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ICES Institute for Clinical Evaluative Sciences

Investigation of Acute Lower Back Pain in Ontario: Are Guidelines Being Followed?

ICES Investigative Report

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About ICES

Ontario's resource for informed health care decision-making

ICES is an independent, non-profit organization that conducts research on a broad range of topical issues to enhance the effectiveness of health care for Ontarians. Internationally recognized for its innovative use of population-based health information, ICES knowledge provides evidence to support health policy development and changes to the organization and delivery of health care services.

Unbiased ICES evidence provides fact-based measures of health system performance; a clearer understanding of the shifting health care needs of Ontarians; and a stimulus for discussion of practical solutions to optimize scarce resources.

Key to ICES' research is our ability to link anonymous population-based health information on an individual patient basis, using unique encrypted identifiers that ensure privacy and confidentiality. This allows scientists to obtain a more comprehensive view of specific health care issues than would otherwise be possible. Linked databases reflecting 12 million of 30 million Canadians allow researchers to follow patient populations through diagnosis and treatment, and to evaluate outcomes.

ICES brings together the best and the brightest talent under one roof. Many of our faculty are not only internationally recognized leaders in their fields, but are also practising clinicians who understand the grassroots of health care delivery, making ICES knowledge clinically-focused and useful in changing practice. Other team members have statistical training, epidemiological backgrounds, project management or communications expertise. The variety of skill sets and educational backgrounds ensures a multi-disciplinary approach to issues management and creates a real-world mosaic of perspectives that is vital to shaping Ontario's future health care.

ICES collaborates with experts from a diverse network of institutions, government agencies, professional organizations and patient groups to ensure research and policy relevance.

Contents

Introduction

In the spring of 2002, the Ontario Ministry of Health and Long-Term Care (MOHLTC) commissioned a series of research reports by the Institute for Clinical Evaluative Sciences (ICES) to examine the utilization of diagnostic tests in Ontario. The request was a reflection of the exponential rise in the use and costs of diagnostic tests and publicized long waiting times for many tests. As part of this line of research, the report examines utilization of radiology for low back pain (LBP) in Ontario, reviews Ontario-specific and international guidelines for the clinical management of LBP, and explores the temporal and geographic trends of lumbar spine X-rays and spinal CT and MRI utilization across the province using routinely collected administrative data. This report also extends previous uses of administrative data by creating an Ontario cohort of persons first diagnosed with lower back pain by a family/general practitioner in 2000. Longitudinal radiology and specialist visit care paths were developed for these persons for up to two years after the back pain diagnosis.

The utilization of plain X-rays of the lumbar spine, and CT and MRI of the spine in Ontario was studied from 1992 to 2001. In addition, a cohort of persons that visited a general practitioner/family physician for lower back pain for the first time in the year 2000 was studied. Radiology and specialist visit “care paths” for up to two years after the diagnosis of back pain were created for this cohort. Claims from the Ontario Health Insurance Plan (OHIP) were used for both analyses.

Over ten years (1992 to 2001), the rate of use of CT (computerized axial tomography) scan and MRI (magnetic resonance imaging) increased markedly (a relative increase of 51% and 452% respectively), along with substantial increases in costs. On the other hand, the number of patients receiving plain X-rays of the lumbar spine decreased by 11%. In a cohort of patients who visited a family physician for lumbar back pain for the first time in 2000, (78%) did not have any radiological investigations (X-ray, CT scan or MRI) or specialist visits. Only 12% of these patients received a lumbar/sacral X-ray within 6 weeks of their initial diagnosis. Thus, it appears that most physicians are following guidelines regarding the investigation of lower back pain (which advise against routine radiologic investigation). Unfortunately, the impact of the guidelines endorsed by the Ontario Guideline Advisory Committee in 2000 could not be specifically assessed.

For patients in this cohort that did have further investigations, lumbar X-ray was the most common investigation performed (17%), followed by CT scans (4%), specialist visits (2%) and MRI scans (0.7%). Most patients had only one radiological test (90%) or one specialist visit (55%) during the two years after the initial investigation. General practitioners and family physicians in Ontario ordered most of the tests for lower back pain, with regional variations in the type of diagnostic technology used.

Currently, OHIP billing codes for CT and MRI of the spine do not distinguish between anatomical regions (e.g. cervical versus lumbar spine). This severely limits the utility of these codes for health services research, and the billing codes should be changed to reflect the anatomical region being imaged, as currently occurs with plain radiography of the spine.

Background

Low back pain (LBP) is extremely common throughout the developed world. The reported one-year prevalence rates range internationally from 25% to 62%.[5,3,10] More than 70 percent of people in developed countries will experience LBP at some time in their lives. Each year, 15 to 45 percent of adults suffer from LBP and one in 20 people present to a hospital with a new episode. LBP is most common between 35 and 55 years of age.[10]

The annual prevalence of LBP in the United States is estimated to be between 15% and 28%.[A3,5] Up to 85% of adults have at least one lifetime episode.[A8,A4] Despite this high prevalence, only about 25% of persons reporting neck or back pain visited a health care provider.[3,14,A3,5] Most visits for LBP are to primary care providers, but it is also the most common reason for visits to orthopaedic surgeons and neurosurgeons.[A3] The direct medical costs of LBP exceed $25 billion dollars (US) per year.[A8,A4]

For most patients, back symptoms are non-specific. The underlying cause of LBP is often unknown and only about 7% of patients suffering from LBP have severe clinical conditions.[11] Early diagnostic imaging often finds spinal disease where there are no symptoms and may not find any clinical abnormalities in LBP patients. LBP has therefore been described as "an illness in search of a disease".[7]

Clinical course of low back pain

Acute LBP refers to spinal or paraspinal symptoms of between two to four weeks in duration in the lumbar/sacral region.[A3] Risk factors for the development of back pain include heavy physical work, frequent bending, twisting, lifting, and prolonged static postures. Psychosocial risk factors include anxiety, depression, and mental stress at work.[A3]
According to the Agency for Healthcare Research and Quality (AHRQ), back pain of less than 3 months duration can be categorized into three groups based on cause:

1. Potentially serious underlying conditions such as neoplasms, infection, fracture or major neurologic compromise;
2. Sciatica symptoms which suggest lumbosacral nerve root impingement;
3. Non-specific symptoms often caused by musculoligamentous or degenerative changes which suggest neither a serious condition nor nerve impingement.

In 90% of patients, acute LBP resolves within six weeks. Between 5-10% of patients receive surgery, however surgical rates vary geographically. [A8] Sixty percent of patients with acute LBP will return to work within one month and 90% will be working within 3 months.[A4]

Guidelines for clinical management of low back pain

Professional judgment plays an important role in the management of acute LBP and may be influenced by health system (availability of diagnostic tests and specialists), physician (mix and practice issues) and patient factors.[15] While LBP diagnosis and treatment lack a true standard of care, there are a number of guidelines that converge in their opinion on diagnosis and management of acute LBP. (Appendix A)

In 2001, the Ontario Guidelines Advisory Committee endorsed guidelines for the management of acute low back pain (Appendix B) in a primary care setting based on previously released international guidelines.[A9] In the absence of red flags gleaned from detailed clinical history that could suggest recent trauma, fracture, infections, tumours, or other severe conditions such as cauda equina syndrome, guidelines suggest that diagnostic intervention is not indicated until the patient has been symptomatic for at least four to six weeks. If red flags are found, referral to a specialist and plain X-rays are indicated. Oblique views are not recommended. If plain X-rays are negative, CT or MRI may be helpful if pain persists for more than four or six weeks. CT or MRI may be indicated when history, physical exam or prior tests suggest a serious cause of back pain such as those mentioned above. Lumbar disc herniation is only detectable with CT or MRI.

After 4 to 6 weeks of symptoms (without obvious red flags), blood tests, including complete counts, erythrocyte sedimentation rate, urinalysis and other specific tests may be indicated to rule out infection or malignancy.[A10]

Imaging techniques and uptake of clinical guidelines

Physician management of LBP varies and current evidence suggests that many tests are performed unnecessarily. A study to assess the management of LBP in the US found that 10/38 (26%) of lumbar spine films and 12/18 (66%) of CT scans and MRIs were inappropriately ordered. Another study found that overuse of imaging ranged from 20% in primary care doctors to 70% among orthopaedic surgeons.[16]

An American study examined the utilization of radiography in acute LBP amongst Carolina care providers (chiropractors, family doctors and orthopaedic specialists).[4] The study enrolled 1633 patients who were followed for a minimum of six months. In 95% of the sample, function improved rapidly and performance of normal tasks had returned by six months. Presence of a neurologic deficit, practitioner diagnosis of disc disease, practitioner assessment of severe pain, long duration before the index visit and presence of sciatica were associated with use of radiography or CT or MRI. Chiropractors and orthopaedic surgeons were more likely to obtain radiographs than primary care physicians. Ownership of a radiograph machine was associated with use of radiography but this did not persist when controlling for practitioner specialty. Solo practice was associated with use of radiography and this persisted after controlling for physician speciality. As well, Caucasian patients were associated with receipt of both lumbar spine radiographs and MRI or CT. Patients with more education, better insurance or claiming worker's compensation were *less* likely to receive lumbar spine radiography.

Uptake of clinical guidelines is often lacking, especially when there is wide variation in the availability of diagnostic tools and the wide array of possible diagnoses.[12,9] Further complicating the use of guidelines for LBP is the concept that promotes the importance of making a specific diagnosis in LBP.[1] According to this line of thinking, a specific diagnosis of LBP, which would require the use of imaging technology, can more accurately direct effective treatments.[1] In contrast, proponents of LBP guidelines argue that LBP technology can find radiologic abnormalities in asymptomatic populations, which can lead to labelling people as ill and can have a negative impact on their quality of life.[7] A randomized controlled trial comparing rapid MRI to radiographs found identical clinical outcomes, yet at an increased cost of care.[8] For these reasons and based on the results of studies comparing persons receiving and not receiving imaging strategies, practice guidelines promote the screening for serious problems without imaging every patient.[7]

The impact of clinical guidelines for LBP has not been fully assessed. One study that examined the impact of guidelines aimed at reducing unnecessary radiographs for LBP in two hospitals in the UK, found that there was no reduction in test ordering.[17] In contrast, a retrospective chart audit conducted in four family practice clinics in Edmonton assessed the impact of AHRQ guidelines for the management of acute low back pain on the use of lumbar radiographs by family physicians in the initial assessment of patients with low back pain.[13] This study concluded that had the physicians used the AHRQ guidelines, the number of lumbar radiographs would have increased from 13% to 44% of initial vis

Spinal CT, MRI and Lumbar/Sacral X-rays

Two separate analyses using administrative data were performed. The first extracted all physician billing records for CT, MRI and lumbar/sacral X-ray between 1992 and 2001. The temporal trends and geographic variation of the utilization of these tests was examined.

The second set of analyses used a disease-based cohort. Using administrative data, a group of patients who had a first visit to a family physician/general practitioner (FP/GP) with LBP were identified. This group of people were followed to determine their rates of CT, MRI and lumbar/sacral X-ray use and the geographic variation of these services. Care paths were created to examine how these people were clinically managed with respect to radiology for their LBP, and to examine the wait times between their initial FP/GP visit and their radiological test. The cohort was also followed for a further two years to identify the development of more serious conditions after their incident LBP diagnosis. Because many of the guidelines for the investigation of low back pain were endorsed near the end of 2001 or later, the available data could not determine the impact of the guidelines on test ordering adherence. However, some of these guidelines were in development or available since the mid- to late-1990s (see Appendix A).

How the analysis was done

Utilization of non-invasive diagnostic tests for LBP in the province was determined from submitted claims to the Ontario Health Insurance Plan (OHIP). The professional component of all spinal X-ray, CT, and MRI claims to OHIP was identified between January 1, 1992 and December 31, 2001, excluding claims that were not reimbursed by OHIP. MRI claims include a base component plus optional repeat codes (i.e. a different plane or pulse sequence). For the purposes of capturing MRI utilization, only the base component was counted. Inclusion criteria for the CT, MRI and X-ray utilization analysis are found in Appendix C.

The cost of diagnostic tests was captured using the professional fee reimbursed to physicians by OHIP. For MRI claims, we additionally captured the professional fee of the repeat codes when there was a repeat code billed on the same day as a base code. Billings for X-rays, unlike CT or MRI claims, sometimes contained the professional and technical fees together. To capture only the professional cost in these situations, the average professional cost allowed by OHIP during the same time period was substituted instead of the combined professional plus technical cost. This was done in 36% of spinal X-ray claims.

Patient age, sex, and postal code at the time of the claim were ascertained from the Registered Persons Data Base (RPDB) and only claims for persons aged 20 or older were analyzed. The county and region (MOH planning regions) of residence for each person was determined by translating the postal code to county codes using the Statistics Canada Postal Code conversion files.

X-rays of the spine were categorized into the following groups based on the billing code used: lumbar (includes lumbosacral), cervical, thoracic, entire spine, and sacrum/coccyx. Yearly utilization and cost trends were described for each group. Further analyses were restricted to the lumbar X-ray group (51% of all spinal X-rays).

Age- and sex-specific rates of spinal CT, MRI, and X-ray utilization were calculated using inter-censal population estimates published by Statistics Canada as the denominator. Rates were adjusted to the 2001 Ontario Census population aged 20 or older using the method of direct standardization.

Referral patterns for spinal CT, MRI, and lumbar X-ray diagnostic tests were examined by capturing the specialty of the referring physician identified on the OHIP billing. Referral patterns were analyzed by geographic area of patient residence (north vs. south). Physician specialty was obtained via linkage to the Ontario Physician Human Resource Data Centre database, which identifies physician specialty on a yearly basis and verifies this information through periodic telephone interviews with physicians.

Geographic variation was calculated using the age- and sex-adjusted rates of CT, MRI and X-ray according to patient counties of residence. Each county was ranked according to its adjusted rate. To illustrate how each county compared with the provincial rate, a rate ratio was derived defined by the adjusted county rate divided by the provincial rate for CT, MRI and X-ray. The ratios were then categorized into 5 groups that illustrated whether and how much the county rate fell above or below the provincial rate. These categories were as follows:

- More than 25% above the provincial rate;
- Between 11% and 25% above the provincial rate;
- Between 10% above or 10% below the provincial rate;
- Between 11% and 25% below the provincial rate;
- More than 25% below the provincial rate.

Limitations

This analysis is subject to the usual caveats underscored when using administrative data. First, these data were not collected for research and, therefore, did not include some variables that may be of interest. For example, the utilization rates were adjusted for age and sex only and did not include adjustment for other confounding covariates (such as co-morbidity and socio-economic status). Overall, the rates account for full-coverage of utilization, as most physicians in Ontario receive their payment through OHIP. However, areas such as Kingston and Hamilton have a large population of physicians paid through alternate payment programs and these are not captured fully in these data. Lastly, at the time that this analysis was performed, only outpatient CT and MRIs were captured.

Findings and Discussion

Exhibit 1. Number, age- and sex-adjusted rate* and cost of outpatient spinal CT, MRI and lumbar/sacral X-rays for persons aged 20 and over, in Ontario, 1992 to 2001

	CT			MRI			Lumbar/sacral x-ray		
	Number	Rate	Cost ($)	Number	Rate	Cost ($)	Number	Rate	Cost ($)
1992	44,147	597	3,612,564	6,239	85	691,288	350,985	4,701	3,058,216
1993	45,588	606	3,719,001	7,754	103	886,273	334,155	4,406	2,905,714
1994	50,431	658	4,051,442	9,075	118	1,057,868	334,790	4,340	2,866,153
1995	52,774	675	4,295,230	10,083	129	1,200,861	315,828	4,026	2,727,661
1996	54,032	680	4,475,907	12,503	157	1,519,438	306,535	3,847	2,674,000
1997	57,734	711	4,775,560	15,302	188	1,795,310	327,830	4,032	2,848,631
1998	61,644	744	5,095,758	21,152	255	2,815,040	337,596	4,072	2,908,181
1999	66,772	791	5,571,687	25,760	305	3,585,169	348,168	4,119	3,011,523
2000	73,598	853	6,220,325	32,861	381	4,646,251	358,068	4,149	3,114,045
2001	79,552	901	6,875,590	41,420	469	6,142,742	369,894	4,190	3,288,320

*Rates per 100,000 population, adjusted to 2001 Ontario Census population aged 20 and over

Data sources: Ontario Health Insurance Plan; Registered Persons Database; Statistics Canada yearly intercensal estimates

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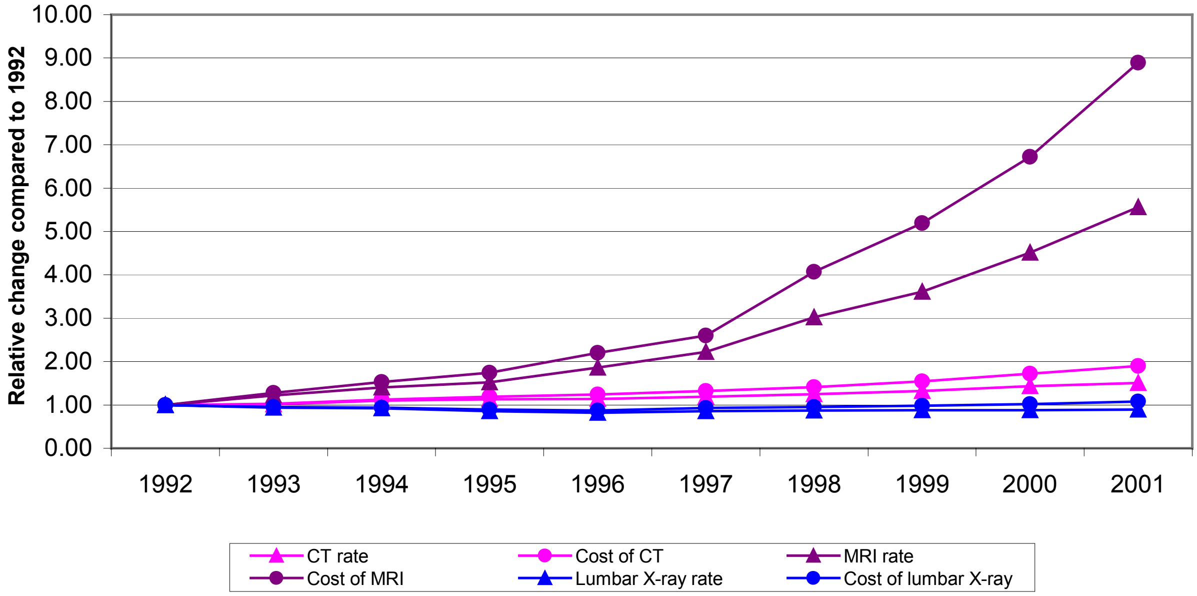
The annual number of tests, age- and sex-adjusted rates and costs were examined from 1992 to 2001.

Exhibit 2. Yearly change in the age- and sex-adjusted rates* and crude costs for spinal CT, MRI and lumbar/sacral X-rays relative to 1992 values for persons aged 20 and over in Ontario, 1992 to 2001



*Rates per 100,000 population, adjusted to 2001 Ontario Census population aged 20 and over
Data sources: Ontario Health Insurance Plan; Registered Persons Database; Statistics Canada yearly intercensal estimates

From 1992 to 2001, CT and MRI adjusted rates increased by 51% and 452%, respectively while the X-ray adjusted rates decreased by 11%. From 2000 to 2001, CT and MRI rates increased 6% and 23%, respectively while adjusted ray rates increased by less than 1%. The crude cost of claims billed to OHIP increased for CT (90%), MRI (789%) and X-ray (8%) by 2001, compared to 1992 costs. Costs from 2000 to 2001 increased 11% for CT, 32% for MRI and 6% for X-ray.

As witnessed in other health services reports, the number of X-rays further dipped in the year 1996 and then recovered to 1995 levels thereafter.[18]

Exhibit 3. Age- and sex-specific rates of spinal CT, MRI and lumbar/sacral X-ray tests per 100,000 population aged 20 and over, in Ontario, 2001

Age group	20-29	30-39	40-49	50-59	60-69	70+	All ages
Women							
CT	288	666	996	1,241	1,385	1,327	926
MRI	178	417	631	700	620	397	483
X-ray	1,862	2,979	4,341	6,052	7,458	8,274	4,753
Men							
CT	313	727	954	1,099	1,245	1,354	875
MRI	142	375	564	632	619	535	455
X-ray	1,837	2,908	3,520	4,142	5,132	6,168	3,596
Both sexes							
CT	301	697	975	1,171	1,317	1,338	901
MRI	160	396	598	667	619	453	469
X-ray	1,850	2,943	3,933	5,111	6,333	7,413	4,190

Data sources: Ontario Health Insurance Plan (OHIP); Registered Persons Database; Statistics Canada yearly intercensal estimates

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Overall utilization of X-ray was higher for women than men in all age categories, while CT utilization was higher for women between 40 and 70 years of age and MRI utilization was higher for women under 60 years of age.

Exhibit 4. Percent* of referring physician specialty for spinal CT, MRI, and lumbar/sacral X-rays by geographic area of patient residence for persons aged 20 and over, in Ontario, 2001

Physician specialty	CT			MRI			X-ray		
	North	South	Overall	North	South	Overall	North	South	Overall
Diagnostic radiology	0.65	3.20	3.08	0.73	3.20	2.88	1.99	0.87	0.96
Emergency medicine	0.43	1.50	1.44	**	0.58	0.50	0.29	0.91	0.87
FP/emergency medicine	4.06	2.94	3.01	1.37	0.72	0.82	2.86	3.15	3.13
General surgery	1.30	0.81	0.84	0.55	0.30	0.33	0.54	0.55	0.55
GP/FP	64.95	60.57	60.74	51.58	20.51	24.82	77.64	77.87	77.82
Hematology	**	0.29	0.29	0.33	1.05	0.94	0.06	0.20	0.19
Internal medicine	1.35	1.16	1.17	2.09	0.71	0.90	1.14	0.62	0.67
Medical oncology	1.03	0.77	0.78	1.59	2.46	2.33	0.62	0.47	0.48
Neurology	1.51	4.79	4.63	5.64	24.91	22.23	0.11	0.48	0.45
Neurosurgery	7.33	2.88	3.09	14.70	14.39	14.46	0.37	0.55	0.54
Orthopedic surgery	10.79	7.46	7.61	13.16	14.78	14.52	5.22	4.06	4.15
Physical medicine and rehab.	1.63	4.15	4.03	1.99	6.95	6.25	0.29	0.88	0.84
Radiation oncology	0.45	0.24	0.25	0.81	1.55	1.44	0.42	0.21	0.22
Rheumatology	1.18	4.00	3.87	1.18	3.63	3.31	1.45	2.80	2.70
Unknown	0.90	0.47	0.49	0.17	0.23	0.22	5.42	3.44	3.60
Total number of referrals	3,986	74,443	79,552	5,776	35,065	41,420	27,893	336,583	369,894

Patient residence unknown		
CT	MRI	X-ray
1123 (1%)	579 (1%)	5418 (1%)

*only specialties with greater than 1% referral for CT, MRI or X-ray are shown

** suppressed due to small cell sizes

Data sources: Ontario Hospital Insurance Plan; Registered Persons Database; Ontario Physician Human Resource Data Centre Database

The distribution of referring physician speciality with referral rates greater than 1% is shown by geographic area of patient residence (northern vs. southern Ontario) for each of the study tests in 2001. GP/FPs ordered 61% of spinal CTs, 25% of spinal MRIs and 78% of lumbar/sacral X-rays in Ontario. A much larger proportion of MRIs in the north were ordered by GP/FPs (52%) than in the south (21%).

Of note, 4% of X-ray records had unknown physician specialty information compared with less than 1% of CT and MRI records. The higher proportion of MRIs ordered by GP/FPs in the north is probably because access to MRI is better in the north than in many southern areas of the province. The low referral rates by neurologists in the north for MRI and the other studied tests may be an indicator of a relative lack of this specialty in the northern areas of the province.

Exhibit 5. Age- and sex-adjusted rates* of spinal CT, MRI and lumbar/sacral X-rays per 100,000 population by county in Ontario, 2001

County	CT			MRI			Lumbar X-ray		
	Number	Adjusted Rate	Adjusted Rate Rank	Number	Adjusted Rate	Adjusted Rate Rank	Number	Adjusted Rate	Adjusted Rate Rank
Algoma	276	290	48	1,166	1,221	3	3,353	3,434	38
Brant	754	811	33	399	430	22	3,685	3,919	26
Bruce	510	1,012	18	149	293	44	1,618	3,079	48
Chatham-Kent	749	904	27	240	295	43	2,591	3,086	47
Cochrane	576	874	29	1,046	1,565	1	3,019	4,594	8
Dufferin	400	1,130	12	133	372	31	1,328	3,850	29
Durham	2,772	756	37	1,652	441	21	14,708	4,066	25
Elgin	771	1,254	8	200	328	37	2,215	3,587	33
Essex	2,742	967	22	1,531	541	8	13,807	4,846	5
Frontenac	1,088	997	19	383	352	36	3,950	3,535	34
Greater Sudbury	448	365	47	664	535	9	4,778	3,868	27
Grey	1,089	1,507	2	291	407	24	3,119	4,207	20
Haldimand-Norfolk	719	873	31	293	360	34	3,778	4,576	11
Haliburton	205	1,399	4	60	449	19	486	3,192	46
Halton	2,253	778	36	1,298	445	20	9,966	3,466	36
Hamilton	3,465	913	24	1,532	410	23	16,470	4,315	17
Hastings	1,032	1,082	15	239	251	48	3,989	4,111	24
Huron	439	987	20	125	282	45	1,640	3,440	37
Kawartha Lakes	831	1,438	3	168	300	41	2,020	3,356	44
Kenora	62	136	49	146	319	39	1,500	3,378	42
Lambton	698	681	40	321	322	38	4,740	4,587	10
Lanark	563	1,127	13	178	361	32	2,291	4,567	13
Leeds-Grenville	862	1,090	14	295	375	30	3,505	4,291	18
Lennox-Addington	305	975	21	112	359	35	1,057	3,363	43
Manitoulin	60	619	43	64	646	7	469	4,714	6
Middlesex	2,599	849	32	1,469	481	14	12,705	4,127	22
Muskoka	269	621	42	172	391	29	1,712	3,795	30
Niagara	3,473	1,043	17	1,512	468	16	14,866	4,404	15
Nipissing	784	1,211	9	336	522	10	3,458	5,320	3
Northumberland	716	1,049	16	240	360	33	2,696	3,852	28
Ottawa	6,918	1,168	11	3,111	521	11	27,194	4,638	7
Oxford	664	874	30	239	315	40	2,865	3,687	31
Parry Sound	319	908	25	166	492	12	1,505	4,324	16
Peel	5,179	733	38	3,273	453	18	29,578	4,197	21
Perth	431	782	35	151	282	46	1,544	2,758	49
Peterborough	1,574	1,539	1	460	454	17	3,629	3,425	39
Prescott-Russell	757	1,291	6	283	476	15	2,767	4,881	4
Prince Edward	203	926	23	58	280	47	785	3,616	32

Rainy River	89	512	45	175	1,064	4	706	4,127	23
Renfrew	920	1,194	10	297	393	28	4,648	5,917	1
Simcoe	3,738	1,307	5	1,120	394	26	10,011	3,508	35
Stormont-Dundas-Glengarry	1,142	1,288	7	351	404	25	4,148	4,589	9
Sudbury	97	494	46	139	704	6	1,083	5,491	2
Thunder Bay	865	729	39	1,482	1,252	2	5,039	4,230	19
Timiskaming	141	513	44	220	806	5	1,271	4,571	12
Toronto	15,595	804	34	9,464	490	13	88,644	4,540	14
Waterloo	2,110	653	41	794	244	49	10,362	3,230	45
Wellington	1,234	876	28	417	295	42	4,816	3,424	41
York	4,943	908	26	2,227	393	27	18,384	3,424	40
Ontario rate	79,552	901		41,420	469		369,894	4,190	

Patient residence unknown		
CT	**MRI**	**X-ray**
1123 (1%)	579 (1%)	10867 (1%)

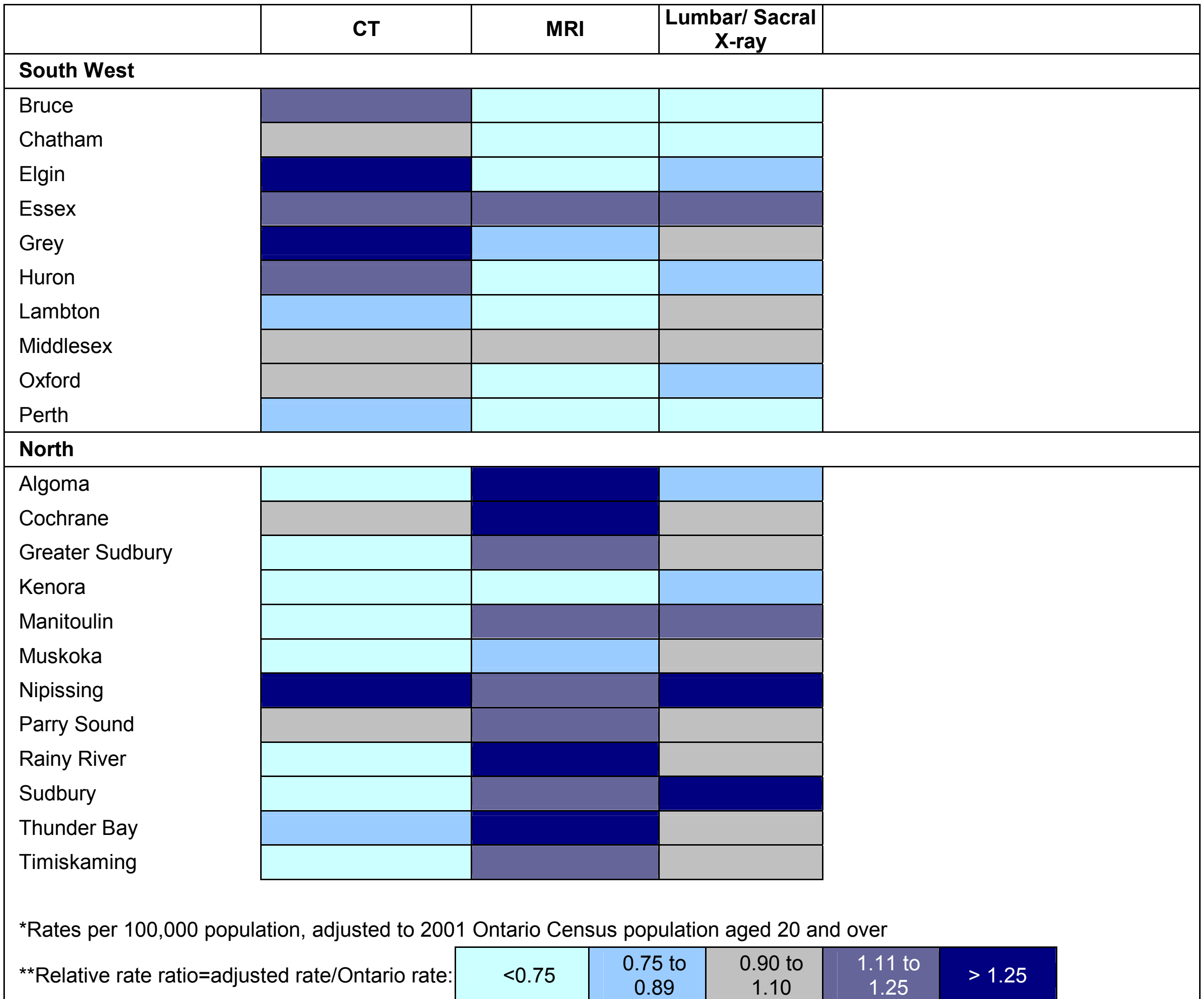
*Adjusted using the 2001 Ontario Census as standard population

Data sources: Ontario Hospital Insurance Plan; Registered Persons Database; Statistics Canada yearly intercensal estimates

Shows the number, adjusted test rates and rank by county.

Exhibit 6. Geographic variation in age- and sex-adjusted relative rate ratios* of spinal CT, MRI and lumbar X-rays for persons aged 20 and over, in Ontario, 2001

Percent Difference from Provincial Average**	Adjusted Rate > 25% Lower than Provincial Average	Adjusted Rate between 11% and 25% Lower than Provincial Average	Adjusted Rate between 10% Below and 10% Above the Provincial Rate	Adjusted Rate between 11% and 25% Above the Provincial Rate	Adjusted Rate More than 25% Above Provincial Average
District Health Council	**CT**	**MRI**	**Lumbar/ Sacral X-ray**		
East					
Frontenac	11–25% above	11–25% lower	11–25% lower		
Hastings	11–25% above	> 25% lower	10% below–10% above		
Lanark	> 25% above	11–25% lower	10% below–10% above		
Leeds-Grenville	11–25% above	11–25% lower	11–25% lower		
Lennox-Addington	11–25% above	11–25% lower	11–25% lower		
Ottawa	> 25% above	11–25% above	11–25% above		
Prescott-Russell	> 25% above	10% below–10% above	11–25% above		
Prince Edward	10% below–10% above	> 25% lower	11–25% lower		
Renfrew	> 25% above	11–25% lower	> 25% above		
Stormont-Dundas-Glengarry	> 25% above	11–25% lower	11–25% above		
Central East					
Durham	11–25% lower	10% below–10% above	10% below–10% above		
Haliburton	> 25% above	10% below–10% above	11–25% lower		
Northumberland	11–25% above	11–25% lower	10% below–10% above		
Peterborough	> 25% above	10% below–10% above	11–25% lower		
Simcoe	> 25% above	11–25% lower	11–25% lower		
Kawartha Lakes	> 25% above	10% below–10% above	11–25% lower		
York	10% below–10% above	11–25% lower	11–25% lower		
Toronto					
Toronto	10% below–10% above	11–25% above	10% below–10% above		
Central West					
Dufferin	> 25% above	11–25% lower	10% below–10% above		
Halton	11–25% lower	10% below–10% above	11–25% lower		
Peel	11–25% lower	10% below–10% above	10% below–10% above		
Waterloo	> 25% lower	> 25% lower	11–25% lower		
Wellington	10% below–10% above	> 25% lower	11–25% lower		
Central South					
Brant	10% below–10% above	10% below–10% above	10% below–10% above		
Haldimand-Norfolk	10% below–10% above	11–25% lower	10% below–10% above		
Hamilton	10% below–10% above	11–25% lower	10% below–10% above		
Niagara	11–25% above	10% below–10% above	10% below–10% above		



Data sources: Ontario Hospital Insurance Plan; Registered Personal Database; Statistics yearly intercensal estimates

This is a broad representation of the variation of spinal CT, MRI and lumbar/sacral X-ray utilization in Ontario. A rate ratio (calculated by the age- and sex-adjusted rate for each county divided by the Ontario rate) compared the county rate to the Ontario rate.

The highest CT utilization was predominantly in the central east part of the province (Peterborough, Kawartha Lakes, Haliburton, Simcoe) and lowest in the north (Kenora, Algoma, Sudbury, Rainy River and Timiskaming). The highest MRI rates were seen in the north with the lowest in the southwestern and rural eastern part of the province (Waterloo, Perth, Huron, Hastings and Prince Edward). The east (Renfrew and Prescott-Russell) and the north (Sudbury and Nipissing) had the highest utilization of X-rays while the lowest utilization occurred in the southwest (Perth, Bruce and Huron).

These regional variations may be attributed to the availability of one diagnostic test over another or to variable access to specialists. Some counties exhibit low or high utilization for all tests shown.

Disease-based Cohort

How the analysis was done

An inception cohort of persons with LBP in Ontario was identified using all OHIP claims with a diagnosis of “lumbar strain, lumbago, coccydynia, sciatica” (OHIP diagnosis code 724) billed between January 1 and December 31, 2000. Only claims billed by family physicians (i.e. non-specialists) were used to identify the inception cohort. The first claim per person during 2000 was identified as the LBP diagnosis date. Persons aged less than 20 at the diagnosis date were excluded.

To create a cohort of people with no previous LBP and no other diseases that would necessitate investigations for the back, all OHIP and hospitalization data in the 5 years prior to each person’s LBP diagnosis date was searched for other previous associated diagnoses and procedures. Persons with a prior diagnosis of LBP in OHIP data were excluded, as were persons with a diagnosis of neoplasm, disorders of the nervous system, arthritis, congenital anomalies, and fractures. Those with prior visits to neurosurgeons or orthopaedic surgeons were excluded, in addition to those with prior CTs, MRIs, EMGs (electromygrams), spinal testing (X-ray or other) or operations on the spine. Appendix D includes a complete listing of all OHIP and hospitalization exclusions. Hospitalization data was taken from the Canadian Institute for Health Information (CIHI) inpatient and same-day surgery databases.

Patient age, sex, and postal code at the time of the LBP diagnosis were determined from the Registered Persons Data Base (RPDB). The District Health Council (DHC) where each person resided was determined by translating the postal code to DHC codes using the Statistics Canada Postal Code conversion files.

Each patient was followed for one year after their LBP diagnosis date to ascertain their utilization of spinal CT, MRI, and lumbar X-ray diagnostic tests, as well as the number of times they visited a back specialist (neurosurgeon, orthopaedic surgeon, neurologist, physical medicine specialist, or rheumatologist). The professional component ofspinal X-ray, CT, and MRI billings to OHIP (excluding claims that were not reimbursed by OHIP) was identified for the cohort within one year after their diagnosis. For MRI utilization, which is billed as a base component plus optional repeat codes (i.e. a different plane or pulse sequence), only the base component was counted. OHIP billings were also used to identify visits to back specialists, using the specialty of the billing physician. Visits on the same day for the same patient to the same specialist were counted as a single visit.

The cost of diagnostic tests was captured using the professional fee reimbursed to physicians by OHIP. For MRI claims, the professional fee of the repeat codes was also captured when there was a repeat code billed on the same day as a base code. Billings for X-rays, unlike CT or MRI claims, sometimes contained the professional and technical fees together. To capture only the professional cost in these situations, the professional cost allowed by OHIP during the same time period was substituted instead of the combined professional plus technical cost. The cost of visits to back specialists was captured as the total amount reimbursed by OHIP to the specialists.

Age- and sex-specific cohort rates were calculated using the age- and sex-specific distribution of the cohort as the denominator for rate calculation. Referral patterns for spinal CT, MRI, and lumbar X-ray were analyzed by identifying the referring physician on the diagnostic test billing in OHIP and linking the physician to the Ontario Physician Human Resources Data Centre (OPHRDC) database to identify the physician specialty. Referral patterns were analyzed according to the geographic area of patient residence (north vs. south).

Geographic variation was calculated using the age- and sex-adjusted rates of CT, MRI and X-ray according to patient District Health Council (DHC) area of residence. Each DHC was ranked according to their adjusted rate. Rates were adjusted to the 2001 Ontario Census population aged 20 and over using the method of direct standardization.

To examine the longitudinal care path for LBP patients the length of follow-up was extended to a two-year period after the LBP diagnosis. The sequence of tests and visits for each patient was established over a two-year period. Only the first type of test or visit was considered in this analysis (i.e. first spinal CT, first MRI, first lumbar X-ray, and first visit to a back specialist). The time (in days) was calculated for each patient between each test/visit and the LBP diagnosis date. The number of days for all patients along the same path was summarized as the median number of days from diagnosis, along with the upper and lower quartile cut-points to assess the variation across patients.

Although the cohort of patients had no prior diagnoses of neoplasms, nervous system disorders, arthritis, congenital anomalies, or fractures, it is possible that some patients were discovered to have these conditions during the follow-up period, accounting for some of the diagnostic test utilization observed. To assess the number of patients for which this could have been the case, OHIP and hospitalization data was examined over a two-year follow-up period from the patient's diagnosis.

Limitations

All the caveats stated for the utilization of CT, MRI and X-rays apply for this analysis. This cohort of patients with LBP is an underestimate of patients with LBP as it was restricted to people with a diagnosis of lumbar strain, lumbago, coccydynia, or sciatica that visited an FP/GP who in turn, billed an OHIP diagnostic code 724. Other OHIP diagnoses related to LBP were also considered during this study (Appendix E). While some diagnoses were associated with a significant percentage of lumbar X-rays (i.e. more than 5%) within one year of follow-up, they include several generalized pain diagnoses that were not specific to the lower back. Persons with intervertebral disc disorders were also associated with a substantial utilization of lumbar/sacral X-rays (19.63%). However, they were excluded because of small numbers performed (2292 people representing only 6% of the lumbar strain cohort). LBP visits made to family physicians that were related to work were not included. The WSIB compensates physician visits for work-related illness or injuries. This data was not available for this report. Finally, as most persons with LBP do not consult a physician, this cohort should not be used as a prevalence estimation of LBP.

Findings and discussion

Exhibit 7. Number and cost of outpatient spinal CT and MRI and lumbar/sacral X-ray one year after diagnosis for a cohort aged 20 and over with incident back problems, in Ontario, 2000

	# of patients (%)		# of tests/services	# of patients with no repeated tests 1 year after diagnosis		Cost of physician services (CDN$)	Cost per patient (CDN$)
CT	1,383	(3.7%)	1,446	1,323	(95.9%)	122,845	88.83
MRI	278	(0.74%)	299	261	(93.9%)	42,890	154.28
Lumbar X-ray	6,546	(17.3%)	6,912	6,207	(94.8%)	61,338	9.37
Back specialist	2,697	(1.84%)	5,298 *	1,482	(54.9%)	300,994	111.60
None of above tests	29,443	(77.88%)	-	-		-	-
Cohort N	37,805		8,657			$528,068	

* Number of visits to specialists where only 1 claim per person per day per physician was counted

Data sources: Ontario Health Insurance Plan; Inpatient/Same-day Surgery Database (Canadian Institute for Health Information); Registered Persons Database

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This exhibit illustrates the number of patients, tests and costs of physician services incurred over a one-year period by patients that visited a general practitioner/family physician (GP/FP) with incident back pain in 2000. Overall, 37,805 patients aged 20 or over were identified as having incident back pain. There were 8362 people who had subsequent radiology tests or back specialist visits in the year after diagnosis of LBP by a GP/FP, costing $528,068 in physician/procedural services in 2000.

In the year after diagnosis, 78% of the cohort had *no* diagnostic tests or specialist visits. In the following two years, 4% of the cohort received spinal CT, 0.7% MRI, 17% a lumbar/sacral X-ray and 2% saw a back specialist. Within six weeks of LBP diagnosis, 12% of the cohort had a lumbar/sacral X-ray. For LBP patients that had a radiological test or a specialist visit, over 90% had only one of the specified radiological tests and 55% had only one specialist visit.

Exhibit 8. Age- and sex-specific rates of spinal CT and MRI and lumbar/sacral X-ray tests and special visits per 100,000 population aged 20 and over in the year following diagnosis of incident back pain in Ontario, 2000

Age group	20-29	30-39	40-49	50-59	60+	All ages
Women						
CT	1,323	2,580	3,973	4,061	2,964	2,761
MRI	319	357	1,063	580	391	530
Lumbar X-ray	11,590	15,415	18,047	21,994	26,230	16,905
Back specialist	4,449	6,061	7,303	9,388	8,725	6,576
None of above services	85,056	80,663	76,665	71,783	68,177	78,579
Men						
CT	2,487	4,426	5,348	5,132	4,710	4,347
MRI	383	1,091	1,092	976	793	893
Lumbar X-ray	13,475	17,235	18,738	19,913	22,558	17,629
Back specialist	5,866	7,670	7,853	8,746	8,775	7,562
None of above services	82,721	77,687	75,970	74,196	71,641	77,346
Both sexes						
CT	1,926	3,652	4,795	4,697	3,890	3,658
MRI	352	783	1,081	815	604	735
Lumbar X-ray	12,566	16,472	18,460	20,759	24,284	17,315
Back specialist	5,183	6,995	7,632	9,007	8,752	7,134
None of above services	83,847	78,935	76,249	73,215	70,013	77,881

N = 37,805

Data sources: Ontario Hospital Insurance Plan; Inpatient/Same-day Surgery Database (Canadian Institute for Health Information); Registered Persons Database

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The CT and MRI rates were higher for men versus women at all age groups (overall 57% and 68% higher, respectively). Lumbar X-ray and specialist visit rates were higher for men under 50 years of age compared with women (4% and 15% higher, respectively). The highest rates for CT and MRI were for patients in their 40s, followed by patients in their 50s. Lumbar X-ray rates were highest for patients over 60 years of age. Men under the age of 50 received more tests than women. Women over 50 years of age were more likely to have a back X-ray, whereas men aged over 50 years were more likely to have an MRI in the one year following their LBP diagnosis.

Exhibit 9. Percent of referring physician specialty by diagnostic test for the spine (MRI, CT, X-ray) one year after diagnosis for a cohort of persons with incident back problems, in Ontario, 2000

Physician specialty	% CT of spine			% MRI of spine			% Lumbar X-ray		
	North	South	Overall	North	South	Overall	North	South	Overall
Diagnostic radiology	*	2.26	2.21	*	*	*	2.49	0.58	0.74
Emergency medicine	*	0.88	0.90	*	*	*	*	0.33	0.36
FP/Emergency medicine	*	1.90	1.87	*	*	*	3.32	1.94	2.08
GP/FP	67.21	75.33	75.03	52.54	28.57	33.11	86.72	88.97	88.67
Neurology	*	2.41	2.28	*	14.29	11.71	*	0.28	0.26
Neurosurgery	9.84	2.41	2.70	22.03	11.34	13.38	*	0.28	0.27
Orthopedic surgery	*	5.99	6.09	*	24.37	21.07	1.66	1.70	1.69
Physical medicine and rehab.	*	3.14	3.25	*	4.62	4.35	*	0.57	0.55
Radiation oncology	*	*	*	*	*	2.01	*	*	0.10
Rheumatology	*	1.02	1.04	*	3.36	2.68	*	0.65	0.61
Total number of referrals	61	1,370	1,446	59	238	299	482	6,344	6,912

Patient residence unknown		
CT	MRI	X-ray
13 (1%)	2 (1%)	83 (1%)

*Unreportable due to small cell sizes

Data sources: Ontario Hospital Insurance Plan; Inpatient/Same-day Surgery Database (Canadian Institute for Health Information); Ontario Physician Human Resource Data Centre Database

The referral patterns for the tests under study for this cohort are shown by physician specialty and by geographic area (northern versus southern areas of Ontario). In many cases in the north region, the number of referrals was extremely small and, therefore, the results were suppressed because of small cell sizes. CT referrals were driven by rates in the south and were primarily made by GP/FPs (75%), followed by orthopaedic surgeons (6%), physical medicine and rehabilitation physicians (3%) and neurologist/neurosurgeons (2% and 3%, respectively). One-third of all referrals for MRI in this cohort came from GP/FPs, with 21% from orthopaedic surgeons, 13% from neurosurgeons and 11% from neurologists. Eighty-nine percent (89%) of lumbar X-rays in the province were ordered by GP/FPs and this was the case in the northern and southern areas of Ontario.

Exhibit 10. Age- and sex-adjusted rates of spinal CT, MRI and lumbar/sacral X-ray and specialist visits per 100,000 population aged 20 and over with incident back pain by, District Health Council, one year after diagnosis in Ontario, 2000

District Health Council	CT			MRI			Lumbar/Sacral X-ray			Back Specialist		
	#	Adjusted Rate	Rank	#	Adjusted Rate	Rank	#	Adjusted Rate	Rank	#	Adjusted Rate	Rank
Algoma-Cochrane-Manitoulin- Sudbury	16	1,242	16	34	2,586	1	190	15,834	16	75	6,683	11
Champlain	189	5,468	2	21	593	10	623	19,142	9	307	9,146	1
Durham-Haliburton-Kawartha-Pine Ridge	89	4,489	6	14	653	8	361	19,649	8	154	8,014	6
Essex-Kent-Lambton	89	3,786	9	10	459	12	430	18,698	10	158	6,766	10
Grand River	27	3,218	11	*		15	160	20,548	4	60	8,531	3
Grey-Bruce-Huron-Perth	55	5,668	1	6	675	7	208	24,195	1	54	6,212	13
Halton-Peel	134	3,090	13	30	607	9	680	17,576	14	280	6,624	12
Hamilton	48	3,400	10	*		15	260	20,152	6	108	8,097	5
Niagara	50	3,811	8	11	716	6	250	20,534	5	114	8,808	2
Northern Shores	31	4,670	4	9	1,513	2	138	23,312	2	45	7,066	8
Northwestern Ontario	11	1,450	15	11	1,413	3	130	18,697	11	36	4,734	16
Simcoe-York	146	4,849	3	19	565		473	17,744	13	218	7,753	7
Southeastern Ontario	67	4,465	7	15	902	4	285	21,055	3	74	4,921	15
Thames Valley	83	4,544	5	10	435	13	357	19,817	7	101	5,405	14
Toronto	276	2,956	14	75	795	5	1,644	17,756	12	761	8,496	4
Waterloo Region-Wellington-Dufferin	59	3,190	12	6	370	14	274	16,321	15	123	6,904	9
Ontario rate	1,383	3,685		278	705		6,546	18,674		2,697	7,480	

Patient residence unknown:

CT	MRI	X-ray	Specialist
13 (1%)	2 (1%)	83 (1%)	29 (1%)

* Unreportable due to small cell sizes

Data sources: Ontario Hospital Insurance Plan; Registered Persons Database; Statistics Canada yearly intercensal estimates

The adjusted rates per 100,000 persons with LBP were ranked from highest rate (1) to lowest rate (16). Algoma-Cochrane-Manitoulin-Sudbury and Northwestern Ontario and Toronto DHC had the lowest utilization of spinal CTs, while the DHCs, and the highest utilization was spread across the province (Grey-Bruce-Huron-Perth, Champlain, and Simcoe-York). The northern part of Ontario had the highest rates of MRI (Algoma-Cochrane-Manitoulin-Sudbury, Northern Shores, and Northwestern Ontario). The lowest rates of MRI were seen in the Hamilton and Grand River DHCs (where the number of MRIs was too low to report) and in Waterloo Region-Wellington-Dufferin DHC. The highest utilization of lumbar X-rays was centred on the western part of Ontario (Grey- Bruce-Huron-Perth, Northern Shores) while DHCs with the lowest adjusted rates were scattered around the province (Algoma-Cochrane-Manitoulin-Sudbury, Waterloo Region-Wellington-Dufferin, Halton-Peel, and Simcoe-York). The highest rates for back specialist visits were in Champlain, Niagara and Grand River DHCs while the lowest rates were in Northwestern Ontario, Southeastern Ontario and Thames Valley DHCs.

Exhibit 11. Geographic variation of services in the year following a visit to a family physician for back pain by a cohort of persons aged 20 and over by health planning region and District Health Council in Ontario, 2000

Percent Difference from Provincial Average**	Adjusted Rate >25% Lower than Provincial Average	Adjusted Rate Between 11% and 25% Below the Provincial Average	Adjusted Rate Between 10% Below and 10% Above the Provincial Rate	Adjusted Rate Between 11% and 25% Above the Provincial Rate	Adjusted Rate More than 25% Above Provincial Average
District Health Council	**CT**	**MRI**	**X-ray**	**Back specialist**	
East					
Champlain	> 1.25	0.75 to 0.89	0.90 to 1.10	1.11 to 1.25	
Southeastern Ontario	1.11 to 1.25	> 1.25	1.11 to 1.25	<0.75	
Central East					
Durham-Haliburton-Kawartha-Pine Ridge	1.11 to 1.25	0.90 to 1.10	0.90 to 1.10	0.90 to 1.10	
Simcoe-York	> 1.25	0.75 to 0.89	0.90 to 1.10	0.90 to 1.10	
Toronto					
Toronto	0.75 to 0.89	1.11 to 1.25	0.90 to 1.10	0.90 to 1.10	
Central West					
Halton-Peel	0.75 to 0.89	0.75 to 0.89	0.90 to 1.10	0.75 to 0.89	
Waterloo Region-Wellington-Dufferin	0.75 to 0.89	<0.75	<0.75	0.90 to 1.10	
Central South					
Grand River	0.75 to 0.89	<0.75	0.90 to 1.10	0.90 to 1.10	
Hamilton	0.90 to 1.10	<0.75	0.90 to 1.10	0.90 to 1.10	
Niagara	0.90 to 1.10	0.90 to 1.10	0.90 to 1.10	1.11 to 1.25	
South West					
Essex-Kent- Lambton	0.90 to 1.10	<0.75	0.90 to 1.10	0.90 to 1.10	
Grey Bruce-Huron-Perth	> 1.25	0.90 to 1.10	> 1.25	0.75 to 0.89	
Thames Valley	1.11 to 1.25	<0.75	0.90 to 1.10	<0.75	
North					
Algoma-Cochrane-Manitoulin-Sudbury	<0.75	> 1.25	<0.75	0.75 to 0.89	
Northern Shores	> 1.25	> 1.25	1.11 to 1.25	0.90 to 1.10	
Northwestern Ontario	<0.75	> 1.25	0.90 to 1.10	<0.75	

**Relative rate ratio=adjusted rate/Ontario rate:

<0.75	0.75 to 0.89	0.90 to 1.10	1.11 to 1.25	> 1.25

Data sources: Ontario Hospital Insurance Plan; Inpatient/Same-day surgery database (Canadian Institute for Health Information); Registered Persons Database

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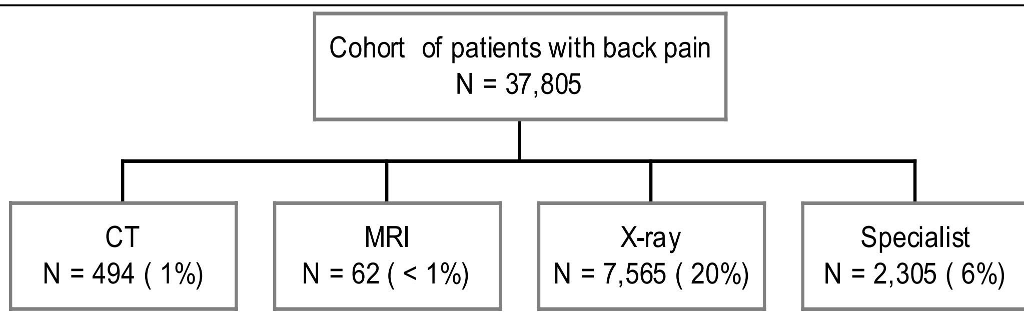
The comparative rate ratio (DHC adjusted rate/provincial rate) shows trends across the planning regions for services provided in the one year following a visit to a family physician for LBP. DHCs in the east (Champlain) and southwest (Grey-Bruce-Huron-Perth) areas of Ontario had adjusted CT scan rates at least 25% above the provincial rates. DHCs in the central east (Simcoe-York) and northern areas (Northern Shores) of Ontario also had rates at least 25% above the provincial average. All northern region DHCs and the Southeastern Ontario DHC had adjusted MRI rates at least 25% higher than the provincial average while the central west and central south DHCs had adjusted MRI rates at least 11% lower than the provincial average. Of note the Hamilton and Essex-Kent-Lambton DHCs had adjusted rates at least 25% lower than the provincial average.

The X-ray rates were less variable than CT or MRI adjusted rates. DHCs from the north (Algoma-Cochrane-Manitoulin-Sudbury) and central west (Waterloo Region-Wellington-Dufferin) had at least 25% lower than average adjusted rates of lumbar X-ray, while areas of the southwest part of the province (except for the London area) had higher than average rates of X-ray. The lower MRI rate found in the Hamilton area was different than that found in other areas with large teaching hospitals, where higher than average rates of MRI were seen. This may be a result of the focus on evidence-based medicine in this region, as MRI is not indicated as first line of investigation. However, caution is required with this interpretation as these rates were not case-adjusted for morbidity.

Exhibits 12 to 16 illustrate diagnostic testing care paths for the study cohort from day of index diagnosis forward two years.

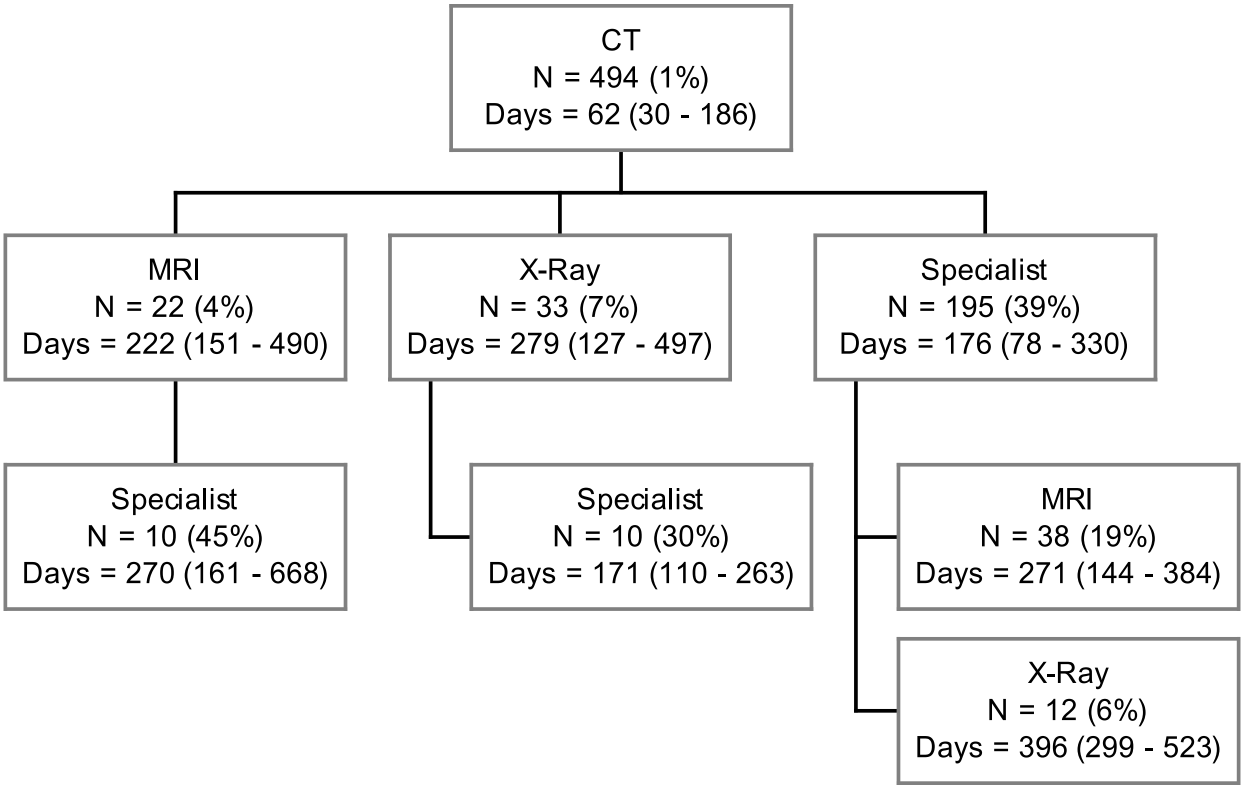
Exhibit 12. Diagnostic testing care path for patients receiving their first test



Data sources: Ontario Health Insurance Plan; Inpatient/Same-day Surgery Database (Canadian Institute for Health Information); Registered Persons Database

This exhibit shows the distribution of first test/visits for the cohort. About 22% of the disease cohort had a radiological test in two years. For 20% of the cohort, X-ray was the first mode of investigation for persons who had additional investigations after their LBP diagnosis. The X-ray was conducted a median of 20 days from the index FP/GP visit. About 6% saw a specialist as their first intervention, a median of 257 days after diagnosis. 1% had a CT scan, a median 62 days afterwards, while less than 1% had an MRI as their first investigation, a median 159 days after the initial visit.

Exhibit 13. Diagnostic testing care path of patients receiving CT as first test



Data sources: Ontario Health Insurance Plan; Inpatient/Same-day Surgery Database (Canadian Institute for Health Information); Registered Persons Database

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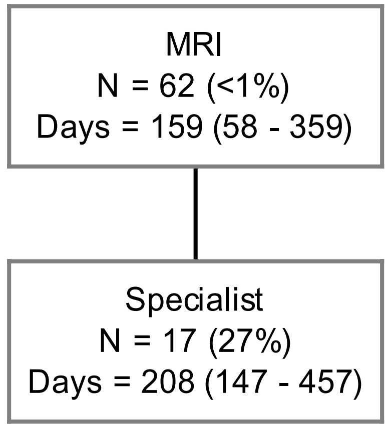
This exhibit describes the care path for the 494 persons (1% of cohort) who received a CT as their first test. For patients who had a CT scan as their first investigation, 50% went on to have another investigation or specialist visit (39% saw a specialist, 7% had a lumbar X-ray and 4% had an MRI).

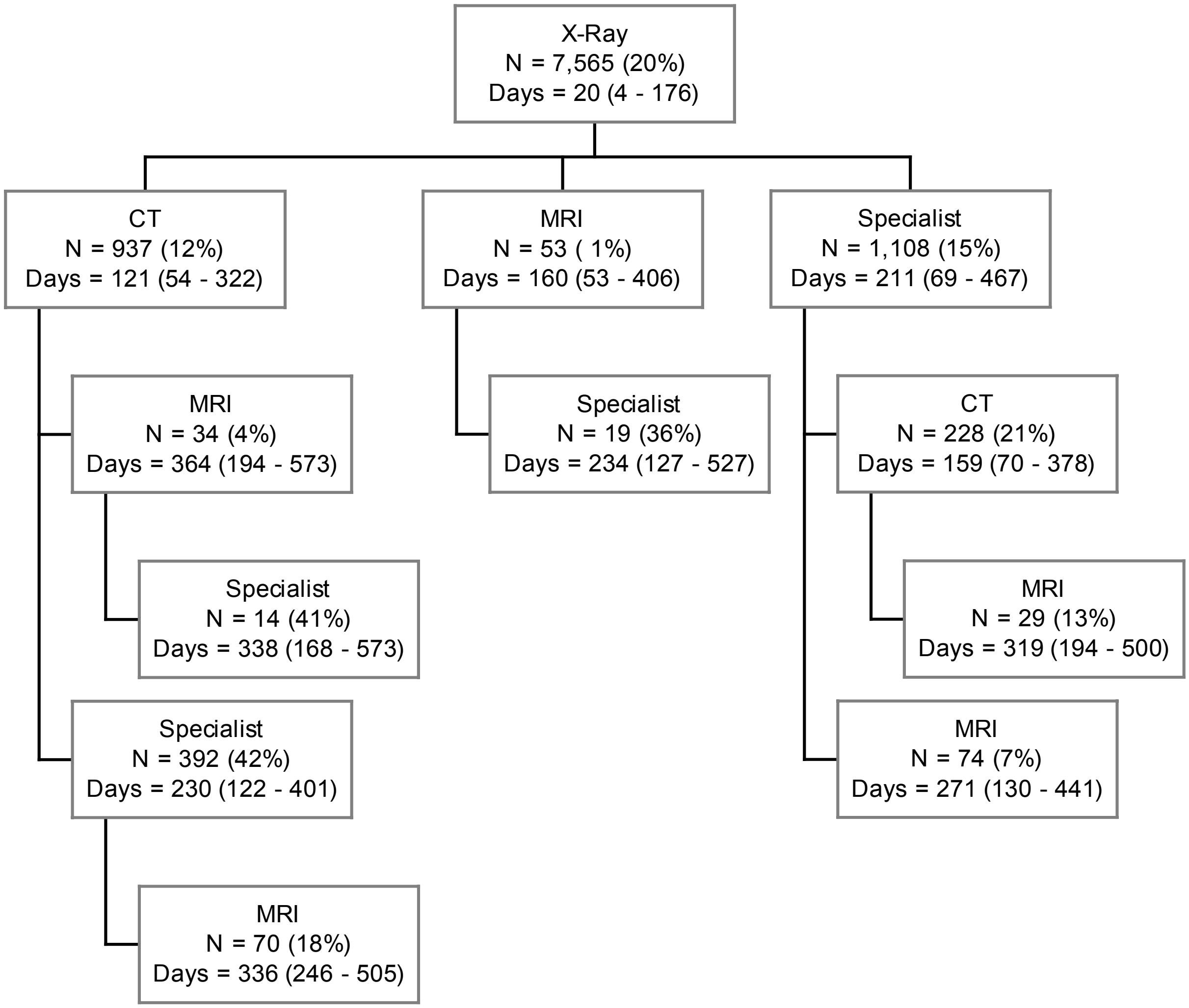
Exhibit 14. Diagnostic testing care path for patients receiving MRI as first test



Data sources: Ontario Health Insurance Plan; Inpatient/Same-day Surgery Database (Canadian Institute for Health Information); Registered Persons Database

This exhibit shows the care path for the 62 persons (<1% of cohort) who received a MRI as their first test. 27% of patients who had an MRI as their first test saw a specialist after this test. For patients who saw a specialist first, only 12% had a radiological investigation after this visit.

Exhibit 15. Diagnostic testing care path for patients receiving X-ray as their first test



Data sources: Ontario Health Insurance Plan; Inpatient/Same-day Surgery Database (Canadian Insititute for Health Informaton); Registered Persons Database

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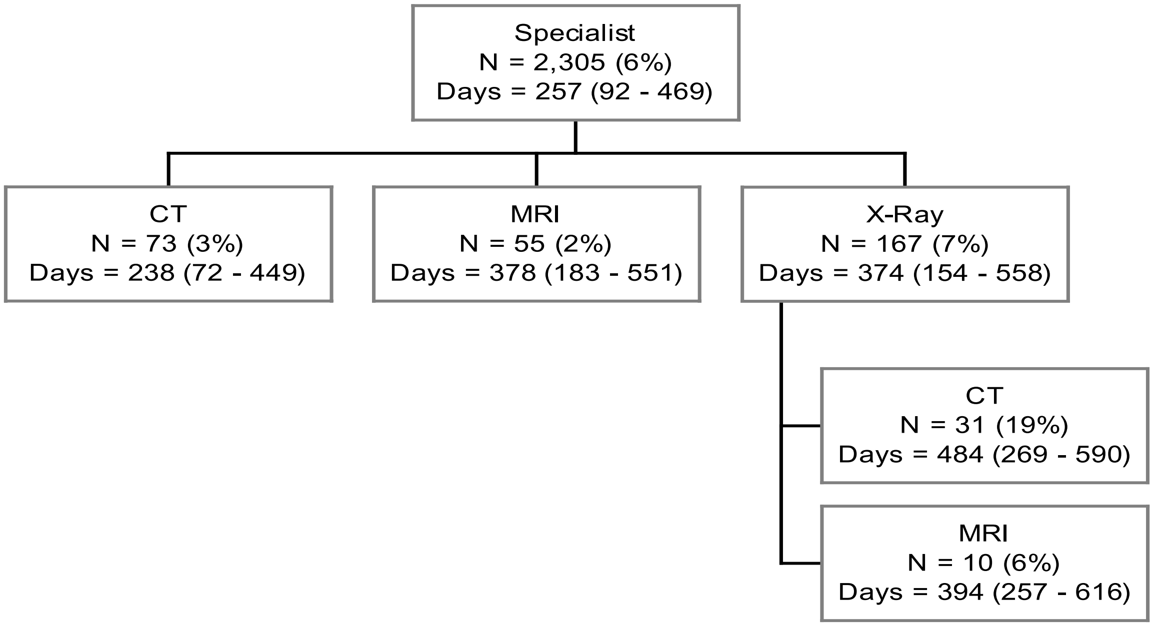
This exhibit illustrates the care path for the 7565 persons (20% of cohort) who received an X-ray as their first test. Most persons who had an X-ray (72%) had no other interventions/visits subsequently.

Exhibit 16. Diagnostic testing care path for patients seeing a specialist prior to any test



Data sources: Ontario Health Insurance Plan; Inpatient/Same-day Surgery Database (Canadian Institute for Health Information); Registered Persons Database

ICES Institute for Clinical Evaluative Sciences

This exhibit shows the care path for the 2305 persons (6% of cohort) who saw a specialist prior to receiving any test. Included with all these exhibits is the median number of days (quartile range) from date of diagnosis (index GP/FP visit) to their test/specialist visit date.

When patients that presented with LBP were followed for 2 years, medical conditions that were subsequently diagnosed included arthritis (6.5% of the cohort), malignant neoplasms (3.8%), nervous system problems (1.8%) and fractures (0.95%) (data not presented). However, more than 80% of the cohort had no significant medical condition diagnosed 2 years after their initial visit for LBP.

Conclusions and Recommendations

Over ten years (1992 to 2001), the rate of CT scan and MRI use for LBP increased, along with a substantial increase in costs. The use of plain X-ray of the lumbar spine did not demonstrate any increase in utilization over the ten-year period. The vast majority of patients who went to a family doctor for lumbar back pain (78%) did not undergo subsequent radiological investigations (X-ray, CT scan or MRI) or specialist visits. For patients who did have further investigations, X-rays were the most common investigation performed, followed by CT scans, specialist visits and MRI scans. The median times for an X-ray, CT scan, MRI or back specialist visit, after the first visit for acute low back pain were 20, 62, 159 and 257 days, respectively. Most patients had no further investigation or specialist visits within two years after any initial investigation or specialist visit. For LBP, general practitioners and family physicians in Ontario ordered most tests, with regional variations in the type of diagnostic technology used.

Because the Ontario GAC guidelines were released in 2000, it was not possible to measure their influence on the use of radiography for the investigation of LBP in Ontario in this report. However, other guidelines were available throughout the 1990s, and they may have influenced the practice of Ontario physicians, contributing to the low rate of radiological investigation for acute LBP.

Currently there are plans to introduce new CT scan and MRI machines in Ontario that would increase the accessibility of these technologies. Given the increased utilization of spinal CT and MRI technology, the effect of improving accessibility should be re-examined for LBP in two to three years. To facilitate any further evaluation for LBP, the CT scan and MRI diagnostic codes should differentiate cervical, thoracic, lumbar and sacral spine anatomic locations as is the case currently for lumbar X-rays. Further work on the non-surgical management (medications, chiropractic manipulation and physiotherapy) of LBP might be considered.

Appendix A. Guidelines reviewed

A1. Agency for Health Care Policy and Research, Public Health Service, U.S. department of Health and Human Services. Acute LBP problems in adults. Clinical Practice Guideline #14. 1994. (**visual algorithms included)**

A2. American College of Radiology. ACR Appropriateness Criteria: Acute LBP – radiculopathy. http://www.acr.org/cgi-bin/fr?tmpl:appcrit,pdf:0479-486_low_back_pain-ac.pdf . 1998. (**table of appropriateness rating included)**

A3. Atlas SJ, Deyo RA. Evaluating and managing acute LBP in the primary care setting. *Journal of Gen Intern Med* 2001; vol 16: 120-31. (**telephone triage algorithm included)**

A4. Bratton RL. Assessment and management of acute LBP. *American Family Physician* 1999; vol 60:2299-308.

A5. Department of Veterans Affairs (U.S.) LBP or sciatica in the primary care setting. May 1999. **(visual algorithm included)**

A6. Goh RH. Magnetic resonance imaging: application to family practice. *Canadian Family Physician* 1999; vol 45: 2118-32.

A7. Health Canada – First Nations and Inuit Health Branch. Clinical practice guidelines for primary care nurse – chapter 7: Musculoskeletal System. http://www.hc-sc.gc.ca/fnihb-dgspni/fnihb/ons/nursing/resources/clinical_guidelines/chapter_7.htm June 2000.

A8. Humphreys SC, Eck JC, Hodges SD. Neuroimaging in LBP. *American Family Physician* 2002; vol 65(11): 2299 – 306. (**visual algorithm included)**

A9. Institute for Clinical Systems Improvement. Health Care Guideline: Adult LBP. http://www.icsi.org/guide/LBP.pdf . 2001. **(visual algorithm included)**

A10. Patel AT, Ogle AA. Diagnosis and management of acute LBP. *American Family Physician* 2000; vol 61: 1779-90.

A11. Rose-Innes AP, Engstrom JW. LBP: An algorithmic approach to diagnosis and management. *Geriatrics* 1998; vol 53(10): 26-45. **(visual algorithm included)**

A12. Royal College of General Practitioners. Clinical Guidelines, Acute LBP. http://www.rcgp.org.uk/rcgp/clinspec/guidelines/backpain/index.asp . December 2001. **(visual algorithm included)**

A13. Washington State Department of Labor and Industries. Criteria for MRI of the lumbar spine. 1999.

Appendix B. Guidelines Advisory Committee: Summary of recommended guidelines for acute low back pain

www.gacguidelines.ca/article.pl

Appendix C. Inclusion criteria—Spinal X-ray, CT scan and MRI in Ontario

X-ray of spine fee codes

- X025, X202, X203, X027, X204, X028, X205, X206, X032, X033, X031, X034, X207

CT of spine fee codes

- X415, X416, X128

MRI of spine fee codes

- X490 – Limited spine, one segment, multislice sequence
- X492 – Limited spine, multislice, repeat
- X493 – Intermediate spine, multislice sequence
- X495 – Intermediate spine, repeat
- X496 – Complex spine, multislice
- X498 – Complex spine, repeat

Appendix D. Exclusions for disease cohort

OHIP exclusions in 5 years prior to index

• Neoplasms	dxcode 140-239
• Nervous system	dxcode: 320-330, 333-344, 348-349, 353-359
• All arthritis	dxcode: 714, 715, 716, 730
• Congenital anomalies	dxcode: 741-759
• Fractures	dxcode: 805, 806, 829
• All fee codes for neurosurgery visits	(See OHIP fee schedule July 1, 2000 -- A23)
• Neurosurgery visits	spec='04'
• All fee codes for orthopaedic surgery visits	(See OHIP fee schedule July 1, 2000 -- A26-27)
• Orthopaedic surgery visits	spec='06'
• X-ray of spine fee codes	X025, X202, X203, X027, X204, X028, X205, X206, X032, X033, X031, X034, X207
• CT fee code	X415, X416, X128
• Other tests on spine fee code	X057, X058, X080, X081X164, J006, J030 X173, J011, J038, J020, Z454, G368, G386
• MRI fee code	X490, X492, X493, X495, X496, X498
• EMG fee code	G455, G456, G459, G466, G457, G469, G458, G465, G467
• Operations of the spine	(See OHIP fee schedule July 1, 2000 – N18-20, X5-7)

CIHI exclusions in 5 years prior to index

(Any CIHI/SDS ICD-9 codes, specify inpatient and outpatient)

1.	324.1	Intraspinal abscess
2.	334.8	Other spinocerebellar diseases
3.	334.9	Unspecified spinocerebellar disease
4.	335, 336	Diseases of the spinal cord
5.	340	MS
6.	342, 344	Other diseases of central nervous system pertaining to spine
7.	349	Reaction to spinal or lumbar puncture
8.	349.81	Cerebrospinal fluid rhinorrhea
9.	350-359	Disorders of peripheral nervous system
10.	720-724	Dorsopathies
11.	737	Curvature of spine
12.	738.5	Other acquired deformity of back or spine
13.	739.3	Lubosacral region nonallopathic lesions
14.	710-739	Diseases of the musculoskeletal system and connective tissue
15.	740-742	Congenital anomalies
16.	754.2	Congenital musculoskeletal deformities of spine
17.	805	Fracture of vertebral column without spinal cord injury
18.	806	Fracture of vertebral column with spinal cord injury
19.	839	Other, multiple and ill-defined dislocations
20.	847	Sprains, strains and other and unspecified parts of back
21.	950 to 957	Injury to nerves and spinal cord

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