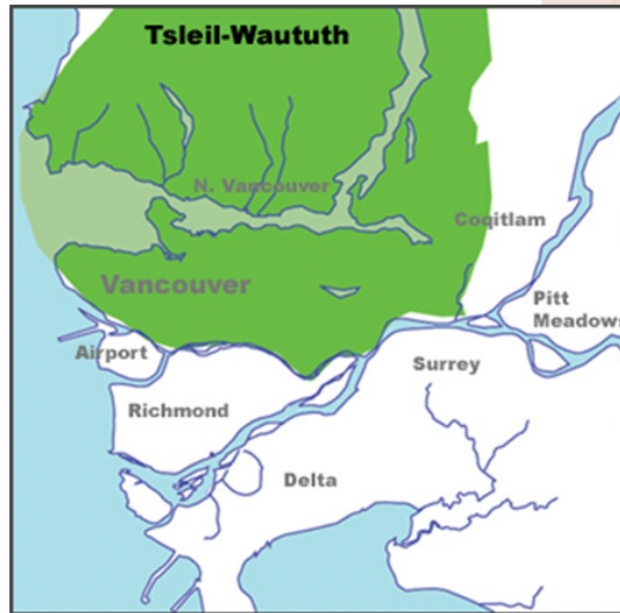
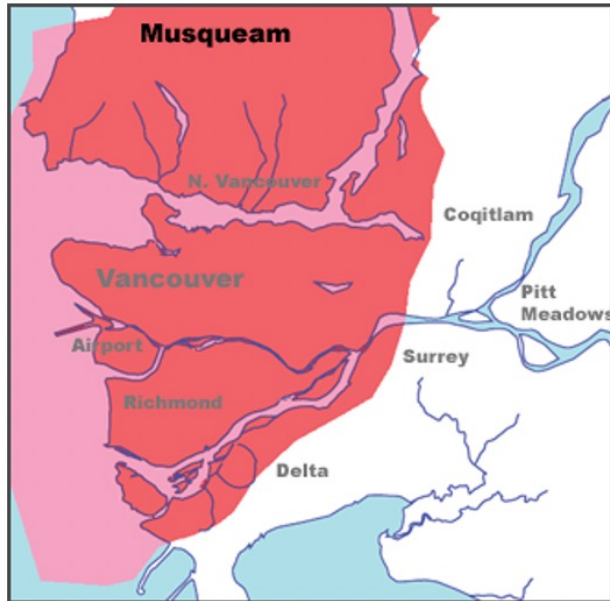


We would like to acknowledge that we are gathered today on the traditional territories of the Musqueam, Squamish and Tsleil-Waututh peoples.

Source: www.johomaps.net/na/canada/bc/vancouver/firstnations/firstnations.html



Appropriateness in Medical Imaging: *Choosing the “right” test for commonly encountered clinical scenarios!*

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Regional Department Head Medical Imaging VCH & PHC,
Abdominal Imaging, Department of Radiology, Vancouver
General Hospital, Vancouver

No
Disclosures



Learning Objectives



Discuss appropriateness and choosing the “right” test for commonly encountered clinical presentations



Review the existing Medical Imaging resources intended to guide referring practitioners



Examine system challenges and potential solutions



Address how health inequities may impact patient access to Medical Imaging

Definitions

- **Medical Imaging Appropriateness:**

“Medical imaging exams are deemed appropriate when health benefits exceed any potential negative consequences or adverse effects.”



k.com - 2047569593

- **Inappropriate Medical Imaging:**

“An imaging test that does not meet the clinical indication criteria, or one that is repeated in an unjustified short period of time.”³

What constitutes an “appropriate” test?

- Applied to investigations such as CT and MRI
- Evidence-based guidelines developed to support clinical decision-making
- Promote the most appropriate diagnostic imaging procedure to ensure patients receive right test at the right time
- As per Canadian Association of Radiologists Imaging Referral Guidelines (2012, in revision)



Canadian Association of Radiologists
L'Association canadienne des radiologistes

Inappropriate testing - what are the consequences?

Canadian studies suggest that 2%-24% of advanced imaging studies may be inappropriate

The degree varies greatly based on the jurisdiction, modality and referring group

May be a response to patient expectation or while awaiting a more appropriate test

- Waitlists for *needed* imaging increase
- Further testing may be required for incidental findings
- False positives can result in harm
- Unnecessary radiation exposure may occur
- Increased congestion in ER departments whilst waiting for testing

Eddy, Kathleen, et al. Appropriate use of CT and MRI in British Columbia.

BC Medical Journal. 2013 February; 55:22-25.

Fraser, James; Reed, Martin. Appropriateness of Imaging in Canada.

Canadian Association of Radiologists Journal. 2013 May; 64(2):82-4.

Why we should do better!

Patient/caregiver factors:

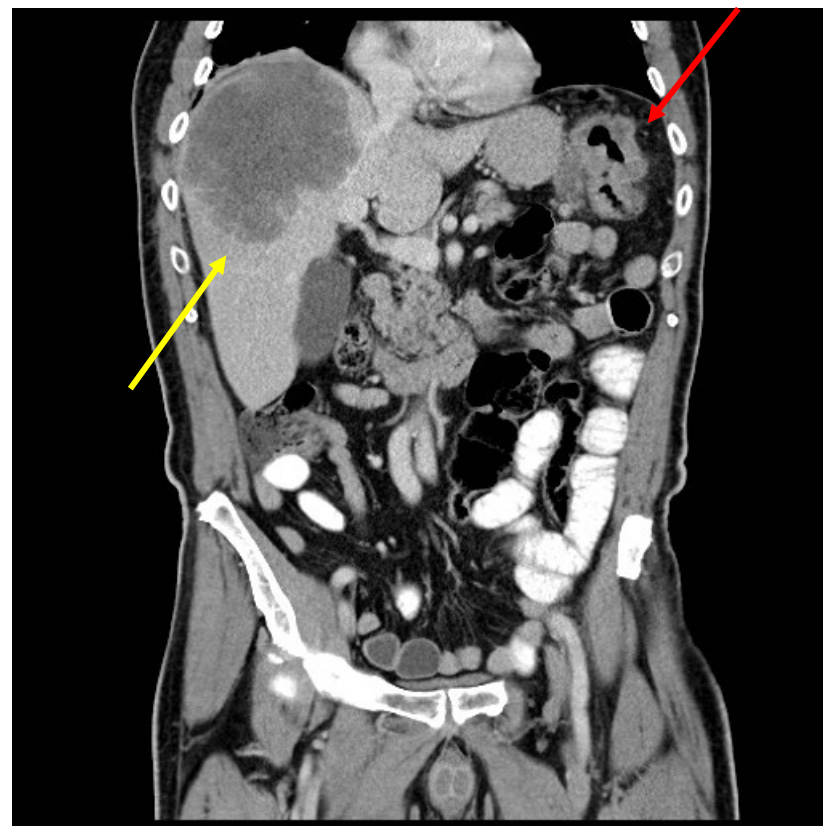
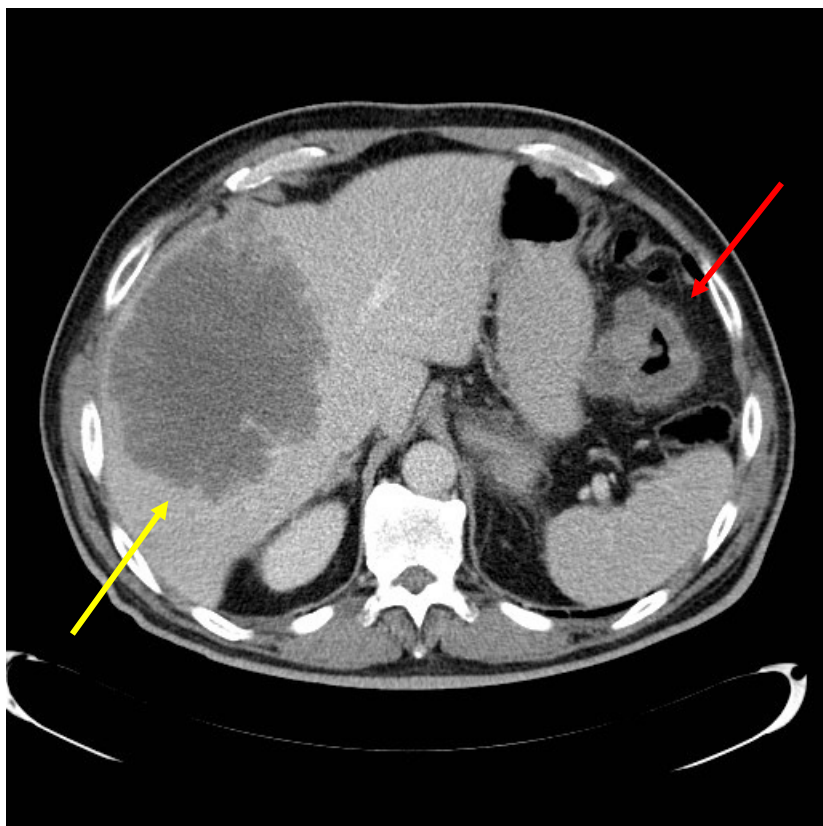
- Need to provide timely patient access
- Inequities in health care system
- Improve patient outcomes
- Economic burden



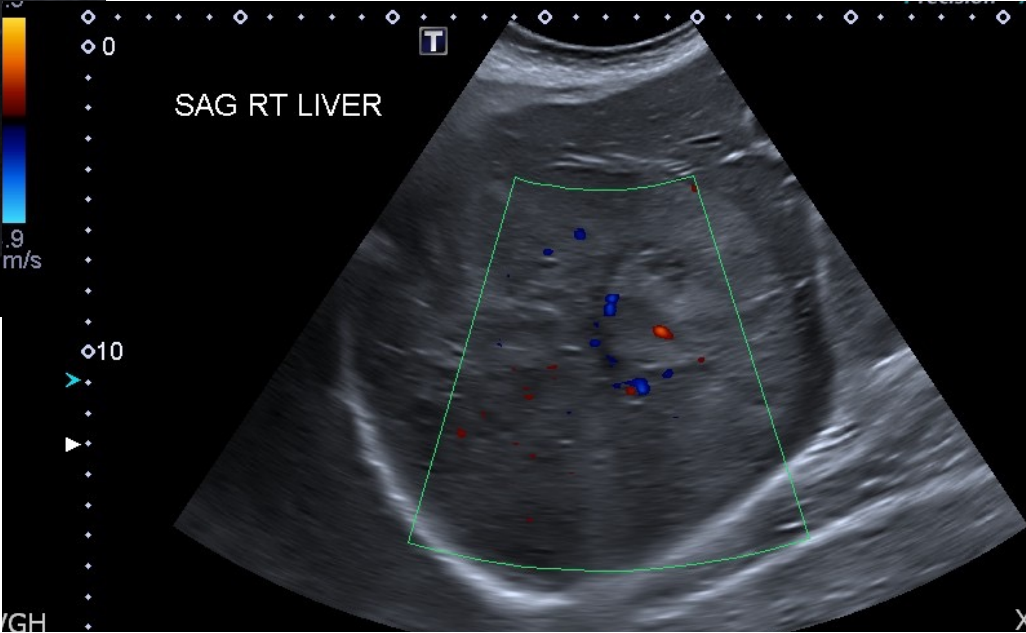
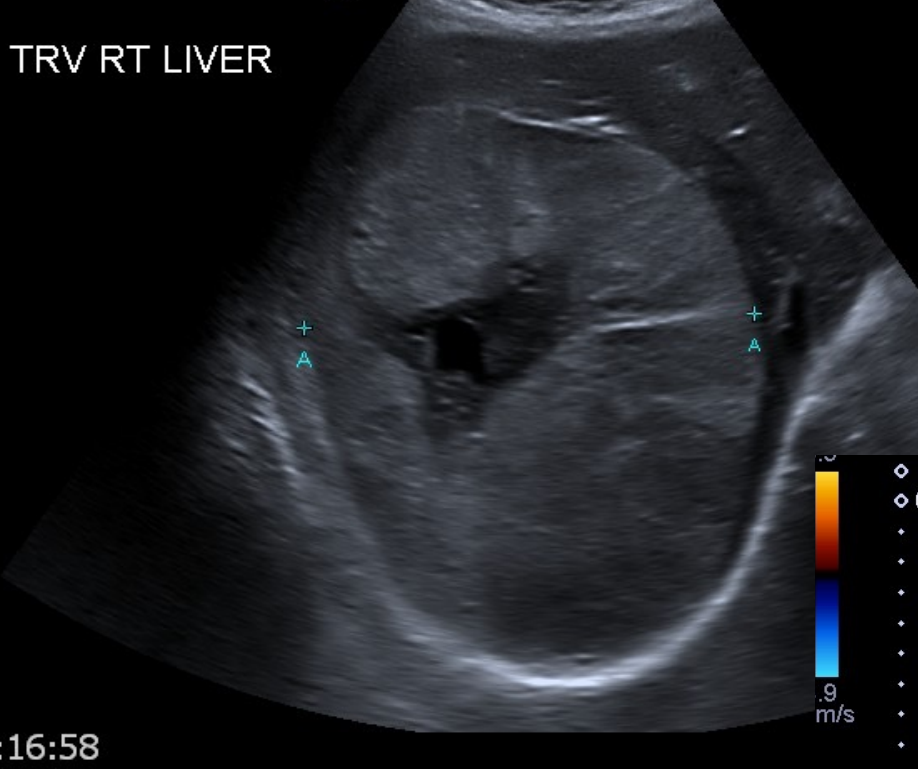
System factors:

- Demand increasing
- Resources are constrained
 - HHR
 - Equipment
 - Funding
- Need to address waitlists & COVID backlogs
- Reduce variation between facilities

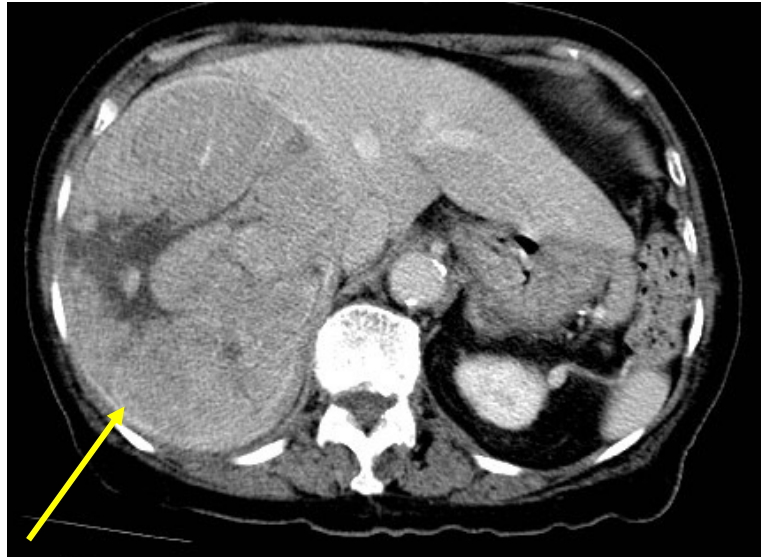
68 yo man with RUQ pain



84 yo female: history of Hep B



CT scan: same patient



What is the economic impact?

The Conference Board of Canada

The Value of Radiology Part II

1 Patients are waiting too long for imaging.

On average, patients wait **50 days for CT** and **69 to 89 days for MRI diagnostics**. The Canadian Association of Radiologists recommends a wait time of only 30 days.

975,375 Canadians wait longer than they should for medical imaging diagnostics.



2 About 1 in 20 patients need to stop working while waiting for imaging diagnostics.

That means **117,045** Canadians are temporarily forced out of the workforce because of excessive wait times.

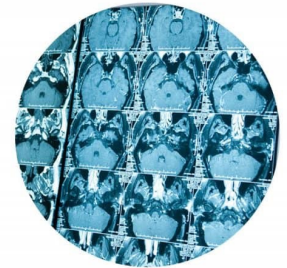
On average, this costs patients waiting for CT diagnostics \$4,136 and those waiting for MRI diagnostics **\$5,853 in lost wages**.



3 Lower employment makes it harder for firms to produce goods and services.

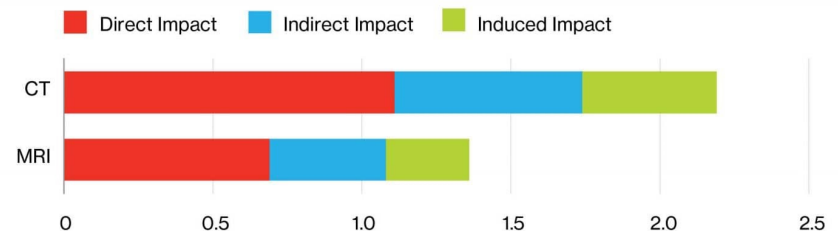
We estimate this took **\$3.5 billion** from the GDP in 2017.

This costs the federal and provincial governments **\$432 million dollars per year in lost revenue**.



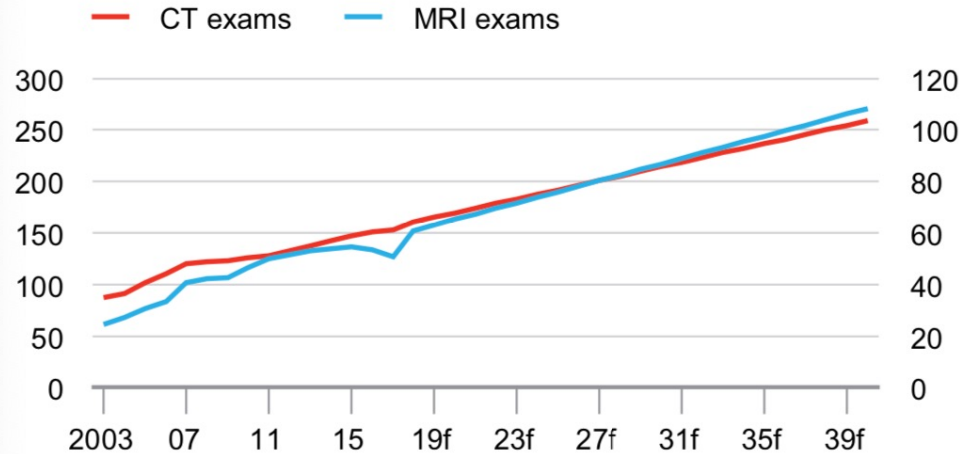
Direct, Indirect, and Induced Impact on Canadian GDP

(2017 \$ billions)



Increasing demand for CT and MRI exams

CT and MRI exams per 1,000 population
(number of exams)



f = forecast

Sources: The Conference Board of Canada; CADTH; CIHI.

Increasing demand for CT and MRI equipment

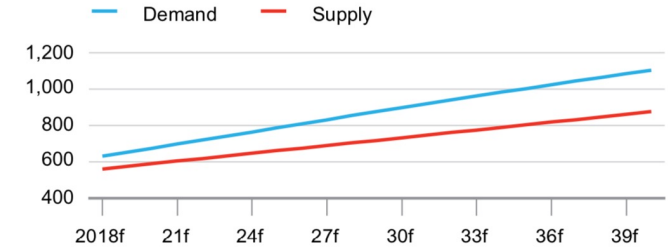
Forecast of demand for medical imaging examinations

	2017	2020	2025	2030	2035	2040
Population (millions)	36.64	37.70	39.43	41.04	42.44	43.63
Number of CT examinations (millions)	5.61	6.62	7.88	9.20	10.54	11.90
Number of MRI examinations (millions)	1.86	2.66	3.28	3.94	4.61	5.29
Number of CT machines	561	672	773	872	966	1,056
Number of MRI machines	366	450	543	639	733	826

Source: The Conference Board of Canada.

CT machines supply and demand

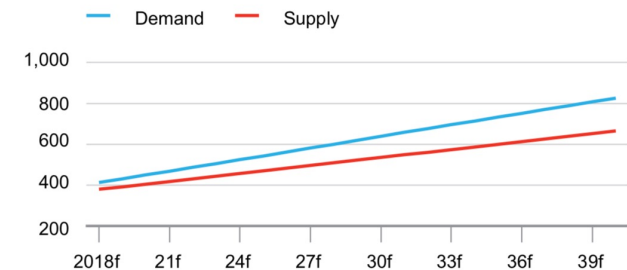
(units)



Source: The Conference Board of Canada.

MRI machines supply and demand

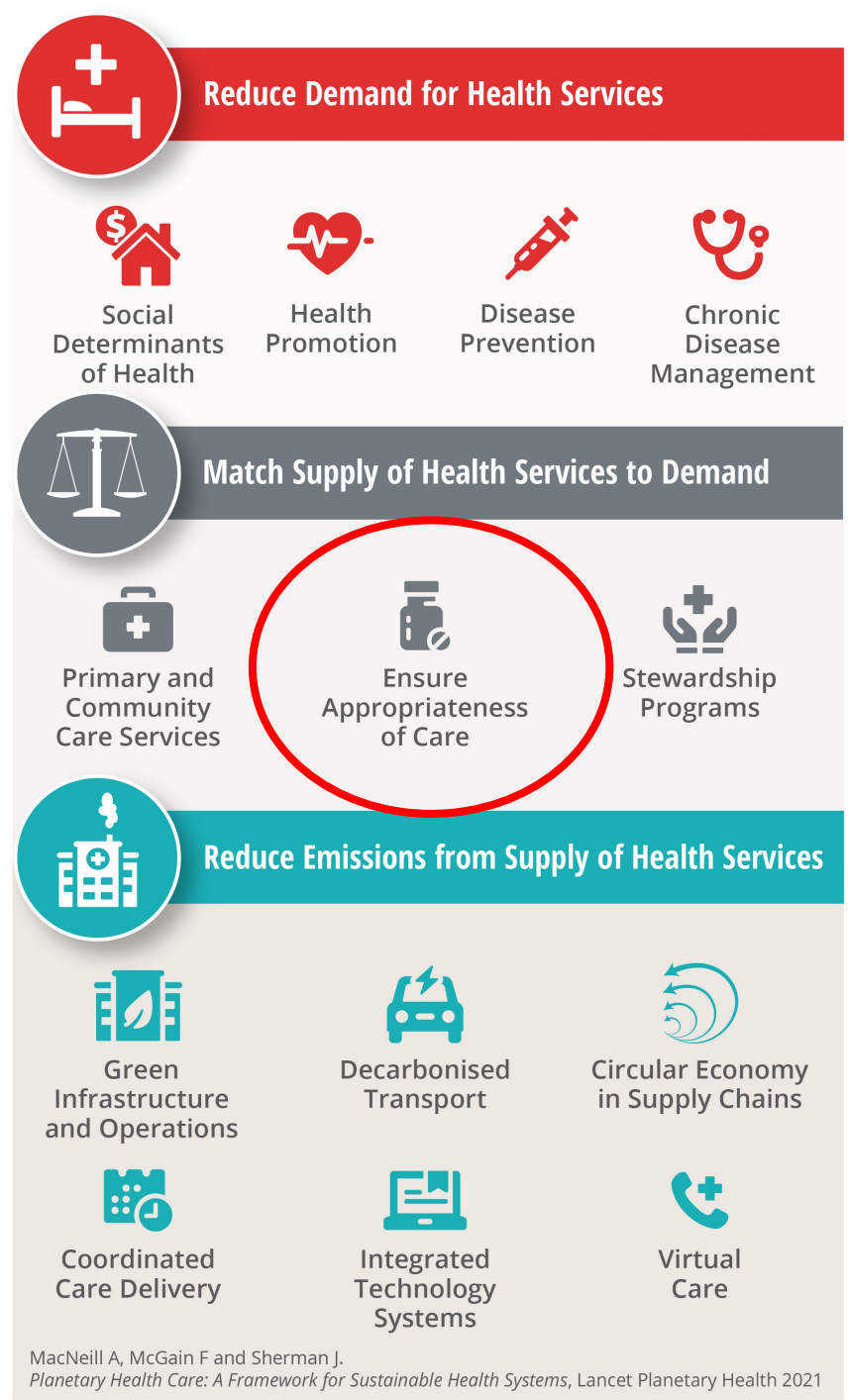
(units)



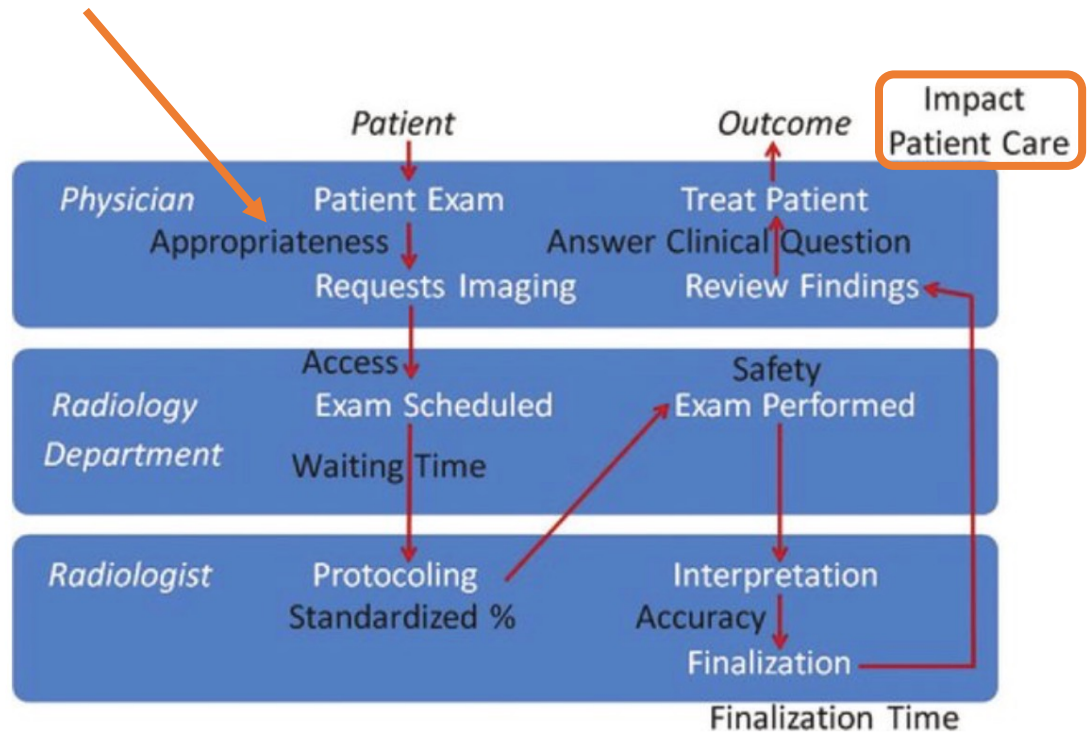
Source: The Conference Board of Canada.

How can this be addressed?

Ensure	Ensure appropriateness of MI •“Right test, right time”
Reduce	Reduce “low-value care”
Decrease	Decrease waste in the health care system

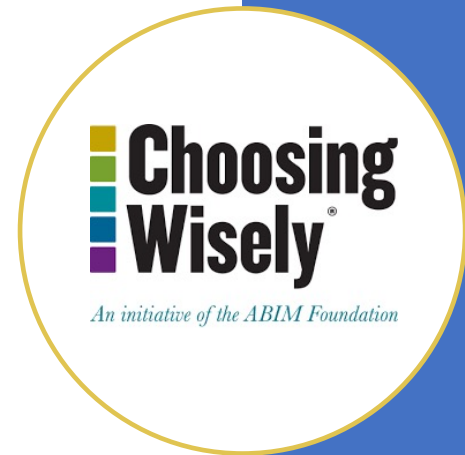


Multiple steps in the patient pathway



Choosing Wisely

- Launched by American Board of Internal Medicine Foundation (ABIMF) in 2012
- Developed to address over-ordering and inappropriate use of tests and treatments
- 103 high-volume imaging examinations are identified as “low-value” by the CW initiative (Levin & Rao, 2017)
- Potential to reduce waste and ensure tests performed are appropriate



Choosing Wisely Canada

- Similar evidence-based guidelines
- Recognize that every patient situation is unique
- Canadian Association of Radiologists endorses five clinical scenarios:
 - Imaging not recommended for:
 1. Lower back pain
 2. Minor head trauma
 3. Uncomplicated headache
 4. CT for appendicitis in children unless after ultrasound has been considered as an option
 5. Ankle X-ray series for minor injury

Unless red flags are present



BC Guidelines



- MRI for hip and knee pain (adults) if degenerative changes seen on X-ray
- CT for pulmonary embolism in low risk (non-pregnant adults)
- Key messages, practitioner and patient/caregiver resources are provided
- Advice on alternatives



Appropriate Imaging for Common Situations in Primary and Emergency Care

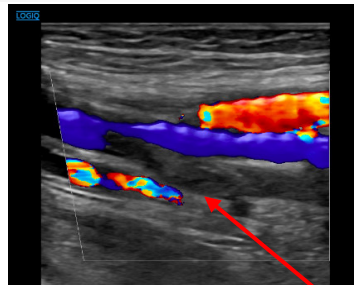
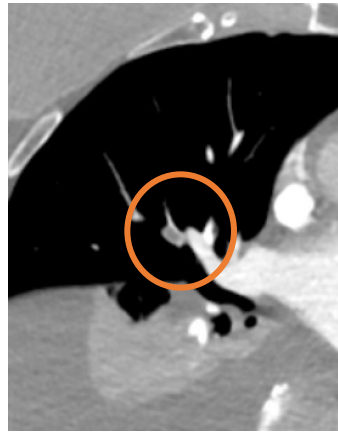
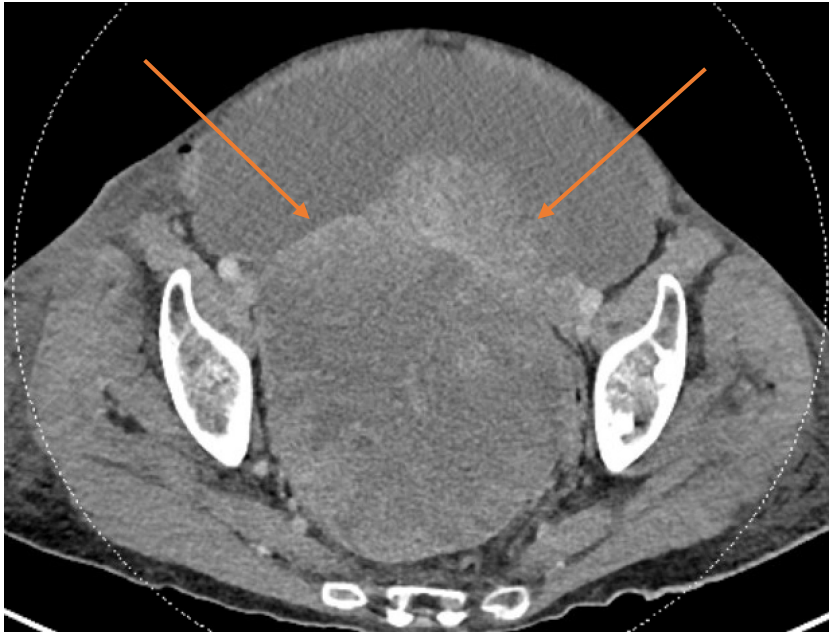
Effective Date: December 11, 2019

Scope

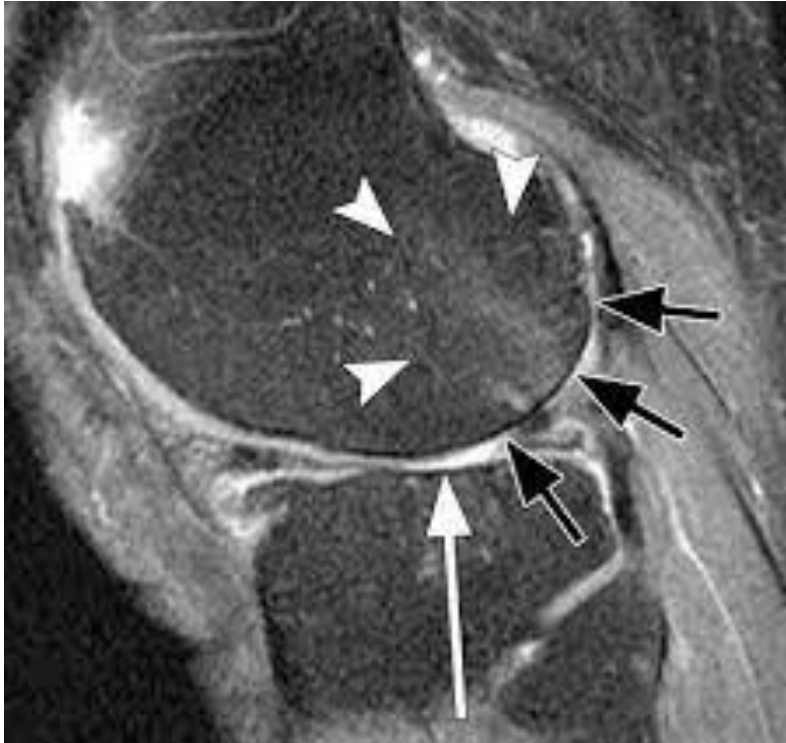
This guideline provides recommendations to primary and emergency care providers on how to assess the need for diagnostic imaging in five common situations: low-back pain (adults), minor head injuries (all ages), uncomplicated headache (adults), hip and knee pain (adults), and suspected pulmonary embolism (non-pregnant adults). Management of these conditions is beyond the scope of this guideline. However, in some cases, notes and alternatives to imaging are provided for additional clinical context.

Key Recommendations

- Imaging is not recommended for uncomplicated headache unless red flags are present ([page 2](#)).
- CT head scans are not recommended in adults and children who have suffered minor head injuries unless positive for a head injury clinical decision rule ([page 3](#)).
- Chest CT for suspected pulmonary embolism is not recommended in low-risk patients with a normal D-dimer result ([page 5](#)).
- Imaging is not recommended for low back pain unless red flags are present ([page 7](#)).
- MRIs of hip or knee joints are not recommended in patients with co-existent pain and moderate to severe osteoarthritis unless red flags are present ([page 8](#)).
- Practitioners are encouraged to consult a radiologist if they have any concerns or questions regarding which imaging test is appropriate for a given problem.



81 yo
female
p/w
bloating



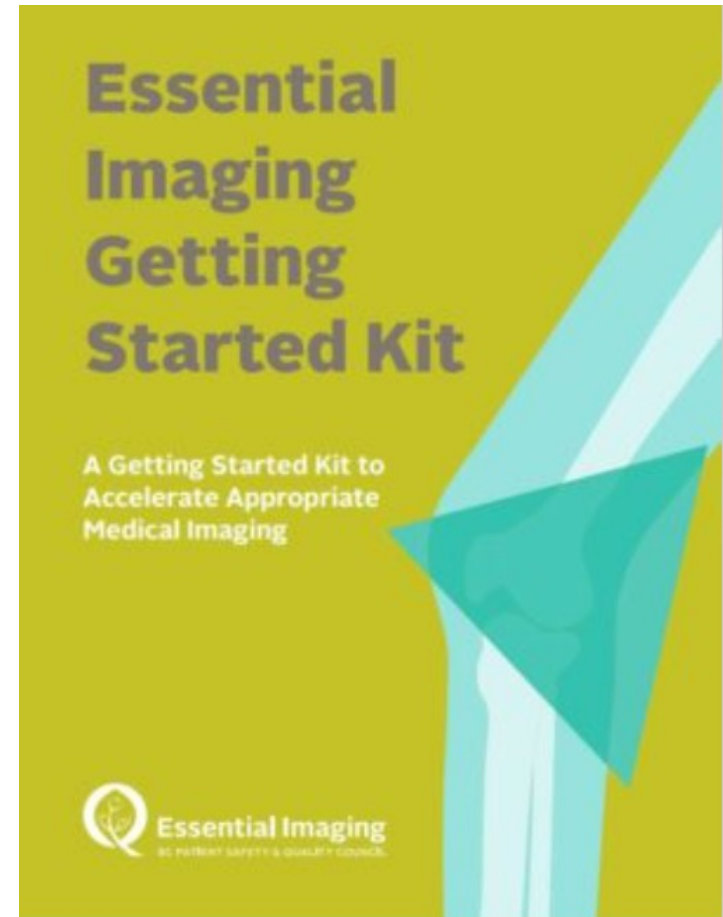
Osteoarthritis of the knee

BC Patient Safety & Quality Council

- Multiple resources on the five common scenarios
- Tool kit and series of webinars
- Recommends a multi-disciplinary approach
- Agree on standardized methodology
- Involve patients & families
- Collect data for QI



BC PATIENT SAFETY
& QUALITY COUNCIL
Working Together. Accelerating Improvement.



Prepare & Review	Establish executive steering committee, project teams	<ul style="list-style-type: none"> • Establish executive steering committee • Identify need for project – is there an issue with inappropriate medical imaging (MI)? • Set up initial project team
	Evaluate rates of appropriateness of selected MI tests	<ul style="list-style-type: none"> • Use data to identify specific areas for projects (refine project team as needed) • E.g., implementation of red flags in order entry • E.g., audit on CT head exams by ED physicians
	Engage and educate physicians and patients	<ul style="list-style-type: none"> • Consensus on appropriate MI referral practices • E.g., develop low back pain patient education materials, for inclusion in patient discharge package • Determine approach to supporting and monitoring community physician compliance with appropriate imaging guidelines

		<ul style="list-style-type: none"> • Identify evaluation metrics
Implement & Sustain	Develop / implement strategy	<ul style="list-style-type: none"> • Re-evaluate practice variation after intervention • Unnecessary MI procedures avoided? • Continue with assessment and feedback (regularly disseminate findings to stakeholders)
	Redirect resources / capacity	<ul style="list-style-type: none"> • MI capacity from unnecessary procedures redirected to areas with unmet demand
Monitor & Evaluate	Develop methodology to replicate project	<ul style="list-style-type: none"> • Document lessons learned • Identify additional opportunities for projects

Suggested strategy for implementation

Other initiatives to streamline Medical Imaging services



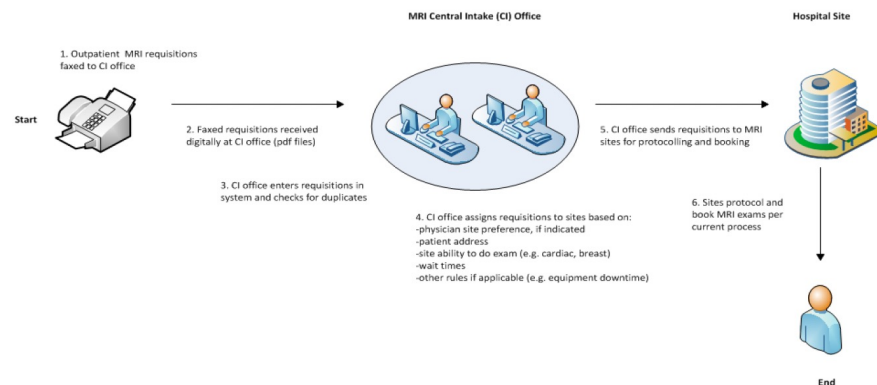
LMMI Central Intake Office (CIO) for MRI

- Centralized intake for referrals for 11 MRI sites across LMMI
- Response to MoH directive in 2015 that sought to address the anticipated increase in MRI referrals
- Internal audit identified duplicate bookings and wide variation in wait times ranging from 3 – 24 months
- Central fax #, ability to request a particular site, distributed based on factors such as postal code, ability of site to perform exam
- Appropriateness checklists (ACLs) implemented for low-back pain and hip/knee MRI







CIO Workflow

The workflow developed for the launch of CIO has remained relatively unchanged in its first year. The following diagram shows the high-level workflow of the CIO:



Forms with ACLs for lumbar spine and hip/knee MRI

**LOWER MAINLAND
MRI APPROPRIATENESS CHECKLIST**

Fax Outpatient Checklist to MRI Central Intake: 1-866-588-6955

IMPORTANT: The following information is required in order for us to process your request. Bold fields must be completed to avoid delays in patients processing. One or more criteria **must** apply for the referred examination type for the MRI exam to proceed. **Please include the MRI appropriateness checklist with the LMMI MRI requisition.**

PATIENT INFORMATION			
LAST NAME		FIRST NAME	
DATE OF BIRTH YYYY MM DD		PERSONAL HEALTH NUMBER	

MRI LUMBAR SPINE APPROPRIATENESS CRITERIA

The purpose of an MRI for lumbar spine is to identify suspected disc herniation, nerve compression, or metastatic disease. The most common cause of low back pain is mechanical and will resolve within 12 weeks. **(For patients 18 years of age and older)**

<input type="checkbox"/> MRI was recommended on a previous imaging report (please attach report)	<input type="checkbox"/> History of cancer or suspected cancer	<input type="checkbox"/> Age > 65 with first episode of severe back pain
<input type="checkbox"/> Previous lumbar spine surgery	<input type="checkbox"/> Use of IV drugs or steroids	<input type="checkbox"/> Pain lasting 12 weeks or longer
<input type="checkbox"/> Cauda equina syndrome	<input type="checkbox"/> Any neurological symptoms	<input type="checkbox"/> Assessment of inflammatory spondyloarthritis
<input type="checkbox"/> Unexplained weight loss, fever or immunosuppression	<input type="checkbox"/> Significant acute traumatic event immediately preceding onset of symptoms	

MRI KNEE and HIP APPROPRIATENESS CRITERIA

The purpose of an MRI for knee or hip is primarily for surgical planning. In most cases, using MRI does not add useful information for patients with moderate-to-severe osteoarthritis (OA). A weight-bearing x-ray is recommended to identify OA. **(For patients 40 years of age and older)**

<input type="checkbox"/> MRI was recommended on a previous imaging report	<input type="checkbox"/> Suspected tumour	<input type="checkbox"/> Patient has had weight-bearing x-ray within the past 6 months and referring clinician has confirmed mild or no evidence of osteoarthritis in the knee or hip
<input type="checkbox"/> Previous knee or hip surgery	<input type="checkbox"/> Osteonecrosis	
<input type="checkbox"/> Suspected infection	<input type="checkbox"/> Fixed locked knee	
	<input type="checkbox"/> Acute/Subacute trauma	

MRI SHOULDER APPROPRIATENESS CRITERIA

The purpose of an MRI shoulder exam is to establish a diagnosis for patients with chronic pain after four to six weeks of conservative treatment, a traumatic injury or pre-operative planning tool. An x-ray is recommended to assess calcifications and bony overview. **(For patients 18 years of age and older)**

ATRAUMATIC	<input type="checkbox"/> Suspected bursitis	POST-TRAUMATIC
<input type="checkbox"/> Inflammatory	<input type="checkbox"/> Suspected labral tear and instability	<input type="checkbox"/> Bankart or Hill-Sachs lesion
<input type="checkbox"/> Neurogenic pain (excluding plexopathy)	<input type="checkbox"/> Suspected shoulder cuff disorders (tendinitis, tear, calcified tendinitis)	<input type="checkbox"/> Neuroopathic syndrome (excluding plexopathy)
<input type="checkbox"/> Pain after rotator cuff repair		<input type="checkbox"/> Non-localized pain
<input type="checkbox"/> Suspected adhesive capsulitis		<input type="checkbox"/> Physical examination findings with dislocation, labral tear or rotator cuff tear
<input type="checkbox"/> Suspected biceps pathology		

Appropriateness Guidance (Does not require submission; for patients 18 years of age and older)





MRI Head for headache: According to Choosing Wisely Canada, imaging for uncomplicated headache should only be considered if red flags are present. Red flags include rapidly increasing frequency and severity of headache; headache causing the patients to wake from sleep; any associated neurological deficit; and new onset of a headache in a patient with a history of cancer or immunodeficiency/concern regarding infection.

MRI Arthrogram: An arthrogram should be performed when the patient history includes a query for labral tear in patient younger than 50 years of age.

CLINICIAN INFORMATION			
REQUESTING CLINICIAN NAME	MSP BILLING NUMBER	CLINICIAN PHONE	CLINICIAN FAX

• Appropriateness criteria are consistent with the Choosing Wisely Canada recommendations: <https://choosingwiselycanada.org>.
 • For appropriateness guidance from a radiologist, referring providers can access the RACE app at <http://www.raceconnect.ca/race-app/>.

BCHA.01100 | MAR.2020

**LOWER MAINLAND
MRI APPROPRIATENESS CHECKLIST**

Fax Outpatient Checklist to MRI Central Intake: 1-866-588-6955

IMPORTANT: The following information is required in order for us to process your request. Yellow highlighted fields must be completed to avoid delays in patient processing. **Please include the MRI appropriateness checklist with the MRI requisition.**

PATIENT INFORMATION	
LAST NAME	FIRST NAME
DATE OF BIRTH YYYY MM DD	PERSONAL HEALTH NUMBER

MRI LUMBAR SPINE APPROPRIATENESS CRITERIA

The purpose of an MRI for lumbar spine is to identify suspected disc herniation, nerve compression, or metastatic disease. The most common cause of low back pain is mechanical and will resolve itself within 12 weeks. **Complete the checklist for all adult patients (18 years of age and older) referred for MRI lumbar spine. One or more of the following must apply in order to be eligible for MRI lumbar spine:**

<input type="checkbox"/> MRI was recommended on a previous imaging report (please attach report)	<input type="checkbox"/> Use of IV drugs or steroids
<input type="checkbox"/> Previous lumbar spine surgery	<input type="checkbox"/> Any neurologic symptoms
<input type="checkbox"/> Cauda equina syndrome	<input type="checkbox"/> Significant acute traumatic event immediately preceding onset of symptoms
<input type="checkbox"/> Unexplained weight loss, fever or immunosuppression	<input type="checkbox"/> Age over 65 with first episode of severe back pain
<input type="checkbox"/> History of cancer or suspected cancer	<input type="checkbox"/> Pain lasting 12 weeks or longer

If the patient meets the lumbar spine appropriateness criteria, indicate if the patient is experiencing:

<input type="checkbox"/> Back dominant pain (Pain above gluteal fold and below the T12 rib)
<input type="checkbox"/> Leg dominant pain (Below the gluteal fold, specific root distribution and radiation below the knee)

MRI KNEE and HIP APPROPRIATENESS CRITERIA

The purpose of an MRI for knee or hip is primarily for surgical planning. In most cases, using MRI does not add useful information for patients with moderate-to-severe osteoarthritis (OA) especially for those with chronic degenerative conditions. A weight-bearing x-ray is recommended to identify OA. **Complete the checklist for patients 40 years of age and older referred for MRI knee or hip. One or more of the following must apply in order to be eligible for MRI knee or hip:**

<input type="checkbox"/> MRI was recommended on a previous imaging report (please attach report)	<input type="checkbox"/> Osteonecrosis
<input type="checkbox"/> Previous knee or hip surgery	<input type="checkbox"/> Fixed locked knee
<input type="checkbox"/> Suspected infection	<input type="checkbox"/> Patient has had a weight-bearing x-ray within the past 6 months and referring clinician has confirmed mild or no evidence of osteoarthritis in the knee or hip
<input type="checkbox"/> Suspected tumour	

CLINICIAN INFORMATION			
REQUESTING CLINICIAN NAME	MSP BILLING NUMBER	CLINICIAN PHONE	CLINICIAN FAX

Appropriateness criteria are consistent with the Choosing Wisely Canada recommendations. For more information, visit <https://choosingwiselycanada.org>.

For appropriateness guidance from a radiologist, call the Rapid Access to Consultative Expertise (RACE) line: 1-604-696-2131 or visit <http://www.raceconnect.ca/>.

Information for referring clinicians on MRI appropriateness can be found at: <http://www.vch.ca/MRI-Central-Intake> and <https://pathwaysbc.ca>.

Value of the CIO



- Compliance of >95% for ACLs
- Decrease of 2-3% referrals for lumbar spine and knee/hip MRI studies
- ACLs provided valuable education for patients

"It's literally gone from one to two years for an MRI, to anywhere from less than a month for serious cancers to nine months for non-urgent issues," she explains. "It's easily saved the average patient at least a year, since that initial meeting I had with Shared Care and the Ministry."

- Other initiatives: eForms
- Aim to integrate with EMRs
- Recent work by MoH on ***MRI Patient Pathways Project*** to have end-to-end MRI triaging system scalable to the province and other modalities



Other resources

- Ultrasound, CT and MRI Prioritization Guidelines
- Suggested wait times for common indications
- Guidance notes for alternative test if there is a lack of availability
- Degree of urgency and prioritization based on CAR classification system

Priority Level	Clinical Example	Maximum Suggested Wait Time
P1	An examination immediately necessary to diagnose and/or treat life-threatening disease. Such an examination will need to be done either stat or not later than the day of the request.	Immediately to 24 hours
P2	An examination indicated within one week of a request to resolve a clinical management imperative.	Maximum 7 calendar days
P3	An examination indicated to investigate symptoms of potential importance.	Maximum 30 calendar days
P4	An examination indicated for long-range management or for prevention.	Maximum 60 calendar days
P5	Timed follow-up exam or specified procedure date recommended by Radiologist and/or clinician.	

Additional phone and electronic resources



**RAPID ACCESS TO
CONSULTATIVE EXPERTISE**



**eLECTRONIC CONSULTATIVE
ACCESS TO SPECIALIST EXPERTISE**

A 3D rendering of a puzzle with one red piece in the center, surrounded by grey pieces. The red piece is the central focus, and the text is overlaid on it.

Health system
challenges and
potential solutions

System Challenges in Medical Imaging

- HHR needs
- Need for equipment replacement/renewal
- Waitlists & COVID backlogs
- Recent CT IV contrast shortage
- Access to Breast Imaging Services



Potential solutions:



Clinical Decision Support (CDS)



Digital Health Gateway App



Central Intake Office expansion

Other modalities, use of AI tools to streamline processes



Other Quality Initiatives

Enhanced prioritization of requisitions
Guidance for incidental findings

Digital Health Gateway App

- Plan to include MI reports from VCH/PHC/FHA
- Already in place in other HAs
- Provides access to other patient information/services



MINISTRY OF HEALTH | DIGITAL HEALTH INITIATIVE

Health Gateway (HGW): Medical Imaging Reports

MIAC Meeting
Oct 27, 2022

BRITISH COLUMBIA

The slide features a dark blue background with a complex network of glowing blue and purple lines and dots, resembling a molecular or data network structure.

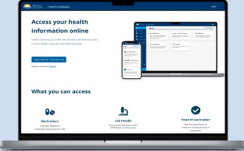


Health Gateway Overview

Existing: Health Gateway Website

- Launched Dec-2019
- Requires BC Services Card (BCSC) to log in
- Over **1.2 million** users and growing

Currently Provides Access To:	To be added:
<ul style="list-style-type: none">• Lab Results – New!• Prescription medication• Health visits• Immunization records• Special Authority requests• BC Vaccine Card• Federal Vaccine Proof• COVID-19 lab test results	<ul style="list-style-type: none">• Medical imaging reports• Hospital visits• Clinical Documents



NEW: Health Gateway Mobile App

- Natural extension of the current Health Gateway web application
- Enables convenient access and meaningful communication with citizens through notifications
- Available free via Apple and Google App stores



BRITISH COLUMBIA | 3

The slide features a light blue background with a subtle pattern of dots and lines. It includes a screenshot of the website interface on a laptop and a screenshot of the mobile app interface on a smartphone.

Health Disparities



Addressing health disparities in MI

- Need a culturally competent healthcare system to provide equitable treatment to patients with diverse beliefs, behaviors and values
- “In Plain Sight” report
- Identified barriers to cancer screening – access, socio-economic, education
- Focused on breast and lung screening
- Effect of COVID-19 pandemic



Cao DJ, Alabousi M, Farshait N, Patlas MN. Barriers to Screening At-risk Populations in Canada. *Can Assoc Radiol J*. 2022:8465371221147307. Epub ahead of print.

Addressing health disparities in MI

- Need to adapt services to social, cultural and linguistic needs
- Address multiple barriers – geographical, refugee status, language, literacy, cultural, restricted access to technology
- Need diverse, culturally competent workforce – training, education
- Ensure targeted measures are effective – data collection
- Awareness of patients needs



[Provision of Culturally Competent Healthcare to Address Healthcare Disparities](#)

Charlotte J. Yong-Hing and Faisal Khosa

Canadian Association of Radiologists Journal 0 10.1177/08465371231154231

Conclusion

- Need to consider appropriateness in Medical Imaging
- Frameworks such as Choosing Wisely, BC Guidelines, BCPSQC resources can provide guidance
- Initiatives including the Central Intake Office for MRI can help to improve access and smooth waitlists
- Ongoing need to provide timely and culturally safe care

Thank you!

alison.harris@vch.ca



Background

- Total health care spending in Canada \$331 billion in 2022 (\$8, 563 per person) – CIHI
- 12.2% GDP in 2022, expected to rise by 0.8% 2022
- Largest costs - hospitals (24.3%), physicians (13.6%) and drugs (13.6%)
- Multiple factors affect wait times – resources, efficiency, seasonal variation, patient complexity/condition, patient choice

MRI – CIHI add CT

- 50 and 90th percentile wait times – 37 and 147 days Canada, 42 and 133 days BC
- Number waiting for MR in BC almost 100k
- Need to ensure appropriate referrals to address needs

Waste in Health Care

- Papanicolas et al (2018) compared 10 of highest-income countries
- US performed the second highest number of MRI scans and the highest number of CT scans per 1000 population (with Canada 7th and 5th respectively) (Papanicolas et al, 2018).

Waste in Health Care

- Shank (2019) focused on 6 domains previously identified by IOM and Berwick & Hackbarth (2012)
- Failure of care delivery
- Failure of care coordination
- Overtreatment or low-value care
- Pricing failure
- Fraud and abuse
- Administrative complexity
- Low-value care is described as “services that provide minimal or no benefit to a patient’s clinical condition”

Waste in Health Care

- Estimated cost of waste to US health system ranged from \$760-\$935 billion equivalent to ~25% of total HC spending
- Projected savings \$191-\$286 (~25%)
- Regarding “overtreatment/low-value care” domain – waste attributed to “low-value screening, testing or procedures”
 - Address with ***Choosing Wisely***, shared decision-making
- In “failure of care delivery” domain – inefficiencies, lack of preventative care
 - Bundled-payment models, QI initiatives, preventative programs

Waste in Health Care

- Canadian healthcare system – Squires, 2022
- Systematic review 174 studies
- Identified inappropriately over- and under-used services, including many imaging and diagnostic tests
- Internationally 20-50% radiological examinations over-utilization (Hendee, 2010)
- Contributes negatively to Planetary Health (MacNeill, 2021)