

Diagnostic Imaging and the SPINE

A Surgeon's Perspective



THE W. GARFIELD WESTON
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Objectives

- LBP
- Diagnostic Utilization
- Problem
- Cost
- Possible Solutions

Overview

- LBP = common complaint
 - Most benign / High frequency of recurrence
- Clinical practice guidelines (CPGs)
 - Numerous / Helpful
 - Numerous limitations
 - often not practical
 - do not consider patient preference
 - do not consider real world implementation challenges
- Imaging Recommendations
 - LBP – > 6 weeks (ACR and CAR)

Investigations

- 45 yo male with 2 years of recurrent back dominant pain
 - No neurologic or leg symptoms or signs
 - X-ray shows some mild degeneration
 - Both patient and PCP are frustrated
 - MRI

Investigations

- 45 yo male LBP
 - Diffuse degenerative disc disease
 - L5-S1 herniated disc impinging on the S1 nerve root
- Diagnosis?
- Now what?

Multiple imaging sequences were obtained through the lumbar spine without the use of contrast.

There are 5 lumbar-type vertebrae. The conus ends appropriately at the L1 level. A tiny focus of low signal intensity is noted within the L2 vertebral body on both T1 and T2-weighted images. In the absence of malignancy, this likely is a small bone island. vertebral body height is well maintained. A small hemangioma is noted in the T11 and T12 vertebral bodies.

The L1-L2, L2-L3 and L3-L4 levels demonstrate degenerative disc disease.

The L4-L5 level demonstrates degenerative disc disease. There is a small annular tear in a right paracentral location.

The L5-S1 level demonstrates degenerative disc disease. There is a mild broad-based disc bulge. There is a small left paracentral herniated disc which is impinging on the left S1 nerve root. ←

IMPRESSION:

1. Degenerative disc disease throughout the lumbar spine.
2. Small annular tear in a right paracentral location at the L4-L5 level.



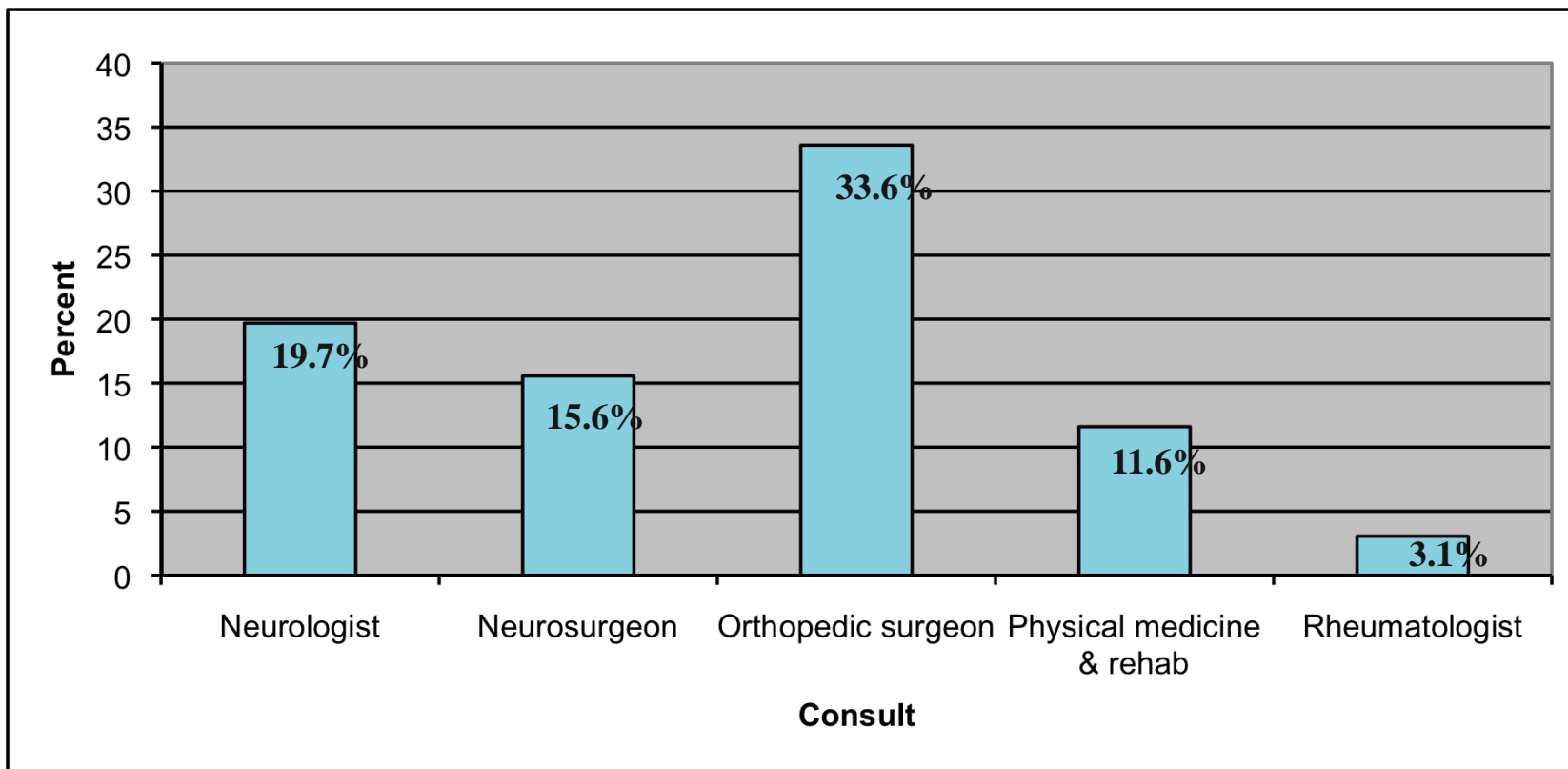
Healthcare Utilization Following Lumbar Spine MRI Ordered By Primary Care Physicians



You JJ, Symons S, Bederman S,
Rampersaud R.

Specialist Referral

Incidence of specialist referral during a maximum 3 years follow-up was:



Imaging

- Increased utilization of spine MRI
 - 600% increase in Ontario
- Reasons for ordering
 - Aid in diagnosis
 - Patient request
 - Specialist referral (esp. surgical)
 - Medicolegal

Laupacis, A, R. Przybysz and M.A. Keller. 2005. "CT and MRI Scanning." In: J.V. Tu, S.P. Pinfold, P. McColgan and A. Laupacis, eds., Access to Health Services in Ontario: ICES Atlas. Toronto, ON: Institute for Clinical Evaluative Sciences.

You, J.J., I. Purdy, D.M. Rothwell, R. Przybysz, J. Fang and A. Laupacis. 2008. "Indications for and Results of Outpatient Computed Tomography and Magnetic Resonance Imaging in Ontario." Canadian Association of Radiologists Journal 59(3): 135-43.

You, J.J., W. Levinson and A. Laupacis. 2009. "Attitudes of Family Physicians, Specialists and Radiologist about the Use of Computed Tomography and Magnetic Resonance Imaging in Ontario." Healthcare Policy 12(1): 54-65.

Indications For and Results of Outpatient Computed Tomography and Magnetic Resonance Imaging in Ontario

CARJ Vol 59, No 3, June 2008

John J You, MD, MSc; Ian Purdy, BA, BScN; Deanna M Rothwell, MSc;
Raymond Przybysz, MSc; Jiming Fang, PhD; Andreas Laupacis, MD, MSc

- 90% of MRIs for LBP are abnormal
- < 2% of CTs for Headache are abnormal
- Value of a negative test is nearly non-existent for LBP

2% of CT scans of the brain for headache found abnormalities that could explain the headache, while over 90% of MRI scans of the spine for back pain were abnormal, although the clinical importance of the abnormalities was unclear.

MRI and the Lumbar Spine

- Modality of choice in evaluation of most spinal disorders.
 - Incidental “abnormal” findings common within asymptomatic individuals.
 - 57-80% abnormalities for those over the age of 60
 - Poor correlation with patient symptoms, therapeutic decision-making and patient outcome.

Modic & Ross. Radiology. 2007; 245(1): 43-61.

Boden et al. JBJS. 1990; 72(3): 403-8.

Beattie et al, Spine 2000; 25(7): 81-28.

MRI and Spine

- Descriptive MRI reports are often “concerning”
 - “large disc herniation”
 - “indentation of the cauda equina”
 - “effacement of the spinal cord”
 - “severe diffuse degenerative disc”...etc

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- Descriptive MRI reports are often “concerning”
 - “large disc herniation”
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 - “effacement of the spinal cord”
 - “severe diffuse degenerative disc”...etc
- Clinically insignificant abnormalities
- “Certificate of disability”

Investigations

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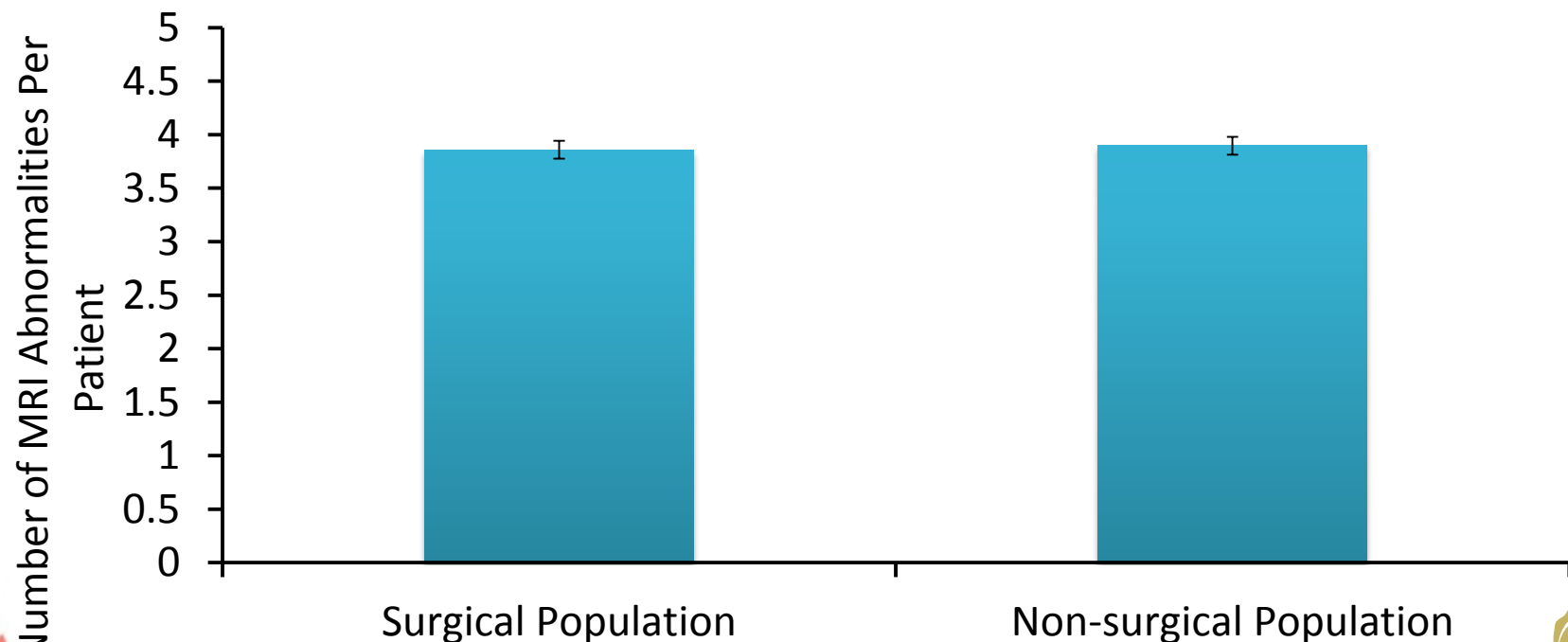
1. Degenerative disc disease throughout the lumbar spine.
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Relationship between spinal magnetic resonance imaging findings and candidacy for spinal surgery

Frederick Cheng John You MD FRCPC Y. Raja Rampersaud MD FRCSC

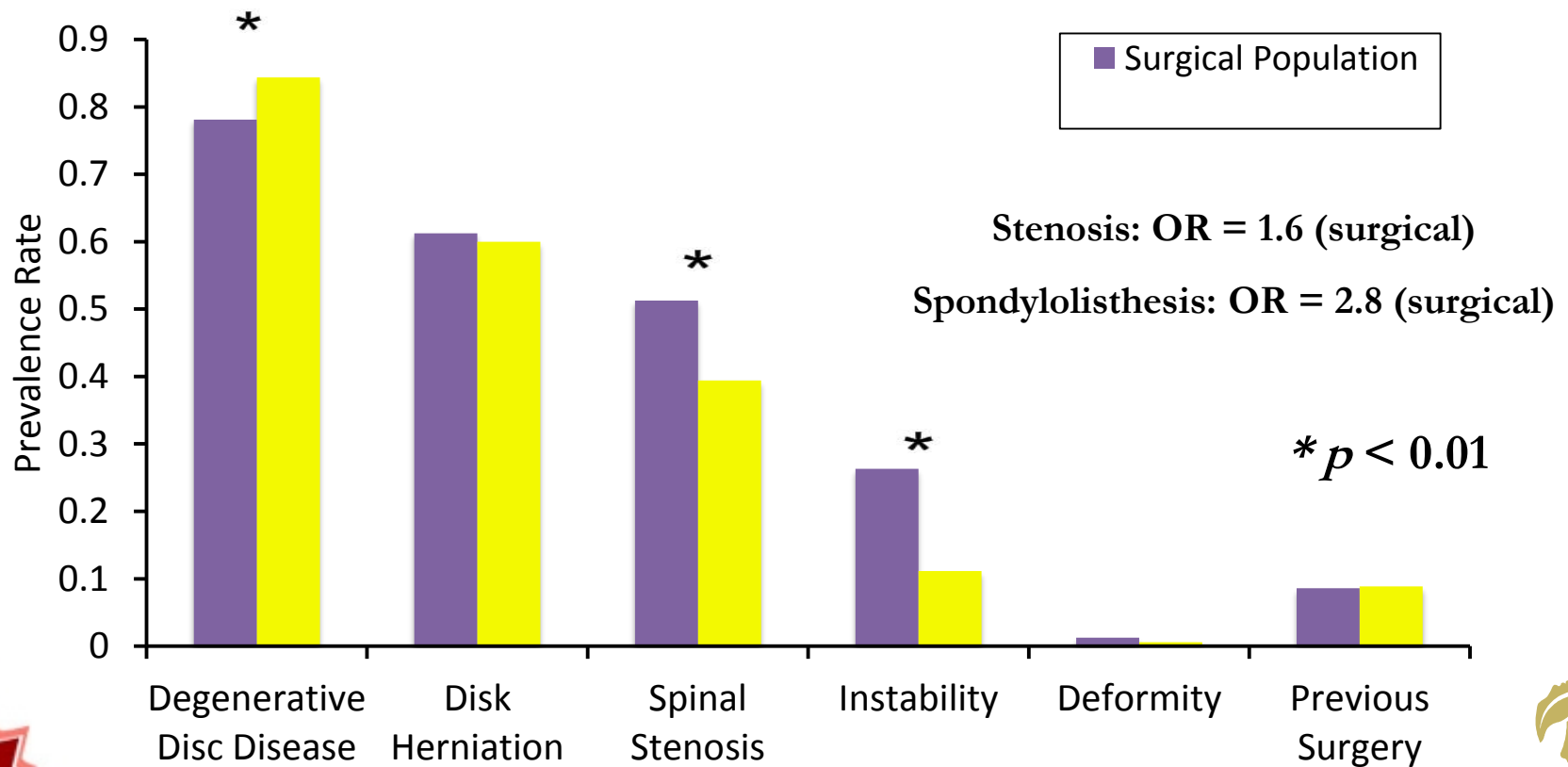
Can Fam Physician 2010;56:e323-30

Figure 1. A comparison of the total amount of intervertebral disk abnormalities on MRI between the surgical & non-surgical populations.



Type of Abnormalities

Figure 2. The prevalence rate for different types of structural abnormalities present on MRI for surgical and non-surgical individuals.

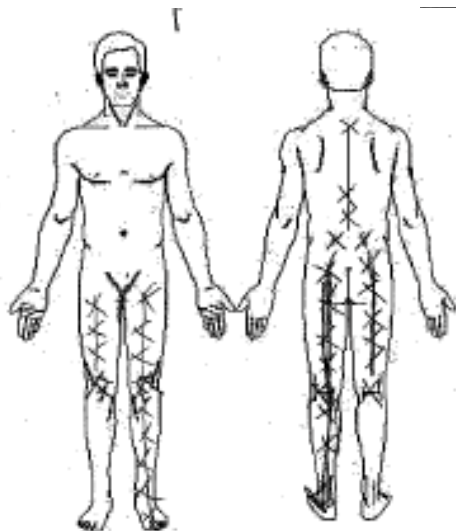




MRI \neq Symptom Correlation



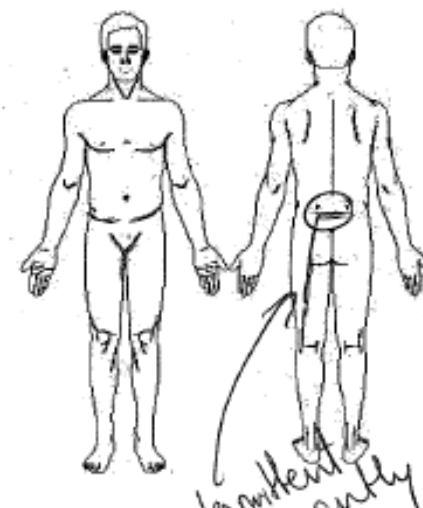
Asymptomatic



Diffuse - Severe



Focal - Mild

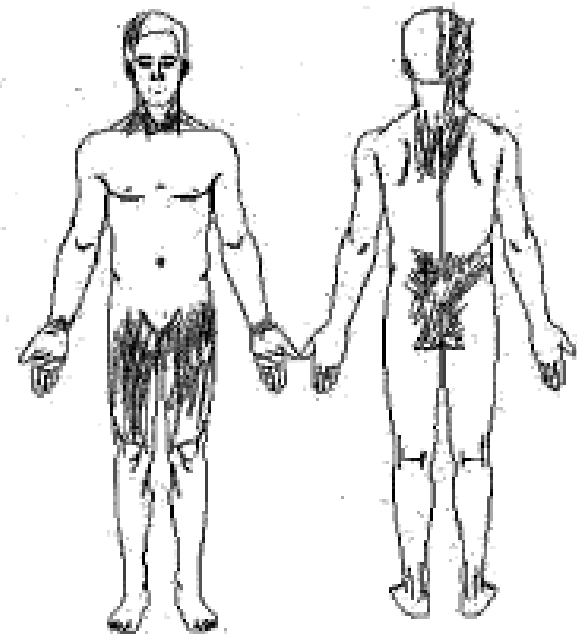


LBP Case

- 45 yo male with 2 years of recurrent back dominant pain
 - No neurologic or leg symptoms or signs
 - X-ray shows some mild degeneration
 - Both patient and PCP are frustrated
 - MRI
 - Diffuse degenerative disc disease
 - L5-S1 herniated disc impinging on the S1 nerve root

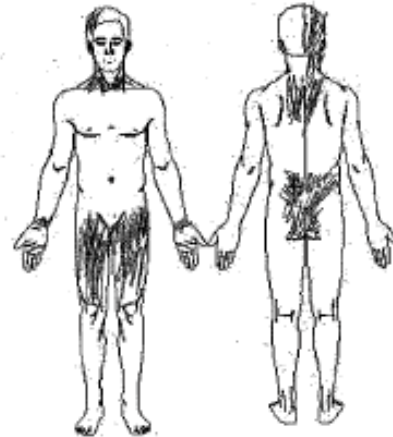
Wrong Care at the Wrong Time

- Surgical referral stream
 - 6-12+ mths wait (if agree to see)
 - No change or worsening symptoms



Wrong Care at the Wrong Time

- Non-surgical, “I can’t help you”
 - Advice given by some
 - Surgeons typically unwilling or unable to do non-op care
 - Referral back to PCP/ PMR/Pain etc
 - Challenging problem with limited resource
- We have to do better for our patients!



Univ
Tor

Primary Care Barriers

- Understanding Primary Care Physicians' Challenges, Barriers and Priorities in Caring for Patients with Low Back Pain.
 - Alleyne J, Harvey B, Meuser J, Rampersaud R.
- Systematic Review, small focus group and a survey of family physicians (n=325) across Ontario

What do patients want?

- Imaging test
- Funded physiotherapy
- Note for work activity restrictions

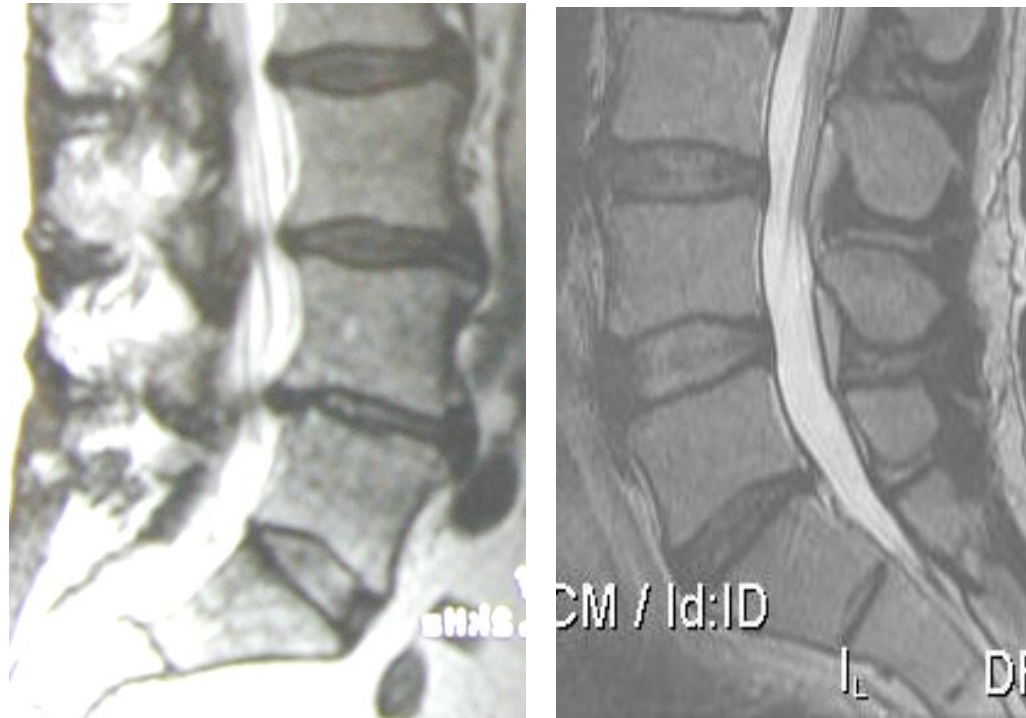


PCP perspective

- Barriers
 - lack of comfort in dealing with complex or recurrent LBP
 - occupational issues
 - lack of patient-friendly key messages
 - lack of easy to use education and assessment tools
 - pain management

PCP perspective

- Education needs regarding the timing and clinical interpretation of imaging reports



Reported reason for specialist referral

- Spine / Neurosurgeon
 - compression of neurologic structures reported on imaging
 - constant leg pain and/or altered sensation
 - patient request for a second opinion.



Proposal for the Development of a Provincial Program to increase access to elective spine care in Ontario

- Submitted by: Ontario Spine Surgeons
- Proposal Written by:
 - Ontario Orthopaedic Expert Panel
 - Add Hoc Multidisciplinary Team
 - Canadian Spine Society
- 14 Centers with annual budget of \$3.2m

Ministry Proposal

- Triage Centers
 - Upstream
 - Shared care with PCP
 - Patient Centered Care
 - CPGs / Best Practices
 - Imaging criteria
 - Education, Education, Education

www.BackCareCanada.ca

BackCareCanada.ca

BackCareCanada.ca was developed by health professionals to provide reliable information & advice based on the latest research & expert opinion.

The goal is to help you better manage your symptoms and to make more informed decisions about seeking treatment.



Cost

- Wait – Times
 - QOL
 - Loss productivity
 - Chronic Disease
 - Human Health Care Resources
- \$\$\$\$

Cost-Effectiveness Analysis of a Reduction in Diagnostic Imaging in Degenerative Spinal Disorders

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Stacey Brener, B.Sc.

Peter C. Coyte, Ph.D.

Y. Raja Rampersaud, M.D.

Study Objectives

- Reduce unnecessary use of imaging thereby improving its efficiency
- Determine cost implications of eliminating umbrella use of CT/MRI from a health care perspective

Data on 2,046 Patients

Condition	Diagnosis	# Patients	# Surgical	# Non-surgical
Lumbar disc herniation/sciatica/radiculopathy	MRI	623	486	137
Lumbar spinal stenosis/claudication	MRI	228	196	32
Degenerative spondylolisthesis	X-ray	87	80	7
Isthmic spondylolisthesis	X-ray	103	91	12
Cervical radiculopathy/herniated nucleus pulposus	MRI	139	86	53
Cervical myelopathy/stenosis	MRI	26	21	5
Axial back pain/DDD*/stenosis/facet osteoarthritis	CA*	470	114	356
Axial neck pain/DDD*/spondylosis	CA*	58	5	53
Coronal deformity/scoliosis	X-ray	50	22	28
Sagittal deformity/kyphosis	X-ray	19	13	6
Tumour/infection	MRI	18	11	7
Inflammatory/rheumatoid arthritis/ankylosing spondylitis	MRI	11	7	4
Myofascial/multifactorial/chronic/regional pain syndrome	CA*	134	5	129
Miscellaneous	MRI	80	24	56
Total	NA	2,046	1,162	884

*CA, clinical assessment.

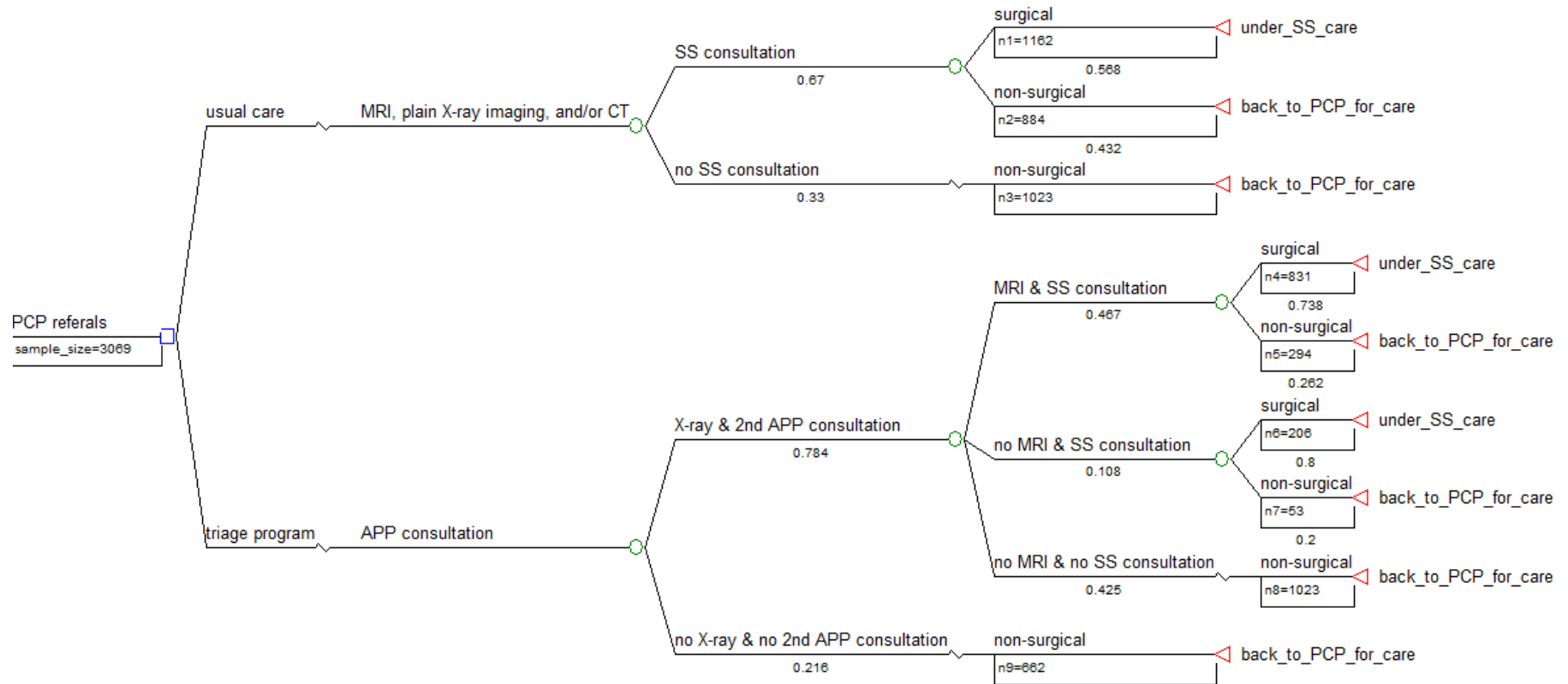
University Health Network
Toronto Western Spine



Study Design

- **Usual care** (some CT/all MRI)
vs. triage program (no CT/some MRI)
- **Outcome:**
number of surgical candidates identified
MRIs used for diagnosis
- **Incremental cost components:**
CTs, MRIs, X-rays, and consultations
- **Cost-effectiveness analysis:**
Use of natural units and resource utilization

Decision Tree



PCP, primary care provider; SS, spine surgeon; APP, advance practice physiotherapist

Outcome and Cost Analyses

	# Surgical candidates	# Diagnostic MRIs	Outcome (surgical candidates/MRI)
Usual Care	1,162	3,069	0.379
Triage Program	1,038	1,228	0.845
Difference	124	1,841	0.466

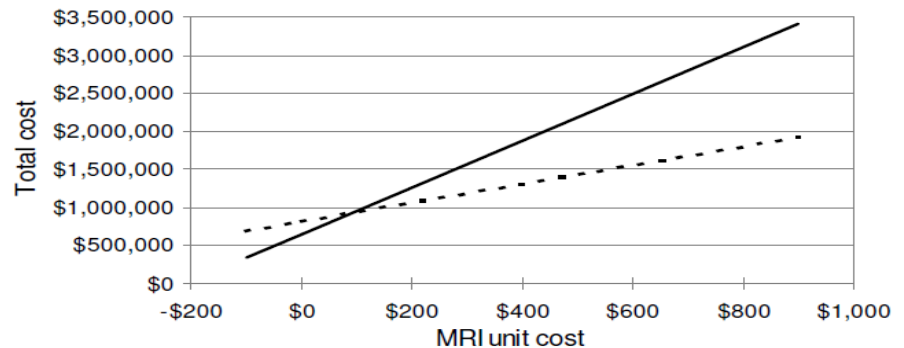
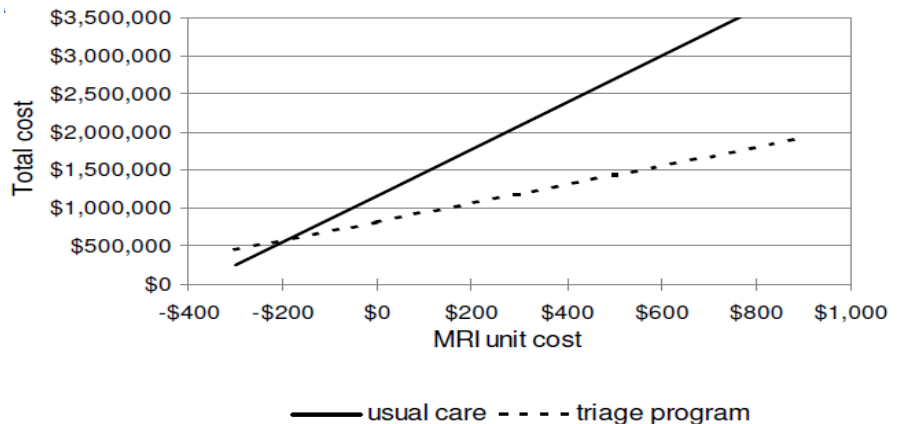
	Savings				Costs	
	CTs	MRIs	SS Consult	Post Care	X-rays	APP Consult
Quantities	869	1,841	662	N/A	1,914	5,576
Prices (2009 CAD)*	\$532	\$899	\$76.30	N/A	\$91.58	\$31.87
Costs (Q x P)	\$462,308	\$1,655,059	\$50,511	\$216,021	\$126,747	\$177,707
Cost Difference	\$2,007,977 in savings for study duration of 31 months					

Triage program is more effective and cheaper.

It is **dominating**.

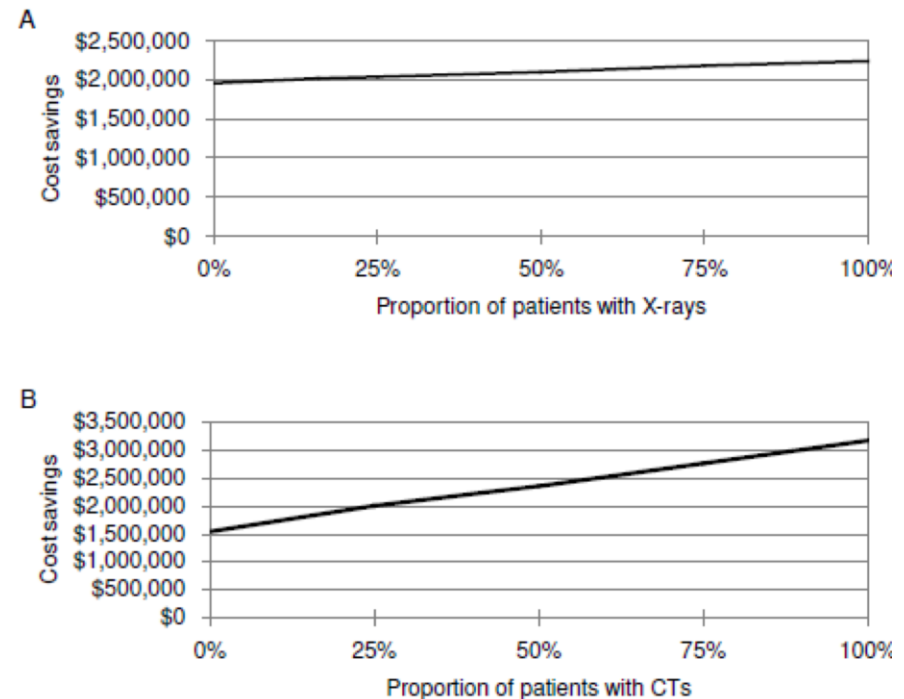
Sensitivity Analyses (1)

- Varying Unit Cost
- If no x-ray/CT
 - MRI < \$84



Sensitivity Analyses (2)

- Triage model always resulted in cost savings
 - Assessor (PCP, Surgeon)
 - X-ray / CT (0-100%)



Provincial Implications

# Spine Surgeries per Year	# Surgeons	# Orthopaedic Surgeons	# Neurosurgeons
25-49	11	6	5
50-74	12	7	5
75-99	8	4	4
>100	31	17	14

Triage program would save Ontario
\$24,234,929 per year

Implications

- **Improved efficiency of MRI use**
 - MRI reallocation and wait times reduction
- **Resource reallocation of cost savings**
 - Education programs
 - For both PCPs & patients
 - Human resources
 - Training and hiring new personnel
 - Establishment of back pain centres
 - Multidisciplinary teams
 - Diagnose, treat, and educate



Limitations

- **Generalizability**
 - Data collected from one clinician's practice
- **Costing assumptions**
 - Macro-costing
 - Ontario Cost Casing Initiative self-reported data
- **Lay belief in MRI**
 - Patient pressure for MRI and consultations

Conclusions

- The proposed triage program improves efficiency of imaging usage
- The proposed triage program generates savings to the provincial health care system
- Future directions:
 - Provincial data and extrapolation
 - Referred
 - Bigger group who only see PCP
 - Knowledge translation to clinical practice should involve all stakeholders.