scans.

A number of organizations, including the International Commission on Radiological Protection (ICRP), with representation from various countries, including the U.S., United Kingdom, Japan, and Germany, and the U.S. National Academy of Sciences have investigated the effects of radiation exposure on individuals. In June 2005, the U.S. National Academy of Sciences published the *Biologic Effects of Ionizing Radiation (BEIR VII): Health Risks from Exposure to Low Levels of Ionizing Radiation*. This study defined low doses as those in the range of near zero up to approximately 100 mSv. The report predicted, for the U.S. population, a lifetime risk of approximately one in a thousand of developing certain types of cancer from a dose of 10 mSv, or one in a hundred of developing cancer from a dose of 100 mSv.

Imaging Standards

The American College of Radiology (ACR) and Great Britain's Radiation Protection Division of the Health Protection Agency have established diagnostic reference levels for some types of CT examinations that guide clinicians in establishing standard CT parameters. By using standard parameters patients are exposed to similar radiation levels for similar examinations. A European Council Directive, pertaining to the health protection of individuals, including patients, from radiation also requires that member states promote the establishment and the use of diagnostic reference levels. Studies of CT dosages done in the U.S. (2000), the United Kingdom

Figure 9: Typical Effective Patient Radiation Exposure from Diagnostic Medical Imaging
Source of data: *CAR Diagnostic Imaging Referral Guidelines,* released September 2005

Diagnostic Procedure	Typical Effective Dose (mSv)	Equivalent # of Chest X-rays	Approximate Equivalent Period of Natural Background Radiation
x-ray—limbs and joints (except hip)	less than 0.01	less than 0.5	less than 1.5 days
x-ray—chest	0.02	1	3 days
x-ray—abdomen or pelvis	0.7	35	4 months
CT—head	2	100	10 months
CT—chest	8	400	3.6 years
CT—abdomen or pelvis	10	500	4.5 years

(2003), and British Columbia (2004) found that there were wide variations in CT examin-ation parameters, resulting in significant variances in patient radiation exposure for similar examinations performed at different locations. For example, the British Columbia study of 18 hospitals noted that radiation from an abdominal CT examination ranged from 3.6 mSv to 26.5 mSv.

Legislation in many provinces, such as Alberta and Saskatchewan, as well as Health Canada's Safety Code guidelines and the medical imaging profession in general, all follow the radiation principle of "as low as reasonably achievable" (ALARA). Although Ontario's *Healing Arts Radiation Protection Act* does not specifically refer to this principle, the June 1987 guidelines, which are intended to complement the Act and to provide additional information on many related aspects of x-ray imaging, are based on the ALARA principle. All the hospitals we visited had general radiological policies based on the ALARA principle. However, given that there are no patient radiation exposure standards for CT examinations in Ontario, a patient could receive more radiation at one hospital than at another for the same type of examination. The Expert Panel on MRI and CT identified the need to promote the standardization of imaging protocols for diagnostic procedures, including CTs, which would serve to ensure that the patient's radiation dose is minimized and that radiation exposure is consistent among hospitals.

In 2002, the ACR developed an accreditation program for CT facilities in the U.S. This voluntary program requires facilities to submit a sample of clinical images, radiation dose measurements, and scanning protocols to the ACR every three years. The ACR compares the patient radiation dose measurements to established reference levels and identifies instances where the radiation exposure is unusually high. Facilities are required to investigate any such instances and to submit documentation to the ACR within 90 days, detailing the investigation, any corrective action taken if necessary, or the justification for the use of higher radiation dose levels.

Pediatric Imaging Protocols

In November 2001, the U.S. Food and Drug Administration (FDA) issued a notification to radiologists and hospital administrators in the United States that emphasized the importance of using radiation doses during CT examinations that are as low as reasonably achievable, especially for pediatric and small adult patients who require less radiation to obtain a diagnostic CT image. Using less radiation is particularly important when the patient is a child. Children exposed to radiation are at a greater risk than adults of developing radiation-related cancer later in life, as many radiation-induced cancers can take decades to develop.

A 2001 American research paper noted that pediatric CT examinations are routinely conducted using the same level of radiation that is used on adults; this practice results in children absorbing significantly more radiation than adults. In fact, staff from the Hospital for Sick Children in Toronto estimated that the use of adult settings for one CT scan of the abdomen and pelvis in a child is approximately equivalent to over 4,000 x-rays, since children's organs are more sensitive to radiation. The FDA also recognized this radiation exposure risk in its 2001 notification, which stressed the importance of adjusting CT settings appropriately for each individual's weight or size, as well as for the part of the body being scanned. Furthermore, the Clinical Practice Parameters and Facility Standards for CTs in independent health facilities (College of Physicians and Surgeons of Ontario), and the practice guideline (American College of Radiologists) for performing and interpreting diagnostic CTs, both refer to utilizing pediatric/small adult protocols to help ensure that acceptable image quality is attained with the lowest possible radiation exposure.

Two of the hospitals that we visited conducted pediatric CTs. The third hospital did not perform pediatric CTs since all such cases were referred to a hospital specializing in pediatric care. To ensure that the radiation exposure during CTs provides sufficient image quality to enable the radiologist to interpret the examination results, manufacturers pre-program CTs with protocols, including pediatric protocols. The technologist can therefore adjust the CT settings to the children's protocol. We found that both hospitals either modified the pre-set pediatric protocols or allowed their radiation technologists to select the most appropriate settings. Staff at one hospital indicated that the modified protocol would often expose a child to less radiation than the manufacturer's pre-set protocols, but not always—the modified protocol might expose the child to more radiation than that from the pre-set protocols. We noted that the number of pediatric CT protocols varied significantly between the two hospitals. One hospital had about 60 different pre-set protocols, based on the child's weight and the body part being scanned, while the other hospital had only one children's pre-set protocol for head CT scans, based on the child's age.

We selected a sample of pediatric CT examinations and requested that hospital staff review them to determine if either the appropriate CT pediatric protocol or other acceptable settings were used. Staff at both hospitals indicated that in almost 50% of the selected cases the appropriate pediatric protocol or settings were not used and that the children were exposed to more radiation than necessary for diagnostic imaging purposes. In addition, staff from a pediatric hospital in Ontario indicated that, when examining CT images taken of children at referring hospitals, they noticed that the radiation exposure was sometimes higher than what was commonly used in a pediatric hospital. While there may have been unique circumstances requiring the use of excess radiation, we were informed that the pediatric hospital staff notified referring Ontario hospitals that the radiation exposure was higher than expected, and also provided referring hospitals with related educational material for conducting CTs on children.

Multiple CT Examinations

Certain patients have multiple CT examinations. For example, trauma patients may need a head, chest, and abdomen and pelvis CT to diagnose the extent of their injury. Each CT examination contributes to an individual's radiation exposure, which is cumulative over an individual's lifetime. The International Commission on Radiological Protection warns that while CT scans are a very useful medical imaging tool, the ease of obtaining results by this mode and the temptation to monitor frequently the course of a disease, should be tempered by the fact that repeated examinations may expose patients to a level of radiation which evidence shows causes cancer.

None of the hospitals that we visited had analyzed the number of CTs by patient to help determine if any patients were receiving more CTs than were medically necessary. However, two of the three hospitals that we visited were able to provide us with information on adult patients that had CTs—in total at these two hospitals, about 85,000 adult CT examinations were conducted in 2005. While all examinations are ordered by a physician, and therefore considered clinically necessary, we noted that about 15,500 patients accounted for 63% of the total 85,000 examinations conducted. These included 353 patients who had at least 10 CT examinations, and several patients who had substantially more examinations than that. One hospital indicated that physicians weigh the benefits and risks to the patient of any examination and also noted that three CT examinations in a year is considered a reasonable standard of care for cancer patients.

Although two hospitals that we visited conducted pediatric CTs, neither had monitored the total number of pediatric CTs performed or the number of multiple CT examinations done on a particular child. At our request, one hospital provided us with a listing of all CT examinations on pediatric patients, while the other hospital was only able to provide us with a partial listing. Based on this information, at least 450 children received CT exams in 2005 at these hospitals. Of these, 58 children received more than one CT, including 14 children who had at least three exams and one child who had six.

We also noted that none of the hospitals that we visited recorded radiation dosages absorbed by patients or tracked patients' cumulative radiation exposure, although two of the three hospitals recorded specific information that could be used to calculate the radiation absorbed by the patient. Furthermore, all of these patients may have received additional CT examinations at other hospitals or in other years, which would also add to their lifetime radiation exposure. We were informed by hospital management that, unfortunately, physicans generally cannot access information on patient CTs completed outside of their hospital. In the United Kingdom, the Health Protection Agency established a National Patient Dose Database in 1992, which contains radiation exposure information from patients' medical x-rays, provided by hospitals on a voluntary basis. Although the current database does not include information on CT examinations, a CT patient radiation dose database is being established in the United Kingdom as well.

Use of Protective Devices

No overall limits have been established for patient exposure to radiation for medical reasons in North America. However, in order to protect patients from the effects of radiation, hospitals are required, under the *Healing Arts Radiation Protection Act*'s regulation, to ensure that protective accessories (for example, a lead sheet to cover sensitive body parts) are available for use by persons who may receive exposure to x-rays. Other organizations, such as Health Canada and the International Commission on Radiological Protection, as well as many research articles, also recommend shielding to protect superficial patient organs, including the thyroid, breasts, and eye lens.

Although none of the hospitals we visited had patient radiation protection policies specific to CTs, all had general patient radiation protection policies. These policies ranged from shielding the reproductive organs to shielding other superficial organs that are outside the area under examination. Our discussions with hospital staff indicated that the patient radiation protection provided varied from hospital to hospital. For example, one hospital informed us that lead sheets were placed over and under a patient's body during a CT exam if doing so did not interfere with the diagnostic image; another hospital provided no similar protection for patients.

Hospital Personnel Radiation Exposure

In Ontario, the *Occupational Health and Safety Act* (Act) establishes limits for occupational radiation exposure in order to ensure that the risks associated with radiation are at an acceptably low level. The radiation dose limits vary by body part because certain areas absorb more radiation and are more susceptible to radiation-induced cancer (for example, superficial organs, such as the eyes, breasts, thyroid, and testes). The annual recommended radiation limit for the whole body is 50 mSv. In addition, a regulation under the Act requires that dosimeters, devices used to measure radiation exposure, be provided to individuals exposed to occupational radiation. This would include medical radiation technologists that work in the CT area and physicians who perform interventional procedures (since interventional procedures may involve irradiating the physician's extremities). Every three months the dosimeters are forwarded to Health Canada or other organizations, which report each individual's radiation exposure back to the hospital and to Health Canada's National Dose Registry. The registry tracks the individual's radiation dose, their cumulative radiation dose for the calendar year, and their lifetime radiation dose. A regulation under the Act requires employers to verify that the effective radiation dosage received by individuals exposed to occupational radiation is reasonable.

At the hospitals we visited, management indicated that they review the radiation exposure reports provided by Health Canada or other organizations to ensure that individuals are below the allowable limits. However, two of the hospitals used reports that are from organizations other than Health Canada and that are only permitted to provide an individual's radiation exposure at the hospital submitting the information. Therefore, these hospitals did not have information on the total radiation exposure for individuals who work at more than one hospital. However, Health Canada notifies the Ministry of Labour if an individual exceeds the annual radiation limit for occupational exposure.

Although the *Occupational Health and Safety Act* does not specifically state how many dosimeters should be worn or where on the body they should be placed, a federal safety code provides some guidance. For example, it recommends that physicians performing interventional procedures wear two finger dosimeters on the hand nearest the radiation beam. However, in the absence of specific regulatory direction in Ontario, each hospital we visited had established its own radiation safety policies and procedures, which varied among the hospitals. For example, radiation safety policies at one hospital specifically stated the number of dosimeters to be provided to x-ray workers and physicians who work with interventional x-ray equipment, and where these dosimeters should be placed on the body. At another hospital, policies stated that radiation workers should wear two dosimeters but did not state where on the body they should be placed or how many dosimeters physicians exposed to radiation should wear.

In 1990, the International Commission on Radiological Protection made recommendations to limit occupational exposure to radiation. It recommended a radiation limit for the whole body of 100 mSv, averaged over five years (or about 20 mSv per year), with the further provision that the effective radiation dose should not exceed 50 mSv in any single year. Health Canada adopted these occupational radiation dose limits, in a federal safety code, as did some other provinces, such as Alberta and British Columbia. Although the radiation limits under the *Occupational Health and Safety Act* are higher than those of these other jurisdictions, our review of the radiation exposure reports available at the hospitals we visited indicated that none of the staff working in the CT area were exposed to over 20 mSv of radiation in 2005. However, our review of the most recent radiation exposure reports of a sample of physicians indicated that occupational radiation exposure may not be sufficiently monitored and tracked in some cases. Specifically, we had the following concerns:

- At one hospital, physicians who performed interventional procedures had radiation exposure results for only one dosimeter, which is worn under a protective lead apron and used to determine whether the whole body's annual radiation dose is below 50 mSv. Although the hospital's policy stated that a second dosimeter could be worn to monitor radiation exposure to areas not covered by the protective lead apron, no additional dosimeter results were available. Therefore, the hospital was unable to tell whether any physicians exceeded annual maximum radiation doses for superficial organs such as the lens of the eye.
- At another hospital, the physicians performing the majority of interventional procedures did not appear to wear their dosimeters since their readings were below the minimum reporting threshold determined by Health Canada. In particular, there was no radiation exposure noted on the radiation exposure reports for five radiologists that performed 79% of the interventional procedures at this hospital.
- At all three hospitals, only one physician performing interventional procedures had wrist dosimeter readings, and only one other physician had a ring dosimeter reading, as recommended by Health Canada's federal Safety Code. Hospital management indicated that these dosimeters are not worn because they restrict physician mobility and may perforate protective gloves, potentially creating infection-control issues.

The Ministry of Labour may periodically inspect hospital dosimetry records to ensure that radiation exposure limits are not exceeded. We reviewed the Ministry of Labour inspection reports at the two hospitals we visited that were subject to a recent inspection. At one hospital, the June 2005 inspection report noted that some physicians who performed interventional procedures using radiation in the operating room were not issued radiation dosimeters. We noted that the hospital itself had previously identified the same issue in September 2004. Management at this hospital indicated that all physicians performing interventional procedures using radiation have now been issued dosimeters, in accordance with the hospital's policies. The other hospital's April 2003 inspection report noted some minor radiation safety issues, which were subsequently corrected by the hospital. We were informed that the third hospital was inspected in the summer of 2006.

Review of CT Operations

The *Healing Arts Radiation Protection Act* (HARP) and related regulations govern x-ray machine features, their operations, and the qualifications of individuals operating them. In addition, it authorizes Ministry inspectors to examine the premises and operations wherever x-ray machines are installed. However, there are no CT operating standards specified under the Act, and the regulation specifically excludes CTs. Therefore, unlike x-ray operations, the Ministry does not examine CT operations, even though CTs expose patients to significantly more radiation.

The government-appointed HARP Commission's role includes advising the Minister on matters relating to the health and safety of persons exposed to radiation from x-rays. At the time of our audit, the Commission was reviewing the *Healing Arts Radiation Protection Act*, including concerns about CT operating standards not being specified under the Act. We were informed that this review also included areas such as the possible establishment of provincial CT radiation guidelines (based on factors such as a patient's gender, age, and weight) as well as a system for tracking patients' cumulative radiation dosages. We were informed that an interim report was provided to the Minister of Health and

Long-Term Care in May 2006, with a final report planned for mid-2007.

The Ontario Health Technology Advisory Committee was also examining the use of CT equipment, including patient radiation exposure, CT imaging standards, and patient shielding practices, and expected to make recommendations to the Ministry in the summer of 2006.

RECOMMENDATION 7

To help minimize the impact of radiation exposure for patients and hospital personnel, hospitals, in conjunction with the Ministry, should:

- ensure that both physicians and patients are aware of the radiation exposure from CTs in order to make better informed decisions on the use of CTs versus other diagnostic imaging options;
- develop and implement standardized patient CT-radiation-exposure protocols, based on international and national best practices, that would ensure that the patient's radiation exposure is as low as reasonably achievable and is consistent among hospitals, and monitor adherence to these protocols through a quality assurance program;
- obtain information from other hospitals regarding CTs and other diagnostic imaging procedures for those patients who have had or will have a significant number of such examinations; and
- ensure that all hospital personnel exposed to occupational radiation wear the recommended dosimeters to enable accurate tracking of radiation to ensure radiation exposure does not exceed the limits established in the *Occupational Health and Safety Act*.

In addition, to help ensure the consistent and appropriate protection of patients from medical radiation, the Ministry of Health and Long-Term Care should review and take appropriate action on the recommendations (once available) of the Healing Arts Radiation Protection Commission and the Ontario Health Technology Advisory Committee, and ensure that CT operations are subject to an appropriate level of review.

EXAMINATION RESULTS

When the CT or MRI examination is complete, the resulting images are sent to a radiologist for analysis. The analysis includes a review of the images, along with any available clinical information, and may also include a comparison of the current images with previous examination results. The radiologist then verbally dictates the results of their analysis, which is transcribed either electronically or by another individual in an examination report. The radiologist reviews the accuracy of the transcribed report, either before or after the report is sent to the referring physician. Any required changes are made, and an addendum is sent to the referring physician where necessary. As well, at the hospitals we visited, referring physicians who have hospital privileges (that is, are permitted to see patients at that hospital) could listen to the radiologist's dictated report in order to obtain preliminary patient information in advance of the written report.

Reporting of Results

The MRI and CT Expert Panel indicated that, as a benchmark, the radiologist's verified report should be available 48 hours from the time that the MRI or CT examination was conducted. This suggested benchmark would apply to both in-patient and outpatient reports. In some cases, the referring physician requests the radiologist's analysis on an urgent (also called "stat") basis, due to the patient's condition. In other cases, the radiologist notes irregularities that need to be brought to the referring physician's attention immediately. Although none of the hospitals we visited had formal policies on the time frame for reporting stat examinations, the hospitals indicated that the radiologist's final report should be sent to the referring physician within one to two days after the patient's examination.

We reviewed the time it took for the radiologist to interpret the images and provide a report to the referring physician and found that, on average, outpatient CT and MRI reports were generally released to the referring physicians within four to 10 days of the examination being performed.

We also reviewed the reporting of stat examinations and noted that the hospitals had different processes for monitoring the completion of stat reports. One hospital used an automated system that alerts radiologists to review the images needed "stat" before all other images and dictate and have transcribed the reports for those images first. Both of the other hospitals used paper-based systems—at one, all stat reporting of diagnostic images was recorded in a manual log as of November 2005, while the other hospital recorded stat results on the envelope containing the examination images. Although all three hospitals indicated that the radiologist would phone the physician to provide immediate feedback and that these cases would be transcribed first, we noted that none of the hospitals monitored to ensure that all stat reports were issued on a timely basis. We therefore requested the stat-reporting information available at the hospitals to determine whether results were reported promptly after the test was performed. However, the hospital where results were documented on the examination envelope was unable to provide us with this information. Our review of the information from the other two hospitals indicated the following:

- At one hospital, the median time to release a stat report to the referring physician in 2005 was four days for a stat MRI report and two days for a stat CT report. However, we noted instances of much longer turnaround times—as high as 96 days for CT reports and 91 days for MRI reports. Hospital management was unable to explain the reasons for the long delays but indicated that many tests are coded as "stat" when they are not truly urgent based on medical need.
- At the second hospital, we noted that the stat-reporting logbook was incomplete. Nevertheless, we found that the reports in the logbook from January 2006 that we sampled were dictated by the radiologist within one day and that almost all were communicated to the referring physician within two days. However, the time to release the formal radiologist's report ranged from two to 13 days.

A 2002 study by a U.S. organization that represents imaging professionals noted that even though most facilities offer referring physicians access to the radiologist's dictated report, few physicians make use of this service and prefer to have a final copy of the report. None of the hospitals we visited had determined the percentage of referring physicians that had access to dictated reports or how often this access was being used. In February 2005, one hospital surveyed referring physicians and found that the majority were satisfied with the turnaround times for radiologists' reports and liked the option of listening to the dictated reports.

Accuracy of Results

There have been a number of studies assessing the accuracy of radiologists' analyses of diagnostic images. These studies generally had a second radiologist review the images and the original radiologist's examination report, and note any differences in interpretation. A 2001 British research article, which summarized research in this area, determined that the level of error in the radiologists' initial analysis varied, depending on the type of diagnostic examination. However, clinically significant or major errors (that would potentially alter patient management decisions) in radiologists' reports ranged from 2% to 20% for CT examinations and from 6% to 20% for MRI examinations. We noted that the American College of Radiology's CT accreditation program states that policies and procedures should be in place to review the diagnostic accuracy of radiologists' analyses. While it is not practical to have every image analyzed by two radiologists, a periodic second reading of a selection of each radiologist's reports is a useful quality assurance process.

None of the hospitals that we visited had a formal quality assurance program in place to periodically ensure that radiologists' analyses of the examination images were accurate. However, radiologists at two of the hospitals we visited indicated that, several years ago, they had periodically discussed and reviewed specific cases with one another, and in some instances with other departments in the hospital. This was done to ensure that the examination images were correctly analyzed, based on the available clinical information. However, this process was eliminated a few years ago due to the radiologists' increased workload. Nevertheless, we were told that informal discussions still occur between radiologists on more complex cases. At the third hospital, radiologists stated that some informal meetings occur between radiologists. As well, if a radiologist is comparing current and past examination results, and notes an error in the interpretation of previous images, it is discussed with the appropriate radiologist. However, none of these meetings or discussions are documented.

One hospital we visited had an external quality review conducted in January 2006 to assess the accuracy of the analyses of diagnostic images performed by one of its radiologists, as a result of concerns raised by physicians within the hospital. The review looked at 66 diagnostic images and the related reports completed by the applicable radiologist, and found that there were "numerous errors of omission in which abnormalities were missed" and that the reporting was "poor enough that patient safety may be jeopardized." The hospital indicated that the radiologist was requested to complete supervised training, but since the radiologist has not worked at the hospital since January 2006, the hospital is not aware if the training is occurring. The implementation of a periodic quality assurance program may more quickly identify these types of situations and ensure that corrective action can be taken on a timely basis.

RECOMMENDATION 8

To help ensure that referring physicians have accurate information on a timely basis for making patient-related decisions, hospitals should:

- adopt benchmarks for the timely reporting of both urgent and normal MRI and CT referrals and monitor adherence to those benchmarks; and
- implement an independent quality assurance program that includes a periodic, preferably external, review of a sample of each radiologist's analysis of diagnostic images.

OTHER MATTER

Incident Reporting

Each hospital determines what constitutes an incident at their institution. At the hospitals we visited, an incident was generally defined as an unusual occurrence causing injury or loss to patients or hospital employees (for example, equipment malfunctions, patient falls, wrong test given, and allergic reactions). In addition, one of the hospitals had a documented near-miss policy, which was defined as an occurrence with a potential to cause injury, loss, or damage to patients, visitors, or employees.

The hospitals we visited all had reporting processes whereby incidents involving patients and hospital employees were reported to hospital management so that corrective action could be taken to reduce future incidents. These processes varied from a manual system with no overall summarized data to an electronic system that categorized each type of incident.

At two of the hospitals, we found that MRI and CT incidents were being tracked and determined that there were a total of 29 incidents in 2005 in the MRI and CT area. These hospitals indicated that they followed up on incidents, although we found that this process was generally not documented. One of these hospitals did inform us that it planned to start documenting the corrective action taken.

The third hospital classified the impact of incidents as critical, severe, moderate, or minor. Incidents with a critical impact involve the actual or potential loss of life, limb, or function. Severe incidents are similar to critical incidents, except that successful intervention occurred, resulting in a positive outcome. This hospital reported a total of 289 medical-imaging incidents, including four critical and severe incidents in the MRI and CT areas, as well as 25 near misses, in the 2005/06 fiscal year.

We were informed that the hospital's Quality of Care Committee was responsible for reviewing all critical and severe incidents, as well as any occurrences or series of occurrences that have the potential to result in harm to patients. In addition, the Committee makes recommendations and evaluates the corrective action proposed or taken by the hospital. We were unable to examine this process, as the *Quality of Care Information Protection Act, 2004* prevails over other Ontario statutes, including the *Auditor General Act*. Therefore any information that is prepared for a quality-of-care committee for the sole or primary purpose of assisting the committee in carrying out its functions is not permitted to be disclosed. As a result, our access to information relating to any analysis, including any trend analysis based on the type or cause of the incident, and any resulting follow-up of critical and severe CT and MRI incidents, was prohibited. Therefore, we were unable to determine whether this hospital had an adequate system in place to analyze and follow up on critical and severe diagnostic imaging incidents and take corrective action, where necessary, to prevent similar incidents in the future.

SUMMARY OF RESPONSES FROM HOSPITALS

In this section, rather than reproducing the individual responses from each of the three hospitals we visited as part of this audit, we have summarized the highlights of the responses we received. Overall, the hospitals generally agreed with our recommendations but indicated that in some cases limited financial and human resources may prevent the implementation of the recommendations. As well, one hospital emphasized that the successful implementation of many of the recommendations would require collaboration with the Ministry of Health and Long-Term Care (Ministry) and other organizations, especially recommendations involving physician practices since they are not employees of the hospital.

Recommendation 1

The hospitals generally agreed with this recommendation. However, one hospital indicated that, while it agreed with identifying possibly inappropriate diagnostic imaging tests—for example, through the use of referral guidelines, it did not have the systems or human resources to implement such a process. Another hospital indicated that it had established a High Cost Utilization Committee to develop policies and mechanisms for monitoring practices pertaining to the use of high-cost interventions, such as the use of CT and MRI equipment. The third hospital commented that referral guidelines should be standardized across the province, and suggested that organizations such as the Canadian Association of Radiologists and the Ontario Medical Association lead this initiative as it is beyond the scope of the hospital. As well, this hospital indicated that these organizations could develop a process to implement the guidelines and provide related physician education.

Recommendation 2

The hospitals had mixed positions on this recommendation. One hospital was in compliance with the recommendation but indicated that incremental funding from various government agencies should reflect the true cost of providing a service to a patient. However, the other hospitals indicated that generating revenue for themselves by providing faster access to Workplace Safety Insurance Board of Ontario (WSIB) patients was beneficial, as long as other patients received access to MRI and CT examinations in accordance with Ontario's wait-time benchmarks. These two hospitals also indicated that, given the WSIB funding structure, they compete with other hospitals to obtain WSIB revenues. Therefore, if these revenues were lost as a result of prioritizing WSIB patients the same as other patients, the hospitals would not be able to operate their MRIs and CTs during the time scheduled to serve WSIB patients, due to funding constraints. If this happened, the hospitals believed that the wait time for all patients would get longer.

Recommendation 3

The hospitals generally agreed with this recommendation. One hospital commented that the Ministry must clearly define the starting point for calculating wait times in order to standardize reporting across all hospitals in Ontario. As well, two of the hospitals indicated that they had implemented the Wait Time Information System. The third hospital indicated that it planned to implement this system but that this would be difficult without both one-time and ongoing funding from the Ministry.

Recommendation 4

One hospital agreed and complies with this recommendation. Another hospital agreed with the recommendation in principal, but noted that it was not a resource priority as it believed that cancellations and no-shows did not significantly impact its operations. The third hospital indicated that although its current system was unable to track the reasons for all cancellations, it also believed that cancellations and no-shows did not significantly impact its operations.

Recommendation 5

The hospitals generally agreed with this recommendation. Furthermore, one hospital indicated that it was working on strategies to increase utilization. Another hospital indicated that it was now operating its MRI regularly on weekends as a result of available staff and additional wait-time funding from the Ministry. However, to further increase this hospital's MRI and CT utilization, additional funding as well as trained technologists and radiologists were needed. The third hospital indicated that provincial standards should be developed for increased CT and MRI utilization, and that stable funding over a multi-year period would be necessary to implement and sustain higher utilization.

Recommendation 6

The hospitals concurred with this recommendation. Furthermore, one hospital indicated that it had established an MRI safety committee to develop and revise policies for MRI safety.

Recommendation 7

One hospital agreed with this recommendation and the other two supported parts of this recommendation. One hospital suggested that education to increase both physician and patient awareness of the radiation exposure from CTs could be facilitated by the Ministry, the Ontario Medical Association, and other organizations. Another hospital commented that implementing standardized patient CT-radiation-exposure protocols required ongoing development, which the hospital would be actively involved in. This hospital also indicated that physicians within the hospital could access the number of prior CTs that a patient has had at the hospital and expected that physicians would take this information into consideration when ordering CTs. However, all the hospitals agreed that it would be beneficial for physicians to be able to access information on whether a patient has had a CT, MRI, or other diagnostic imaging test completed outside of their hospital. Having said that, one hospital highlighted that technological changes to link patient information are required before this can be achieved.

One hospital indicated that it had changed its practice such that physicians performing interventional procedures now wear a second dosimeter to monitor radiation exposure to areas of the body not covered by the protective lead apron. Another hospital indicated that dosimeters must be worn in accordance with the hospital's policies but reiterated that infection-control practices take precedence over physicians wearing ring and wrist dosimeters.

One hospital suggested that the Ministry, the Healing Arts Radiation Protection Commission, and the Ontario Health Technology Advisory Committee establish standards and guidelines for CTs. As well, another highlighted that CT operations should be examined by the Ministry or subject to some other type of accreditation or manufacturer-supported quality control program.

Recommendation 8

Two of the hospitals agreed with both parts of this recommendation. However, one of these hospitals noted that it would be unable to implement either part given current resource priorities. This hospital also indicated that funding to implement such a recommendation should include funding for physicians involved in the quality assurance process. The second hospital indicated that provincial benchmarks for reporting MRI and CT results should be established by hospitals in collaboration with the Ontario Medical Association and the Ministry. As well, this hospital commented that additional funding would be required to implement a quality assurance program and suggested that the College of Physicians and Surgeons of Ontario be involved with this program.

The third hospital indicated that it agreed with part of the recommendation and had started developing a system to monitor the stat reporting turnaround time. However, the hospital did not support the use of an external quality assurance review, since it anticipated there would be very few qualified external reviewers, due to the hospital's physicians' work being sub-specialized. Nevertheless, this hospital did support using internal reviewers to conduct periodic quality assurance reviews. As well, to help prevent diagnostic errors in the future, the hospital has requested that physicians report errors they encounter, so that an anonymous presentation can be made to all physicians working in that area.

SUMMARY OF MINISTRY OF HEALTH AND LONG-TERM CARE RESPONSE

This report was also provided to the Ministry of Health and Long-Term Care, which indicated that, overall, it agreed with the recommendations and appreciated the need for appropriate standards, guidelines, and best practices. The Ministry also expressed awareness of the financial and human resources needed to enable it to move forward with its agenda to improve access and reduce wait times for MRI and CT services.

The Ministry further expressed its commitment to the goal of providing timely and equitable access to MRI and CT services for all residents of Ontario. The Ministry indicated that, to achieve this goal and at the same time address the recommendations of the report relating to the Ministry, it has implemented many strategies through:

- the Ontario Health Technology Advisory Committee;
- the Diagnostic Services Committee, a committee with joint representation from the Ministry and the Ontario Medical Association established to further the Ontario Medical Association Agreement;
- the Diagnostic Imaging Safety Committee; and
- the Wait Time MRI and CT Expert Panel (whose second report was expected to be completed by November 2006).

With respect to Recommendation 7, the Ministry indicated that the Diagnostic Imaging Safety Committee, established in September 2006, is developing recommendations for minimizing the impact of radiation exposure for patients and hospital personnel. The Ministry anticipated that the Committee's work in this area would be completed and presented by February 2007.