Diagnostic Imaging Pathways, RANZCR and the ‘Choosing Wisely’ Campaign

Prof Richard Mendelson

Royal Perth Hospital, Perth, Western Australia

richard.mendelson@health.wa.gov.au
Learning outcome:

• Implement the use of “Diagnostic Imaging Pathways”
  to identify appropriate diagnostic imaging tests for patients in connection with the RANZCR recommendations for the ‘Choosing Wisely’ campaign
• Background
• RANZCR contribution to Choosing Wisely
• Background

• RANZCR contribution to Choosing Wisely
Choosing Wisely Australia

• Choosing Wisely Australia is an initiative that is helping the medical community and patients start an important conversation about ways to improve the quality of care by addressing those tests, treatments and procedures where evidence shows they provide no benefit and in some cases, lead to harm.

• RANZCR is a founding partner of the Choosing Wisely Australia campaign

• Initiative identifies tests, treatments and procedures that are commonly used but can often provide no or limited benefit to the patient and in some cases, lead to harm
5 questions to ask your doctor before you get any test, treatment, or procedure

Some medical tests, treatments, and procedures provide little benefit. And in some cases, they may even cause harm. Use the 5 questions to ask your doctor to make sure you end up with the right amount of care — not too much and not too little.

1. **DO I REALLY NEED THIS TEST OR PROCEDURE?**
   Medical tests help you and your doctor or other health care provider decide how to treat a problem. And medical procedures help to actually treat it.

2. **WHAT ARE THE RISKS?**
   Will there be side effects? What are the chances of getting results that aren’t accurate? Could that lead to more testing or another procedure?

3. **ARE THERE SIMPLER, SAFER OPTIONS?**
   Sometimes all you need to do is make lifestyle changes, such as eating healthier foods or exercising more.

4. **WHAT HAPPENS IF I DON’T DO ANYTHING?**
   Ask if your condition might get worse — or better — if you don’t have the test or procedure right away.

5. **WHAT ARE THE COSTS?**
   Costs can be financial, emotional or a cost of your time. Where there is a cost to the community, is the cost reasonable or is there a cheaper alternative?

Adapted from material developed by Consumer Reports.
RANZCR website:

- “A national conversation about more appropriate health care”
- “Eliminating unnecessary tests”
- “The six items on our list are commonly used tests that are not always necessary for every patient.”
Diagnostic Imaging Pathways

• Evidence and Consensus based
• Multidisciplinary
• AGREE 2 compliant

• AIMS:
  – reduce inappropriate imaging
  – Promote appropriate imaging
DIP: Key features

- **Web-based electronic format only**
- **Non-commercial and freely available**
- **Common clinical scenarios**
  - Focus on symptoms rather than pathology wherever possible
- **Algorithmic / flow-chart structure**
- **All modalities**
- **“Layered” format:** (i.e. as much or as little information as required)
- **Teaching points**
- **Image gallery**
- **“Consumer” information**
- **Ionizing radiation training module**
Also available as a free downloadable interactive App for mobile devices
Inappropriate imaging

- About 10-30% of imaging is inappropriate
- Pertains to primary and hospital practice

- No imaging indicated
- Wrong modality
- Correct modality, wrong protocol
- Correct imaging, wrong timing
- Imaging NOT performed, but required

Bairstow et al, IJQH 2010
Picano, BMJ 2004
RCR BMJ 1992
Health Council of Canada, 2010
Britt 2014

"Well, Bob, it looks like a paper cut, but just to be sure let's do lots of tests."
Why inappropriate tests matter

- Risk without benefit
  - Hazard of the test, ionizing radiation
- Cost without benefit
- Delay in diagnosis
- False positive diagnoses /’red herrings’/
  ‘incidentalomas’/ over-diagnosis
- Threat to effective allocation of resources
Causes of inappropriate use of imaging are multiple and complex

- Knowledge gap
  » More choices
  » Complex technology
  » Keeping up to date difficult
- Medicolegal factors
- Perceived need for “certainty”
- “Imaging is so good, why should I examine the patient?”
- Patient expectations
- Clinicians’ time constraints
- self-referral
- Poor correlation with patient outcomes
- Failure of radiologists in roles of consultants and gatekeepers
Causes of inappropriate use of imaging are multiple and complex

- Knowledge gap
  » More choices
  » Complex technology
  » Keeping up to date difficult
- Medicolegal factors
- Perceived need for “certainty”
- “Imaging is so good, why should I examine the patient?”
- Patient expectations
- Clinicians’ time constraints
- self-referral
- Poor correlation with patient outcomes
- Failure of radiologists in roles of consultants and gatekeepers
Causes of inappropriate use of imaging are multiple and complex

- Knowledge gap
  » More choices
  » Complex technology
  » Keeping up to date difficult
- Medicolegal factors
- Perceived need for “certainty”
- “Imaging is so good, why should I examine the patient?”
- Patient expectations
- Clinicians’ time constraints
- self-referral
- Poor correlation with patient outcomes
- Failure of radiologists in roles of consultants and gatekeepers
Perceived need for certainty /lack of awareness of Limitations of DI

- **No test is 100% accurate**
- **Unrealistic expectations of DI e.g.**
  - “Weight loss. CT abdo to r/o cancer”
  - “abdo pain ?cause. CT abdo, please”
**Clinical certainty of disease**

Exclusion threshold  
Tests required  
Action threshold

0%  
Clinical certainty of disease

100%  
Clinical certainty of disease

Strep throat  
Cancer

*After Scally, Medical Imaging 1999*
Causes of inappropriate use of imaging are multiple and complex

- Knowledge gap
  - More choices
  - Complex technology
  - Keeping up to date difficult
- Medicolegal factors
- Perceived need for “certainty”
- “Imaging is so good, why should I examine the patient?”
- Patient expectations
- Clinicians’ time constraints
- Self-referral
- Poor correlation with patient outcomes
- Failure of radiologists in roles of consultants and gatekeepers
“Why examine the patient when imaging is so good?”

“I don’t have time to take a history and examine the patient”

“Get a CT scan then I’ll see the patient!”

(surgical reg on-call)
“I don’t have time to take a history and examine the patient”

“Get a CT scan then I’ll see the patient!” (surgical reg on-call)

“Why examine the patient when imaging is so good?”

Imaging is not a substitute for the clinical paradigm!
The Clinical Paradigm

History + Physical examination

Provisional diagnosis (PRE-TEST PROBABILITY)

Euratom directive, 1998
Is imaging indicated?
  Is there previous imaging?
  Will it change diagnosis?
  Will it change management?
  Will it do more harm than good?
Is it the appropriate imaging?
  Is there a non-ionizing alternative?

POST-TEST PROBABILITY

DECISION SUPPORT TOOLS

RADIOLOGY CONSULTATION

IMAGING PROTOCOL

TEST
Clinical paradigm is important:

To determine provisional diagnosis and pre-test probability

• Provisional diagnosis required:
  – To choose correct imaging modality (if any)
  – To correctly protocol the imaging examination

• Pre-test probability required:
  – To assess whether imaging indicated / useful
  – To determine the significance of the result of the test
  – Has the clinical context been conveyed to the imaging specialist to enable the report to be informed by that knowledge?
Clinical paradigm is important:

To determine provisional diagnosis and pre-test probability

• Provisional diagnosis required:
  – To choose correct imaging modality (if any)
  – To correctly protocol the imaging examination

Eg

“renal colic protocol “ (low-dose non-enhanced CT)
vs
“mesenteric ischaemia protocol” (multiphase pre- & post-contrast CT)

BUT ... both “CT abdomen”
Clinical paradigm is important:

To determine provisional diagnosis and pre-test probability

- Provisional diagnosis required:
  - To choose correct imaging modality (if any)
  - To correctly protocol the imaging examination

- Pre-test probability required:
  - To assess whether imaging indicated / useful
  - To determine the significance of the result of the test
  - Has the clinical context been conveyed to the imaging specialist to enable the report to be informed by that knowledge?

Probabilistic theory
Bayes theorem

Post-test odds * = pre-test odds x likelihood ratio #

#LR = \frac{\text{prob of result in patients with disease X}}{\text{prob of same result in patients without disease X}}

(A measure of test predictive value)

* Odds = \frac{\text{probability}}{1- \text{probability}}
• Background

• RANZCR contribution to Choosing Wisely
5 questions to ask your doctor before you get any test, treatment, or procedure

Some medical tests, treatments, and procedures provide little benefit. And in some cases, they may be harmful. Use the 5 questions to ask your doctor to make sure you end up with the right amount of care — not too much.

1. DO I REALLY NEED THIS TEST OR PROCEDURE?

Medical tests help you and your doctor or other health care provider decide how to treat a problem. And medical procedures help to actually treat it.

2. WHAT ARE THE RISKS?

Will there be side effects? What are the chances of getting results that aren’t accurate? Could that lead to more testing or another procedure?

3. ARE THERE SIMPLER, SAFER OPTIONS?

Sometimes all you need to do is make lifestyle changes, such as eating healthier foods or exercising more.

4. WHAT HAPPENS IF I DON’T DO ANYTHING?

Ask if your condition might get worse — or better — if you don’t have the test or procedure right away.

5. WHAT ARE THE COSTS?

Costs can be financial, emotional or a cost of your time. Where there is a cost to the community, is the cost reasonable or is there a cheaper alternative?

Adapted from material developed by Consumer Reports.
RANZCR contribution to Choosing Wisely: 5 (sic) things to question

1. Ankle trauma
2. Suspected lower limb Deep Vein Thrombosis
3. Suspected Pulmonary Embolism
4. Low back pain
5. Cervical spine trauma
6. Head trauma
RANZCR contribution to Choosing Wisely:

5 \textit{(sic)} things to question

1. Ankle trauma
2. Suspected lower limb Deep Vein Thrombosis
3. Suspected Pulmonary Embolism
4. Low back pain
5. Cervical spine trauma
6. Head trauma
Ankle trauma

1. Don’t request imaging for acute ankle trauma unless indicated by the Ottawa Ankle Rules
Validated prospectively on 453 patients. *(Stiel, JAMA 1993)*

Implementation resulted in a decrease in the use of ankle radiography by 28% and foot radiography by 14% without affecting the incidence of fracture detection.

The Ottawa Ankle Rules have also been prospectively applied in several other studies.
2. Don’t request duplex compression US for suspected lower limb DVT in ambulatory outpatients unless the Wells Score

- is greater than 2, OR
- if less than 2, D dimer assay is positive.
Wells Criteria

- This clinical prediction rule is designed to increase the probability of an accurate diagnosis of deep venous thrombosis. 1-4
  - Active cancer (patient receiving treatment for cancer within the previous 6 months or currently receiving palliative treatment) (1 point)
  - Paralysis, paresis, or recent plaster immobilisation of the lower extremities (1 point)
  - Recently bedridden for 3 days or more, or major surgery within the previous 12 weeks requiring general or regional anaesthesia (1 point)
  - Localised tenderness along in the distribution of the deep venous system (1 point)
  - Entire leg swollen (1 point)
  - Calf swelling at least 3cm larger than that on the asymptomatic side (measured 10cm below tibial tuberosity) (1 point)
  - Pitting oedema confined to the symptomatic leg (1 point)
  - Collateral superficial veins (nonvaricose) (1 point)
  - Previously documented DVT (1 point)
  - Alternative diagnosis at least as likely as DVT (-2 points)

Score of 2 or higher = DVT likely and Score of less than 2 = DVT unlikely
Low back pain

4. Don’t perform imaging for patients with non-specific acute low back pain and no indicators of a serious cause for low back pain.
**Red flags for the investigation of acute low back pain**

Patients with any of the following Red Flags may benefit from plain radiographs:

- Age of onset < 20 years or > 55 years
- Recent history of violent trauma
- Constant progressive, non mechanical pain (no relief with bed rest)
- Thoracic pain
- Past medical history of malignant tumour
- Prolonged use of corticosteroids
- Drug abuse, immunosuppression, HIV
- Systemically unwell
- Unexplained weight loss
- Unexplained neurological symptoms (including cauda equina syndrome)
- Structural deformity
- Fever
6. Don’t request computed tomography (CT) head scans in patients with a head injury, unless indicated by a validated clinical decision rule.
The Canadian CT Head Rule is a clinical decision rule for adults with a minor head injury, although individual patient factors must be taken into account.

**High Risk Head Injury**
- Focal neurological deficit
- Patients on oral anticoagulants/anti-platelet agents or with a bleeding disorder
- Cerebral depressed skull fracture
- GCS < 13 at any time since injury
- Post-traumatic seizure
- Unstable vital signs with major trauma

**Minor Head Injury**
- Patient with a history of loss of consciousness, amnesia, or disorientation and a GCS of 13 or greater when examined

**Trivial Head Injury**
- No loss of consciousness, no amnesia and no disorientation

**Canadian CT Head Rule**
High risk (of abnormality requiring neurosurgical intervention)
- GCS score < 15 at 2h after injury
- Suspected open or depressed skull fracture
- Any sign of basilar skull fracture (hemotympanum, raccoon eyes, subdural fluid accumulation/ intracerebral. Battle’s sign)
- Vomiting two or more times
- Aged 65 or older

Medium risk (for demonstrating brain injury on CT not requiring neurosurgical intervention)
- Retrograde amnesia of more than 30 minutes
- Dangerous mechanism (pedestrian, struck by motor vehicle, occupant ejected from motor vehicle, fall from a height of more than 1 meter or live stairs

- Any high risk factors
- Either of the medium risk factors
- No high or medium risk factors

- CT Head
- CT Head or close observation depending on resources
- Very low risk for significant intracranial injury

Role of MRI
- Head Injury Advice
High Risk (of abnormality requiring neurosurgery intervention)

- GCS < 15 at 2hr after injury
- Suspected open or depressed skull
- Any sign of basal skull
  - Haemotypanum, ‘raccoon’ eyes, CSF ottorhoea/rhinorrhoea, Battle’s sign
- Vomiting 2 or more times
- Aged 65 or older

Medium risk (for brain injury on CT not requiring neurosurgery intervention)

- Retrograde amnesia of > 30 minutes
- Dangerous mechanism
  - Pedestrian vs motor vehicle, occupant ejected from MV, fall > 1 metre or 5 stairs
Suspected Pulmonary Embolism

3. Don’t request any diagnostic testing for PE) unless indicated by Wells Score (or Charlotte Rule) followed by PE Rule-out Criteria (in patients not pregnant).

Low risk patients in whom diagnostic testing is indicated should have PE excluded by a negative D dimer, not imaging.
Cervical Spine trauma

5. Don’t request imaging of the cervical spine in trauma patients, unless indicated by a validated clinical decision rule.
CANADIAN C-SPINE RULE

Any high-risk factor that mandates radiography?
- Age ≥ 65 yr or dangerous mechanism or paraesthesia in extremities

No

Any low-risk factor that allows safe assessment of range of motion?
- Simple rear-end motor vehicle collision or sitting position in ED or ambulatory at any time or delayed (not immediate) onset of neck pain or absence of midline cervical tenderness

Yes
- Able to rotate neck actively?
  - 45° left and right

Yes
- No imaging of C-spine needed

Rule not applicable if:
- Non-trauma case or GCS <15 or unstable vital signs or age < 16 years or acute paralysis or known vertebral disease or previous C spine surgery

Imaging required

Unsure
DIAGNOSTIC IMAGING PATHWAYS ("DIP")

www.imagingpathways.health.wa.gov.au

An online decision support and educational tool for diagnostic imaging

DIP app
A version of Diagnostic Imaging Pathways for portable devices

Download free from the Apple (now) or Android app store (in 2 weeks time)
Choosing Wisely Australia

5 THINGS
CLINICIANS AND CONSUMERS SHOULD QUESTION

1. Don’t request imaging for acute ankle trauma unless indicated by the Ottawa Ankle Rules (localised bone tenderness or inability to weight bear as defined in the Rules).

Most clinically significant acute ankle injuries can be diagnosed with history, examination, and selective use of plain radiographs.

Extensive validation studies have shown that the Ottawa Ankle Rules can be safely applied to adult and paediatric populations.

Selective use of plain radiographs in patients with acute ankle injury is useful in identifying patients who have sustained clinically important fracture, dislocation, or osteochondral injuries. However, acute ligamentous injuries involving the anterior talofibular ligament can be diagnosed clinically, and treated symptomatically.

When there are persistent symptoms (such as pain and swelling) after an acute injury, which rule out bony instability or other internal derangements, such as osteochondral injuries, MRI can be used if the non-urgent or delayed elective or urgent weight bearing x-rays show no abnormalities.

2. Don’t request duplex compression ultrasound for suspected lower limb deep venous thrombosis in ambulatory outpatients unless the Wells Score (deep venous thrombosis risk assessment score) is greater than 2, OR if less than 2, D dimer assay is positive.

The potential complications of untreated deep venous thrombosis (DVT) include thrombus propagation, pulmonary embolism (PE) and death from PE. A significant but under-appreciated long-term complication is post-thrombotic syndrome (PTS) and this can occur in up to 40% of patients with proximal DVT, as a result of venous incompetence and repairs.

Wells et al (2003) showed that ambulatory outpatients with suspected lower limb DVT and a DVT risk assessment score (Wells Score) of less than 2, can have DVT excluded by a negative result on D dimer assay, obviating the need to perform duplex compression ultrasound. The lower limit of the negative predictive value of the combination of a score <2 and negative D dimer was found to be 95.7. The Wells Score has been extensively and externally validated since first publication.

The Royal Australian and New Zealand College of Radiologists®

RADIOLIGISTS IMPROVING QUALITY FOR MEDICAL IMAGING

The Royal Australian and New Zealand College of Radiologists is proud to be a founding partner of the Choosing Wisely campaign.

Choosing Wisely Australia® is a health profession-led initiative that aims to start a national conversation about more appropriate health care.

The College of Radiologists has today released a list of 6 items that clinicians and consumers should question:

1. Don’t request imaging for acute ankle trauma unless indicated by the Ottawa Ankle Rules (localised bone tenderness or inability to weight bear as defined in the Rules).

2. Don’t request duplex compression ultrasound for suspected lower limb deep venous thrombosis in ambulatory outpatients unless the Wells score (deep venous thrombosis risk assessment score) is greater than 2, OR if less than 2, D dimer assay is positive.

3. Don’t request any diagnostic testing for suspected pulmonary embolism (PE) unless indicated by Wells Score (or Charlotte Rule) followed by PE Rule-out Criteria (in patients not pregnant). Low risk patients in whom diagnostic testing is indicated should have PE excluded by a negative D dimer, not imaging.

4. Don’t perform imaging for patients with non-specific acute low back pain and no indicators of a serious cause for low back pain.

5. Don’t request imaging of the cervical spine in trauma patients, unless indicated by a validated clinical decision rule.

6. Don’t request computed tomography (CT) head scans in patients with a head injury, unless indicated by a validated clinical decision rule.
THANK YOU!

www.imagingpathways.health.wa.gov.au