
**Medicare Benefits Schedule Review
Taskforce**

**First Report from the Diagnostic
Imaging Clinical Committee - Low
Back Pain**

August 2016

Important note

The views and recommendations in this review report from the clinical committee have been released for the purpose of seeking the views of stakeholders.

This report does not constitute the final position on these items which is subject to:

△ Stakeholder feedback;

Then

△ Consideration by the MBS Review Taskforce;

Then *if endorsed*

△ Consideration by the Minister for Health; and

△ Government.

Stakeholders should provide comment on the recommendations via the [online consultation tool](#).

Confidentiality of comments:

If you want your feedback to remain confidential please mark it as such. It is important to be aware that confidential feedback may still be subject to access under freedom of information law.

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1. Executive Summary

The Medicare Benefits Schedule (MBS) Review Taskforce (the Taskforce) is undertaking a program of work that considers how more than 5,700 items on the MBS can be aligned with contemporary clinical evidence and practice and improves health outcomes for patients. The Taskforce will also seek to identify any services that may be unnecessary, outdated or potentially unsafe.

The Taskforce is committed to providing recommendations to the Minister that will allow the MBS to deliver on each of these four key goals:

- △ Affordable and universal access
- △ Best practice health services
- △ Value for the individual patient
- △ Value for the health system.

The Taskforce has endorsed a methodology whereby the necessary clinical review of MBS items is undertaken by Clinical Committees and Working Groups. The Taskforce has asked the Clinical Committees to undertake the following tasks:

1. Consider whether there are MBS items that are obsolete and should be removed from the MBS.
2. Consider identified priority reviews of selected MBS services.
3. Develop a program of work to consider the balance of MBS services within its remit and items assigned to the Committee.
4. Advise the Taskforce on relevant general MBS issues identified by the Committee in the course of its deliberations.

The recommendations from the Clinical Committees are released for stakeholder consultation. The Clinical Committees will consider feedback from stakeholders and then provide recommendations to the Taskforce in a Review Report. The Taskforce will consider the Review Report from Clinical Committees and stakeholder feedback before making recommendations to the Minister for consideration by Government.

In the 2011-12 Budget, the Australian Government committed to continue the systematic review of MBS items to ensure that they reflect contemporary evidence, improve health outcomes for patients and represent value for money under the Comprehensive Management Framework for the MBS. A rolling program of reviews of MBS funded services was commenced. These reviews shared many of the features of the current program of reviews being undertaken under the auspices of the MBS Review Taskforce.

In 2013 the department initiated a review of imaging for low back pain under the Medical Services Advisory Committee (MSAC)'s MBS Review process. As part of MSAC's MBS Review process, the department established the MBS Review Working Group for the MBS Review on Diagnostic Imaging for Low Back Pain (the Working Group). Following the finalisation of the final report of the low back pain review (Appendix B) the Working Group developed their key findings and recommendations.

With the inception of the MBS Review Taskforce as announced in the 2015-16 Budget, it was decided that any specific MBS reviews which had not concluded would be brought in under the work of the Taskforce and the relevant Clinical Committees. The MBS Review of Imaging for Low Back Pain was one such review.

The Diagnostic Imaging Clinical Committee (the Committee) was established in 2015 to undertake a review of relevant MBS items. The review was referred to the Taskforce, and allocated to the Committee for consideration.

1.1 Background to the MBS Review of Imaging for Low Back Pain (2013)

In 2013 the Department of Health initiated a review of imaging for low back pain under the Medical Services Advisory Committee (MSAC)'s MBS Review process. Evidence indicated that routine imaging of the lower back is not associated with clinically meaningful benefits and can lead to harm. Most presentations of low back pain do not require diagnostic imaging as the result of any imaging is unlikely to change clinical management.

The review evaluated the available evidence to inform assessment of the existing MBS items for imaging of low back pain, to consider whether the items reflect contemporary evidence, improve health outcomes for patients, and represent value for money. The focus of the review was on imaging for low back pain requested by primary care practitioners. Nuclear medicine services were considered to be out-of-scope of the review as, while these services are used in the diagnosis of low back conditions, they have a limited role in the initial investigation of low back pain.

As part of MSAC's MBS Review process, the department established a Review Working Group. The Review Working Group comprised nominated experts to provide clinical input and ensure the review reflects current Australian practice.

Following the finalisation of the final report of the low back pain review (Appendix B) the Review Working Group developed their key finding and recommendation. In 2015 the MBS Review Taskforce was established to consider how the items on the MBS can be aligned with contemporary clinical evidence and practice and improve health outcomes for all patients. The review was referred to the MBS Review Taskforce, and allocated to the Diagnostic Imaging Clinical Committee for consideration.

1.2 Areas of responsibility of the Diagnostic Imaging Clinical Committee

The following 45 MBS items were identified for review by the Imaging for Low Back Pain Working Group. A full list of items and descriptions are listed in Appendix C.

△ Diagnostic Imaging Services (Category 5)

- Group I3 – **Diagnostic Radiology**, Subgroup 4 – **Radiographic Examination of Spine** (12 items)
 - 58106, 58108, 58109, 58111, 58112, 58114, 58115, 58117, 58120, 58121, 58123, 58126
- Group I3 – **Diagnostic Radiology**, Subgroup 12 – **Radiographic examination with opaque or contrast media** (4 items)

- 59700, 59701, 59724, 59725
- Group I2 – **Computed Tomography** (5 items)
 - 56223, 56226, 56229, 56232, 56233
- Group I5 – **Magnetic Resonance Imaging** (24 items)
 - 63151, 63154, 63157, 63158, 63164, 63167, 63176, 63179, 63187, 63188, 63191, 63192, 63201, 63204, 63207, 63208, 63222, 63225, 63234, 63237, 63258, 63259, 63262, 63263

1.3 Recommendations

The Committee broadly agreed with the key recommendations of the Working Group, subject to a number of amendments. Below are the Working Group key recommendations followed by the Committee recommendations.

RECOMMENDATION ONE *CONSIDER GP-REQUESTED MRI OF THE LUMBAR-SACRAL SPINE, FOR DEFINED INDICATIONS, WITH STRATEGIES FOR ENSURING APPROPRIATE REQUESTING BY CLINICIANS*

The working group recommended consideration of GP-requested MRI of the lumbar-sacral spine, for defined indications, with strategies for ensuring appropriate requesting by clinicians.

Allied health-requested MRI is not a recommendation of the Working Group of the MBS Review, but the Working Group acknowledged the chiropractor and physiotherapy members' concurrent proposal supporting chiropractor/physiotherapy-requested MRI of the lumbar-sacral spine.

The Committee endorsed the Working Group recommendation that MBS funding for GP-requested MRI of the lumbar-sacral spine, for defined indications should be considered, with strategies for ensuring appropriate requesting by clinicians.

The Committee did not support the chiropractor and physiotherapy members' concurrent proposal suggesting requesting for MRI of the lumbo-sacral spine be extended to allied health providers. The Committee recommended against expanding requesting for MRI to allied health providers.

RECOMMENDATION TWO *CONSIDER LIMITING CT REQUESTING FOR LOW BACK PAIN FOR GPs*

The Working Group recommended consideration of limiting CT requesting by GPs. In the event of a GP-requested MBS item for MRI of the lumbar-sacral spine, CT should only be used to assess low back pain where MRI is unavailable or contraindicated.

The Committee endorsed the recommendation of the Working Group to consider limiting requesting by GPs, subject to a modification. The modification clarifies that CT should only be used for selective clinical indications, instead of only where MRI is unavailable or contraindicated. Further work will be required to describe and define these selective indications. For example, CT is inappropriate for non-specific low back pain, however CT is appropriate in some patients for post-operative imaging where it is needed to assess the positions of implanted devices and hardware.

The Committee recommend that in the event of a MBS item for GP-requested MRI of the lumbo-sacral spine, CT should only be used to assess low back pain where MRI is unavailable or contraindicated or where CT is superior e.g. acute trauma or assessing the positions of implanted devices and hardware.

RECOMMENDATION THREE *CONSIDER AMENDING ITEM DESCRIPTORS TO CLARIFY THE INDICATIONS FOR LOW BACK IMAGING FOR EACH MODALITY*

The Working Group recommended there be consideration of amending item descriptors to clarify the indications for low back imaging for each modality. In particular, plain x-rays of lower back could be limited to suspected fracture or inflammatory spondyloarthritis.

The Committee endorsed the recommendation of the Working Group to consider amending item descriptors to clarify the indications for low back imaging for each modality but noted a number of implementation issues which will need to be addressed, including clarifying indications for low back pain imaging for each modality. Therefore a comprehensive list of appropriate tests would need to be developed and it will be challenging to restrict the length of the list without excluding some appropriate tests.

The Committee did not agree with limiting of plain x-rays of the lower back to suspected fracture or inflammatory spondyloarthritis.

RECOMMENDATION FOUR *LIMIT USE OF MULTI-REGION RADIOGRAPHY OF THE SPINE AND, IN PARTICULAR, THREE OR FOUR REGION IMAGING ON THE SAME DAY.*

The Working Group recommended limiting the use of multi-region radiography of the spine and, in particular, three or four region imaging on the same day.

The Committee endorsed this recommendation of the Working Group but with some clarifications and explicit exclusions, as follows.

Limit use of multi-region radiography of the spine for patients with low back pain and, in particular, three or four region radiography (excluding trauma and scoliosis) on the same day.

In addition, the Committee made a specific recommendation to limit the use of three and four multi-region plain radiography of the spine requested by allied health practitioners.

The Committee considered two options to limit three and four multi-region radiography of the spine to:

- △ Option 1. requesting by medical practitioners; or
- △ Option 2. requesting by medical specialists.

These options are intended to address a finding of the Working Group that there is a significant volume of multi-region plain radiography of the spine requested in primary care by allied health practitioners and in particular chiropractors for both the three and four region studies.

The Committee noted three and four region studies have limited clinical utility and should be provided to a carefully selected cohort of patients who may benefit from these services; for example, the assessment of patients with scoliosis, which in most cases would be assessed by spinal specialists rather than primary care providers.

The Committee agreed that, as a first step, the requesting of these studies be limited to medical practitioners (option 1) and, if this does not diminish the volume of services, then requesting should be confined to medical specialists (option 2). Under both options, allied health practitioners will be unable to request multi-region spinal radiography studies.

Members noted the need to implement the regulatory amendments in a way to prevent 'work arounds' by some providers, such as requesting single level studies in combination.

1.4 Committee Endorsement of Other Recommendations from the Working Group

The Committee endorsed the following recommendations of the Working Group.

1. Ask the Department of Human Services to provide feedback to primary care practitioners about their volume of testing relative to their peers.
2. Request consideration of the need for education initiatives targeting clinicians regarding the appropriate use of imaging for low back pain, including continuing professional development courses for clinicians (referral to Royal Australian College of General Practitioners (RACGP), The Royal Australian and New Zealand College of Radiologists (RANZCR), the National Prescribing Service or the Commission on Safety and Quality in Health Care).
3. Request consideration of the need for community education initiatives to address patient expectations around diagnostic imaging for low back pain.
4. Request that RANZCR considers options for providing radiologist feedback to requesters regarding appropriate imaging for low back pain and, where applicable, placing imaging findings within the context of age-related changes.
5. Consider the development of tools to assist appropriate clinician requesting, including the development of clinical decision support that is linked to requesting.

1.5 CONSUMER ENGAGEMENT

The Committee did have a consumer representative. The Committee recommendations have been summarised for consumers in Appendix A. The summary describes the medical service, the recommendation of the clinical experts and why the recommendation has been made for all major changes and proposed new items.

Importantly however, the Committee believes it is important to find out from consumers if they will be helped or disadvantaged by the recommendations – and how, and why. Following the public consultation the Committee will assess the advice from consumers and decide whether any changes

are needed to the recommendations. The Committee will then send the recommendations to the MBS Taskforce. The Taskforce will consider the recommendations as well as the information provided by consumers in order to make sure that all the important concerns are addressed. The Taskforce will then provide the recommendation to government.

2. About the Medicare Benefits Schedule (MBS) Review

2.1 Medicare and the MBS

What is Medicare?

Medicare is Australia's universal health scheme which enables all Australian residents (and some overseas visitors) to have access to a wide range of health services and medicines at little or no cost.

Introduced in 1984, Medicare has three components, being free public hospital services for public patients, subsidised drugs covered by the Pharmaceutical Benefits Scheme, and subsidised health professional services listed on the Medicare Benefits Schedule (MBS).

What is the Medicare Benefits Schedule (MBS)?

The Medicare Benefits Schedule (MBS) is a listing of the health professional services subsidised by the Australian government. There are over 5,700 MBS items which provide benefits to patients for a comprehensive range of services including consultations, diagnostic tests and operations.

2.2 What is the MBS Review Taskforce?

The government has established a Medicare Review Taskforce to review all of the 5,700 MBS items to ensure they are aligned with contemporary clinical evidence and practice and improve health outcomes for patients.

What are the goals of the Taskforce?

The Taskforce is committed to providing recommendations to the Minister that will allow the MBS to deliver on each of these four key goals:

- △ **Affordable and universal access**— the evidence demonstrates that the MBS supports very good access to primary care services for most Australians, particularly in urban Australia. However, despite increases in the specialist workforce over the last decade, access to many specialist services remains problematic with some rural patients being particularly under-served.
- △ **Best practice health services**— one of the core objectives of the Review is to modernise the MBS, ensuring that individual items and their descriptors are consistent with contemporary best practice and the evidence base where possible. Although the Medical Services Advisory Committee (MSAC) plays a crucial role in thoroughly evaluating new services, the vast majority of existing MBS items pre-dates this process and has never been reviewed.
- △ **Value for the individual patient**—another core objective of the Review is to have a MBS that supports the delivery of services that are appropriate to the patient's needs, provide real clinical value and do not expose the patient to unnecessary risk or expense.
- △ **Value for the health system**—achieving the above elements of the vision will go a long way to achieving improved value for the health system overall. Reducing the volume of services that provide little or no clinical benefit will enable resources to be redirected to new and existing services that have proven benefit and are underused, particularly for patients who cannot readily access those services currently.

2.3 Methods: The Taskforce's approach

The Taskforce is reviewing the existing MBS items, with a primary focus on ensuring that individual items and usage meet the definition of best practice.

Within the Taskforce's brief there is considerable scope to review and advise on all aspects which would contribute to a modern, transparent and responsive system. This includes not only making recommendations about new items or services being added to the MBS, but also about a MBS structure that could better accommodate changing health service models.

The Taskforce has made a conscious decision to be ambitious in its approach and seize this unique opportunity to recommend changes to modernise the MBS on all levels, from the clinical detail of individual items, to administrative rules and mechanisms, to structural, whole-of-MBS issues.

The Taskforce will also develop a mechanism for the ongoing review of the MBS once the current Review is concluded.

As the Review is to be clinician-led, the Taskforce has decided that the detailed review of MBS items should be done by Clinical Committees. The Committees are broad based in their membership and members have been appointed in their individual capacity, not as representatives of any organisation. This draft report details the work done by the specific Clinical Committee and describes the Committee's recommendations and their rationale.

This report does not represent the final position of the Clinical Committee. A consultation process will inform recommendations of the Committee and assist it in finalising its report to the MBS review Taskforce.

Following consultation, the Clinical Committee will provide its final advice to the MBS Review Taskforce. The Taskforce will consider the Review Report from Clinical Committees and stakeholder feedback before making recommendations to the Minister for consideration by Government.

2.4 Prioritisation process

All MBS items will be reviewed during the course of the MBS Review. However, given the breadth of and timeframe for the Review, each Clinical Committee has needed to develop a work plan and assign priorities keeping in mind the objectives of the Review. With a focus on improving the clinical value of MBS services, the Clinical Committees have taken account of factors including the volume of services, service patterns and growth and variation in the per capita use of services, to prioritise their work. In addition to MBS data, important resources for the Taskforce and the Clinical Committees have included:

- △ The Choosing Wisely recommendations, both from Australian and internationally
- △ National Institute for Health and Care Excellence (NICE UK) Do Not Do recommendations and clinical guidance
- △ Other literature on low value care, including Elshaug et al's¹ Medical Journal of Australia article on potentially low value health services
- △ The Australian Commission on Safety and Quality in Health Care's (ACSQHC) Atlas of Healthcare Variation.

3. About the Low Back Pain Working Group.

The Low Back Pain Working Group was established by the Diagnostic Imaging Clinical Committee to make recommendations to the MBS Review Taskforce on the review of MBS items within its remit, based on rapid evidence review and clinical expertise.

3.1 Diagnostic Imaging Clinical Committee members

Table 1: Diagnostic Imaging Clinical Committee members

| Name | Position/Organisation |
|------------------------------------|---|
| Professor Ken Thomson (Chair) | Program Director, Radiology and Nuclear Medicine, Alfred Hospital |
| Professor Stacy Goergen | Director of Research, Monash Imaging; Clinical Adjunct Professor, Southern Clinical School, Monash University |
| Professor Alexander Pitman | Director of Nuclear Medicine and PET, Lake Imaging; Adjunct Professor, Medical Imaging, University of Notre Dame |
| Dr William Macdonald | Executive Director, Imaging West; Head, Nuclear Medicine, Fiona Stanley Hospital; President, Australasian Association of Nuclear Medicine Specialists |
| Dr Richard Ussher | Director of Training, Radiology, Ballarat Health Services; Director, Grampians BreastScreen |
| Dr Walid Jammal | Clinical Lecturer, Faculty of Medicine, University of Sydney; Conjoint Senior Lecturer, School of Medicine, University of Western Sydney; General Practitioner, Private practice |
| Associate Professor Rachael Moorin | Health Policy & Management, School of Public Health, Curtin University; Principal Researcher, Health Centre of Excellence, Silver Chain Group; Adjunct Associate Professor, University of Western Australia |
| Ms Geraldine Robertson | Consumer Representative |
| Professor Jenny Doust | Professor of Clinical Epidemiology, Centre for Research in Evidence Based Practice, Bond University and general practitioner |
| Dr David Brazier | Head of MRI Unit, Royal North Shore Hospital and examiner for RANZCR. |
| Dr Matthew Andrews | MBS Review Taskforce (Ex-Officio) |

3.2 Low Back Pain Imaging Working Group members

The MBS Review of Imaging for Low Back Pain commenced in 2013 and the Working Group comprised radiologists, GPs, other relevant medical specialists and allied health practitioners. The membership of the Working Group is below.

Table 2: Low Back Pain Imaging Working Group members

| Name | Position/Organisation |
|-------------------------------|--|
| Dr Walid Jammal* | Medical Services Advisory Committee |
| Professor Mark Khangure | Australian Medical Association |
| A/Professor Graeme Miller | Family Medicine Research Centre, University of Sydney |
| Professor Rachelle Buchbinder | Australian Rheumatology Association |
| Professor Stacy Goergen* | Royal Australian and New Zealand College of Radiologists |
| Professor Chris Maher | Australian Physiotherapy Association |
| Dr Robert Cooper | Australasian Association of Nuclear Medicine Specialists |
| Professor Michael Schutz | Protocol Advisory Sub Committee of the MSAC |
| Dr Michael Yelland | Royal Australian College of General Practitioners |
| Dr Craig Moore | Chiropractor's Association of Australia |
| Dr Ron Shnier | Australian Diagnostic Imaging Association |
| Dr Rob Kuru | Australian Orthopaedic Association |
| Professor Adrian Nowitzke | Neurosurgical Society of Australia |
| Dr Hayden Prime | Australian Diagnostic Imaging Association |
| Dr Kelly Macgroarty** | Australian Society of Orthopaedic Surgeons |
| Dr Marinis Pirpiris** | Australian Society of Orthopaedic Surgeons |
| Dr Chris Clohesy** | Australian Medical Association |

* These members are also members of the Diagnostic Imaging Clinical Committee

** These members did not participate in the final two meetings, where the key findings and recommendations were developed, but they did in the initial meetings which developed the scope and the protocol.

3.3 Conflicts of interest

All members of the Taskforce, Clinical Committees and Working Groups are asked to declare any conflicts of interest at the start of their involvement and reminded to update their declarations periodically.

3.4 Stakeholder engagement

Regular and open consultation is a critical element of the MBS Taskforce's clinician-led process. It will also inform ongoing monitoring and evaluation of the items in the future. A part of the work of the Taskforce will be making recommendations to Government on processes for ongoing review of the MBS to ensure that it remains consistent with clinical practice as it changes over time.

This report does not represent the final position of the Committee. Following this current consultation process, the Committee will consider stakeholder feedback and provide its final advice to the MBS Review Taskforce, which will in turn consider and make recommendations to the Minister for Health and the Government.

The Diagnostic Imaging Clinical Committee will make a series of recommendations to the Taskforce over the course of the MBS Review.

Targeted Consultation

The following medical colleges, craft groups, peak bodies, and consumer groups have been identified for targeted consultation:

- △ Allied Health Professions Australia
- △ Australasian Association of Nuclear Medicine Specialists
- △ Australasian College of Physical Scientists and Engineers in Medicine
- △ Australian Diagnostic Imaging Association
- △ Australian College of Rural and Remote Medicine
- △ Australian Institute of Radiography
- △ Australian and New Zealand Bone & Mineral Society
- △ Australian and New Zealand Society for Vascular Surgery
- △ Australian Medical Association
- △ The Australian Physiotherapy Association
- △ Australian Radiation Protection and Nuclear Safety Agency
- △ Australian Rheumatology Association
- △ Australian Society for Ultrasound in Medicine
- △ Australian Sonographers Association
- △ Chiropractors' Association of Australia
- △ Consumers Health Forum of Australia
- △ Diagnostic Imaging and Monitoring Association
- △ Endocrine Society of Australia
- △ Royal Australian and New Zealand College of Radiologists
- △ Royal Australasian College of Physicians
- △ Royal Australasian College of Surgeons
- △ Royal Australian College of General Practitioners
- △ Rural Doctors Association of Australia
- △ The Thoracic Society of Australia and New Zealand
- △ NSW Environment Protection Authority
- △ Radiation Health Unit, QLD Health
- △ SA Environment Protection Authority
- △ WA Radiological Council
- △ Radiation Safety, Victorian Department of Health & Human Services
- △ Radiation Safety, ACT Health
- △ Northern Territory Department of Health
- △ Radiation Protection Unit, Tasmanian Department of Health & Human Services.

4. MBS Review of Imaging for Low Back Pain (2013)

4.1 Background of the Review

In 2013 the Department of Health initiated a review of imaging for low back pain under the Medical Services Advisory Committee (MSAC)'s MBS Review process. Evidence indicated that routine imaging of the lower back is not associated with clinically meaningful benefits and can lead to harm. Most presentations of low back pain do not require diagnostic imaging as the result of any imaging is unlikely to change clinical management.

The review evaluated the available evidence to inform assessment of the existing MBS items for imaging of low back pain, to consider whether the items reflect contemporary evidence, improve health outcomes for patients, and represent value for money. The focus of the review was on imaging for low back pain requested by primary care practitioners. Nuclear medicine services were considered to be out-of-scope of the review as, while these services are used in the diagnosis of low back conditions, they have a limited role in the initial investigation of low back pain.

Following the finalisation of the final report of the low back pain review (Appendix B) the Review Working Group developed their key finding and recommendation. The review was referred to the MBS Review Taskforce, and allocated to the Diagnostic Imaging Clinical Committee for consideration.

4.2 Purpose of the Review

Concerns have been raised that some diagnostic imaging items on the MBS are used inappropriately in patients who present with low back pain. International Clinical Practice Guidelines (CPGs) are consistent in recommending that imaging for low back pain should be reserved for patients with suspected serious pathology, those with persisting pain or those with sciatica/radiculopathy who are being considered for spinal interventional therapy of any kind. For most people with low back pain without clinical signs and symptoms that are known to be associated with malignancy, cauda equina syndrome, fracture and spinal infection, imaging is unlikely to help identify the cause of pain, alter treatment or decrease recovery time.

A 2014 report, using the Bettering of Health and Evaluation of Health Care (BEACH) data, found that over the last 10 years, the GP imaging order rate for initial presentations of back problems is almost double the rate of overall GP imaging orders for back problems. The authors noted that “the high rate of imaging at initial encounter for back problems is inconsistent with all established guidelines for the management of back problems”.

However, it is not possible from this dataset to distinguish between patients who presented with a “new” problem of low back pain of short duration and who had no clinical signs and symptoms of significant pathology (in whom imaging maybe inappropriate) and patients who had had clinical signs and symptoms of significant pathology, or where the patient was first presenting with low back pain but symptoms had existed for some time (in whom imaging is more likely to be appropriate).

Furthermore, use of lumbar spine imaging may be associated with a number of harms, including exposure to radiation (in the case of x-ray and CT); exposure to iodinated contrast (in the case of CT);

risk of labelling patients with a diagnosis that is not the cause of the low back pain; incidental findings that have no clinical significance but trigger further investigation; increased risk of surgery and interventional procedure and unnecessary utilisation of resources and increased financial cost to the patient and healthcare system.

4.3 Focus of the Review

The focus of the low back pain imaging Review was restricted to primary care presentations for low back pain. Low back pain is the second most common clinical complaint leading people to seek care from general practice in Australia with over 90% of patients presenting in primary care with low back pain being classified as having non-specific low back pain, with no identifiable cause. However, low back pain is occasionally the presenting symptom of an underlying serious pathology that requires urgent imaging, such as malignancy or infection. These causes account for approximately 1% of acute back pain presentations in primary care. Other causes of back pain, such as sciatica, spinal stenosis and inflammatory causes may require imaging after an initial trial of conservative management.

GPs are eligible to request MBS services relating to low back imaging using radiography, computed tomography (CT) and nuclear medicine. Allied health practitioners (such as chiropractors, osteopaths and physiotherapists) are eligible to request a selection of radiography items, but cannot request CT or nuclear medicine. Magnetic resonance imaging (MRI) services on the MBS are generally restricted to requests from medical specialists (excluding GPs) or consultant physicians. GPs are only able to request MRI for a small subset of specific indications, including:

- △ MRI of the spine for a patient under 16 years of age, following radiographic examination, for unexplained back pain where significant pathology is suspected; and
- △ MRI of the spine for a patient 16 years or older for suspected cervical radiculopathy or cervical spine trauma.

Allied health practitioners are currently not eligible to request CT or MRI items relating to the lower back.

Nuclear medicine services were considered to be out-of-scope for the Review as, while these services are used in the diagnosis of lower back conditions, they have a limited role in the initial investigation of low back pain.

HealthConsult, a health technology assessment group, was commissioned to undertake an evidence review which comprised a review of national and international clinical guidelines; a systematic review of the clinical evidence; a secondary data analysis; and a systematic review of the economic evidence. HealthConsult's report is at Appendix B.

4.4 Review Methodology

The Review methodology comprised the following components: consulting with key stakeholders; developing a review protocol, which outlined the detailed review methodology (including specifying the key clinical/research questions for the systematic review, preparing the clinical flowcharts);

analysing secondary data sources (Medicare Australia and the BEACH Program); an analysis of guideline concordance; conducting a systematic literature review for diagnostic and economic evidence; and undertaking an assessment and analysis of the evidence to draw conclusions in relation to the clinical/research questions.

The scope of the Review was restricted to imaging for low back pain in adults using radiography, CT or MRI. Appendix C provides a list of the MBS items that were in scope for the review. These items are for imaging of the low back region, but are not exclusively used in patients that present with low back pain.

5. Low Back Pain

5.1 What is low back pain?

Low back pain refers to pain and discomfort affecting the lumbar and/or sacral regions of the spine. Depending on its duration, low back pain can either be acute (pain lasting for no longer than six weeks), subacute (six to 12 weeks) or chronic (pain lasting for more than 12 weeks).^{2,3}

CPGs endorse a simple triage approach where patients presenting with low back pain are classified into one of three categories using patient history and physical examination:⁴

- △ Low back pain associated with sciatica or spinal canal stenosis (narrowing)
- △ Serious spinal pathology (malignancy, cauda equina syndrome, fracture, spinal infection, spondyloarthritis)
- △ Non-specific low back pain.

Approximately 90% of low back pain cases fall into the latter category where the patho-anatomical source of the pain is not specified.^{1,2} The recommended treatment for acute non-specific low back pain is advice and provision of analgesics. The advice focuses on providing patients with an explanation of the problem, advising on self-management, and encouraging them to carry on with normal daily activities. Most people experience rapid improvement in pain and function within one month, with further improvement for up to three months, although recurrences are common.

The lifetime prevalence of low back pain has been estimated to be 79.2% in Australian adults⁵ and 84% in adolescents⁶, with about one in 10 people experiencing significant activity limitation.⁵ The prevalence of back pain has increased over successive national surveys. In the most recent (2011-12) National Health Survey from the Australian Bureau of Statistics (ABS), it was estimated that approximately 2.8 million Australians have back pain and disc disorders, representing 12.4% of the population.⁷

Serious spinal pathology

A small proportion of patients present with low back pain as the initial manifestation of a more serious pathology, such as malignancy, cauda equina syndrome, fracture, spinal infection or spondyloarthritis. The low prevalence of these serious pathologies (approximately 1% in the primary care setting)⁸ does not justify routine testing of patients presenting with low back pain, and clinicians instead rely on screening tools to aid clinical decisions about when to refer patients for further testing.⁹

Many CPGs for back pain recommend awareness of 'red flags' to help identify patients with a higher likelihood of serious pathology who may then become candidates for more extensive diagnostic investigations.⁹ Suggested 'red flags' include significant trauma, unexplained weight loss, unexplained fever, recent infection, history of malignancy, immune suppression, long term glucocorticoid use, suspicion of ankylosing spondylitis (AS) or other inflammatory conditions, neurological defects, or age >70 years. However, the use of 'red flags' as a screening tool is controversial as different guidelines endorse different sets of red flags. Furthermore, some

commonly accepted 'red flags' have been shown to have high false positive rates, rendering them poorly specific for the identification of serious spinal disorders as a large proportion of patients would be imaged unnecessarily.⁸ In this Australian cohort of patients presenting to primary care with low back pain, over 80% of patients had at least one red flag for serious pathology.

5.2 Low back pain imaging

Appropriate use of low back imaging

International CPGs are consistent in recommending that diagnostic investigations should be reserved for patients with suspected serious pathology or those with radiculopathy who are being considered for spinal interventional therapy of any kind. For most people with low back pain without clinical signs and symptoms that are known to be associated with malignancy, cauda equina syndrome, fracture and spinal infection, imaging is unlikely to help identify the cause of pain, alter treatment decisions or decrease recovery time.¹⁰ Substantial improvement in pain and function generally occurs in the first four weeks in most patients with acute low back pain, with or without radiculopathy, regardless of whether and how patients are treated.¹¹ Furthermore, inappropriate use of lumbar spine imaging may be associated with a number of direct harms, such as radiation exposure, and downstream harms, such as unnecessary surgery and interventional procedures.

Despite this, studies suggest that some clinicians continue to request low back imaging routinely or without a clear indication, perhaps to reassure their patients or themselves, to meet patient expectations regarding diagnostic tests, or to try to identify a specific anatomical diagnosis for the low back pain.¹² Data from the BEACH program have shown that approximately 15% of all GP presentations in Australia for an initial consultation for back symptoms or complaints lead to lumbar or lumbosacral imaging. This trend has remained fairly consistent over the past decade, although there has been a marginal decrease in GP referrals for plain radiography and a small increase in computed tomography (CT) scans and magnetic resonance imaging (MRI).¹³

Incidental findings that have no clinical significance but trigger further investigation

Imaging findings from plain x-rays and advanced imaging studies are not strongly associated with acute low back pain symptoms.^{10,14} For 95 per cent of primary care presentations, x-rays for non-specific low back pain demonstrate no abnormality or minor degeneration.¹⁵ The prevalence of degenerative changes seen in imaging studies in patients with back pain has been shown to be similar to the prevalence found in patients without back pain^{2,16}, indicating that many of these findings may actually be considered non-pathological or normal, age-related changes.¹⁷

Unnecessary utilisation of resources and increased financial costs

Unnecessary imaging can lead to unnecessary use of health care resources and increased financial costs to the patient and healthcare system. These costs are both direct and indirect, the latter due to waiting time in emergency departments, prolonged length of stay in a hospital, and time away from work and other responsibilities.¹⁸

Conditions relevant to low back pain

The frequency of conditions that require urgent identification, due to the potential for permanent neurologic sequelae with delayed diagnosis, is low. In patients with low back pain in primary care settings, approximately 0.7% have metastatic cancer, 0.01% have spinal infection, and 0.04% have cauda equina syndrome.^{19,20} Vertebral compression fractures and inflammatory back disease are more common (approximately 4% and <1%, respectively), but the diagnostic urgency for these conditions is not as great, because they are not generally associated with progressive or irreversible neurologic impairment. However, a large proportion of patients have signs and symptoms that make it difficult to distinguish between non-specific low back pain from significant disease.

Harms associated with low back imaging

Exposure to ionising radiation

Lumbar plain radiography and CT contributes to an individual's cumulative low-level radiation exposure.²¹ This is particularly important in babies, children, and adolescents who are more sensitive to the carcinogenic effects of exposure to ionising radiation. However, low back radiation exposure is also of particular concern for women of child-bearing age because of the proximity of the low back to the gonads, which are difficult to effectively shield.²²

The average effective radiation dose from lumbar plain radiography (1.3 millisieverts (mSv)) is 65 times higher than from chest radiography (0.02 mSv), but approximately 2.5 times lower than from lumbar spine CT (3.3 mSv).²³ MRI does not use ionising radiation.

Exposure to iodinated contrast

Lumbar CT may involve use of iodinated contrast, which is associated with nephropathy and hypersensitivity reactions.^{18,24} It should be noted, that the MBS data shows that less than 0.6% of all CT scans of the lumbosacral region use intravenous contrast medium.

Gadolinium-based contrast agents (GBCA) are sometimes used with MRI scans to improve visibility.²⁵ According to expert clinical advice, GBCA are rarely used for imaging for low back pain. GBCA are generally acknowledged to be safe; however, it is recommended that they should not be administered to patients with either acute or significant chronic kidney disease due to the potential risk of nephrogenic systemic fibrosis.^{26,27} Furthermore, the U.S. Food and Drug Administration (FDA) is currently investigating the risk of brain deposits following repeated use of GBCA. It is unknown whether these gadolinium deposits are harmful or can lead to adverse health effects, but the FDA has recommended that health care professionals should consider limiting GBCA to clinical circumstances in which the additional information provided by the contrast is necessary.²⁸

Increased risk of surgery and interventional procedures

Lumbar spine imaging can lead to additional tests, follow-up, and referrals, and may sometimes result in invasive procedures, such as surgery. Although the increased number of unnecessary operations that occur from unneeded imaging tests is difficult to estimate, strong associations have been shown between rates of spinal MRI and rates of spinal surgery and other interventional

procedures.^{29,30} Patients who undergo imaging may be subjected prematurely to surgery that has limited or questionable benefit but exposes them to potentially serious complications.^{12,17}

Risk of labelling patients with a diagnosis that is not the cause of pain

Spine imaging could result in unintended harms from labelling effects, which occur when patients are told that they have a condition or an imaging ‘abnormality’ that they were not previously aware of and which has minimal prognostic significance.³¹ Knowledge of clinically irrelevant imaging findings might hinder recovery and result in chronic low back pain by causing patients to worry more, focus excessively on minor back symptoms, or avoid exercise and other recommended activities because of fears that they could cause more structural damage.³²

5.3 Current MBS arrangement for imaging services

The focus of the MBS review was restricted to primary care presentations for low back pain (to GPs and allied health practitioners). As shown in the below table, GPs are eligible to request MBS services relating to low back imaging using x-ray, CT and nuclear medicine. Other primary care health providers (such as chiropractors, osteopaths and physiotherapists) are eligible to request some, but not all, x-ray imaging services.

MRI services on the MBS are generally restricted to requests from recognised specialists (non-GP) or consultant physicians. GPs are currently not eligible to request MRI items relating to the lower back of adults but can request MRI of the spine for patients under 16 years following radiographic examination. However, GPs are eligible to request MRI of the head, cervical spine and knee for specified clinical indications in people aged 16 years and over. The RACGP has developed clinical guidance³³ for MRI referral that emphasises the importance of clinical history and physical examination to guide appropriate use of MRI.

Table 3: Summary of eligible providers for requesting low back imaging services on the MBS

| Provider group | X-ray | CT | Nuclear medicine imaging | MRI |
|---|--------------|-----------|---------------------------------|-----------------|
| General practitioners | Yes | Yes | Yes | No ^b |
| Other primary health providers ^a | Yes | No | No | No |
| Specialists and consultant physicians | Yes | Yes | Yes | Yes |

Abbreviations: CT, computed tomography; MBS, Medicare Benefits Schedule; MRI, magnetic resonance imaging.

a Includes chiropractors, osteopaths and physiotherapists. These providers are eligible to request only some of the x-ray imaging services available on the MBS.

b GPs are eligible to request MRI of the spine (MBS items 63510 and 63511) for patients under 16 years following radiographic examination.

5.4 The MBS items relevant to Imaging for Low Back Pain

There are numerous items listed on the [Diagnostic Imaging Services Table](#) of the MBS that relate to low back imaging and are within scope for the review (see Appendix C for the complete list). The below table presents the CT and radiographic imaging MBS item numbers that can be requested by GPs. Other primary health providers (chiropractors, osteopaths and physiotherapists) can only request five of the items shown in the table (58106, 58109, 58112, 58120 and 58121).

The listed MBS items are for imaging of the low back region, but are not exclusively used in patients that present with low back pain. Some of the MBS items for radiographic examination include imaging for the low back as well as other regions of the spine, such as the cervical (neck), thoracic, and sacrococcygeal regions.

Table 4: MBS item numbers relating to low back CT and radiography

| Type of imaging | MBS item Number |
|---------------------|--|
| Computed tomography | 56223, 56226, 56229, 56232, 56233 |
| Radiography | 58106, 58108, 58109, 58111, 58112, 58114, 58115, 58117, 58120, 58121, 58123, 58126, 59700, 59701, 59724, 59725 |

Source: MBS Online, accessed 16 May 2014

Note: Other primary health providers (chiropractors, osteopaths and physiotherapists) can only request items 58106, 58109, 58112, 58120 and 58121 (see Explanatory Notes shown in Appendix C).

The following table presents MBS items relating to MRI of the low back, categorised according to clinical indication.

Table 5: MBS item numbers relating to low back MRI

| Clinical indication | MBS item numbers |
|--------------------------|----------------------------|
| Spinal infection | 63151, 63157, 63201, 63207 |
| Spinal malignancy/tumour | 63154, 63158, 63204, 63208 |
| Cauda equina | 63164, 63187, 63222, 63258 |
| Sciatica | 63176, 63191, 63234, 63262 |
| Spinal canal stenosis | 63179, 63192, 63237, 63263 |
| Myelopathy | 63167, 63188, 63225, 63259 |

Source: MBS Online, accessed 16 May 2014

5.5 MBS items considered out of scope for the review

GPs are eligible to request MRI of the spine for patients under 16 years following radiographic examination (MBS items 63510 and 63511). The MBS review focused on imaging for low back pain in adults and therefore these MBS items are out of scope. Although nuclear medicine services are used in the diagnosis of low back conditions, these services have a limited role in investigating back pain and the items are not specific to back pain. For this reason, and because these services are more commonly initiated by specialists (and after other imaging), they are out of scope for the review.

5.6 The Clinical Decision Pathway

Recent guidance from the RANZCR recommends that patients presenting to primary care with low back pain are classified according to a diagnostic triage, using a combination of patient history and physical examination, with or without biochemical testing and neurological examination.³⁴ The three diagnostic categories are: (i) low back pain associated with sciatica or spinal canal stenosis, (ii) serious spinal pathology (malignancy, cauda equina syndrome, fracture, spinal infection, spondyloarthritis), and (iii) non-specific low back pain.

In the absence of a specific cause for the low back pain, and if there are no signs or symptoms of a serious pathology in the patient history or on physical examination, conservative care with patient education is the first step in pain management. Conservative care may include information about low back pain, reinforcement of positive expectations, education about self-management and self-responsibility, pain management and control, and increase in exercise tolerance.³⁵ In the absence of radicular pain, non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants and manipulation may be considered.³⁶ Routine imaging and bed rest are discouraged. Patients with severe non-specific low back pain that has persisted for more than 6-12 weeks, may be referred to allied health practitioners or specialists.³⁷ After clinical reassessment, work-up (including imaging) may be considered.

In patients with radiculopathy syndrome, spinal canal narrowing, or with suspected ankylosing spondylitis, imaging may be deferred until after a trial of conservative management. In cases where the condition persists after conservative management, further investigations may be conducted or the patient referred to an appropriate specialist.

Clinical guidance recommends that low back imaging should only be requested in the presence of severe or progressive neurological deficits or the presence of suspected serious spinal pathologies.^{12,35} Patients with suspected osteoporotic or non-osteoporotic fractures of the spine require plain radiography only, which can be requested and managed, in some cases, in the primary care setting. In the case of suspected serious spinal pathology such as malignancy or infection, it is appropriate for GPs to conduct initial work-up prior to specialist referral. In patients suspected of skeletal metastases, plain radiography may be sufficient for diagnosis. If a serious spinal pathology is confirmed by the GP or cannot be excluded after initial work-up, the patient should be referred to a specialist for further investigation and management. If there are risk factors for, or signs of, cauda equina syndrome, emergency referral or hospital admission is recommended as treatment often involves emergency surgical decompression. Diagnosis of the cause for cauda equina syndrome is usually confirmed by an MRI or CT scan, depending on availability.

A frequent motivation for obtaining imaging in the primary care setting is to exclude an underlying serious pathology, such as malignancy, as the cause of low back pain. Although MRI is recommended as the modality of choice for a range of conditions including suspected bone marrow pathology, cauda equina syndrome, spinal cord compression, epidural abscess, paraspinal masses, infective processes, disc herniation, nerve root, thecal sac and spinal cord pathology, GPs and allied health practitioners are ineligible to request MRI of the low back under the MBS and may be using other imaging modalities that do not reflect 'best practice' for patient work-up prior to specialist referral. Alternatively, some patients may themselves be covering the cost of non-rebatable MRI services requested by GPs, particularly if there are long waiting lists to see a specialist.

6. MBS Data for Low Back Pain Imaging

As noted previously, the items in scope for the review of imaging for low back pain apply to imaging of the low back region but are not exclusively used for low back imaging. For example, x-ray item 58112 specifies two of a possible four examinations of the spine, two of which are not low back (MBS items 58110 and 58103).

Importantly, with the exception of MRI, the item descriptors do not specify an indication for imaging. As a consequence, none of the in-scope items are used exclusively for patients who present with low back pain. It is therefore not possible to determine the extent of the use of the in-scope items for assessment of low back pain, the appropriateness of requests for these items, or the associated cost to the MBS of imaging for low back pain. As such, the analysis focuses on trends in services for imaging of the low back region but does not provide detail on benefits paid.

6.1 Plain radiography

Table 6 shows the total services for all included x-ray items from 2009-10 to 2013-14. Seven of these items are specifically for services provided on equipment that is 10 years old or older. According to the Explanatory Notes relating to requests for diagnostic imaging, physiotherapists, chiropractors and osteopaths may request MBS items 58106, 58109, 58112, and are the only specialty type to which MBS items 58120 and 58121 apply.

Nine of the 16 included x-ray items started on the MBS during the five-year period investigated in this Review; 2009-10 to 2013-14. Seven MBS items (58111, 58114, 58117, 58123, 58126, 59701, 59725) started on 1 July 2011, and very low numbers of services were provided in the following years. These items will not be discussed further in this Review.

The other two items, 58120 and 58121, both started on the MBS on 1 January 2010, specifically for use by allied health practitioners (physiotherapists, chiropractors and osteopaths). MBS item 58120 is for imaging of four regions of the spine. It is identical to item 58108 but with the additional specification that the service must not have been provided on the same patient within the same calendar year. From 2009-10 to 2010-11, services for item 58120 increased by 7,521 while services for item 58108 decreased by 6,105, suggesting that use by allied health practitioners shifted from item 58108 to item 58120 over this period. Although services for items 58120 and 58121 appear to double from 2009-10 to 2010-11, this is an artefact of having only 6 months of data for these items by June 2010 (these items were introduced on the MBS on 1 January 2010). The rate of requests for items 58120 and 58121 did not substantially change from 2009-10 to 2010-11.

Similarly, MBS items 58121 and 58115 are identical (imaging of three regions of the spine), except that item 58121 must not be provided on the same patient within the same calendar year and can only be used by allied health practitioners. From 2009-10 to 2010-11, the number of services for 58115 decreased by 103,863 while the number of services for item 58121 grew by a similar magnitude (90,417).²² Therefore, it would appear that a large proportion of services for item 58115 were replaced by services for item 58121. Due to these rapid changes in total services for these MBS items from 2009-10 to 2010-11, growth to 2013-14 is shown in Table 6 for both the five-year period

from 2009-10 (five-year growth) and the four-year period from 2010-11 (four-year growth). Subsequent reporting of service growth for x-ray items is restricted in this Review to four-year growth.

Three x-ray items constituted at least 90% of the total of all included x-ray services from 2010-11 onwards: 58106 (lumbosacral), 58112 (two examinations of the spine) and 58121 (three examinations of the spine). Analysis of the profile of service use for low back x-ray items largely focuses on these three items (main x-ray items).

Services for MBS item 58106 increased slightly from 2009-10 to 2010-11 but decreased over each of the subsequent years, by 1.2% from 2010-11 to 2013-14. Services for item 58112 increased slightly over the first three years and decreased over the following two years, resulting in 1% growth over 5 years. As item 58121 started on the MBS half way through the 2009-10 financial year, these data represent only 6 months of use. After slight growth from 2010-11 to 2011-12, services for this item subsequently fell, and by 2013-14 were 36% lower than in 2010-11. Overall, x-ray services for the main x-ray items fell by 9.5% from 2010-11 to 2013-14.

Table 1: Total services for included x-ray items, 2009-10 to 2013-14

| Item | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | % of total, 2013-14 ^a | 5-year growth ^b | 4-year growth ^c |
|--------------------------------------|----------------------------|----------------|----------------|----------------|----------------|----------------------------------|----------------------------|----------------------------|
| 58106 | 325,935 | 329,611 | 332,084 | 329,042 | 325,501 | 52.5% | -0.1% | -1.2% |
| 58108 | 8,331 | 2,226 | 2,390 | 2,942 | 2,677 | 0.4% | -67.9% | 20.3% |
| 58109 | 15,084 | 15,907 | 16,521 | 17,040 | 17,849 | 2.9% | 18.3% | 12.2% |
| 58111 ^{d,e} | Not applicable | Not applicable | 396 | 217 | 116 | 0.0% | Not applicable | Not applicable |
| 58112 | 129,625 | 130,605 | 134,371 | 132,716 | 131,920 | 21.3% | 1.8% | 1.0% |
| 58114 ^{d,e} | Not applicable | Not applicable | 6 | 11 | 19 | 0.0% | Not applicable | Not applicable |
| 58115 | 124,006 | 20,143 | 21,618 | 23,685 | 24,365 | 3.9% | -80.4% | 21.0% |
| 58117 ^{d,e} | Not applicable | Not applicable | 21 | 16 | 6 | 0.0% | Not applicable | Not applicable |
| 58120 ^d | 6,173 ^f | 13,694 | 14,918 | 15,421 | 15,439 | 2.5% | 150.1% | 12.7% |
| 58121 ^d | 65,944 ^f | 156,361 | 160,142 | 140,985 | 100,292 | 16.2% | 52.1% | -35.9% |
| 58123 ^{d,e} | Not applicable | Not applicable | 218 | 186 | 73 | 0.0% | Not applicable | Not applicable |
| 58126 ^{d,e} | Not applicable | Not applicable | 4 | 18 | 1 | 0.0% | Not applicable | Not applicable |
| 59700 | 2,058 | 1,707 | 1,594 | 1,486 | 1,540 | 0.2% | -25.2% | -9.8% |
| 59701 ^{d,e} | Not applicable | Not applicable | 2 | 1 | 0 | 0.0% | Not applicable | Not applicable |
| 59724 | 610 | 517 | 494 | 446 | 439 | 0.1% | -28.0% | -15.1% |
| 59725 ^{d,e} | Not applicable | Not applicable | 1 | 0 | 0 | 0.0% | Not applicable | Not applicable |
| Total | 677,766 | 670,771 | 684,780 | 664,212 | 620,237 | 100% | -8.5% | -7.5% |
| Total for 3 main items (bold) | 521,504 | 616,577 | 626,597 | 602,743 | 557,713 | 89.9% | 6.9% | -9.5% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Note: Analysis of the profile of service use for low back x-ray items largely focuses on the main three items shown in bold.

Allied health practitioners (physiotherapists, chiropractors and osteopaths) may request items 58106, 58109, 58112, 58120 and 58121. Items 58120 and 58121 apply only to allied health practitioners.

a Proportion of total services for all included items.

b 5-year growth refers to growth from 2009-10 to 2013-14.

c 4-year growth refers to growth from 2010-11 to 2013-14.

d Item start date is within 5-year investigation period (2009-10 to 2013-14). See Appendix C for start dates.

e Item is specifically for services provided on equipment that is 10 years old or older.

f Data shown are for the second 6 months of the financial year.

Due to changes in the repertoire of relevant MBS items in 2009-10, growth data for x-ray services is reported from 2010-11 to 2013-14. Services for the three main x-ray items fell by 9.5% over this period, driven by a 35.9% fall in services for the allied health-specific item 58121. For x-ray services

provided with MBS items 58108 and 58112 (all three specialty groups), no change was observed from 2010-11 to 2013-14 in total number of services (overall 0.2% decrease).

6.2 Computed Tomography

The following table shows the total services from 2009-10 to 2013-14 for all included CT items (all of which started on the MBS prior to 2009-10). When these services are provided on equipment that is 10 years old or older, items 56229 and 56232 apply instead, and these items are infrequently used. MBS items 56226 and 56232 specify the use of contrast medium and make up only a small proportion of all low back CT services. MBS item 56233 is used for examination of two of three possible regions: cervical, thoracic or lumbar spine (i.e. may include investigations that exclude low back).

In 2013-14, two MBS items (56223 and 56233) accounted for 99.4% of all services for the included CT items. As 92.3% of all services are accounted for by a single item (56223; lumbosacral region, without intravenous contrast medium), it was designated as the main CT item, and CT service profile trends will focus on this item only.

After an initial fall of around 8% from 2009-10 to 2010-11, the number of CT services with this item grew by 27.4% from 2010-11 to 2013-14. Of note, the decrease in use of CT in 2009-10 occurred across all CT items and corresponds with the release of a Professional Services Review (PSR) report expressing concern about appropriate requesting of CT services. The report led to a period of intense media focus on the risks of radiation, which appeared to change some clinical behaviour at the time.

Table 7: Total services for included CT, 2009-10 to 2013-14

| Item | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | % of total, 2013-14 ^a | 5-year growth ^b | 4-year growth ^c |
|--------------------|----------------|----------------|----------------|----------------|----------------|----------------------------------|----------------------------|----------------------------|
| 56223 | 267,028 | 246,258 | 277,928 | 297,930 | 313,846 | 92.3% | 17.5% | 27.4% |
| 56226 | 1,340 | 1,341 | 1,648 | 1,755 | 1,651 | 0.5% | 23.2% | 23.1% |
| 56229 ^d | 63 | 172 | 138 | 106 | 187 | 0.1% | 196.8% | 8.7% |
| 56232 ^d | 2 | 1 | 5 | 3 | 4 | 0.0% | 100.0% | 300.0% |
| 56233 | 19,377 | 17,255 | 19,892 | 22,725 | 24,259 | 7.1% | 25.2% | 40.6% |
| Total | 287,810 | 265,027 | 299,611 | 322,519 | 339,947 | 100% | 18.1% | 28.3% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Note: Analysis of the profile of service use for low back CT items largely focuses on the main item shown in bold.

^a Proportion of total services for all included items.

^b 5-year growth refers to growth from 2009-10 to 2013-14.

^c 4-year growth refers to growth from 2010-11 to 2013-14.

^d Item is specifically for services provided on equipment that is 10 years old or older.

The majority of low back CT imaging is undertaken using item 56223, which has shown substantial growth in recent years. When low back CT is indicated, CT without contrast is preferred over CT with contrast (MBS items 56226 and 56232). Requests for two CT examinations (MBS item 56233), some of which may not include lumbar imaging, represents less than 10% of all low back CT services.

6.3 Magnetic Resonance Imaging

The 24 included MRI items include the 12 shown in Table 8 and another 12 that are specifically for services provided on equipment that is 10 years old or older. These other 12 items were introduced

onto the MBS on 1 July 2011 but each has since been used no more than six times per year. Therefore, they have been excluded from this table.

The MBS item descriptor for MRI specifies the indication for imaging, not the region of the spine to be imaged, and total item services are shown grouped by these specified indications. There are two items for each indication, and these services differ in the breadth of region imaged; within each indication, items listed first (lower item numbers) image a more restricted area (one region or two contiguous regions) while those listed second (higher item numbers) image a broader region of the spine (three contiguous regions or two non-contiguous regions).

Overall, services for all included MRI items increased by 25% over the 5 years from 2009-10 to 2013-14. Some MBS items showed much higher growth: 63151 (infection), 63222 (cauda equina), 63234 (sciatica), 63237 (spinal stenosis) all grew by over 40% over this period. However, none of these accounted for more than 3.3% of total included MRI services in 2013-14. Services for some items decreased in the first year of this period, but by very small proportions, and all items resumed growth over all or most subsequent years.

Five MRI items each constituted at least 5% of services for all included MRI items in 2013-14. Two items are for investigation of malignancy/tumour (63154 and 63204), and one item for each of sciatica (63176), spinal canal stenosis (63179) and myelopathy (63167). Analysis of the profile of service use largely focuses on these five items, which together constitute 85% of all included MRI services in 2013-14.

For sciatica, spinal stenosis and myelopathy, the included MBS item is for the service that images a more restricted region of the back (one region or two contiguous regions) while for tumour, both items are included (see Appendix C for item descriptors). In terms of number of services, sciatica is the most common indication for spinal MRI (48.1%) while spinal canal stenosis is the next most common indication (16.9%).

No items for infection or cauda equina are included in the main MRI item group; these indications make up only 3.9% and 2.8%, respectively, of total services for all included MRI items.

Table 8: Total services for included MRI items, 2009-10 to 2013-14

| Indication | Item | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | % of total, 2013-14 ^a | 5-year growth ^b | 4-year growth ^c |
|-----------------|--------------------|---------------|---------------|---------------|---------------|---------------|----------------------------------|----------------------------|----------------------------|
| Infection | 63151 | 2,064 | 2,059 | 2,312 | 2,505 | 3,169 | 2.9% | 53.5% | 53.9% |
| | 63201 | 767 | 832 | 818 | 1,011 | 1,111 | 1.0% | 44.9% | 33.5% |
| Tumour | 63154 | 5,420 | 5,372 | 5,561 | 5,966 | 6,616 | 6.0% | 22.1% | 23.2% |
| | 63204 | 5,354 | 5,668 | 5,988 | 6,439 | 7,069 | 6.4% | 32.0% | 24.7% |
| Cauda equina | 63164 | 878 | 888 | 1,004 | 947 | 920 | 0.8% | 4.8% | 3.6% |
| | 63222 | 1,531 | 1,649 | 1,814 | 2,047 | 2,195 | 2.0% | 43.4% | 33.1% |
| Sciatica | 63176 | 42,999 | 45,317 | 48,278 | 50,940 | 53,103 | 48.1% | 23.5% | 17.2% |
| | 63234 | 1,614 | 1,947 | 2,302 | 2,497 | 2,341 | 2.1% | 45.0% | 20.2% |
| Spinal stenosis | 63179 | 15,207 | 14,568 | 16,392 | 17,031 | 18,611 | 16.9% | 22.4% | 27.8% |
| | 63237 | 2,618 | 2,690 | 2,835 | 3,110 | 3,696 | 3.3% | 41.2% | 37.4% |
| Myelopathy | 63167 | 7,006 | 7,247 | 7,961 | 8,163 | 8,438 | 7.6% | 20.4% | 16.4% |
| | 63225 | 2,745 | 2,509 | 2,996 | 3,038 | 3,119 | 2.8% | 13.6% | 24.3% |
| All | Total ^d | 88,203 | 90,746 | 98,271 | 103,714 | 110,395 | 100% | 25.2% | 21.7% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Note: Analysis of the profile of service use for spinal MRI items largely focuses on the main five items shown in bold.

^a Proportion of total services for all included items.

^b 5-year growth refers to growth from 2009-10 to 2013-14.

^c 4-year growth refers to growth from 2010-11 to 2013-14.

^d This total includes an additional 12 items not shown here for which six or fewer services were provided in any year, so totals may not add up exactly.

There has been constant growth in the number of MBS services for spinal MRI. While analysis of these MRI items is a useful indicator, it is not reflective of presentations for low back pain in a primary care setting, as primary care practitioners are unable to request MRI imaging for low back pain using these item numbers. Furthermore, from these data it is not possible to determine the proportion of MRI scans that are positive for serious conditions.

6.4 Imaging services by requesting specialty type

The following sections describe the MBS services for items related to low back x-ray, low back CT and spinal MRI by type of specialty group: allied health, GPs or specialists.³⁸

X-ray

Usage trends across specialty types for main x-ray items, 2013-14

Services for the main x-ray items (58106, 58112 and 58121) during 2013-14 are shown by specialty type in Table 9, along with the proportion of the total services for these main items that were requested by each of the specialisations. A total of 555,387 services were provided for these three items during this period, the majority of which were requested by GPs (61.0%), who most frequently request MBS item 58106 (lumbosacral spine x-ray), then MBS item 58112 (two examinations including lumbosacral and/or sacrococcygeal imaging). The use of low back x-ray imaging by specialists is far less common; they request only 11.2% of all main x-ray item services. However, when they do request low back x-ray imaging, like GPs they most frequently request items 58106 and 58112. Allied health practitioners request 27.8% of the main x-ray item services, but tend to use item 58121 more frequently than the other two main item or any of the other included items.

As noted earlier, MBS item 58121 applies only to use by allied health practitioners. It specifies three examinations, including lumbosacral and/or sacrococcygeal imaging, and stipulates that the imaging must not have been performed on the same patient within the same calendar year.

Table 9: Services for main x-ray items by speciality type, 2013-14

| Item number | GPs | Specialists | Allied health | Total services |
|-------------------------------------|----------------|---------------|----------------|----------------|
| 58106 | 245,779 | 43,267 | 35,524 | 324,570 |
| 58112 | 93,256 | 18,742 | 19,640 | 131,638 |
| 58121 | 0 | 8 | 99,171 | 99,179 |
| Total | 339,035 | 62,017 | 154,335 | 555,387 |
| % of total services for all 3 items | 61.0% | 11.2% | 27.8% | 100% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section.

Accessed 9 June 2015

Allied health requests for main x-ray items by specialty group

Physiotherapists, chiropractors and osteopaths may request x-ray items 58106, 58109, 58112, 58120 and 58121. Services for the main x-ray items requested by allied health practitioners during 2013-14 are shown by specialty group in the following table. A large majority of these services were chiropractor-requested (86.8%), and the remaining were requested by physiotherapists (9.9%) and osteopaths (3.3%).

Table 10: Allied health requested services for main x-ray items by speciality type, 2013-14

| Item number | Allied health total | Chiropractor | Osteopath | Physiotherapist | Item total |
|--------------------|---------------------|----------------|--------------|-----------------|----------------|
| 58106 | 35,524 | 21,572 | 3,257 | 10,695 | 35,524 |
| 58112 | 19,640 | 14,678 | 1,271 | 3,691 | 19,640 |
| 58121 | 99,171 | 97,772 | 516 | 883 | 99,171 |
| Total | 154,335 | 134,022 | 5,044 | 15,269 | 154,335 |
| % of allied health | 100% | 86.8% | 3.3% | 9.9% | Not applicable |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section.

Accessed 9 June 2015

7. Health Consult's Evidence Review Report

Health Consult was commissioned to conduct an evidence review to inform the Working Group. The evidence review examined data from Medicare Australia and the BEACH Program as well as undertaking an analysis of the CPGs and a systematic literature review. Health Consult's evidence review report contains a significant amount of data which is not replicated in this report.

7.1 Conclusions of the Evidence Review Report

CPGs generally recommend MRI in preference to CT and x-ray for investigation of patients who present with suspected spinal canal stenosis, suspected spinal malignancy, suspected spinal infection, or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy. CT is often recommended where MRI is contraindicated, not tolerated or not available. X-ray is recommended by CPGs in preference to MRI and CT for suspected cases of vertebral fracture or other bone-related pathology. X-ray is also often recommended in preference to MRI or CT for suspected inflammatory spondyloarthritis. However, if radiographs of the sacroiliac joints are normal or equivocal, MRI is acknowledged as the best imaging modality to identify inflammation.

In patients with suspected spinal canal stenosis, suspected inflammatory spondyloarthritis, or with signs and symptoms of sciatica/radiculopathy, CPGs recommend that imaging should be deferred until at least a 4 to 6 week trial of conservative management, unless neurologic deficits are progressive or severe enough to consider surgical intervention. Repeat MRI without significant clinical deterioration in symptoms and/or signs is not recommended.

Although the identified CPGs were evidence-based to some extent, the recommendations were often supplemented with consensus opinion due to the limited quantity and quality of evidence available. In particular, for those guidelines that preferentially recommended MRI over CT, there was no transparent link to the evidence to support this preference. However, some guidelines noted that MRI offers better visualisation of soft tissue, vertebral marrow, and the spinal canal, and a superior safety profile in terms of no ionising radiation.

While CPG recommendations may take into consideration the relative harms and benefits of each imaging modality, assessment of the comparative harms of the different imaging modalities was out of scope for the review of the clinical evidence undertaken for this MBS Review.

The systematic review did not reveal any clear benefit for MRI over CT in terms of diagnostic accuracy for patients presenting with low back pain and suspected spinal canal stenosis, spinal malignancy, spinal infection, or the signs/symptoms of sciatica/radiculopathy. The available evidence was limited in terms of quantity and quality, thus rendering it difficult to draw firm conclusions, particularly as high quality comparative studies are lacking. Importantly, there was no evidence identified for the diagnostic accuracy of imaging for suspected cauda equina syndrome or for suspected vertebral fracture in patients with low back pain.

The systematic review identified a small number of published economic analyses; however, this evidence does not allow a comparison of cost-effectiveness between imaging modalities in the population of interest for this review, or in the general low back pain population.

Although MRI is recommended in CPGs as the modality of choice for detection of a range of serious underlying pathologies, GPs are unable to refer a patient for a Medicare rebate eligible MRI of the lumbosacral spine for any indication. As a consequence, CT and x-ray may instead be used for patient work-up prior to specialist referral. The evidence indicates that the use of CT and x-ray are not inappropriate in terms of their diagnostic utility in patients with low back pain and suspicion of underlying serious pathology; however, they do have the added disadvantage of low-level radiation exposure.

The ability to robustly investigate whether current requesting of imaging services for low back pain is appropriate, and to determine the associated cost to the MBS of inappropriate low back pain imaging, is constrained because the MBS item descriptors are not limited specifically to low back pain, and information is not available on the purpose of the imaging request. Furthermore, neither the MBS data nor the BEACH data provide information about the duration of low back pain prior to presentation to a primary care provider. In cases where low back pain has persisted over a long period of time prior to the presentation or in the presence of red flag symptoms, the use of imaging is appropriate.

8. Key Findings and Recommendations of the MBS Review

The Working Group developed a protocol for the review including development of research questions that guided the evidence review that was undertaken by Health Consult *MBS Reviews Imaging for Low Back Pain Final Report, September 2015*. The Health Consult report is published alongside the Committee Report. Following are the key findings and recommendations from the Working Group.

8.1 MBS Review Imaging for Low Back Pain Working Group Key Findings

The Working Group considered the report and made key findings as follows:

1. Patients with recent onset non-specific low back pain do not need imaging

National and international guidelines consistently recommend against imaging for recent onset non-specific low back pain. In these cases, imaging is recommended only where serious underlying pathology is suspected.

2. Unnecessary imaging of the lower back is being requested by primary health care practitioners

Inappropriate imaging is indicated by a high level of multiple imaging, by wide variations in imaging by geographical region and by evidence from the BEACH study showing requests for imaging for more than 25% of general practice patients with initial presentations of low back pain.³⁹

3. While the published literature does not reveal a clear benefit for Magnetic Resonance Imaging (MRI) over computed tomography (CT) in terms of diagnostic accuracy for patients presenting with low back pain, expert consensus suggests that MRI offers better sensitivity and specificity and a superior safety profile

MRI is recommended by clinical guidelines as the modality of choice for investigation of a range of serious underlying pathologies

Improvements could be made in the selection of individual modalities for imaging of low back pain

General practitioners and allied health practitioners currently do not have access to an MBS item for MRI of the lower back. As a consequence, investigation may be deferred ahead of specialist consultation, or CT and x-ray used for patient work-up prior to specialist referral, contrary to clinical guideline recommendations.

4. Improvements could be made in the application of individual modalities for imaging of low back pain

Even where an appropriate modality is selected, its application is not always appropriate. For example, MBS data indicate a high level of three and four area x-rays of the back for the same patient on the same day, with these requests primarily being made by chiropractors. The Working Group could identify no clinical indication for x-ray of the whole back.

5. There are significant variations, by state and region, of requesting for individual modalities

These variations are likely to be due to a variety of reasons, including clinician referral patterns. The Australian Commission on Safety and Quality in Health Care has produced a draft report on clinical variation across a range of health services, including CT of the lumbar spine. Significant variations in requesting for CT of the lumbar spine were identified by geographical region, with the number of MBS-funded services across more than 320 local areas ranging from 209 to 2,464 per 100,000 people.

6. There was insufficient evidence to inform an economic analysis of the use of the available modalities in the primary care setting

The cost of unnecessary imaging could not be established from the available data, and there was insufficient evidence to inform the comparative costs of individual modalities. The Working Group noted evidence from one study that the use of MRI changed patient management in 50% of cases, enabling surgery to be avoided.

8.2 Recommendations of the Working Group

Key recommendations

1. Consider GP-requested MRI of the lumbar-sacral spine, for defined indications, with strategies for ensuring appropriate requesting by clinicians

Allied health-requested MRI is not a recommendation of the Working Group of the MBS Review, but the Working Group acknowledged the chiropractor and physiotherapy members' intention to submit a concurrent proposal supporting chiropractor/physiotherapy-requested MRI of the lumbar-sacral spine.

2. Consider limiting CT requesting by GPs

In the event of a GP-requested MBS item for MRI of the lumbar-sacral spine, CT should only be used to assess low back pain where MRI is unavailable or contraindicated.

3. Consider amending item descriptors to clarify the indications for low back imaging for each modality. In particular, plain x-rays of lower back could be limited to suspected fracture or inflammatory spondyloarthritis

4. Limit use of multi-region radiography of the spine and, in particular, three or four area imaging on the same day

Other recommendations

The Committee endorsed these recommendations of the Working Group.

1. Ask the Department of Human Services to provide feedback to primary care practitioners about volume testing relative to their peers.
2. Request consideration of the need for education initiatives targeting clinicians regarding the appropriate use of imaging for low back pain, including continuing professional development (CPD) courses for clinicians (referral to Royal Australian College of General Practitioners (RACGP), The Royal Australian and New Zealand College of Radiologists (RANZCR), the National Prescribing Service or the Commission on Safety and Quality in Health Care).
3. Request consideration of the need for community education initiatives to address patient expectations around diagnostic imaging for low back pain.
4. Request that RANZCR considers options for providing radiologist feedback to requesters regarding appropriate imaging for low back pain and, where applicable, placing imaging findings within the context of age-related changes.
5. Consider the development of tools to assist appropriate clinician requesting, including the development of clinical decision support that is linked to requesting.

9. Recommendations

The Committee broadly agreed with the key recommendations of the Working Group, subject to a number of amendments. Below are the Working Group key recommendations followed by the Committee recommendations.

RECOMMENDATION ONE *CONSIDER GP-REQUESTED MRI OF THE LUMBAR-SACRAL SPINE, FOR DEFINED INDICATIONS, WITH STRATEGIES FOR ENSURING APPROPRIATE REQUESTING BY CLINICIANS*

The Working Group recommended consideration of GP-requested MRI of the lumbar-sacral spine, for defined indications, with strategies for ensuring appropriate requesting by clinicians

Allied health-requested MRI is not a recommendation of the Working Group of the MBS Review, but the Working Group acknowledged the chiropractor and physiotherapy members' concurrent proposal supporting chiropractor/physiotherapy-requested MRI of the lumbar-sacral spine.

The Committee endorsed the Working Group recommendation that MBS funding for GP-requested MRI of the lumbar-sacral spine, for defined indications should be considered, with strategies for ensuring appropriate requesting by clinicians

The Committee did not support the chiropractor and physiotherapy members' concurrent proposal suggesting requesting for MRI of the lumbo-sacral spine be extended to allied health providers. The Committee recommended against expanding requesting for MRI to allied health providers.

RECOMMENDATION TWO *CONSIDER LIMITING CT REQUESTING FOR LOW BACK PAIN FOR GPs*

The Working Group recommended consideration of limiting CT requesting by GPs. In the event of a GP-requested MBS item for MRI of the lumbar-sacral spine, CT should only be used to assess low back pain where MRI is unavailable or contraindicated.

The Committee endorsed the recommendation of the Working Group to consider limiting requesting by GPs, subject to a modification. The modification clarifies that CT should only be used for selective clinical indications, instead of only where MRI is unavailable or contraindicated. Further work will be required to describe and define these selective indications. For example, CT is inappropriate for non-specific low back pain, however CT is appropriate in some patients for post-operative imaging where it is needed to assess the positions of implanted devices and hardware.

The Committee recommend that in the event of a MBS item for GP-requested MRI of the lumbo-sacral spine, CT should only be used to assess low back pain where MRI is unavailable or contraindicated or where CT is superior e.g. acute trauma or assessing the positions of implanted devices and hardware.

RECOMMENDATION THREE *CONSIDER AMENDING ITEM DESCRIPTORS TO CLARIFY THE INDICATIONS FOR LOW BACK IMAGING FOR EACH MODALITY*

The Working Group recommended there be consideration of amending item descriptors to clarify the indications for low back imaging for each modality. In particular, plain x-rays of lower back could be limited to suspected fracture or inflammatory spondyloarthritis.

The Committee endorsed the recommendation of the Working Group to consider amending item descriptors to clarify the indications for low back imaging for each modality but noted a number of implementation issues which will need to be addressed, including clarifying indications for low back pain imaging for each modality. Therefore a comprehensive list of appropriate tests would need to be developed and it will be challenging to restrict the length of the list without excluding some appropriate tests.

The Committee did not agree with limiting of plain x-rays of the lower back to suspected fracture or inflammatory spondyloarthritis.

RECOMMENDATION FOUR *LIMIT USE OF MULTI-REGION RADIOGRAPHY OF THE SPINE AND, IN PARTICULAR, THREE OR FOUR REGION IMAGING ON THE SAME DAY.*

The Working Group recommended limiting the use of multi-region radiography of the spine and, in particular, three or four region imaging on the same day.

The Committee endorsed this recommendation of the Working Group but with some clarifications and explicit exclusions, as follows.

Limit use of multi-region radiography of the spine for patients with low back pain and, in particular, three or four region radiography (excluding trauma and scoliosis) on the same day.

In addition, the Committee made a specific recommendation to limit the use of three and four multi-region plain radiography of the spine requested by allied health practitioners.

The Committee considered two options to limit three and four multi-region radiography of the spine to:

- Δ Option 1. requesting by medical practitioners; or
- Δ Option 2. requesting by medical specialists.

These options are intended to address a finding of the Working Group that there is a significant volume of multi-region plain radiography of the spine requested in primary care by allied health practitioners and in particular chiropractors for both the three and four region studies.

The Committee noted three and four region studies have limited clinical utility and should be provided to a carefully selected cohort of patients who may benefit from these services; for example, the assessment of patients with scoliosis, which in most cases would be assessed by spinal specialists rather than primary care providers.

The Committee agreed that, as a first step, the requesting of these studies be limited to medical practitioners (option 1) and, if this does not diminish the volume of services, then requesting should be confined to medical specialists (option 2). Under both options, allied health practitioners will be unable to request multi-region spinal radiography studies.

Members noted the need to implement the regulatory amendments in a way to prevent 'work arounds' by some providers, such as requesting single level studies in combination.

9.1 Committee Endorsement of Other Recommendations from the Working Group

RECOMMENDATION FIVE

The Committee endorsed the following recommendations of the Working Group.

1. Ask the Department of Human Services to provide feedback to primary care practitioners about their volume of testing relative to their peers.
2. Request consideration of the need for education initiatives targeting clinicians regarding the appropriate use of imaging for low back pain, including continuing professional development courses for clinicians (referral to Royal Australian College of General Practitioners (RACGP), The Royal Australian and New Zealand College of Radiologists (RANZCR), the National Prescribing Service or the Commission on Safety and Quality in Health Care).
3. Request consideration of the need for community education initiatives to address patient expectations around diagnostic imaging for low back pain.
4. Request that RANZCR considers options for providing radiologist feedback to requesters regarding appropriate imaging for low back pain and, where applicable, placing imaging findings within the context of age-related changes.
5. Consider the development of tools to assist appropriate clinician requesting, including the development of clinical decision support that is linked to requesting.

10. Multi Region Radiography of the Spine Requested in Primary Care (Key Recommendation 4)

The Diagnostic Imaging Clinical Committee is concerned about the significant volume of three and four region plain x-ray studies of the spine requested by chiropractors. The volume of studies performed is not consistent with the limited clinical utility of these tests. These studies involve imaging of the cervical, thoracic, lumbosacral and sacrococcygeal spine in combination, and may unnecessarily expose patients to relatively high radiation doses.

To address this, the Committee propose that requesting of three and four region radiography of the spine be restricted to medical practitioners (i.e. excluding allied health practitioners). It notes that this type of imaging has a limited clinical role largely confined to medical specialist assessment and management of scoliosis.

10.1 Single Region Plain Imaging of the Spine

The MBS items for radiography of the spine are included in Group I3 (Diagnostic Radiology), Subgroup 4 (Radiographic examination of spine) of the Diagnostic Imaging Services Table. There are separate MBS items for plain imaging of the four regions of the spine - cervical, thoracic, lumbosacral and sacrococcygeal. These items can be requested by a medical practitioner as well as chiropractors, physiotherapist and osteopaths.

Table 11: MBS item descriptors for single region plain imaging of the spine (as at 1 July 2015)

| Item number | Item descriptor | Fee | Benefit |
|-------------|-------------------------------|---------|------------------------------|
| 58100 | Spine Cervical (R) | \$67.15 | 75% = \$50.40; 85% = \$57.10 |
| 58102 | Spine Cervical (R) (Nk) | \$33.60 | 75% = \$25.20; 85% = \$28.60 |
| 58103 | Spine Thoracic (R) | \$55.10 | 75% = \$41.35; 85% = \$46.85 |
| 58105 | Spine Thoracic (R) (Nk) | \$27.55 | 75% = \$20.70; 85% = \$23.45 |
| 58106 | Spine Lumbosacral (R) | \$77.00 | 75% = \$57.75; 85% = \$65.45 |
| 58111 | Spine Lumbosacral (R) (Nk) | \$38.50 | 75% = \$28.90; 85% = \$32.75 |
| 58109 | Spine Sacrococcygeal (R) | \$47.00 | 75% = \$35.25; 85% = \$39.95 |
| 58117 | Spine Sacrococcygeal (R) (Nk) | \$23.50 | 75% = \$17.65; 85% = \$20.00 |

Table 12: Service volumes of single region plain imaging from 2010-11 to 2014-15 (Date of Service)

| Item number | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|-------------|----------------|---------|---------|---------|---------|
| 58100 | 174,859 | 177,061 | 172,783 | 170,827 | 166,083 |
| 58102 | Not applicable | 180 | 99 | 94 | 50 |
| 58103 | 72,376 | 72,704 | 72,827 | 71,747 | 70,735 |
| 58105 | Not applicable | 87 | 47 | 45 | 27 |
| 58106 | 328,569 | 331,138 | 327,728 | 324,634 | 317,819 |
| 58111 | Not applicable | 413 | 201 | 118 | 88 |
| 58109 | 15,819 | 16,439 | 16,982 | 17,811 | 27,558 |
| 58117 | Not applicable | 23 | 14 | 6 | 8 |

Note: Because MBS items 58102, 58105, 58111 and 58117 were introduced on the MBS on 1 July 2011, there is no data for these items in the 2010/11 financial year. Source: unpublished data (Department of Health)

General practitioners and specialists request over 89% of radiography of the lumbosacral spine, while allied health practitioners (chiropractors, physiotherapists and osteopaths) request less than 11%. Of the allied health requests, chiropractors request over 71% of these services (21, 575), followed by physiotherapists (10,695) and osteopaths (3,257).

Table 13: Requesting speciality of Medicare item 58106 (spine - lumbosacral) for 2013-14

| Item number | GPs | Specialists | Allied health | Total services |
|---------------------|---------|-------------|---------------|----------------|
| 58106 | 245,779 | 43,267 | 35,524 | 324,570 |
| % of total services | 75.8% | 13.3% | 10.9% | 100% |

Source: unpublished data (Department of Health)

10.2 Multiple Region Plain Imaging of the Spine

There are also MBS items for Radiography of two, three of four regions of the spine. The two region spine plain imaging can be requested by a medical practitioner as well as chiropractors, physiotherapist and osteopaths. The three and four region items listed below are limited to medical practitioners only, with multi area items specifically for allied health practitioners discussed later in this paper.

Table 14: MBS item descriptors for multiple region plain imaging of the spine (as at 1 July 2015)

| Item number | Item descriptor | Fee | Benefit |
|-------------|---|----------|---------------------------------|
| 58112 | Spine, two examinations of the kind referred to in items 58100, 58103, 58106 and 58109 (R) | \$97.25 | 75% = \$72.95; 85% = \$82.70 |
| 58123 | Spine, two Examinations of the kind referred to in items 58100, 58102, 58103, 58105, 58106, 58109, 58111 and 58117 (R) (NK) | \$48.65 | 75% = \$36.50; 85% = \$41.40 |
| 58115 | Spine, three examinations of the kind mentioned in items 58100, 58103, 58106 and 58109 (R) | \$110.00 | 75% = \$82.50; 85% = \$93.50 |
| 58124 | Spine, three examinations of the kind mentioned in items 58100, 58102, 58103, 58105, 58106, 58109, 58111 and 58117 (R) (NK) | \$55.00 | 75% = \$41.25; 85% = \$46.75 |
| 58108 | Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal (R) | \$110.00 | 75% = \$82.50; 85% = \$93.50 |
| 58114 | Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal (R) (NK) | \$55.00 | 75% = \$41.25; 85% = \$46.75 |

Table 15: Service volumes of multiple region plain imaging of the spine from 2010-11 to 2014-15 (Date of Service)

| Item number | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|--------------|----------------|---------|---------|---------|---------|
| 58112 | 130,778 | 133,581 | 132,049 | 131,708 | 137,699 |
| 58123 | Not applicable | 242 | 165 | 72 | 97 |
| 58115 | 19,238 | 21,763 | 23,360 | 24,402 | 25,377 |
| 58124 | Not applicable | 15 | 16 | 4 | 10 |
| 58108 | 2,177 | 2,441 | 2,914 | 2,679 | 2,781 |
| 58114 | Not applicable | 7 | 11 | 18 | 14 |

Note: Because MBS items 58123, 58124 and 58114 were introduced on the MBS on 1 July 2011, there is no data for these items in the 2010/11 financial year. Source: unpublished data (Department of Health)

Table 16: Requesting speciality of Medicare item 58112 (two regions spine) for 2013-14

| Item number | GPs | Specialists | Allied health | Total services |
|----------------------------|--------|-------------|---------------|----------------|
| 58112 | 93,256 | 18,742 | 19,640 | 131,638 |
| % of total services | 70.84% | 14.24% | 14.92% | 100% |

Source: unpublished data (Department of Health)

As shown above, general practitioners and specialists collectively request approximately 85% of plain imaging of the two region spine, while allied health practitioners request close to 15%.

Table 17: Allied health requesting speciality of Medicare item 58112 (two regions spine) for 2013-14

| Item number | Chiropractors | Physiotherapists | Osteopaths | Total services |
|----------------------------|---------------|------------------|------------|----------------|
| 58112 | 14,678 | 1,271 | 3,691 | 19,640 |
| % of total services | 74.74% | 6.47% | 18.79% | 100% |

Source: unpublished data (Department of Health)

Of the allied health requests, chiropractors request over 75% of these services (14,678), followed by physiotherapists (19%) and osteopaths (6%).

Where the plain imaging of two regions of the spine is provided (item 58112) the item numbers for the individual regions of the spine being studied must be specified (i.e. from items 58100, 58103, 58106 and 58109) on the accounts or patient assignment forms. This is also a requirement of three and four region radiography of the spine.

10.3 Allied Health only Referrals of Multiple Region Radiography of the Spine

In addition to the MBS items already described, there are three and four region spine imaging items which can be requested only by chiropractors, physiotherapists and podiatrists. These items are restricted to one service per patient within the same calendar year and were introduced on 1 January 2010 (items 58120 and 58121) and 1 July 2011 (items 58126 and 58127).

The introduction of new allied health only items, subsequently limited the use of items 58115 and 58108 to general practitioners and specialists. These allied health only items, which included time restrictions, were introduced because of concern about the volumes and clinical necessity of three and four region spinal x-rays. The new items aimed to reduce unnecessary exposure to radiation by limiting the number of services that can be requested by allied health practitioners for a particular patient in a calendar year.

Table 18: MBS item descriptors for Allied Health only referred multiple region plain imaging of the spine

| Item number | Item descriptor | Fee | Benefit |
|--------------|---|----------|---------------------------------|
| 58121 | Spine, three examinations of the kind mentioned in items 58100, 58103, 58106 and 58109 (R), If the Service to Which Item 58120 or 58121 applies has not been performed on the same patient within the same calendar year. | \$110.00 | 75% = \$82.50; 85% = \$93.50 |
| 58127 | Spine, three examinations of the kind mentioned in items 58100, 58102, 58103, 58105, 58106 and 58109, 58111 and 58117 if the service to which item 58120, 58121, 58126 or 58127 applies has not been performed on the same patient within the same calendar year (R) (Nk) | \$55.00 | 75% = \$41.25 85% = \$46.75 |
| 58120 | Spine, four regions, Cervical, Thoracic, Lumbosacral and Sacrococcygeal (R), if the service to which item 58120 or 58121 applies has not been performed on the same patient within the same calendar year. | \$110.00 | 75% = \$82.50 85% = \$93.50 |
| 58126 | Spine, four Regions, Cervical, Thoracic, Lumbosacral and Sacrococcygeal, if the service to which item 58120, 58121, 58126 or 58127 applies has not been performed on the same patient within the same calendar year (R) (Nk) | \$55.00 | 75% = \$41.25; 85% = \$46.75 |

Table 19: Service volumes of three and four region plain imaging requested by allied health practitioners from 2010-11 to 2014-15 (Date of Service)

| Item number | 2010-2011 | 2011-2012 | 2012-2013 | 2013-2014 | 2014-2015 |
|-------------|----------------|-----------|-----------|-----------|-----------|
| 58121 | 155,903 | 161,605 | 129,537 | 99,185 | 103,227 |
| 58127 | Not applicable | 1,507 | 881 | 145 | 16 |
| 58120 | 13,667 | 14,899 | 15,442 | 15,448 | 17,947 |
| 58126 | Not applicable | <10 | 18 | <10 | <10 |

Note: Because MBS items 58126 and 58127 were introduced on the MBS on 1 July 2011, there is no data for these items in the 2010/11 financial year.

To ensure that the data remains de-identified, where there are low service volumes the data has been displayed as <10. Source: unpublished data (Department of Health)

Chiropractors are responsible for nearly 99% of requests for three region spine examinations, with osteopaths and physiotherapists making up the remaining 1%.

Table 20: Requesting speciality of Medicare item 58121 (three regions spine) for 2013-14

| Item number | Chiropractor | Osteopath | Physiotherapist | Total for Allied Health |
|--------------------|--------------|-----------|-----------------|-------------------------|
| 58121 | 97,772 | 516 | 883 | 99,171 |
| % of allied health | 98.6% | 0.5% | 0.9% | 100% |

Source: unpublished data (Department of Health)

Table 21: Comparison of GP/specialist and allied health practitioners requesting for plain imaging – three region spine.

| Financial Year | GP/ Specialist Referred | | Allied Health referred | | Total Services (All referrers) |
|----------------|-------------------------|---------------|------------------------|---------------|--------------------------------|
| | 58115 & 58124 | % of Services | 58121 & 58127 | % of Services | |
| 2010/11 | 19,238 | 11% | 155,903 | 89% | 175,141 |
| 2011/12 | 21,778 | 12% | 163,112 | 88% | 184,890 |
| 2012/13 | 23,376 | 15% | 130,418 | 85% | 153,794 |
| 2013/14 | 24,406 | 20% | 99,330 | 80% | 123,736 |
| 2014/15 | 25,387 | 20% | 103,243 | 80% | 128,630 |

Source: unpublished data (Department of Health)

Table 22: Comparison of GP/specialist and allied health practitioners requesting for plain imaging – four region spine.

| Financial Year | GP/ Specialist Referred | | Allied Health referred | | Total Services (All referrers) |
|----------------|-------------------------|---------------|------------------------|---------------|--------------------------------|
| | 58108 & 58114 | % of Services | 58120 & 58126 | % of Services | |
| 2010/11 | 2,177 | 14% | 13,667 | 86% | 15,844 |
| 2011/12 | 2,448 | 14% | 14,903 | 86% | 17,351 |
| 2012/13 | 2,925 | 16% | 15,460 | 84% | 18,385 |
| 2013/14 | 2,697 | 15% | 15,449 | 85% | 18,146 |
| 2014/15 | 2,795 | 13% | 17,948 | 87% | 20,743 |

Since 2010/11, the use of multi region radiography by allied health practitioners has far exceeded the use by GPs and specialists. The reduction of allied health requesting of Medicare items 58121 and 58127 in 2012/13 and 2013/14, can be attributed to the 1 November 2012 changes to the

Diagnostic Imaging Services Table, which introduced minimum formal qualification for those performing Medicare-funded diagnostic radiology services. The performance of these services was restricted to:

- a) a medical practitioner; or
- b) a medical radiation practitioner (person registered or licensed as a medical radiation practitioner under a law of a State or Territory) who is employed by a medical practitioner or provides the service under the supervision of a medical practitioner in accordance with accepted medical practice; or
- c) a dental practitioner (for items 57901 to 57969) who is employed by a medical practitioner or provides the service under the supervision of a medical practitioner in accordance with accepted medical practice.

As a result of these changes, allied health practitioners are no longer able to **perform** Medicare-funded diagnostic radiology services. This incidentally reduced the number of chiropractor-requested three region plain imaging of spine services.

11. Findings of the Diagnostic Imaging Clinical Committee

The Diagnostic Imaging Clinical Committee noted that the volume of three and four region spinal radiography studies (almost 150,000 studies in 2014/15) is excessive. Although changes to MBS requirements (and in particular the changes that limited the performance of these studies to certain practitioners) has led to a decrease in the number of studies performed (about 50,000 fewer in 2014/15 compared to 2011/12), the volume of tests remains excessive given the limited clinical utility of these tests and hence the unnecessary of exposure of patients to relatively high radiation doses.

The Committee noted too, that a very high proportion of these studies are requested by chiropractors. However, these studies only have clinical value in selected conditions, such as the assessment of scoliosis or following acute severe trauma. If used inappropriately patients are unnecessarily exposed to relatively high radiation doses. Two region spinal imaging does have clinical value in circumstances where the suspected pathology is at, or close to, the junction of two areas of the spine.

11.1 Recommendations

To address the overuse of three and four region spinal radiography studies, the Committee considered two options as follows:

- △ Restrict requesting to medical practitioners
- △ Restrict requesting to medical specialists.

The Committee recommends a staged and escalated approach to address the problem. It recommends that, as a first step, the requesting of these studies be limited to medical practitioners and, if this does not diminish the volume of services, then requesting should be confined to medical

specialists. If service use continues at high levels, then consideration could be given to restricting the services to defined clinical conditions such as assessment of scoliosis and following acute severe trauma. In all options, allied health practitioners would no longer be able to request three and four region spinal radiography studies.

The Committee noted that regulatory amendments will be required to implement this proposal and in a manner that will prevent 'work arounds' by some practitioners (for instance by requesting single level studies in combination).

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13. Glossary

| Term | Definition |
|--|---|
| ACSQHC | The Australian Commission on Safety and Quality in Health Care |
| Department, The | Australian Government Department of Health |
| DHS | Australian Government Department of Human Services |
| GP | General practitioner |
| High-value care | Services of proven efficacy reflecting current best medical practice, or for which the potential benefit to consumers exceeds the risk and costs. |
| Inappropriate use / misuse | The use of MBS services for purposes other than those intended. This includes a range of behaviours ranging from failing to adhere to particular item descriptors or rules, through to deliberate fraud. |
| Low-value care | The use of an intervention which evidence suggests confers no or very little benefit on patients, or that the risk of harm exceeds the likely benefit, or, more broadly, that the added costs of the intervention do not provide proportional added benefits. |
| MBS item | An administrative object listed in the MBS and used for the purposes of claiming and paying Medicare benefits, comprising an item number, service descriptor and supporting information, Schedule fee and Medicare benefits. |
| MBS service | The actual medical consultation, procedure, test to which the relevant MBS item refers. |
| MSAC | Medical Services Advisory Committee |
| Multiple operation rule | A rule governing the amount of Medicare benefit payable for multiple operations performed on a patient on the one occasion. In general, the fees for two or more operations are calculated by the following rule: 100% for the item with the greatest Schedule fee plus 50% for the item with the next greatest Schedule fee plus 25% for each other item. |
| Multiple services rules (diagnostic imaging) | A set of rules governing the amount of Medicare benefit payable for multiple diagnostic imaging services provided to a patient at the same attendance (same day). See MBS Explanatory Note DIJ for more information. |
| Obsolete services | Services that should no longer be performed as they do not represent current clinical best practice and have been superseded by superior tests or procedures. |
| Pathology episode coning | An arrangement governing the amount of Medicare benefit payable for multiple pathology services performed in a single patient episode. When more than three pathology services are requested by a general practitioner in a patient episode, the benefits payable are equivalent to the sum of the benefits for the three items with the highest Schedule fees. |
| PBS | Pharmaceutical Benefits Scheme |
| PHCAG | Primary Health Care Advisory Group |

Appendix A Summary for Consumers

Low Back Working Group recommendations

This appendix describes the medical service, recommendations of the Clinical Experts and why the recommendation has been made.

| Item | What it does | Committee Recommendation | What would be different | Why |
|---|--------------|---|---|--|
| Recommendation 1: Consider GP-requested MRI of the lumbar-sacral spine, for defined indications, with strategies for ensuring appropriate requesting by clinicians | | | | |
| N/A | N/A | Consider GP-requested MRI of the lumbar-sacral spine, for defined indications, with strategies for ensuring appropriate requesting by clinicians | If implemented, GPs would be able to request MRI of the lumbar-sacral spine for certain clinical reasons. They currently cannot request MRI of the lumbar-sacral spine. | MRI is a better imaging tool than CT for certain clinical reasons. Patients need to have the most appropriate test based on their symptoms. |
| Recommendation 2: Consider limiting CT requesting for low back pain for GPs | | | | |
| N/A | N/A | If GPs did end up being able to request MRI of the lumbar-sacral spine (recommendation 1), GPs could only request CT of the lumbar-sacral spine for certain clinical reasons. | GP requested CT of the lumbar-sacral spine could only be performed for certain clinical reasons. Currently GPs can request CT of the lumbar-sacral spine for any clinical reason. | Patients are exposed to a significant radiation dose when they undergo CT of the lumbar-sacral spine. CT is not appropriate for non-specific low back pain. Patients need to have the most appropriate test based on their symptoms. |

| Item | What it does | Committee Recommendation | What would be different | Why |
|---|---|--|---|--|
| Recommendation 3: Consider amending item descriptors to clarify the indications for low back imaging for each modality | | | | |
| N/A | N/A | Consider amending item descriptors to clarify the indications for low back imaging for each modality. | Each modality (i.e. X-ray, CT, MRI) used to image the lumbar-sacral spine would have a list of clinical reasons for which the test is most appropriate. | Given that patients are exposed to radiation when they undergo certain diagnostic imaging tests, it is important that these tests are performed for the right reason based on the patients symptoms. Evidence within the report shows that certain tests are better for certain reasons. |
| Recommendation 4: Limit use of multi-region radiography of the spine and, in particular, three or four region imaging on the same day. | | | | |
| 58121 and 58127 three region xray of the spine. 58120 and 58126 four region xray of the spine | X-ray of three or four regions of the spine on the same day | Limit use of multi-region radiography of the spine and, in particular, three or four region imaging on the same day. In addition, limit the use of three and four region x-rays of the spine requested by allied health practitioners (i.e. chiropractors, physiotherapists) | Allied health practitioners would no longer be able to request three and four region xrays of the spine. Currently, allied health practitioners can currently request the three and four region xrays of the spine. | There are significant numbers of three and four region xrays of the spine being requested by allied health practitioners. Three and four region X-ray of the spine have very limited circumstances in which they are useful and should be provided to a carefully selected group of patients, as they contribute a |

| Item | What it does | Committee Recommendation | What would be different | Why |
|------|--------------|--------------------------|-------------------------|-------------------------------------|
| | | | | high radiation dose to the patient. |

**Appendix B MBS Review of Imaging for Low Back Pain Working
Group Report**



Australian Government

Department of Health

MBS Reviews
IMAGING FOR LOW BACK PAIN
FINAL REPORT

September 2015

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Abbreviations

| Abbreviation | Definition |
|--------------|---|
| AAMPGG | Australian Acute Musculoskeletal Pain Guideline Group |
| ABS | Australian Bureau of Statistics |
| ACC | Accident Compensation Corporation |
| ACP | American College of Physicians |
| ACR | American College of Radiology |
| ACOEM | American College of Occupational and Environmental Medicine |
| AHRQ | Agency for Healthcare Research and Quality |
| AIMSH | AIM Specialty Health |
| APS | American Pain Society |
| AS | Ankylosing spondylitis |
| AUROC | Area Under Receiver Operating Characteristic curve |
| BEACH | Bettering the Evaluation and Care of Health |
| CADTH | Canadian Agency for Drugs and Technologies in Health |
| CAR | Canadian Association of Radiologists |
| CI | Confidence interval |
| COST | Cooperation in Science and Technology |
| CPG | Clinical Practice Guideline |
| CR | Cost ratio |
| CT | Computed tomography |
| EQ-5D | 5-dimension EuroQol |
| ESR | Erythrocyte sedimentation rate |
| ESSG | European Spondyloarthropathy Study Group |
| FDA | Food and Drug Administration |
| GBCA | Gadolinium-based contrast agents |
| G-I-N | Guidelines International Network |
| GP | General practitioner |
| HNP | Herniated nucleus pulposus |
| HPA | Health Protection Agency |
| HTA | Health Technology Assessment |
| ICER | Incremental cost-effectiveness ratio |
| ICSI | Institute for Clinical Systems Improvement |
| IHE | Institute of Health Economics |
| IHM | Italian Health Ministry |
| LBP | Low back pain |
| MBS | Medicare Benefits Schedule |
| MLBP | Mechanical low back pain |
| MQIC | Michigan Quality Improvement Consortium |
| MRI | Magnetic resonance imaging |
| NASS | North American Spine Association |
| NCCPC | National Collaborating Centre for Primary Care |
| NHMRC | National Health and Medical Research Council |
| NICE | National Institute for Health and Care Excellence |
| NPS | National Prescribing Service |
| NSAID | Non-steroidal anti-inflammatory drug |
| OHA | Oregon Health Authority |
| PICO | Patient, Intervention, Comparator, Outcome |

| Abbreviation | Definition |
|--------------|--|
| PSR | Professional Services Review |
| QALY | Quality-adjusted life year |
| QUADAS | Quality Assessment of Diagnostic Accuracy Studies |
| RACGP | Royal Australian College of General Practitioners |
| RANZCR | Royal Australian and New Zealand College of Radiologists |
| RCGP | Royal College of General Practitioners |
| RCT | Randomised controlled trial |
| ROC | Receiver operating characteristics |
| RWG | Review Working Group |
| SA | South Australia |
| SI | Sacroiliac |
| SIGN | Scottish Intercollegiate Guidelines Network |
| SROC | Summary Receiver Operating Characteristics |
| TNF | Tumour necrosis factor |
| TOP | Toward Optimized Practice |
| UK | United Kingdom |
| US | United States of America |
| WA | Western Australia |
| WGSC | Work Group Consensus Statement |

Executive summary

The vast majority of Medicare Benefits Schedule (MBS) items are longstanding, with only a small proportion of services funded having undergone formal evidence-based assessment. MBS reviews seek to ensure the Schedule reflects current clinical practice and contemporary evidence.

This Report presents the collection and analysis of evidence to inform assessment of the existing MBS items for imaging for low back pain (LBP) to ensure the items reflect contemporary evidence, improve health outcomes for patients and represent value for money.

Description of imaging for low back pain

The focus of this MBS review is restricted to primary care presentations for LBP. LBP is the second most common clinical complaint leading people to seek care from general practice in Australia. Over 90% of patients presenting in primary care with low back pain are classified as having non-specific LBP, with no identifiable cause (Krismer et al, 2007, van Tulder et al, 1997). However, LBP is occasionally the presenting symptom of an underlying serious pathology, accounting for approximately 1% of acute back pain presentations in primary care (Henschke et al, 2009).

General practitioners (GPs) are eligible to request MBS services relating to low back imaging using radiography, computed tomography (CT) and nuclear medicine. Other primary care health providers (such as chiropractors, osteopaths and physiotherapists) are eligible to request a selection of radiography items, but cannot request CT or nuclear medicine. Magnetic resonance imaging (MRI) services on the MBS are generally restricted to requests from recognised specialists or consultant physicians. Primary care providers are currently not eligible to request MRI items relating to the low back of adults.

The scope of the review is restricted to imaging for LBP in adults using radiography, CT or MRI. Appendix 3 provides a list of the MBS items that are in scope for the review. These items are for imaging of the low back region, but are not exclusively used in patients that present with LBP.

Purpose of the review

Concerns have been raised that some diagnostic imaging items on the MBS are used inappropriately in patients who present with LBP. International clinical practice guidelines (CPGs) are consistent in recommending that imaging for LBP should be reserved for patients with suspected serious pathology or those with sciatica/radiculopathy who are being considered for spinal interventional therapy of any kind. For most people with LBP without clinical signs and symptoms that are known to be associated with malignancy, cauda equina syndrome, fracture and spinal infection, imaging is unlikely to help identify the cause of pain, alter treatment or decrease recovery time (Chou et al, 2011a).

Furthermore, inappropriate use of lumbar spine imaging may be associated with a number of harms, including exposure to radiation (in the case of X-ray and CT); exposure to iodinated contrast (in the

case of CT); increased risk of surgery and interventional procedure; risk of labelling patients with a diagnosis that is not the cause of the LBP; incidental findings that have no clinical significance but trigger further investigation; and unnecessary utilisation of resources and increased financial cost to the patient and healthcare system. Although not explicitly addressed in the evidence review, the potential harms of imaging should also be taken into consideration when determining the most appropriate imaging approach; these are briefly discussed in Section 0.

This MBS Review therefore evaluates the available evidence to determine the most appropriate imaging approach for those patients with LBP with suspected serious underlying pathology or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy.

This Review Report outlines the rationale behind conducting the review of the MBS items relevant to imaging for LBP services and the process undertaken to identify and appraise the available information on the MBS items of interest.

Review methodology

The review methodology comprised the following components: consulting with key stakeholders; developing a review protocol, which outlined the detailed review methodology (including specifying the key clinical/research questions for the systematic review, preparing the clinical flowcharts); analysing secondary data sources (Medicare Australia and the Bettering the Care and Evaluation of Health (BEACH) Program); an analysis of guideline concordance; conducting a systematic literature review for diagnostic and economic evidence; and undertaking an assessment and analysis of the evidence to draw conclusions in relation to the clinical/research questions.

The research methodology, including the clinical/research questions, is explained in detail in Section 2.

Stakeholder consultation

Stakeholder engagement is a pivotal part of the MBS Reviews process, particularly as feedback helps inform the final Review Report. During the review process, stakeholders were informed of the intention of the review of imaging for LBP, and were given the opportunity to comment on the review scope and the proposed methodology. Relevant documents were released for public consultation and stakeholder comments were considered and incorporated prior to finalisation of the review protocol.

As part of the MBS Review process, the Department established a Review Working Group (RWG). The RWG comprises nominated experts to provide clinical input and ensure the review reflects current Australian practice. Appendix 2 outlines the RWG members for this review.

Summary of findings

Clinical guidance on imaging in low back pain

Five Australian and 21 international CPGs/clinical algorithms for imaging for LBP were identified by the literature search (see Section 4 for details). Almost all CPGs were evidence-based, generally relying on observational studies or, in some cases, non-randomised comparative studies, and often supplemented with consensus opinion due to the poor quality evidence available. The recommendations/guidance was generally consistent, with imaging not recommended for non-specific LBP, and certain imaging modalities recommended in specific situations where clinical signs/symptoms are present, or where serious underlying pathology is suspected. MRI is the most commonly recommended modality, except for cases of suspected vertebral fracture or suspected inflammatory spondyloarthritis, where X-ray is recommended (see Table ES-1). CT is often recommended only when MRI is contraindicated or unavailable.

The general preference in CPGs for the use of MRI over CT is not clearly linked to the clinical evidence, but often appears to relate to a consensus that MRI has no ionising radiation and offers better soft tissue contrast resolution than CT.

Table ES.1 Simplified summary of clinical guidance relating to imaging for LBP

| Clinical condition/indication | Imaging timing | Preferred modality | Alternative modality |
|--|---|---|---|
| Signs/symptoms of sciatica/radiculopathy | Defer until after a 4 to 6-week trial of conservative therapy, unless neurologic deficits are severe or progressive | MRI (if patient is a potential candidate for surgery or epidural steroid injection) | CT when MRI is contraindicated or unavailable |
| Signs/symptoms of cauda equina syndrome | Immediate surgical evaluation with imaging if clinical findings are equivocal | MRI | CT when MRI is contraindicated or unavailable |
| Suspected spinal canal stenosis | Defer until after a 4 to 6-week trial of conservative therapy, unless neurologic deficits are severe or progressive | MRI (if patient is a potential candidate for surgery or epidural steroid injection) | CT myelography if MRI is contraindicated or inconclusive, or CT when MRI and CT myelography is contraindicated, inconclusive or inappropriate |
| Suspected inflammatory spondyloarthritis | Defer until after a 4 to 6-week trial of conservative therapy | Radiography | MRI if sacroiliac joint changes are not present or equivocal |
| Suspected spinal malignancy | Immediate if history of cancer, otherwise defer until after an unsuccessful trial of conservative therapy | MRI if strong risk factors (history of cancer), otherwise radiography | CT when MRI is contraindicated or unavailable |

| Clinical condition/ indication | Imaging timing | Preferred modality | Alternative modality |
|-----------------------------------|---|--------------------|---|
| Suspected spinal infection | Immediate | MRI | CT when MRI is contraindicated or unavailable |
| Suspected vertebral fracture | For suspected compression fracture, defer until after a trial of conservative therapy | Radiography | CT or bone scan |

Abbreviations: ACP, American College of Physicians; CT, computed tomography; MRI, magnetic resonance imaging; RANZCR, Royal Australian and New Zealand College of Radiologists.

Note: This simplified summary is derived from Section 4 of this report. It is largely based on the RANZCR Educational Module (2014), which is adapted from the ACP guideline (Chou et al, 2011).

For many of the clinical indications examined, CT is recommended when MRI is contraindicated or unavailable. CT can be requested by GPs (and specialists) but not by allied health professionals. The only imaging modality on the MBS that can be requested by allied health professionals for patients who present with LBP is X-ray, which is appropriate, according to CPGs, as a first-line imaging modality for patients with suspected vertebral fracture and suspected inflammatory spondyloarthropathy.

Evidence for the effectiveness of imaging for low back pain

Diagnostic accuracy

Four systematic reviews were identified that assessed the diagnostic accuracy of imaging (CT, MRI, X-ray) in the populations of interest. The four systematic reviews (van Rijn et al, 2012; Wassenaar et al, 2012; Sidiropoulos et al, 2008; Jarvik and Deyo, 2002) ranged in quality from good to poor (see Section 5.1.2 for details of these reviews, and Appendix 6 for quality assessment forms). Where the systematic reviews reported the quality of the individual diagnostic accuracy studies, it was noted that most included studies suffered from several potential biases. As such, there are legitimate concerns regarding the generalisability and validity of the reported sensitivities and specificities.

Two additional original diagnostic accuracy studies were identified that were published after the search dates of the included systematic reviews, one of which was of fair quality (Moranjic et al, 2011) and one of poor quality (Shankar et al, 2009).

Table ES.2 depicts the imaging modalities for which estimates of diagnostic accuracy are available, as well as those pairs of modalities for which either direct comparative evidence is available or a systematic review has published findings regarding their comparative diagnostic accuracy.

No diagnostic accuracy studies or systematic reviews were identified for suspected cauda equina syndrome. Likewise, no diagnostic accuracy statistics were identified for suspected vertebral fracture, although one systematic review commented that while radiographs may be adequately sensitive for compression fractures, they do not distinguish between acute and chronic fractures, and that MRI is more specific, identifying marrow oedema or an associated hematoma (Jarvik and Deyo,

2002). Studies reporting on the diagnostic accuracy of imaging for LBP were identified for all other indications, including studies that compared MRI with CT, MRI with X-ray, and CT with X-ray.

Table ES.2 Availability of diagnostic accuracy estimates for MRI, CT and X-ray

| Population with LBP | MRI | CT | X-ray | MRI and CT compared ^a | CT and X-ray compared ^a | MRI and X-ray compared ^a |
|--|-----|-----|-------|----------------------------------|------------------------------------|-------------------------------------|
| Signs/symptoms of sciatica/radiculopathy | Yes | Yes | No | Yes | No | No |
| Suspected spinal stenosis | Yes | Yes | No | Yes | No | No |
| Suspected inflammatory spondyloarthritis | Yes | Yes | Yes | Yes | Yes | Yes |
| Suspected spinal malignancy | Yes | No | Yes | No | No | Yes |
| Suspected spinal infection | Yes | No | Yes | No | No | Yes |

Note: No diagnostic accuracy studies were identified for suspected cauda equine syndrome or suspected vertebral fracture.

Abbreviations: CT, computed tomography; MRI, magnetic resonance.

^a Comparison may be based on primary diagnostic studies that directly compare modalities, or systematic reviews that compare the diagnostic accuracy of modalities using comparative diagnostic studies (direct evidence, if available) or non-comparative diagnostic studies (indirect evidence).

Table ES.3 shows further details of the three indications for which comparative diagnostic accuracy findings are available for CT versus MRI: lumbar disc herniation, spinal stenosis and sacroiliitis. Sensitivity and specificity estimates from all included studies are presented in Table ES.5.

Only a limited number of studies were found that directly compare MRI and CT in the same patients (three for lumbar disc herniation and three for spinal stenosis¹). The remaining studies report the diagnostic characteristics for a single modality only. For all three indications, similar diagnostic accuracy was reported for MRI and CT. None of the identified systematic reviews or primary studies concluded that one modality has superior diagnostic accuracy to the other.

In their systematic review, Jarvik and Deyo (2002) make the concluding remarks that “for patients with *systemic* diseases, MRI probably offers the greatest sensitivity and specificity; for patients with *degenerative* conditions that produce neurologic compromise, MRI offers results comparable to those obtained with CT. The frequent finding of abnormalities in normal adults limits the specificity of all these tests”.

¹ It is possible that some of the studies included in Sidiropoulos (2008) were direct comparative studies, but details of the included studies were not reported by this systematic review.

Table ES.3 Clinical evidence of the comparative diagnostic accuracy of MRI and CT in patients with LBP

| Suspected indication | Ref ID | Quality ^a | Study type | Findings for MRI versus CT | Comment |
|----------------------------------|------------------------|----------------------|--|-----------------------------|--|
| Lumbar disc herniation | Jarvik and Deyo (2002) | Poor ^b | SR (includes 2 direct comparative studies) | Similar diagnostic accuracy | Limited studies using outdated equipment (1989 and 1993) |
| | Moranjkic (2011) | Fair | 1 direct comparative study | Similar diagnostic accuracy | More recent study (2011) |
| Spinal stenosis | Jarvik and Deyo (2002) | Poor ^b | SR (includes 3 direct comparative studies, 13 non-comparative studies ^c) | Similar diagnostic accuracy | All studies prior to 1992 ² |
| Spondyloarthritis (sacroiliitis) | Sidiropoulos (2008) | Poor ^b | SR (includes 10 CT studies, 13 MRI studies) | Similar diagnostic accuracy | Diagnostic evidence for early sacroiliitis is available for MRI only, which depicts active inflammation in SI joints when radiographs are normal and equivocal |

Abbreviations: CT, computed tomography; LBP, low back pain; MRI, magnetic resonance; SI, sacroiliac joint; SR, systematic review.

^a Quality assessment was undertaken for the purposes of this MBS Review and is presented in Appendix 6.

^b Jarvik and Deyo (2002) and Sidiropoulos et al (2008) received a poor quality rating, primarily because individual study characteristics were not reported and quality assessment of individual studies was not reported.

^c Total number of non-comparative studies is unclear due to poor reporting.

Comparative diagnostic accuracy findings were reported for radiography versus MRI for the three indications shown in Table ES.4: sacroiliitis, spinal malignancy and spinal infection. For each of these indications, MRI had greater diagnostic accuracy than radiography except for sacroiliitis, for which radiography is considered adequate once the disease is sufficiently advanced to be detected radiographically.

Only one study (case-control) directly compared X-ray and MRI in the same patients (Shankar et al, 2009). The findings of Jarvik and Deyo (2002) are based on diagnostic studies that examined either X-ray or MRI (i.e. conclusion were based on comparisons across studies). Sidiropoulos (2008) investigated the diagnostic accuracy of all three imaging modalities but due to poor reporting, it is unclear whether any of the included studies were direct comparative studies. Sensitivity and specificity estimates from all included studies are presented in Table ES.5.

² These two studies were also included in a systematic review by Kent et al (1992), and were not separately referenced in Jarvik and Deyo (2002).

Table ES.4 Clinical evidence of the comparative diagnostic accuracy of X-ray and MRI or CT in patients with LBP

| Suspected indication | Ref ID | Quality ^a | Study type | Finding for X-ray versus MRI or CT | Comment |
|----------------------------------|------------------------|----------------------|---|---|--|
| Spondyloarthritis (sacroiliitis) | Sidiropoulos (2008) | Poor ^b | SR (pooled analyses of 18 studies) | X-ray, CT and MRI have similar diagnostic accuracy except in early disease where MRI is more sensitive. | For early disease, evidence is presented for X-ray and MRI but not for CT. |
| | Shankar (2009) | Poor | Case-control (1 direct comparative study) | MRI is better than X-ray for detecting early disease. | Study limited to early disease. |
| Spinal malignancy | Jarvik and Deyo (2002) | Poor ^b | SR (1 study) | MRI is better than X-ray (SR findings, not study findings) | No CT studies identified, but authors speculate MRI is probably also better than CT. |
| Spinal infection | Jarvik and Deyo (2002) | Poor ^b | SR (1 study) | MRI is better than X-ray. | No CT studies identified, but authors speculate MRI is probably also better than CT. |

Abbreviations: CT, computed tomography; LBP, low back pain; MRI, magnetic resonance, SR, systematic review.

^a Quality assessment was undertaken for the purposes of this MBS Review and is presented in Appendix 6.

^b Jarvik and Deyo (2002) and Sidiropoulos et al (2008) received a poor quality rating, primarily because individual study characteristics were not reported and quality assessment of individual studies was not reported.

It must be emphasised that the quality of evidence for these diagnostic assessments is poor to fair, and that a great deal of variation exists in populations, study design and quality that make cross-study comparisons of diagnostic accuracy problematic. For many studies, patients with pre-existing diagnoses were used, providing two clear groups of positive and negative subjects. This design can introduce spectrum bias, which was discussed in a number of studies. Reporting of study design by the systematic reviews was limited, making an assessment of the degree of possible bias difficult. Similarly, the standards used to establish the reference diagnosis, critical to a comparison of diagnostic statistics, were not always reported. Finally, although all of the included systematic reviews related to patients with LBP, it is not clear whether all of the included diagnostic accuracy studies had LBP as a criterion for study eligibility.³ Together, these factors impact on the generalisability of the findings and fundamentally undermine attempts to make meaningful comparisons of diagnostic accuracy estimates from different studies.

Caveats aside, the limited clinical evidence indicates that MRI and CT have similar diagnostic accuracy in terms of sensitivity and specificity in patients with LBP and suspected lumbar disc herniation, spinal

³ Noted in particular for studies relating to spinal canal stenosis and spinal infection.

canal stenosis and sacroiliitis. MRI is superior to X-ray for spinal malignancy, spinal infection and early sacroiliitis.

The evidence review does not assess the potential harms of the different imaging modalities, which must also be taken into consideration when determining the most appropriate imaging strategy.

Table ES.5 Sensitivity and specificity estimates for MRI, CT and X-ray in patients with LBP

| Suspected indication | Type | Study ID, Quality ^a | Study type (number of included studies) | Source | Sensit. (%) | Specif (%) | AUROC | LR+ | LR- | DOR |
|------------------------|------|---|---|------------------|-------------|------------|----------------|----------------------|------------------------|-------|
| Lumbar disc herniation | CT | Moranjic (2011), Fair | 1 study, (direct comparison with MRI) | Study 1 | 92.3 | 85.7 | 0.624 | N/A | N/A | N/A |
| | | Van Rijn (2012), Good | SR (pooled analysis of 6 studies ⁴) | Pooled estimates | 77 | 74 | N/A | 2.94 | 0.31 | 9.61 |
| | | Jarvik and Deyo (2002), Poor ^b | SR (2 direct comparative studies) | Study 1 | 88-94 | 57-64 | 0.85-0.86 | 2.1-6.9 ^d | 0.11-0.54 ^d | N/A |
| | | | | Study 2 | 60 | 86 | N/A | N/A | N/A | N/A |
| | MRI | Moranjic (2011), Fair | 1 study (direct comparison with CT) | Study 1 | 91.6 | 66.7 | 0.875 | N/A | N/A | N/A |
| | | Wassenaar (2012), Fair | SR (pooled analysis of 5 studies) | Pooled estimates | 75 | 77 | — ^c | 3.3 | 0.33 | 10.12 |
| | | Jarvik and Deyo (2002), Poor ^b | SR (2 direct comparative studies) | Study 1 | 89-100 | 43-57 | 0.81-0.84 | 1.1-33 ^d | 0-0.93 ^d | N/A |
| | | | | Study 2 | 64 | 87 | N/A | 1.1-33 ^d | 0-0.93 ^d | N/A |
| | MRI | | | Study 1 | 81 | 100 | N/A | N/A | N/A | N/A |

⁴ One of these studies used expert panel consensus as the reference standard rather than findings at surgery.

| Suspected indication | Type | Study ID, Quality a | Study type (number of included studies) | Source | Sensit. (%) | Specif (%) | AUROC | LR+ | LR- | DOR |
|----------------------------------|------|---|---|------------------|--------------------|---------------------|-------|-----|-----|-----|
| LDH with nerve root compression | | Wassenaar (2012), Fair | SR (2 studies) | Study 2 | 92 | 52 | N/A | N/A | N/A | N/A |
| Spinal stenosis | CT | Jarvik and Deyo (2002), Poor ^b | SR (13 studies) | Range | 70-100 | 80-96 | N/A | N/A | N/A | N/A |
| | | Wassenaar (2012), Fair | SR (2 studies) | Study 1 | 96 | 68 | N/A | N/A | N/A | N/A |
| | | | | Study 2 | 87 | 75 | N/A | N/A | N/A | N/A |
| | | Jarvik and Deyo (2002), Poor ^b | SR (5 studies) | Ranges | 81-97 | 72-100 | N/A | N/A | N/A | N/A |
| Spondyloarthritis (sacroiliitis) | CT | Sidiropoulos (2008), Poor ^b | SR (pooled analyses of 10 studies) | Pooled estimates | 49 | 100 ⁵ | N/A | N/A | N/A | N/A |
| | MRI | Sidiropoulos (2008), Poor ^b | SR (2 pooled analyses of 8 & 5 studies ⁶) | Pooled estimates | 40/27 ⁷ | 100/94 ⁸ | N/A | N/A | N/A | N/A |
| | | Jarvik and Deyo (2002), Poor ^b | SR (1 study) | Study 1 | 55 | Not applicable | N/A | N/A | N/A | N/A |
| | | Shankar (2009), Poor | Case-control (1 study) | Study 1 | 88 | 100 | N/A | N/A | N/A | N/A |

⁵ Specificity estimates based on a single study of patients with mechanical LBP.

⁶ Eight studies for active changes, five studies for chronic changes in the sacroiliac joint.

⁷ Estimates for active changes/chronic changes due to sacroiliitis.

⁸ Estimates for active changes/chronic changes due to sacroiliitis.

| Suspected indication | Type | Study ID, Quality ^a | Study type (number of included studies) | Source | Sensit. (%) | Specif (%) | AUROC | LR+ | LR- | DOR |
|----------------------|-------|---|---|------------------|-----------------|-------------------|-------|--------|-----------|-----|
| | X-ray | Sidiropoulos (2008), Poor ^b | SR (pooled analyses of 18 studies) | Pooled estimates | 35 | 100 ⁹ | N/A | N/A | N/A | N/A |
| | | Jarvik and Deyo (2002), Poor ^b | SR (1 study) | Study 1 | 45 | 100 | N/A | N/A | N/A | N/A |
| | | Shankar (2009), Poor | Case-control (1 study) | Study 1 | 0 ¹⁰ | 100 ¹¹ | N/A | N/A | N/A | N/A |
| Spinal malignancy | MRI | Jarvik and Deyo (2002), Poor ^b | SR (5 studies) | Ranges | 83-93 | 90-97 | N/A | 8.3-31 | 0.07-0.19 | N/A |
| | X-ray | Jarvik and Deyo (2002), Poor ^b | SR (1 study) | Study 1 | 60 | 99.5 | N/A | N/A | N/A | N/A |
| Spinal infection | MRI | Jarvik and Deyo (2002), Poor ^b | SR (1 study) | Study 1 | 96 | 92 | N/A | 12 | 0.14 | N/A |
| | X-ray | Jarvik and Deyo (2002), Poor ^b | SR (1 study) | Study 1 | 82 | 57 | N/A | 1.9 | 0.32 | N/A |

Abbreviations: AUROC, area under receiver operating characteristic curve; CT: computed tomography; DOR, diagnostic odds ratio; LDH, lumbar disc herniation; LR+, positive likelihood ratio; LR-, negative likelihood ratio; MRI, magnetic resonance imaging; ROC, receiver operating characteristic; SR, systematic review.

Note: refer to Section 5 of this Review for 95% confidence intervals for the point estimates in this table.

a Quality assessment was undertaken for the purposes of this MBS Review and is presented in Appendix 6.

b Jarvik and Deyo (2002) and Sidiropoulos et al (2008) received a poor quality rating, primarily because individual study characteristics were not reported and quality assessment of individual studies was not reported.

c A ROC plot was presented but an AUROC was not reported.

d Range for study 1 and study 2.

⁹ Specificity estimates based on two studies of patients with mechanical LBP.

¹⁰ Represents no inflammatory or structural changes detected in any subjects.

¹¹ Represents no inflammatory or structural changes detected in any subjects.

Change in patient management

Five publications/reports describing four studies were identified that assessed the effect of imaging on change in patient clinical management (see Section 5.2 for details). In summary, the results of the two most relevant studies are in line with recommendations in CPGs that state that imaging should be limited to patients with particular signs or symptoms, or suspected underlying pathology, or those who are being considered for surgery. One study showed that MRI in patients with a clinical diagnosis of neural compression changed the original diagnosis from surgery to conservative management in 50% of cases (Rankine et al, 1998). Another study showed that in patients with LBP for whom there was clinical uncertainty about whether to perform imaging, performing early imaging in all patients provided no additional benefit for diagnosis, treatment or management compared with imaging only if or when it is clinically indicated (Gilbert et al, 2004).

Evidence for the cost implications of imaging for low back pain

Six cost-effectiveness analyses and four cost analyses were identified by the literature search (see Section 6.1 for details). The perspective taken in all of the included studies was that of direct costs to the healthcare system; however, indirect costs were also considered in one of the studies. Five studies were conducted in the primary care setting, two were in a hospital outpatient setting, one was in a specialist care setting, one was in a workers compensation setting, and one did not limit the setting. Six studies were conducted in the US, two were in the UK, one was in Denmark and one was in Australia. This may limit the applicability of the findings to the Australian health system.

The economic evidence identified did not allow a comparison of cost-effectiveness between imaging modalities in the population of interest for this review, or in the general LBP population.

The economic and costing studies most relevant to the patient population defined in this review included one study conducted in patients with the signs and symptoms of radiculopathy (Webster et al, 2013) and two studies in patients with suspected cancer (Hollingworth et al, 2003; Joines et al, 2001).

The results of Webster et al (2013) suggest that performing early MRI in patients with suspected radiculopathy is not beneficial and is costly, which is in line with guideline recommendations to limit MRI in this patient group until at least a month after pain onset and a trial of conservative therapy. The applicability of the study by Hollingworth et al (2003) is uncertain as it compared rapid MRI (a technique not regularly used in Australia) with X-ray. The study by Joines et al (2001), provides some guidance on the most cost-effective criteria to base a decision to perform MRI or bone scan/MRI in patients with suspected underlying cancer. Once again, limiting assessment for suspected cancer to those with certain clinical, laboratory and imaging findings is consistent with recommendations in published guidelines.

Current usage of imaging for low back pain services in Australia

MBS data

While MBS data can provide insights in relation to claiming patterns for existing items, it is not possible to ascertain a complete picture of servicing for LBP in primary care, or whether current requesting is appropriate. Interpretation of the MBS data is limited because: information is not available on the purpose of the imaging request; item descriptors are not limited specifically to LBP; and there are restrictions in relation to the type of providers that can request CT and MRI.

The analysis of low back imaging services was not limited solely to those services that can be requested by primary care providers, as the relative volume of service requests by specialists (subsequent to primary care presentations) and the trends over time in specialist requests, may also be informative.

Forty-five MBS items were identified that may be used in a work-up for LBP: 16 X-ray items, five CT items and 24 spinal MRI items (see Section 3.1; item descriptors in Appendix 3). Twenty one of these items are specifically for services provided on equipment that is 10 years old or older. Rather than specifying the region of the back to be imaged, spinal MRI items specify the indication or suspected indication. Therefore the MBS data for X-ray and CT imaging is predominantly for low back conditions while the MBS data for MRI imaging can be for conditions at any region of the back (with the exception of sciatica and cauda equina, which are entirely low back).

Importantly for interpretation, none of the included imaging services are used exclusively for patients who present with LBP.

Due to the large number of relevant MBS items, a subset of high usage items was selected from each imaging group based on the total frequency of claims (see Section 3.1 for further details). These groups, referred to as the main items, consisted of three X-ray items (58106, 58112, 58121), one CT item (56223; without contrast) and five MRI items (63154, 63167, 63176, 63179, 63204). Over recent years, total services for the main X-ray items have fallen while services grew for the main CT and MRI items.

All three specialty types use X-ray items 58106 and 58112, but only allied health professionals use item 58121 (three examinations of the spine, no more than once per patient per calendar year). This item was introduced on the MBS on 1 January 2010, replacing use of item 58115 by allied health professionals. Due to this and other changes in the repertoire of relevant X-ray MBS items in 2009-10, growth data for X-ray services is reported from 2010-11 to 2013-14.

Overall, the number of services for the three main X-ray items fell by 9.5% from 2010-11 to 2013-14, driven by a 35.9% fall in services for the allied health-specific item 58121, while services for the other two items (58108 and 58112) remained largely constant. In 2013-14, most services for the main X-ray items were requested by GPs (61%), having grown in number by only 1% over the previous four years. Specialists requested 11% of the main X-ray services in 2013-14, which had increased in

number over the previous four years by 11.3%. In 2013-14, a large proportion of requests for the three main X-ray items were from allied health professionals (28%), having already fallen in number by 26.3%¹² over the prior four years.

Over 90% of services for the included CT items were for item 56223, and 90% of these services were requested by GPs, with the balance requested by specialists (allied health professionals are not permitted to request CT). After a drop of around 8% in the prior year (2009-10), services grew by 28.3% from 2010-11 to 2013-14, driven by both GPs (28.2%) and specialists (21.6%).

All included MRI items are specialist-requested services and the total number of these services grew over the five years from 2009-10 to 2013-14 by 24.8%. For the item relating to spinal MRI for signs and symptoms of sciatica (MBS item 63176), particularly high growth was observed in requests from specialty groups outside the main four groups (neurosurgery, orthopaedic surgery, rheumatology and neurology).

Repeat servicing within three months was low with either the main CT item or the most frequently used X-ray item (2.0% and 2.8%, respectively), and was largely performed by specialist groups (especially orthopaedic surgery and neurosurgery). Cascade imaging from X-ray and/or CT, ending with MRI, was also infrequent (less than five percent of index procedures for all specialty types), except for requests from specialists for X-ray followed by MRI, which accounted for 9.2% of specialist index X-ray procedures in 2013-14. For all sequences investigated, the incidence of cascade imaging has increased substantially over five years, ranging from 86% to 139% growth.

BEACH dataset

A recent report from The Family Medicine Research Centre, University of Sydney, investigated GP imaging requests in Australia, with a section dedicated to imaging requests for back problems (Britt et al, 2014). Changes in GP requesting behaviour were assessed by comparing data from two three-year data periods: Period 1, April 2002–March 2005 inclusive; and Period 2, April 2009–March 2012 inclusive.

Similar to the MBS data, interpretation of the BEACH dataset is limited because GP encounters for management of back problems are not exclusively in patients who present with the symptom of pain.

Data are reported for management of all (any) back problems, and are further classified according to diagnostic status (back syndrome or back symptom/complaint) and problem status (old or new). Data are also reported for X-ray and CT scans according to the region of the back imaged (including lumbar imaging and lumbosacral imaging).

¹² From 2010-11 to 2013-14, overall allied health-requested services for all 16 included X-ray items fell by a similar amount. Only items 58120 and 58109 increased in services over this period, but as their numbers were small, the impact on the overall growth was minimal.

The BEACH dataset provides additional information as it captures MRI requests from GPs, who are ineligible to request spinal MRI services for adults under the MBS.

Between 2002-05 and 2009-12, there was a statistically significant increase in the number of problems managed per GP-patient encounter; however, the number of back problems managed per encounter and the rate of imaging for back problems remained stable over this period (see Section 3.2.1).

Of all GP imaging requests for any back problem, the proportion managed with low back X-ray decreased from 2002-05 to 2009-12 (32.9% to 26.4%) whereas the proportion managed with low back CT scans increased (from 22.9% in 2002-05 to 27.8% in 2009-12). This corresponds to a decrease in low back X-ray request rates from 5.3 to 4.4 per 100 back problems managed by GPs, and an increase in low back CT request rates from 3.7 to 4.7 per 100 back problems.

As the use of MRI was not reported by body region, MRI data relates to the management of problems in any region of the back, which does not allow an assessment of MRI trends for low back in particular. Spinal MRI requests for any back problems increased from 0.2 per 100 back problems managed by GPs in 2002-05 to 0.8 per 100 back problems managed in 2009-12. As a proportion of all GP imaging requests for any back problem, spinal MRI increased from 1.3% in 2002-05 to 4.9% in 2009-12.

Britt et al (2014) note that the reduction in diagnostic radiology imaging rates observed from 2002-05 to 2009-12, although quantitatively small, is consistent with the change in Australian guidelines (AAMPGG 2004) favouring the use of MRI investigation of complex back problems. They speculate that the limited ability of GPs to request MRI probably explains the greater increase in requests for CT scans than in requests for MRIs.

Conclusions

CPGs generally recommend MRI in preference to CT and X-ray for investigation of patients who present with suspected spinal canal stenosis, suspected spinal malignancy, suspected spinal infection, or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy. CT is often recommended where MRI is contraindicated, not tolerated or not available. X-ray is recommended by CPGs in preference to MRI and CT for suspected cases of vertebral fracture or other bone-related pathology. X-ray is also often recommended in preference to MRI or CT for suspected inflammatory spondyloarthritis; however, if radiographs of the sacroiliac joints are normal or equivocal, MRI is acknowledged as the best imaging modality to identify inflammation.

In patients with suspected spinal canal stenosis, suspected inflammatory spondyloarthritis, or with signs and symptoms of sciatica/radiculopathy, CPGs recommend that imaging should be deferred until after a 4- to 6- week trial of conservative management, unless neurologic deficits are progressive or severe enough to consider surgical intervention. Repeat MRI without significant clinical deterioration in symptoms and/or signs is not recommended.

Although the identified CPGs were evidence-based to some extent, the recommendations were often supplemented with consensus opinion due to the limited quantity and quality of evidence available. In particular, for those guidelines that preferentially recommended MRI over CT, there was no transparent link to the evidence to support this preference. However, some guidelines noted that MRI offers better visualisation of soft tissue, vertebral marrow, and the spinal canal, and a superior safety profile in terms of no ionising radiation.

Whereas CPG recommendations may take into consideration the relative harms and benefits of each imaging modality, assessment of the comparative harms of the different imaging modalities was out of scope for the review of the clinical evidence undertaken for this MBS Review.

The systematic review did not reveal any clear benefit for MRI over CT in terms of diagnostic accuracy for patients presenting with LBP and suspected spinal canal stenosis, spinal malignancy, spinal infection, or the signs/symptoms of sciatica/radiculopathy. However, the available evidence was limited in terms of quantity and quality, thus rendering it difficult to draw firm conclusions, particularly as high quality comparative studies are lacking. Importantly, there was no evidence identified for the diagnostic accuracy of imaging for suspected cauda equina syndrome or for suspected vertebral fracture in patients with LBP.

The systematic review identified a small number of published economic analyses; however, this evidence does not allow a comparison of cost-effectiveness between imaging modalities in the population of interest for this review, or in the general LBP population.

Although MRI is recommended as the modality of choice for detection of a range of serious underlying pathologies, primary care providers are ineligible to request MRI of the low back under the MBS. As a consequence, CT and X-ray may instead be used for patient work-up prior to specialist referral. The evidence indicates that the use of CT and X-ray are not inappropriate in terms of their diagnostic utility in patients with LBP and suspicion of a particular underlying serious pathology; however, they do have the added disadvantage of low-level radiation exposure.

The ability to robustly investigate whether current requesting of imaging services for LBP is appropriate, and to determine the associated cost to the MBS of inappropriate LBP imaging, is constrained because the MBS item descriptors are not limited specifically to LBP, and information is not available on the purpose of the imaging request. Furthermore, the MBS data do not provide information about the duration of LBP prior to presentation to a primary care provider. In cases where LBP has persisted over a long period of time, the use of imaging may not be inappropriate.

1. BACKGROUND ON IMAGING FOR LOW BACK PAIN

1.1. Description of imaging for low back pain

1.1.1. Low back pain

Low back pain (LBP) refers to pain and discomfort affecting the lumbar and/or sacral regions of the spine. Depending on its duration, LBP can either be acute (pain lasting for no longer than six weeks), subacute (six to 12 weeks) or chronic (pain lasting for more than 12 weeks) (van Tulder et al, 2003; Spitzer et al, 1987).

Clinical practice guidelines (CPGs) endorse a simple triage approach where patients presenting with LBP are classified into one of three categories using patient history and physical examination (Koes et al, 2010):

- LBP associated with sciatica or spinal canal stenosis (narrowing);
- serious spinal pathology (malignancy, cauda equina syndrome, fracture, spinal infection, spondyloarthritis); or
- non-specific LBP.

Approximately 90% of LBP cases fall into the latter category where the patho-anatomical source of the pain is not specified (Krismer et al, 2007, van Tulder et al, 1997). The recommended treatment for acute non-specific LBP is advice and provision of analgesics. The advice focuses on providing patients with an explanation of the problem, advising on self-management, and encouraging them to carry on with normal daily activities. Most people experience rapid improvement in pain and function within one month, with further improvement for up to three months, although recurrences are common.

1.1.2. Serious spinal pathology

A small proportion of patients present with LBP as the initial manifestation of a more serious pathology, such as malignancy, cauda equina syndrome, fracture, spinal infection or spondyloarthritis. The low prevalence of these serious pathologies (approximately 1% in the primary care setting) (Henschke et al, 2009) does not justify routine testing of patients presenting with LBP, and clinicians instead rely on screening tools to aid clinical decisions about when to refer patients for further testing (Downie et al, 2013).

Many CPGs for back pain recommend awareness of 'red flags' to help identify patients with a higher likelihood of serious pathology who may then become candidates for more extensive diagnostic investigations (Downie et al, 2013). Suggested 'red flags' include significant trauma, unexplained weight loss, unexplained fever, recent infection, history of malignancy, immune suppression, long term glucocorticoid use, suspicion of ankylosing spondylitis (AS) or other inflammatory conditions, neurological defects, or age >70 years. However, the use of 'red flags' as a screening tool is controversial as different guidelines endorse different sets of red flags. Furthermore, some

commonly accepted 'red flags' have been shown to have high false positive rates, rendering them poorly specific for the identification of serious spinal disorders as a large proportion of patients would be imaged unnecessarily (Henschke et al, 2009). Two recent Cochrane reviews (Henschke et al, 2013; Williams et al, 2013) have questioned the diagnostic accuracy of red flags to screen for particular pathologies such as malignancy and fracture, and are summarised below.

Henschke et al (2013) conducted a systematic review of studies examining the diagnostic accuracy of 'red flags' to screen for spinal malignancy in patients presenting with LBP. The systematic literature search, undertaken in April 2012, identified eight relevant studies that examined a total of 20 index tests, only seven of which were evaluated by more than one study. Diagnostic imaging and clinical follow-up at least 6 months after initial consultation were deemed to be appropriate reference standards.

Only one study assessed the diagnostic accuracy of a combination of index tests (Deyo et al, 1988). This study reported that a combination of age greater than 50 years, history of cancer, unexplained weight loss, or failure to improve with conservative therapy had a sensitivity of 100% for detecting malignancy. Conversely, the diagnostic performance of most 'red flags' when used in isolation is poor. According to Henschke et al (2013), the exception was a previous history of cancer, which had a sufficiently high positive likelihood ratio to meaningfully increase the probability of malignancy.

Based on the available evidence, the authors suggested that in patients with LBP, an indication of spinal malignancy should not be based on the results of one single 'red flag'. Instead, the possibility of spinal malignancy should be considered when a combination of 'red flags' are found to be positive (Henschke et al, 2013).

The Cochrane review by Williams et al (2013) aimed to provide information on the diagnostic accuracy of tests used to screen for vertebral fracture in patients presenting with LBP or for lumbar spine examination. Based on a literature search conducted in March 2012, eight studies were identified that reported on a total of 29 groups of similar index tests,¹³ only two of which were reported in more than two studies. Furthermore, only two of the included studies thoroughly investigated combinations of 'red flags', despite the fact that this would most likely reflect the use of such indicators in clinical practice (Williams et al, 2013).

Five 'red flags' are commonly recommended in CPGs for fracture (osteoporosis, history of trauma, corticosteroid use, older age and female gender); however, osteoporosis was not examined in any of the identified studies. Three of the remaining four 'red flags' (significant trauma, older age and corticosteroid use), showed promising results in the primary care setting, but when used in isolation had modest diagnostic accuracy, considering they are required to detect a condition that has a low

¹³ For example, trauma = significant trauma, history of trauma, major trauma, direct trauma, or fall; age = age with six different cut-offs.

prevalence (Williams et al, 2013). In addition, one tertiary care study reported that the presence of contusion or abrasion was informative, with reasonable sensitivity and high specificity.

Across the broader range of ‘red flags’, the majority neither increased the likelihood of fracture enough when present, nor decreased its likelihood enough when absent to guide decisions about the need for further investigation. The authors reported that the most favourable results to implicate fracture are found when combinations of ‘red flags’ are present, with positive likelihood ratios generally greater in magnitude and precision (Williams et al, 2013). Overall, the Cochrane review found that existing recommendations for screening of fracture are not well supported by the available evidence and should be reviewed.

1.1.3. Appropriate use of low back imaging

International CPGs are consistent in recommending that diagnostic investigations should be reserved for patients with suspected serious pathology or those with radiculopathy who are being considered for spinal interventional therapy of any kind (see Section 4 for a summary of recommendations from relevant CPGs). For most people with LBP without clinical signs and symptoms that are known to be associated with malignancy, cauda equina syndrome, fracture and spinal infection, imaging is unlikely to help identify the cause of pain, alter treatment decisions or decrease recovery time (Chou et al, 2011a). Substantial improvement in pain and function generally occurs in the first four weeks in most patients with acute LBP, with or without radiculopathy, regardless of whether and how patients are treated (Pengel et al, 2003). Furthermore, as discussed in Section 0, inappropriate use of lumbar spine imaging may be associated with a number of direct harms, such as radiation exposure, and downstream harms, such as unnecessary surgery and interventional procedures.

Despite this, studies suggest that some clinicians continue to request low back imaging routinely or without a clear indication, perhaps to reassure their patients or themselves, to meet patient expectations regarding diagnostic tests, or to try to identify a specific anatomical diagnosis for the LBP (Chou et al, 2009). Data from the Bettering the Care and Evaluation of Health (BEACH) program have shown that approximately 15% of all general practitioner (GP) presentations in Australia for new back symptoms or complaints lead to lumbar or lumbosacral imaging (refer to Section 3.2 for a summary of the BEACH findings). This trend has remained fairly consistent over the past decade, although there has been a marginal decrease in GP referrals for plain radiography and a small increase in computed tomography (CT) scans and magnetic resonance imaging (MRI) (Britt et al, 2014).

1.1.4. Harms associated with low back imaging

Exposure to ionising radiation

Lumbar plain radiography and CT contributes to an individual’s cumulative low-level radiation exposure (Chou et al, 2012). This is particularly important in babies, children, and adolescents who are more sensitive to the carcinogenic effects of exposure to ionising radiation. However, low back

radiation exposure is also of particular concern for women of child-bearing age because of the proximity of the low back to the gonads, which are difficult to effectively shield (Fazel et al, 2009).

The average effective radiation dose from lumbar plain radiography (1.3 millisieverts (mSv)) is 65 times higher than from chest radiography (0.02 mSv), but approximately 2.5 times lower than from lumbar spine CT (3.3 mSv).¹⁴ MRI does not use ionising radiation.

Exposure to iodinated contrast

Lumbar CT may involve use of iodinated contrast, which is associated with nephropathy and hypersensitivity reactions (Stacul et al, 2011; RANZCR, 2009). It should be noted, however, that according to MBS data (Section 3.1), less than 0.6% of all CT scans of the lumbosacral region use intravenous contrast medium.

Gadolinium-based contrast agents (GBCA) are sometimes used with MRI scans to improve visibility.¹⁵ GBCA are generally acknowledged to be safe; however, it is recommended that they should not be administered to patients with either acute or significant chronic kidney disease due to the potential risk of nephrogenic systemic fibrosis (Davis et al, 2009; RANZCR, 2013). Furthermore, the U.S. Food and Drug Administration (FDA) is currently investigating the risk of brain deposits following repeated use of GBCA. It is unknown whether these gadolinium deposits are harmful or can lead to adverse health effects, but the FDA has recommended that health care professionals should consider limiting GBCA to clinical circumstances in which the additional information provided by the contrast is necessary.¹⁶

Increased risk of surgery and interventional procedures

Lumbar spine imaging can lead to additional tests, follow-up, and referrals, and may sometimes result in invasive procedures, such as surgery. Although the increased number of unnecessary operations that occur from unneeded imaging tests is difficult to estimate, strong associations have been shown between rates of spinal MRI and rates of spinal surgery and other interventional procedures (Lurie et al, 2003; Verrilli et al, 1996). Patients who undergo imaging may be subjected prematurely to surgery that has limited or questionable benefit but exposes them to potentially serious complications (Chou et al, 2012; Flynn et al, 2011).

Risk of labelling patients with a diagnosis that is not the cause of pain

Spine imaging could result in unintended harms from labelling effects, which occur when patients are told that they have a condition or an imaging 'abnormality' that they were not previously aware of (Fisher et al, 1999). Knowledge of clinically irrelevant imaging findings might hinder recovery and

¹⁴ Western Australia Department of Health, [Ionising radiation in diagnostic imaging](#); last reviewed November 2014.

¹⁵ According to expert clinical advice, gadolinium-based contrast medium is rarely used for imaging for LBP.

¹⁶ Safety alert for human medical products, posted on the FDA website 27th July 2015.

result in chronic LBP by causing patients to worry more, focus excessively on minor back symptoms, or avoid exercise and other recommended activities because of fears that they could cause more structural damage (Leeuw et al, 2007).

Incidental findings that have no clinical significance but trigger further investigation

Imaging findings from plain X-rays and advanced imaging studies are not strongly associated with acute LBP symptoms (van Tulder et al, 1997; Chou et al, 2011a). For 95 per cent of primary care presentations, X-rays for non-specific LBP demonstrate no abnormality or minor degeneration (Hollingworth et al, 2002). The prevalence of degenerative changes seen in imaging studies in patients with back pain has been shown to be similar to the prevalence found in patients without back pain (van Tulder et al, 1997; Jarvic et al, 2002), indicating that many of these findings may actually be considered non-pathological or normal, age-related changes (Flynn et al, 2011).

Unnecessary utilisation of resources and increased financial costs

Unnecessary imaging can lead to unnecessary use of health care resources and increased financial costs to the patient and healthcare system. These costs are both direct and indirect, the latter due to waiting time in emergency departments, prolonged length of stay in a hospital, and time away from work and other responsibilities (RANZCR, 2014).

1.1.5. Incidence and prevalence of conditions relevant to low back pain

LBP is a common reason for people seeking care in emergency departments and back complaint is the second most common clinical complaint leading people to seek care from general practice in Australia (Britt et al, 2014a). The lifetime prevalence of LBP has been estimated to be 79.2% in Australian adults (Walker et al, 2004) and 84% in adolescents (Jeffries et al, 2007), with about one in 10 people experiencing significant activity limitation (Walker et al, 2004). The prevalence of back pain has increased over successive national surveys. In the most recent (2011-12) National Health Survey from the Australian Bureau of Statistics (ABS), it was estimated that approximately 2.8 million Australians have back pain and disc disorders, representing 12.4% of the population (ABS, 2012).

Over 90% of patients presenting in primary care are classified as having non-specific LBP, with no identifiable cause (Krismer et al, 2007; van Tulder et al, 1997). The frequency of conditions that require urgent identification, due to the potential for permanent neurologic sequelae with delayed diagnosis, is low. In patients with LBP in primary care settings, approximately 0.7% have metastatic cancer, 0.01% have spinal infection, and 0.04% have cauda equina syndrome (Deyo et al, 1992; Jarvik and Deyo, 2002). Vertebral compression fractures and inflammatory back disease are more common (approximately 4% and <1%, respectively), but the diagnostic urgency for these conditions is not as great, because they are not generally associated with progressive or irreversible neurologic impairment.

1.2. Description of the services under review

1.2.1. Current MBS arrangements for imaging services

The focus of this MBS review is restricted to primary care presentations for LBP (i.e. non-specialist). As shown in Table 0-1, GPs are eligible to request MBS services relating to low back imaging using X-ray, CT and nuclear medicine. Other primary care health providers (such as chiropractors, osteopaths and physiotherapists) are eligible to request some, but not all, X-ray imaging services.

MRI services on the MBS are generally restricted to requests from recognised specialists or consultant physicians. GPs are currently not eligible to request MRI items relating to the low back of adults but can request MRI of the spine for patients under 16 years following radiographic examination. However, GPs are eligible to request MRI of the head, cervical spine and knee for specified clinical indications in people aged 16 years and over. The Royal Australian College of General Practitioners (RACGP) has developed clinical guidance for MRI referral that emphasises the importance of clinical history and physical examination to guide appropriate use of MRI (RACGP, 2013).

Table 0-1 Summary of eligible providers for requesting low back imaging services on the MBS

| Provider group | X-ray | CT | Nuclear medicine imaging | MRI |
|---|-------|-----|--------------------------|-----------------|
| General practitioners | Yes | Yes | Yes | No ^b |
| Other primary health providers ^a | Yes | No | No | No |
| Specialists and consultant physicians | Yes | Yes | Yes | Yes |

Abbreviations: CT, computed tomography; MBS, Medicare Benefits Schedule; MRI, magnetic resonance imaging.

^a Includes chiropractors, osteopaths and physiotherapists. These providers are eligible to request only some of the X-ray imaging services available on the MBS.

^b GPs are eligible to request MRI of the spine (MBS items 63510 and 63511) for patients under 16 years following radiographic examination.

1.2.2. The MBS items relevant to imaging for low back pain

There are numerous items listed on the Diagnostic Imaging Services Table of the MBS that relate to low back imaging and are within scope for the review. Table 0-2 presents the CT and radiographic imaging MBS item numbers that can be requested by GPs. Other primary health providers (chiropractors, osteopaths and physiotherapists) can only request five of the items shown in the table (58106, 58109, 58112, 58120 and 58121).

The listed MBS items are for imaging of the low back region, but are not exclusively used in patients that present with LBP. Some of the MBS items for radiographic examination include imaging for the low back as well as other regions of the spine, such as the cervical (neck), thoracic, and sacrococcygeal regions. The current item descriptors and Schedule fees are provided in Appendix 3.

Table 0-2 MBS item numbers relating to low back CT and radiography

| Type of imaging | MBS item Number |
|---------------------|--|
| Computed tomography | 56223, 56226, 56229, 56232, 56233 |
| Radiography | 58106, 58108, 58109, 58111, 58112, 58114, 58115, 58117, 58120, 58121, 58123, 58126, 59700, 59701, 59724, 59725 |

Source: MBS Online, accessed 16 May 2014

Note: Other primary health providers (chiropractors, osteopaths and physiotherapists) can only request items 58106, 58109, 58112, 58120 and 58121 (see Explanatory Notes shown in Appendix 3).

Abbreviations: CT, computed tomography; MBS, Medicare Benefits Schedule.

Table 0-3 presents MBS items relating to MRI of the low back, categorised according to clinical indication. The current item descriptors and Schedule fees are provided in Appendix 3. As mentioned above, GPs and other primary care providers are currently unable to request MRI of the low back of adults.

Table 0-3 MBS item numbers relating to low back MRI

| Clinical indication | MBS item numbers |
|--------------------------|----------------------------|
| Spinal infection | 63151, 63157, 63201, 63207 |
| Spinal malignancy/tumour | 63154, 63158, 63204, 63208 |
| Cauda equina | 63164, 63187, 63222, 63258 |
| Sciatica | 63176, 63191, 63234, 63262 |
| Spinal canal stenosis | 63179, 63192, 63237, 63263 |
| Myelopathy | 63167, 63188, 63225, 63259 |

Source: MBS Online, accessed 16 May 2014

Abbreviations: MBS, Medicare Benefits Schedule; MRI, magnetic resonance imaging.

1.2.3. MBS items considered out of scope for the review

GPs are eligible to request MRI of the spine for patients under 16 years following radiographic examination (MBS items 63510 and 63511). The current review focuses on imaging for LBP in adults and therefore these MBS items are out of scope. For ease of reference, the current item descriptors and Schedule fees for these services are provided in Appendix 3.

Although nuclear medicine services are used in the diagnosis of low back conditions, these services have a limited role in investigating back pain and the items are not specific to back pain. For this reason, and because these services are more commonly initiated by specialists (and after other imaging), they are out of scope for the review.

1.3. The clinical decision pathway

Recent guidance from the Royal Australian and New Zealand College of Radiologists (RANZCR) recommends that patients presenting to primary care with LBP are classified according to a diagnostic triage, using a combination of patient history and physical examination, with or without

biochemical testing and neurological examination (Goergen et al, 2014). The three diagnostic categories are: (i) LBP associated with sciatica or spinal canal stenosis, (ii) serious spinal pathology (malignancy, cauda equina syndrome, fracture, spinal infection, spondyloarthritis), and (iii) non-specific LBP.

In the absence of a specific cause for the LBP, and if there are no signs or symptoms of a serious pathology in the patient history or on physical examination, conservative care with patient education is the first step in pain management. Conservative care may include information about LBP, reinforcement of positive expectations, education about self-management and self-responsibility, pain management and control, and increase in exercise tolerance (Chou et al, 2007). In the absence of radicular pain, non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants and manipulation may be considered (Chou et al, 2007; Koes et al, 2006). Routine imaging and bed rest are discouraged. Patients with severe non-specific LBP that has persisted for more than 6-12 weeks, may be referred to allied health practitioners or specialists (Williams et al, 2010; Good-Year et al 2002). After clinical reassessment, work-up (including imaging) may be considered.

In patients with radiculopathy syndrome, spinal canal narrowing, or with suspected ankylosing spondylitis, imaging may be deferred until after a trial of conservative management. In cases where the condition persists after conservative management, further investigations may be conducted or the patient referred to an appropriate specialist.

Clinical guidance recommends that low back imaging should only be requested in the presence of severe or progressive neurological deficits or the presence of serious spinal pathologies (Chou et al, 2009; Chou et al, 2007). Patients with suspected osteoporotic or non-osteoporotic fractures of the spine require plain radiography only, which can be requested and managed, in some cases, in the primary care setting. In the case of suspected serious spinal pathology such as malignancy or infection, it may be appropriate for GPs to conduct initial work-up prior to specialist referral. Work-up may include blood tests (e.g. erythrocyte sedimentation rate, C-reactive protein, white blood cell count) and imaging. In patients suspected of skeletal metastases, plain radiography may be sufficient for diagnosis. If a serious spinal pathology is confirmed by the GP or cannot be excluded after initial work-up, the patient should be referred to a specialist for further investigation and management. If there are risk factors for, or signs of, cauda equina syndrome, emergency referral or hospital admission is recommended as treatment often involves emergency surgical decompression. Diagnosis of cauda equina syndrome is usually confirmed by an MRI or CT scan, depending on availability.

A frequent motivation for obtaining imaging in the primary care setting is to exclude an underlying serious pathology, such as malignancy, as the cause of LBP. Although MRI is recommended as the modality of choice for a range of conditions including suspected bone marrow pathology, cauda equina syndrome, spinal cord compression, epidural abscess, paraspinal masses, infective processes, disc herniation, nerve root, thecal sac and spinal cord pathology (see Section 4 for a summary of CPG

recommendations), primary care providers are ineligible to request MRI of the low back under the MBS and may be using other imaging modalities that do not reflect 'best practice' for patient work-up prior to specialist referral. Alternatively, some patients may themselves be covering the cost of non-rebatable MRI services requested by GPs, particularly if there are long waiting lists to see a specialist.

2. REVIEW METHODOLOGY

The review methodology involved an analysis of secondary data (e.g. MBS claims), a guideline concordance analysis and a systematic literature review for clinical and economic evidence. This section presents the research questions and methodology for each of these review components.

2.1. Secondary data analysis

Medicare data were analysed to determine the current service profile for imaging of the low back. The analysis of MBS data are limited due to the inability to distinguish imaging that is undertaken to investigate LBP versus other indications.

2.1.1. The research questions for the MBS analysis

The MBS data were examined to determine:

- (1) What is the profile of claiming relating to MBS items for low back imaging?
 - a. Are there any temporal or geographic trends associated with usage of this item?
 - b. What are the characteristics of patients undergoing low back imaging?
 - c. Are the MBS claims data consistent with trends in the incidence/prevalence of LBP?
 - d. What is the profile of service providers requesting low back imaging?
 - e. Are patients undergoing repeat imaging of the low back?
 - f. Are patients undergoing multiple types of imaging (i.e. cascade referrals, for example X-ray, followed by CT, followed by MRI)?
- (2) What is the profile of benefits relating to MBS items for low back imaging?
 - a. What are the out-of-pocket costs for low back imaging?

2.1.2. Method for analysis of MBS data

MBS data relates to private medical services (provided in- or out-of-hospital), where the services are provided to patients regardless of whether or not they have private health cover.

MBS data were obtained for each of the imaging items in scope for the review (see Section 0 and Appendix 3) for each of the financial years from 2009-10 to 2013-14. Data were analysed by patient gender, age group, patterns of use and discipline of provider requesting the test. The analysis was not limited solely to those services that can be requested by primary care providers, as the relative volume of service requests by specialists (subsequent to primary care presentations) and the trends over time in specialist requests, may also be informative.

Results of the analysis of the MBS data are presented in Section 3.1. A summary of data from the BEACH program, relating specifically to GP requests for imaging for back problems, is provided Section 3.2.

2.2. Guideline concordance

2.2.1. *The purpose of the guideline concordance analysis*

The review is informed by an analysis of relevant CPGs and evidence-based clinical management algorithms that advise on the appropriate imaging modalities for the clinical presentations and serious pathologies listed in Table 0-2. While Australian CPGs are preferable in terms of applicability, clinical guidance from comparable health systems overseas is also included.

2.2.2. *Methods for guideline concordance analysis*

Searches of guideline databases were undertaken to locate any existing guidelines relevant to imaging for LBP. The search included the Guidelines International Network (G-I-N)¹⁷, the National Guidelines Clearinghouse¹⁸, the National Health and Medical Research Council (NHMRC)¹⁹, the National Institute for Health and Care Excellence (NICE)²⁰, and the Scottish Intercollegiate Guidelines Network (SIGN)²¹. The search strings used and the results are presented in Appendix 4.

Relevant clinical guidance relating to imaging in patients with LBP is summarised in Section 4. The available clinical guidance is evidence-based, where available, but is sometimes supplemented with expert opinion due to the limited high quality published clinical evidence available. The review of relevant CPGs is used to determine whether the current profile of services for LBP imaging is consistent with 'best practice' (summarised in Section 4.3).

2.3. Systematic literature review for clinical evidence

2.3.1. *The research questions for the literature review of clinical evidence*

The key research questions for the clinical evidence review are:

1. What is the optimal imaging approach for patients who present to primary care with LBP and:
 - signs/symptoms of sciatic pain/radiculopathy;
 - signs/symptoms of cauda equina syndrome;
 - suspected spinal canal stenosis;
 - suspected inflammatory spondyloarthritis;
 - suspected spinal malignancy;
 - suspected spinal infection; or
 - suspected vertebral fracture?
- a) When should imaging be performed?

¹⁷ [Guidelines International Network \(G-I-N\)](#)

¹⁸ [AHRQ National Guideline Clearinghouse](#)

¹⁹ [NHMRC Guidelines and Publications](#)

²⁰ [NICE Guidance](#)

²¹ [SIGN Published Guidelines](#)

- b) What imaging modality should be used?
2. In patients who present to primary care with LBP, under what circumstances is imaging using plain X-ray or CT appropriate?

2.3.2. Methods for literature review of clinical evidence

Search strategy

A comprehensive search of peer-reviewed scientific literature was conducted to identify studies that provide clinical evidence relating to the diagnostic accuracy of imaging in patients with LBP with suspected serious underlying pathology, or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy. Electronic databases were searched for original research papers, including systematic reviews and meta-analysis as shown in Table 0-1. The search of embase.com was not restricted by date and was searched up to 11 May 2015. Databases maintained by Health Technology Assessment (HTA) agencies and the Cochrane Library were also searched to identify relevant literature and existing HTAs of imaging for LBP in the population of interest. The specific search terms used to identify relevant literature are outlined in Appendix 4. In addition, the reference lists of relevant systematic reviews, selected narrative reviews, evidence-based treatment guidelines and primary articles were also examined.

The search was broad and designed to identify multiple levels of clinical evidence (Level I to Level III) as well as published economic evaluations and CPGs. Thus, the reference database which contained all citations identified via the EMBASE, Medline, Cochrane Library, website and manual searches contained 9,478 citations. Targeted searches were performed within the reference database to identify potentially relevant citations for the guideline, clinical evidence and economic sections. These targeted searches are also outlined in Appendix 4.

Table 0-1 Databases searched – clinical evidence

| Database | Search period |
|---|-------------------|
| embase.com (EMBASE and Medline) | Up to 11 May 2015 |
| The Cochrane Library (includes Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, Cochrane Central Register of Controlled Trials, NHS Economic Evaluation Database, Health Technology Assessment, Cochrane Methodology Register) | Up to 11 May 2015 |
| Relevant HTA websites and databases ^a | Up to 18 May 2015 |

^a The following HTA websites were searched: Agency for Healthcare Research and Quality (AHRQ) at [AHRQ](#); Canadian Agency for Drugs and Technologies in Health (CADTH) at [CADTH Reports](#); National Institute for Health and Care Excellence (NICE) at [NICE, UK](#).

No studies examining the effect of imaging for LBP on change in patient management were identified by the literature search described above, thus, an additional search was carried out. This search was conducted in PubMed only on 18 June 2015. The specific search terms used to identify relevant literature for this outcome are also outlined in Appendix 4.

Eligibility criteria for studies of diagnostic utility

The Patient, Intervention, Comparator, Outcome (PICO) criteria defined for the review of diagnostic utility are shown in Table 0-2. The PICO criteria were determined on the basis of information provided in the literature, as well as clinical advice. Clinical guidance recommends that low back imaging should only be requested where a thorough patient history and physical examination indicates that there may be a medically serious cause for the LBP. In patients without clinical signs and symptoms that are known to be associated with a serious pathology, routine imaging is not associated with clinically meaningful benefits but can lead to harms. As such, the review will focus on determining the most appropriate imaging approach for those patients for whom imaging is indicated.

These criteria were used to define the eligibility criteria for inclusion of studies. The identification of relevant clinical evidence was undertaken using a hierarchical step-wise approach, beginning with a targeted search of the reference database to identify systematic reviews and meta-analyses that fulfilled the PICO criteria. Where higher level evidence was not available, the reference database was searched for progressively lower levels of evidence.

Table 0-2 PICO criteria for the review of imaging for LBP

| Population | Index test | Reference standard | Comparator | Outcomes |
|--|---|---|---|---|
| Adults presenting to primary care (GPs, physiotherapists, chiropractors, osteopaths, etc.) with LBP and: <ul style="list-style-type: none"> signs/symptoms of <ul style="list-style-type: none"> sciatica/radiculopathy cauda equina syndrome suspected <ul style="list-style-type: none"> spinal canal stenosis inflammatory spondyloarthritis spinal malignancy spinal infection vertebral fracture | Imaging of the low back: <ul style="list-style-type: none"> CT X-ray MRI | <ul style="list-style-type: none"> Surgical findings Clinical and/or laboratory follow-up | <ul style="list-style-type: none"> Other imaging modality Delayed imaging | <ul style="list-style-type: none"> Diagnostic accuracy Change in patient management |

Abbreviations: CT, computed tomography, GP, general practitioner, LBP, low back pain, MRI, magnetic resonance imaging

The exclusion criteria for the review of clinical evidence for diagnostic utility were as follows:

1. Wrong study type – excludes non-systematic (narrative) reviews, editorials, letters, conference abstracts, non-clinical studies, case reports, case series.
2. Wrong population – excludes studies in which the population does not at least overlap with the population defined in Table 0-2.
3. Wrong/no test – excludes studies that do not assess at least one of CT, X-ray or MRI.
4. Wrong outcomes – excludes studies that do not assess a diagnostic accuracy outcome (such as sensitivity, specificity, accuracy, likelihood ratio or diagnostic odds ratio) or change in patient management.

5. Not in English.

The results of the search for published clinical studies and a review of the evidence is presented in Section 5.1.

The exclusion criteria for the review of clinical evidence for change in management were as follows:

1. Wrong study type – excludes non-systematic (narrative) reviews, editorials, letters, conference abstracts, non-clinical studies, case reports, case series.
2. Wrong population – excludes studies in which the population does not at least overlap with the population defined in Table 0-2.
3. Wrong/no test – excludes studies that do not assess at least one of CT, X-ray or MRI.
4. Wrong outcomes – excludes studies that do not assess change in patient management.
5. Not in English.

The results of the search for published clinical studies and a review of the evidence is presented in Section 5.2.

2.4. Systematic literature review for economic evidence

2.4.1. *The research questions for the literature review of economic evidence*

Only a preliminary economic analysis was conducted as part of this review, relying on studies identified through the systematic literature review. The key research question was:

1. What is the most cost-effective imaging approach for patients who present to primary care with LBP and:
 - signs/symptoms of sciatic pain/radiculopathy;
 - signs/symptoms of cauda equina syndrome;
 - suspected spinal canal stenosis;
 - suspected inflammatory spondyloarthritis;
 - suspected spinal malignancy;
 - suspected spinal infection; or
 - suspected vertebral fracture?

2.4.2. *Methods for literature review of economic evidence*

Search strategy

A comprehensive search of peer-reviewed scientific literature was conducted to identify studies that provided evidence relating to the cost implications and cost-effectiveness of imaging in patients with LBP and a suspected serious underlying pathology, or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy. The search strategy used is the same as that described in Section 2.3.2.

Eligibility criteria for studies

The PICO criteria defined for this review are shown in Table 0-2. The population, intervention and comparator criteria were used to define the eligibility/exclusion criteria for inclusion of studies. A targeted search of the reference database was performed which aimed to identify relevant trial-based costing studies, cost analyses and economic modelling studies. The search terms used to perform the targeted search are presented in Appendix 4.

Published costing studies or economic analyses were eligible if they assessed the cost implications or cost-effectiveness of one low back imaging modality compared with another imaging modality, or they compared immediate imaging with delayed imaging, in the patient populations listed in the PICO criteria.

The exclusion criteria for the review of economic evidence were as follows:

1. Wrong study type – excludes citations/studies that do not report the results of a costing study or economic analysis.
2. Wrong population – excludes studies in which the population does not at least overlap with the population defined in Table 0-2.
3. Wrong/no test – excludes studies that do not assess at least one of CT, X-ray or MRI.
4. Wrong outcomes – excludes studies that do not assess an economic outcome such as cost or cost-effectiveness.

The results of the search for costing studies and economic analyses and a review of the evidence is presented in Section 6. The evidence was discussed in light of its applicability to the Australian health system.

3. SECONDARY DATA ANALYSIS

This section presents an analysis of the available secondary data that describes the use of imaging of the low back in Australia. An analysis of MBS data was undertaken to determine the current service profile for imaging of the low back using radiography, CT or MRI. Interpretation of the MBS data are limited due to the inability to distinguish imaging that is undertaken to investigate LBP versus other indications. For this reason, and because the MBS data will not capture MRI requests from primary care providers, data from the BEACH program, which is a continuous national study of GP clinical activity in Australia, has been included to provide further information on current usage of imaging for management of back problems.

3.1. MBS services for low back imaging

3.1.1. Total services for all included imaging items

The MBS item descriptors and fees for the 16 radiography items, five CT items and 24 MRI items in scope for the review of imaging for LBP are provided in Appendix 3. Although these items apply to imaging of the low back region (e.g. lumbosacral and sacrococcygeal), not all items are exclusively used for low back imaging. For example, X-ray item 58112 specifies two of a possible four examinations of the spine, two of which are not low back (MBS items 58110 and 58103). X-ray item 58121 may include imaging of the cervical or thoracic spine, but will always include at least one low back examination (MBS item 58106 and/or 58109).

Importantly, with the exception of MRI, the item descriptors do not specify an indication for imaging. As a consequence, none of the in-scope items are used exclusively for patients who present with LBP. It is therefore not possible to determine the extent of the use of the in-scope items for assessment of LBP, the appropriateness of requests for these items, or the associated cost to the MBS of imaging for LBP. As such, the analysis focuses on trends in services for imaging of the low back region but does not provide detail on benefits paid.

The total number of services on the MBS for each of the included items are shown for X-ray (Table 0-3), CT (Table 0-4) and MRI (Table 8: Total services for included MRI items, 2009-10 to 2013-14). This section describes the growth in services from 2009-10 to 2013-14 and the selection of items for further investigation in this Review. For each item, the number of services is shown as a proportion of all services for included items from that imaging group in 2013-14. For X-ray and CT imaging, the higher usage items that constitute at least 90% of services for that imaging type were designated as the 'main items'.

Compared with radiography and CT, there is a greater number of included MRI items and a greater spread of usage amongst them. For this reason, MRI items that each accounted for at least 5% of all included MRI services were designated as the main MRI items.

X-ray

Table 0-3 shows the total services for all included X-ray items from 2009-10 to 2013-14. Seven of these items are specifically for services provided on equipment that is 10 years old or older.

According to the Explanatory Notes relating to requests for diagnostic imaging services (see Appendix 3), physiotherapists, chiropractors and osteopaths may request MBS items 58106, 58109, 58112, and are the only specialty type to which MBS items 58120 and 58121 apply.

Nine of the 16 included X-ray items started on the MBS during the five-year period investigated in this Review; 2009-10 to 2013-14. Seven MBS items (58111, 58114, 58117, 58123, 58126, 59701, 59725) started on 1 July 2011, and very low numbers of services were provided in the following years. These items will not be discussed further in this Review.

The other two items, 58120 and 58121, both started on the MBS on 1 January 2010, specifically for use by allied health professionals (physiotherapists, chiropractors and osteopaths). MBS item 58120 is for imaging of four regions of the spine. It is identical to item 58108 but with the additional specification that the service must not have been provided on the same patient within the same calendar year. From 2009-10 to 2010-11, services for item 58120 increased by 7,521 while services for item 58108 decreased by 6,105, suggesting that use by allied health professionals shifted from item 58108 to item 58120 over this period.²²

Similarly, MBS items 58121 and 58115 are identical (imaging of three regions of the spine), except that item 58121 must not be provided on the same patient within the same calendar year and can only be used by allied health professionals. From 2009-10 to 2010-11, the number of services for 58115 decreased by 103,863 while the number of services for item 58121 grew by a similar magnitude (90,417).²² Therefore, it would appear that a large proportion of services for item 58115 were replaced by services for item 58121.

Due to these rapid changes in total services for these MBS items from 2009-10 to 2010-11, growth to 2013-14 is shown in Table 0-3 for both the five-year period from 2009-10 (five-year growth) and the four-year period from 2010-11 (four-year growth). Subsequent reporting of service growth for X-ray items is restricted in this Review to four-year growth.

Three X-ray items constituted at least 90% of the total of all included X-ray services from 2010-11 onwards: 58106 (lumbosacral), 58112 (two examinations of the spine) and 58121 (three examinations of the spine). Analysis of the profile of service use for low back X-ray items largely focuses on these three items (main X-ray items).

Services for MBS item 58106 increased slightly from 2009-10 to 2010-11 but decreased over each of the subsequent years, by 1.2% from 2010-11 to 2013-14. Services for item 58112 increased slightly

²² Although services for items 58120 and 58121 appear to double from 2009-10 to 2010-11, this is an artefact of having only 6 months of data for these items by June 2010 (these items were introduced on the MBS on 1 January 2010). The rate of requests for items 58120 and 58121 did not substantially change from 2009-10 to 2010-11.

over the first three years and decreased over the following two years, resulting in 1% growth over 5 years. As item 58121 started on the MBS half way through the 2009-10 financial year, these data represent only 6 months of use. After slight growth from 2010-11 to 2011-12, services for this item subsequently fell, and by 2013-14 were 36% lower than in 2010-11. Overall, X-ray services for the main X-ray items fell by 9.5% from 2010-11 to 2013-14.

Table 0-3 Total services for included X-ray items, 2009-10 to 2013-14

| Item | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | % of total, 2013-14 ^a | 5-year growth ^b | 4-year growth ^c |
|-------------------------------|---------------------------|----------------|----------------|----------------|----------------|----------------------------------|----------------------------|----------------------------|
| 58106 | 325,935 | 329,611 | 332,084 | 329,042 | 325,501 | 52.5% | -0.1% | -1.2% |
| 58108 | 8,331 | 2,226 | 2,390 | 2,942 | 2,677 | 0.4% | -67.9% | 20.3% |
| 58109 | 15,084 | 15,907 | 16,521 | 17,040 | 17,849 | 2.9% | 18.3% | 12.2% |
| 58111 ^{d,e} | Not applicable | Not applicable | 396 | 217 | 116 | 0.0% | N/A | N/A |
| 58112 | 129,625 | 130,605 | 134,371 | 132,716 | 131,920 | 21.3% | 1.8% | 1.0% |
| 58114 ^{d,e} | Not applicable | Not applicable | 6 | 11 | 19 | 0.0% | N/A | N/A |
| 58115 | 124,006 | 20,143 | 21,618 | 23,685 | 24,365 | 3.9% | -80.4% | 21.0% |
| 58117 ^{d,e} | Not applicable | Not applicable | 21 | 16 | 6 | 0.0% | N/A | N/A |
| 58120 ^d | 6,173 ^f | 13,694 | 14,918 | 15,421 | 15,439 | 2.5% | 150.1% | 12.7% |
| 58121^d | 65,944^f | 156,361 | 160,142 | 140,985 | 100,292 | 16.2% | 52.1% | -35.9% |
| 58123 ^{d,e} | Not applicable | Not applicable | 218 | 186 | 73 | 0.0% | N/A | N/A |
| 58126 ^{d,e} | Not applicable | Not applicable | 4 | 18 | 1 | 0.0% | N/A | N/A |
| 59700 | 2,058 | 1,707 | 1,594 | 1,486 | 1,540 | 0.2% | -25.2% | -9.8% |
| 59701 ^{d,e} | Not applicable | Not applicable | 2 | 1 | 0 | 0.0% | N/A | N/A |
| 59724 | 610 | 517 | 494 | 446 | 439 | 0.1% | -28.0% | -15.1% |
| 59725 ^{d,e} | Not applicable | Not applicable | 1 | 0 | 0 | 0.0% | N/A | N/A |
| Total | 677,766 | 670,771 | 684,780 | 664,212 | 620,237 | 100% | -8.5% | -7.5% |
| Total for 3 main items (bold) | 521,504 | 616,577 | 626,597 | 602,743 | 557,713 | 89.9% | 6.9% | -9.5% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Note: Analysis of the profile of service use for low back X-ray items largely focuses on the main three items shown in bold (items 58106, 58112 and 58121). Allied health professionals (physiotherapists, chiropractors and osteopaths) may request items 58106, 58109, 58112, 58120 and 58121. Items 58120 and 58121 apply only to allied health professionals.

^a Proportion of total services for all included items.

^b 5-year growth refers to growth from 2009-10 to 2013-14.

^c 4-year growth refers to growth from 2010-11 to 2013-14.

^d Item start date is within 5-year investigation period (2009-10 to 2013-14). See Appendix 3 for start dates.

^e Item is specifically for services provided on equipment that is 10 years old or older.

^f Data shown are for the second 6 months of the financial year.

Due to changes in the repertoire of relevant MBS items in 2009-10, growth data for X-ray services is reported from 2010-11 to 2013-14. Services for the three main X-ray items fell by 9.5% over this period, driven by a 35.9% fall in services for the allied health-specific item 58121. For X-ray services provided with MBS items 58108 and 58112 (all three specialty groups), no change was observed from 2010-11 to 2013-14 in total number of services (overall 0.2% decrease).

Computed tomography

Table 0-4 shows the total services from 2009-10 to 2013-14 for all included CT items (all of which started on the MBS prior to 2009-10). When these services are provided on equipment that is 10 years old or older, items 56229 and 56232 apply instead, and these items are infrequently used. MBS items 56226 and 56232 specify the use of contrast medium and make up only a small proportion of all low back CT services. MBS item 56233 is used for examination of two of three possible regions: cervical, thoracic or lumbar spine (i.e. may include investigations that exclude low back).

In 2013-14, two MBS items (56223 and 56233) accounted for 99.4% of all services for the included CT items. As 92.3% of all services are accounted for by a single item (56223; lumbosacral region, without intravenous contrast medium), it was designated as the main CT item, and CT service profile trends will focus on this item only.

After an initial fall of around 8% from 2009-10 to 2010-11, the number of CT services with this item grew by 27.4% from 2010-11 to 2013-14. Of note, the decrease in use of CT in 2009-10 occurred across all CT items and corresponds with the release of a Professional Services Review (PSR) report expressing concern about appropriate requesting of CT services. The report led to a period of intense media focus on the risks of radiation, which appeared to change some clinical behaviour at the time.

Table 0-4 Total services for included CT items, 2009-10 to 2013-14

| Item | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | % of total, 2013-14 ^a | 5-year growth ^b | 4-year growth ^c |
|--------------------|----------------|----------------|----------------|----------------|----------------|----------------------------------|----------------------------|----------------------------|
| 56223 | 267,028 | 246,258 | 277,928 | 297,930 | 313,846 | 92.3% | 17.5% | 27.4% |
| 56226 | 1,340 | 1,341 | 1,648 | 1,755 | 1,651 | 0.5% | 23.2% | 23.1% |
| 56229 ^d | 63 | 172 | 138 | 106 | 187 | 0.1% | 196.8% | 8.7% |
| 56232 ^d | 2 | 1 | 5 | 3 | 4 | 0.0% | 100.0% | 300.0% |
| 56233 | 19,377 | 17,255 | 19,892 | 22,725 | 24,259 | 7.1% | 25.2% | 40.6% |
| Total | 287,810 | 265,027 | 299,611 | 322,519 | 339,947 | 100% | 18.1% | 28.3% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Abbreviations: CT, computed tomography

Note: Analysis of the profile of service use for low back CT items largely focuses on item 56223.

^a Proportion of total services for all included items.

^b 5-year growth refers to growth from 2009-10 to 2013-14.

^c 4-year growth refers to growth from 2010-11 to 2013-14.

^d Item is specifically for services provided on equipment that is 10 years old or older.

The majority of low back CT imaging is undertaken using item 56223, which has shown substantial growth in recent years. When low back CT is indicated, CT without contrast is preferred over CT with contrast (MBS items 56226 and 56232). Requests for two CT examinations (MBS item 56233), some of which may not include lumbar imaging, represents less than 10% of all low back CT services.

Magnetic resonance imaging

The 24 included MRI items include the 12 shown in Table 8: Total services for included MRI items, 2009-10 to 2013-14 and another 12 that are specifically for services provided on equipment that is 10 years old or older (designated NK; see Appendix 3). These other 12 items were introduced onto the MBS on 1 July 2011 but each has since been used no more than six times per year. Therefore they have been excluded from this table and from further consideration in this report.

The MBS item descriptor for MRI specifies the indication for imaging, not the region of the spine to be imaged, and total item services are shown grouped by these specified indications. There are two items for each indication, and these services differ in the breadth of region imaged; within each indication, items listed first (lower item numbers) image a more restricted area (one region or two contiguous regions) while those listed second (higher item numbers) image a broader region of the spine (three contiguous regions or two non-contiguous regions).

Overall, services for all included MRI items increased by 25% over the 5 years from 2009-10 to 2013-14. Some MBS items showed much higher growth: 63151 (infection), 63222 (cauda equina), 63234 (sciatica), 63237 (spinal stenosis) all grew by over 40% over this period. However, none of these accounted for more than 3.3% of total included MRI services in 2013-14. Services for some items decreased in the first year of this period, but by very small proportions, and all items resumed growth over all or most subsequent years.

Five MRI items each constituted at least 5% of services for all included MRI items in 2013-14. Two items are for investigation of malignancy/tumour (63154 and 63204), and one item for each of sciatica (63176), spinal canal stenosis (63179) and myelopathy (63167). Analysis of the profile of service use largely focuses on these five items (shown in bold in Table 8: Total services for included MRI items, 2009-10 to 2013-14), which together constitute 85% of all included MRI services in 2013-14.

For sciatica, spinal stenosis and myelopathy, the included MBS item is for the service that images a more restricted region of the back (one region or two contiguous regions) while for tumour, both items are included (see Appendix 3 for item descriptors). In terms of number of services, sciatica is the most common indication for spinal MRI (48.1%) while spinal canal stenosis is the next most common indication (16.9%).

No items for infection or cauda equina are included in the main MRI item group; these indications make up only 3.9% and 2.8%, respectively, of total services for all included MRI items.

Table 0-5 Total services for included MRI items, 2009-10 to 2013-14

| Indication | Item | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | % of total, 2013-14 ^a | 5-year growth ^b | 4-year growth ^c |
|-----------------|--------------------|---------------|---------------|---------------|---------------|---------------|----------------------------------|----------------------------|----------------------------|
| Infection | 63151 | 2,064 | 2,059 | 2,312 | 2,505 | 3,169 | 2.9% | 53.5% | 53.9% |
| | 63201 | 767 | 832 | 818 | 1,011 | 1,111 | 1.0% | 44.9% | 33.5% |
| Tumour | 63154 | 5,420 | 5,372 | 5,561 | 5,966 | 6,616 | 6.0% | 22.1% | 23.2% |
| | 63204 | 5,354 | 5,668 | 5,988 | 6,439 | 7,069 | 6.4% | 32.0% | 24.7% |
| Cauda equina | 63164 | 878 | 888 | 1,004 | 947 | 920 | 0.8% | 4.8% | 3.6% |
| | 63222 | 1,531 | 1,649 | 1,814 | 2,047 | 2,195 | 2.0% | 43.4% | 33.1% |
| Sciatica | 63176 | 42,999 | 45,317 | 48,278 | 50,940 | 53,103 | 48.1% | 23.5% | 17.2% |
| | 63234 | 1,614 | 1,947 | 2,302 | 2,497 | 2,341 | 2.1% | 45.0% | 20.2% |
| Spinal stenosis | 63179 | 15,207 | 14,568 | 16,392 | 17,031 | 18,611 | 16.9% | 22.4% | 27.8% |
| | 63237 | 2,618 | 2,690 | 2,835 | 3,110 | 3,696 | 3.3% | 41.2% | 37.4% |
| Myelopathy | 63167 | 7,006 | 7,247 | 7,961 | 8,163 | 8,438 | 7.6% | 20.4% | 16.4% |
| | 63225 | 2,745 | 2,509 | 2,996 | 3,038 | 3,119 | 2.8% | 13.6% | 24.3% |
| All | Total ^d | 88,203 | 90,746 | 98,271 | 103,714 | 110,395 | 100% | 25.2% | 21.7% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Abbreviations: MRI, magnetic resonance imaging

Note: Analysis of the profile of service use for spinal MRI items largely focuses on the main five items shown in bold (items 63154, 63204, 63176, 63179 and 63167).

^a Proportion of total services for all included items.

^b 5-year growth refers to growth from 2009-10 to 2013-14.

^c 4-year growth refers to growth from 2010-11 to 2013-14.

^d This total includes an additional 12 items not shown here for which six or fewer services were provided in any year, so totals may not add up exactly.

There has been constant growth in the number of MBS services for spinal MRI. While analysis of these MRI items is a useful indicator, it may not be reflective of presentations for LBP in a primary care setting, and does not indicate the use of imaging by the GP prior to referral to a specialist. Furthermore, from these data it is not possible to determine the proportion of MRI scans that are positive for serious conditions.

3.1.2. Low back imaging items: geographic and temporal trends

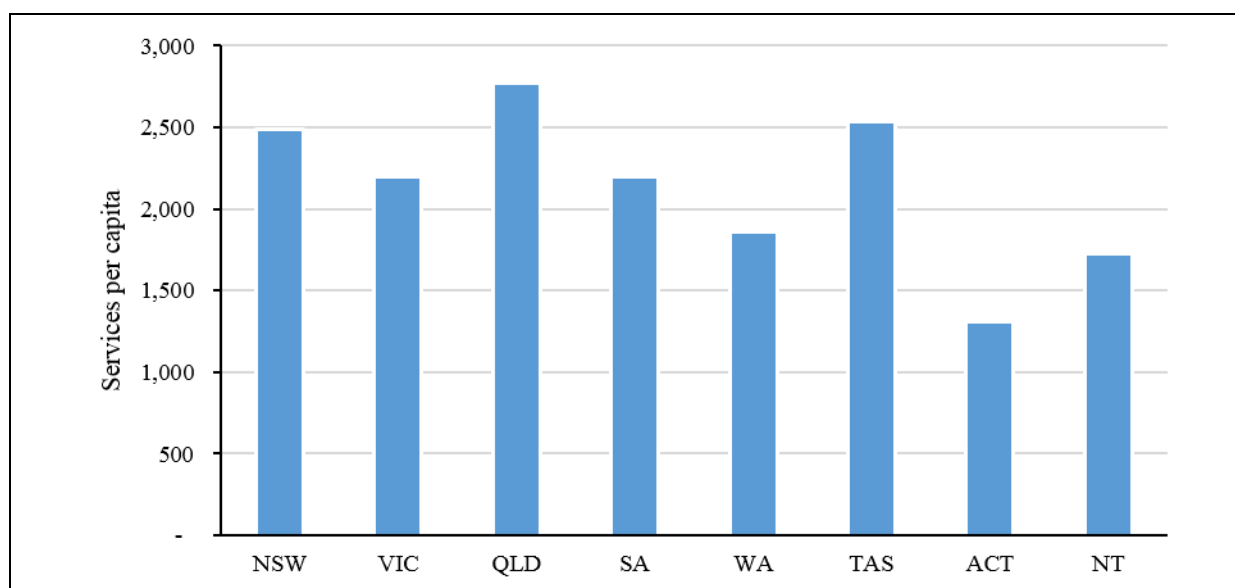
X-ray

Figure 3.1-1 shows the combined per capita services for the main X-ray items in 2013-14 (data for all figures in this section are presented in Appendix 7, Table A-Error! No text of specified style in document..1). The highest per capita usage was in Queensland, which was 18% above the national average (Table A-Error! No text of specified style in document..1).

Figure 3.1-2 shows growth trends from 2010-11 to 2013-14 for the combined services for the main X-ray items (as discussed earlier, data for 58121 is for only 6 months of 2009-10, so growth from 2010-11 is reported instead). Overall, national per capita use of the main X-ray items fell by 14.5% over this four-year period (Table

A-7.1). Services fell in each state/territory except in the Northern Territory, where services grew 40.8% (yet remained almost 30% lower than the national average in 2013-14).

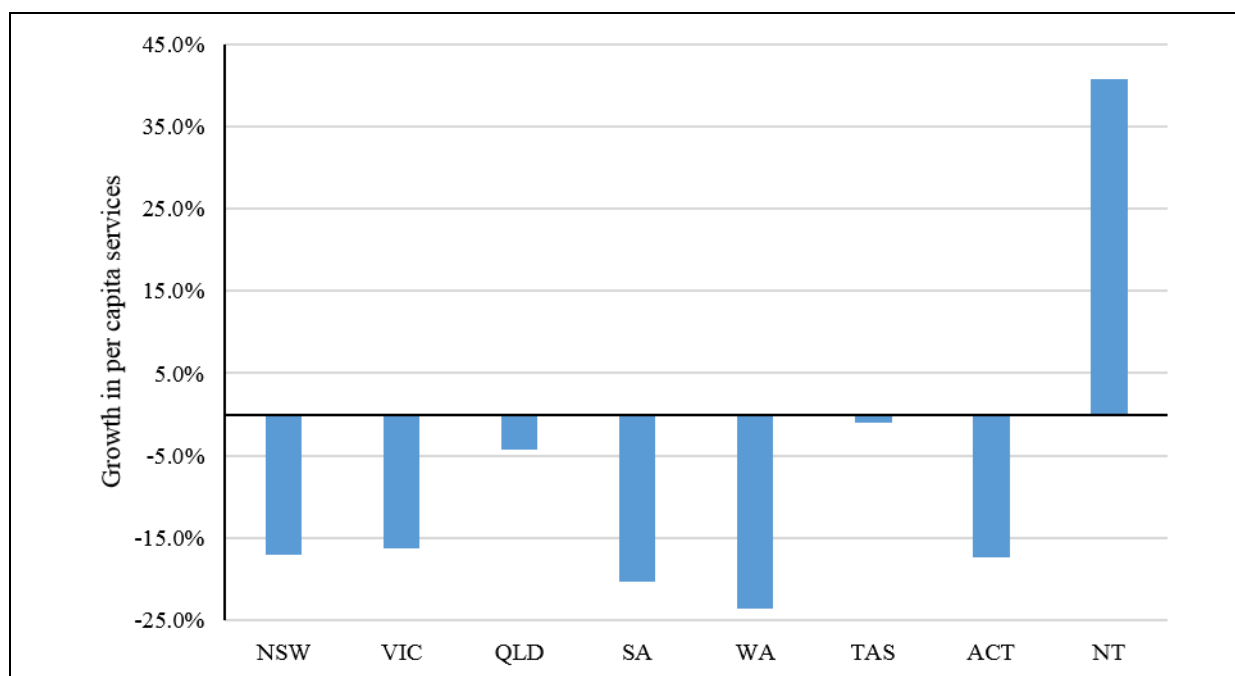
Figure 0-1 Services per capita by state, for main X-ray items (MBS items 58106, 58112 and 58121 combined), 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

Figure 0-2 Growth in services for main X-ray items (MBS items 58106, 58112 and 58121 combined) per capita, 2010-11 to 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

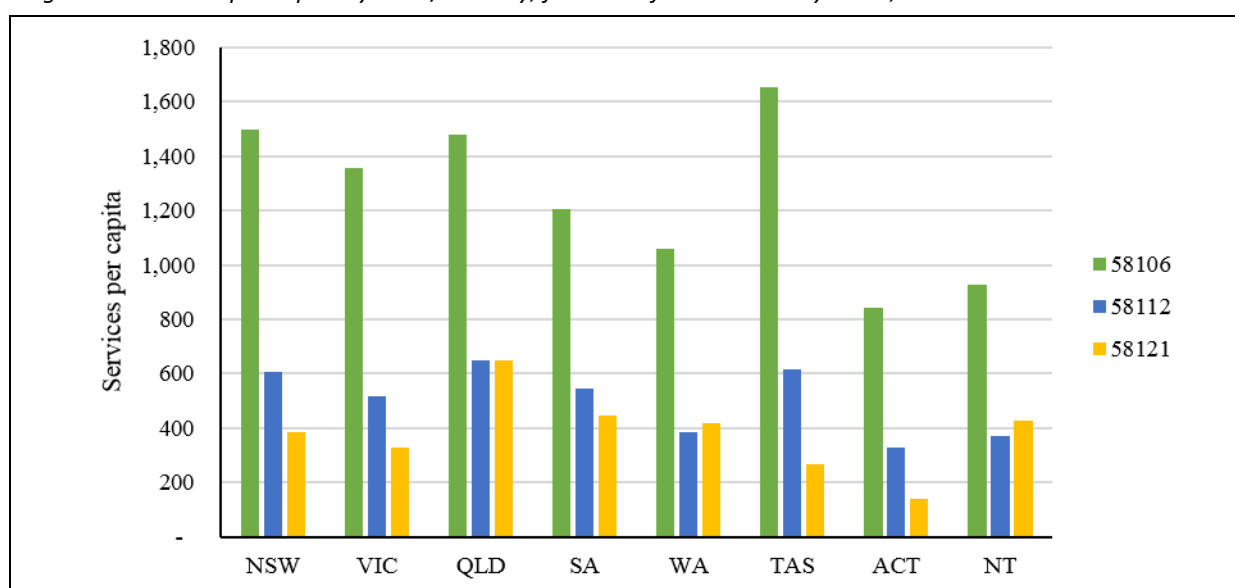
Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

Figure 3.1-3 shows the per capita services in 2013-14 by state for each of the main X-ray items. The item provided most frequently nationally, 58106, is also most frequently provided in each of the states/territories. Usage rates for this item vary across states almost two-fold, with the Australian Capital Territory having the lowest per capita services (844 per 100,000 population), and Tasmania the highest (1,655 per 100,000 population). The latter is around 20% higher than the national average of 1,377 per 100,000 population (Appendix 7, Table A-Error! No text of specified style in document..1).

A similar trend is seen for MBS item 58112, with up to two-fold variation in per capita services between states, and the highest per capita rate (Queensland at 648 per 100,000 population) being 16% higher than the national average (558 per 100,000 population).

Figure 3.1-3 shows that MBS item 58121, which applies only to physiotherapists, chiropractors and osteopaths, has the greatest variability in per capita services, with over a four-fold difference between the lowest (Australian Capital Territory at 140 per 100,000 population) and highest (Queensland at 647 per 100,000 population), the latter being 53% higher than the national average (424 per 100,000 population).

Figure 0-3 Services per capita by state/territory, for each of the main X-ray items, 2013-14

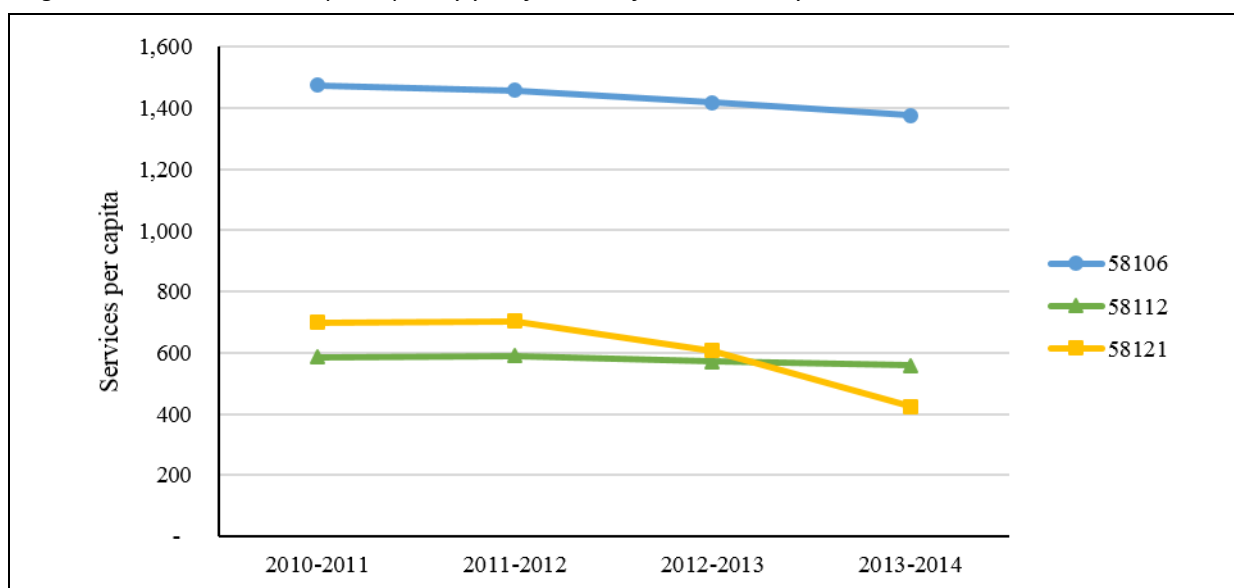


Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month. Item 58121 applies only to allied health professionals.

The national per capita usage trends from 2010-11 to 2013-14 for each of the three main X-ray items is shown in Figure 3.1-4. Per capita services for all items decreased over this period; item 58106 by 6.6%, 58112 by 4.6% and item 58121 by a very large 39.4% (Appendix 7, Table A-Error! No text of specified style in document..1).

Figure 0-4 National services per capita by year for each of the main X-ray items, 2009-10 to 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month. MBS item 58121 applies only to allied health professionals.

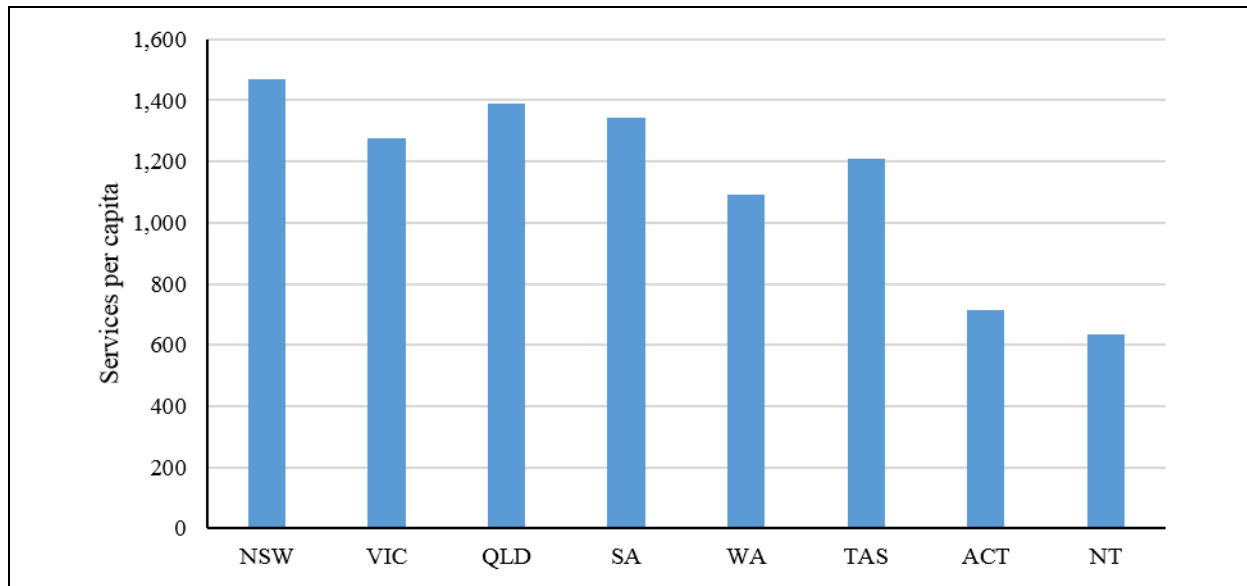
There is no obvious reason for the observed differences across states in the per capita X-ray services for low back. Referring practitioner preferences may influence usage in the smaller states/territories.

Computed tomography

The per capita services for the main CT item, MBS item 56223, is shown in Figure 3.1-5 (data for all figures in this section are presented in Appendix 7, Table A-Error! No text of specified style in document..2). Across the larger states there is more uniformity of per capita use observed for the main X-ray items; per capita use is highest in New South Wales, although only 10.5% higher than the national average. As for X-ray (Figure 3.1-1), high per capita service rates are seen in Tasmania while particularly low rates were seen in the Northern Territory and the Australian Capital Territory (52% and 46% lower than the national rates, respectively).

The highest growth in per capita usage occurred in Queensland (19.4%) and the Northern Territory (51.8%) (Figure 3.1-6), which are also the two highest growth states for the main X-ray items. The national per capita use of CT item 56223 increased by 8.9% from 2009-10 to 2013-14. Growth trends in national per capita usage (Figure 3.1-7) show that a contraction occurred in 2010-11, which was followed by 20.5% growth to 2013-14 (see also Appendix 7, Table A-Error! No text of specified style in document..2).

Figure 0-5 Services per capita by state/territory for main CT item (56223), 2013-14

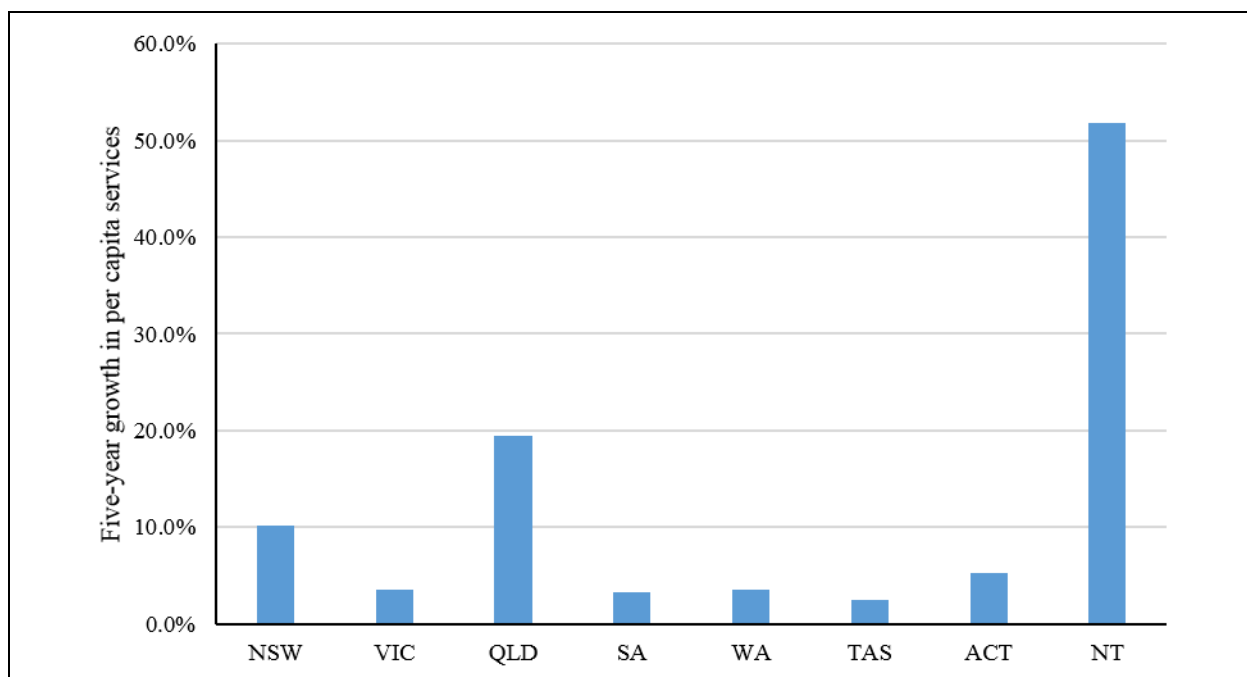


Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Abbreviations: CT, computed tomography

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

Figure 0-6 Growth in services per capita for main CT item (56223), by state/territory, 2009-10 to 2013-14

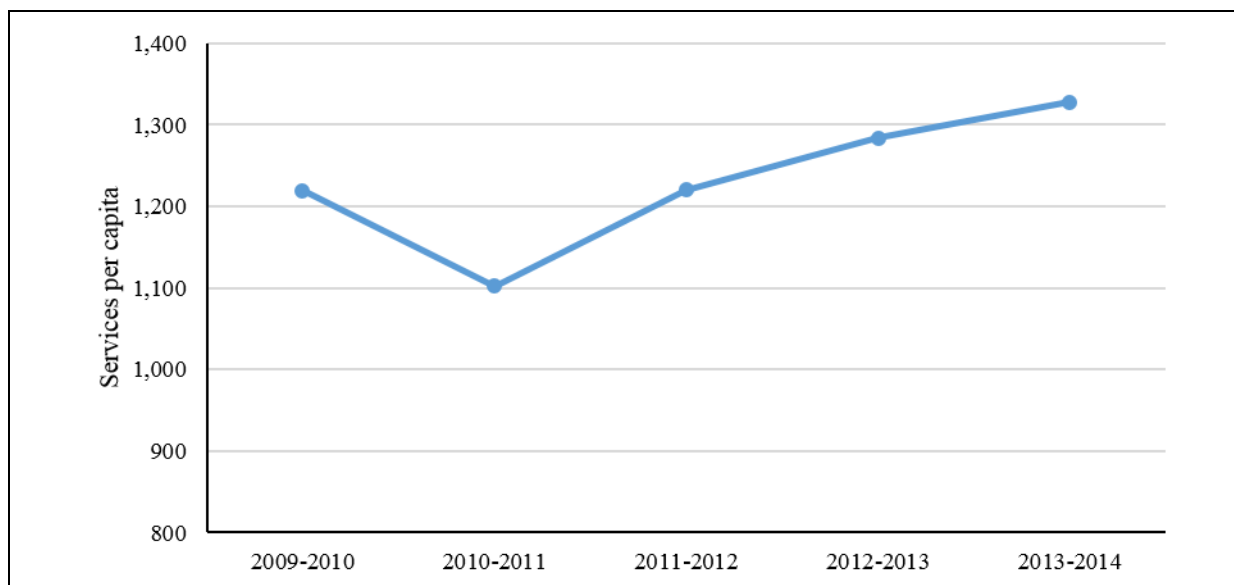


Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Abbreviations: CT, computed tomography

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

Figure 0-7 National services per capita by year for main CT item (56223), 2009-10 to 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Abbreviations: CT, computed tomography

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

As for X-ray imaging, there is no obvious reason for the observed differences across states in the per capita CT services for low back. Referring practitioner preferences may influence usage in the smaller states/territories.

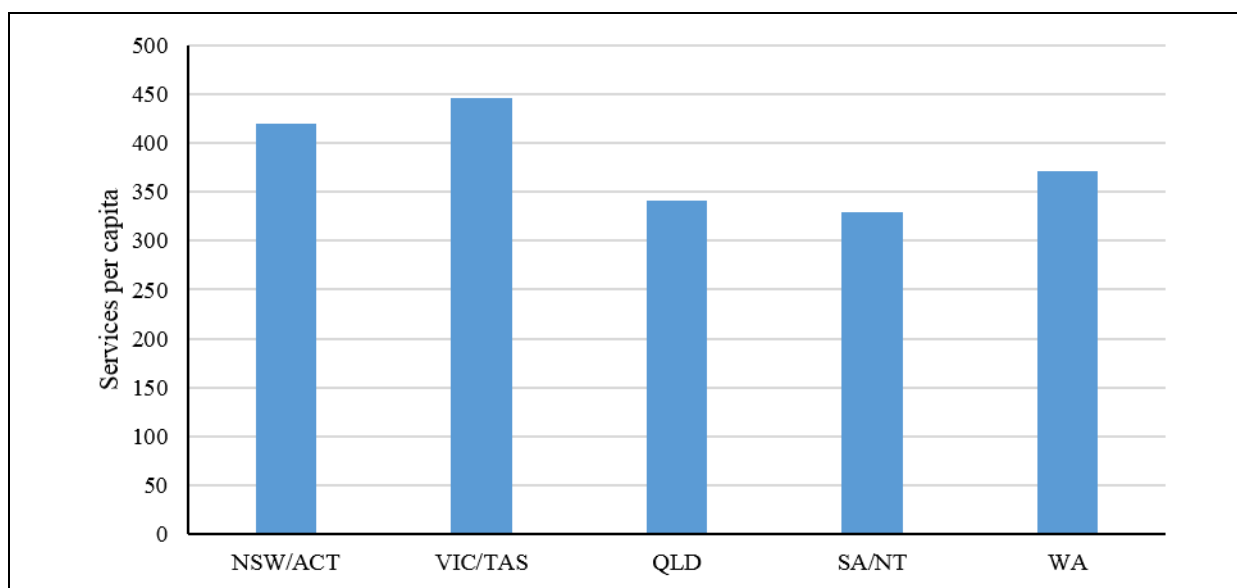
Magnetic resonance imaging

As discussed above for total services, analysis of per capita use of the five main MRI items is limited by a lack of specificity for LBP. Furthermore, as only specialists can request MRI imaging, this data does not reflect presentations in a primary care setting, and does not indicate the use of imaging by the GP prior to referral to a specialist. However, this analysis may provide a useful indicator of the patterns of MRI use subsequent to primary care presentations.

Figure 3.1-8 shows the combined per capita services for the main MRI items in 2013-14 (data for all figures in this section are presented in Appendix 7, Table A-**Error! No text of specified style in document..3**). Data for Tasmania, the Australian Capital Territory and the Northern Territory are combined with other states as indicated, presumably due to a low level of activity in these states. Per capita services in Victoria/Tasmania were 12% above the national average, whereas South Australia/Northern Territory were 17.3% below the national average.

Victoria/Tasmania and New South Wales/Australian Capital Territory experienced the highest growth rates in MRI services per capita from 2009-10 to 2013-14, and growth occurred in all states/territories (Figure 3.1-9).

Figure 0-8 Services per capita by state/territory, for main MRI items (MBS items 63154, 63204, 63176, 63179 and 63167 combined), 2013-14

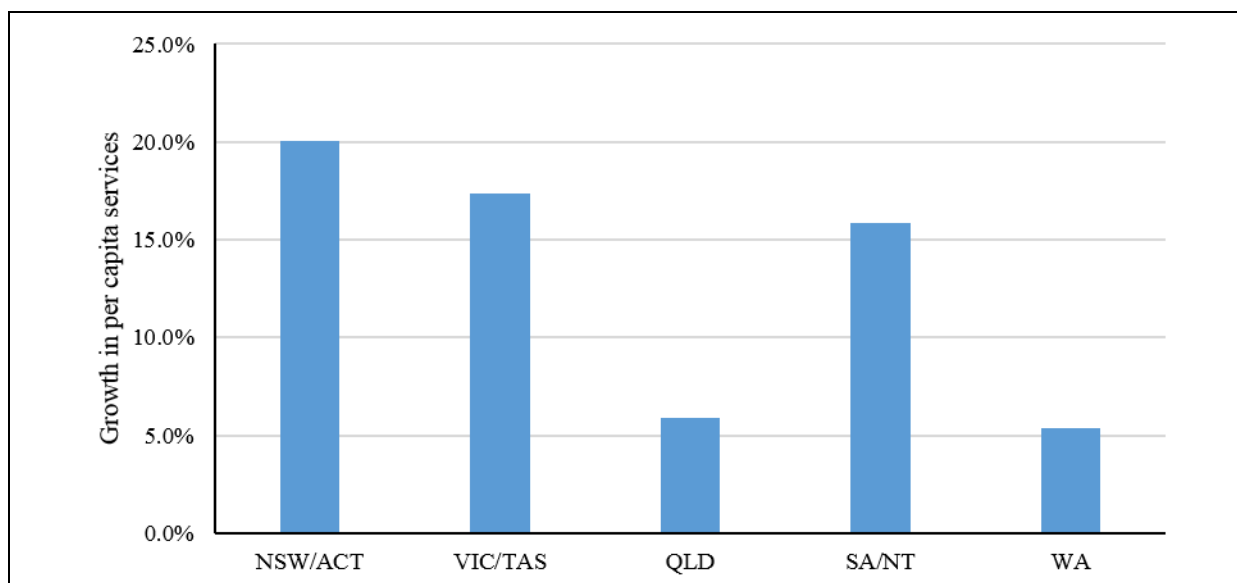


Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Abbreviations: MRI, magnetic resonance imaging

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

Figure 0-9 Growth in services for main MRI items (MBS items 63154, 63204, 63176, 63179 and 63167 combined) per capita by state/territory, 2009-10 to 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

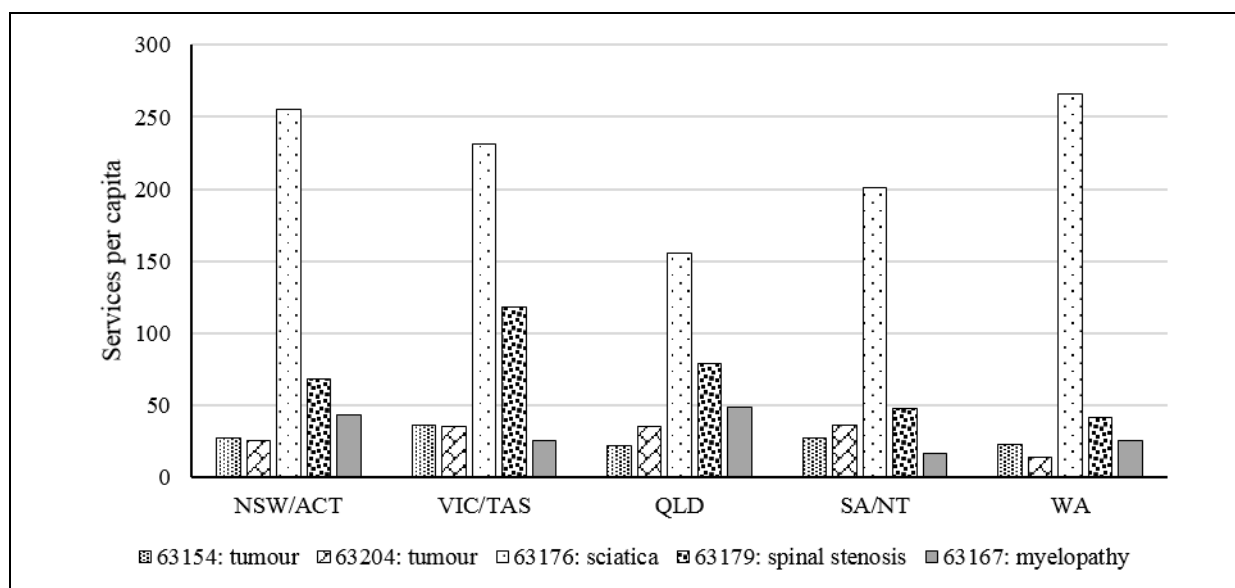
Abbreviations: MRI, magnetic resonance imaging

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

Figure 3.1-10 shows the per capita services by state/territory for each of the main MRI items individually. The most frequently provided item, 63176 (sciatica), is also most frequently provided in each of the states/territories. In 2013-14, there were 398 per capita services for the main MRI items nationally (Appendix 7, Table A-**Error! No text of specified style in document..3**). The relative per capita rates of MRI imaging for spinal stenosis and sciatica varies greatly between states, with the

ratio being approximately 1:6 in Western Australia and 1:4 in New South Wales/Australian Capital Territory, but 1:2 in Victoria/Tasmania, where MRI is provided to patients with suspected spinal stenosis at a rate 49% higher than the national rate.

Figure 0-10 Services per capita by state/territory for each of the main MRI items, 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Abbreviations: MRI, magnetic resonance imaging

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

National per capita usage trends from 2009-10 to 2013-14 are shown for each of the main MRI items in Table 0-6. These data are shown in tabular form in order to present combined data for the two MRI imaging items for tumour (63154 and 63204). When these two items are considered as a single category, per capita services grew 18% from 2009-10 to 2013-14, similar to the growth rate for the other items over this period (13-15%).

Table 0-6 National services per capita by year for main MRI items, 2009-10 to 2013-14

| Item | 2009-2010 | 2010-2011 | 2011-2012 | 2012-2013 | 2013-2014 | 5-year growth |
|--------------------------|-----------|-----------|-----------|-----------|-----------|---------------|
| 63154: tumour | 25 | 24 | 24 | 26 | 28 | 12% |
| 63204: tumour | 24 | 25 | 26 | 28 | 30 | 25% |
| 63204 plus 63154: tumour | 49 | 49 | 50 | 54 | 58 | 18% |
| 63176: sciatica | 196 | 203 | 212 | 219 | 225 | 15% |
| 63179: spinal stenosis | 69 | 65 | 72 | 73 | 79 | 14% |
| 63167: myelopathy | 32 | 32 | 35 | 35 | 36 | 13% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Abbreviations: MRI, magnetic resonance imaging

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

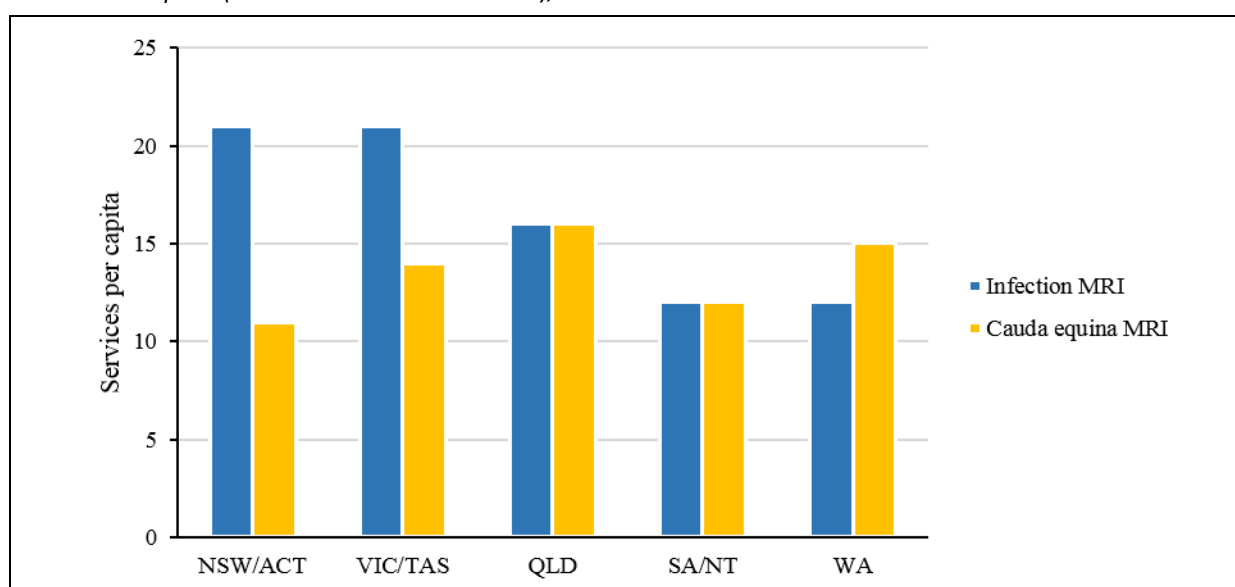
MRI items for infection and cauda equina

As discussed above, due to relatively low usage, the spinal MRI items for infection and cauda equina are not represented among the main items shown above for MRI. Figure 3.1-11 shows per capita

usage in 2013-14 of MRI items for investigation of infection (63151 and 63201 combined), and cauda equina syndrome (MRI items 63164 and 63222 combined). Data are also available in Appendix 7, Table A-7.4. In New South Wales/Australian Capital Territory and Victoria/Tasmania, per capita use of spinal MRI for infection is higher, whereas per capita use of MRI for cauda equina syndrome is higher in Queensland and Western Australia.

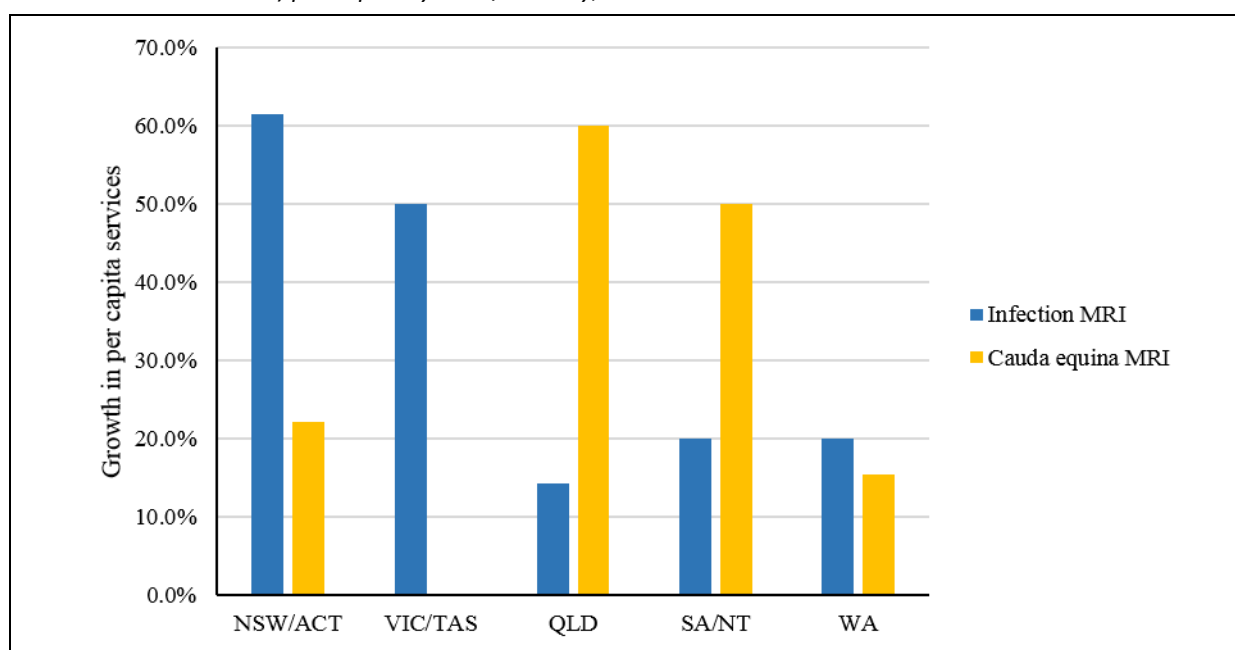
Figure 3.1-12 shows growth in combined infection MRI items and combined cauda equina MRI items for the five-year period from 2009-10 to 2013-14. Per capita services grew by 62% in New South Wales/Australian Capital Territory and by 50% in Victoria/Tasmania, the two states with the highest per capita rates in 2013-14, while growth in all other states remained at 20% or under. For combined cauda equina items, per capita services grew 60% in Queensland, 50% in South Australia/Northern Territory, while growth in the other states was 22% or lower (no growth in Victoria/Tasmania).

Figure 3.1-11 Services per capita by state/territory for MRI items for infection (MBS items 63151 and 63201) and cauda equina (MBS items 63164 and 63222), 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 6 July 2015
Abbreviations: MRI, magnetic resonance imaging.

Figure 3.1-12 Growth in MRI services for infection (MBS items 63151 and 63201) and cauda equina (MBS items 63164 and 63222) per capita by state/territory, 2009-10 to 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 6 July 2015
Abbreviations: MRI, magnetic resonance imaging.

As for X-ray and CT imaging, there is no obvious reason for the observed differences across states/territories in the per capita CT services for low back. Referring practitioner preferences may influence usage in the smaller states and territories.

3.1.3. Low back imaging items by age and gender

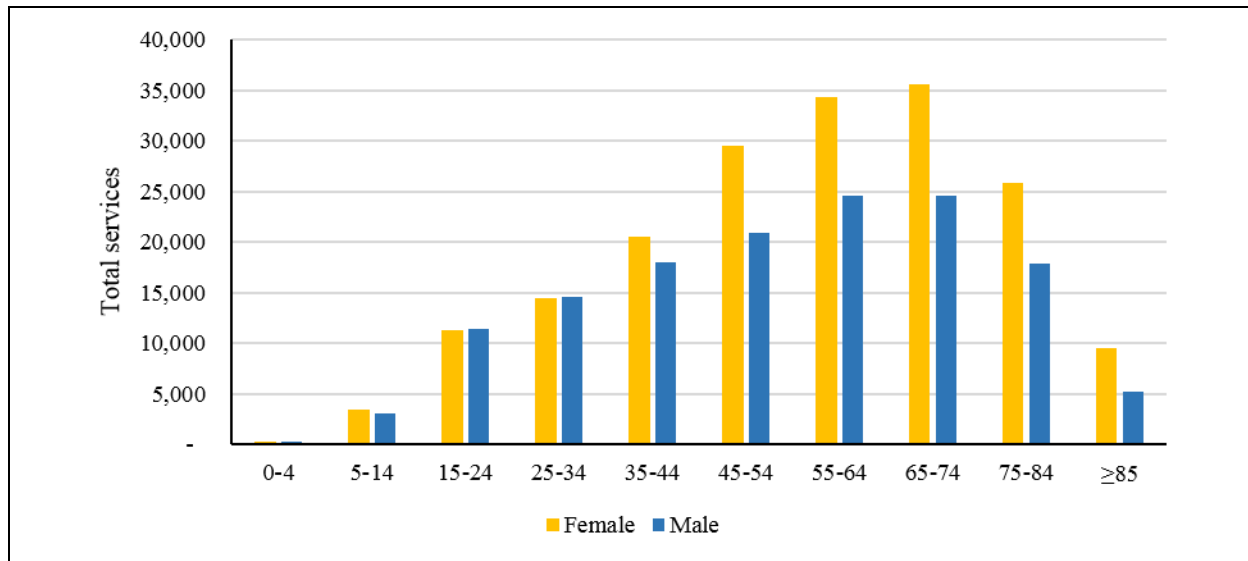
X-ray

Data for this section are shown in Table A-**Error! No text of specified style in document..1** in Appendix 7. Gender differences by age group are shown for MBS items 58106 (Figure 3.1-13), 58112 (Figure 3.1-14), and 58121 (Figure 3.1-15).

Across all age groups in 2013-14, 32% more females than males received imaging with item 58106, and 59% more females than males received imaging with item 58112. The gender difference for item 58121, which applies only to allied health professionals, was only 13% (see Appendix 7, Table A-**Error! No text of specified style in document..1**). For items 58106 and 58112, at each age group, more females than males typically received the service. For item 58121 younger patients were more often female and older patients were more often male.

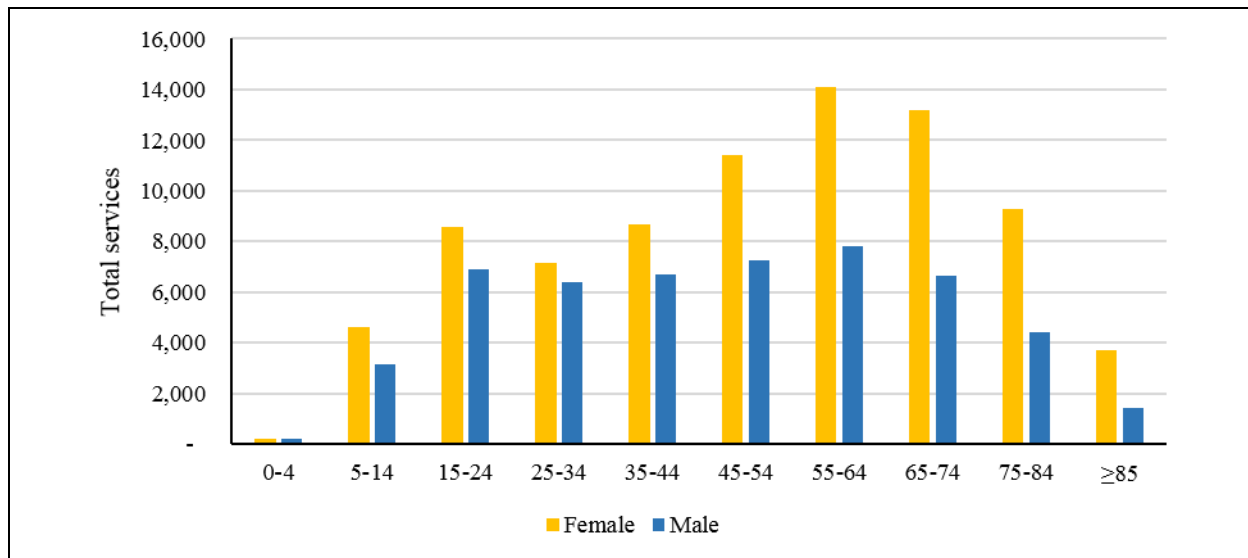
For MBS items 58106 (lumbosacral) and 58112 (two examinations of the spine), imaging services peak for patients 55 to 74 years of age. However, peak services for item 58121 (three examinations of the spine) is from 15 to 44 years of age. As described in Section 3.1.1, item 58121 applies only to allied health professionals (Table 9: Services for main x-ray items by speciality type, 2013-14) while a high proportion of the other two items are GP-requested.

Figure 0-11 Total services for X-ray item 58106 by age group and gender, 2013-14



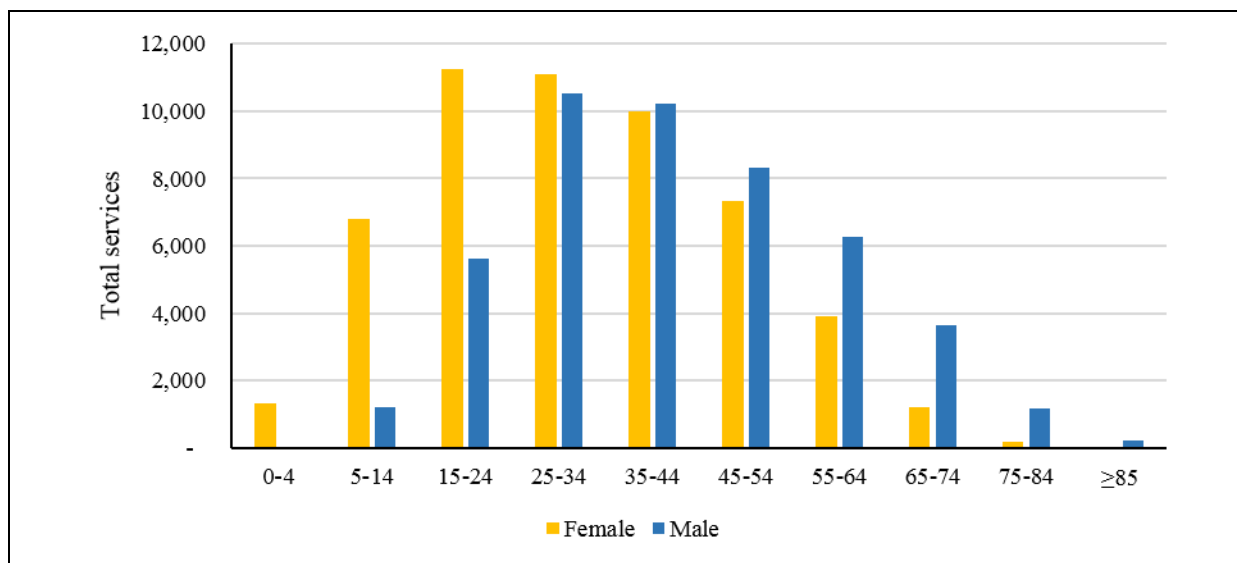
Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Figure 0-12 Total services for X-ray item 58112 by age group and gender, 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Figure 0-13 Total services for X-ray item 58121 by age group and gender, 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

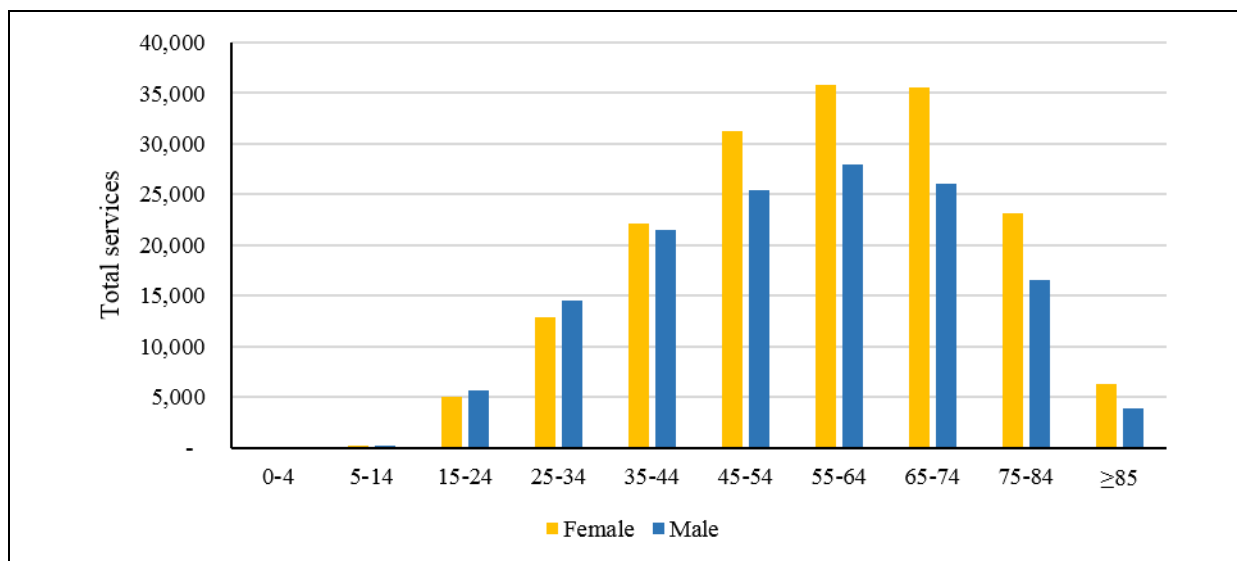
Note: MBS item 58121 applies only to physiotherapists, chiropractors and osteopaths.

Patients receiving low back X-ray are more likely to be older and female, unless referred by an allied health professional, in which case they are less likely to be old, and where they are older, they are more likely to be male.

Computed tomography

In 2013-14, 22% more females than males received imaging with item 56223, and services were more frequent in patients 45 to 74 years of age (Figure 3.1-16; see also Appendix 7, Table A-Error! No text of specified style in document..2). However, in younger age brackets (15-34 years), slightly more males received this service.

Figure 0-14 Total services for CT item 56223 by age group and gender, 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Abbreviations: CT, computed tomography.

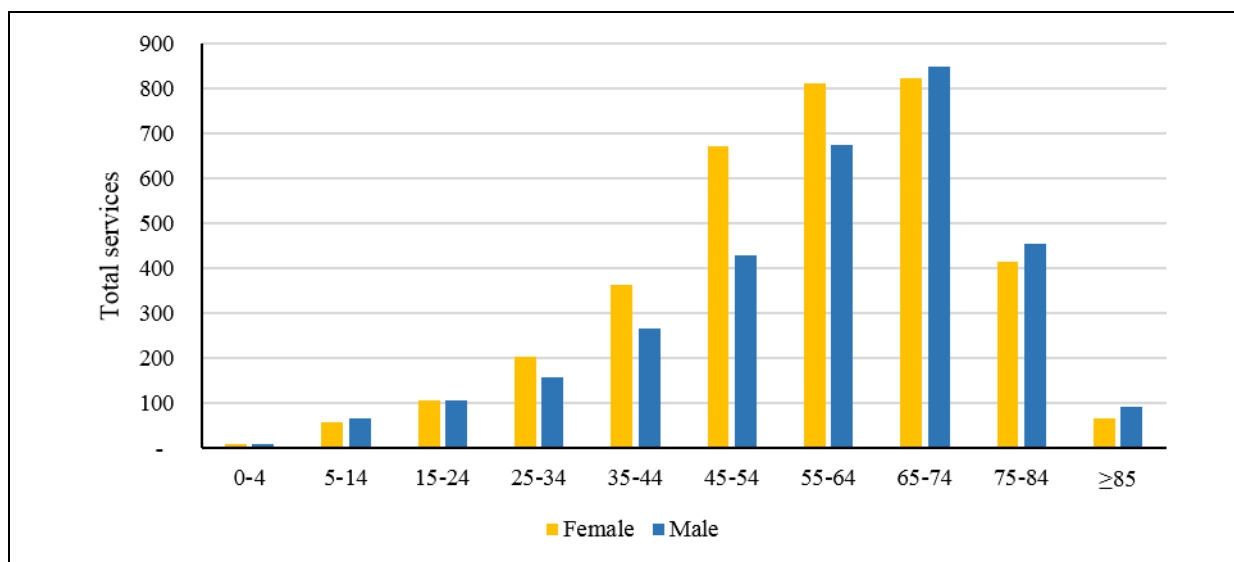
CT imaging of the low back is more commonly performed in females, and peaks at 55-74 years of age.

Magnetic resonance imaging

Data for this section are shown in Table A-**Error! No text of specified style in document.**3 in Appendix 7. Total services by gender and age group are shown for each of the main MRI items in Figure 0-15 to Figure 0-19. For all but one of the five main items, more females than males receive the service in almost all age brackets. The number of services typically peaks around 45 to 74 years of age for all items.

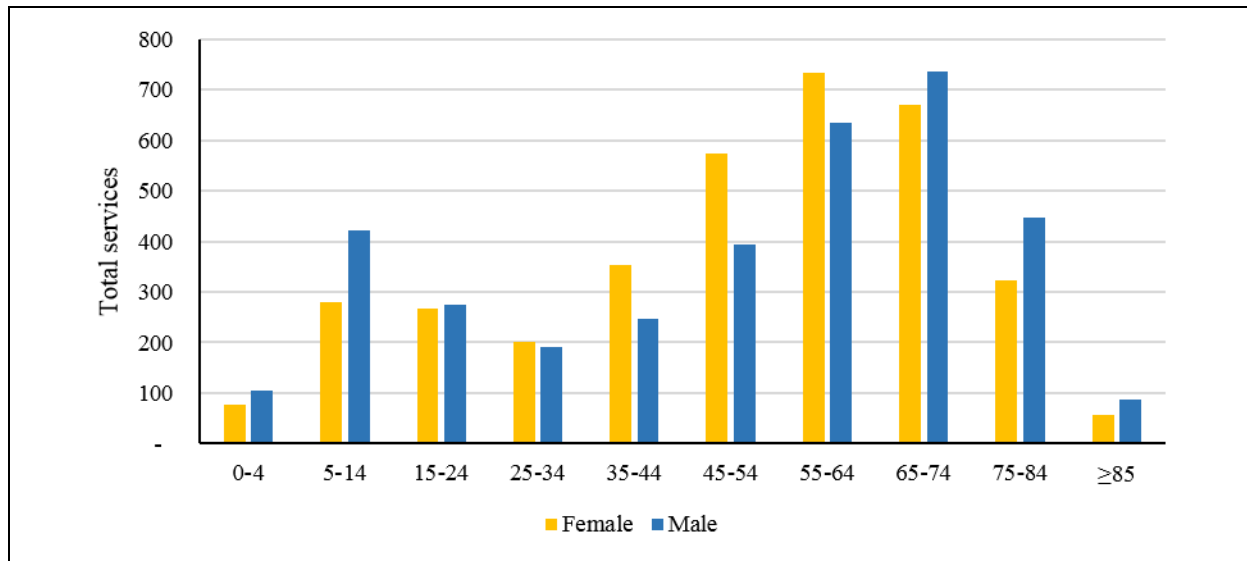
For MBS item 63204 (tumour), total services are provided equally between the genders, but there are more females than males in the 35-64 age brackets, and more males than females in the older age brackets (65 years and over) and the 0 to 14 years age brackets. MBS item 63204 differs from the other spinal MRI item for tumour, item 63154, in that it includes a broader region of the back (three contiguous, or two non-contiguous regions as opposed to two contiguous regions or one region; see Appendix 3 for MBS item descriptors).

Figure 0-15 Total services for MRI item 63514 (tumour) by age group and gender, 2013-14



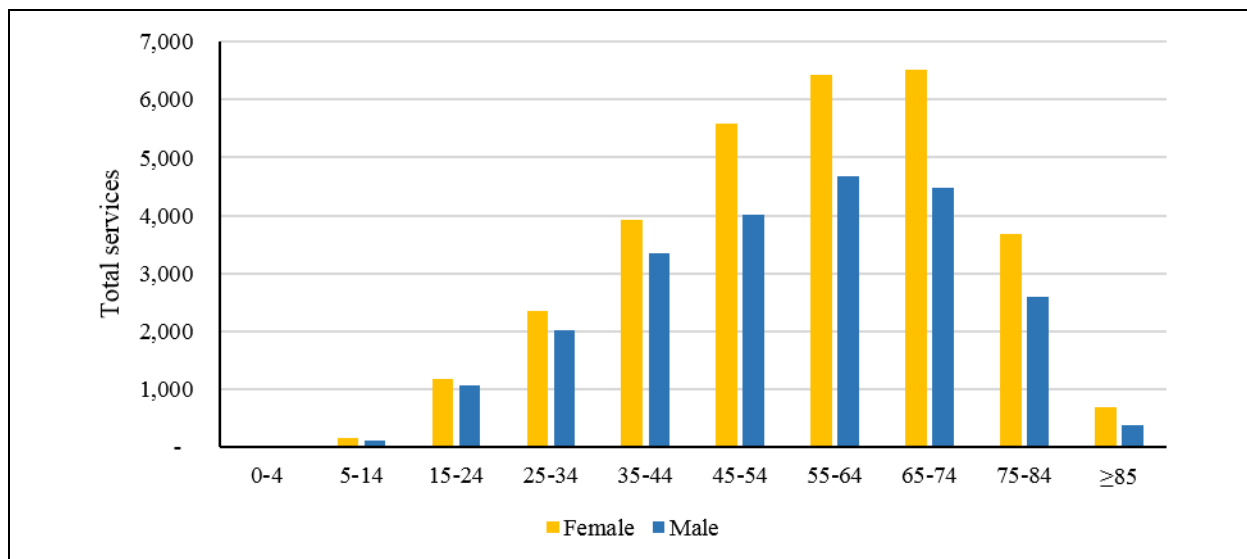
Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015
Abbreviations: MRI, magnetic resonance imaging.

Figure 0-16 Total services for MRI item 63204 (tumour) by age group and gender, 2013-14



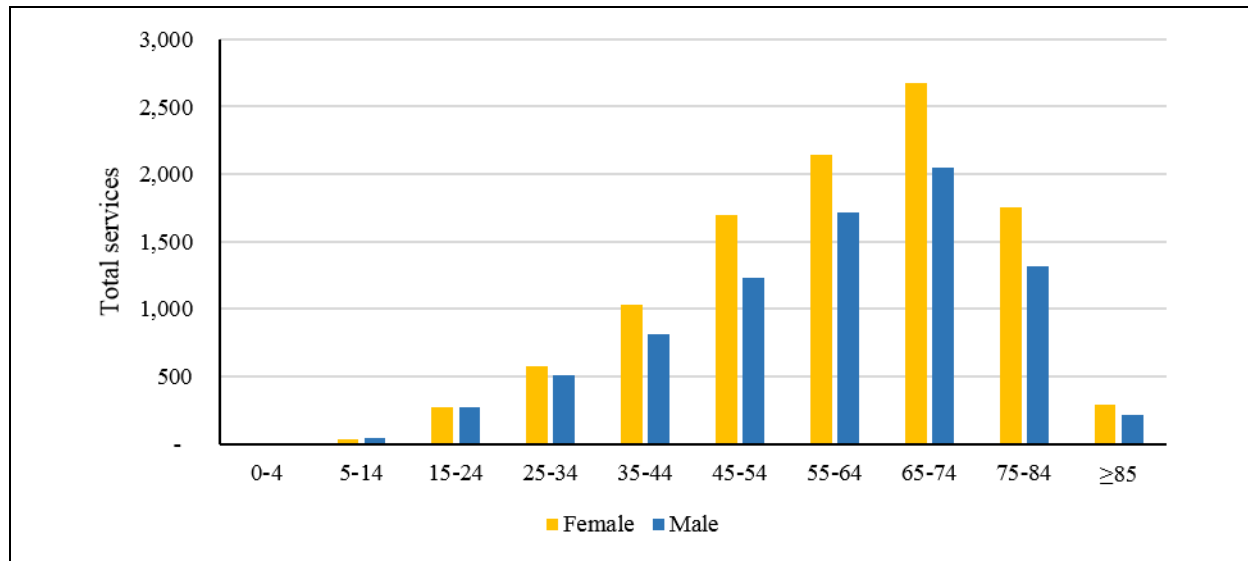
Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015
 Abbreviations: MRI, magnetic resonance imaging.

Figure 0-17 Total services for MRI item 63176 (sciatica) by age group and gender, 2013-14



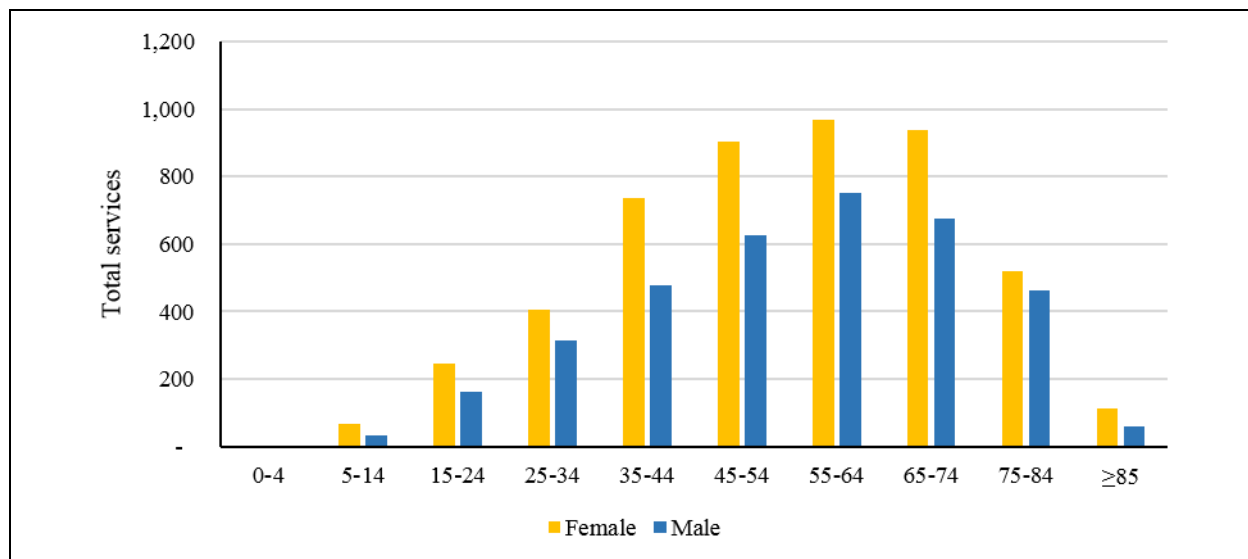
Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015
 Abbreviations: MRI, magnetic resonance imaging.

Figure 0-18 Total services for MRI item 63179 (spinal stenosis) by age group and gender, 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015
 Abbreviations: MRI, magnetic resonance imaging.

Figure 0-19 Total services for MRI item 63167 (myelopathy) by age group and gender, 2013-14

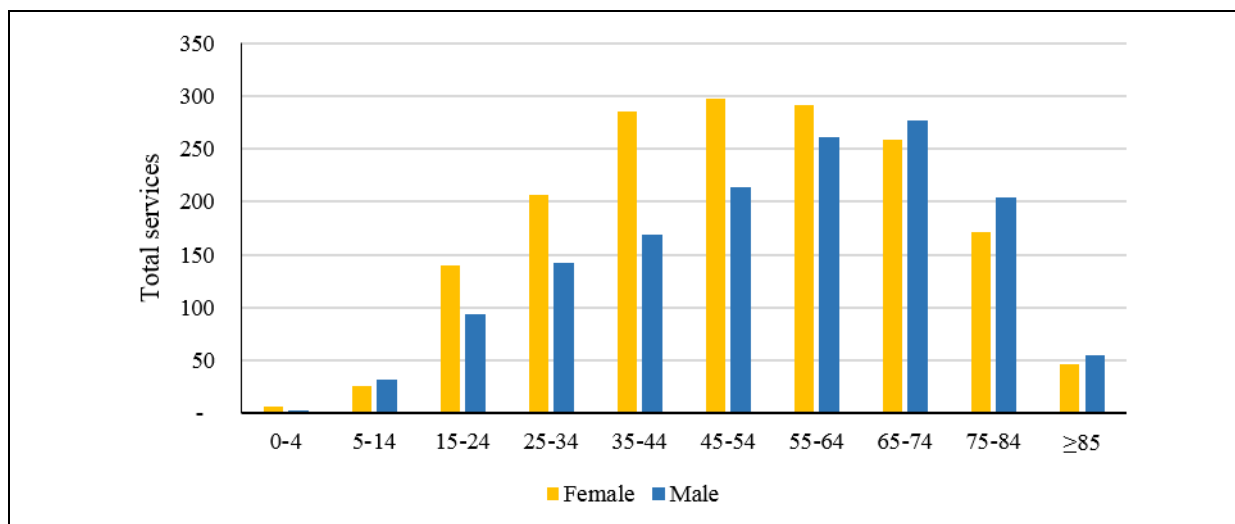


Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015
 Abbreviations: MRI, magnetic resonance imaging.

MRI items for infection and cauda equina

Figure 0-20 and Figure 0-21 show the total services by age group and gender for items 63151 and 63201, respectively in 2013-14. For both of these spinal MRI items for infection, imaging occurs more often in women up to and including the 55 to 64 years age bracket, after which the service is more frequently provided to males.

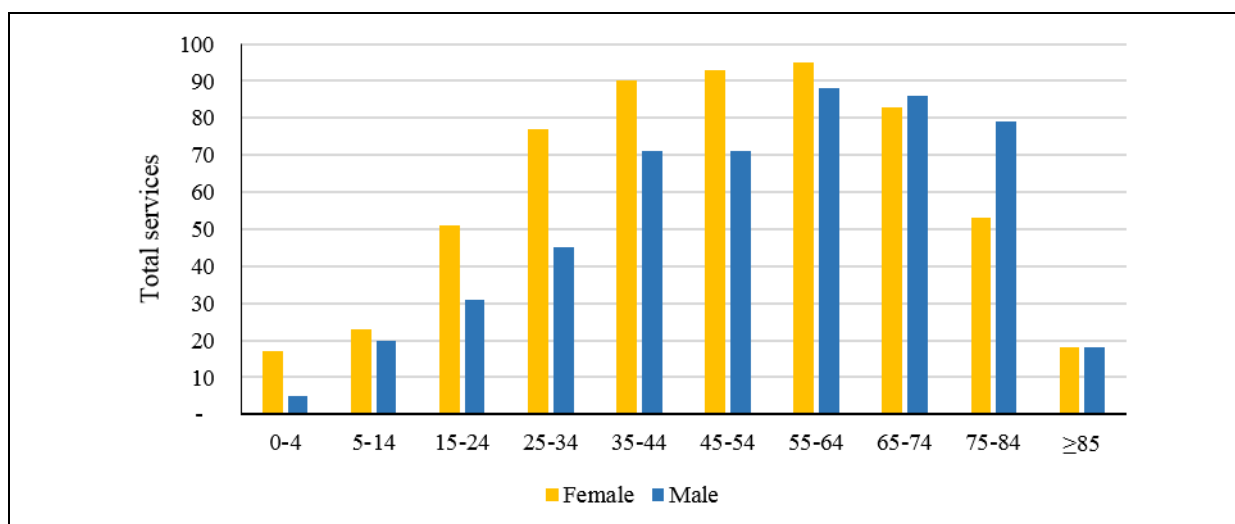
Figure 0-20 Total services for MRI item 63151 (infection) by age group and gender, 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 6 July 2015

Abbreviations: MRI, magnetic resonance imaging.

Figure 0-21 Total services for MRI item 63201 (infection) by age group and gender, 2013-14

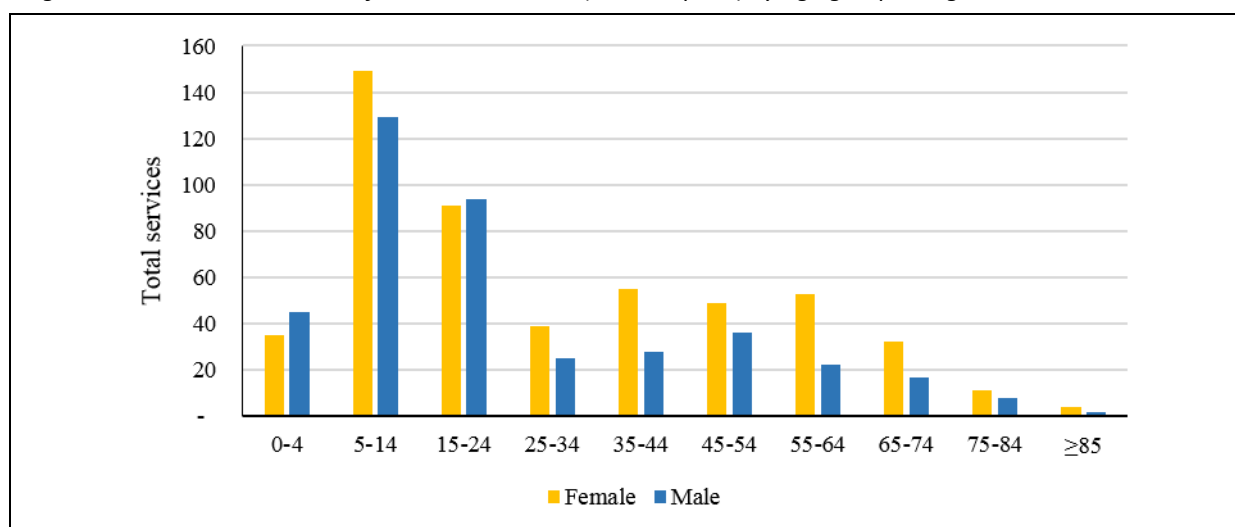


Source: Department of Human Services, Medicare Australia Statistics. Accessed 6 July 2015

Abbreviations: MRI, magnetic resonance imaging.

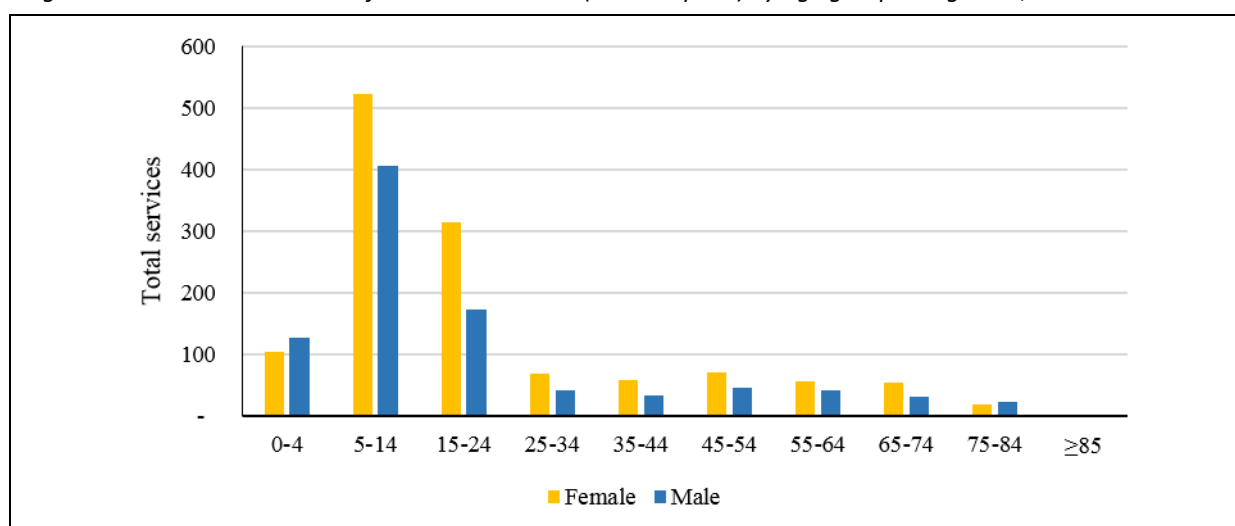
Total services by age and gender in 2003-14 are shown for the two cauda equina MRI items in Figure 0-22 (63164) and Figure 0-23 (63222). This service is more often provided to patients 5 to 24 years of age (especially pronounced for item 63222). This profile is not consistent with the most frequent cause of cauda equina, which is herniated lumbar disc (McNamee, 2013). For most age groups spinal MRI for cauda equina is provided to more females than males (for both items, patients under 5 years are more likely to be male).

Figure 0-22 Total services for MRI item 63164 (cauda equina) by age group and gender, 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 6 July 2015
Abbreviations: MRI, magnetic resonance imaging.

Figure 0-23 Total services for MRI item 63222 (cauda equina) by age group and gender, 2013-14



Source: Department of Human Services, Medicare Australia Statistics. Accessed 6 July 2015
Abbreviations: MRI, magnetic resonance imaging.

Of the five main spinal MRI items, most MRI imaging is performed in females for sciatica around the age of 55-74 years. The gender imbalance switches in older age groups for tumour and infection imaging. It is unclear why MRI for cauda equina is more common in children and young adults.

3.1.4. Imaging services by requesting specialty type

The following sections describe the MBS services for items related to low back X-ray, low back CT and spinal MRI by type of specialty group: allied health, GPs or specialists.²³

²³ Dentistry was included with specialists, but the proportions of services requested by the two dentistry groups were exceedingly small.

*X-ray****Usage trends across specialty types for main X-ray items, 2013-14***

Services for the main X-ray items (58106, 58112 and 58121) during 2013-14 are shown by specialty type in Table 9: Services for main x-ray items by speciality type, 2013-14, along with the proportion of the total services for these main items that were requested by each of the specialisations. A total of 555,387 services were provided for these three items during this period, the majority of which were requested by GPs (61.0%), who most frequently request MBS item 58106 (lumbosacral spine X-ray), then MBS item 58112 (two examinations including lumbosacral and/or sacrococcygeal imaging). The use of low back X-ray imaging by specialists is far less common; they request only 11.2% of all main X-ray item services. However, when they do request low back X-ray imaging, like GPs they most frequently request items 58106 and 58112 (Appendix 7, Table A-Error! No text of specified style in document..1). Allied health professionals request 27.8% of the main X-ray item services, but tend to use item 58121 more frequently than the other two main items (Table 9: Services for main x-ray items by speciality type, 2013-14) or any of the other included items (Table A-Error! No text of specified style in document..1).

As noted earlier, MBS item 58121 applies only to use by allied health professionals. It specifies three examinations, including lumbosacral and/or sacrococcygeal imaging, and stipulates that the imaging must not have been performed on the same patient within the same calendar year (see Appendix 3 for item descriptors).

Table 0-7 Services for main X-ray items by specialty type, 2013-2014

| Item number | GPs | Specialists | Allied health | Total services |
|--|----------------|---------------|----------------|----------------|
| 58106 | 245,779 | 43,267 | 35,524 | 324,570 |
| 58112 | 93,256 | 18,742 | 19,640 | 131,638 |
| 58121 | 0 | 8 | 99,171 | 99,179 |
| Specialty type total for main items | 339,035 | 62,017 | 154,335 | 555,387 |
| % of total services for all 3 items | 61.0% | 11.2% | 27.8% | 100% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: GP, general practitioner.

Note: Data for each financial year from 2009-2010 shown in Appendix 7. MBS item 58121 applies only to allied health professionals.

Allied health requests for main X-ray items by specialty group

Physiotherapists, chiropractors and osteopaths may request X-ray items 58106, 58109, 58112, 58120 and 58121. Services for the main X-ray items requested by allied health professionals during 2013-14 are shown by specialty group in Table 10: Allied health requested services for main x-ray items by speciality type, 2013-14. A large majority of these services were chiropractor-requested (86.8%), and the remaining were requested by physiotherapists (9.9%) and osteopaths (3.3%).

Table 0-8 Allied health-requested services for main X-ray items (58106, 58112 and 58121), by specialty group, 2013-2014

| Item number | Allied health total | Chiropractor | Osteopath | Physiotherapist | Item total |
|------------------------|---------------------|----------------|--------------|-----------------|----------------|
| 58106 | 35,524 | 21,572 | 3,257 | 10,695 | 35,524 |
| 58112 | 19,640 | 14,678 | 1,271 | 3,691 | 19,640 |
| 58121 | 99,171 | 97,772 | 516 | 883 | 99,171 |
| Specialty total | 154,335 | 134,022 | 5,044 | 15,269 | 154,335 |
| % of allied health | 100% | 86.8% | 3.3% | 9.9% | – |

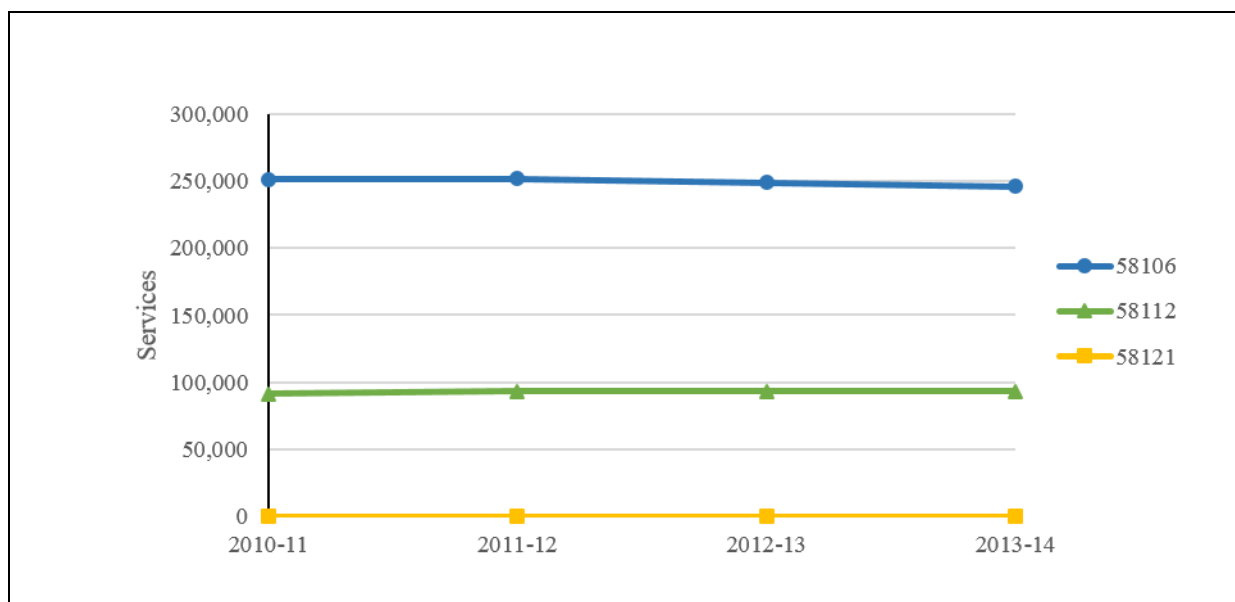
Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Temporal trends in main X-ray items usage

As discussed earlier, data for the main X-ray items do not include a full 12-month period for item 58121, so temporal trends are reported below for the four-year period from 2010-11 to 2013-14. However, data for all five years investigated are shown in Appendix 7.

From 2010-11 to 2013-14, services for the main X-ray items combined fell by 9.5%, (Table 0-3), although trends were different for the three specialty groups. During this period there was little change in the annual number of GP-requested services for the X-ray main items (Figure 0-24), which overall decreased by 1.0% (see also Appendix 7, Table A-Error! No text of specified style in document..1). Services for item 58106 decreased by 2.2% while services for item 58112 increased by 2.3%.

Figure 0-24 GP-requested services for main X-ray items from 2010-11 to 2013-14



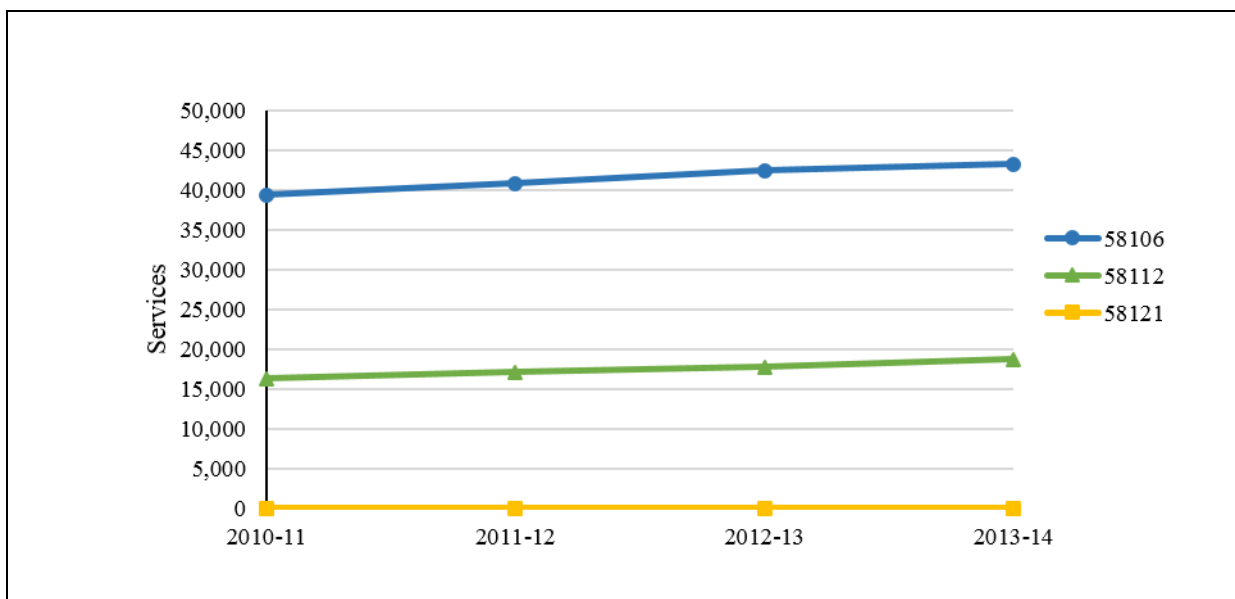
Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: GP, general practitioner.

Note: MBS item 58121 applies only to allied health professionals.

As can be seen in Figure 0-25, from 2010-11 to 2013-14 the number of specialist-requested services for the main X-ray items increased steadily, by 11.3% overall (9.7% for item 58106 and 15.1% for item 58112; Appendix 7, Table A-Error! No text of specified style in document..2).

Figure 0-25 Specialist-requested services for main X-ray items from 2010-11 to 2013-14

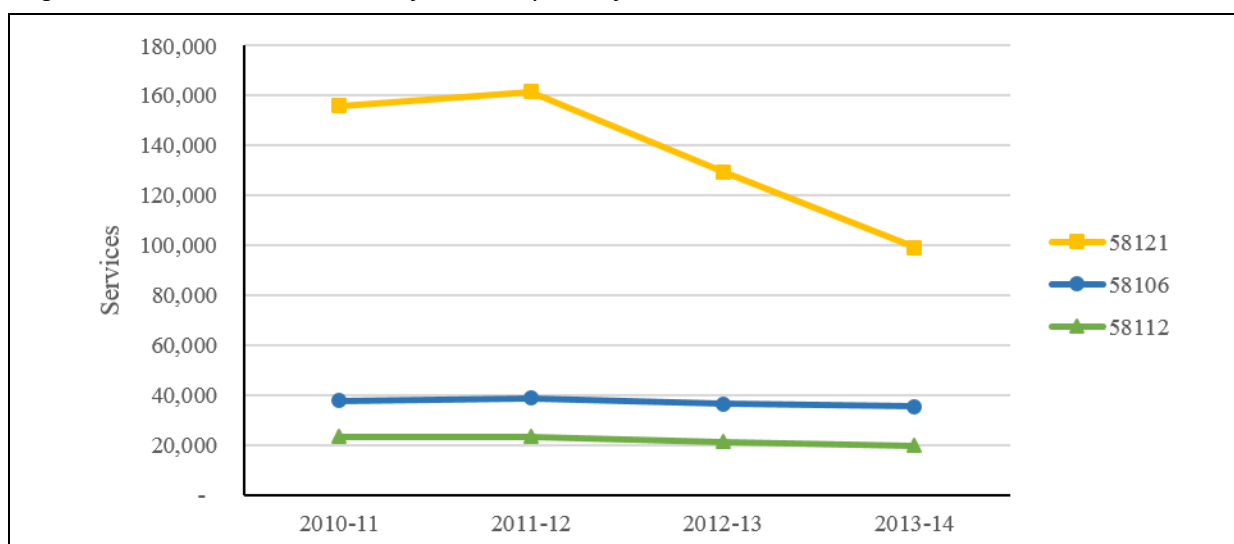


Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Note: MBS item 58121 applies only to allied health professionals.

Figure 0-26 shows allied health-requested services for each of the main X-ray items from 2010-11 to 2013-14 (also see Table A-Error! No text of specified style in document..3 in Appendix 7). Services for the less-frequently used items fell over this period: 58106 by 5.8% and 58112 by 15.9%, but a greater decrease was seen for item 58121, which fell by 36.4%. Overall, allied health-requested services fell by 28.9% for these three main included X-ray items, and by 26.3% for all 16 included X-ray items (not shown).

Figure 0-26 Allied health use of main X-ray items from 2010-11 to 2013-14



Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Almost two thirds (61.0%) of the main X-ray item services are requested by GPs, almost one third (27.8%) by allied health professionals (who are mostly chiropractors), and a small proportion (11.2%) by specialists. From 2010-11 to 2013-14, use of the main X-ray item services by GPs remained somewhat stable (1.0% decrease), but there was increased use by specialists (11.3%) and a substantial decrease in use by allied health professionals (28.9%).

Computed tomography

Usage trends across specialty types for the main CT item, 2013-14

Services for the main CT item during 2013-14 are shown by specialty type in Table 0-9 (data are shown for all included CT items in Appendix 7, Table A-Error! No text of specified style in document..2). Almost 90% of the main CT item services were requested by GPs, while 10% were requested by specialists. Allied health professionals are ineligible to request CT services on the MBS.

Table 0-9 Services for the main CT item by specialty type, 2013-2014

| Item number | GP | Specialists | Total services |
|--------------------------------------|---------|-------------|----------------|
| 56223 | 281,771 | 31,669 | 313,440 |
| % of total services for main CT item | 89.9% | 10.1% | — |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: CT, computed tomography; GP, general practitioner.

Temporal trends in main CT item usage

Services for item 56223 fell from 2009-10 to 2010-11 by 7.3%, largely due to fewer GP requests (Table 3.1-8). Both GP- and specialist-requested services grew steadily from 2010-11 to 2013-14, with an overall growth of 27.5% over these three years.

Table 0-10 Services for main CT item from 2009-10 to 2013-14 by specialty type

| Type | Item 56223 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth | Growth since 2010-11 |
|-------------|---------------------------|----------------|------------------|------------------|-----------------|-----------------|---------------|----------------------|
| GPs | Services Annual growth | 238,610 N/A | 219,858 -7.9% | 248,286 12.9% | 266,971 7.5% | 281,771 5.5% | N/A 18.1% | N/A 28.2% |
| Specialists | Services Annual growth | 26,565 N/A | 26,034 -2.0% | 29,071 11.7% | 30,718 5.7% | 31,669 3.1% | N/A 19.2% | N/A 21.6% |
| Total | Services Annual growth | 265,176 N/A | 245,893 -7.3% | 277,357 12.8% | 297,689 7.3% | 313,440 5.3% | N/A 18.2% | N/A 27.5% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: CT, computed tomography; GP, general practitioner.

Note: Allied health professionals not shown separately as no more than one service per year was requested during this period. These services are included in the total.

The majority (90%) of CT scans of the low back are requested by GPs. After the drop in services from 2009-10 to 2010-11, there has been substantial growth in services requested by both GPs (28.2%) and specialists (21.6%).

Magnetic resonance imaging

This section reports data for specialists only, as GPs and allied health professionals are not eligible to request MBS-funded MRI using the items included in this Review.²⁴

Temporal trends in main MRI items usage

Table 3.1-9 shows the specialist-requested services and annual growth for the main MRI items from 2009-10 to 2013-14. Largely stable growth occurred for each of these items over this period, with five-year growth of between approximately 20 to 30% for each of these items (average; 24.8%). The only reduction in services was observed in 2010-11 for 63145 (tumour) and 63197 (sciatica), but these changes were small at around 1%.

²⁴ During this five-year period there were no services requested by allied health professionals for any included MRI items, and only 4 services for one included MRI item requested by a GP (not included in data reported here).

Table 0-11 Specialist-requested services for main MRI items from 2009-10 to 2013-14

| Main MRI items | Description | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth |
|------------------------|---------------|---------|---------|---------|---------|---------|---------------|
| 63204: tumour | Services | 5,385 | 5,656 | 5,956 | 6,435 | 7,032 | N/A |
| | Annual growth | N/A | 5.0% | 5.3% | 8.0% | 9.3% | 30.6% |
| 63154: tumour | Services | 5,380 | 5,320 | 5,562 | 5,918 | 6,611 | N/A |
| | Annual growth | N/A | -1.1% | 4.5% | 6.4% | 11.7% | 22.9% |
| 63176: sciatica | Services | 42,246 | 45,303 | 47,999 | 50,967 | 52,851 | N/A |
| | Annual growth | N/A | 7.2% | 6.0% | 6.2% | 3.7% | 25.1% |
| 63179: spinal stenosis | Services | 14,860 | 14,707 | 16,106 | 17,045 | 18,589 | N/A |
| | Annual growth | N/A | -1.0% | 9.5% | 5.8% | 9.1% | 25.1% |
| 63167: myelopathy | Services | 7,009 | 7,253 | 7,899 | 8,220 | 8,401 | N/A |
| | Annual growth | N/A | 3.5% | 8.9% | 4.1% | 2.2% | 19.9% |
| Total | Services | 74,880 | 78,239 | 83,522 | 88,585 | 93,484 | N/A |
| | Annual growth | N/A | 4.5% | 6.8% | 6.1% | 5.5% | 24.8% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

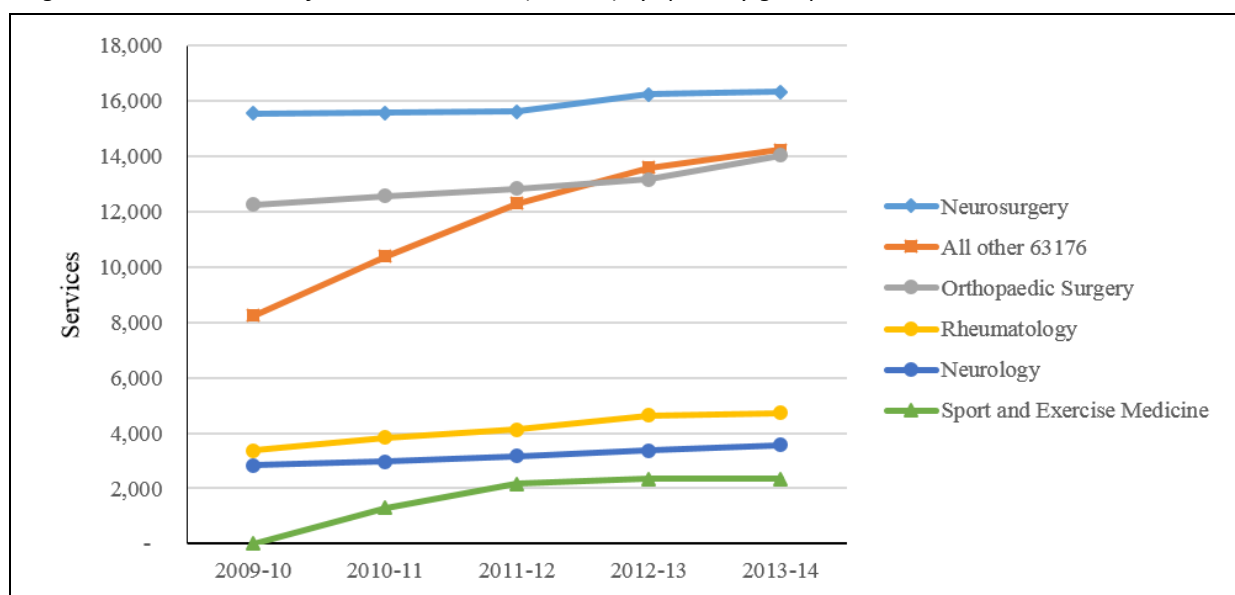
Abbreviations: MRI, magnetic resonance imaging.

Temporal trends across specialty groups

Specialist-requested services for the most commonly used spinal MRI item, 63176 (sciatica), which grew by 25.1% over the five years from 2009-10 to 2013-14, was further disaggregated by specialty group, and temporal trends in usage were examined (Figure 0-27; see also Appendix 7, Table A-**Error! No text of specified style in document..1**). The most frequently requested specialty groups were neurosurgery, orthopaedic surgery, rheumatology and neurology, which grew on average 21% from 2009-10 to 2013-14. The fastest-growing specialty group was sport and exercise medicine, which grew from no services in 2009-10 to 2,347 services in 2013-14. The remaining 39 specialty groups requesting item 63176 are shown as a combined group, which grew by 72% over this period.²⁵

²⁵ Due to the small number of services in many of these groups, ranking of individual specialist groups by percentage growth is not meaningful. Only sports and exercise medicine was notable as a group with exceptionally high growth.

Figure 0-27 Services for MRI item 63176 (sciatica) by specialty group, 2009-10 to 2013-14



Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: MRI, magnetic resonance imaging.

The four largest specialty groups requesting spinal MRI for suspected sciatica are neurosurgery, orthopaedic surgery, rheumatology and neurology. The number of services requested by these specialty groups has increased over time, but there has also been a substantial increase in the number of services requested by other specialty groups, most notably sport and exercise medicine specialists.

3.1.5. Repeat and cascading imaging

Repeat imaging using X-ray and MRI

The repeated use of imaging for the same patients was investigated for the most commonly used MBS items: 58106 for X-ray imaging and 56223 for CT imaging. Repeated imaging using MRI was not investigated as GPs and allied health professionals are ineligible to request the included MBS items for spinal MRI.

Table 3.1-10 shows the number of services from 2009-10 to 2013-14 for items 58106 and 56223 that were provided to patients who had already received that service within the prior 3 months.²⁶ Repeat X-ray imaging is slightly more common than repeat CT imaging with these items, with 2.5% to 2.8% of total services for 58106 being provided as repeat services and 1.6% to 2.0% being repeated provision of item 56223.

²⁶ A longer timeframe may reflect imaging after therapy or a different low back problem.

Table 0-12 Repeat services within 3 months for MBS items 58106 (X-ray) and 56223 (CT) from 2009-10 to 2013-14

| Item | Description | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 |
|-------------------------|----------------------------|---------|---------|---------|---------|---------|
| 58106 (X-ray) | Total services | 323,955 | 328,565 | 331,127 | 327,711 | 324,570 |
| | Repeated services | 7,967 | 8,434 | 8,815 | 9,019 | 9,193 |
| | % that are repeat services | 2.5% | 2.6% | 2.7% | 2.8% | 2.8% |
| 56223 (CT) | Total services | 265,176 | 245,893 | 277,357 | 297,689 | 313,440 |
| | Repeated services | 4,233 | 3,864 | 4,935 | 5,543 | 6,303 |
| | % that are repeat services | 1.6% | 1.6% | 1.8% | 1.9% | 2.0% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: CT, computed tomography.

In 2013-14, less than 1% of allied health professional-requested X-ray services for item 58106 were for repeat imaging using the same item in the same patient, and this proportion was 1.1% for GPs (Table 3.1-11). However, 14.4% of specialist-requested services resulted in repeat services in the same patient. The specialty groups that most frequently initiated repeat imaging using the same MBS item are orthopaedic surgeons and neurosurgeons, with 23.7% and 17.9%, respectively, of item 58106 service requests resulting in repeat imaging.²⁷

A similar trend was observed for MBS item 56223, although not as pronounced, with 7.7% of specialist-requested services being repeat imaging (Table 3.1-11). For orthopaedic surgeon requests, 7.6% of item 56223 services were for repeated imaging, which is less than the 23.7% observed for item 58106.²⁸

These same trends in specialty groups were observed from 2009-10 through to 2012-13, and are not reported in this Review.

Table 0-13 Repeat services within 3 months for MBS items 58106 and 56223 by specialty type and group, 2013-14

| Item | Description | Allied Health | GPs | Specialists | Orthopaedic surgeons | Neurosurgeons |
|-------------------------|----------------------------|---------------|---------|-------------|----------------------|---------------|
| 58106 (X-ray) | Services in 2013-14 | 35,524 | 245,779 | 43,263 | 18,388 | 9,457 |
| | Repeated services | 171 | 2,803 | 6,219 | 4,350 | 1,689 |
| | % that are repeat services | 0.5% | 1.1% | 14.4% | 23.7% | 17.9% |
| 56223 (CT) | Services in 2013-14 | 0 | 281,771 | 31,669 | 6,343 | 8,347 |
| | Repeated services | 0 | 3,850 | 2,453 | 484 | 1,736 |

²⁷ Orthopaedic surgeons and neurosurgeons request item 58106 X-ray imaging more frequently than any other specialty group (42.5% and 21.9% of specialist-requested services, respectively, not shown).

²⁸ Orthopaedic surgeons and neurosurgeons request item 53223 CT imaging more frequently than any other specialty group (20.0% and 26.4% of specialist-requested services, respectively, not shown).

| Item | Description | Allied Health | GPs | Specialists | Orthopaedic surgeons | Neurosurgeons |
|------|----------------------------|---------------|------|-------------|----------------------|---------------|
| | % that are repeat services | 0% | 1.4% | 7.7% | 7.6% | 20.8% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: GPs, general practitioners.

For the most frequently used X-ray and CT items, the amount of repeat imaging was low and largely performed by specialist groups (especially orthopaedic surgery and neurosurgery).

Cascade imaging after X-ray or CT imaging

The number of times that either X-ray item 58106 or CT item 56223 was followed by a service with one of the five main MRI items was investigated. Similarly, the number of times that X-ray was followed by CT and then by MRI, or CT was followed by X-ray and then by MRI, was also investigated. Table 0-14 lists the sequence of items investigated. The second service was provided within 3 months of the index service, and the third service was provided within 3 months of the second service.

Table 0-14 Sequences of MBS item claims investigated for cascade imaging

| Sequence | MBS service 1 (index service) | MBS service 2 (within 3 months of index service) | MBS service 3 (within 3 months of service 2) |
|----------|-------------------------------|--|--|
| 1 | 58106 | 63154, 63167, 63176, 63179, or 63204 | N/A |
| 2 | 56223 | 63154, 63167, 63176, 63179, or 63204 | N/A |
| 3 | 58106 | 56223 | 63154, 63167, 63176, 63179, or 63204 |
| 4 | 56223 | 58106 | 63154, 63167, 63176, 63179, or 63204 |

Abbreviations: MBS, Medicare Benefits Schedule.

Table 0-15 shows the total number of times each sequence occurred from 2009-10 to 2013-14. In 2013-14, the total number of events of each of *Sequences 1, 2 and 3* were similar; *Sequence 4* events were only slightly less frequent. These sequences are examined by specialty type below.

Table 0-15 Number of events by sequence, 2009-10 to 2013-14

| Sequence | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth |
|----------|---------|---------|---------|---------|---------|---------------|
| 1 | 6,264 | 8,258 | 9,870 | 11,473 | 13,278 | 112% |
| 2 | 7,214 | 7,854 | 9,534 | 11,407 | 13,398 | 86% |
| 3 | 5,709 | 7,432 | 9,492 | 11,346 | 13,652 | 139% |
| 4 | 4,403 | 4,793 | 6,158 | 8,308 | 10,015 | 127% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 17 June 2015.

Sequence 1

Table 0-16 shows the number of times that *Sequence 1* occurred (i.e. where X-ray item 58106 is followed by one of the main MRI items) in 2013-14, by specialty type. This sequence was most frequently initiated by a GP (61.3% of all *Sequence 1* events), and represents 3.3% of all GP-requested services for item 58106. While there were fewer specialist-initiated *Sequence 1* events, they formed a higher proportion of all specialist-requested services for item 58106 (9.2%).

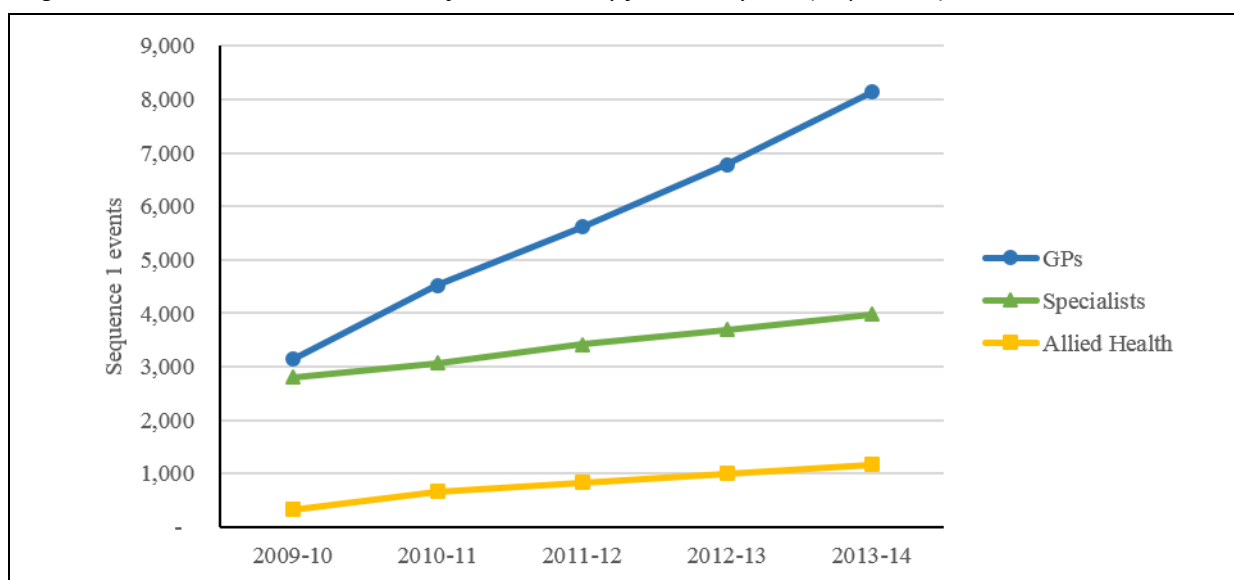
Table 0-16 Number of instances where low back X-ray is followed by MRI (*Sequence 1*)

| Specialty type | Sequence 1 events 2013-14 | % of total Sequence 1 events | No. of index services 2013-14 | % of index services that are Sequence 1 |
|----------------|---------------------------|------------------------------|-------------------------------|---|
| GPs | 8,133 | 61.3% | 245,779 | 3.3% |
| Specialists | 3,977 | 30.0% | 43,267 | 9.2% |
| Allied Health | 1,168 | 8.8% | 35,524 | 3.3% |
| Total | 13,278 | — | 324,570 | — |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 and 17 June 2015.

Figure 0-28 shows the growth in the number of *Sequence 1* events, by the specialty type requesting the index service (data also shown in Appendix 7, Table A-**Error! No text of specified style in document..1**). In 2009-10, the number of GP- and specialist-initiated *Sequence 1* events were similar, but growth over the subsequent four years was greater for GPs. From 2009-10 to 2013-14 the number of allied health professional-initiated *Sequence 1* events increased by 262%, but constituted only 8.8% of all *Sequence 1* events in 2013-14.

Figure 0-28 Growth in instances of low back X-ray followed by MRI (*Sequence 1*)



Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 17 June 2015.

Abbreviations: GP, general practitioner; MRI, magnetic resonance imaging.

Sequence 2

As allied health professionals cannot request MBS-funded CT scans, no services are reported for this specialty group, only for GPs and specialists (Table 0-17). Instances where a low back CT service (MBS item 56223) is followed by one of the main MRI items are largely GP-initiated (88.9% versus 11.1% for specialist-initiated). However, the rate at which requests for low back CT (MBS item 56223) are followed by MRI is similar for GPs and specialists (4.2% and 4.7% respectively).

Table 0-17 Number of instances where low back CT is followed by MRI (Sequence 2)

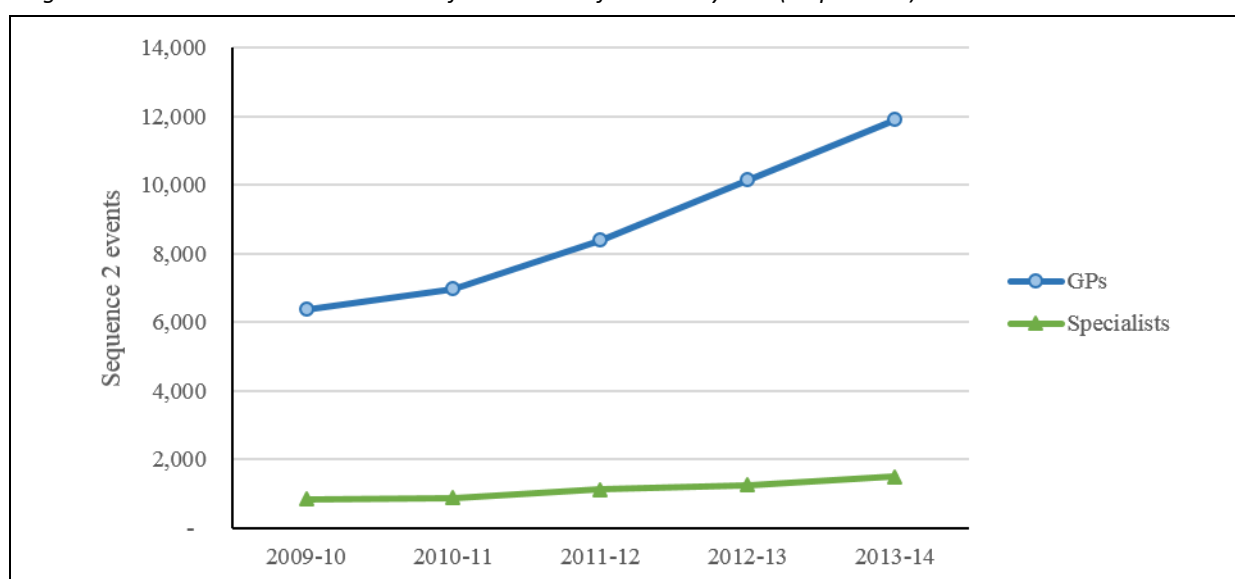
| Specialty type | Sequence 2 events 2013-14 | % of total Sequence 2 events | No. of index services 2013-14 | % of index services that are Sequence 2 |
|----------------|---------------------------|------------------------------|-------------------------------|---|
| GPs | 11,907 | 88.9% | 281,771 | 4.2% |
| Specialists | 1,491 | 11.1% | 31,669 | 4.7% |
| Total | 13,398 | N/A | 313,440 | N/A |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 and 17 June 2015.

Abbreviations: GPs, general practitioners; MRI, magnetic resonance imaging.

Figure 0-29 shows the growth in the number of *Sequence 2* events, by the specialty type requesting the index service (data also shown in Appendix 7, Table A-Error! No text of specified style in document..2). Growth over this period was similar for both specialty types (86.9% for GPs, 77.1% for specialists).

Figure 0-29 Growth in instances of low back CT followed by MRI (Sequence 2)



Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 17 June 2015.

Abbreviations: CT, computed tomography; GP, general practitioner; MRI, magnetic resonance imaging.

Sequence 3

Table 0-18 shows the number of instances in 2013-14 of *Sequence 3* (i.e. X-ray item 58106 followed by CT item 56223 followed by one of the main MRI items), by the specialty type requesting the index

service. Almost 90% of these events are GP-initiated, but the proportion of total index services that lead to this imaging sequence is similar for each of the specialty groups (3% to 4.4%).

Table 0-18 Number of instances where low back X-ray is followed by low back CT and then MRI (Sequence 3)

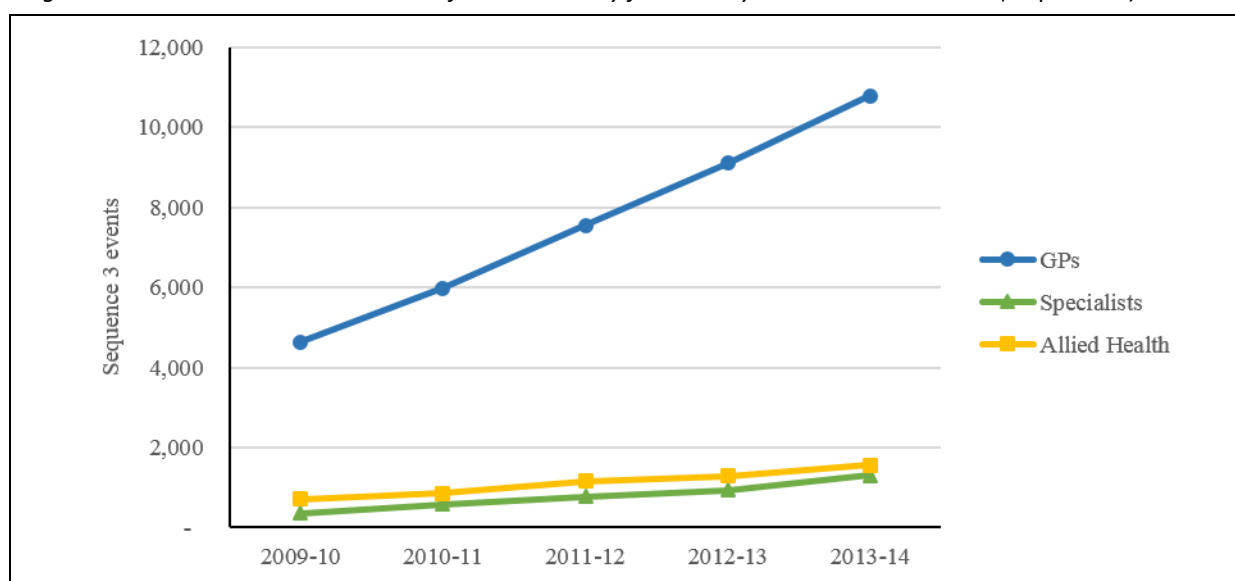
| Specialty type | Sequence 3 events, 2013-14 | % of total Sequence 3 events | No. of index services 2013-14 | % of index services that are Sequence 3 |
|----------------|----------------------------|------------------------------|-------------------------------|---|
| GPs | 10,789 | 89.3% | 245,779 | 4.4% |
| Specialists | 1,299 | 10.7% | 43,267 | 3.0% |
| Allied health | 1,564 | 12.9% | 35,524 | 4.4% |
| Total | 12,088 | N/A | 324,570 | N/A |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 and 17 June 2015.

Abbreviations: GPs, general practitioners; MRI, magnetic resonance imaging.

Figure 0-30 shows the growth in the number of *Sequence 3* events, by the specialty type requesting the index service (data also shown in Appendix 7, Table A-**Error! No text of specified style in document..3**). Growth over this period was high for each specialty type, but was twice as high for specialists (258.8%) than for GPs (132.8%) or allied health (119.7%).

Figure 0-30 Growth in instances of low back X-ray followed by low back CT then MRI (Sequence 3)



Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 17 June 2015.

Abbreviations: CT, computed tomography; GP, general practitioner; MRI, magnetic resonance imaging.

Sequence 4

As allied health professionals cannot request MBS-funded CT scans, no services are reported for this specialty group.²⁹ Table 0-19 shows the number of instances in 2013-14 of *Sequence 4* (i.e. CT (MBS

²⁹ One allied health-initiated sequence was reported in 2010-11, but for simplicity is not included here.

item 56223) followed by X-ray (MBS item 58106) followed by one of the main MRI items), by the specialty type requesting the index service. Over 90% of these events are initiated by a GP requesting a low back CT scan, but the proportion of index services that lead to this imaging sequence is similar for both specialty types.

Table 0-19 Number of instances where low back CT is followed by low back X-ray and then MRI (Sequence 4)

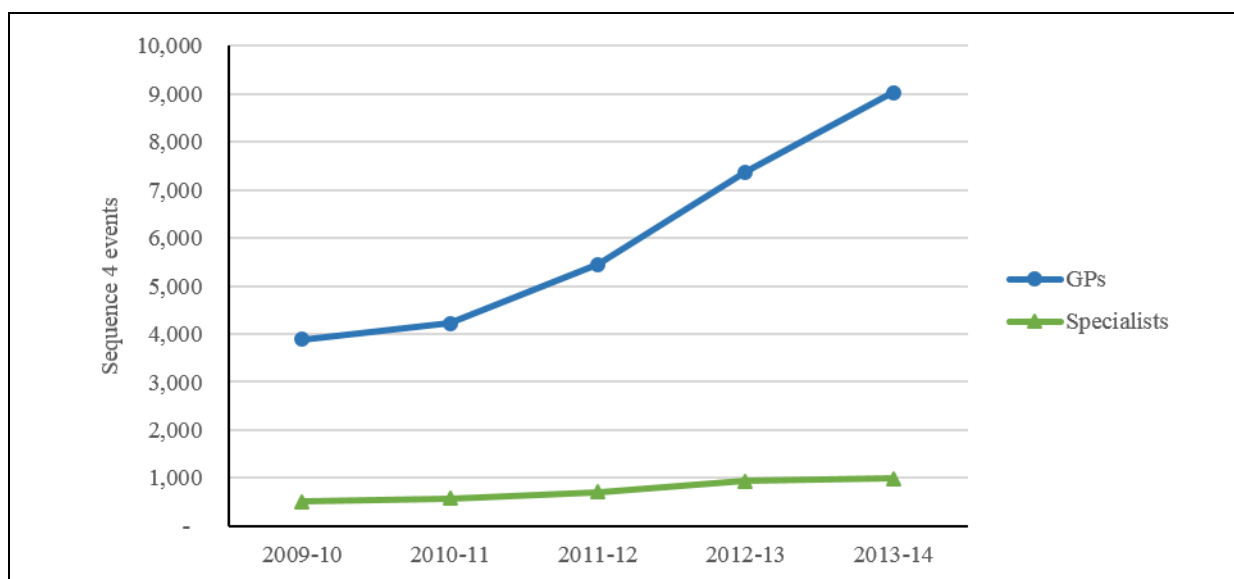
| Specialty type | Sequence 4 events, 2013-14 | % of total Sequence 4 events | No. of index services 2013-14 | % of index services that are Sequence 4 |
|----------------|----------------------------|------------------------------|-------------------------------|---|
| GPs | 9,028 | 90.1% | 281,771 | 3.2% |
| Specialists | 987 | 9.9% | 31,669 | 3.1% |
| Total | 10,015 | N/A | 313,440 | N/A |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 and 17 June 2015

Abbreviations: CT, computed tomography; GPs, general practitioners; MRI, magnetic resonance imaging.

Figure 0-31 shows the growth in the number of *Sequence 4* events, by the specialty type requesting the index service (data also shown in Appendix 7, Table A-Error! No text of specified style in document..4). Growth over this period was high for both specialty types, but higher for GP-initiated events (132.1%) than for specialist-initiated events (92.0%).

Figure 0-31 Growth in instances of low back CT followed by low back X-ray then MRI (Sequence 4)



Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 4 June 2015.

Abbreviations: CT, computed tomography; GP, general practitioner; MRI, magnetic resonance imaging.

Cascade imaging from X-ray and/or CT, ending with MRI, was infrequent (less than five percent of index procedures for all specialty types) except for specialists requests for X-ray followed by MRI, which accounted for 9.2% of index X-ray procedures in 2013-14. Substantial five-year growth was observed for these cascading sequences (86% to 139%).

3.2. BEACH Report on imaging for back pain

The Bettering the Evaluation and Care of Health (BEACH) program randomly samples around 1000 Australian GPs annually, collecting data on 100 consecutive consultations and the resulting requests for imaging tests. Based on such data, an investigative report on imaging requests was published in 2014: *Evaluation of imaging ordering by GPs in Australia, 2002-03 to 2011-12* (Britt et al, 2014). Data are reported for management of all (any) back problems, and are further classified according to diagnostic status (back syndrome or back symptom/complaint) and problem status (old or new). Data is also reported for X-ray and CT scans according to the region of the back imaged (including lumbar imaging and lumbosacral imaging). The results of this report that are relevant to this MBS Review are summarised in this section.

While the BEACH dataset provides additional information as it captures MRI requests from GPs (who are ineligible to request spinal MRI in adults under the MBS), interpretation of the data published in the report by Britt et al (2014) is limited because GP encounters for management of back problems are not exclusively in patients who present with LBP.

3.2.1. Overview of encounters and problems during the study periods

Any problems managed

The Britt et al (2014) report investigated GP-patient encounters over two three-year study periods: 1 April 2002 to 31 March 2005 (Period 1) and 1 April 2009 to 31 March 2012 (Period 2). Table 0-20 shows the number of GPs that participated in the study and the total number of sampled encounters with patients. GPs could report up to four problems per encounter. While the number of encounters did not change from 2002-05 to 2009-12, a statistically significant increase was observed in the number of problems managed per 100 encounters, increasing from 149.1 to 157.6.

Problems were categorised as either new or old (problem status), with the former indicating the patient had not previously consulted any medical practitioner for that problem or during the current episode of a recurrent problem. That is, new problems represent the first GP visit for that problem or episode. From 2002-05 to 2009-12 the proportion of managed problems that were new remained unchanged. Due to the increase in problems managed per encounter, the total number of new problems managed per encounter also increased.

Table 0-20 Encounters and problems managed across entire BEACH study

| Problems | Description | 2002-05 | 2009-12 |
|------------------|--|-----------------------------|-----------------------------|
| All problems | Total number of participating GPs | 2,961 | 2,930 |
| | Total encounters sampled ^a | 296,100 | 293,000 |
| | Number of problems managed (all problems) | 441,591 | 461,761 |
| | Number of problems managed per 100 encounters (95% CI) | 149.1 (148.1, 150.2) | 157.6 (156.4, 158.8) |
| All new problems | Number of problems that were new | 166,704 | 173,427 |

| Problems | Description | 2002-05 | 2009-12 |
|----------|--|--------------------------|--------------------------|
| | New problems as a proportion of all problems (95% CI) | 37.8 (37.3, 38.2) | 37.6 (37.1, 38.0) |
| | Number of new problems managed per 100 encounters (95% CI) | 56.3 (55.6, 57.0) | 59.2 (58.5, 59.9) |

Source: Britt et al (2014), Table 3.3

Abbreviations: BEACH, Bettering the Evaluation and Care of Health; CI, confidence interval; GP, general practitioner.

Note: bold indicates statistically significant difference between study periods.

a Each GP records details of 100 consecutive encounters.

Back problems managed

Table 0-21 shows data for the management of back problems. In addition to reporting the management of all (any) back problem, data are also shown by diagnostic status:

- back syndrome (diagnosed conditions); and
- back symptom/complaint (undiagnosed conditions).

These diagnostic groups each represent approximately 50% of all back problems.

Table 0-21 Back problems managed, by problem type

| Back problem | Description | 2002-05 | 2009-12 |
|------------------------|---|----------------|----------------|
| Any | Number of any back problems managed | 11,146 | 10,584 |
| | Number of any back problems managed per 100 encounters (95% CI) | 3.8 (3.6, 3.9) | 3.6 (3.5, 3.7) |
| Back syndrome | Number of back syndromes managed | 5,712 | 5,280 |
| | Back syndrome as a proportion of any back problems | 51.2 | 49.9 |
| | Number of back syndromes per 100 encounters (95% CI) | 1.9 (1.9 2.0) | 1.8 (1.7 1.9) |
| Back symptom/complaint | Number of back symptoms/complaints managed | 5,434 | 5,304 |
| | Back symptoms/complaints as a proportion of any back problems | 48.8 | 50.1 |
| | Number of back symptoms/complaints per 100 encounters (95% CI) | 1.8 (1.7, 1.9) | 1.8 (1.7, 1.9) |

Source: Britt et al (2014), Table 5.1

Abbreviations: CI, confidence interval.

Note: there were no statistically significant differences between study periods.

Unlike the management rate of any problem, which increased between 2002-05 and 2009-12, the management rate of back problems did not change significantly between these periods. The management rate of the two types of back problem, back syndrome and back symptom/complaint, also did not change (Table 0-21).

While the management rate for back problems remained unchanged, the authors note that from the start of Period 1 (2002-05) to the end of Period 2 (2009-12), a substantial increase was observed in the national average number of GP visits per year over this period of time, corresponding to more than one additional visit per head of population in 2011-12 compared to 10 years earlier.

Extrapolating the back problem management data to national estimates, the number of encounters involving back problems increased by 673,000, from 3.64 million encounters (95% CI: 3.52, 3.77) in 2002-05 to 4.32 million (95% CI: 4.19, 4.44) in 2009-12. Therefore a consequent increase in MBS services relevant to imaging for back problems would be expected in the absence of any change in management practice.

3.2.2. Imaging requests for any problem

National estimates of imaging requests for any problem increased from 8.45 million in 2002-05 to 12.23 million in 2009-12. Approximately half of this increase is accounted for by the increase in the number of GP visits discussed above, while the rest would be due to a change in either GP requesting behaviour or the nature of problems being presented. The latter is not the case for back problems, as revealed by the stable rate of back problem management discussed above. Therefore, back imaging requesting patterns were investigated to determine whether any increases here contributed to the overall inflation of imaging.

3.2.3. Imaging requests for any back problem

The investigation of GP imaging requesting for back problem management is reported in Table 0-22. Between 2002-05 and 2009-12 there were no statistically significant differences in either the likelihood that at least one imaging test was requested (13.9% versus 14.5%), the number of tests requested per back problem presented (16.1 versus 16.8 per 100 back problems) or the number of tests requested per tested back problem (1.16 per tested problem for both periods).

Extrapolating to national estimates shows that there was an increase in the total number of imaging tests requested for back problems in 2002-05 (590,000) compared to 2009-12 (730,000). In light of the consistent rates of imaging requesting for back problems and the consistent rates of back problem managed per encounter, the authors concluded that higher rates of GP visits is the sole cause of the observed increase in the number of imaging tests requested for back problems nationally. The proportion of total imaging requests that were requested for back problems fell significantly over this period from 6.9% to 5.9%, presumably due to increases in imaging for other conditions.

Table 0-22 GP imaging requests generated by management of any back problem

| Description | 2002-05 | 2009-12 |
|---|-------------------|-------------------|
| Number of any back problems managed | 11,146 | 10,584 |
| Number of any back problems for which ≥ 1 imaging test requested (n) | 1,546 | 1,531 |
| Likelihood of requesting ≥ 1 test (% of all problems) | 13.9 (13.1, 14.6) | 14.5 (13.7, 15.2) |
| Number of imaging requests generated for any back problem (n) | 1,800 | 1,776 |
| Number of imaging requests per 100 back problems (95% CI) | 16.1 (15.2, 17.1) | 16.8 (15.8, 17.7) |
| Number of tests requested per tested back problem | 1.16 | 1.16 |

| Description | 2002-05 | 2009-12 |
|--|---------|---------|
| Proportion of total imaging requests associated with management of back problems | 6.9 | 5.9 |

Source: Britt et al (2014), Table 4.4 and Table 5.2

Abbreviations: CI, confidence interval; GP, general practitioner.

Note: there were no statistically significant differences between study periods.

3.2.4. Imaging requests by back problem type and status

The findings for back syndrome and back symptoms/complaints were similar to each other (Table 0-23) and to any back problem; there are no statistically significant changes from 2002-05 to 2009-12 in the likelihood of requesting at least one imaging test, the number of tests requested per 100 problems, and the number of tests requested per tested back problem. As the problem management rate did not change for either back syndrome or back symptoms/ complaints over this period (Table 0-21), it was concluded by the authors that the estimated increases in imaging requests extrapolated from this data were entirely due to an increased GP-visit rate.

While no temporal changes were observed for back syndrome or back symptoms/complaints, the likelihood of requesting at least one imaging test was much higher in patients presenting with new back syndrome compared to old back syndrome (e.g. 27.6% versus 10.3% respectively, during 2009-12). A similar trend was observed for new back symptoms/ complaints, of which 25.4% resulted in imaging requests compared to 10.7% for old back symptoms/complaints during 2009-12.

The Britt et al (2014) report also presents management likelihood and test request rate by gender and age group for all back problems, and also for back syndrome and back symptoms/complaints (these demographics are also reported for new problems by problem type). However, given that this data does not differentiate between back pain and LBP, it was considered not sufficiently relevant to the current Review of imaging for LBP to be reproduced here.

Table 0-23 Imaging requests for back problems by problem type, and by problem status

| Back problem | Description | 2002-05 | 2009-12 | New problems, 2002-05 | New problems, 2009-12 | Old problems, 2002-05 | Old problems, 2009-12 |
|------------------------|--|-------------------|-------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Back syndrome | Number of back syndromes managed | 5,712 | 5,280 | 1,550 | 1,317 | 4,162 | 3,963 |
| | Proportion of back syndromes | N/A | N/A | 27.1 | 25.0 | 72.9 | 75.0 |
| | Number of back syndromes for which ≥ 1 imaging test requested (n) | 775 | 770 | NR | NR | NR | NR |
| | Likelihood of requesting ≥ 1 test (% of back syndrome) | 13.6 (12.6, 14.6) | 14.6 (13.5, 15.6) | 26.1 (23.7, 28.4) | 27.6 (25.0, 30.1) | 8.9 (8.0, 9.8) | 10.3 (9.3, 11.3) |
| | Number of imaging requests generated for back syndrome (n) | 893 | 895 | 469 | 436 | 424 | 459 |
| | Number of imaging requests per 100 back syndrome (95% CI) | 15.6 (14.4, 16.8) | 17.0 (15.7, 18.2) | 30.3 (27.3, 33.2) | 33.1 (29.8, 36.4) | 10.0 (9.1, 11.3) | 11.6 (10.4, 12.8) |
| | Number of tests requested per tested back syndrome | 1.15 | 1.15 | 1.16 | 1.16 | NR | NR |
| Back symptom/complaint | Number of back symptoms/complaints managed | 5,434 | 5,304 | 1,419 | 1,321 | 4,015 | 3,983 |
| | Proportion of back symptoms/complaints | N/A | N/A | 26.1 | 24.9 | 73.9 | 75.1 |
| | Number of back symptoms/complaints for which ≥ 1 imaging test requested (n) | 771 | 761 | NR | NR | NR | NR |
| | Likelihood of requesting ≥ 1 test (% of back symptoms/complaints) | 14.2 (13.1, 15.2) | 14.3 (13.3, 15.4) | 26.4 (23.8, 28.9) | 25.4 (22.8, 28.1) | 9.9 (8.9, 10.9) | 10.7 (9.6, 11.7) |
| | Number of imaging requests generated for back symptoms/complaints (n) | 907 | 881 | 448 | 390 | 459 | 491 |
| | Number of imaging requests per 100 back symptoms/complaints (95% CI) | 16.7 (15.4, 18.0) | 16.6 (15.3, 17.9) | 31.6 (28.3, 34.9) | 29.5 (26.2, 32.8) | 11.4 (10.2, 12.6) | 12.3 (11.1, 13.6) |

| Back problem | Description | 2002-05 | 2009-12 | New problems, 2002-05 | New problems, 2009-12 | Old problems, 2002-05 | Old problems, 2009-12 |
|--------------|---|---------|---------|--------------------------|--------------------------|--------------------------|--------------------------|
| | Number of tests requested per tested back symptoms/complaints | 1.18 | 1.16 | 1.19 | 1.16 | NR | NR |

Source: Britt et al (2014), Table 5.5, Table 5.8, Table 5.11 and Table 5.14.

Abbreviations: CI, confidence interval; NR, not reported

Note: there were no statistically significant differences between study periods for back syndrome or back symptoms/complaints or new back problems (either type). Significance of differences between study periods for old problems was not reported, but from the confidence intervals it can be ascertained that there were no statistically significant differences between study periods.

3.2.5. Medicare imaging groups

The problems managed and imaging tests requested are recorded by GPs on the BEACH survey forms in free text but are subsequently classified by trained secondary coders to more specific terms using the International Classification of Primary Care – Version 2 PLUS (ICPC-2 PLUS). This labels problems managed with pre-defined terms and codes (i.e. back syndrome problems; ‘disc syndrome; lumbosacral’ is designated code L86013). A similar process labels imaging requests (i.e. ‘X-ray; spine; lumbar’ is designated code L41033). The labels used to describe the imaging tests are referred to here as test descriptors.

To better align the imaging request codes with the classification of MBS items that would ultimately be used by the service provider, the ICPC-2 PLUS codes were re-classified into one of five groups (Medicare imaging groups); diagnostic radiology, ultrasound, CT, nuclear medicine imaging, and MRI. Within each Medicare imaging group, further information about the region of the body that was imaged is provided by the test descriptor (ICPC-2 PLUS label; Table 3.2–5).

Table 0-5 Example of ICPC-2 PLUS codes and labels, assigned to one of five Medicare imaging groups

| Group | ICPC-2 PLUS code | ICPC-2 PLUS label |
|----------------------------------|------------------|--------------------------------------|
| Diagnostic radiology (continued) | L41064 | X-ray; back lower |
| | L41065 | X-ray; forearm |
| | L41066 | X-ray; leg lower |
| | L41067 | X-ray; metacarpal |
| | L41068 | X-ray; metatarsal |
| | L41123 | X-ray; sternum |
| | L41124 | Test; densitometry |
| | N41001 | Radiology; diagnostic neurological |
| | N41004 | X-ray; skull |
| | P41001 | Radiology; diagnostic; psychological |
| | R41001 | Radiology; diagnostic; respiratory |

Source: Britt et al (2014) Appendix 5, Table A5.3

Abbreviations: ICPC-2 PLUS; International Classification of Primary Care – Version 2 PLUS.

Britt et al (2014) reports imaging data by Medicare imaging group, of which X-ray, CT scan and MRI are relevant to the current Review (ultrasound and nuclear medicine imaging are out of scope). For X-ray and CT scans, data were further disaggregated with a test descriptor that indicates the body region under investigation. Only the most frequently used test descriptors are presented in each Medicare imaging group. The test descriptors relevant to the current Review of imaging for LBP are:

Diagnostic radiology:

- X-ray; spine; lumbar
- X-ray; spine; lumbosacral

CT scans:

- CT scan; spine; lumbar
- CT scan; spine; lumbosacral

It should be noted that these test descriptors do not relate to specific MBS items; consultation data from the BEACH study is used to allocate imaging requests to test descriptors (MBS item descriptors only refer to lumbosacral imaging, which includes lumbar imaging).

Britt et al (2014) does not report the management of problems with MRI using test descriptors³⁰, and all MRI data are reported as a single Medicare imaging group. Therefore MRI data in this section, which cannot be limited to low back imaging, represents the use of MRI for any back problem.

Data for the low back test descriptors are combined post hoc for each of the X-ray and CT Medicare groups. Test request rate calculations are based on the assumption by the authors of the current Review that X-ray and CT imaging of low back problems may be allocated to either lumbar or lumbosacral test descriptors, but not both, and therefore that these rates are additive.

Imaging request rates are reported for all problems (not shown here), back problems, and the categories of back problems (back syndrome, new back syndrome, back symptom/complaint, and new back symptom/complaint), and are reported below for the indicated test descriptors.

3.2.6. Low back imaging requests for any back problems

Table 0-6 shows the number of imaging requests for a selection of test descriptors specific to low back, by Medicare imaging group. It should be noted that in addition to the test descriptors tabulated here, it is possible that others such as 'X-ray; back' or 'X-ray; spine' (i.e. no further specification of region) may include imaging requests for patients with LBP. However, these groups would also include patients with back pain in other regions, and so data for these test descriptors were not included in the current Report.

The two test descriptors shown in Table 3.2-6 for each of diagnostic radiology and CT scans are those most frequently used for low back imaging within these Medicare imaging groups, and together represent over 50% of all GP imaging requests (diagnostic radiology, CT, ultrasound, MRI and nuclear medicine) for any back problems, low back or otherwise. As discussed above, the data for MRI requests are not reported in Britt et al (2014) by test descriptor, and so cannot be limited to low back imaging.

Of all GP imaging requests for any back problem, the proportion managed with low back X-ray decreased from 2002-05 to 2009-12 (32.9% to 26.4%), and increased for both low back CT scans

³⁰ The BEACH study data pertaining to body region investigated with MRI is used to categorise the use of MRI using similar test descriptors (e.g. MRI; spine; lumbar, and MRI; spine; lumbosacral), but they are not used in Britt et al (2014), possibly due to the low number of MRI orders placed by GPs, which are not publicly funded.

(22.9% to 27.8%) and spinal MRI (1.3% to 4.9%). This corresponds to the following changes in request rates per 100 back problems: low back X-ray, 5.3 to 4.4; low back CT, 3.7 to 4.7; and MRI, 0.2 to 0.8.

This shift from diagnostic radiology to CT and MRI arose from statistically significant changes in the request rates of low back lumbosacral X-rays, low back lumbar CT scans and MRI for any back problem. The request rate for lumbosacral X-rays decreased from 3.5 per 100 back problems in 2002-05 to 2.3 per 100 back problems in 2009-12. Conversely, the lumbar CT scan request rate increased from 1.9 to 3.0 per 100 back problems over this period. As a consequence of these changes, lumbar CT scans became more frequently requested than lumbosacral X-rays (test rate per 100 back problems of 3.0 versus 2.3 respectively), switching the most frequently requested imaging for low back problems from X-ray to CT scans (lumbar X-ray requests increased marginally and lumbosacral CT scans remained stable over this period).

The rate at which MRI tests were requested for any back problem quadrupled between these periods (0.2% to 0.8% of back problems) but, as mentioned earlier, these data are not restricted to low back. It should also be noted that GP-requested MRI is not reimbursed by Medicare, so imaging from these requests would be privately funded.

Table 0-6 Imaging requests by MBS imaging group and test descriptor for all back problems

| Imaging | Type of test requested for back problems | No. of tests, 2002-05 | % of all imaging tests for all back problems (95% CI), 2002-05 | Test rate per 100 back problems (95% CI), 2002-05 | No. of tests, 2009-12 | % of all imaging tests for all back problems (95% CI), 2009-12 | Test rate per 100 back problems (95% CI), 2009-12 |
|----------------------|---|------------------------------|---|--|------------------------------|---|--|
| Diagnostic radiology | X-ray; spine; lumbosacral | 387 | 21.5 (19.5, 23.5) | 3.5 (3.1, 3.9) | 246 | 13.9 (12.1, 15.6) | 2.3 (2.0, 2.7) |
| | X-ray; spine; lumbar | 206 | 11.4 (9.9, 13.0) | 1.8 (1.6, 2.1) | 222 | 12.5 (10.9, 14.1) | 2.1 (1.8, 2.4) |
| | <i>Total for above descriptors³¹</i> | 593 | 32.9 | 5.3 | 468 | 26.4 | 4.4 |
| Computed tomography | CT scan; spine; lumbar | 209 | 11.6 (10.1, 13.1) | 1.9 (1.6, 2.1) | 315 | 17.7 (15.8, 19.7) | 3.0 (2.6, 3.3) |
| | CT scan; spine; lumbosacral | 203 | 11.3 (9.7, 12.9) | 1.8 (1.5, 2.1) | 179 | 10.1 (8.5, 11.7) | 1.7 (1.4, 2.0) |
| | <i>Total for above descriptors³¹</i> | 412 | 22.9 | 3.7 | 494 | 27.8 | 4.7 |
| MRI | MRI (for any back problem) | 24 | 1.3 (0.8, 1.9) | 0.2 (0.1, 0.3) | 87 | 4.9 (3.8, 6.0) | 0.8 (0.6, 1.0) |

³¹ Calculated post hoc from data in table (combined tests rates assume problems are managed with an order for either lumbosacral or lumbar imaging but not both).

Source: Britt et al (2014), Table 5.4

Abbreviations: CI, confidence interval; CT, computed tomography; MRI, magnetic resonance imaging

Note: bold indicates statistically significant difference between study periods.

3.2.7. Low back imaging requests for back syndrome

Temporal trends for back syndrome

Medicare imaging group data for back syndrome management is shown in Table 3.2-7. During 2002-05, low back X-ray and low back CT were requested for similar proportions of back syndrome problems (5.0 and 4.9 per 100 back syndrome problems, respectively) but, as observed for any back problem, by 2009-12 the management of back syndrome involved less frequent requesting of low back X-rays (3.8 per 100 cases) and a higher requesting rate for low back CT scans (5.9 per 100 cases).

From 2002-05 to 2009-12, statistically significant changes occurred in the request rates for lumbosacral X-ray (3.2% to 2.1%) and lumbar CT (2.5% to 3.8%), and CT became more frequently requested than X-ray for low back syndromes (the request rates for lumbar X-ray and lumbosacral CT scans remained constant between these time periods).

As observed for any back problem, the test rate of MRI for back syndrome at any region also increased substantially, from 0.2 to 0.9 requests per 100 back syndrome problems.

Table 3.2-7 Imaging requests by MBS imaging group and test descriptor for back syndrome

| Imaging | Type of test requested for back syndrome | No. of tests, 2002-05 | % of all imaging tests for back syndrome (95% CI), 2002-05 | Test rate per 100 back syndrome problems (95% CI) 2002-05 | No. of tests, 2009-12 | % of all imaging tests for back syndrome (95% CI), 2009-12 | Test rate per 100 back syndrome problems (95% CI), 2009-12 |
|----------------------|---|-----------------------|--|---|-----------------------|--|--|
| Diagnostic radiology | X-ray; spine; lumbosacral | 181 | 20.3 (17.5, 23.1) | 3.2 (2.7, 3.7) | 111 | 12.4 (10.1, 14.7) | 2.1 (1.7, 2.5) |
| | X-ray; spine; lumbar | 103 | 11.5 (9.2, 13.8) | 1.8 (1.4, 2.2) | 89 | 9.9 (7.9, 12.0) | 1.7 (1.3, 2.1) |
| | Total for above descriptors ³² | 284 | 31.8 | 5.0 | 200 | 22.3 | 3.8 |

³² Calculated post hoc from data in table (combined tests rates assume problems are managed with an order for either lumbosacral or lumbar imaging but not both).

| Imaging | Type of test requested for back syndrome | No. of tests, 2002-05 | % of all imaging tests for back syndrome (95% CI), 2002-05 | Test rate per 100 back syndrome problems (95% CI) 2002-05 | No. of tests, 2009-12 | % of all imaging tests for back syndrome (95% CI), 2009-12 | Test rate per 100 back syndrome problems (95% CI), 2009-12 |
|---------------------|---|-----------------------|--|---|-----------------------|--|--|
| Computed tomography | CT scan; spine; lumbar | 142 | 15.9 (13.4, 18.4) | 2.5 (2.1, 2.9) | 199 | 22.2 (19.3, 25.2) | 3.8 (3.2, 4.3) |
| | CT scan; spine; lumbosacral | 138 | 15.5 (12.9–18.0) | 2.4 (2.0–2.8) | 109 | 12.2 (9.8–14.5) | 2.1 (1.6–2.5) |
| | <i>Total for above descriptors³²</i> | <i>280</i> | <i>31.4</i> | <i>4.9</i> | <i>308</i> | <i>34.4</i> | <i>5.9</i> |
| MRI | MRI (for back syndrome at any region) | 10 | 1.1 (0.4, 1.8) | 0.2 (0.1, 0.3) | 48 | 5.4 (3.8, 6.9) | 0.9 (0.6, 1.2) |

Source: Britt et al (2014) Table 5.7

Abbreviations: CI, confidence interval; CT, computed tomography; MRI, magnetic resonance imaging

Note: bold indicates statistically significant difference between study periods

Temporal trends for new back syndrome

Table 3.2-8 shows the test rate data for new presentations of back syndrome. In 2009-12, almost 20% of new back syndrome problems were managed with either low back X-ray (9.2%) or low back CT (9.5%), representing a slight decrease and increase, respectively, from 2002-05. This is consistent with that described for back syndrome of any status.

Lumbosacral X-ray showed a statistically significant decrease while the lumbar CT scan test rate increased from 3.8% to 6.1% (not statistically significant). These changes switched the most frequently requested test from lumbosacral X-ray in 2002-05 to lumbar CT in 2009-12. The request rates for the other test descriptors, lumbar X-ray and lumbosacral CT scans, remained constant between these time periods.

The MRI test rate for any new back syndrome increased from 0.0% to 1.1% of new back problems, although the number is small (the former represents a single request while the latter is 14 requests).

Table 3.2-8 Imaging requests by MBS imaging group and test descriptor for new back syndrome

| Imaging | Type of test requested for new back syndrome | No. of tests, 2002-05 | % of all imaging tests for new back syndromes (95% CI), 2002-05 | Test rate per 100 new back syndromes (95% CI), 2002-05 | No. of tests, 2009-12 | % of all imaging tests for new back syndrome (95% CI), 2009-12 | Test rate per 100 new back syndromes (95% CI), 2009-12 |
|----------------------|---|-----------------------|---|--|-----------------------|--|--|
| Diagnostic radiology | X-ray; spine; lumbosacral | 111 | 23.7 (19.6, 27.8) | 7.2 (5.7, 8.6) | 60 | 13.8 (10.4, 17.2) | 4.6 (3.3, 5.8) |
| | X-ray; spine; lumbar | 51 | 10.9 (7.9, 13.8) | 3.3 (2.3, 4.2) | 61 | 14.0 (10.5, 17.5) | 4.6 (3.4, 5.9) |
| | <i>Total for above descriptors³³</i> | <i>162</i> | <i>34.6</i> | <i>10.5</i> | <i>121</i> | <i>27.8</i> | <i>9.2</i> |
| Computed tomography | CT scan; spine; lumbar | 59 | 12.6 (9.5, 15.7) | 3.8 (2.8, 4.8) | 80 | 18.3 (14.5, 22.2) | 6.1 (4.7, 7.4) |
| | CT scan; spine; lumbosacral | 76 | 16.2 (12.7, 19.7) | 4.9 (3.8, 6.0) | 45 | 10.3 (7.3, 13.3) | 3.4 (2.4, 4.4) |
| | <i>Total for above descriptors³³</i> | <i>135</i> | <i>28.8</i> | <i>8.7</i> | <i>125</i> | <i>28.6</i> | <i>9.5</i> |
| MRI | MRI (for new back syndrome at any region) | 1 | 0.2 (CI not determined) | 0.0 (CI not determined) | 14 | 3.2 (1.5, 4.9) | 1.1 (0.5, 1.6) |

Source: Britt et al (2014) Table 5.10

Abbreviations: CI, confidence interval; CT, computed tomography; MRI, magnetic resonance imaging

Note: bold indicates statistically significant difference between study periods

Impact of new presentations imaging for back syndrome

The data for new back syndrome is a subset of all back syndrome, so the confidence intervals reported for the entire group and its subset cannot be compared to assess the statistical significance of any differences between them. However, trends in the data can provide insight into the impact on management decisions of a presentation being new.

A comparison of Table 3.2-7 and Table 3.2-8 shows that for the four low back test descriptors for diagnostic radiology and CT, imaging requests were more frequent for new presentations than for all presentations during both study periods. Lumbosacral X-rays were requested for 7.2% of new presentations and 3.2% of all presentations in 2002-05 (4.6% versus 2.1% respectively in 2009-12). This impact is generally more pronounced for diagnostic radiology than CT.

³³ Calculated post hoc from data in table (combined tests rates assume problems are managed with an order for either lumbosacral or lumbar imaging but not both).

The MRI test rate for new back syndrome at any region is similar to that for back syndrome of any status at any region (1.1% versus 0.9% respectively in 2009-12).

3.2.8. Low back imaging requests for back symptom/complaint

Temporal trends for back symptoms/complaints

Table 3.2-9 shows the Medicare imaging group data for patients with back symptoms/ complaints. Back symptoms/complaints were more than twice as likely to result in low back X-ray imaging than low back CT imaging in 2002-05 (5.7 versus 2.4 per 100 back symptoms/complaints, respectively). This difference diminished in 2009-12, as the frequency of low back X-rays requests decreased (5.0 per 100 back symptoms/complaints) and low back CT scans were requested more frequently (3.5 per 100 back symptoms/complaints). However, the switch in most frequently requested imaging type from X-ray to CT scan observed for both any back problem and back syndrome did not occur for back symptoms/complaints. These moderate changes from 2002-05 to 2009-12 were driven by statistically significant changes in the request rates of both lumbosacral X-ray (3.8 to 2.5 tests per 100 back symptoms/complaints) and lumbar CT scan (1.2 to 2.2 tests per 100 back symptoms/complaints).

The rate of requesting MRI for back symptoms/complaints at any region more than doubled from 2002-05 to 2009-12.

Table 3.2-9 Imaging requests by MBS imaging group and test descriptor for back symptoms/complaints

| Imaging | Type of test requested for back symptoms/complaints | No. of tests, 2002-05 | % of all imaging tests for back symptoms/complaints (95% CI), 2002-05 | Test rate per 100 back symptoms/complaints (95% CI), 2002-05 | No. of tests, 2009-12 | % of all imaging tests for any back symptoms/complaints (95% CI), 2009-12 | Test rate per 100 back symptoms/complaints (95% CI), 2009-12 |
|----------------------|---|-----------------------|---|--|-----------------------|---|--|
| Diagnostic radiology | X-ray; spine; lumbosacral | 206 | 22.7 (20.0, 25.5) | 3.8 (3.2, 4.3) | 135 | 15.3 (12.8, 17.8) | 2.5 (2.1, 3.0) |
| | X-ray; spine; lumbar | 103 | 11.4 (9.2, 13.5) | 1.9 (1.5, 2.3) | 133 | 15.1 (12.6, 17.6) | 2.5 (2.0, 3.0) |
| | Total for above descriptors ³⁴ | 309 | 34.1 | 5.7 | 268 | 30.4 | 5.0 |

³⁴ Calculated post hoc from data in table (combined tests rates assume problems are managed with an order for either lumbosacral or lumbar imaging but not both).

| Imaging | Type of test requested for back symptoms/complaints | No. of tests, 2002-05 | % of all imaging tests for back symptoms/complaints (95% CI), 2002-05 | Test rate per 100 back symptoms/complaints (95% CI), 2002-05 | No. of tests, 2009-12 | % of all imaging tests for any back symptoms/complaints (95% CI), 2009-12 | Test rate per 100 back symptoms/complaints (95% CI), 2009-12 |
|---------------------|---|-----------------------|---|--|-----------------------|---|--|
| Computed tomography | CT scan; spine; lumbar | 67 | 7.4 (5.6, 9.1) | 1.2 (0.9, 1.5) | 116 | 13.2 (10.8, 15.5) | 2.2 (1.8, 2.6) |
| | CT scan; spine; lumbosacral | 65 | 7.2 (5.5, 8.8) | 1.2 (0.9, 1.5) | 70 | 7.9 (6.0, 9.8) | 1.3 (1.0, 1.7) |
| | <i>Total for above descriptors³⁴</i> | 132 | 14.6 | 2.4 | 186 | 21.1 | 3.5 |
| MRI | MRI (for back symptom/ complaints at any region) | 14 | 1.5 (0.7, 2.4) | 0.3 (0.1, 0.4) | 39 | 4.4 (3.0, 5.9) | 0.7 (0.5, 1.0) |

Source: Britt et al (2014) Table 5.13

Abbreviations: CI, confidence interval; CT, computed tomography; MRI, magnetic resonance imaging

Note: bold indicates statistically significant difference between study periods

Temporal trends for new back symptoms/complaints

Where back symptoms/complaints are new presentations, the difference in request rates for low back X-rays and low back CT scans is more pronounced, with low back X-rays over four times more frequent than low back CT scans in 2002-05 (12.3 versus 3.0 tests per 100 new back symptoms/complaints, respectively; Table 3.2-10). The same temporal trends were observed, with low back X-ray request rates decreasing (to 9.3 per 100 new back symptoms/complaints) and low back CT request rates increasing (to 5.2 per 100 new back symptoms/complaints). Despite these shifts, low back X-rays remained the most frequently requested imaging test for new back symptoms/complaints. Again, statistically significant changes were observed in lumbosacral X-ray and lumbar CT scan request rates.

MRI for new back symptoms/complaints at any region also increased from 2002-05 to 2009-12, although the numbers in both study periods were very low.

Table 3.2-10 Imaging requests by MBS imaging group/test descriptor for new back symptoms/complaints

| Imaging | Type of test requested for new back symptoms/complaints | No. of tests, 2002-05 | % of all imaging tests for new back symptoms/complaints (95% CI), 2002-05 | Test rate per 100 new back symptoms/complaints (95% CI), 2002-05 | No. of tests, 2009-12 | % of all imaging tests for new back symptoms/complaints (95% CI), 2009-12 | Test rate per 100 new back symptoms/complaints (95% CI), 2009-12 |
|------------------------------|---|-----------------------|---|--|-----------------------|---|--|
| Diagnostic radiology (X-ray) | X-ray; spine; lumbosacral | 112 | 25.0 (21.0, 29.0) | 7.9 (6.4, 9.4) | 112* | 25.0* (10.1, 17.6) | 4.1 (2.9, 5.3) |
| | X-ray; spine; lumbar | 63 | 14.1 (10.8, 17.4) | 4.4 (3.3, 5.6) | 69 | 17.7 (13.8, 21.5) | 5.2 (4.0, 6.5) |
| | Total for above descriptors ³⁵ | 175 | 39.1 | 12.3 | – (*) | – (*) | 9.3 |
| Computed tomography | CT scan; spine; lumbar | 18 | 4.0 (2.2, 5.8) | 1.3 (0.7, 1.9) | 42 | 10.8 (7.5, 14) | 3.2 (2.2, 4.2) |
| | CT scan; spine; lumbosacral | 24 | 5.4 (3.3, 7.4) | 1.7 (1.0, 2.4) | 27 | 6.9 (4.4, 9.4) | 2.0 (1.3, 2.8) |
| | Total for above descriptors ³⁵ | 42 | 9.4 | 3.0 | 69 | 17.7 | 5.2 |
| MRI | MRI (for back symptom/ complaints at any region) | 1 | 0.2 (CI not determined) | 0.1 (CI not determined) | 5 | 1.3 (0.2, 2.4) | 0.4 (0.0, 0.7) |

Source: Britt et al (2014) Table 5.16

Abbreviations: CI, confidence interval; CT, computed tomography; MRI, magnetic resonance imaging

Note: bold indicates statistically significant difference between study periods

* These figures are likely to be in error, as they are the same as for Period 1 yet the % of tests point estimate of 25.0 does not fall within the confidence interval, and these data are inconsistent with the differences in test rates, which are reported as being statistically different.

Impact of new presentation on imaging for back symptoms/complaints

A comparison of the requesting rate for back symptoms/complaints (Table 3.2-9) and the subgroup of new back symptoms/complaints (Table 3.2-10) shows similar trends to that for back syndrome versus new back syndrome. During 2002-05, 7.9 per 100 new back symptoms/ complaints led to a lumbosacral X-ray request while only 3.8 per 100 back symptoms/ complaints overall received this request (4.1 versus 2.5 per 100 respectively in 2009-12). In both study periods, new presentations also resulted in more lumbar X-ray requests and CT requests of both types although, as seen with back syndrome, this impact is generally more pronounced for diagnostic radiology than CT.

³⁵ Calculated post hoc from data in table (combined tests rates assume problems are managed with an order for either lumbosacral or lumbar imaging but not both).

The MRI test rate for new back symptoms/complaints at any region is slightly lower than that for all back symptoms/complaints at any region (0.4% versus 0.7% respectively in 2009-12). The new presentations group in 2002-05 is too small for meaningful assessment of the rate.

3.2.9. Correlation between imaging type changes and clinical practice guidelines

The reduction in diagnostic radiology imaging rates observed from 2002-05 to 2009-12 occurred after publication of an NHMRC-approved evidence review of the management of musculoskeletal pain, including acute LBP, produced by the Australian Acute Musculoskeletal Patient Guideline Group (AAMP GG 2004; now rescinded). The publication signalled a change in practice, recommending that plain X-rays of the lumbar spine are not routinely requested in patients with acute non-specific LBP as – with the exception of suspected fracture – X-rays are of limited diagnostic value.

MRI was recommended by the AAMP GG in cases where alerting features of serious conditions are present, such as cancer, infection and other specific and rare conditions. Although the BEACH data for MRI are not specific to imaging of the low back region, it is possible that the increase in spinal MRI use over the period from 2002-05 to 2009-12 may also be a result of AAMP GG guidance. The substantial increase in CT imaging requests over the same period may have occurred in lieu of MRI, as CT may be perceived to have similar diagnostic accuracy to MRI while being more accessible and less costly (reimbursed without referral to a specialist and more widely available).

4. REVIEW OF GUIDELINES RELEVANT TO IMAGING FOR LOW BACK PAIN

This section presents the results of the literature search for CPGs and the guideline concordance analysis conducted for imaging for LBP.

4.1. Australian guidelines

Five Australian CPGs/clinical algorithms relating to imaging for LBP were identified by the literature search. A summary of these is presented in Table 0-24. Clinical guidance has also been published by the Australian Acute Musculoskeletal Pain Guideline Group (AAMPGG 2003; 2004) and endorsed by the NHMRC; however, this guidance has been rescinded and is therefore not included below.

Table 0-24 Summary of Australian CPGs/clinical algorithms

| ID | Title | Method | Affiliation |
|-------------------|--|---|---|
| Goergen 2014 | Educational modules for appropriate imaging referrals: acute low back pain | Based on existing CPGs and evidence | Royal Australian and New Zealand College of Radiologists (RANZCR) |
| WA Health 2013 | Diagnostic imaging pathways – low back pain | Not stated | Government of Western Australia, Department of Health (WA Health) |
| NPS 2012 | What is appropriate medical imaging for low back pain? | Based on existing CPGs | National Prescribing Service (NPS) MedicineWise |
| SA Health 2011 | Lumbar disorders: diagnostic imaging in low back pain | Based on existing CPGs | Government of South Australia, Department for Health and Ageing (SA Health) |
| WorkCover SA 2010 | Managing acute-subacute low back pain: clinical practice guideline | Evidence-based: SR of existing CPGs and updated literature search | WorkCover Corporation of South Australia (WorkCover SA) |

Abbreviations: CPG, clinical practice guideline; SR, systematic review.

RANZCR 2014

A summary of the suggestions for diagnostic imaging in patients with acute LBP is presented in Table 0-25. This table is adapted from the American College of Physicians (ACP) guideline (Chou et al, 2011). CT is not mentioned in the summary of suggestions for diagnostic imaging. However, the RANZCR Educational Module (2014) states that CT is the test of choice for acute post traumatic LBP when fracture is the main or sole question (moderate to severe mechanism of injury in the young, more mild trauma in the elderly). A listed weakness of CT is that it does not demonstrate spinal cord, nerve roots, epidural space, or contents of thecal sac due to soft tissue contrast resolution that is inferior to MRI. Furthermore, although CT enables diagnosis of sacroiliitis, discitis and osteomyelitis earlier than plain radiographs, diagnosis cannot be made as early as MRI. MRI is listed as the

modality of choice for: suspected bone marrow pathology; cauda equina syndrome/spinal cord compression; epidural abscess; paraspinal masses/infective processes; suspected disc herniation, nerve root, thecal sac, spinal cord pathology.

Table 0-25 Summary of suggestions for diagnostic imaging in patients with acute LBP – RANZCR 2014

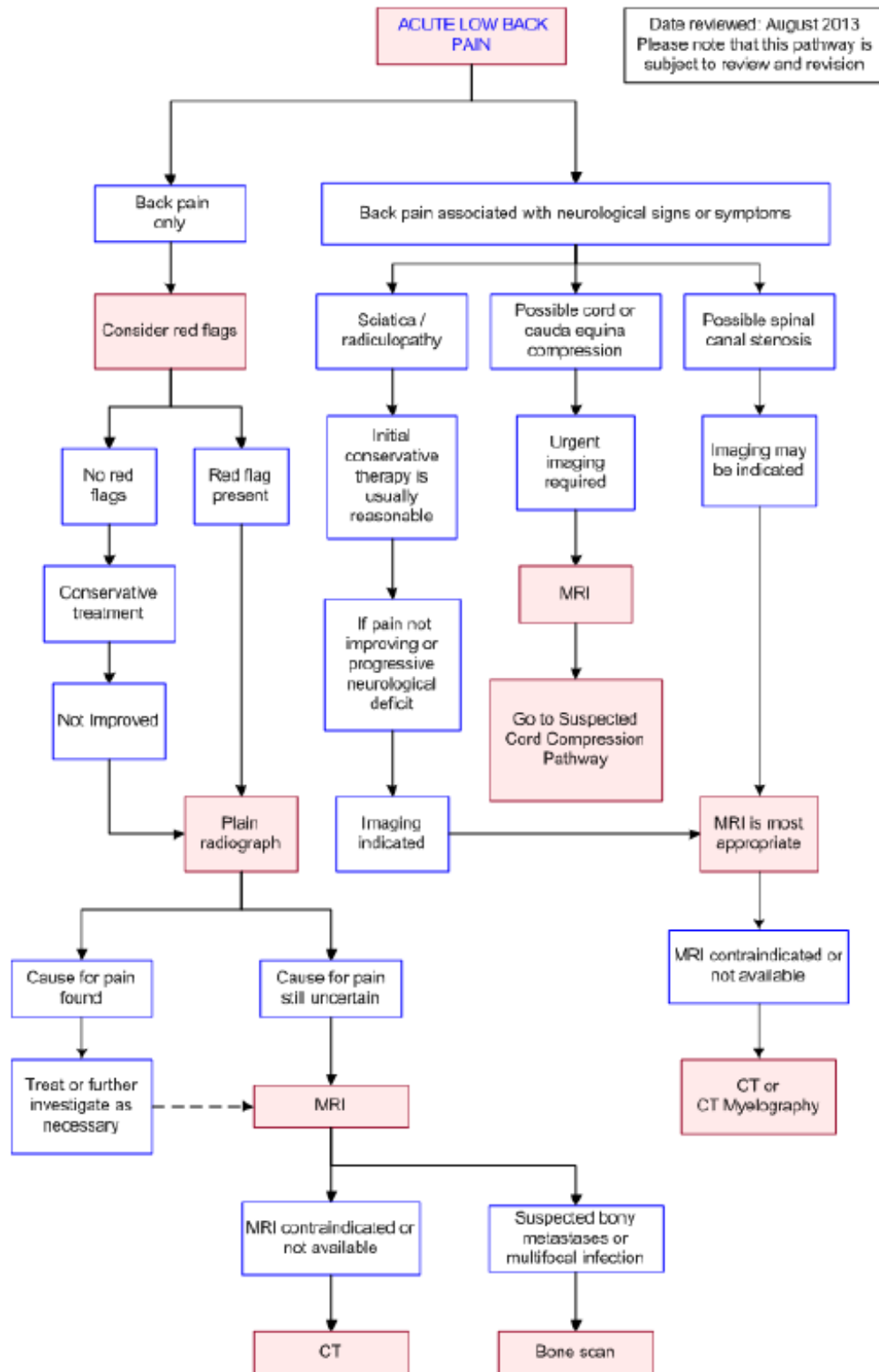
| Clinical situation | Imaging action | Indications for initial imaging |
|--|----------------------|--|
| Immediate imaging | Radiography plus ESR | <ul style="list-style-type: none"> Major risk factors for cancer (new onset of LBP with history of cancer, multiple risk factors for cancer, strong clinical suspicion of cancer) Consider MRI if initial imaging result is negative but a high degree of clinical suspicion for cancer remains |
| | MRI | <ul style="list-style-type: none"> Risk factors for spinal infection (new onset of low back pain with fever and history of intravenous drug use or recent infection) Risk factors for or signs of cauda equine syndrome (new urine retention, faecal incontinence or saddle anaesthesia) Severe neurological deficits (progressive motor weakness or motor deficits at multiple neurological levels) |
| Defer imaging after a trial of therapy | Radiography ± ESR | <ul style="list-style-type: none"> Weaker risk factors for cancer (unexplained weight loss or age >50 years) Risk factors for or signs of ankylosing spondylitis (morning stiffness that improves with exercise, alternating buttock pain, awakening because of back pain during the second part of the night, or younger age [20 to 40 years]) Risk factors for vertebral compression fracture (history of osteoporosis, use of corticosteroids, significant trauma, or older age [>65 years for men or >75 years for women]) |
| | MRI | <ul style="list-style-type: none"> Signs and symptoms of radiculopathy (back pain with leg pain in an L4, L5 or S1 nerve root distribution or positive result on straight leg raise or crossed straight leg raise test) in patients who are candidates for surgery or epidural steroid injection Risk factors for or symptoms of spinal stenosis (radiating leg pain, older age, or pseudoclaudication) in patients who are candidates for surgery |
| No imaging | No action | <ul style="list-style-type: none"> No criteria for immediate imaging and back pain improves or resolved after a 1-month trial of therapy Previous spinal imaging with no change in clinical status |

Abbreviations: ESR, erythrocyte sedimentation rate; LBP, low back pain; MRI, magnetic resonance imaging; RANZCR, Royal Australian and New Zealand College of Radiologists.

WA Health 2013

A diagnostic imaging pathway was published by the Department of Health, Western Australia (WA Health) in 2013. As shown in Figure 0-32, in patients with LBP associated with neurological signs and symptoms, MRI and CT are recommended in certain circumstances: (i) for suspected cord or cauda equina compression, urgent imaging with MRI is recommended; and (ii) for sciatica or radiculopathy which does not respond to initial conservative therapy, or for possible spinal canal stenosis, MRI is also recommended, with CT and CT myelography recommended if MRI is contraindicated or not available. Plain radiograph, followed by MRI is recommended for patients with LBP without associated neurological signs or symptoms who have 'red flags' present.

Figure 0-32 Diagnostic pathway for LBP – WA Health 2013



Source: [Western Australia Department of Health Diagnostic Imaging Pathways webpage for low back pain](#)

Abbreviations: CT, computed tomography; LBP, low back pain; MRI, magnetic resonance imaging; WA, Western Australia.

NPS 2012

A Back Pain Choices Tool was developed by the National Prescribing Service (NPS) MedicineWise and the George Institute and is based on recommendations in existing CPGs from the NHMRC (2003), the United Kingdom's National Institute for Health and Clinical Excellence (NICE, 2009) and the ACP/APS (Chou et al, 2007). The Back Pain Choices guidance is the same as that shown above in Table 0-25, adapted from the ACP/APS joint guideline (Chou et al, 2007).

SA Health

The clinical recommendations from the Department for Health and Ageing, South Australia (SA Health) are based on information from the RANZCR and the Health Protection Agency (HPA; UK). A summary of the recommendations is presented in Table 0-26.

Table 0-26 Summary of clinical recommendations – SA Health

| Recommendation |
|--|
| No imaging <ul style="list-style-type: none"> In the absence of red flags in non-specific LBP of less than 12 weeks duration. |
| Perform imaging <ul style="list-style-type: none"> If serious underlying conditions are suspected by the presence of clinical red flags or by other test results If neurologic deficits are severe or progressive If radicular symptoms consistent with a disc herniation have been present for more than 4-6 weeks and are severe enough to consider surgical intervention If the history and clinical signs suggest spinal/neurogenic claudication and symptoms are of sufficient duration (often several months) and severity to consider surgical intervention. |
| Imaging modality <ul style="list-style-type: none"> MRI is widely considered to be the best test for most patients with lumbar disorders who require advanced imaging, although CT scan gives better definition of bony structures. Consideration needs to be given to costs, risks and contraindications. |

Abbreviations: CT, computed tomography; LBP, low back pain; MRI, magnetic resonance imaging; SA, South Australia.

WorkCover SA

The WorkCover SA guideline is based on a systematic review of existing CPGs as well as an updated search of published individual studies. With regards to diagnostic imaging, the guideline notes that:

- Workers with non-traumatic acute LBP and sciatica, or with uncomplicated, non-specific subacute LBP do not initially require diagnostic imaging.
- Diagnostic imaging may assist in determining the diagnosis in the investigation of workers with LBP after lumbar blunt trauma or acute injuries (falls, motor vehicle/motorcycle, pedestrian or cyclist accidents etc.).
- If there is an absence of expected improvement or worsening of the condition of the worker at reassessment, diagnostic imaging could be considered to exclude serious conditions, although additional radiological views are not routinely indicated.

Specific recommendations around imaging, and the associated grades, are presented in Table 0-27.

Table 0-27 Summary of clinical recommendations – WorkCover SA

| Recommendation | Grade |
|--|-------------------------------------|
| Clinical assessment and investigation | Not applicable |
| Workers presenting with acute uncomplicated low back pain (< 4 weeks duration) do not initially require X-rays or specific investigations. | B ³⁶ , CIG ³⁷ |
| Workers presenting with a non-traumatic acute low back pain (< 4 weeks duration) and sciatica, or with uncomplicated subacute low back pain (4-12 weeks duration) and no previous treatment trial, do not initially require X-rays. | B ³⁶ , CIG ³⁷ |
| At reassessment, if there is an absence of expected improvement or worsening of the condition of the worker, an X-ray could be considered to exclude serious conditions, although additional radiological views are not routinely indicated. | B ³⁶ |
| In the investigation of patients with low back pain after lumbar blunt trauma or acute injuries (falls, motor-vehicle accidents, motorcycle, pedestrian, cyclists, etc.) X-rays may assist in determining the diagnosis. | B ³⁶ , CIG ³⁷ |
| Common radiological findings in patients with low back pain (e.g. osteoarthritis, lumbar spondylosis, spinal canal stenosis) also occur in asymptomatic people; hence, such conditions may not be the cause of the pain. | B ³⁶ |

Abbreviations: CIG, Canadian Imaging Guidelines.

4.2. International guidelines

A summary of the non-Australian guidelines identified during the literature search is presented in Table 0-28. While the majority of guidelines relate to LBP generally, a number related to specific types of LBP including degenerative lumbar spondylolisthesis (NASS, 2014), lumbar disc herniation and radiculopathy (NASS, 2012), degenerative lumbar spinal stenosis (NASS, 2011), and ankylosing spondylitis (Sidiropoulos et al, 2008).

The recommendations/guidance given in the guidelines are generally consistent, with imaging not recommended for non-specific LBP, and certain imaging modalities recommended in specific situations where serious underlying pathology is suspected. MRI is the most commonly recommended modality, except for suspected vertebral fracture or bone-related pathology, where X-ray is recommended. CT is usually recommended where MRI is contraindicated. This is consistent with the advice provided in the Australian guidelines summarised in Section 4.1.

The general preference in CPGs for the use of MRI over CT is not clearly referenced to the clinical evidence, but is sometimes attributed to MRI having no ionising radiation and providing better visualisation than CT (e.g. of soft tissue, vertebral marrow, and the spinal canal). Assessment of the relative harms of the various imaging modalities was out of scope for the evidence review presented in Section 5 of this report. The CPG from the ACP (Chou et al, 2011) states that CT contributes to cumulative low-level radiation exposure, which could promote carcinogenesis. The CPG refers to a

³⁶ Body of evidence can be trusted to guide practice in most situations.

³⁷ Canadian Imaging Guidelines (updated version CAR 2012).

study that projected 1,200 additional future cases of cancer on the basis of the 2.2 million lumbar CT scans performed in the United States in 2007 (Berrington de Gonzalez et al, 2009). Another study (Smith-Bindman et al, 2008) estimated one additional case of cancer for every 270 women aged 40 years (approximately doubled risk for a woman aged 20 years) who had coronary angiography, a procedure associated with a radiation dose similar to that of lumbar spine CT (Fazel et al, 2009). The CPG also notes that lumbar CT involves the use of iodinated contrast, which is associated with hypersensitivity reactions and nephropathy.

Table 0-28 Summary of international CPGs/clinical algorithms

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|------------|---|---|--|--|
| AIMSH 2015 | Clinical Appropriateness Guidelines: Advanced Imaging, Appropriate Use Criteria: Imaging of the Spine | Based on existing CPGs and evidence | AIM Specialty Health (AIMSH) | Unless contraindicated, MRI is the preferred modality for most lumbar spine advanced imaging, except for a few indications which include CT evaluation of bony abnormalities (such as suspected fracture or fracture follow-up; skeletal abnormalities including spondylolisthesis in operative candidates; osseous tumor assessment; and developmental vertebral abnormalities) as well as CT myelography. |
| MQIC 2014 | Management of acute low back pain | Evidence-based: SR of clinical evidence | Michigan Quality Improvement Consortium (MQIC) | <p>Patients with high risk of serious pathology (red flags and high index of suspicion)</p> <p><i>Cauda equina syndrome or severe or progressive neurological deficit</i> Refer for emergency studies and definitive care [C³⁸].</p> <p><i>Spinal fracture or compressions</i> Plain lumbosacral spine X-ray [B³⁹]. After 10 days, if fracture still suspected or multiple sites of pain, consider either bone scan [C³⁸] or referral [D⁴⁰] before considering CT or MRI.</p> <p><i>Cancer or infection</i> CBC, UA, ESR [C³⁸]. If still suspicious, consider referral or seek further evidence (e.g. bone scan [C³⁸], other labs – negative plain film X-ray does not rule out disease).</p> |
| NASS 2014 | Evidence-based clinical guidelines for multidisciplinary spine care: diagnosis and treatment of | Evidence-based: SR of clinical evidence | North American Spine Association (NASS) | <p>The lateral radiograph is the most appropriate, non-invasive test for detecting degenerative lumbar spondylolisthesis [B⁴¹; suggested].</p> <p>The most appropriate, non-invasive test for imaging the stenosis accompanying degenerative lumbar spondylolisthesis is MRI [WGCS⁴²].</p> <p>Plain myelography or CT myelography are useful studies to assess spinal stenosis in patients with degenerative lumbar spondylolisthesis especially those who have contraindications to MRI [B⁴¹, suggested].</p> |

³⁸ C = Observational studies.³⁹ B = Controlled trials, no randomisation.⁴⁰ D = Opinion of expert panel.⁴¹ B = Fair evidence (Level II or III studies with consistent findings) for or against recommending intervention.⁴² Work Group Consensus Statement.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|----------|---|--|--|--|
| | degenerative lumbar spondylolisthesis | | | <p>In patients with degenerative lumbar spondylolisthesis with associated spinal stenosis for whom MRI is either contraindicated or inconclusive, CT myelography is suggested as the most appropriate test to confirm the presence of anatomic narrowing of the spinal canal or the presence of nerve root impingement [WGCS⁴²].</p> <p>In patients with degenerative lumbar spondylolisthesis with associated spinal stenosis for whom MRI and CT myelography are contraindicated, CT is suggested as the most appropriate test to confirm the presence of anatomic narrowing of the spinal canal or the presence of nerve root impingement [WGCS⁴²].</p> |
| CAR 2012 | 2012 CAR Diagnostic Imaging Referral Guidelines | Evidence-informed; based on expert opinion or case studies | Canadian Association of Radiologists (CAR) | <p>MRI: indicated in special circumstances [B⁴³]</p> <p>If imaging is indicated, MRI is the best modality. Imaging is only indicated if there are 'red flag' indications:</p> <ul style="list-style-type: none"> • Suspected cancer • Suspected infection • Cauda equina syndrome • Severe/progressive neurologic deficit • Suspected compression fracture <p>If there is clinical concern about an epidural abscess or hematoma which may present with acute pain but no neurological symptoms, urgent imaging is required.</p> <p>In patients with suspected uncomplicated herniated disc or spinal stenosis, imaging is only indicated after an unsuccessful 4-6 week trial of conservative management.</p> <p>CT: indicated in special circumstances [B]</p> <p>As above.</p> <p>CT is only indicated if MRI is contraindicated or unavailable. CT can provide excellent imaging. In very large patients, image noise can be a problem. The radiation dose is also a consideration.</p> <p>X-ray: indicated only in specific circumstances [B]</p> <p>X-ray may be used if a compression fracture or a metastasis is suspected. However, it does not distinguish between an acute and an old fracture and it is not as sensitive as MRI for metastases.</p> |

⁴³ B = Any of the following: (i) studies with a blind and independent comparison of the new test and reference standard in a set of non-consecutive patients or confined to a narrow spectrum of subjects; (ii) studies in which the reference standard was not performed on all subjects; (iii) systematic reviews of such studies; (iv) diagnostic clinical practice guidelines/clinical decision rules not validated in a test set.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|-----------------|---|---|---|--|
| ICSI 2012 | Health care guideline: adult acute and subacute low back pain | Evidence-based: SR of clinical evidence | ICSI, Institute for Clinical Systems Improvement (ICSI) | <p>Clinicians should not recommend imaging (including CT, MRI and X-ray) for patients with non-specific back pain (moderate-quality evidence⁴⁴) [Strong⁴⁵].</p> <p>Imaging may be considered for low back pain when fracture is suspected (moderate-quality evidence⁴⁴) [Strong⁴⁵].</p> <p>Clinicians should not recommend imaging (including CT, MRI and X-ray) for patients in the first six weeks of radicular pain (moderate-quality evidence⁴⁴) [Strong⁴⁵].</p> <p>Imaging should be done to rule out underlying pathology or for those who are considering surgery, including epidural steroid injections (moderate-quality evidence⁴⁴) [Strong⁴⁵].</p> |
| NASS 2012 | Clinical guidelines for diagnosis and treatment of lumbar disc herniation and radiculopathy | Evidence-based: SR of clinical evidence | North American Spine Association (NASS) | <p>There is a relative paucity of high quality studies on advanced imaging in patients with lumbar disc herniation. It is the opinion of the work group that in patients with history and physical examination findings consistent with lumbar disc herniation with radiculopathy, MRI be considered as the most appropriate, non-invasive test to confirm the presence of lumbar disc herniation. In patients for whom MRI is either contraindicated or inconclusive, CT or CT myelography are the next most appropriate tests to confirm the presence of lumbar disc herniation [WGCS⁴²].</p> <p>In patients with history and physical examination findings consistent with lumbar disc herniation with radiculopathy, MRI is recommended as an appropriate, non-invasive test to confirm the presence of lumbar disc herniation [A⁴⁶].</p> <p>In patients with history and physical examination findings consistent with lumbar disc herniation with radiculopathy, CT scan, myelography and/or CT myelography are recommended as appropriate tests to confirm the presence of lumbar disc herniation [A⁴⁶].</p> |
| Livingston 2012 | Advanced imaging for low back pain | Based on Chou 2007 | Oregon Health Authority (OHA) | <p>Routine imaging for non-specific pain (X-ray, CT, MRI)</p> <p>Clinicians should not routinely obtain imaging in patients with non-specific back pain (moderate-quality evidence) [Strong].</p> |

⁴⁴ Chou et al (2011); French et al (2010); Chou et al (2009);

⁴⁵ The work group recognizes that there is a balance between harms and benefit, based on moderate quality evidence, or that there is uncertainty about the estimates of the harms and benefits of the proposed intervention that may be affected by new evidence. Alternative approaches will likely be better for some patients under some circumstances.

⁴⁶ A = Good evidence (Level 1 studies with consistent findings) for or against recommending intervention.

| | | | | |
|--|--|--|--|---|
| | | | | <p>Imaging for underlying conditions present or suspected (X-ray, CT, MRI)</p> <p>Clinicians should perform diagnostic imaging and testing for patients with low back pain when severe or progressive neurologic deficits are present or when serious underlying conditions [listed below] are suspected on the basis of history and physical examination (moderate-quality evidence) [Strong].</p> <p><i>Cancer</i></p> <ul style="list-style-type: none"> • History of cancer with new onset of LBP – MRI • Unexplained weight loss; failure to improve after 1 month; age > 50 years; symptoms such as painless neurologic deficit, night pain or pain increased in supine position – lumbosacral plain radiography • Multiple risk factors for cancer present – plain radiography or MRI <p><i>Spinal column infection</i></p> <ul style="list-style-type: none"> • Fever; intravenous drug use; recent infection – MRI <p><i>Cauda equina syndrome</i></p> <ul style="list-style-type: none"> • Urinary retention; motor deficits at multiple levels; faecal incontinence; saddle anaesthesia – MRI <p><i>Vertebral compression fracture</i></p> <ul style="list-style-type: none"> • History of osteoporosis; use of corticosteroids; older age – lumbosacral plain radiography <p><i>Ankylosing spondylitis</i></p> <ul style="list-style-type: none"> • Morning stiffness; improvement with exercise; alternating buttock pain; awakening due to back pain during the second part of the night; younger age – anterior-posterior pelvis plain radiography <p><i>Nerve compression/disorders (e.g. herniated disc with radiculopathy)</i></p> <ul style="list-style-type: none"> • Back pain with leg pain in an L4, L5, or S1 nerve root distribution present < 1 month; positive straight leg raise test or crossed straight leg raise test – None • Radiculopathic symptoms present >1 month; severe/progressive neurologic deficits (such as foot drop), progressive motor weakness – MRI (only if patient is a potential candidate for surgery or epidural steroid injection) <p><i>Spinal stenosis</i></p> <ul style="list-style-type: none"> • Radiating leg pain; older age; pain usually relieved with sitting (pseudoclaudication a weak predictor) – None • Spinal stenosis symptoms present > 1 month – MRI (only if patient is a potential candidate for surgery or epidural steroid injection) |
|--|--|--|--|---|

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|-----------|---|--|--------------------------------------|---|
| | | | | Advanced imaging Clinicians should evaluate patients with persistent low back pain and signs or symptoms of radiculopathy or spinal stenosis with MRI (preferred) or CT only if they are potential candidates for surgery or epidural steroid injection (for suspected radiculopathy) (moderate-quality evidence) [Strong]. |
| Chou 2011 | Diagnostic imaging for low back pain: Advice for high-value health care from the American College of Physicians | Based on SR conducted for Chou 2007; recommendations adapted from Chou 2007. | American College of Physicians (ACP) | Immediate imaging <i>Radiography + ESR</i> <ul style="list-style-type: none"> Major risk factors for cancer (new onset of low back pain with history of cancer, multiple risk factors for cancer, or strong clinical suspicion for cancer) <i>MRI</i> <ul style="list-style-type: none"> Risk factors for spinal infection (new onset of low back pain with fever and history of intravenous drug use or recent infection) Risk factors for or signs of the cauda equina syndrome (new urine retention, faecal incontinence, or saddle anaesthesia) Severe neurologic deficits (progressive motor weakness or motor deficits at multiple neurologic levels) Defer imaging after a trial of therapy <i>Radiography ± ESR</i> <ul style="list-style-type: none"> Weaker risk factors for cancer (unexplained weight loss or age >50 y) Risk factors for or signs of ankylosing spondylitis (morning stiffness that improves with exercise, alternating buttock pain, awakening because of back pain during the second part of the night, or younger age [20 to 40 y]) Risk factors for vertebral compression fracture (history of osteoporosis, use of corticosteroids, significant trauma, or older age [>65 y for men or >75 y for women]) <i>MRI</i> <ul style="list-style-type: none"> Signs and symptoms of radiculopathy (back pain with leg pain in an L4, L5, or S1 nerve root distribution or positive result on straight leg raise or crossed straight leg raise test) in patients who are candidates for surgery or epidural steroid injection Risk factors for or symptoms of spinal stenosis (radiating leg pain, older age, or pseudoclaudication) in patients who are candidates for surgery |

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|-------------|---|---|---|---|
| | | | | No imaging <ul style="list-style-type: none"> No criteria for immediate imaging and back pain improved or resolved after a 1-month trial of therapy Previous spinal imaging with no change in clinical status |
| Hegman 2011 | Low back disorders. Occupational medicine practice guidelines. Evaluation and management of common health problems and functional recovery in workers | Evidence-based: SR of clinical evidence | American College of Occupational and Environmental Medicine (ACOEM) | MRI <ul style="list-style-type: none"> MRI for patients with acute LBP during the first 6 weeks if they have demonstrated progressive neurologic deficit, cauda equina syndrome, significant trauma with no improvement in atypical symptoms, a history of neoplasia (cancer), or atypical presentation (e.g., clinical picture suggests multiple nerve root involvement) – Recommended, Insufficient Evidence [I⁵²] MRI is not recommended for acute radicular pain syndromes in the first 6 weeks unless they are severe and not trending towards improvement and both the patient and the surgeon are willing to consider prompt surgical treatment, assuming the MRI confirms ongoing nerve root compression. Repeat MRI without significant clinical deterioration in symptoms and/or signs is also not recommended. – Not Recommended, Evidence [C⁴⁷] MRI is recommended for patients with subacute or chronic radicular pain syndromes lasting at least 4 to 6 weeks in whom the symptoms are not trending towards improvement if both the patient and surgeon are considering prompt surgical treatment, assuming the MRI confirms ongoing nerve root compression. In cases where an epidural glucocorticosteroid injection is being considered for temporary relief of acute or subacute radiculopathy, MRI at 3 to 4 weeks (before the epidural steroid injection) may be reasonable. – Moderately Recommended, Evidence [B⁴⁸] MRI is recommended as an option for the evaluation of select chronic LBP patients in order to rule out concurrent pathology unrelated to injury. This option should not be considered before 3 months and only after other treatment modalities (including NSAIDs, aerobic exercise, other exercise, and considerations for manipulation and acupuncture) have failed. – Recommended, Insufficient Evidence [I⁵²] |

⁴⁷ Recommendation against routinely providing the intervention. The EBPP found at least intermediate evidence that harms and costs exceed benefits based on limited evidence.

⁴⁸ The intervention is recommended for appropriate patients. The intervention improves important health and functional outcomes based on intermediate quality evidence that benefits substantially outweigh harms and costs.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|----------|--|--|----------------------------------|--|
| | | | | <ul style="list-style-type: none"> • Standing or weight-bearing MRI for any back or radicular pain syndrome or condition – Not Recommended, Insufficient Evidence [I⁴⁹] <p>CT</p> <ul style="list-style-type: none"> • Routine CT for acute, subacute, or chronic non-specific LBP, or for radicular pain syndromes – Not Recommended, Insufficient Evidence [I⁴⁹] • CT for patients with acute or subacute radicular pain syndrome that has failed to improve within 4 to 6 weeks and there is consideration for an epidural glucocorticoid injection or surgical discectomy – Recommended, Evidence [C⁵⁰] <p>X-ray</p> <ul style="list-style-type: none"> • Routine X-ray for acute, non-specific LBP – Not Recommended, Evidence [C⁵¹] • X-ray for acute LBP with red flags for fracture or serious systemic illness, subacute LBP that is not improving, or chronic LBP as an option to rule out other possible conditions – Recommended, Insufficient Evidence [I⁵²] • Flexion and extension views for evaluating symptomatic spondylolisthesis in which there is consideration for surgery or other invasive treatment or occasionally in the setting of trauma – Recommended, Insufficient Evidence [I⁵²] |
| TOP 2011 | Guideline for the evidence-informed primary care | Adapted from eight existing guidelines ⁵³ | Toward Optimized Practice (TOP)/ | <p>Diagnostic imaging</p> <p>For acute low back pain (no red flags), diagnostic imaging tests, including X-ray, CT and MRI are not indicated [G1, G4, G8⁵³].</p> |

⁴⁹ The evidence is insufficient for an evidence-based recommendation. The intervention is not recommended for appropriate patients because of high costs or high potential for harm to the patient.

⁵⁰ The intervention is recommended for appropriate patients. There is limited evidence that the intervention may improve important health and functional benefits.

⁵¹ Recommendation against routinely providing the intervention. There is at least intermediate evidence that harms and costs exceed benefits based on limited evidence.

⁵² The intervention is recommended for appropriate patients and has nominal costs and essentially no potential for harm. The EBPP feels that the intervention constitutes best medical practice to acquire or provide information in order to best diagnose and treat a health condition and restore function in an expeditious manner. The EBPP believes based on the body of evidence, first principles, or collective experience that patients are best served by these practices, although the evidence is insufficient for an evidence-based recommendation.

⁵³ G1: Chou et al (2007); G2: ICSI 2006 and ICSI 2008; G3: USPSTF 2004; G4: van Tulder et al (2004); G5: Burton et al (2004); G6: CHR 2005 and 2006; G7: AAMPG 2003; Bussieres et al (2008).

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|-----------|--|---|---|---|
| | management of low back pain | | Institute of Health Economics (IHE) Alberta | <p>In the absence of red flags, routine use of X-rays is not justified due to the risk of high doses of radiation and lack of specificity.</p> <p>Chronic low back pain</p> <p>In chronic low back pain, X-rays of the lumbar spine are very poor indicators of serious pathology. Hence, in the absence of clinical red flags spinal X-rays are not encouraged. More specific and appropriate diagnostic imaging should be performed on the basis of the pathology being sought (e.g. DEXA scan for bone density, bone scan for tumours and inflammatory diseases). However, lumbar spine X-rays may be required for correlation prior to more sophisticated diagnostic imaging, for example prior to an MRI scan. In this case, the views should be limited to standing AP and lateral in order to achieve better assessment of stability and stenosis. Oblique views are not generally recommended. CT scans are best limited to suspected fractures or contraindication to MRI.</p> <p>In the absence of red flags, radiculopathy, or neurogenic claudication, MRI scanning is generally of limited value [EO⁵⁴].</p> <p>Oblique view X-rays are not recommended; they add only minimal information in a small percentage of cases, and more than double the patient's exposure to radiation.</p> |
| NASS 2011 | Diagnosis and treatment of degenerative lumbar spinal stenosis | Evidence-based: SR of clinical evidence | North American Spine Association (NASS) | <p>In patients with history and physical examination findings consistent with degenerative lumbar spinal stenosis, MRI is suggested as the most appropriate, non-invasive test to confirm the presence of anatomic narrowing of the spinal canal or the presence of nerve root impingement [B⁵⁵].</p> <p>In patients with history and physical examination findings consistent with degenerative lumbar spinal stenosis, for whom MRI is either contraindicated or inconclusive, CT myelography is suggested as the most appropriate test to confirm the presence of anatomic narrowing of the spinal canal or the presence of nerve root impingement [B⁵⁵].</p> <p>In patients with history and physical examination findings consistent with degenerative lumbar spinal stenosis for whom MRI and CT myelography are contraindicated, inconclusive or inappropriate, CT is the preferred test to confirm the presence of anatomic narrowing of the spinal canal or the presence of nerve root impingement [B⁵⁵].</p> |

⁵⁴ Expert opinion – Guideline Development Group.

⁵⁵ B = Fair evidence (Level II or III studies with consistent findings) for or against recommending intervention.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|----------|---|-------------------|-------------------------------------|---|
| ACR 2011 | ACR Appropriateness criteria: low back pain | Literature review | American College of Radiology (ACR) | <p>Uncomplicated acute low back pain⁵⁶</p> <ul style="list-style-type: none"> • MRI without contrast [2] • MRI with and without contrast [2] • CT without contrast [2] • CT with contrast [2] • CT with and without contrast [1] • X-ray [2] • X-ray myelography [2] <p>Patient with one or more of the following: low-velocity trauma, osteoporosis, focal and/or progressive deficit, prolonged symptom duration, age >70 years⁵⁶</p> <ul style="list-style-type: none"> • MRI without contrast [8] <i>MRI preferred. CT useful if MRI is contraindicated or unavailable, and/or for problem solving</i> • MRI with and without contrast [3] • CT without contrast [6] • CT with contrast [3] • CT with and without contrast [1] • X-ray [6] • X-ray myelography [1] • X-ray discography [1] <p>Patient with one or more of the following: suspicion of cancer, infection, and/or immunosuppression⁵⁶</p> <ul style="list-style-type: none"> • MRI with and without contrast [8] <i>Contrast useful for neoplasia subjects suspected of epidural or intraspinal disease. MRI may be sufficient if there is low risk of epidural and/or intraspinal disease</i> • MRI without contrast [7] • CT with contrast [6] <i>MRI preferred. CT useful if MRI is contraindicated or unavailable, and/or for problem solving</i> • CT without contrast [6] <i>CT useful if MRI is contraindicated or unavailable, and/or for problem solving</i> • CT with and without contrast [3] |

⁵⁶ Rating scale: 1-3, usually not appropriate; 4-6, may be appropriate; 7-9, usually appropriate.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|----------|--|-----------------------------------|------------------------------|--|
| | | | | <ul style="list-style-type: none"> • X-ray [5] • X-ray myelography [2] <p>Low back pain and/or radiculopathy. Surgery or intervention candidate⁵⁶</p> <ul style="list-style-type: none"> • MRI without contrast [8] • MRI with and without contrast [5] • CT with contrast [5] <i>CT useful if MRI is contraindicated or unavailable, and/or for problem solving</i> • CT without contrast [5] <i>CT useful if MRI is contraindicated or unavailable, and/or for problem solving</i> • CT with and without contrast [3] • X-ray discography and post discography CT [5] • X-ray [4] <i>Usually not sufficient for decision making without MR and/or CT imaging</i> <p>Cauda equina syndrome, multifocal deficits or progressive deficit</p> <ul style="list-style-type: none"> • MRI without contrast [9] <i>Use of contrast depends on clinical circumstances</i> • MRI with and without contrast [8] <i>Use of contrast depends on clinical circumstances</i> • CT with contrast [5] • CT without contrast [5] • CT with and without contrast [3] • X-ray [4] • X-ray myelography [2] |
| UOM 2010 | Acute low back pain: guidelines for clinical care ambulatory | Evidence-based and expert opinion | University of Michigan (UOM) | <p>Initial visit</p> <p>X-rays, MRI, or CT scan are not recommended for routine evaluation of patients with acute low back problems within the first 4-6 weeks of symptoms unless a red flag and high index of suspicion is noted on clinical evaluation.</p> <p>For radicular pain without weakness, by ≥ 3 weeks</p> <p>If no improvement obtain MRI [IIB⁵⁷].</p> |

⁵⁷ II = may be reasonable to perform; B = controlled trials, no randomisation.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|----------------|---|--|--|---|
| NICE 2009 | Low back pain: early management of persistent non-specific low back pain | Evidence-based: SR of clinical evidence | National Institute for Health and Care Excellence (NICE); National Collaborating Centre for Primary Care; (NCCPC)/ Royal College of General Practitioners (RCGP) | Assessment and imaging <ul style="list-style-type: none"> Do not offer X-ray of the lumbar spine for the management of non-specific low back pain Consider MRI when a diagnosis of spinal malignancy, infection, fracture, cauda equina syndrome or ankylosing spondylitis or other inflammatory disorder is suspected Only offer an MRI scan for non-specific low back pain within the context of a referral for an opinion on spinal fusion |
| Bussi res 2008 | Diagnostic imaging practice guidelines for musculoskeletal complaints in adults – an evidence-based approach – Part 3: spinal disorders | Evidence-based: SR of guidelines and clinical evidence | None ^a | Adult patient with uncomplicated LBP (< 4 weeks duration) <ul style="list-style-type: none"> Radiographs not initially indicated. Adult patient with uncomplicated subacute (4-12 wks' duration) or persistent LBP (<12 wks' duration) AND no previous treatment trial <ul style="list-style-type: none"> Radiographs not initially indicated. Adult patient with non-traumatic acute LBP (<4 wks' duration) AND sciatica <p><i>Common causes of sciatica</i></p> <ul style="list-style-type: none"> Radiographs not initially indicated [B⁵⁸], unless patient age > 50 or has progressive neurologic deficits. <p><i>Suspected lumbar disc herniation</i></p> <ul style="list-style-type: none"> Radiographs not initially indicated unless patient age > 50 or has progressive neurologic defects [B] Special investigations not initially indicated [C⁵⁸] <p><i>Suspected degenerative spondylolisthesis/lateral stenosis</i></p> <ul style="list-style-type: none"> Radiographs indicated if patient age > 50 or has progressive neurologic deficits: posteroanterior (or anteroposterior), lateral lumbar views [GPP⁵⁸] Special investigations not initially indicated [C⁵⁸] |

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|-------------------|---|---|-------------------------------|--|
| | | | | <p><i>Suspected lumbar degenerative spinal stenosis</i></p> <ul style="list-style-type: none"> • Radiographs indicated if patient age > 50 or has progressive neurologic deficits: posteroanterior (or anteroposterior), lateral lumbar views [GPP⁵⁸] • Special investigations not initially indicated [C⁵⁸] <p>Adult patient re-evaluation in the absence of expected treatment response or worsening after 4 to 6 wks</p> <ul style="list-style-type: none"> • Radiographs indicated: PA (or AP), lateral lumbar views [B⁵⁸]. Additional views not routinely indicated [C⁵⁸] <p>Adults with complicated LBP and indicators/contraindications to spinal manipulative therapy</p> <ul style="list-style-type: none"> • Radiographs indicated: PA (or AP), lateral lumbar views [B⁵⁸]. Main purpose of lumbar spine radiographs is to exclude LBP caused by: malignancies; infective spondylitis; inflammatory SpA; fractures; and instability. <p>Suspected inflammatory spondyloarthropathies, compression fracture, neoplasia, infection</p> <ul style="list-style-type: none"> • Additional radiological views: spot AP or PA angled lumbosacral, oblique SI views [C⁵⁸] • Special investigations in complicated LBP (even if conventional radiographs are negative)[B⁵⁸]: <ul style="list-style-type: none"> ○ MRI is generally the preferred investigation ○ CT may be needed for bony details (especially multiplanar reformatted images) <p>Suspected cauda equina syndrome</p> <ul style="list-style-type: none"> • Emergency referral without imaging; if clinical findings are equivocal, medical referral and specialised imaging recommended [B⁵⁸] • Special investigations (as above) |
| Sidiropoulos 2008 | Evidence-based recommendations for the management of ankylosing spondylitis: systematic literature search of the 3E | Evidence-based: SR of clinical evidence | 3E Initiative in Rheumatology | <p>Diagnosis of ankylosing spondylitis</p> <p>In chronic back pain of at least 3 months duration, the presence of several of the following features makes the diagnosis of AS likely: inflammatory back pain, alternating buttock pain, response to NSAIDs, onset of symptoms before age 45, peripheral disease manifestations (arthritis, dactylitis, enthesitis), confirmed acute anterior uveitis, positive family history, HLA-B27 positive, sacroiliitis/spondylitis by imaging. [C⁵⁸]</p> <p>For early diagnosis of AS, no additional imaging is required if definite radiographic changes of sacroiliitis are present. If radiographs of the SI joints are normal or equivocal, MRI is the best imaging</p> |

⁵⁸ Grading not defined.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|-----------------|---|---|---|--|
| | Initiative in Rheumatology involving a broad panel of experts and practising rheumatologists | | | modality to identify inflammation of the sacroiliac joints and spine. CT is a sensitive tool for identifying structural changes of the SI joints but the risks of radiation exposure need to be considered. [B ⁵⁸] |
| Chou 2007 | Diagnosis and treatment of low back pain: A joint clinical practice guideline from the American College of Physicians and the American Pain Society | Evidence-based: SR of clinical evidence | American College of Physicians (ACP)/ American Pain Society (APS) | <p><i>Recommendation 2:</i> Clinicians should not routinely obtain imaging or other diagnostic tests in patients with non-specific low back pain [strong recommendation, moderate-quality evidence].</p> <p><i>Recommendation 3:</i> Clinicians should perform diagnostic imaging and testing for patients with low back pain when severe or progressive neurologic deficits are present or when serious underlying conditions are suspected on the basis of history and physical examination [strong recommendation, moderate-quality evidence].</p> <p><i>Recommendation 4:</i> Clinicians should evaluate patients with persistent low back pain and signs or symptoms of radiculopathy or spinal stenosis with MRI (preferred) or CT only if they are potential candidates for surgery or epidural steroid injection (for suspected radiculopathy) [strong recommendation, moderate-quality evidence].</p> |
| Rossignol 2007 | Clinic on low back pain in interdisciplinary practice | Review of clinical evidence and clinical experience | Robert-Sauvé Research Institute in Workplace Health and Safety | Radiographic, MRI or CT scan examinations are rarely indicated for patients with simple back pain [Strong]. |
| Airaksinen 2006 | European guidelines for the management of chronic non-specific low back pain | Not stated ^b | European Cooperation in Science and Technology (COST) B13 | <ul style="list-style-type: none"> • There is moderate evidence that radiographic imaging is not recommended for chronic non-specific low back patients [level B⁵⁹]. • There is moderate evidence that MRI is the best imaging procedure for use in patients with radicular symptoms, or for those in whom discitis or neoplasm is strongly suspected [level B⁵⁹] |

⁵⁹ Generally consistent findings provided by (a systematic review of) multiple low quality RCTs.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|--------------|--|------------------------|-------------------------------|--|
| | | | Working Group | <ul style="list-style-type: none"> There is moderate evidence that facet joint injections, MRI and discography are not reliable procedures for the diagnosis of facet joint pain and discogenic pain [level B⁵⁹]. <p>Recommendations</p> <ul style="list-style-type: none"> We do not recommend radiographic imaging for chronic non-specific low back patients. We recommend MRI in patients with serious red flags and for evaluation of radicular symptoms. Plain radiography is recommended for structural deformities. We do not recommend MRI, CT, or facet blocks for the diagnosis of facet joint pain or discography for discogenic pain. |
| Negrini 2006 | Diagnostic therapeutic flow charts for low back pain patients: the Italian clinical guidelines | Review of SRs and CPGs | Italian Health Ministry (IHM) | <p>Back pain < 1 month</p> <p>Use following diagnostic modalities if suspected secondary ‘red flags’:</p> <ul style="list-style-type: none"> <i>Tumour</i> – ESR, MRI <i>Cauda equina syndrome</i> – immediate surgical evaluation <i>Aorta aneurysm</i> – surgical evaluation, immediate abdominal US <i>Fracture</i> – X-ray <i>Infection</i> – MRI <i>Inflammatory back pain</i> – MRI/CT of sacroiliac joints/HLA B27 <p>Sciatica patient</p> <ul style="list-style-type: none"> After 4-6 weeks, CT and MRI are recommended if surgery is considered because of neurological signs and symptoms. [A⁶⁰] MRI is first choice imaging for disc herniation, alternatively CT scan can be considered [A⁶⁰] <p>Suspected spinal stenosis</p> <ul style="list-style-type: none"> Use CT (or MRI) [A⁶⁰] |

⁶⁰ Generally consistent (≥ 75% studies showed a similar result) findings provided by (a systematic review of) multiple high quality RCTs.

| ID | Title | Method | Affiliation | Recommendations/considerations [Grade of recommendation] |
|----------|---------------------------------------|---|---|--|
| ACC 2004 | New Zealand acute low back pain guide | Evidence-based: SR of clinical evidence | Accident Compensation Corporation (ACC) | <p>If ‘red flags’ are present (notes related to imaging only):</p> <ul style="list-style-type: none"> • Radiological investigations (X-rays and CT scans) carry the risk of potential harm from radiation-related effects and should be avoided if not required for diagnosis and management. • MRI scans are not indicated for non-specific acute low back pain. • Many people without symptoms show abnormalities on X-rays and MRI. The chances of finding coincidental disc prolapse increase with age. It is important to correlate MRI findings with age and clinical signs before advising surgery. |

Abbreviations: AP, anteroposterior; AS, ankylosing spondylitis; CBC, complete blood count; CT, computed tomography; EBPP, Evidence-Based Practice Panel; EO, Expert Opinion; ESR, erythrocyte sedimentation rate; GPP, Good Practice Point; I, insufficient evidence; HLA, human leukocyte antigen; LBP, low back pain; MRI, magnetic resonance imaging; NSAID, non-steroidal anti-inflammatory drug; PA, posteroanterior; RCT, randomised controlled trial; SI, sacroiliac; SpA, spondyloarthritis; SR, systematic review; UA, urinalysis; US, ultrasound; WGCS, Work Group Consensus Statement.

a No affiliation stated but developed to assist chiropractors and other primary care providers in decision making.

b Another COST B13 guideline for acute non-specific low back pain noted the guidance was based on Cochrane reviews, updated evidence and existing guidelines.

4.3. Concordance between MBS descriptors and Australian and international guidelines

Australian and international guidelines recommend that imaging should not be used for non-specific LBP. Using MBS data, it is not possible to determine the extent of use of MBS items by primary care providers for imaging in patients with non-specific LBP; the item descriptors for X-ray and CT do not specify an indication for imaging, and information is not available from Medicare on the purpose of the imaging request.

CPGs are generally consistent in recommending that for cases where serious underlying pathology is suspected, the imaging modality of choice is MRI, with CT used where MRI is contraindicated or unavailable. Although not explicitly stated in all guidelines, MRI appears to be preferred over CT because it involves less radiation exposure and is claimed to have better soft tissue visualisation. The guidelines do not refer to any specific body of evidence that clearly supports a claim for superior diagnostic accuracy of MRI over CT. X-ray is recommended by CPGs as the first-line imaging modality for suspected cases of vertebral fracture or other bone-related pathology, and for suspected inflammatory spondyloarthritis.

Table 0-29 summarises the MBS indications for the diagnostic imaging items in scope for this Review. The ability of clinicians to refer patients for these tests differs between modalities. MRI can only be requested by a specialist or consultant physician. CPGs recommend urgent referral where there are signs and symptoms of cauda equina syndrome, with MRI as the modality of choice; thus, primary care providers should not be imaging in these cases.

Allied health professionals (physiotherapists, chiropractors and osteopaths) may request low back radiography items 58106, 58109, 58112, 58120 and 58121 only. The use of these items may be appropriate for patients with LBP and suspected vertebral fracture or suspected inflammatory spondyloarthritis, but not where other serious underlying pathologies are suspected.

GPs are able to request low back X-ray and CT scans on the MBS. Although CPGs often preferentially recommend MRI over CT for imaging of the low back where serious pathologies are suspected, they are also supportive of the use of CT. If an MRI investigation is warranted (based on best clinical practice outlined in guidelines), a GP must first refer the patient to a specialist who can request the MRI. Alternatively, if the patient is willing to pay for an MRI out-of-pocket, the GP can request an MRI directly, which means that (i) the patient may avoid a specialist visit if no pathology is found, or (ii) the patient would arrive at the specialist appointment with the results already available, potentially avoiding an additional specialist visit.

Table 0-29 Summary of MBS indications for radiography, CT and MRI

| Imaging type | Item numbers | Indication/s | Referral restrictions |
|---|--|---|--|
| Diagnostic radiology – radiographic examination of spine | 58106, 58108, 58109, 58111, 58112, 58114, 58115, 58117, 58120, 58121, 58123, 58126 | <ul style="list-style-type: none"> • Spine lumbosacral • Spine sacrococcygeal • Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal | Allied health professionals (physiotherapists, chiropractors and osteopaths) may request items 58106, 58109, 58112, 58120 and 58121 only |
| Diagnostic radiology – radiographic examination with opaque or contrast media | 59700, 59701, 59724, 59725 | <ul style="list-style-type: none"> • Discography, each disc • Myelography, one or more regions | Cannot be requested by allied health professionals |
| Computed tomography | 56223, 56226, 56229, 56232, 56233 | <ul style="list-style-type: none"> • Scan of spine, lumbosacral region • Scan of spine, two examinations | Cannot be requested by allied health professionals |
| Magnetic resonance imaging | 63151, 63154, 63157, 63158, 63164, 63167, 63176, 63179, 63187, 63188, 63191, 63192, 63201, 63204, 63207, 63208, 63222, 63225, 63234, 63237, 63258, 63259, 63262, 63263 | <ul style="list-style-type: none"> • Scan of one region or two contiguous regions of the spine for infection, tumour, congenital malformation of the spinal cord or the cauda equina or the meninges, myelopathy, sciatica, spinal canal stenosis. • Scan of three contiguous regions of the spine or two non-contiguous regions of the spine for infection, tumour, congenital malformation of the spinal cord or the cauda equina or the meninges, myelopathy, sciatica, spinal canal stenosis. | Restricted to specialist or consultant physician only |

5. REVIEW OF THE CLINICAL EVIDENCE FOR IMAGING FOR LOW BACK PAIN

This section presents the results of the systematic literature review on imaging for LBP in relation to the clinical research questions presented in Section 2.3.2. The PICO criteria for the review specifies two clinical outcomes: diagnostic accuracy, and change in patient management. The evidence base for each of these outcomes is presented separately below. The evidence review does not include an assessment of the comparative harms of the different imaging modalities (which is briefly addressed in Section 0).

5.1. Diagnostic accuracy

5.1.1. Search results

A targeted search of the literature database was undertaken to identify systematic reviews and meta-analyses on the diagnostic accuracy of imaging in patients with LBP with suspected serious underlying pathology or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy. Further details are provided in Appendix 4. From a total of 9,477 citations, 82 citations were identified. When exclusion criteria were applied, a total of four systematic review/meta-analyses were included.

Table 0-30a Summary of the process used to identify relevant studies

| Step | embase.com 11 May 2015 | Cochrane Library 11 May 2015 |
|---|---------------------------|---------------------------------|
| Number of citations retrieved by search | 50 | 32 |
| Number of duplicate citations removed | 1 | 4 |
| Total number of citations screened | 49 | 28 |
| Number of citations excluded in title/abstract review | 42 | 18 |
| Citations screened by full text review | 7 | 10 |
| Citations excluded in full text review: | 5 | 8 |
| Included citations from each database | 2 | 2 |

Note: total included citations was four.

Table 0-31b Detail of citations excluded in the process used to identify relevant studies

| Step | Exclusion criteria | embase.com 11 May 2015 | Cochrane Library 11 May 2015 |
|---|------------------------|---------------------------|---------------------------------|
| Number of citations excluded in title/abstract review | Wrong publication type | 27 | 61 |
| | Wrong/no test | 6 | 8 |
| | Wrong population | 7 | 3 |
| | Wrong outcomes | 1 | 0 |
| | Wrong study type | 1 | 0 |
| | Not in English | 0 | 1 |
| Citations excluded in full text review | Wrong publication type | 1 | 1 |
| | Wrong/no test | 2 | 4 |
| | Wrong population | 2 | 2 |
| | Wrong outcomes | 0 | 1 |
| | Wrong study type | 0 | 0 |

An additional systematic review (Hancock et al, 2007) was identified that evaluated the ability of different diagnostic modalities (clinical examination, MRI, CT scans, X-ray, ultrasound, or spinous process vibration) to identify the disc, facet joint or sacroiliac joint as the source of non-specific LBP. Participants had to have LBP and no known or suspected serious pathology (such as fracture, malignancy, or infection). The review concluded that the use of MRI for identifying the disc as a source of non-specific LBP has diagnostic value, however, the usefulness of this test in clinical practice, particularly for guiding treatment selection, remains unclear. As CPGs are consistent in recommending that imaging should not be used for non-specific LBP, the Hancock (2007) systematic review, which specifically focused on patients with non-specific LBP, is not discussed further.

For each clinical indication, a targeted search of the database retrieved through the original literature search strategy was undertaken to identify primary studies published after the search date of the included systematic reviews. Two additional original diagnostic accuracy studies were included in the review of clinical evidence to supplement the data available from the included systematic reviews.

5.1.2. Overview of the included studies

Table 0-32 presents the citations of the four systematic reviews identified in the literature search for the diagnostic accuracy of imaging in adults who present with LBP with suspected serious underlying pathology or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy. There were no relevant health technology assessments identified.

Two reviews (van Rijn et al, 2012; Wassenaar et al, 2012) were from the same research group in the Netherlands. The search strategy used by these reviewers was developed to identify publications for four separate systematic reviews on the diagnostic test accuracy of imaging techniques (MRI, CT, X-ray, or myelography) for identifying or excluding lumbar spinal pathology. The van Rijn (2012) review focused on CT while the Wassenaar (2012) review focused on MRI. The planned reviews on X-ray and myelography do not appear to have been published, which may be due to a lack of evidence for these two imaging modalities in the populations of interest.

One systematic review by Sidiropoulos et al (2008) was undertaken to underpin evidence-based CPGs developed by the 3E (Evidence, Experts, Exchange) Initiative in Rheumatology (see Section 4.2 for further details of this CPG and the relevant recommendations regarding imaging in patients with LBP and suspected ankylosing spondylitis).

A targeted search of the literature database identified two additional diagnostic accuracy studies (Moranjic et al, 2011; Shankar et al, 2009) that were published after the search date of the included systematic reviews.

Table 0-32 Citation details for identified systematic reviews and subsequent published primary studies of diagnostic accuracy of imaging for low back pain

| Study | Ref ID | Citation |
|---------------------------|-------------------|---|
| Systematic reviews | van Rijn 2012 | van Rijn RM, Wassenaar M, Verhagen AP, Ostelo RW, Ginai AZ, Boer MR, et al. (2012) Computed tomography for the diagnosis of lumbar spinal pathology in adult patients with low back pain or sciatica: a diagnostic systematic review (Provisional abstract). <i>European Spine Journal</i> 21: 228-239. |
| | Wassenaar 2012 | Wassenaar M, Rijn RM, Tulder MW, Verhagen AP, Windt DA, Koes BW, et al. (2012) Magnetic resonance imaging for diagnosing lumbar spinal pathology in adult patients with low back pain or sciatica: a diagnostic systematic review (Provisional abstract). <i>European Spine Journal</i> 21: 220-227. |
| | Sidiropoulos 2008 | Sidiropoulos PI, Hatemi G, Song IH, Avouac J, Collantes E, Hamuryudan V, et al. (2008). Evidence-based recommendations for the management of ankylosing spondylitis: Systematic literature search of the 3E Initiative in Rheumatology involving a broad panel of experts and practising rheumatologists. <i>Rheumatology</i> , 47(3):355-61. |
| | Jarvik 2002 | Jarvik JG, Deyo RA (2002). Diagnostic evaluation of low back pain with emphasis on imaging. <i>Annals of Internal Medicine</i> , 137(7):586-97. |
| Other studies | Moranjkic 2011 | Moranjkic M, Ercegovic Z, Hodzic M, Brkic H (2011). Diagnostic characteristics of neuroradiological tests in lumbar disc herniation. <i>Acta Medica Saliniana</i> 40(1): 1-6. |
| | Shankar 2009 | Shankar S, Abhisheka K, Kumar AVSA, Chaturvedi A (2009). Evaluation of magnetic resonance imaging and radionuclide bone scan in early spondyloarthropathy. <i>Indian Journal of Rheumatology</i> , 4(4):142-8. |

Table 0-33 shows the clinical presentations and serious pathologies that were investigated in each of the four identified systematic reviews and two additional diagnostic accuracy studies. Three systematic reviews (van Rijn et al, 2012; Wassenaar et al, 2012; Jarvik and Deyo, 2002) investigated the diagnostic accuracy of imaging for LBP for a number of clinical indications. The literature search did not identify any systematic reviews or original studies that assessed the diagnostic accuracy of any imaging modality for the diagnosis of cauda equina syndrome.

Table 0-33 Clinical indications in the identified systematic reviews and subsequent published primary studies of diagnostic accuracy of imaging for low back pain

| Clinical indication | Systematic Review | | | | Primary study | |
|-------------------------------------|-------------------|----------------|-------------------|-------------------|---------------|---------------|
| | van Rijn 2012 | Wassenaar 2012 | Sidiropoulos 2008 | Jarvik 2002 | Moranjic 2011 | Shankar 2009 |
| Sciatica/radiculopathy ^a | CT | MRI | None | X-ray, MRI and CT | MRI and CT | None |
| Spinal stenosis | CT | MRI | None | X-ray, MRI and CT | None | None |
| Inflammatory spondyloarthritis | CT | MRI | X-ray, MRI and CT | X-ray, MRI and CT | None | X-ray and MRI |
| Spinal malignancy | CT | MRI | None | X-ray, MRI and CT | None | None |
| Spinal infection | CT | MRI | None | X-ray, MRI and CT | None | None |
| Vertebral fracture | CT | MRI | None | X-ray, MRI and CT | None | None |

Note: Diagnostic accuracy of imaging technique for the diagnosis of cauda equina syndrome was not assessed in any of the systematic reviews or primary studies.

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging

^a Included studies examined imaging for lumbar disc herniation

Table 0-34 and Table 0-35 present a summary of the characteristics of the four included systematic reviews and two primary studies. Ideally, diagnostic performance should be assessed in studies of test accuracy with an independent, blinded comparison with a valid reference standard among consecutive persons with a defined clinical presentation (Level II diagnostic evidence according to NHMRC criteria; see Appendix 5). The studies of imaging in patients with LBP consist of observational studies including prospective and retrospective cohort and case-control studies with surgical findings, biopsy or expert panel consensus as the reference standard. The majority of primary studies poorly described the selection of patients and blinding of reference test results.

Two systematic reviews only identified studies conducted in the secondary care setting (van Rijn et al, 2012; Wassenaar et al, 2012), one systematic review only included imaging modalities that are used in the primary care setting (Jarvik and Deyo, 2002), and one systematic review did not specify the setting (Sidiropoulos et al, 2008). The reviews by van Rijn et al (2012) and Wassenaar et al (2012) may have an overrepresentation of studies with relatively high prior probabilities of the clinical presentations and serious pathologies of interest as some studies may have included only those

patients likely to undergo, or that indeed underwent, surgery. Furthermore, in the secondary care setting patients are likely to have a higher prior probability due to referral of only those patients with a relatively high suspicion of specific pathology.

Diagnostic accuracy was mainly reported in terms of sensitivity, specificity, and a summary estimate of sensitivity and specificity using a receiver operating characteristics (ROC) curve. Three reviews clearly mentioned the use of reference standards; the fourth review formed the basis of a CPG and did not specifically mention the reference standards used in the included studies (Sidiropoulos et al, 2008).

Table 0-34 Characteristics of included systematic reviews of diagnostic accuracy of imaging for low back pain

| Ref ID and Quality ^a | Literature search date and Study eligibility | Number of studies, Number of patients and Setting | Patient population | Intervention / index test | Comparators | Reference standard | Outcome measures | Meta-analysis |
|--|--|---|--|---|-------------|--|--|--|
| <ul style="list-style-type: none"> van Rijn 2012 Good quality | <ul style="list-style-type: none"> search to Dec 2009 prospective or retrospective cohort or case-control studies assessing diagnostic accuracy published full reports with sufficient data to construct a two-by-two table comparison with a reference standard | <ul style="list-style-type: none"> 7 observational studies N=498 discs All identified studies were in the secondary care setting | <ul style="list-style-type: none"> Adult patients with LBP or sciatica suspected to be caused by specific pathology: radicular syndrome spinal stenosis spinal tumours spinal infection/inflammation spondylolisthesis, spondylolysis, spinal fractures AS disc displacement osteoporotic fractures other degenerative disc diseases | <ul style="list-style-type: none"> CT | N/A | <ul style="list-style-type: none"> surgical findings (6 studies) expert panel opinion (1 study) diagnostic work-up (0 studies) MRI (0 studies) | <ul style="list-style-type: none"> sensitivity specificity positive LR negative LR | <ul style="list-style-type: none"> Yes (6 out of the 7 studies) |
| <ul style="list-style-type: none"> Wassenaar 2012 Fair quality | <ul style="list-style-type: none"> search to Dec 2009 prospective or retrospective cohort or case-control studies assessing | <ul style="list-style-type: none"> 8 observational studies N=467 patients All identified studies were in the | <ul style="list-style-type: none"> Adult patients with LBP or sciatica suspected to be caused by specific lumbar spinal pathology: radicular syndrome spinal stenosis spinal tumours | <ul style="list-style-type: none"> MRI | N/A | <ul style="list-style-type: none"> surgical findings (7 studies) expert panel consensus (1 study) | <ul style="list-style-type: none"> sensitivity specificity positive LR negative LR | <ul style="list-style-type: none"> Yes (5 out of the 8 studies) |

| Ref ID and Quality ^a | Literature search date and Study eligibility | Number of studies, Number of patients and Setting | Patient population | Intervention / index test | Comparators | Reference standard | Outcome measures | Meta-analysis |
|--|--|---|--|--|-------------|--|--|---------------|
| | diagnostic accuracy <ul style="list-style-type: none"> published full reports with sufficient data to construct a two-by-two table comparison with a reference standard | <i>secondary care setting</i> | <ul style="list-style-type: none"> spinal infection/inflammation spondylolisthesis, spondylolysis, spinal fractures AS disc displacement osteoporotic fractures other degenerative disc diseases | | | <ul style="list-style-type: none"> diagnostic work-up (0 studies) | | |
| <ul style="list-style-type: none"> Sidiropoulos 2008 (CPG) Poor quality | <ul style="list-style-type: none"> search to Aug 2006 appropriate study population relevant outcomes with data on selected outcome measures excluded case reports, studies with TNF-α antagonists, animal studies, | <ul style="list-style-type: none"> Guideline included 467 papers covering diagnosis, treatment and monitoring Setting not specified | Patients with ankylosing spondylitis and evident or suspected sacroiliitis | <ul style="list-style-type: none"> X-ray MRI CT | Not clear | Not mentioned | <ul style="list-style-type: none"> sensitivity specificity positive LR negative LR | No |

| Ref ID and Quality ^a | Literature search date and Study eligibility | Number of studies, Number of patients and Setting | Patient population | Intervention / index test | Comparators | Reference standard | Outcome measures | Meta-analysis |
|---|---|---|--|--|--|---|--|---------------|
| | narrative reviews, commentaries and duplications | | | | | | | |
| <ul style="list-style-type: none"> Jarvik 2002 Poor quality | <ul style="list-style-type: none"> search from Jan 1966-Sep 2001 excluded animal studies, paediatric studies, case reports, review articles, editorials, and non-English articles | <ul style="list-style-type: none"> 73 studies N=not reported Setting of included studies not reported but review focused on imaging modalities used in the primary care setting only | Patients with LBP in the primary setting due to: <ul style="list-style-type: none"> herniated disc spinal stenosis spinal fracture spinal malignancy spinal infection AS | <ul style="list-style-type: none"> CT MRI X-ray radionuclide imaging (planar imaging, SPECT) | <ul style="list-style-type: none"> MRI bone scintigraphy | <ul style="list-style-type: none"> myelography expert panel consensus biopsy | <ul style="list-style-type: none"> sensitivity specificity positive LR negative LR | No |

Abbreviations: AS, ankylosing spondylitis; CPG, clinical practice guideline; CT, computed tomography; LBP, low back pain; LR, likelihood ratio; MRI, magnetic resonance imaging; SPECT, single-photon emission computerised tomography; TNF, tumour necrosis factor.

^a See Appendix 6 for quality assessment forms.

Table 0-35 Characteristics of subsequent published primary studies of diagnostic accuracy of imaging for low back pain

| Ref ID and Quality ^a | Number of patients, Setting and Country | Patient population Inclusions/Exclusions | Intervention/ index test | Comparators | Reference standard | Outcome measures |
|---|---|--|--|-------------|--|--|
| <ul style="list-style-type: none"> • Moranjic 2011 • Fair quality | <ul style="list-style-type: none"> • Prospective study of 70 patients (30 operated on due to MRI, 40 operated on due to CT) • Not clear but secondary care setting likely • Bosnia and Herzegovina | <p>Patients with:</p> <ul style="list-style-type: none"> • radicular pain and evidence of nerve root irritation with a positive nerve root tension sign or a corresponding neurologic deficit • multiple herniations, with at least one being symptomatic • candidates for surgery who had undergone advanced vertebral imaging showing disk herniation (protrusion, extrusion, or sequestered fragment) at a level and side corresponding to the clinical symptoms due to disc herniation <p>Exclusions</p> <ul style="list-style-type: none"> • prior lumbar surgery • cauda equina syndrome • scoliosis >15 degrees • segmental instability • vertebral fractures • spinal infection • spinal tumour • inflammatory spondyloarthropathy • pregnancy • inability to have surgery within 6 months | <ul style="list-style-type: none"> • MRI • CT | N/A | <ul style="list-style-type: none"> • surgical findings | <ul style="list-style-type: none"> • sensitivity • specificity |
| <ul style="list-style-type: none"> • Shankar 2009 • Poor quality | <ul style="list-style-type: none"> • Prospective case-control study of 132 SIJ in 66 patients (33 in the study group and 33 in | <p>Study group:</p> <ul style="list-style-type: none"> • aged 18 to 42 years • inflammatory LBP, satisfying the Calin criteria and the ESSG criteria • disease duration <2 years <p>Control group:</p> | <ul style="list-style-type: none"> • X-ray • MRI • radionuclide bone scan | N/A | <ul style="list-style-type: none"> • Cases – detailed clinical assessment, assessment of disease activity and functional impairment | <ul style="list-style-type: none"> • sensitivity • specificity • PV |

| Ref ID and Quality ^a | Number of patients, Setting and Country | Patient population Inclusions/Exclusions | Intervention/ index test | Comparators | Reference standard | Outcome measures |
|---------------------------------|--|--|--------------------------|-------------|--|------------------|
| | the control group) • <i>Tertiary care setting</i> • <i>India</i> | • mechanical LBP | | | • Controls – established diagnosis of mechanical LBP | |

Abbreviations: AS, ankylosing spondylitis; CT, computed tomography; ESSG, European Spondyloarthropathy Study Group; LBP, low back pain; MRI, magnetic resonance imaging; PV, predictive value; SIJ, sacroiliac joint.

5.1.3. Methodological quality assessment and statistical analysis

Appendix 6 provides the quality assessment form for each of the included studies. The systematic review by van Rijn et al (2012) was assessed to be of good quality whereas the other review from the same researchers (Wassenaar et al, 2012) was judged to be of only fair quality because the characteristics of the included studies were not reported. The systematic review underpinning the CPG from the 3E Initiative in Rheumatology (Sidiropoulos et al, 2008) was given a poor quality rating because individual study characteristics and quality assessment was not reported. This rating refers to the reporting of the systematic literature review component of the publication and is not a reflection of the quality of the CPG. The systematic review by Jarvik and Deyo (2002) received a poor quality rating, primarily because individual study characteristics were not reported and quality assessment was not formally undertaken.

The authors of the van Rijn et al (2012) and Wassenaar et al (2012) reviews employed independent duplicate processes for study inclusion, data extraction, and methodological quality assessment to reduce the risks of reviewer error and bias during the review. The authors acknowledge that a study design filter was used in the search strategy to limit the number of citations and this increases the risk of missing important publications; however, the authors claimed that this was addressed by checking the references of included studies as well as review articles.

In the van Rijn et al (2012) and Wassenaar et al (2012) reviews, methodological quality was assessed in each of the included primary studies using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) tool. The QUADAS tool consists of 11 items that refer to internal validity. Both systematic reviews included nine additional items described in the Cochrane Handbook for Diagnostic Test Accuracy Reviews. The overall quality of the included studies was not indicated in the publications; however, methodological quality assessment was shown for each included study. No summary quality score was applied “since the interpretation of summary score may be problematic or misleading”.

The van Rijn (2012) publication noted that the majority of studies poorly described the selection of patients, blinding of reference test results, and whether cut-off values were pre-specified (therefore resulting in high risk of selection and reviewer bias). None of the studies reported enough information to assess the items on the delay between index test and reference test, observer variation, instrument variation, appropriate patient subgroups, appropriate sample size, and whether treatment or intervention was initiated between index test and reference test. Furthermore, the authors noted that assessment of the diagnostic accuracy of the use of MRI in isolation from other clinical observations or test results may not be reflective of routine clinical practice as diagnosis and treatment decisions are not based on MRI findings only.

The Wassenaar (2012) publication noted that the results were only based on a limited number of studies of moderate quality with several unaddressed sources of heterogeneity. The authors state

that “poor reporting of several quality items hindered assessment of the risk of bias and may have affected the validity of the reported sensitivities and specificities”.

According to the publication by Sidiropoulos et al (2008), evidence was categorised according to study design using a hierarchy of evidence in descending order according to study quality, and the highest level of available evidence for each question was reviewed in detail. Although level of evidence was clearly taken into consideration when formulating and grading recommendations, individual study quality does not appear to have been assessed.

The systematic review by Jarvik and Deyo (2002) informally evaluated the quality of individual study methods; major potential biases were identified, but neither quantitative data extraction nor scoring was done. The overall quality of the evidence base was only mentioned for some clinical indications. The authors noted that biases were common in the studies reviewed. The most common biases were failure to apply a single reference test to all patients, test review bias (study test was reviewed with knowledge of the final diagnosis), diagnosis review bias (determination of the final diagnosis was affected by the study test), and spectrum bias (only severe cases of disease were included). Most studies had several potential biases, and therefore estimates of sensitivity and specificity must be considered imprecise. A formal meta-analysis was not undertaken because “the diagnostic hardware and software, gold standards, and patient selection methods were heterogeneous and the number of studies was small”.

Table 0-36 presents the statistical methods used in the four systematic reviews and two primary studies identified in the literature search. All four systematic reviews reported on sensitivity, specificity, positive and negative likelihood ratios. Sensitivities and specificities for each index test with 95% confidence interval were presented in forest plots. Further, two systematic reviews (van Rijn et al, 2012; Wassenaar et al, 2012) presented summary estimates of sensitivity and 1-specificity in ROC curves. Only one systematic review (van Rijn et al, 2012) performed a bivariate analysis accounting for both within-study and between-study variation. Pooled estimates of sensitivity and specificity were shown only if studies had clinical homogeneity (for example same reference standard, similar definition of disc herniation).

Table 0-36 Statistical methods used in the included systematic reviews and subsequent published primary studies

| Study | Ref ID | Statistical methods |
|--------------------|---------------|--|
| Systematic reviews | van Rijn 2012 | <ul style="list-style-type: none"> • Sensitivity and specificity with 95% CI were calculated and presented in a forest plot. • Meta-analyses were performed to calculate pooled estimates of sensitivity and specificity using STATA 10 Software (provides random effects analysis). • ROC plot of sensitivity against 1-specificity was generated using STATA 10. • Summary estimates of sensitivity and specificity, prior probabilities, DOR, and LR_s for the diagnostic accuracy of CT. • Heterogeneity was addressed by adding each individual QUADAS item as covariate to the bivariate model. |

| Study | Ref ID | Statistical methods |
|------------------------|-------------------|--|
| | Wassenaar 2012 | <ul style="list-style-type: none"> • Sensitivity and specificity with 95% CI were calculated and presented in a forest plot. • Meta-analyses were performed to calculate pooled estimates of sensitivity and specificity using STATA 10 Software (provides random effects analysis). • ROC plot of sensitivity against 1-specificity was generated using STATA 10. • Summary estimates of sensitivity and specificity, prior probabilities, DOR, and LR for the diagnostic accuracy of CT. • Heterogeneity was addressed descriptively. |
| | Sidiropoulos 2008 | <ul style="list-style-type: none"> • Not described but sensitivity and specificity was reported in table format as supplementary data |
| | Jarvik 2002 | <ul style="list-style-type: none"> • Sensitivity, specificity, positive LR, and negative LR as reported by the included studies were presented in a table format. |
| Primary studies | Moranjkic 2011 | <ul style="list-style-type: none"> • Sensitivity and specificity were calculated. • ROC plots of sensitivity against 1-specificity were generated and diagnostic accuracy was summarised using the AUC statistic. |
| | Shankar 2009 | <ul style="list-style-type: none"> • Sensitivity, specificity and predictive values were calculated. • ROC plots of sensitivity against 1-specificity were generated and diagnostic accuracy was summarised using the AUC statistic. |

Abbreviations: AUC, area under the curve; CI, confidence interval; CT, computed tomography; DOR, diagnostic odds ratio; LR, likelihood ratio; QUADAS, Quality Assessment of Diagnostic Accuracy Studies; SROC, Summary Receiver Operating Characteristics.

5.1.4. Sciatica/radiculopathy

There were three systematic reviews that assessed the diagnostic accuracy of imaging (MRI, CT, and X-ray) in the diagnosis of radiculopathy or sciatica caused by lumbar disc herniation in patients with LBP (van Rijn et al, 2012; Wassenaar et al, 2012; Jarvik and Deyo, 2002).

There was also one diagnostic accuracy study published after the search date of the most recent systematic review that compared the diagnostic accuracy of MRI to that of CT in the diagnosis of lumbar disc herniation (extrusion) in patients with radicular pain (Moranjkic et al, 2011).

van Rijn 2012

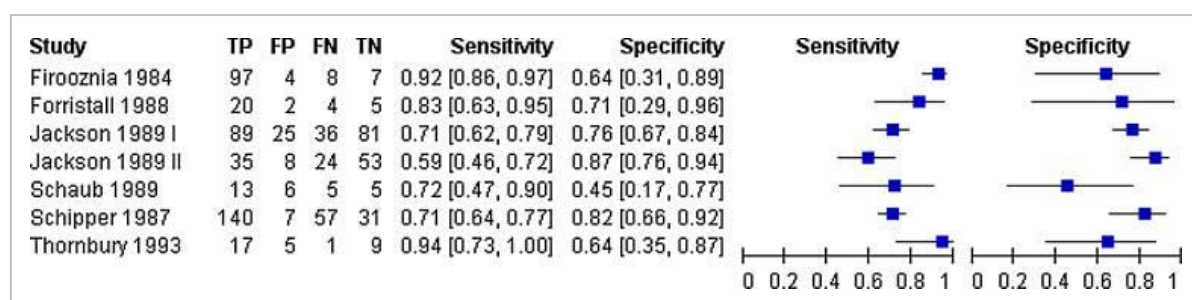
The systematic review by van Rijn et al (2012) investigated the diagnostic accuracy of CT in identifying specific lumbar spinal pathology in adult patients with LBP or sciatica⁶¹. Lumbar spinal pathology included radicular syndrome, herniated disc, spinal stenosis, spinal tumours, spinal fractures, spinal infection, spinal inflammation, spondylolisthesis, spondylolysis, ankylosing spondylitis, disc displacement, osteoporotic fracture, and other degenerative disc diseases. The review found no studies evaluating the diagnostic accuracy of CT for pathologies such as spinal stenosis, spinal tumours, fractures and infection. However, seven studies (total of 498 discs) were identified that described the diagnostic accuracy of CT in identifying lumbar disc herniation, which was defined as herniated disc pulposus, including protruded, extruded or sequestered disc, or causing nerve root compression. The characteristics of the included studies, as reported in van Rijn et

⁶¹ Sciatica was defined as nerve root pain or radiating leg pain.

al (2012), are shown in Appendix 7. Prevalence of lumbar disc herniation varied across the included studies from 49% to 90%.

Figure 5.1-1 shows the individual results from the seven included studies comparing CT to a reference standard for identifying lumbar disc herniation. Six out of the seven studies used findings at surgery as the reference standard, and one study (Thornbury et al, 1993) used expert panel consensus. Amongst the six studies that used surgery as a reference standard, the sensitivity of CT in identifying lumbar disc herniation in patients with LBP or sciatica ranged from 59% to 92% and the specificity ranged from 45% to 87%.

Figure 0-33 Forest plot of primary studies describing sensitivity and specificity of CT for lumbar disc herniation, with accompanying 95% confidence intervals



Source: van Rijn et al (2012), Figure 3, p233

Abbreviations: CI, confidence interval; FN, false negative; FP, false positive; TN, true negative; TP, true positive.

Note: The study by Thornbury et al (1993) used expert panel consensus as a reference standard. The reference standard for all other studies was findings at surgery.

The authors considered the six studies that used findings at surgery as a reference standard were sufficiently homogenous for a meta-analysis, and the pooled estimates are shown in Table 5.1-7. Summary estimates of 77% for sensitivity (95% CI 66-86%) and 74% for specificity (95% CI 62-83%) were found for CT compared to surgical findings.

The influence of pre-defined potential sources of heterogeneity was determined by adding each individual QUADAS item as covariate to the bivariate model. Of the 20 QUADAS items assessed, item 4 (partial verification) and item 13 (use of an appropriate CT technology) influenced the results of the bivariate analysis as shown in Table 5.1-7. The item for selection bias (item 1) was poorly described and could, therefore, not be added as a covariate to the model. The authors were unable to evaluate the influence of differences in pathology and different reference standards on sensitivity and specificity, since six out of seven studies investigated the accuracy of CT in identifying lumbar disc herniation with surgical findings as the reference standard. Exploratory analysis on the influence of the use of a prospective versus a retrospective study design and measurements at disc level versus patient level did not result in a different accuracy of CT.

Table 0-37 Results of bivariate analysis with summary estimates of diagnostic accuracy, and the prior probability of lumbar disc herniation

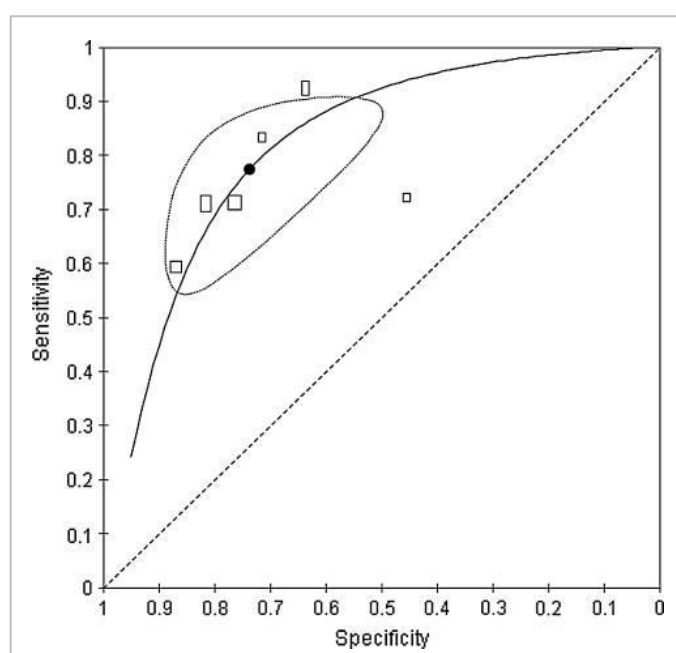
| Target condition | Reference test | Covariates | Sensitivity, (95% CI) | Specificity (95% CI) | Mean prior probability (range) | LR+ (95% CI) | LR- (95% CI) | DOR (95% CI) |
|------------------------|----------------|-------------------------------------|-----------------------|----------------------|--------------------------------|------------------|------------------|--------------------|
| Lumbar disc herniation | Surgery | N/A | 0.77 (0.66-0.86) | 0.74 (0.62-0.83) | 69.5% (49.2-90.5) | 2.94 (2.12-4.09) | 0.31 (0.22-0.43) | 9.61 (6.22-14.84) |
| | | QUADAS item 4: partial verification | 0.77 (0.65-0.86) | 0.73 (0.61-0.83) | N/A | 2.88 (2.07-4.00) | 0.32 (0.22-0.46) | 9.08 (5.58-14.77) |
| | | QUADAS item 13: used technology | 0.79 (0.65-0.89) | 0.76 (0.60-0.87) | N/A | 3.30 (1.79-6.07) | 0.27 (0.15-0.50) | 12.01 (4.22-34.17) |

Source: van Rijn et al (2012), Table 2

Abbreviations: CI, confidence interval; DOR, diagnostic odds ratio; LR, likelihood ratio; QUADAS, Quality Assessment of Diagnostic Accuracy Studies.

Figure 5.1-2 presents the summary ROC curves of the sensitivity and specificity of the six included studies that described the diagnostic accuracy of CT with surgical findings as the reference standard and lumbar disc herniation as specific pathology.

Figure 0-34 SROC curve based on the six included diagnostic studies of CT



Source: van Rijn et al (2012), Figure 4, p234

Abbreviations: SROC, summary receiver operating characteristics.

Note: The six studies assessed the diagnostic accuracy of CT in identifying lumbar disc herniation, using surgical findings as reference standard. The width of the rectangles is proportional to the number of patients with possible or without lumbar disc herniation; the height of the blocks is proportional to the number of patients with lumbar disc herniation (proven or probable). The solid line is the SROC curve; the black spot is the mean value for sensitivity and specificity; the ellipse around the black spot represents the 95% CI around this summary estimate.

Overall, findings from this review suggest that a considerable proportion of patients are being incorrectly classified (misdiagnosed) as false negative and false positive using CT for lumbar disc herniation. However, all of the included studies were published prior to 1994 and the authors suggest that the use of newer CT techniques may result in slightly better accuracy compared with the use of old CT technology.

Due to the limited number of studies, heterogeneity amongst the included studies, large variation in prior probabilities⁶² of the underlying pathologies of LBP, and the lack of a gold reference standard, the authors warn that the results of the review should be interpreted with caution. Only patients with a strong suspicion of a specific underlying pathology are subjected to surgery and therefore the results of studies in surgical populations can be biased, leading to a potential overestimation of the diagnostic accuracy of the index test.

Wassenaar 2012

The systematic review by Wassenaar et al (2012) investigated the diagnostic accuracy of MRI in identifying specific lumbar spinal pathology in adult patients with LBP or sciatica⁶³. Lumbar spinal pathology included radicular syndrome, herniated disc, spinal stenosis, spinal tumours, spinal fractures, spinal infection, spinal inflammation, spondylolisthesis, spondylolysis, ankylosing spondylitis, disc displacement, osteoporotic fracture, and other degenerative disc diseases. Eight studies were included in this review, with a total of 467 patients of which 1,476 discs or foramina were assessed. The included studies were stratified based on the following pathologies: lumbar disc herniation (further subdivided into herniated nucleus pulposus (HNP) and nerve root compression due to HNP), and spinal stenosis (discussed in Section 5.1.6). No studies evaluating the diagnostic accuracy of MRI for pathologies such as spinal tumours, infection and fractures were identified by the review.

Data from five studies (comprising 197 patients and 322 discs) comparing MRI to surgical findings for identifying HNP were considered to be sufficiently homogeneous for meta-analysis. One study (Birney et al, 1992) was excluded from the pooled analysis as it presented the results for the combined identification of HNP and degenerative disc disease. This study and one other (Bernard et al, 1994) used older MRI techniques with less advanced visualising capacities, which may have resulted in poorer identification of lumbar spinal pathology. As shown in Figure 0-35, across the five studies with surgical findings as a reference standard, the sensitivity of MRI for HNP ranged from 64% to 92% and the specificity ranged from 55% to 100%. Prior probabilities ranged from 49% to 77%, with a mean prior probability of 63%. Pooled analysis resulted in a summary estimate of sensitivity of

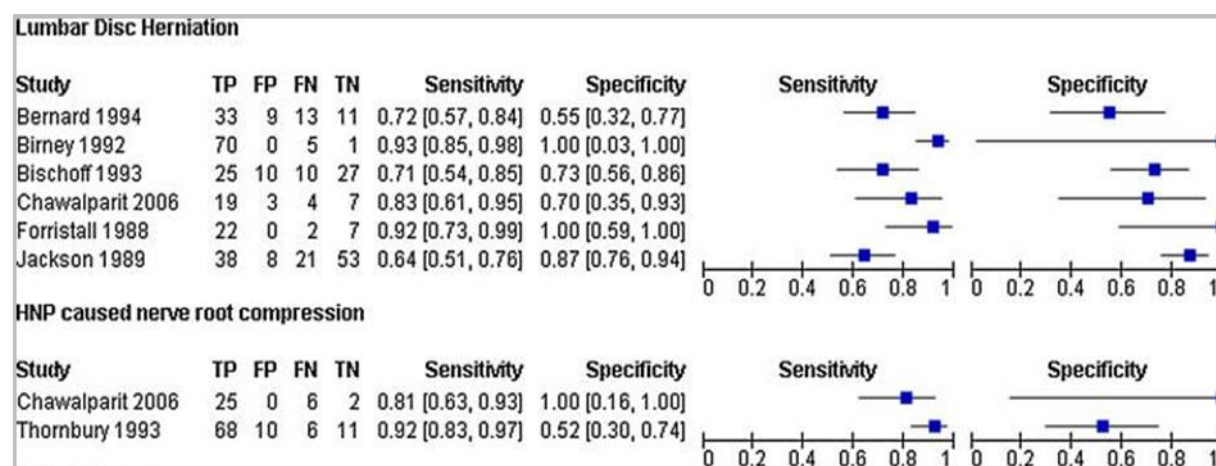
⁶² The diagnostic value of CT depends on the prior probability (prevalence) of the underlying pathology in the investigated population. In general, a high prior probability results in a high positive diagnostic value and a low negative diagnostic value, and vice versa.

⁶³ Sciatica was defined as nerve root pain or radiating leg pain.

75% (95% CI 65-83%) and specificity of 77% (95% CI 61-88%). These estimates are similar to those reported for CT compared with surgical findings in a comparable population (Table 0-37).

The diagnostic accuracy of MRI in the identification of nerve root compression due to HNP was evaluated in two studies, comprising 128 patients (Chawalparit et al, 2006; Thornbury et al, 1993). The studies demonstrated sensitivities of 81% and 92%, and specificities of 100% and 52%, respectively (Figure 0-35). The studies used a different reference standard (findings at surgery versus expert panel consensus), thus precluding statistical pooling. The individual study results are also shown in Table 5.1-8.

Figure 0-35 Forest plot of primary studies describing sensitivity and specificity of MRI for lumbar disc herniation and nerve root compression, with accompanying 95% confidence intervals



Source: Wassenaar et al (2012), Figure 4, p224

Abbreviations: CI, confidence interval; FN, false negative; FP, false positive; TN, true negative; TP, true positive.

Table 0-8 Results of bivariate analysis with summary estimates of diagnostic accuracy, and the prior probability of the condition

| Target condition | Source | Reference standard | Sensitivity (95% CI) | Specificity (95% CI) | Prior probability (range) | LR+ (95% CI) | LR- (95% CI) | DOR (95% CI) |
|------------------------------------|------------------|-----------------------|----------------------|----------------------|---------------------------|-------------------|-------------------|---------------------|
| LDH | Pooled estimates | Surgery | 75 (65, 83) | 77 (61, 88) | 63 (mean) (49, 77) | 3.30 (1.76, 6.21) | 0.33 (0.21, 0.50) | 10.12 (3.88, 26.39) |
| LDH causing nerve root compression | Study 1 | Surgery ⁶⁴ | 81 (63, 93) | 100 (16, 100) | 93.9 (NR) | NR | NR | NR |
| | Study 2 | Expert panel | 92 (83, 97) | 52 (30, 74) | 77.9 (NR) | NR | NR | NR |

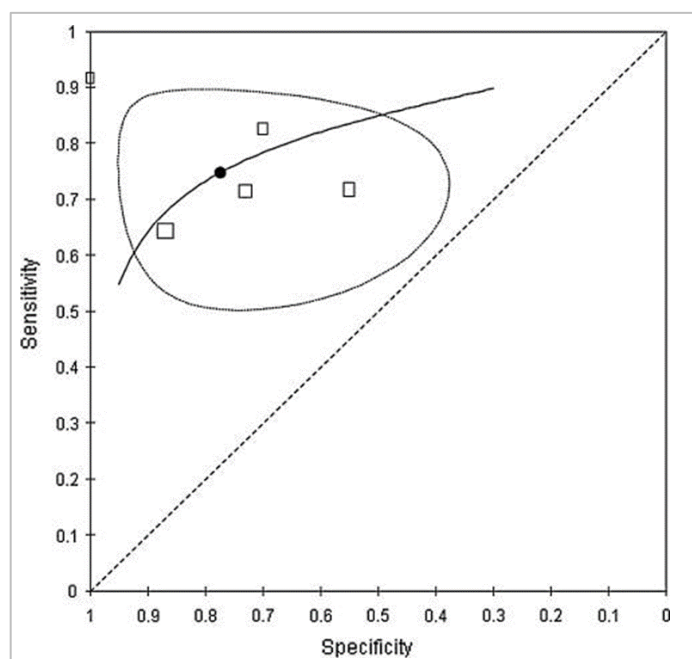
Source: Wassenaar et al (2012), Table 2

Abbreviations: CI, confidence interval; DOR, diagnostic odds ratio; LDH, lumbar disc herniation; LR, likelihood ratio; QUADAS, Quality Assessment of Diagnostic Accuracy Studies.

⁶⁴ Partial verification: performed on only those patients who underwent surgery.

The pooled estimates of sensitivity and specificity from the five studies that described the diagnostic accuracy of MRI compared with surgical findings for identifying HNP are presented in the summary ROC curve shown in Figure 0-36.

Figure 0-36 Hierarchical SROC curve based on bivariate analysis of the five included studies of MRI



Source: Wassenaar et al (2012), Figure 5, p225

Abbreviations: CI, confidence interval; HNP, herniated nucleus pulposus; MRI, magnetic resonance imaging; SROC, summary receiver operating characteristics.

Note: The five studies assessed the diagnostic accuracy of MRI for identifying lumbar disc herniation, using surgical findings as a reference standard. The width of the rectangles is proportional to the number of patients with possible or without lumbar disc herniation; the height of the blocks is proportional to the number of patients with lumbar disc herniation (proven or probable). The solid line is the SROC curve; the black spot is the mean value for sensitivity and specificity; the ellipse around the black spot represents the 95% CI around this summary estimate. Note: one study by Birney et al, (1992) was excluded from the pooled analysis as it presented the results for the combined identification of HNP and degenerative disc disease.

The findings from this review suggest that a considerable proportion of patients are being incorrectly classified as false negative or false positive using MRI for the identification of HNP. However, due to the limited number of studies, heterogeneity amongst the included studies, large variation in prior probabilities in the underlying pathologies of LBP, and the lack of a gold reference standard, the authors warn that these results should be interpreted with caution and may not be generalisable beyond the secondary care setting. As mentioned earlier, surgery – especially when combined with clinical follow-up – is often regarded as the best reference test, but is subject to partial verification bias as often only patients with a strong suspicion of a specific underlying cause will be subjected to surgery.

The authors pose that the value of MRI in identifying lumbar spinal pathology largely depends on the role of MRI results in clinical decisions regarding the management of LBP or sciatica and resulting outcomes. This could be either to exclude patients without the target condition to spare invasive treatments, or to identify as many patients as possible when delayed treatment results in worse patient outcomes. The role of MRI thereby largely depends on the suspected underlying pathology as

well as the setting and patient characteristics. The authors acknowledge that their review assessed the accuracy of the isolated use of MRI; combined diagnostic information from MRI with other clinical observations or test results may provide different estimates of diagnostic accuracy.

Jarvik and Deyo 2002

The systematic review by Jarvik and Deyo (2002) described the diagnostic accuracy of plain radiography, CT, and MRI in the diagnosis of lumbar disc herniation in adult patients with LBP (Table 5.1-9).

The review identified two studies that compared the diagnostic accuracy of CT to MRI in the diagnosis of herniated disc (Thornbury et al, 1993; Jackson et al, 1989b), both of which were identified in the reviews by van Rijn et al (2012) and Wassenaar et al (2012). There were no studies that assessed the diagnostic accuracy of plain radiography in the diagnosis of herniated disc; the authors stated that radiographs cannot directly visualise discs and are insensitive to herniations.

In the two included diagnostic studies, CT had sensitivities ranging from 62% to 90%, and specificities ranging from 70% to 87%. MRI had sensitivities ranging from 60% to 100%, and specificities ranging from 43% to 97%. In one study with expert consensus as a reference standard (Thornbury et al, 1993),⁶⁵ the area under the ROC was 0.81 to 0.84 for MRI versus 0.85 to 0.86 for CT. Therefore, based on the available evidence, CT and MRI appear to be almost equal in accuracy in terms of diagnosing herniated discs.

Table 5.1-9 Diagnostic accuracy of imaging techniques for lumbar disc herniation

| Index test | Sensitivity (%) | Specificity (%) | Positive LR | Negative LR |
|------------|-----------------|-----------------|-------------|-------------|
| CT | 62-90 | 70-87 | 2.1-6.9 | 0.11-0.54 |
| MRI | 60-100 | 43-97 | 1.1-33 | 0-0.93 |
| X-ray | NA | NA | NA | NA |

Source: Jarvik and Deyo (2002), Table 3, p589

Abbreviations: CT, computed tomography; LR, likelihood ratio; MRI, magnetic resonance imaging; NA, not available.

Moranjkic et al 2011

There was one study identified after the search date of the systematic reviews by van Rijn et al (2012) and Wassenaar et al (2012). The small prospective observational study by Moranjkic et al (2011) compared the diagnostic accuracy of MRI and CT in detecting lumbar disc herniation (extrusions), with surgical findings as the reference standard. The study included 70 patients with radicular pain who underwent surgery for lumbar disc herniation based on either MRI findings (30 patients, mean age 45.3 years) or CT scan findings (40 patients, mean age 46.2 years). The diagnostic accuracy of MRI and CT were compared and the relationship between the type of imaging test

⁶⁵ Thornbury et al (1993) established an expert panel to review all initial radiographic and clinical data and 6-month follow-up data. Radiologists were blinded to the final diagnosis, which was made with knowledge of the imaging tests being evaluated (diagnosis review bias).

performed preoperatively and outcome was determined. This study was considered to be of fair methodological quality.

The study showed that MRI and CT had similar sensitivity in detecting disc extrusions (91.6% and 92.3%, respectively). Specificity in detecting extrusions was 66.7% for MRI and 85.7% for CT. The authors claimed that ROC curve analysis revealed a more favourable diagnostic profile for MRI (AUROC=0.875; 95% CI 0.686-0.959) as compared to CT (AUROC=0.624; 95% CI 0.437-0.810).

The authors concluded that for radiological evaluation of lumbar herniated discs, there is no evidence that spinal CT is inferior to MRI; for evaluation of lumbar nerve root compression, spiral CT is less reliable than MRI. Since both CT and MRI exhibit similar sensitivities and specificities in identifying lumbar disc extrusions, the authors pose that CT constitutes a viable preoperative diagnostic option prior to lumbar disc surgery.

Although not directly relevant to the PICO criteria for this Review, the study also found no statistically significant difference between the type of preoperative neuroradiological examination (CT versus MRI) and recovery after surgery, as assessed at six months using the Roland-Morris Low Back Pain and Disability Questionnaire and pain severity on a Visual Analogue Scale.

5.1.5. Cauda equina syndrome

No studies or systematic reviews were identified evaluating the diagnostic accuracy of any type of imaging for the diagnosis of cauda equina syndrome.

The systematic review by Jarvik and Deyo (2002) concluded that CT or MRI and surgical evaluation should be done immediately in patients with symptoms of the cauda equina syndrome. However, the review did not identify any relevant studies that described the diagnostic characteristics of these imaging modalities in this patient population.

5.1.6. Suspected spinal canal stenosis

There were three systematic reviews that reported the diagnostic accuracy of imaging (MRI, CT, X-ray) in the diagnosis of spinal stenosis in patients with LBP (van Rijn et al, 2012; Wassenaar et al, 2012; Jarvik and Deyo 2002).

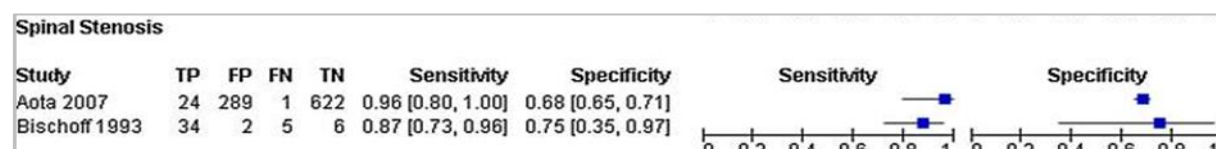
The systematic review by van Rijn et al (2012) failed to identify any studies that evaluated the diagnostic accuracy of CT in the detection of spinal stenosis in patients with LBP.

Wassenaar 2012

The systematic review by Wassenaar et al (2012) identified two studies that evaluated the diagnostic accuracy of MRI in the identification of spinal stenosis in adult patients with LBP or sciatica, comprising 118 patients and 983 foramina (Aota et al, 2007; Bischoff et al, 1993). Both studies used findings at surgery as the reference standard. The two studies showed MRI had high sensitivities of 96% and 87%, and lower specificities of 68% and 75%, respectively (Figure 5.1-6). Pooling of summary estimates was not performed for these two studies due to the wide variation in prior

probabilities (the prevalence of spinal canal stenosis was 2.7% in one study and 82.9% in the other). The review authors did not report the characteristics of the two included studies in their publication, but stated that the difference in prior probabilities may have been due to different population characteristics or the unequal number of foramina/levels assessed in each study. In terms of the quality of the individual studies, only one (Bischoff et al, 1993) blinded the reference standard results; however, the representativeness of the patient population was unclear for this study due to poor reporting.

Figure 0-37 Forest plot of primary studies describing sensitivity and specificity of MRI for spinal stenosis, with accompanying 95% confidence intervals



Source: Wassenaar et al (2012), Figure 4, p224.

Abbreviations: FN, false negative; FP, false positive; TN, true negative; TP, true positive.

Jarvik and Deyo 2002

The systematic review by Jarvik and Deyo (2002) aimed to describe the diagnostic accuracy of plain radiography, CT, and MRI for detecting spinal canal stenosis in adult patients with LBP (Table 0-38). There were no studies identified that assessed the diagnostic accuracy of spinal stenosis causing LBP. The authors claim that radiographs only detect compromise of the vertebral canal by bone; thus, myelography, CT, and MRI are more sensitive for central stenosis because they depict compromise by soft tissue as well.

The review refers to an earlier 'literature synthesis' of the accuracy of imaging (CT, MRI and myelography) for the diagnosis of lumbar spinal stenosis in adults without prior surgery (Kent et al, 1992), which identified two MRI studies, ten CT studies and three studies that employed both MRI and CT. The authors of the literature synthesis claimed that data could not be pooled because the studies varied greatly in case selection, definition of test and disease categories, and geographic locale. It is not clear whether any of these studies included patients with LBP as the publication noted abnormal findings in asymptomatic patients.

Nevertheless, based on the quoted ranges from Kent et al (1992), the Jarvik and Deyo (2002) review concluded that MRI and CT had similar sensitivities and specificities for the diagnosis of spinal stenosis in patients with LBP.

Table 0-38 Diagnostic accuracy of imaging techniques for spinal stenosis

| Index test | Sensitivity (%) | Specificity (%) | Positive LR | Negative LR |
|------------|----------------------|-----------------|-------------|-------------|
| CT | 70-100 ⁶⁶ | 80-96 | 4.5-22 | 0.10-0.12 |
| MRI | 81-97 ⁶⁶ | 72-100 | 3.2-ND | 0.10-0.14 |
| X-ray | NA | NA | NA | NA |

Source: Jarvik and Deyo (2002), Table 3, p589

Abbreviations: CT, computed tomography; LR, likelihood ratio; MRI, magnetic resonance imaging; NA, not available; ND, not defined.

5.1.7. Suspected inflammatory spondyloarthritis

There were four systematic reviews that aimed to assess the accuracy of imaging (CT, MRI, X-ray) in the diagnosis of inflammatory spondyloarthritis in patients with LBP (van Rijn et al, 2012; Wassenaar et al, 2012; Sidiropoulos et al, 2008; Jarvik and Deyo, 2002).

The systematic reviews by van Rijn et al (2012) and Wassenaar et al (2012) investigated the diagnostic accuracy of CT and MRI, respectively, and did not identify any relevant studies.

A search to update the evidence from the systematic literature search conducted by Sidiropoulos et al (2008) identified a small case-control study that assessed the diagnostic accuracy of MRI and plain radiography in the early diagnosis of spondyloarthropathy (Shankar et al, 2009).

Sidiropoulos 2008

Sidiropoulos et al (2008) presented evidence that assessed the sensitivity and specificity of X-ray, CT, and MRI in the diagnosis of suspected sacroiliitis. Table 0-39 shows pooled estimates of the diagnostic accuracy of X-ray, CT and MRI for various findings; MRI had a low sensitivity (40%) for active inflammatory changes and an even lower sensitivity (27%) for chronic inflammatory changes in sacroiliac joints, but specificity was high for both (100% and 94%, respectively). Likewise, plain radiography and CT had low sensitivity (35% and 49%, respectively) but high specificity (100% for both X-ray and CT) in identifying changes associated with sacroiliitis.

⁶⁶ Sensitivity for both MRI and CT are reported as 90% in Table 3 of Jarvik and Deyo (2002), but the text (p590 and p592) reports the ranges quoted here.

Table 0-39 Diagnostic accuracy of imaging techniques for patients with suspected sacroiliitis

| Imaging | Indication | Number of studies | Total number of patients | Sensitivity (%) | Number of studies | Total number of MLBP controls | Specificity (%) |
|---------|--------------------------------|-------------------|--------------------------|-----------------|-------------------|-------------------------------|-----------------|
| X-ray | Sacroiliitis | 18 | 2015 | 35 | 2 | 159 | 100 |
| CT | Sacroiliitis | 10 | 247 | 49 | 1 | 13 | 100 |
| MRI | Sacroiliitis – active changes | 8 | 344 | 40 | 1 | 12 | 100 |
| | Sacroiliitis – chronic changes | 5 | 241 | 27 | 1 | 48 | 94 |

Source: Sidiropoulos et al (2008), Table S4 (Supplementary Data)

Abbreviations: CT, computed tomography; MLBP, mechanical low back pain; MRI, magnetic resonance imaging.

Note: This table presents the diagnostic properties of imaging in studies assessing patients with suspected AS (based on suggestive IBP and/or physical examination and/or limitation of spinal mobility). Controls were either MLBP or a broader spectrum (MLBP, rheumatic diseases, healthy). There were no studies reporting on the diagnostic properties of CT in sclerosis.

The Sidiropoulos et al (2008) review notes that only one study assessed the diagnostic accuracy of MRI in patients at a pre-radiographic stage (Brandt et al, 1999). The study population was 58 patients with early AS (axial spondylarthropathy according to expert opinion), with 68 MLBP patients as controls. Active inflammatory changes in sacroiliac (SI) joints had both high sensitivity (87.9%) and specificity (98.5%), and thus an extremely high likelihood ratio (58.6). In the same study, sensitivity of MRI for active lesions in the spine was lower (40.9%).

The Sidiropoulos et al (2008) review states that MRI represents a significant advance in the diagnosis of ankylosing spondylitis during the pre-radiographic stage. Active inflammation in SI joints is depicted by MRI years prior to plain radiography. In recognition of the high cost of MRI and limited availability of MRI at the time, the guideline proposes that MRI is undertaken to identify inflammation of the SI joints and spine in those cases of early ankylosing spondylitis where radiographs of the SI joints are normal or equivocal. The authors note that CT is a sensitive tool for identifying structural changes of the SI joints but the risks of radiation exposure need to be considered.

Jarvik and Deyo 2002

The systematic review by Jarvik and Deyo (2002) described the accuracy of plain radiography, CT, and MRI for diagnosing ankylosing spondylitis in patients with LBP (Table 0-40). There were no studies identified that assessed the diagnostic accuracy of CT for detecting sacroiliitis. One prospective cross-sectional study (Marc et al, 1997), assessed 31 patients with spondyloarthropathy and 14 controls with mechanical spinal disease, although the reference standard used to assemble these populations is not reported by Jarvik and Deyo (2002). Radiography (anteroposterior and lateral views only) had a sensitivity of 45% and a specificity of 100%, although the authors note that spectrum bias may have inflated both measurements. In the same study, MRI had a sensitivity of 55% (reportedly, specificity

could not be determined). Abnormalities on MRI were often visible early in the disease process, at a time when there were not yet any clinical manifestations or radiographic or bone scan changes.

Table 0-40 Diagnostic accuracy of imaging techniques for ankylosing spondylitis (sacroiliitis)

| Index test | Sensitivity (%) | Specificity (%) | Positive LR | Negative LR |
|------------|------------------|-----------------|-------------|-------------|
| CT | NA | NA | NA | NA |
| MRI | 55 ⁶⁷ | NA | NA | NA |
| X-ray | 45 ⁶⁸ | 100 | NA | 0.55-0.74 |

Source: Jarvik and Deyo (2002), Table 3

Abbreviations: CT, computed tomography; LR, likelihood ratio; MRI, magnetic resonance imaging; NA, not available.

Shankar 2009

A small case-control study by Shankar et al (2009) assessed the diagnostic accuracy of MRI and plain radiography in the early diagnosis of spondyloarthropathy at a large tertiary care hospital in South India. The study included 33 adults with inflammatory LBP of less than two years' duration, defined according to the Calin criteria and satisfying the European Spondyloarthropathy Study Group (ESSG) criteria. An equal number of controls were included from patients presenting with mechanical low backache and having an established diagnosis to explain the pain, such as prolapsed intervertebral disc or spondylolisthesis. Although not clear from the publication, the reference standard appears to be detailed clinical assessment and assessment of disease activity and functional impairment. This study was considered to be of poor methodological quality.

The study found that plain radiography played no role in the early diagnosis of spondyloarthropathy as it did not detect any inflammatory or structural changes, and was normal in all study participants.

MRI had a sensitivity of 87.9% (abnormalities present in 29/33 patients), a specificity of 100% (no abnormalities detected in the control group), a positive predictive value of 100% and a negative predictive value of 89.19%. All inflammatory changes (synovial enhancement, bone marrow oedema and subchondral oedema) were detected by MRI in the study group. MRI also picked up structural changes, such as bone erosion before they appeared on conventional radiograph while among structural changes (erosions, sclerosis and ankylosis) ankylosis was not detected by MRI. Bone marrow oedema was the most common finding and was seen in 26/29 (90%) patients with positive MRI findings.

The authors concluded that MRI was a highly sensitive imaging modality for the early detection of inflammatory and structural changes of sacroiliitis, with changes apparent as early as three months of disease. They reiterated that MRI is the method of choice in the evaluation of sacroiliitis in patients with early spondyloarthropathy due to the higher quality of images, absence of ionising radiation, and mainly the capacity of detecting and differentiating acute and chronic alterations.

⁶⁷ This result is reported in Jarvik and Deyo (2002) as 56% in Table 3 and 55% in the text (p592).

⁶⁸ This result is reported in Jarvik and Deyo (2002) as 26-45% in Table 3 and 45% in the text (p590).

However, as a diagnostic case-control study, sensitivity and specificity may be exaggerated compared with clinical practice because patients with borderline or mild expressions of the disease, and conditions mimicking the disease are excluded (spectrum bias).

5.1.8. Suspected spinal malignancy

There were three systematic reviews that aimed to assess the accuracy of imaging (CT, MRI, X-ray) in the diagnosis of spinal malignancy in patients with LBP (van Rijn et al, 2012; Wassenaar et al, 2012; Jarvik and Deyo, 2002).

The systematic reviews by van Rijn et al (2012) and Wassenaar et al (2012) aimed to investigate the diagnostic accuracy of CT and MRI, respectively; however, no relevant studies were identified.

Jarvik and Deyo 2002

The systematic review by Jarvik and Deyo (2002) described the diagnostic accuracy of plain radiography, CT, and MRI for spinal malignancy in adult patients with LBP (Table 0-41). There were no studies identified that assessed the diagnostic accuracy of CT in detecting spinal malignancy. Based on one study in primary care patients (Deyo et al, 1988), the presence of a lytic or blastic lesion on plain radiographs was 60% sensitive and 99.5% specific for cancer. Sensitivity improved to 70% when compression fractures were included in the analysis, but specificity declined to 95%.

The Jarvik and Deyo (2002) review refers to five studies that assessed the accuracy of MRI for diagnosing spinal metastases; however, the relationship between these five studies and the results reported in Table 0-41 is unclear. Furthermore, it is unclear whether any of the study populations related to patients presenting with LBP. Nevertheless, the table below shows that the sensitivity of MRI ranged from 83% to 93% for detection of spinal malignancy, and specificity ranged from 90% to 97%. The authors concluded that MRI is probably more sensitive and specific than other imaging tests for detecting malignancies causing LBP.

Table 0-41 Diagnostic accuracy of imaging techniques for spinal malignancy

| Index test | Sensitivity (%) | Specificity (%) | Positive LR | Negative LR |
|------------|-----------------|-----------------|-------------|-------------|
| CT | NA | NA | NA | NA |
| MRI | 83-93 | 90-97 | 8.3-31 | 0.07-0.19 |
| X-ray | 60 | 99.5 | 12-120 | 0.40-0.42 |

Source: Jarvik and Deyo (2002), Table 3, p589

Abbreviations: CT, computed tomography; LR, likelihood ratio; MRI, magnetic resonance imaging; NA, not available.

5.1.9. Suspected spinal infection

There were three systematic reviews that aimed to assess the accuracy of imaging (CT, MRI, X-ray) in the diagnosis of spinal infection in patients with LBP (van Rijn et al, 2012; Wassenaar et al, 2012; Jarvik and Deyo, 2002).

The systematic reviews by van Rijn et al (2012) and Wassenaar et al (2012) aimed to investigate the diagnostic accuracy of CT and MRI, respectively; however, no relevant studies were identified.

Jarvik and Deyo 2002

The systematic review by Jarvik and Deyo (2002) described the diagnostic accuracy of plain radiography and MRI for spinal infection in adult patients with LBP (Table 0-42); there were no studies identified that assessed the diagnostic accuracy of CT for detecting spinal infection. A single “well-designed” study in 37 patients who were clinically suspected of having vertebral osteomyelitis reported that X-ray had a sensitivity of 82% and a specificity of 57% (Modic et al, 1985). The same study demonstrated that MRI was more accurate than plain radiography with a sensitivity of 96% and specificity of 92%. The review authors concluded that MRI is probably more sensitive and specific than other imaging tests for detecting infections causing back pain; however, it is not clear whether patients in the included study by Modic et al (1985) presented with LBP. The authors of the systematic review note that MRI better delineates the extent of infection, which is critical in determining the need for surgery. They claim that for vertebral infections, similar to metastases, radiographic changes occur relatively late and changes are not specific.

Table 0-42 Diagnostic accuracy of imaging techniques for spinal infection

| Index test | Sensitivity (%) | Specificity (%) | Positive LR | Negative LR |
|------------|-----------------|-----------------|-------------|-------------|
| CT | NA | NA | NA | NA |
| MRI | 96 | 92 | 12 | 0.04 |
| X-ray | 82 | 57 | 1.9 | 0.32 |

Source: Jarvik and Deyo (2002), Table 3, p589

Abbreviations: CT, computed tomography; LR, likelihood ratio; MRI, magnetic resonance imaging; NA, not available.

5.1.10. Suspected vertebral fracture

There were three systematic reviews that aimed to assess the accuracy of imaging (CT, MRI, X-ray) in the diagnosis of vertebral fracture in patients with LBP (van Rijn et al, 2012; Wassenaar et al, 2012; Jarvik and Deyo, 2002).

The systematic reviews by van Rijn et al (2012) and Wassenaar et al (2012) aimed to investigate the diagnostic accuracy of CT and MRI, respectively, for the detection of spinal fractures in adult patients with LBP; however, no relevant studies were identified.

The systematic review by Jarvik and Deyo et al (2002) comment that radiographs may be adequately sensitive for vertebral compression fractures but they are poor at distinguishing acute and chronic fracture. They claim MRI is more specific than radiology for compression fractures because it identifies bone marrow oedema or an associated hematoma. However, the review did not present the diagnostic characteristics of any imaging modality in the diagnosis of fractures to support this claim.

5.2. Change in patient management

The following section describes how different models and modalities of diagnostic imaging impact on the clinical management of patients with LBP.

5.2.1. Search results

As described in Section 2.3, the search for evidence of imaging studies in patients with LBP with suspected serious underlying pathology or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy failed to identify any studies that assessed the effect of imaging on change in patient management. Thus, a separate literature search was conducted for this outcome and the results are outlined below.

Five publications/reports describing four studies were identified that assessed the effect of imaging on change in patient clinical management. The citation details of the five publications are shown in Table 0-43. It should be noted that Gillan et al (2001) provides a description of a subgroup of patients also included in Gilbert et al (2004).

Table 0-43 Identified original studies for imaging in low back pain – change in patient management

| Ref ID | Citation |
|--------------|--|
| Li 2011 | Li, A. L. and D. Yen (2011). "Effect of increased MRI and CT scan utilization on clinical decision-making in patients referred to a surgical clinic for back pain." <i>Can J Surg</i> 54(2): 128-132. |
| Dey 2004 | Dey, P., C. W. Simpson, et al. (2004). "Implementation of RCGP guidelines for acute low back pain: a cluster randomised controlled trial." <i>Br J Gen Pract</i> 54(498): 33-37. |
| Gilbert 2004 | Gilbert, F. J., A. M. Grant, et al. (2004). "Does early imaging influence management and improve outcome in patients with low back pain? A pragmatic randomised controlled trial." <i>Health Technol Assess</i> 8(17): iii, 1-131. |
| Gillan 2001 | Gillan, M. G., F. J. Gilbert, et al. (2001). "Influence of imaging on clinical decision making in the treatment of lower back pain." <i>Radiology</i> 220(2): 393-399. |
| Rankine 1998 | Rankine, J. J., K. P. Gill, et al. (1998). "The therapeutic impact of lumbar spine MRI on patients with low back and leg pain." <i>Clin Radiol</i> 53(9): 688-693. |

5.2.2. Overview of the included studies

Two RCTs, one prospective cohort study with a historical control group, and one prospective cohort study in which all patients received management plans based on both clinical and imaging assessments were included. The characteristics of these studies are presented in Table 0-44.

The study by Rankine et al (1998) provides the most useful data for the change in management outcome, as it is the only study that specifically measures the impact of performing imaging with MRI on patient management within individual patients. This study also has a patient population that is within the population defined for this Review.

The study by Gilbert et al (2004) provides a randomised comparison of the diagnosis and subsequent management of early MRI/CT for all patients in whom the need for imaging is uncertain, compared with standard practice in which MRI/CT imaging is only performed if/when clinically indicated. Dey et al (2004) also provide a randomised comparison in which the use of X-ray in patients presenting to clinics that have undergone education on clinical guidelines that recommend against use of X-rays is compared with patients presenting to clinics that have not undergone this education. A broader

population of patients with LBP are included in these studies, some of whom may overlap with the population defined for this Review.

Finally, the study by Li et al (2011) compared change in investigations and clinical outcomes in patients presenting to a surgical clinic during two different time periods (2009 and 1996) using a historical cohort as a comparator. This study, while providing some information on change in management, is the least relevant to this Review.

Table 0-44 Characteristics of identified original studies for imaging in low back pain – change in management

| Ref ID and Quality ^a | Study design | Country (number of centres) | Population | Intervention | Comparator | Outcome |
|---|--------------------------|-----------------------------|--|--|---|---|
| <ul style="list-style-type: none"> Rankine 1998 Fair quality | Prospective cohort study | UK (1) | Patients with low back and leg pain, with a clinical diagnosis of neural compression, referred by their GP to a specialist surgical spinal clinic; N=72 | Post-MRI | Pre-MRI | Change in management following receipt of MRI results |
| <ul style="list-style-type: none"> Gilbert 2004, Gillan 2001 Good quality | RCT – 2 year follow-up | UK (15) | Patients with symptomatic lumbar spine disorders for whom there was clinical uncertainty about whether to perform imaging; N=782 | MRI or CT as soon as possible | No MRI or CT unless a clear clinical indication developed (e.g. a decision to perform surgery) or the clinical situation deteriorated | Therapeutic impact (change in treatment plan following imaging) |
| <ul style="list-style-type: none"> Dey 2004 Fair quality | Cluster RCT | UK (44) | Aged 18 to 64, registered with a GP in one of three Primary Care Groups, consulted their GP about an episode of acute LBP for which they had not already sought advice in the previous 6 months. | Practices offered outreach visits to promote national guidelines on acute LBP, ⁶⁹ access to fast-track physiotherapy and a triage service for patients with persistent symptoms | No outreach visits etc. | Change in: <ul style="list-style-type: none"> referral for X-ray sickness certificate prescribed opioids or muscle relaxants referral to secondary care referral to physiotherapist or education program |

⁶⁹ Royal College of General Practitioners (RCGP). Clinical guidelines for the management of acute low back pain. ([url supplied in publication; can no longer be accessed](#)).

| Ref ID and Quality ^a | Study design | Country (number of centres) | Population | Intervention | Comparator | Outcome |
|--|---|-----------------------------|---|---|--|---|
| <ul style="list-style-type: none"> • Li 2011 • <i>Poor quality</i> | Prospective cohort study with a historical comparator | UK (1) | <p>Patients with LBP who had pain in the thoracic or lumbar spine who had not previously seen a surgeon. Patients with fracture or progressive neurologic deficits that required immediate assessment were excluded.</p> <p>N=160</p> | Consultations conducted from April to June 2009 | Consultations conducted from April to May 1996 | <p>Change in:</p> <ul style="list-style-type: none"> • investigations • clinical outcomes |

Abbreviation: CT, computed tomography; GP, general practitioner; LBP, low back pain; MRI, magnetic resonance imaging; RCT, randomised controlled trial.

^a See Appendix 6 for quality assessment forms.

5.2.3. Results

The results of each of the included change in management studies are described in detail below.

Rankine 1998

The aim of the study by Rankine et al (1998) was to assess the therapeutic impact of performing MRI in patients with low back and leg pain and with a clinical diagnosis of spinal stenosis who were referred to a specialist surgical spinal clinic. In this prospective cohort study, 72 patients had a clinical history, physical examination, and tests of functional and psychological disability undertaken at the time of the request for the MRI. A diagnosis management plan was developed based on the initial findings, and then revised if required following receipt of the MRI findings. This study was considered to be of fair methodological quality, primarily because two triage clinicians were included in the study (a physiotherapist and a nurse) and there was no discussion regarding the consistency of their initial and updated management plans.

More than half the diagnoses changed following receipt of the MRI results. Most notably, only half of the 46 patients diagnosed with a disc prolapse based on the clinical assessment retained that diagnosis following MRI. In addition, the number of patients retaining their initial diagnosis after MRI was lower for the following diagnoses: spinal stenosis (6 patients to 2 patients), non-specific LBP (5 patients to 2 patients), foraminal stenosis (3 patients to 1 patient), loading/spinal instability (2 patients to 1 patient), vascular disease (1 patients to 0 patients), annular tear (1 patient to 0 patients) and ligament strain (1 patient to 0 patients).

As shown in Table 0-45, two out of 17 patients given a conservative management plan following the clinical assessment had it changed to surgery following receipt of the MRI results. Most notably, however, 23 out of 48 patients given a surgical management plan following the clinical assessment had that changed to conservative management following MRI. Clinical, examination and MRI findings were assessed to see if any were significant predictors of final conservative or surgical management. Sudden onset of pain was a significant predictor of conservative management, while male gender, below knee leg pain, and compression on MRI were all significant predictors of surgical management. Based on the results of their study, the authors concluded that “MRI is appropriate in any patient where a surgical option is considered and will therefore depend on local surgical practice.”

Table 0-45 Rankine 1998 – Management plan pre- and post-MRI

| Management plan before MRI | Management plan after MRI –conservative | Management plan after MRI – surgery | Total patients |
|----------------------------|---|-------------------------------------|-----------------------|
| Conservative | 15 | 2 | 17 |
| Further investigations | 4 | 3 | 7 |
| Surgery | 23 | 25 | 48 |
| Total patients | 42 | 30 | 72 |

Source: Rankine et al (1998): Table 4, p 690.

Abbreviation: MRI, magnetic resonance imaging.

Gilbert 2004

The aim of the study by Gilbert et al (2004) was to determine whether the early use of MRI or CT influences the management and clinical outcome of patients with LBP; only the diagnosis, management and therapeutic portions of the study will be reported here. A subgroup study is also described in this report, as well as being published by Gillan et al (2011).

A total of 782 patients who had been referred to a consultant orthopaedic specialist or neurosurgeon in one of 15 hospitals in Scotland (14) or England (1) over a 24-month period were included. Patients were randomised to either 'early imaging' (MRI or CT as soon as practicable) or 'delayed, selective imaging' (no imaging unless a clear clinical indication developed). The actual use of imaging in the trial was 89.8% in the 'early imaging' group (82.5% MRI and 7.4% CT) and 29.6% in the 'delayed, selective imaging' group (24.4% MRI and 5.1% CT). This study was considered to be of good methodological quality.

In the before-and-after analysis of a subgroup of 145 patients presented in Table 0-46, Gilbert et al (2004)⁷⁰ found no significant difference in change in diagnosis or change in treatment between the two groups, although a slightly higher proportion of patients in the 'delayed, selective imaging' group compared with the 'early imaging' group had their diagnosis altered during the course of the study (54% versus 43%). Based on the before-and-after subgroup study, Gillan et al (2011) conclude that "imaging may increase diagnostic confidence [results not shown here] but has minimal influence on diagnostic or therapeutic decisions for patients with LBP."

Table 0-46 Gilbert 2004 – Changes in diagnosis and treatment between trial entry and follow-up assessments (subgroup analysis)

| Change | Description | Early imaging number (%) | Delayed, selective imaging number (%) | Chi-squared between-groups P value |
|------------------------------|-------------------------|--------------------------|---------------------------------------|------------------------------------|
| Diagnosis altered | Yes | 35 (43.2) | 34 (54.0) | 0.27 |
| | No | 46 (56.8) | 29 (46.0) | N/A |
| Treatment altered | Yes | 39 (50.6) | 29 (46.8) | 0.73 |
| | No | 38 (49.4) | 33 (53.2) | N/A |
| Change in proposed treatment | Change to less invasive | 27 (35.1) | 18 (29.0) | 0.75 |
| | No change | 38 (49.4) | 33 (53.2) | N/A |
| | Change to more invasive | 12 (15.6) | 11 (17.7) | N/A |

Source: Gilbert et al (2004): Table 5, p 18 and Table 6, p 19.

Gilbert et al (2004) also examined the differences in management over the two years of the study in patients randomised to 'early imaging' compared with 'delayed, selective imaging'. As shown in Table

⁷⁰ Also presented in Gillan et al (2011).

0-47, the only significant difference between groups was the higher number of outpatient consultations for the 'early imaging' group (83.5% versus 67.9%). Of those who had an outpatient consultation, there were fewer consultations per patient in the 'early imaging' group compared with the 'delayed, selective imaging' group (2.29 versus 2.77), thus resulting in similar per patient outpatient consultations across the whole trial population (1.91 versus 1.88).

Based on their assessment of the effect of 'early imaging' on diagnosis, clinical management, therapeutic management and clinical outcome, the authors note that "although the early use of MRI does not appear to affect management overall, the benefit that it delivers is of questionable clinical benefit."

Table 0-47 Gilbert 2004 – Difference in management (all patient analysis)

| Management | Description | Early imaging n (%) | Delayed, selective imaging n (%) | P value |
|--------------------------|-----------------------------------|---------------------|----------------------------------|---------|
| Outpatient consultations | Yes | 328 (83.5) | 264 (67.9) | <0.001 |
| | No | 49 (12.5) | 95 (24.4) | N/A |
| | Did not attend | 16 (4.1) | 30 (7.7) | N/A |
| Admitted to hospital | Yes | 31 (7.9) | 26 (6.7) | 0.52 |
| | No | 362 (92.1) | 363 (93.3) | |
| Surgery | Yes | 27 (6.9) | 20 (5.1) | 0.31 |
| | No | 364 (92.6) | 363 (93.3) | N/A |
| | Waiting list/referred | 1 (0.3) | 3 (0.8) | N/A |
| | Referred but patient declined | 1 (0.3) | 2 (0.5) | N/A |
| | Referred but no evidence in notes | 0 | 1 (0.3) | N/A |
| Injections | Yes | 70 (17.8) | 76 (19.5) | 0.54 |
| | No | 320 (81.4) | 313 (80.5) | N/A |
| | Referred but no evidence in notes | 1 (0.3) | 0 | N/A |
| | Did not attend | 2 (0.5) | 0 | N/A |
| Physiotherapy | Yes | 248 (63.1) | 233 (59.9) | ≥0.05 |
| | No | 134 (34.1) | 144 (37.0) | N/A |
| | Referred | 5 (1.3) | 6 (1.5) | N/A |
| | Did not attend | 6 (1.5) | 6 (1.5) | N/A |

Source: Gilbert et al (2004): Table 5, p 18 and Table 6, p 19.

Abbreviations: GP, general practitioner.

Table 0-6 Gilbert 2004 – Difference in physiotherapy management (all patient analysis)

| Management | Description | Early imaging n (%) | Delayed, selective imaging n (%) | P value |
|--|-------------|---------------------|----------------------------------|---------|
| Private physiotherapist/osteopath/chiropractor | Yes | 81 (22.0) | 94 (26.9) | ≥0.05 |
| | No | 288 (78.0) | 255 (73.1) | N/A |
| Back support/corset/brace | Yes | 111 (30.2) | 102 (29.1) | ≥0.05 |

| Management | Description | Early imaging n (%) | Delayed, selective imaging n (%) | P value |
|------------------------|-------------|---------------------|----------------------------------|---------|
| | No | 257 (69.8) | 248 (70.9) | N/A |
| GP consultations | Yes | 261 (70.7) | 244 (70.1) | ≥0.05 |
| | No | 108 (29.3) | 104 (29.9) | N/A |
| Prescription medicines | Yes | 261 (70.9) | 240 (69.0) | ≥0.05 |
| | No | 107 (29.1) | 108 (31.0) | N/A |
| Bought medicines | Yes | 150 (40.8) | 146 (42.2) | ≥0.05 |
| | No | 218 (59.2) | 200 (57.8) | N/A |
| Taken time of work | Yes | 156 (46.0) | 142 (44.9) | ≥0.05 |
| | No | 183 (54.0) | 174 (55.1) | N/A |

Source: Gilbert et al (2004): Table 5, p 18 and Table 6, p 19.

Abbreviations: GP, general practitioner.

Dey 2004

Dey et al (2004) aimed to investigate the impact of an educational strategy to promote the use of CPGs for acute LBP primary care management on patient management. The CPG was from the Royal College of General Practitioners (updated in 1999) and recommends that for uncomplicated episodes of acute LBP, lumbar spine X-ray is not required. This was a cluster-randomised trial in which 24 health centres were randomised to either an intervention arm, where centres were offered outreach visits to promote the guidelines as well as access to fast-track physiotherapy and a triage service for patients with persistent symptoms. Due to a lack of blinding and the subjective nature of the outcomes, this study was rated as fair quality.

The results of the study are summarised in Table 5.2-7 and show that there was no difference in the proportion of patients who were referred for X-ray between the intervention and control groups. A multivariate analysis, adjusted for primary care group, health centre population and manually or computer-stored records had no effect on the results.

Table 5.2-7 Dey 2004 – Comparison of outcome measures

| Outcome | Intervention number (%) | Control number (%) | Chi-squared P value |
|--|-------------------------|--------------------|---------------------|
| Referred for X-ray | 158 (15.1) | 156 (13.7) | 0.62 |
| Sickness certificates | 186 (17.7) | 219 (19.2) | 0.74 |
| Prescribed opioids or muscle relaxants | 196 (18.7) | 213 (18.7) | 0.99 |
| Referred for secondary care | 36 (3.4) | 26 (2.3) | 0.12 |
| Referred to physiotherapy or educational program | 273 (26.0) | 157 (13.8) | 0.01 |

Source: Dey et al (2004): Table 3, p37.

Li 2011

Li et al (2011) aimed to determine the association between radiologic and clinical diagnoses and measure the impact of the use of MRI and CT scans on patients referred to a surgical clinic for LBP for the purpose of a quality assurance assessment. In order to achieve this, the investigations and outcomes from two cohorts were compared: one from 1996 (N=142) and one from 2009 (N=160). It should be noted that patients with fracture or progressive neurological deficits who required immediate assessment were excluded from the study. Following assessment of the quality of this study, it was deemed to be of poor methodological quality for the purpose of this review due to the historical nature of the comparator group and the clinical assessors, the lack of characteristics with which to compare the two groups, and the lack of any adjustment for potential differences between the groups.

A summary of the results of the study are presented in Table 5.2-8. A significantly greater proportion of patients had an MRI investigation in the 2009 cohort compared with the 1996 cohort (74% versus 11%), while significantly fewer patients in the 2009 cohort had radiographs compared with the 1996 cohort (39% versus 68%). With regards to outcomes, the proportion of patients who required a “second opinion only” was reduced from 11% in 1996 to 3% in 2009. A greater proportion of patients in 2009 were considered to have “chronic pain not amenable to surgery” (34% versus 25%), however this was not statistically significant ($p=0.11$). The authors concluded that there was a “poor association between radiologic and clinical diagnoses of patients referred to a surgical clinic for low-back pain” and that “requiring an MRI and CT scan as a prerequisite to being seen at a surgical clinic is not an effective use of resources.”

Table 5.2-8 Li 2011 – Investigations and outcomes from 1996 and 2009

| Investigation/Outcome | Description | 1996 n (%) | 2009 n (%) | P value* |
|-----------------------|---|------------|------------|----------|
| Investigation | MRI | 15 (11) | 111 (73) | <0.001 |
| | CT | 50 (37) | 62 (41) | 0.52 |
| | Radiograph | 92 (68) | 60 (39) | <0.001 |
| | Bone scan | 9 (7) | 6 (4) | 0.43 |
| | Nerve conduction study | 3 (2) | 5 (3) | 0.73 |
| | Myelogram | 5 (4) | 1 (1) | 0.11 |
| | None | 8 (6) | 1 (1) | 0.014 |
| Outcome | Chronic pain not amenable to surgery | 36 (25) | 54 (34) | 0.11 |
| | Surgical candidates offered an operation | 27 (19) | 25 (16) | 0.44 |
| | Symptomatically improved to the point of not wanting an operation | 19 (13) | 16 (10) | 0.36 |
| | Second opinion only | 16 (11) | 5 (3) | 0.005 |
| | Mechanical back pain appropriate for referral to physiotherapy | 14 (10) | 14 (9) | 0.74 |

| Investigation/Outcome | Description | 1996 n (%) | 2009 n (%) | P value* |
|-----------------------|--|------------|------------|----------|
| | Inadequate trial of non-operative treatment; given a follow-up assessment | 12 (9) | 13 (8) | 0.92 |
| | No-show | 7 (5) | 8 (5) | 0.98 |
| | Medico-legal assessment | 5 (4) | 5 (3) | 0.85 |
| | Confirmation from a specialist that surgery was not required | 5 (4) | 13 (8) | 0.09 |
| | Seeking the cause for symptoms related to a body system other than the spine | 1 (1) | 7 (4) | 0.07 |

Source: Li et al (2011): Table 1, p 129 and Table 4, p 130.

Abbreviation: CT, computed tomography; MRI, magnetic resonance imaging.

* Based on Pearson chi-squared test or Fisher exact test as appropriate.

6. REVIEW OF THE ECONOMIC EVIDENCE FOR IMAGING FOR LOW BACK PAIN

This section presents a summary of economic and costing analyses identified through the systematic literature review of imaging for LBP. A formal modelled economic evaluation of imaging for LBP was not within the scope of this review.

6.1. Studies relevant to the economic evaluation of imaging for low back pain

A review of the published literature was conducted to source published costing studies and economic analyses relevant to imaging in patients with LBP. Due to the small number of studies available, the literature search was not limited to the population criteria defined for this review: patients with LBP with suspected serious underlying pathology, or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy. Rather, any costing studies or economic analyses that assessed imaging with X-ray, CT or MRI in patients with any LBP were included. The search identified six cost-effectiveness analyses and four cost analyses.

A summary of the characteristics of the identified studies is presented in Table 0-48. Only three of the identified studies were in specific populations of interest for this review: two studies were conducted in patients with LBP with suspected underlying cancer and one study was conducted in patients with the signs/symptoms of radiculopathy. The remaining studies were conducted in more general LBP populations.

The six cost-effectiveness analyses included two modelled analyses (both in patients with LBP with suspected underlying cancer), three cost-effectiveness analyses based on RCT data and one cost-effectiveness analysis based on a cohort study. Of the four included cost analyses, three were based on cohort data and one was based on RCT data.

The perspective taken in all of the included studies was that of direct costs to the healthcare system, while in one of the studies indirect costs were also considered. Five of the included studies were conducted in the primary care setting. Of the remaining five studies, two were in a hospital outpatient setting, one was in a specialist care setting, one was in a workers compensation setting and one did not limit the setting.

The majority of the studies were conducted in the US. In addition, two were in the UK, one was in Denmark and one was in Australia. This may limit the applicability of the findings to the Australian health system.

Each of the included studies will be described in detail below.

Table 0-48 Summary of economic evidence related to imaging in patients with LBP

| Reason for imaging | Study ID | Study type | Country | Perspective | Setting | Population | Intervention | Comparator | Outcomes |
|---|-------------------|---|---------|-------------|----------------------|--|---|--|---|
| Imaging to exclude cancer | Hollingworth 2003 | C/E analysis based on a Markov model | US | Healthcare | Primary care | Patients with LBP referred for imaging to exclude cancer as source of pain | Rapid MRI | X-ray | ICER |
| | Joines 2001 | Modelled C/E analysis | US | Healthcare | Primary care | Patients with LBP and 'red flags' for cancer | 11 different diagnostic strategies that considered clinical findings, ESR, and X-ray prior to imaging (MRI or bone scan) and biopsy | Diagnostic strategies were compared against each other | <ul style="list-style-type: none"> • Cost per patient • Cost per case found • Incremental cost per additional case found |
| Imaging to assess suspected radiculopathy | Webster 2013 | Cost analysis based on a retrospective cohort study | US | Healthcare | Workers compensation | Claimants with at least 1 day of compensated lost time and at least 1 year of job tenure for LBP | Early MRI for suspected radiculopathy | No early MRI for suspected radiculopathy | Total medical costs post-MRI |
| Imaging to assess LBP | Graves 2014 | Cost analysis based on a prospective cohort study | US | Healthcare | Any | Workers with new occupational LBP claims | Adherence to guidelines for MRI | Early MRI | Cost ratio |

| Reason for imaging | Study ID | Study type | Country | Perspective | Setting | Population | Intervention | Comparator | Outcomes |
|--------------------|---------------|--|-----------|-------------|--------------------------|--|---|---|---|
| | Mortimer 2013 | C/E analysis based on a RCT | Australia | Healthcare | Primary care | Patients with acute LBP | Active implementation of the AAMPGG guidelines | Standard implementation of AAMPGG guidelines | Cost per X-ray avoided |
| | Kim 2011 | C/E analysis based on prospective cohort study | Canada | Healthcare | Hospital outpatients | Outpatients with non-emergency back pain referred to a surgical practice | Triage program based on 2001 Ontario guidelines (\pm X-ray, \pm MRI) | Usual care (MRI, CT and/or X-ray) | ICER |
| | Jensen 2010 | Cost analysis based on a comparison of two retrospective cohorts | Denmark | Healthcare | Public outpatient clinic | Adults with LBP or leg pain rated at least 3 on an 11-point numeric rating scale of 2-12 months duration | Routine MRI | Needs-based MRI | <ul style="list-style-type: none"> • Incremental cost • Incremental duration of treatment |
| | Gilbert 2004 | C/E analysis based on a RCT | UK | Healthcare | Specialist care | Symptomatic lumbar spine disorder with clinical uncertainty about need for imaging | Early MRI/CT | Delayed MRI/CT (no imaging unless clinical indication subsequently developed) | ICER |

| Reason for imaging | Study ID | Study type | Country | Perspective | Setting | Population | Intervention | Comparator | Outcomes |
|--------------------|-------------|------------------------------|---------|-------------------------|--------------|----------------------------------|----------------|-------------------|---|
| | Jarvik 2003 | Cost analysis based on a RCT | US | Healthcare | Primary care | LBP ± radiating leg pain | Rapid MRI | X-ray | <ul style="list-style-type: none"> • Incremental cost • Incremental outcome |
| | Miller 2002 | C/E analysis based on a RCT | UK | Healthcare/ Societal | Primary care | LBP ≥ 6 weeks and no 'red flags' | X-ray referral | No X-ray referral | ICER |

Abbreviations: AAMPPG, Australian Acute Musculoskeletal Pain Guidelines Group; C/E, cost-effectiveness; CT, computed tomography; ESR, erythrocyte sedimentation rate; ICER, incremental cost-effectiveness ratio; LBP, low back pain; MRI, magnetic resonance imaging; RCT, randomised controlled trial.

6.1.1. Imaging to exclude cancer

Two studies were identified that aimed to assess the cost-effectiveness of different imaging modalities to exclude cancer in patients with LBP (Hollingworth et al, 2003; Joines et al, 2001).

Hollingworth 2003

The study by Hollingworth et al (2003) aimed to compare the relative efficiency of lumbar X-ray and rapid MRI for diagnosing cancer-related LBP in primary care patients using a modelled analysis. According to the authors, rapid MRI is quicker and less expensive than conventional MRI because it is limited to selected sequences and has slightly reduced image resolution. As shown in Table 0-49, the ICERs were > \$200,000 per case detected and nearly \$300,000 per QALY. The authors concluded that “there is currently not enough evidence to support the routine use of rapid [MRI] to detect cancer as a cause of LBP in primary care patients.” As this study is limited to an assessment of rapid MRI, not conventional MRI, it has limited applicability to the Australian setting.

Table 0-49 Hollingworth 2003

| Group | Imaging technique | Cost/patient ^a | Incremental cost ^a | Effectiveness | Incremental effectiveness | CER ^a | ICER ^a |
|------------------------|-------------------|---------------------------|-------------------------------|---------------|---------------------------|------------------|-------------------|
| Cost per case detected | X-ray | \$147 | N/A | 0.00553 | N/A | \$26,496 | N/A |
| | Rapid MRI | \$282 | \$135 | 0.00617 | 0.00063 | \$45,720 | \$213,927 |
| Cost per QALY | X-ray | \$406 | N/A | 0.00982 QALY | N/A | \$41,390 | N/A |
| | Rapid MRI | \$535 | \$128 | 0.01025 QALY | 0.00043 QALY | \$52,161 | \$296,176 |

Source: Hollingworth et al (2003): Table 3, p 308.

Abbreviations: CER, cost-effectiveness ratio; ICER, incremental cost-effectiveness ratio; MRI, magnetic resonance imaging; QALY, quality-adjusted life years.

^a All costs in US\$.

Joines 2001

Joines et al (2001) aimed to compare the cost-effectiveness of 11 clinically plausible diagnostic strategies for diagnosing cancer as a cause of LBP in primary care patients. Strategies differed in the choice and arrangement of clinical findings, ESR, and X-ray prior to imaging and possible biopsy. Lumbar MRI was the imaging study employed in the baseline analysis. Sensitivity analyses examined imaging with bone scan alone or bone scan followed in series by MRI (if bone scan is positive).

Strategies were compared in terms of overall sensitivity, specificity and diagnostic cost-effectiveness. Strategy sensitivity was defined as the proportion of patients with spinal malignancy who were correctly identified following work-up and biopsy. Strategy specificity was defined as the proportion of patients without spinal malignancy who were spared a biopsy. Costs were represented by Medicare (US) reimbursement for the diagnostic tests and procedures employed. The cost of lumbar MRI was \$562. Strategies were arranged in order of increasing cost, and incremental cost-effectiveness ratios (ICERs) were computed as the increase in cost divided by the number of additional cases found in going from one strategy to the next most expensive strategy. A set of

dominant strategies was then identified using ICERs and the principles of simple and extended dominance.

A summary of a selection of the findings is presented in Table 0-50. In the baseline analysis, where MRI was used as the imaging method before single biopsy and the ESR cut-off was >20 mm/hr, the five dominant strategies ranged in sensitivity from 0.400 (image if ESR+ and X-ray+) to 0.732 (image everyone). Strategy specificity ranged from 0.9997 to 0.9794. Diagnostic cost per patient ranged from \$14 to \$241, and ICERs ranged from \$8,397 to \$624,781. Using an ESR cut-off point of 50 mm/hr rather than 20 mm/hr resulted in lower costs and fewer unnecessary biopsies for strategies that employed ESR.

The authors note that the goal of a diagnostic strategy, for both the physician and patient, is to maximise sensitivity while avoiding the discomfort, inconvenience and risk of unnecessary biopsy. The most sensitive approach would be to image everyone with a clinical finding; however, this would result in a substantial number of unnecessary biopsies and an ICER that is prohibitive compared with the next most effective strategy. The 'selective testing' strategy is relatively low cost per case found and results in few unnecessary biopsies; however, under baseline assumptions only slightly more than half of cancers are found. The most specific strategy of serial testing with ESR followed by X-ray, and imaging only if both are positive is inexpensive but has poor sensitivity (fewer than half of cancer cases are found, even with repeat biopsy). Based on the findings of the cost-effectiveness analyses, the authors recommend a strategy of "imaging patients who have a clinical finding (history of cancer, age ≥ 50 years, weight loss, or failure to improve with conservative therapy) in combination with either an elevated ESR (≥ 50 mm/hr) or a positive X-ray, or using the same approach but imaging directly those patients with a history of cancer."

MRI offers greater specificity than bone scan, with comparable sensitivity and the added advantage of providing anatomic detail in all patients imaged. Serial imaging with bone scan followed by MRI offers the greatest specificity. The choice between these imaging options could also be influenced by considerations that were not included in the decision model. For example, if non-spinal metastases are suspected, then serial imaging might be chosen. If myeloma is suspected based upon clinical presentation, then MRI would be a better choice.

The authors did not consider the costs of treatment, utilities associated with treatment outcomes, or the costs associated with missed diagnoses of cancer or incidental findings. The authors acknowledge that incidental findings on MRI scan, such as disc protrusion not associated with nerve root impingement and disc degeneration could lead to patient concern, additional care-seeking and follow-up imaging without significant clinical benefit to the patient.

Table 0-50 *Joines 2001 – imaging strategy using MRI*

| Dominant strategies from baseline analysis ^a | Strategy sensitivity | Strategy specificity | Cases found/ 1000 patients | Cases missed/ 1000 patients | Patients biopsied without cancer/ 1000 patients | Total biopsies/ 1000 patients | Cost/ patient | Cost/ case found | Incremental cost per additional case found |
|---|----------------------|----------------------|----------------------------|-----------------------------|---|-------------------------------|---------------|------------------|--|
| Image if positive ESR and positive X-ray | 0.400 | 0.9997 | 2.6 | 4.0 | 0.3 | 3.4 | \$14 | \$5,283 | - |
| Selective testing | 0.525 | 0.9992 | 3.5 | 3.1 | 0.8 | 4.8 | \$21 | \$6,026 | \$8,397 |
| Image if Hx cancer or positive X-ray | 0.588 | 0.9980 | 3.9 | 2.7 | 2.0 | 6.5 | \$42 | \$10,706 | \$50,020 |
| Image if Hx cancer or positive ESR or positive X-ray | 0.701 | 0.9919 | 4.6 | 2.0 | 8.1 | 13.5 | \$110 | \$23,703 | \$91,428 |
| Image everyone | 0.732 | 0.9794 | 4.8 | 1.8 | 20.4 | 26.1 | \$241 | \$49,814 | \$624,781 |

Source: Joines et al (2001): Table 2, p 17 and Table 3, p 20.

Abbreviations: ESR, erythrocyte sedimentation rate; Hx, history; MRI, magnetic resonance imaging.

^a Baseline analysis assumes MRI as imaging test, ESR cut-off point of 20, prevalence of cancer 0.66%, and a single biopsy. Strategies are arranged in order of increasing cost.

6.1.2. Imaging to assess suspected radiculopathy

One study was identified that aimed to assess the costs associated with early MRI for assessment of patients with (or without) suspected radiculopathy (Webster et al, 2013).

Webster 2013

The aim of the study by Webster et al (2013) was to determine the effect of early MRI (≤ 30 days) on disability and medical costs in patients with acute, disabling, work-related LBP with and without radiculopathy. Disability was defined as the number of days of continuous paid indemnity (lost wage replacement for temporary total or temporary partial lost days) followed by a more than 7-day period without indemnity payments, and truncated at the end of the two-year follow-up period. Medical services were identified using Current Procedural Terminology codes and costs were based on paid-to-date medical services. The types of medical costs included are not described in the publication.

As shown in Table 6.1-5, post-MRI medical expenditure was significantly higher for patients who received early MRI compared with no early MRI, regardless of whether patients had radiculopathy or not. This relationship also held when only patients with ≤ 30 days of disability were included in the analysis. The authors conclude that “providers and patients should be made aware that when early MRI is not indicated, it provides no benefits, and worse outcomes are likely.” It is difficult to interpret the results of this study given there is no indication provided of what the included medical costs are and what costs are driving the significantly higher medical expenditure seen in those undergoing early MRI. The authors do note that the greater medical costs in the early MRI group “suggests that obtaining an early MRI may be the first indication of a cascade pattern of care that is characterised by overprescribing, overtesting, intensive and ineffective treatment, and ultimately, poor outcomes.”

Table 0-51 Webster 2013 – duration first disability episode post-MRI (days)^a

| Group | Use of MRI | Mean days | 95% CI | P value |
|------------------|------------|-----------|------------|---------|
| Radiculopathy | No MRI | 50 | 38.0, 61.9 | |
| | Early MRI | 184 | 155, 213 | NR |
| Non-specific LBP | No MRI | 44.4 | 37.5, 51.4 | |
| | Early MRI | 165 | 129, 202 | NR |

Source: Webster et al (2013): Table 3, p 1943 and Table 5, p 1944.

Abbreviations: CI, confidence interval; LBP, low back pain; MRI, magnetic resonance imaging; NR, not reported.

Table 0-5 Webster 2013 –medical costs post-MRI^b

| Group | Condition | Use of MRI | Mean cost | 95% CI | P value |
|---|------------------|------------|-----------|--------------------|---------|
| Total medical costs post-MRI ^b | Radiculopathy | No MRI | \$4,100 | \$2,399, \$5,802 | |
| | | Early MRI | \$22,339 | \$16,017, \$28,661 | NR |
| | Non-specific LBP | No MRI | \$2,306 | \$1,771, \$2,842 | |
| | | Early MRI | \$17,028 | \$12,142, \$21,914 | NR |
| Total medical expenditure post-MRI ^c | Radiculopathy | No MRI | \$7,173 | –\$6,140, \$20,485 | 0.03 |
| | | Early MRI | \$20,989 | \$11,989, \$29,989 | 0.03 |
| | Non-specific LBP | No MRI | \$4,855 | \$1,201, \$8,508 | <0.0001 |
| | | Early MRI | \$17,803 | \$13,544, \$22,062 | <0.0001 |
| Total medical expenditure post-MRI in patients with disability ≤ 30 days ^c | Radiculopathy | No MRI | \$8,579 | \$4,286, \$12,873 | 0.004 |
| | | Early MRI | \$16,222 | \$12,568, \$19,877 | 0.004 |
| | Non-specific LBP | No MRI | \$747 | –\$1,290, \$2,784 | <0.0001 |
| | | Early MRI | \$9,331 | \$6,104, \$12,557 | <0.0001 |

Source: Webster et al (2013): Table 3, p 1943 and Table 5, p 1944.

Abbreviations: CI, confidence interval; LBP, low back pain; MRI, magnetic resonance imaging; NR, not reported.

a Disability duration post-MRI for the no-MRI groups was defined as the time from 16 days (the median time to MRI for the early MRI groups) after the claim onset to the end of the first disability episode.

b Medical costs post-MRI for the no-MRI groups were calculated from 16 days post-onset to the end of the 2-year follow-up period. All costs in US\$.

c Mean cost results based on a multivariate regression analysis adjusting for age, sex, job tenure, jurisdiction state, morphine equivalent in first 15 days, time to first lumbar MRI and average weekly medical costs pre-MRI. All costs in US\$.

6.1.3. Imaging to assess LBP

Six studies were identified that aimed to assess the cost-effectiveness of different imaging modalities in patients with LBP. Two of these studies assessed the effect of adherence to imaging CPGs (Graves et al, 2014; Mortimer et al, 2013), while another assessed the effect of a triage service, aimed at reducing unnecessary imaging and consultations, against no triage (Kim et al, 2011). The remaining studies assessed either different applications of a single imaging modality (e.g. needs-based MRI versus routine MRI) or compared an imaging modality with no imaging or other modalities (Jensen et al, 2010; Jarvik et al, 2003; Miller et al, 2002).

Graves 2014

Graves et al (2014) used data from a prospective, population-based cohort study to estimate the health care utilisation and costs associated with adherence to guidelines for the use of early MRI for acute occupational LBP. The guidelines recommend early MRI (within first 6 weeks after injury) for patients with 'red flags', with no MRI within the first 6 weeks after injury for patients without red flags. As shown in Table 6.1-8, costs for workers with imaging not adherent to guidelines were significantly higher than costs for workers with imaging adherent to guidelines, with inpatient costs being more than three times higher. In addition, the number of injections and surgeries, as well as physical and occupational therapy visits, were significantly higher for workers with imaging not adherent to guidelines (Table 6.1-7). The number of CT scans and chiropractic visits were significantly

higher in workers with imaging adherent to guidelines. The authors conclude that “Nonadherence to guidelines for early MRI was associated with increased likelihood of lumbosacral injections or surgery and higher costs for outpatient, inpatient, and non-medical services, and disability compensation.”

Increased use of interventions (such as lumbosacral injections or surgery) are not necessarily problematic if they result in improved patient outcomes. While not directly measuring patient outcomes in their study, the authors discuss the findings of a number of studies that showed that early imaging did not result in cost-effectiveness improvements in pain, functioning or healthcare.

Table 0-6 Graves 2014 –relative risk of adhering to clinical practice guidelines for the use of early MRI for acute occupational low back pain

| Service | Relative risk (95% confidence interval) ^a |
|---------------------|--|
| Computed tomography | 0.40 (0.18, 0.92) |
| X-ray | 1.04 (0.81, 1.34) |
| Injection | 1.93 (1.43, 2.62) |
| Surgery | 2.16 (1.28, 3.66) |

Source: Graves et al (2014): table 3, p 657.

^a Propensity score-adjusted regression analysis.

Table 0-7 Graves 2014 – incidence rate ratio for office visits of adhering to clinical practice guidelines for acute occupational low back pain

| Number of office visits | Incidence rate ratio (95% confidence interval) ^a |
|---|---|
| Chiropractic | 0.82 (0.69, 0.97) |
| Physical therapy / occupational therapy | 1.54 (1.33, 1.80) |
| Outpatient | 1.52 (1.30, 1.77) |

Source: Graves et al (2014): table 3, p 657.

^a Propensity score-adjusted regression analysis.

Table 0-8 Graves 2014 – costs for services of adhering to clinical practice guidelines for the use of early MRI for acute occupational low back pain

| Costs ^a | Cost ratio (95% confidence interval) ^b |
|--------------------------|---|
| Outpatient services | 1.52 (1.33, 1.70) |
| Inpatient services | 3.10 (1.72, 4.47) |
| Non-medical ^c | 1.87 (1.34, 2.39) |
| Disability compensation | 1.63 (1.34, 1.92) |
| Total costs | 1.62 (1.38, 1.86) |

Source: Graves et al (2014): table 3, p 657.

^a Costs in US\$. Total reimbursed amounts for procedures and visits that occurred within 1 year following injury, inflation adjusted to 2005 equivalents, based on Medical Consumer Price Index.

^b Propensity score-adjusted regression analysis.

^c Non-medical costs include reimbursement for vocational (return-to-work) assistance or rehabilitation, employability assessments, worker transportation, medical devices, and other costs not included in other cost categories.

Mortimer 2013

The aim of the study by Mortimer et al (2013) was to test the effectiveness and cost-effectiveness of a multifaceted, theory-informed, intervention for implementing the Australian Acute

Musculoskeletal Pain Guidelines Group (AAMP GG 2004) guidelines for LBP in general practice in Victoria.⁷¹ The key messages to be communicated via workshop sessions to clinicians randomised to the intervention were: (i) diagnostic X-rays are rarely necessary in the management of LBP; and (ii) remaining active reduces pain and disability. Clinicians randomised to the control group received standard dissemination of the guidelines. Three different cost scenarios were included in the analysis: (i) the 'base case' which included development (amortised), delivery and imaging costs; (ii) 'no development cost' which included delivery and imaging costs only (the development cost of the intervention was excluded); and (iii) 'full development cost' which included development (full), delivery and imaging. The results of the analysis are presented in Table 6.1-9. The authors note in the abstract that the base case analysis (which is actually based on the 'no development cost' analysis in Table 6.1-9c) resulted in a saving of \$135 per X-ray avoided (although the 95% CI did not rule out an additional cost per X-ray avoided) and \$89 per additional consult adherent for X-ray. Savings of \$50 per additional consult adherent for imaging and \$30 per additional consult adherent to advice to stay active were also seen. When the full development cost is included, there is an additional cost per X-ray avoided of \$298. The authors conclude that "active implementation [of the guideline] entails a significant upfront investment that may not be offset by health gains and/or reductions in health service utilisation of sufficient magnitude to render active implementation cost effective."

Table 0-9a Mortimer 2013 – effectiveness of X-ray

| Effectiveness (imaging referral) | Active implementation, mean ± SD | Standard dissemination, mean ± SD | Adj IRR ^a | Difference ± SE |
|----------------------------------|----------------------------------|-----------------------------------|----------------------|-----------------|
| X-ray | 14.6 ± 12.1 | 19.2 ± 14.6 | 0.83 (0.61, 1.12) | -3.43 ± 3.10 |

Source: Mortimer et al (2013): Table 2, p 4, Table 3, p 5 and Table 4, p 5.

Abbreviations: Adj, adjusted; CI, confidence interval; Exp Coef, exponentiated coefficient; IRR, incidence rate ratio; SE, standard error; SD, standard deviation.

^a Adjusted for GP age, years since GP graduated, self-reported interest in LBP, number of GPs per practice, practice method of billing, rural/metro practice.

Table 0-9b Mortimer 2013 –effectiveness of adherence to guidelines

| Effectiveness (adherence) | Active implementation, n (%) | Standard dissemination, n (%) | Adj ORa (95% CI) | Difference ± SE |
|---------------------------|------------------------------|-------------------------------|----------------------|-----------------|
| X-ray | 126 (83) | 109 (68) | 1.76* (1.01, 3.05) | 0.099 ± 0.052 |
| Imaging | 119 (78) | 89 (56) | 2.36** (1.48, 3.79) | 0.177** ± 0.056 |
| Activity | 121 (80) | 82 (51) | 4.49** (1.90, 10.60) | 0.297** ± 0.044 |
| Bed rest | 163 (99) | 168 (98) | 2.91 (0.30, 27.83) | 0.011 ± 0.012 |

Source: Mortimer et al (2013): Table 2, p 4, Table 3, p 5 and Table 4, p 5.

Abbreviations: Adj, adjusted; CI, confidence interval; OR, odds ratio; SE, standard error.

Notes: *X-ray adherence* defined as GPs not referring for a lumbosacral plain X-ray; *Imaging adherence* was defined as GPs not referring for any of the following three diagnostic tests: X-ray, CT and MRI; *Activity adherence* defined as "Advise the patient to continue with their normal daily activities" regardless of other interventions selected ("Paracetamol", "Nonsteroidal anti-inflammatory drugs", "Advise the patient to do specific back exercises", "Advise the patient to do general exercises (e.g. walking)", "Manual therapy", "Referral to another

⁷¹ This guideline, published on the NHMRC website, has since been rescinded.

health care provider”, “Other”); *Bed rest adherence* defined as either not recommending “Bed rest”, or recommending “Bed rest” for ≤ 2 days.

* $p < 0.05$; ** $p < 0.01$

a Adjusted for GP age, years since GP graduated, self-reported interest in LBP, number of GPs per practice, practice method of billing, rural/metro practice.

Table 0-9c Mortimer 2013 – cost scenarios

| Cost | Active implementation, mean \pm SD | Standard dissemination, mean \pm SD | Exp Coef ^a (95% CI) | Difference \pm SE |
|-----------------------|--------------------------------------|---------------------------------------|--------------------------------|----------------------|
| Base case | \$4,612 \pm 3,239 | \$4,941 \pm 3,208 | 0.92 (0.70, 1.22) | –\$375.55 \pm 724 |
| No development cost | \$4,529 \pm 3,239 | \$4,941 \pm 3,208 | 0.91 (0.69, 1.20) | –\$462.93 \pm 723 |
| Full development cost | \$5,944 \pm 3,239 | \$4,941 \pm 3,208 | 1.21 (0.95, 1.54) | \$1,023.26 \pm 695 |

Source: Mortimer et al (2013): Table 2, p 4, Table 3, p 5 and Table 4, p 5.

Abbreviations: CI, confidence interval; Exp Coef, exponentiated coefficient; SE, standard error; SD, standard deviation.

a Adjusted for GP age, years since GP graduated, self-reported interest in LBP, number of GPs per practice, practice method of billing, rural/metro practice.

Kim 2011

Kim et al (2011) evaluated against usual care the cost-effectiveness of a hypothetical triage program for non-emergent spinal disorders that aimed to reduce unnecessary imaging costs. The triage program was expected to involve an advanced practice physiotherapist who would determine which patients were non-surgical; some would be identified in the initial consultation and some would be identified following X-ray imaging. Remaining patients would be referred to the spine surgeon and undergo MRI if required. Usual care involved initial MRI with X-ray and/or CT. The outcome of interest was the number of surgical candidates identified per MRI performed. The authors report that the triage program incurred additional costs of \$109,720 from additional consultations and X-rays, while saving \$2,117,697 from eliminated CT and MRI; this resulted in a cost-saving of \$2,007,977. The number of surgical candidates identified per MRI was 0.328-0.418 for usual care and 0.736-0.885 for the triage program, which reflects a large improvement in MRI efficiency. As costs were reduced and efficiency was improved, the triage program was shown to dominate usual care.

Jensen 2010

Jensen et al (2010) aimed to investigate whether “needs-based MRI” and “routine up-front MRI” in patients with LBP resulted in differences in duration of treatment, number of contacts with clinicians and referral for surgery. Data were drawn from two retrospective cohorts; the needs-based cohort included patients seen up to June 2006 who received MRI based on clinical indications, while the routine cohort included patients seen after June 2006 where all patients with leg pain or LBP (and a score of ≥ 3 on an 11-point numeric rating scale) received an MRI. The results of this study are summarised in Table 6.1-10 and show that the needs-based group had significantly longer duration at, and visits to, the clinic compared with the routine group. Based on these findings, the authors concluded that routine MRI reduced the duration of treatment and contacts with clinicians, while not increasing costs. However, the validity of the conclusions are questionable as the patients undergoing needs-based versus routine MRI may have been different; that is, the needs-based group

may have had a greater proportion of patients with underlying indications that impacted on the amount of medical care they required.

Table 0-10 Jensen 2010

| Outcome/cost | Group | Needs-based MRI, N=169 | Routine MRI, N=208 | P value |
|--------------|-----------------------------------|------------------------|--------------------|---------|
| Outcome | Referred to surgery (n, %) | 15 (9) | 17 (8) | 0.81 |
| | Duration at clinic (median, days) | 160 | 115 | 0.0001 |
| | Visits at clinic (median, n) | 4 | 3 | 0.003 |
| Costs | MRI (per patient) | €142 ^a | €332 ^a | - |
| | Visit (patient) | €826 ^a | €624 ^a | - |
| | Total (patient) | €968 | €957 | - |

Source: Jensen et al (2010): table 1, p 4 and table 2, p 4.

Abbreviations: MRI, magnetic resonance imaging.

^a Calculated post hoc for this review.

Gilbert 2004

The study by Gilbert et al (2004) aimed to establish whether early use of MRI or CT influences treatment and outcome of patients with LBP, and whether it is cost-effective. Patients with LBP referred to specialist care (24 orthopaedists and one neurosurgeon) were randomised to either 'early imaging' (MRI or CT as soon as practicable) or 'delayed, selective imaging' (no imaging unless a clear clinical indication developed). It should be noted that patients who required immediate imaging due to signs suggestive of serious abnormalities or disease or required surgical intervention were excluded from the patient population, as were those who clearly did not require imaging. Of the patients included in the early imaging group, 82.4% had an MRI scan and 7.4% had a CT scan, while of the patients included in the delayed imaging group, 24.4% had an MRI scan and 5.1% had a CT scan. The mean time to scanning was 4.1 weeks in the early imaging arm and 20.1 weeks in the delayed imaging arm. The results of the cost-effectiveness analysis are summarised in Table 6.1-11. The improved utility of early imaging over delayed imaging was small and not statistically significant based on changes from baseline to 8 months, and 9 months to 24 months. Based on the overall duration of the trial (24 months) the ICER associated with early MRI/CT in this patient group was US\$2,124/QALY. The authors note there was a 9% chance that the early imaging policy was both more effective and less costly, 4% chance it was less costly but less effective and < 0.05% chance that it was more costly and less effective; therefore, there was a 94.9% chance that the ICER for early versus delayed imaging was < US\$50,000. The authors concluded that "decisions about the use of imaging depend on judgements concerning whether the small observed improvement in outcome justifies additional cost."

Table 6.1-11 Gilbert 2004

| Time to scanning | Group | Early MRI or CT, mean \pm SD | Delayed MRI or CT, mean \pm SD | Mean difference (95% CI) |
|--|---------------------------------|--------------------------------|----------------------------------|------------------------------------|
| 0-8 months (early MRI or CT N = 337; delayed MRI or CT N = 311) | EQ-5D | 0.557 \pm 0.308 | 0.527 \pm 0.337 | 0.025 (–0.021, 0.070) ^b |
| | Total cost/patient ^a | \$429 \pm 517 | \$361 \pm 763 | \$68 ^c |
| | ICER | N/A | N/A | \$2,720/QALY ^c |
| 9-24 months (early MRI or CT N = 357; delayed MRI or CT N = 335) | EQ-5D | 0.599 \pm 0.313 | 0.539 \pm 0.350 | 0.057 (0.013, 0.101) ^b |
| | Total cost/patient ^a | \$272 \pm 562 | \$253 \pm 438 | \$19 ^c |
| | ICER | N/A | N/A | \$333/QALY ^c |
| 0-24 months (N not reported for early or delayed imaging) | EQ-5D | 1.114 | 1.027 | 0.041 (–0.006, 0.087) ^b |
| | Total cost/patient ^a | \$701 \pm 841 | \$614 \pm 935 | \$87 (–\$41, \$209) |
| | ICER | N/A | N/A | \$2,124/QALY |

Source: Table 2, p 348, Table 4, p 350 and text p 346.

Abbreviations: CI, confidence interval; CT, computed tomography; EQ-5D, 5-dimension EuroQol; ICER, incremental cost-effectiveness ratio; MRI, magnetic resonance imaging; QALY, quality-adjusted life years; SD, standard deviation.

^a All costs in US\$.

^b Adjusted for age, sex, diagnostic category, clinician and baseline score.

^c Calculated post hoc for this review.

Jarvik 2003

Jarvik et al (2003) aimed to determine the clinical and economic consequences of replacing spine radiographs with rapid MRI for primary care patients with LBP. Patients whose primary physicians considered they needed an X-ray were randomised to either X-ray or rapid MRI. A selection of the results of the analysis of outcomes and costs are summarised in Table 6.1-12. The results showed little difference in outcomes between those undergoing X-ray or rapid MRI, with the only significant differences being for time trade-off and patient reassurance. Overall mean out-of-pocket expenses were significantly lower for MRI (\$29 versus \$86 for X-ray); the mean additional rapid MRI cost was significantly higher for patients randomised to X-ray than rapid MRI (\$140 versus \$61), while additional X-ray cost significantly more for patients randomised to MRI compared with X-ray (\$12 versus \$7). Finally, the mean cost of physical medicine per patient was significantly higher for patients randomised to X-ray (\$180) compared with rapid MRI (\$94). The authors concluded that “substituting rapid MRI for radiographic evaluations in the primary care setting may offer little additional benefit to patients, and it may increase the costs of care because of the increased number of spine operations that patients are likely to undergo.” It should be noted that four spine surgeries were carried out in the 185 patients randomised to X-ray, compared with 10 in 180 patients randomised to rapid MRI; however, the difference in mean per patient cost of spine surgery was not statistically significantly different between X-ray and rapid MRI (–\$261; 95% CI –\$560, \$37).

Table 6.1-12 Jarvik 2003

| Outcome/cost | Group | X-ray, N=170 | Rapid MRI, N=170 | Difference (95% CI) ^b | P value |
|--------------------|--|-----------------|---------------------|-------------------------------------|---------|
| Outcome | Disability days, lost work ^a | 1.26 | 1.57 | -0.30 (-0.92, 1.15) | N/A |
| | Disability days, limited activity ^a | 5.38 | 5.60 | -0.22 (-1.69, 1.84) | N/A |
| | Disability days, bed ^a | 1.31 | 1.04 | 0.28 (-0.38, 1.00) | N/A |
| Costs ^c | Total health care costs | \$1,651 | \$2,121 | -\$470 (-\$1,044, \$105) | 0.11 |
| | Time cost of subsequent care | \$342 | \$212 | \$130 (-\$35, \$295) | 0.12 |
| | Out-of-pocket expenses | \$86 | \$29 | \$57 (\$11, \$102) | 0.02 |
| | Total societal costs | \$2,059 | \$2,380 | -\$321 (-\$1,100, \$458) | 0.42 |

Source: Jarvik et al (2003): Table 3, p 2815 and Table 4, p 2816.

Abbreviations: MRI, magnetic resonance imaging

a A higher score indicates worse health.

b Confidence interval from analysis of covariance analysis adjusting for baseline score and study site.

c All costs in US\$.

Miller 2002

The aim of the study by Miller et al (2002) was to determine if X-ray is cost-effective compared with usual care (no referral for X-ray) in patients with LBP of at least 6 weeks duration. The analysis was based on data from a RCT conducted in the UK. As shown in Table 6.1-13, all costs were significantly higher for X-ray compared with usual care, while the satisfaction score was also significantly higher for X-ray compared with usual care. The analysis showed that the additional cost per unit of satisfaction for X-ray was £19.54 while the net economic benefit associated with X-ray was £115 per patient. The authors conclude that X-ray “is likely to be cost-effective only when satisfaction is valued relatively highly. Strategies to enhance satisfaction for patients with LBP without using lumbar [X-ray] should be pursued.”

Table 6.1-13 Miller 2002

| Analysis ^a | Group | X-ray, N=195 | Usual care, N=199 | Difference | P value |
|-----------------------------|---|-----------------|----------------------|--------------------|---------|
| Cost analysis | Direct costs, mean/patient | £150 | £109 | £41 | <0.001 |
| | Indirect costs, mean/patient | £449 | £392 | £49 | 0.373 |
| | All resource use, mean/patient | £590 | £507 | £83 | <0.001 |
| Cost-effectiveness analysis | Direct costs, mean/patient | £150 | £109 | £41 | <0.001 |
| | Effect (satisfaction score), mean/patient | 20.71 | 18.61 | 2.1 | <0.01 |
| | Additional cost per unit of satisfaction | N/A | N/A | £19.54 | N/A |
| Cost-benefit analysis | Cost 1 – change in overall resource use due to radiograph | N/A | N/A | £72 | N/A |
| | Cost 2 – valuation of risks from radiation ^b | N/A | N/A | £43 | N/A |
| | Benefit 1 – valuation of reassurance from radiograph ^c | N/A | N/A | £30 | N/A |
| | Net economic benefit associated with X-ray | N/A | N/A | £115 extra/patient | N/A |

Source: Miller et al (2002): Table 4, p 2295.

^a All costs in US\$.

^b Willingness to pay to reduce radiation risk to zero (n=340).

^c Willingness to pay for potential reassurance benefit of radiograph (n=347).

6.2. Applicability to the Australian system

It is likely that the majority of the evidence presented here is not directly applicable to the Australian setting. Only one of the included studies was conducted in Australia (Mortimer et al, 2013). The remaining studies were conducted primarily in the US (six studies), with two conducted in the UK and one conducted in Denmark.

The Australian study compared active implementation of the AAMPGG 2004 guideline⁷² with standard dissemination, and found that active implementation significantly increased adherence to guideline recommendations regarding referrals for X-ray, CT and MRI, as well as activity. Costs were reduced (although not statistically significantly) only if the development cost of the intervention (two interactive, facilitated workshops) was not included. While the results suggest that the active implementation of the guideline via an intervention may not be cost-effective (better outcome/higher cost), it does suggest that encouraging clinicians to limit imaging in patients with LBP to those with particular signs or symptoms, or suspected underlying pathology, will lead to both improved outcomes (less imaging) and lower costs.

⁷² This guideline, published on the NHMRC website, has since been rescinded.

7. FINDINGS AND CONCLUSIONS

This section sets out the findings and conclusions of the review of imaging for LBP – using radiography, CT or MRI – based on the analysis of the available MBS and BEACH data, guideline concordance, and clinical and economic evidence obtained through systematic literature review.

7.1. Appropriateness of the MBS items for service

Five Australian and 21 international CPGs/clinical algorithms for imaging for LBP were identified by the literature search. Australian and international CPGs, summarised in Section 4, are consistent in recommending that imaging should not be used for non-specific LBP. In addition, they state that for cases where serious underlying pathology is suspected, the imaging modality of choice is generally MRI, with X-ray recommended for suspected cases of vertebral fracture and suspected inflammatory spondyloarthritis, and CT used where MRI is contraindicated, not tolerated or not available. If signs of cauda equina syndrome are present, emergency referral is recommended.

Imaging (X-ray or MRI) is recommended in patients with inflammatory spondyloarthritis, but only after a 4- to 6-week trial of conservative management. Imaging (MRI) is not recommended for acute radicular pain syndromes in the first 4 to 6 weeks unless they are severe and not trending towards improvement and both the patient and the surgeon are willing to consider prompt surgical treatment if the MRI confirms ongoing nerve root compression. If neurological signs and symptoms persist after a 4- to 6- week trial of conservative therapy, MRI is recommended in patients who are candidates for surgery. Repeat MRI without significant clinical deterioration in symptoms and/or signs is not recommended.

The indications for reimbursement for X-ray and CT are broader than those recommended in CPGs, with no restriction placed on the indication for imaging. On the other hand, MRI is indicated for specific reasons – including infection, tumour, congenital malformation of the spinal cord or the cauda equina or the meninges, myelopathy, sciatica, spinal canal stenosis – which is in line with CPGs. In addition, MBS-reimbursed referral for MRI is restricted to specialist or consultant physicians only. Thus, if an MRI investigation is warranted (based on best clinical practice outlined in guidelines), a GP must first refer a patient to a specialist. This likely results in an additional specialist visit for patients who require investigation via MRI; the patient will be referred to a specialist who will request the MRI, and will then be required to return to the specialist to receive the results. In cases where the patient is willing to pay for an MRI out-of-pocket, the GP can request an MRI directly, which means that (i) the patient may avoid a specialist visit if no pathology is found, or (ii) the patient would arrive at the specialist appointment with the results already available, potentially avoiding an additional specialist visit.

7.2. Current usage of imaging for low back pain in Australia

An analysis of MBS data was undertaken to determine the current service profile for imaging of the low back using radiography, CT or MRI. Interpretation of the MBS data is limited due to the inability to distinguish imaging that is undertaken to investigate LBP versus other indications. For this reason, and because the MBS data will not capture MRI requests from primary care providers, data from the BEACH program, which is a continuous national study of GP clinical activity in Australia, has been included to provide further information on current usage of imaging for management of back problems. Similar to MBS data, interpretation of the BEACH data are limited because GP encounters for management of back problems are not exclusively in patients who present with LBP.

7.2.1. MBS data findings

A total of 45 MBS items were identified that may be used in a work-up for LBP: 16 X-ray items, five CT items and 24 spinal MRI items. Nuclear medicine items were out of scope for the review. Rather than specifying the region of the back to be imaged, spinal MRI items specify the indication or suspected indication. Therefore the MBS data for X-ray and CT imaging is predominantly for low back conditions while the MBS data for MRI imaging can be for conditions at any region of the back (with the exception of sciatica and cauda equina which are entirely low back). It is also possible that the imaging services captured by the MBS data include investigations for patients requiring low back imaging who do not have LBP.

On the basis that LBP is a common condition, and presuming the reason for low back imaging will frequently be to investigate LBP, this Review investigated the MBS data for low back X-ray and CT imaging, and for spinal MRI for indications included in the PICO criteria. Due to the large number of relevant MBS items, a subset of high usage items was selected from each imaging group based on the total frequency of claims. These groups consisted of three X-ray items (58106, 58112, 58121), one CT item (56223, without contrast) and five MRI items (63154, 63167, 63176, 63179, 63204). These items were then investigated for geographic and temporal trends, demographic trends, requesting specialty type (i.e. GPs, specialists, allied health professionals) and usage profile in terms of multiple and cascade imaging in individual patients.

Of the combined services for all three main X-ray items, 61% were requested by GPs, 11% by specialists and 28% by allied health professionals. All three specialty types use two of the three main X-ray items (58106 and 58112), but only allied health professionals use the other item (58121, which is for three examinations of the spine, no more than once per patient per calendar year).

Ninety percent of CT imaging with item 56223 was requested by GPs, with the balance requested by specialists (allied health professionals are ineligible to request CT services on the MBS). All included MRI items are specialist-requested services (GPs and allied health professionals are ineligible to request the in-scope spinal MRI items).

In 2013-14, the highest per capita services for the main X-ray items were in Queensland, at 18% above the national average. For the main CT item, imaging was most commonly used in New South Wales although rates were similar across most states (52% and 46% lower than the national average in the Northern Territory and the Australian Capital Territory, respectively). The main MRI items were most commonly used in Victoria⁷³ and New South Wales.⁷⁴

Per capita services for the X-ray item used entirely by allied health professionals (58121) showed more variation across states than the other two X-ray items. In 2013-14, Queensland per capita services for item 58121 were 53% higher than the national rate, while in the Australian Capital Territory they were 67% lower.

Imaging was more commonly performed in females than males for all three imaging modalities. In the case of X-ray item 58121, and the two tumour-specific MRI items (63514 and 63204), gender differences swapped in older age brackets to become more frequently used in male patients (over 45 years for item 58121 and over 65 years for the two MRI items).

Over the four-year period from 2010-11 to 2013-14, total services for the three main X-ray items fell by 14.5% across all speciality groups combined. This reduction was driven by a 36.4% fall in allied health-requested services for item 58121. GP-requested services decreased by only 1.0% and specialist-requested services increased by 11.3%.

Services fell in 2010-11 for the main CT item, 56223, with 8% fewer GP requests and 2.0% fewer specialist requests. However, in subsequent years, substantial growth occurred in both GP requests (21.6%) and specialist requests (27.5%).

All five main MRI items grew from 2009-10 to 2013-14, showing growth in almost every year, and overall growth of 25% over this five-year period. The most frequently requested MRI item was for sciatica (63176), for which the 25.1% growth in services was largely driven by high growth in requests from specialty groups that requested the services relatively infrequently in 2009-10, rather than the specialty groups (such as neurosurgery) that have consistently used the item. For example, requests for item 63176 by sport and exercise medicine specialists increased from no services in 2009-10 to 2,347 services in 2013-14.

Repeat services for X-ray item 58106 in the same patient (within 3 months) accounted for 0.5% of allied health-requested services and 1.1% of GP-requested services. Similarly a low rate of repeat imaging was also observed for CT item 56223 by GPs (1.4%). The majority of repeat services for these items were requested by specialists (X-ray; 14.4% and CT; 7.7%), mostly by orthopaedic surgeons and neurosurgeons.

⁷³ Data combined with Tasmania.

⁷⁴ Data combined with Australian Capital Territory.

Four sequences of cascade imaging in the same patient were investigated, starting with either X-ray or CT and ending with MRI. *Sequence 1* started with X-ray item 58106 and *Sequence 2* started with CT item 56223, with both being followed within 3 months by imaging with MRI using one of the five main MRI items. In 2013-14, 3.7% of all services for X-ray item 58106 and 4.3% of all services for CT item 56223 were followed by MRI in the same patient within 3 months.

The other two sequences that were investigated included the same two index items, followed by two different imaging modalities, each within 3 months of the prior claim: either X-ray followed by CT (*Sequence 3*), or CT followed by X-ray (*Sequence 4*), both ending with MRI. In 2013-14, 4.4% of all services for X-ray item 58106 and 3.2% of all services for CT item 56223 resulted in these imaging sequences.

The proportion of index services that resulted in cascade imaging was similar for each of the four sequences, ranging from 3.0% to 4.7%, except for X-ray followed by MRI (*Sequence 1*), which occurred in 9.2% of specialist-requested X-ray services versus 3.3% of GP-requested X-ray services. However, as both X-ray and CT are more frequently requested by GPs than by specialists (approximately 6-fold and 9-fold more frequently, respectively, in 2013-14), the total number of GP-initiated sequences was greater than specialist-initiated sequences for all four sequences investigated.

From 2009-10 to 2013-14, the number of times that X-ray was followed by MRI in the same patient (*Sequence 1*) grew 112%, mostly driven by a 159% increase in GP-initiated sequences (versus 42% for specialists). There was less growth seen over this time period for CT followed by MRI in the same patient (*Sequence 2*; 86%), with similar growth for GP- and specialist-initiated sequences.

For X-ray followed by CT then MRI in the same patient (*Sequence 3*), growth was high for all specialty groups, especially specialist-initiated *Sequence 3* events, which grew 259%. GP-initiated *Sequence 3* events grew 132% and, as these constitute the bulk of all *Sequence 3* events, this drove the overall growth of 139%.

Sequences of CT followed by X-ray then MRI in the same patient (*Sequence 4*) grew by 127%, again driven by growth in GP-initiated sequences (132% versus 92% for specialists).

7.2.2. BEACH study findings

A recent report from The Family Medicine Research Centre, University of Sydney, investigated GP imaging requests in Australia, with a section dedicated to imaging requests for back problems (Britt et al, 2014). Changes in GP requesting behaviour were assessed by comparing data from two three-year data periods: Period 1, April 2002–March 2005 inclusive; and Period 2, April 2009–March 2012 inclusive. Back problems were separated into ‘back symptom/complaint’, which are undifferentiated back problems without a specific diagnosis; and ‘back syndrome’, which groups patients with back problems where the GP has applied a specific diagnostic label. The two groups have been further separated into ‘new’ and ‘old’ problems to indicate whether this is the patient’s initial attendance for

the problem. The report did not investigate LBP in particular, which limits the interpretation of the results. However, the Medicare imaging groups data for X-ray and CT were further categorised into test descriptors based on the body region being managed; lumbar and lumbosacral imaging were the test descriptors relevant to the low back.

Between 2002-05 and 2009-12, the number of problems managed per GP-patient encounter increased by a statistically significant amount (149.1 to 157.6 problems per 100 encounters). The number of back problems managed per encounter, however, remained stable over this period. The rate of imaging for back problems (both back syndrome and back symptoms/ complaints) was also consistent. Therefore the only contribution by back problems to the observed increase in all imaging over this period is from the increase in the national average number of GP visits.

Of all GP imaging requests for any back problem, the proportion managed with low back X-ray decreased from 2002-05 to 2009-12 (32.9% to 26.4%) whereas the proportion managed with low back CT scans increased (from 22.9% in 2002-05 to 27.8% in 2009-12). This corresponds to a decrease in low back X-ray request rates from 5.3 to 4.4 per 100 back problems managed by GPs, and an increase in low back CT request rates from 3.7 to 4.7 per 100 back problems. Overall, the proportion of all problems in any region of the back that are managed with low back X-ray or low back CT imaging is around 10%⁷⁵, and 15-20%⁷⁶ of new presentations of these problems. The shift from diagnostic radiology to CT scans was observed for both back syndrome and back symptoms/complaints. In the case of back syndrome, the change was of sufficient magnitude to switch the most commonly requested imaging from low back X-ray to low back CT scans (3.8 and 5.9 tests per 100 back syndrome problems, respectively).

As the use of MRI was not reported by body region, MRI data relates to the management of problems in any region of the back, which does not allow an assessment of MRI trends for low back in particular. MRI requests for any back problems increased from 0.2 per 100 back problems managed in 2002-05 to 0.9 per 100 back problems managed in 2009-12.

The marginal reduction in diagnostic radiology imaging rates observed from 2002-05 to 2009-12 occurred after publication of NHMRC-endorsed guidelines from the AAMPPG, which recommended that plain X-rays of the lumbar spine are not routinely requested in patients with acute non-specific LBP. Although the data for MRI are not limited to imaging of the low back region, the increase in its use over this period may also be a result of this guidance.

⁷⁵ Shown for all back problems in Table 0- (X-ray 4.4%; CT 4.7%) totaling 9.1%.

⁷⁶ Table 3.2-8 shows new back syndrome is managed with low back imaging in 18.7% of presentations (X-ray 9.2%; CT 9.5%) and Table 3.2-10 shows new back symptoms/complaints are managed with low back imaging in 14.5% of presentations (X-ray 9.3%; CT 5.2%).

7.3. Evidence for the effectiveness of imaging for low back pain

Evidence-based clinical guidance recommends that low back imaging should only be requested where a thorough patient history and physical examination indicates that there may be a medically serious cause for the LBP. As such, the focus of the clinical evidence review is on determining the most appropriate imaging approach for those patients with LBP with suspected serious underlying pathology or the signs/symptoms of cauda equina syndrome or sciatica/ radiculopathy.

7.3.1. Diagnostic accuracy

Four systematic reviews were identified that assessed the diagnostic accuracy of imaging (CT, MRI, X-ray) in the populations of interest. The four systematic reviews (van Rijn et al, 2012; Wassenaar et al, 2012; Sidiropoulos et al, 2008; Jarvik and Deyo, 2002) ranged in quality from good to poor. Quality ratings were downgraded primarily because the characteristics of the included studies were not reported and/or quality assessment of the included studies was not undertaken/reported. Where the systematic reviews reported the quality of the individual diagnostic accuracy studies, it was noted that assessment of the risk of bias was hindered by poor reporting of several quality items, and that most included studies suffered from several potential biases. As such, there are legitimate concerns regarding the generalisability and validity of the reported sensitivities and specificities.

Two additional original diagnostic accuracy studies were identified that were published after the search dates of the included systematic reviews, one of which was of fair quality (Moranjic et al, 2011) and one of poor quality (Shankar et al, 2009).

Sciatica/radiculopathy

On the basis of the available evidence from three systematic reviews and one subsequent diagnostic accuracy study, MRI and CT appear to have similar diagnostic accuracy for sciatica or radiculopathy caused by lumbar disc herniation in patients with LBP. However, these results should be interpreted with caution due to biases in the included studies. The optimal imaging approach for sciatica/radiculopathy may therefore depend on other factors, such as resolution and radiation exposure.

There is limited evidence for the diagnostic accuracy of MRI in sciatica or radiculopathy caused by nerve root compression and no evidence for the diagnostic accuracy of CT in this indication. There were no studies identified that assessed the diagnostic accuracy of X-ray for detecting sciatica or radiculopathy.

Cauda equina syndrome

No systematic reviews or diagnostic accuracy studies were identified that specifically investigated the diagnostic accuracy of imaging for the detection of cauda equina syndrome in patients with LBP.

Suspected spinal canal stenosis

On the basis of the limited evidence available from two systematic reviews investigating the accuracy of MRI and CT in the diagnosis of spinal canal stenosis in patients with LBP, it is not clear whether one imaging modality is superior to the other. MRI and CT both appear to have reasonable sensitivity and specificity for diagnosing spinal stenosis, although the generalisability of the study findings to patients presenting with LBP is unclear. The optimal imaging approach for spinal canal stenosis may therefore depend on other factors, such as resolution and radiation exposure. There were no studies identified that assessed the diagnostic accuracy of X-ray for detecting spinal stenosis causing LBP.

Suspected inflammatory spondyloarthritis

Two systematic reviews and one subsequent diagnostic accuracy study investigated the diagnostic accuracy of detecting inflammatory spondyloarthritis in patients with LBP. Overall, MRI is recommended as the imaging modality of choice for the detection of sacroiliitis in patients with early spondyloarthropathy. Although there is no clear evidence that MRI has superior diagnostic accuracy compared with CT, MRI has other benefits, such as the absence of ionising radiation, and capacity of detecting and differentiating acute and chronic alterations. Plain radiography is less sensitive than CT and MRI for the detection of sacroiliitis in patients with early spondyloarthropathy.

Suspected spinal malignancy

On the basis of the available evidence from one systematic review, MRI appears to be more sensitive than plain radiography for the detection of spinal malignancy. However, it is unclear whether the included diagnostic accuracy studies were specifically in patients presenting with LBP. No diagnostic accuracy studies were identified that investigated CT in the detection of spinal malignancy in patients with LBP.

Suspected spinal infection

One systematic review provides evidence of the diagnostic accuracy of imaging for suspected spinal infection. On the basis of the very limited evidence available from only one small comparative study of uncertain generalisability, MRI appears to have superior diagnostic accuracy compared with plain radiography for the detection of spinal infection in patients with LBP. No diagnostic accuracy studies were identified that investigated CT in the detection of spinal infection in patients with LBP.

Suspected vertebral fracture

Three systematic reviews aimed to investigate the diagnostic accuracy of imaging for suspected vertebral fracture in patients with LBP; however, no diagnostic accuracy studies were identified. One of these reviews commented that while radiographs may be adequately sensitive for compression fractures, they do not distinguish between acute and chronic fractures, and that MRI is more specific, identifying marrow oedema or an associated hematoma (Jarvik and Deyo, 2002).

7.3.2. *Change in patient management*

Four studies were identified that assessed the effect of imaging on change in patient clinical management. The results of the two most relevant studies are in line with recommendations in CPGs that state that imaging should be limited to patients with particular signs or symptoms, or suspected underlying pathology, or those who are being considered for surgery. One study showed that performing an MRI has a positive effect on the management of patients with a clinical diagnosis of neural compression. Following MRI, the clinical diagnosis changed in 50% of patients; most notably, of 48 patients originally considered for surgery, 23 were changed to conservative management (Rankine et al, 1998). Importantly, another study showed that in patients with LBP for whom there was clinical uncertainty about whether to perform imaging, performing early imaging in all patients provided no additional benefit for diagnosis, treatment or management compared with imaging only if or when it is clinically indicated (Gilbert et al, 2004). The remaining two studies (Dey et al, 2004; Li et al, 2011), while providing interesting results, do not substantially contribute to the findings described above.

7.4. Evidence for the cost implications of imaging for low back pain

The literature search identified six cost-effectiveness analyses and four cost analyses. The economic evidence does not allow a comparison of cost-effectiveness between imaging modalities in the population of interest for this review, or in the general LBP population.

The economic and costing studies most relevant to this review are the two studies in patients with suspected cancer (Hollingworth et al, 2003; Joines et al, 2001), and the single study conducted in patients with the signs and symptoms of radiculopathy (Webster et al, 2013).

While conducted in the US, the results of the study by Webster et al (2013) do suggest that performing early MRI in patients with suspected radiculopathy is not beneficial and is costly, which is in line with guideline recommendations to limit MRI in this patient group until at least a month after pain onset and a trial of conservative therapy. The applicability of the study by Hollingworth et al (2003) is uncertain as it compared rapid MRI (a technique not regularly used in Australia) with X-ray. The study by Joines et al (2001), however, does provide some guidance on the most cost-effective criteria to base a decision to perform MRI or bone scan/MRI in patients with suspected underlying cancer. Once again, limiting assessment for suspected cancer to those with particular clinical, laboratory and imaging findings is consistent with recommendations in published guidelines (see Section 4).

7.5. Conclusions

CPGs generally recommend MRI in preference to CT and X-ray for investigation of patients who present with suspected spinal canal stenosis, suspected spinal malignancy, suspected spinal infection, or the signs/symptoms of cauda equina syndrome or sciatica/radiculopathy. CT is often recommended where MRI is contraindicated, not tolerated or not available. X-ray is recommended

by CPGs in preference to MRI and CT for suspected cases of vertebral fracture or other bone-related pathology. X-ray is also often recommended in preference to MRI or CT for suspected inflammatory spondyloarthritis; however, if radiographs of the sacroiliac joints are normal or equivocal, MRI is acknowledged as the best imaging modality to identify inflammation.

In patients with suspected spinal canal stenosis, suspected inflammatory spondyloarthritis, or with signs and symptoms of sciatica/radiculopathy, CPGs recommend that imaging should be deferred until at least a 4- to 6- week trial of conservative management, unless neurologic deficits are progressive or severe enough to consider surgical intervention. Repeat MRI without significant clinical deterioration in symptoms and/or signs is not recommended.

Although the identified CPGs were evidence-based to some extent, the recommendations were often supplemented with consensus opinion due to the limited quantity and quality of evidence available. In particular, for those guidelines that preferentially recommended MRI over CT, there was no transparent link to the evidence to support this preference. However, some guidelines noted that MRI offers better visualisation of soft tissue, vertebral marrow, and the spinal canal, and a superior safety profile in terms of no ionising radiation.

While CPG recommendations may take into consideration the relative harms and benefits of each imaging modality, assessment of the comparative harms of the different imaging modalities was out of scope for the review of the clinical evidence undertaken for this MBS Review.⁷⁷

The systematic review did not reveal any clear benefit for MRI over CT in terms of diagnostic accuracy for patients presenting with LBP and suspected spinal canal stenosis, spinal malignancy, spinal infection, or the signs/symptoms of sciatica/radiculopathy. However, the available evidence was limited in terms of quantity and quality, thus rendering it difficult to draw firm conclusions, particularly as high quality comparative studies are lacking. Importantly, there was no evidence identified for the diagnostic accuracy of imaging for suspected cauda equina syndrome or for suspected vertebral fracture in patients with LBP.

The systematic review identified a small number of published economic analyses; however, this evidence does not allow a comparison of cost-effectiveness between imaging modalities in the population of interest for this review, or in the general LBP population.

Although MRI is recommended in CPGs as the modality of choice for detection of a range of serious underlying pathologies, primary care providers are ineligible to request MRI of the low back under the MBS. As a consequence, CT and X-ray may instead be used for patient work-up prior to specialist referral. The evidence indicates that the use of CT and X-ray are not inappropriate in terms of their

⁷⁷ Of note, the FDA posted a safety alert regarding gadolinium-based contrast agents (GBCA) on their website on 27th July 2015. The FDA is currently investigating the risk of brain deposits following repeated use of GBCA. The FDA has recommended that health care professionals should consider limiting GBCA to clinical circumstances in which the additional information provided by the contrast is necessary.

diagnostic utility in patients with LBP and suspicion of underlying serious pathology; however, they do have the added disadvantage of low-level radiation exposure.

The ability to robustly investigate whether current requesting of imaging services for LBP is appropriate, and to determine the associated cost to the MBS of inappropriate LBP imaging, is constrained because the MBS item descriptors are not limited specifically to LBP, and information is not available on the purpose of the imaging request. Furthermore, the MBS data do not provide information about the duration of LBP prior to presentation to a primary care provider. In cases where LBP has persisted over a long period of time, the use of imaging may not be inappropriate.

APPENDIX 1 References

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APPENDIX 2 Review Working Group Members

As part of the MBS Review process, the Department of Health established a Review Working Group (RWG). The RWG is a time-limited working group of nominated representatives to provide advice to the Department on the scope of the review, clinical practice and policy issues. The members of the RWG are listed in Table A-2.1.

Table A-Error! No text of specified style in document..1 Members of the RWG

| Name | Representing |
|-------------------------------|---|
| Dr Robert Cooper | Australasian Association of Nuclear Medicine Specialists |
| Dr Hayden Prime | Australian Diagnostic Imaging Association |
| Dr Ron Shnier | Australian Diagnostic Imaging Association |
| Dr Chris Clohesy | Australian Medical Association |
| Professor Mark Khangure | Australian Medical Association |
| Dr Rob Kuru | Australian Orthopaedic Association |
| Professor Chris Maher | Australian Physiotherapy Association |
| Professor Rachelle Buchbinder | Australian Rheumatology Association |
| Dr Kelly Macgroarty | Australian Society of Orthopaedic Surgeons |
| Dr Marinis Pirpiris | Australian Society of Orthopaedic Surgeons |
| Dr Craig Moore | Chiropractors Association of Australia |
| Professor Adrian Nowitzke | Neurosurgical Society of Australasia |
| Professor Stacy Goergen | The Royal Australian and New Zealand College of Radiologists |
| Dr Michael Yelland | The Royal Australian College of General Practitioners |
| Assoc Professor Graeme Miller | Family Medicine Research Centre |
| Dr Walid Jamal | General practitioner; Member of the Protocol Advisory Sub-Committee of MSAC; Member of the Evaluation Sub-Committee of MSAC |
| Professor Michael Schuetz | Orthopaedic surgeon; Member of the Protocol Advisory Sub-Committee of MSAC |
| Chair and Secretariat | Department of Health |

APPENDIX 3 MBS Information*MBS items in scope for the review*

MBS items relating to low back imaging (CT, MRI and radiography) are shown in Tables A-3.1–A-3.4. The relevant Explanatory Notes are shown in Table A-3.5.

Table A-Error! No text of specified style in document..1 MBS items relating to diagnostic radiology of the low back – Group I3, Subgroup 4 – Radiographic examination of spine

| Item number | Start date | MBS item number description |
|-------------|---|---|
| 58106 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Dec-1991 Schedule Fee: 01-Nov-2004 | SPINE LUMBOSACRAL (R) Bulk bill incentive Fee: \$77.00 Benefit: 75% = \$57.75 85% = \$65.45 (See para DIQ of explanatory notes to this Category) |
| 58108 | <ul style="list-style-type: none"> Item: 01-Nov-2001 Description: 01-Nov-2001 Schedule Fee: 01-Jan-2010 | Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal (R) Bulk bill incentive Fee: \$110.00 Benefit: 75% = \$82.50 85% = \$93.50 (See para DIQ of explanatory notes to this Category) |
| 58109 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Dec-1991 Schedule Fee: 01-Nov-2004 | SPINE SACROCCOCCYGEAL (R) Bulk bill incentive Fee: \$47.00 Benefit: 75% = \$35.25 85% = \$39.95 (See para DIQ of explanatory notes to this Category) |
| 58111 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | SPINE LUMBOSACRAL (R) (NK) Bulk bill incentive Fee: \$38.50 Benefit: 75% = \$28.90 85% = \$32.75 (See para DIQ of explanatory notes to this Category) |
| 58112 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Dec-1991 Schedule Fee: 01-Nov-2004 | NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item Spine, two examinations of the kind referred to in items 58100, 58103, 58106 and 58109 (R) Bulk bill incentive Fee: \$97.25 Benefit: 75% = \$72.95 85% = \$82.70 (See para DIQ of explanatory notes to this Category) |
| 58114 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal (R) (NK) Bulk bill incentive Fee: \$55.00 Benefit: 75% = \$41.25 85% = \$46.75 (See para DIQ of explanatory notes to this Category) |
| 58115 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Nov-2002 Schedule Fee: 01-Jan-2010 | NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item Spine, three examinations of the kind mentioned in items 58100, 58103, 58106 and 58109 (R) Bulk bill incentive |

| Item number | Start date | MBS item number description |
|-------------|---|--|
| | | Fee: \$110.00 Benefit: 75% = \$82.50 85% = \$93.50 (See para DIQ of explanatory notes to this Category) |
| 58117 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | SPINE SACROCOCCYGEAL (R) (NK) Bulk bill incentive Fee: \$23.50 Benefit: 75% = \$17.65 85% = \$20.00 (See para DIQ of explanatory notes to this Category) |
| 58120 | <ul style="list-style-type: none"> Item: 01-Jan-2010 Description: 01-Jan-2010 Schedule Fee: 01-Jan-2010 | Spine, four regions, cervical, thoracic, lumbosacral and sacroccocygeal (R), if the service to which item 58120 or 58121 applies has not been performed on the same patient within the same calendar year Bulk bill incentive Fee: \$110.00 Benefit: 75% = \$82.50 85% = \$93.50 |
| 58121 | <ul style="list-style-type: none"> Item: 01-Jan-2010 Description: 01-Jan-2010 Schedule Fee: 01-Jan-2010 | NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item Spine, three examinations of the kind mentioned in items 58100, 58103, 58106 and 58109 (R), if the service to which item 58120 or 58121 applies has not been performed on the same patient within the same calendar year Bulk bill incentive Fee: \$110.00 Benefit: 75% = \$82.50 85% = \$93.50 |
| 58123 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item Spine, two examinations of the kind referred to in items 58100, 58102, 58103, 58105, 58106, 58109, 58111 and 58117 (R) (NK) Bulk bill incentive Fee: \$48.65 Benefit: 75% = \$36.50 85% = \$41.40 (See para DIQ of explanatory notes to this Category) |
| 58126 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | Spine, four regions, cervical, thoracic, lumbosacral and sacroccocygeal, if the service to which item 58120, 58121, 58126 or 58127 applies has not been performed on the same patient within the same calendar year (R) (NK) Bulk bill incentive Fee: \$55.00 Benefit: 75% = \$41.25 85% = \$46.75 (See para DIQ of explanatory notes to this Category) |

Source: MBS Online, accessed 16 May 2014

Note: Bold indicates item start date on MBS is within 5-year period of investigation in this Review (2009-10 to 2013-14).

(NK): the addition of (NK) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older. This equipment must have been first installed in Australia ten or more years ago, or in the case of imported pre-used equipment, must have been first manufactured ten or more years ago.

(R): Imaging services marked with the symbol (R) are not eligible for a Medicare rebate unless the diagnostic imaging procedure is performed under the professional supervision of a:

(a) specialist or a consultant physician in the practice of his or her specialty who is available to monitor and influence the conduct and diagnostic quality of the examination, and if necessary to personally attend the patient; or

(b) practitioner who is not a specialist or consultant physician who meets the requirements of A or B hereunder, and who is available to monitor and influence the conduct and diagnostic quality of the examination and, if necessary, to personally attend the patient.

A. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner at the location where the service was rendered and the rendering of those services entitled the payment of Medicare benefits.

B. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner in nursing homes or patients' residences and the rendering of those services entitled payment of Medicare benefits.

Table A-Error! No text of specified style in document..2 MBS items relating to diagnostic radiology of the low back – Group I3 Subgroup 12 – Radiographic examination with opaque or contrast media

| Item number | Start date | MBS item number description |
|-------------|---|---|
| 59700 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Nov-2001 Schedule Fee: 01-Nov-2004 | DISCOGRAPHY, each disc, with or without preliminary plain films and with preparation and contrast injection - (R) Bulk bill incentive (Anaes.) Fee: \$96.55 Benefit: 75% = \$72.45 85% = \$82.10 (See para DIQ of explanatory notes to this Category) |
| 59701 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | DISCOGRAPHY, each disc, with or without preliminary plain films and with preparation and contrast injection - (R) (NK) Bulk bill incentive (Anaes.) Fee: \$48.30 Benefit: 75% = \$36.25 85% = \$41.10 (See para DIQ of explanatory notes to this Category) |
| 59724 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Nov-2001 Schedule Fee: 01-Nov-2004 | MYELOGRAPHY, 1 or more regions, with or without preliminary plain films and with preparation and contrast injection, not being a service associated with a service to which item 56219 applies - (R) Bulk bill incentive (Anaes.) Fee: \$226.45 Benefit: 75% = \$169.85 85% = \$192.50 (See para DIQ of explanatory notes to this Category) |
| 59725 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | MYELOGRAPHY, 1 or more regions, with or without preliminary plain films and with preparation and contrast injection, not being a service associated with a service to which item 56219 or 56259 applies - (R) (NK) Bulk bill incentive (Anaes.) Fee: \$113.25 Benefit: 75% = \$84.95 85% = \$96.30 (See para DIQ of explanatory notes to this Category) |

Source: MBS Online, accessed 16 May 2014

Note: Bold indicates item start date on MBS is within 5-year period of investigation in this Review (2009-10 to 2013-14).

(NK): the addition of (NK) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older. This equipment must have been first installed in Australia ten or more years ago, or in the case of imported pre-used equipment, must have been first manufactured ten or more years ago.

(R): Imaging services marked with the symbol (R) are not eligible for a Medicare rebate unless the diagnostic imaging procedure is performed under the professional supervision of a:

(a) specialist or a consultant physician in the practice of his or her specialty who is available to monitor and influence the conduct and diagnostic quality of the examination, and if necessary to personally attend the patient; or

(b) practitioner who is not a specialist or consultant physician who meets the requirements of A or B hereunder, and who is available to monitor and influence the conduct and diagnostic quality of the examination and, if necessary, to personally attend the patient.

A. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner at the location where the service was rendered and the rendering of those services entitled the payment of Medicare benefits.

B. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner in nursing homes or patients' residences and the rendering of those services entitled payment of Medicare benefits.

Table A-Error! No text of specified style in document..3 MBS items relating to computed radiography of the low back – Category 5 – Diagnostic Imaging Services, Group I2 – Computed Tomography

| Item number | Start date | MBS item number description |
|-------------|--|--|
| 56223 | <ul style="list-style-type: none"> Item: 01-Nov-2001 Description: 01-Nov-2001 Schedule Fee: 01-Nov-2004 | <p>COMPUTED TOMOGRAPHY - scan of spine, lumbosacral region, without intravenous contrast medium, payable once only, whether 1 or more attendances are required to complete the service (R) (K) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$240.00 Benefit: 75% = \$180.00 85% = \$204.00</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 56226 | <ul style="list-style-type: none"> Item: 01-Nov-2001 Description: 01-Nov-2001 Schedule Fee: 01-Nov-2004 | <p>COMPUTED TOMOGRAPHY - scan of spine, lumbosacral region, with intravenous contrast medium and with any scans of the lumbosacral region of the spine prior to intravenous contrast injection when undertaken; only 1 benefit payable whether 1 or more attendances are required to complete the service (R) (K) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$351.40 Benefit: 75% = \$263.55 85% = \$298.70</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 56229 | <ul style="list-style-type: none"> Item: 01-Nov-2001 Description: 01-Nov-2001 Schedule Fee: 01-Nov-2004 | <p>COMPUTED TOMOGRAPHY - scan of spine, lumbosacral region, without intravenous contrast medium, payable once only, whether 1 or more attendances are required to complete the service (R) (NK) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$122.50 Benefit: 75% = \$91.90 85% = \$104.15</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 56232 | <ul style="list-style-type: none"> Item: 01-Nov-2001 Description: 01-Nov-2001 Schedule Fee: 01-Nov-2004 | <p>COMPUTED TOMOGRAPHY - scan of spine, lumbosacral region, with intravenous contrast medium and with any scans of the lumbosacral region of the spine prior to intravenous contrast injection when undertaken; only 1 benefit payable whether 1 or more attendances are required to complete the service (R) (NK) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$177.45 Benefit: 75% = \$133.10 85% = \$150.85</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 56233 | <ul style="list-style-type: none"> Item: 01-Nov-2001 Description: 01-Nov-2001 Schedule Fee: 01-Nov-2004 | <p><i>NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item</i></p> <p>COMPUTED TOMOGRAPHY - scan of spine, two examinations of the kind referred to in items 56220, 56221 and 56223 without intravenous contrast medium payable once only, whether 1 or more attendances are required to complete the service (R) (K) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$240.00 Benefit: 75% = \$180.00 85% = \$204.00</p> <p>(See para DIQ of explanatory notes to this Category)</p> |

Source: MBS Online, accessed 16 May 2014

Note:

(NK): the addition of (NK) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older. This equipment must have been first installed in Australia ten or more years ago, or in the case of imported pre-used equipment, must have been first manufactured ten or more years ago.

(K): the addition of (K) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older, and where equipment is located in a remote area.

(R): Imaging services marked with the symbol (R) are not eligible for a Medicare rebate unless the diagnostic imaging procedure is performed under the professional supervision of a:

(a) specialist or a consultant physician in the practice of his or her specialty who is available to monitor and influence the conduct and diagnostic quality of the examination, and if necessary to personally attend the patient; or

(b) practitioner who is not a specialist or consultant physician who meets the requirements of A or B hereunder, and who is available to monitor and influence the conduct and diagnostic quality of the examination and, if necessary, to personally attend the patient.

A. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner at the location where the service was rendered and the rendering of those services entitled the payment of Medicare benefits.

B. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner in nursing homes or patients' residences and the rendering of those services entitled payment of Medicare benefits.

Table A-Error! No text of specified style in document..4 MBS items relating to magnetic resonance imaging of the low back – Category 5 – Diagnostic Imaging Services, Group I5 – Magnetic Resonance Imaging

| Item number | Start date | MBS item number description |
|-------------|---|---|
| 63151 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | MAGNETIC RESONANCE IMAGING performed under the professional supervision of an eligible provider at an eligible location where the patient is referred by a specialist or by a consultant physician - scan of one region or two contiguous regions of the spine for: - infection (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65 (See para DIQ of explanatory notes to this Category) |
| 63154 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | - tumour (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65 (See para DIQ of explanatory notes to this Category) |
| 63157 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | MAGNETIC RESONANCE IMAGING performed under the professional supervision of an eligible provider at an eligible location where the patient is referred by a specialist or by a consultant physician - scan of one region or two contiguous regions of the spine for: - infection (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIQ of explanatory notes to this Category) |
| 63158 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - tumour (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIQ of explanatory notes to this Category) |
| 63164 | <ul style="list-style-type: none"> Item: 01-Aug-2004 | - congenital malformation of the spinal cord or the cauda equina or the meninges (R) (Contrast) |

| Item number | Start date | MBS item number description |
|-------------|---|---|
| | <ul style="list-style-type: none"> Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | Bulk bill incentive (Anaes.) Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65 (See para DIQ of explanatory notes to this Category) |
| 63167 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | - myelopathy (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65 (See para DIQ of explanatory notes to this Category) |
| 63176 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | - sciatica (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65 (See para DIQ of explanatory notes to this Category) |
| 63179 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | - spinal canal stenosis (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65 (See para DIQ of explanatory notes to this Category) |
| 63187 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - congenital malformation of the spinal cord or the cauda equina or the meninges (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIQ of explanatory notes to this Category) |
| 63188 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - myelopathy (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIQ of explanatory notes to this Category) |
| 63191 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - sciatica (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIQ of explanatory notes to this Category) |
| 63192 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - spinal canal stenosis (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIQ of explanatory notes to this Category) |
| 63201 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 | MAGNETIC RESONANCE IMAGING performed under the professional supervision of an eligible provider at an eligible location where the |

| Item number | Start date | MBS item number description |
|-------------|---|---|
| | <ul style="list-style-type: none"> Schedule Fee: 01-Aug-2004 | <p>patient is referred by a specialist or by a consultant physician - scan of three contiguous regions or two non contiguous regions of the spine for:</p> <p>- infection (R) (Contrast)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63204 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | <p>- tumour (R) (Contrast)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63207 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | <p>MAGNETIC RESONANCE IMAGING performed under the professional supervision of an eligible provider at an eligible location where the patient is referred by a specialist or by a consultant physician - scan of three contiguous regions or two non contiguous regions of the spine for:</p> <p>- infection (R) (NK) (Contrast)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63208 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | <p>- tumour (R) (NK) (Contrast)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63222 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | <p>- congenital malformation of the spinal cord or the cauda equina or the meninges (R) (Contrast)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63225 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | <p>- myelopathy (R) (Contrast)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63234 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | <p>- sciatica (R) (Contrast)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80</p> |

| Item number | Start date | MBS item number description |
|-------------|---|---|
| | | (See para DIQ of explanatory notes to this Category) |
| 63237 | <ul style="list-style-type: none"> Item: 01-Aug-2004 Description: 01-Aug-2004 Schedule Fee: 01-Aug-2004 | - spinal canal stenosis (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIQ of explanatory notes to this Category) |
| 63258 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - congenital malformation of the spinal cord or the cauda equina or the meninges (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |
| 63259 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - myelopathy (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |
| 63262 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - sciatica (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |
| 63263 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | - spinal canal stenosis (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |

Source: MBS Online, accessed 16 May 2014

Note: Bold indicates item start date on MBS is within 5-year period of investigation in this Review (2009-10 to 2013-14).

(NK): the addition of (NK) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older. This equipment must have been first installed in Australia ten or more years ago, or in the case of imported pre-used equipment, must have been first manufactured ten or more years ago.

(K): the addition of (K) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older, and where equipment is located in a remote area.

(R): Imaging services marked with the symbol (R) are not eligible for a Medicare rebate unless the diagnostic imaging procedure is performed under the professional supervision of a:

(a) specialist or a consultant physician in the practice of his or her specialty who is available to monitor and influence the conduct and diagnostic quality of the examination, and if necessary to personally attend the patient; or

(b) practitioner who is not a specialist or consultant physician who meets the requirements of A or B hereunder, and who is available to monitor and influence the conduct and diagnostic quality of the examination and, if necessary, to personally attend the patient.

A. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner at the location where the service was rendered and the rendering of those services entitled the payment of Medicare benefits.

B. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner in nursing homes or patients' residences and the rendering of those services entitled payment of Medicare benefits.

Explanatory notes DIM and DIQ (from MBS Online, accessed 16 May 2014)**DID****Requests for Diagnostic Imaging Services****Who may request a diagnostic imaging service**

The following practitioners may request a diagnostic imaging service:

- Specialists and consultant physicians can request any diagnostic imaging service.
- Other medical practitioners can request any service and specific Magnetic Resonance Imaging Services – see DIO.
- A medical practitioner, on behalf of the treating practitioner, for example, by a resident medical officer at a hospital on behalf of the patient's treating practitioner.
- Dental Practitioners, Physiotherapists, Chiropractors, Osteopaths and Podiatrists registered or licensed under State or Territory laws.
- Participating nurse practitioners and participating midwives.

Physiotherapists, Chiropractors and Osteopaths may request:

57712, 57715, 58100 to 58106 (inclusive), 58109, 58112, 58120 and 58121

DIM**Group I3 – Diagnostic Radiology****Subgroup 4: Radiographic examination of the spine***Multiple regions*

Multiple region items require that the regions of the spine to be studied must be specified on any account issued or patient assignment form completed.

Item 58112 - spine, two regions

Where item 58112 is rendered (spine, two regions), the item numbers for the regions of the spine being studied must be specified (i.e. from items 58100, 58103, 58106 and 58109).

Example: for a radiographic examination of the spine where the cervical and thoracic regions are to be studied, item numbers 58100 and 58103 must be specified on any account issued or patient assignment forms completed.

Item 58115 – spine, three region

Where item 58115 is rendered (spine, three regions), the item numbers for the regions of the spine being studied must be specified (items 58100, 58103, 58106 and 58109).

Example: for a radiographic examination of the spine where the cervical, the thoracic and the lumbosacral regions are to be studied, item numbers 58100, 58103 and 58106 must be specified on any accounts issued or patient assignment forms completed.

Item 58115 & 58108 – spine, three and four region

For three and four region radiographic examinations items 58115 and 58108 do not apply when requested by a physiotherapist, chiropractor or osteopath.

Items 58120 and 58121

Items 58120 and 58121 apply to physiotherapists, chiropractors and osteopaths who request a three or four region x-ray and only allow a benefit for one of the items, per patient, per calendar year.

DIQ**Bulk Billing Incentive**

To provide an incentive to bulk-bill, for out of hospital services that are bulk billed the schedule fee is reduced by 5% and rebates paid at 100% of this revised fee (except for item 61369, and all items in Group I5 - Magnetic Resonance Imaging).

For items in Group I5 - Magnetic Resonance Imaging, the bulk billing incentive for out of hospital services is 100% of the Schedule Fee listed in the table.

MBS items out of scope for the review

Although not within the scope of this review of imaging for LBP in adults, Table A-3.5 shows the MBS items that can be requested by GPs for MRI of the head, spine and knee. The associated explanatory note (DIO) follows the table.

Table A-Error! No text of specified style in document..5 MBS items relating to MRI that can be requested by GPs (out of scope)

| Item number | MBS item number description |
|-------------|--|
| 63510 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient under 16 years following radiographic examination for:</p> <ul style="list-style-type: none"> - significant trauma (R) (Contrast) (Anaes.); or - unexplained neck or back pain with associated neurological signs (R) (Contrast) (Anaes.); or - unexplained back pain where significant pathology is suspected (R) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIO of explanatory notes to this Category)</p> |
| 63511 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient under 16 years following radiographic examination for:</p> <ul style="list-style-type: none"> - significant trauma (R) (NK) (Contrast) (Anaes.); or - unexplained neck or back pain with associated neurological signs (R) (NK) (Contrast) (Anaes.); or - unexplained back pain where significant pathology is suspected (R) (NK) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIO of explanatory notes to this Category)</p> |
| 63551 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of head for a patient 16 years or older for any of the following:</p> <ul style="list-style-type: none"> - unexplained seizure(s) (R) (Contrast) (Anaes.) - unexplained chronic headache with suspected intracranial pathology (R) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$403.20 Benefit: 75% = \$302.40 85% = \$342.75 (See para DIO of explanatory notes to this Category)</p> |
| 63552 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of head for a patient 16 years or older for any of the following:</p> <ul style="list-style-type: none"> - unexplained seizure(s) (R) (NK) (Contrast) (Anaes.) - unexplained chronic headache with suspected intracranial pathology (R) (NK) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$201.60 Benefit: 75% = \$151.20 85% = \$171.40 (See para DIO of explanatory notes to this Category)</p> |
| 63554 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient 16 years or older for suspected:</p> <ul style="list-style-type: none"> - cervical radiculopathy (R) (Contrast) (Anaes.) |

| Item number | MBS item number description |
|-------------|--|
| | <p>Bulk bill incentive</p> <p>Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65</p> <p>(See para DIO of explanatory notes to this Category)</p> |
| 63555 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient 16 years or older for suspected:</p> <ul style="list-style-type: none"> - cervical radiculopathy (R) (NK) (Contrast) (Anaes.) <p>Bulk bill incentive</p> <p>Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35</p> <p>(See para DIO of explanatory notes to this Category)</p> |
| 63557 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient 16 years or older for suspected:</p> <ul style="list-style-type: none"> - cervical spine trauma (R) (Contrast) (Anaes.) <p>Bulk bill incentive</p> <p>Fee: \$492.80 Benefit: 75% = \$369.60 85% = \$418.90</p> <p>(See para DIO of explanatory notes to this Category)</p> |
| 63558 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient 16 years or older for suspected:</p> <ul style="list-style-type: none"> - cervical spine trauma (R) (NK) (Contrast) (Anaes.) <p>Bulk bill incentive</p> <p>Fee: \$246.40 Benefit: 75% = \$184.80 85% = \$209.45</p> <p>(See para DIO of explanatory notes to this Category)</p> |
| 63560 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of knee following acute knee trauma for a patient 16 years or older with:</p> <ul style="list-style-type: none"> - inability to extend the knee suggesting the possibility of acute meniscal tear (R) (Contrast) (Anaes.); or - clinical findings suggesting acute anterior cruciate ligament tear. (R) (Contrast) (Anaes.) <p>Bulk bill incentive</p> <p>Fee: \$403.20 Benefit: 75% = \$302.40 85% = \$342.75</p> <p>(See para DIO of explanatory notes to this Category)</p> |
| 63561 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of knee following acute knee trauma for a patient 16 years or older with:</p> <ul style="list-style-type: none"> - inability to extend the knee suggesting the possibility of acute meniscal tear (R) (NK) (Contrast) (Anaes.); or - clinical findings suggesting acute anterior cruciate ligament tear. (R) (NK) (Contrast) (Anaes.) <p>Bulk bill incentive</p> <p>Fee: \$201.60 Benefit: 75% = \$151.20 85% = \$171.40</p> <p>(See para DIO of explanatory notes to this Category)</p> |

Source: MBS Online, accessed 16 May 2014

Explanatory note DIO (from MBS Online, accessed 16 May 2014)

DIO**Itemisation**

MRI items in Group I5, items 63001 to 63561, are divided into subgroups defined according to the area of the body to be scanned, (i.e. head, spine, musculoskeletal system, cardiovascular system or body) and the number of occasions in a defined period in which Medicare benefits may be claimed by a patient. Subgroups are divided into individual items, with each item being for a specific clinical indication.

Eligible services

Group I5 items 63507 to 63561 apply only to a MRI service performed:

- a) on request by a medical practitioner other than a specialist or consultant physician, where the request made in writing identifies the clinical indication for the service;
- b) under the professional supervision of an eligible provider; and
- c) with eligible equipment and partial eligible equipment.

[See MBS Online for further information relating to DIO].

APPENDIX 4 Literature Search

The initial literature search strategy focused on three key areas: (i) current clinical practice for imaging in LBP; (ii) the diagnostic accuracy of imaging in patients presenting with LBP and suspected underlying serious pathology; and (iii) the cost implications associated with the use of diagnostic imaging in this patient group. A search was carried out that aimed to identify data for all three areas; the databases/websites search and the search terms used are shown in Table A-Error! No text of specified style in document..1.

Table A-Error! No text of specified style in document..1 Search strategy for clinical (diagnostic), economic and guideline evidence

| Search terms | Citations |
|--|-----------|
| EMBASE/Medline – guidelines, clinical evidence and economic evidence <i>Population</i> 'low back' OR 'lower back' OR lumbosacral OR lumbar OR 'sacrum'/exp OR sacrum) AND ('pain'/exp AND pain) <i>Test</i> ('imaging'/exp OR imaging) OR ('mri'/exp OR mri) OR ('magnetic resonance'/exp OR 'magnetic resonance') OR (ct AND scan) OR ('x-ray'/exp OR 'x-ray') OR radiograph* OR 'computed tomography') <i>Outcome</i> ((diagnos* AND ('performance'/exp OR 'performance' OR yield OR agree*)) OR sensitivity OR specificity OR 'sensitivity and specificity'/exp OR 'sensitivity and specificity' OR 'specificity and sensitivity'/exp OR 'specificity and sensitivity' OR accura* OR 'accuracy'/exp OR 'accuracy' OR 'diagnostic accuracy'/exp OR 'diagnostic accuracy' OR 'false positive' OR 'false negative' OR 'true positive' OR 'true negative' OR 'positive predictive value' OR 'negative predictive value' OR 'positive likelihood ratio' OR 'negative likelihood ratio' OR 'receiver operating' OR 'diagnostic odds' OR ppv OR npv OR plr OR nlr OR roc OR sroc OR dor OR 'precision'/exp OR 'precision' OR predictive NEAR/4 value* OR 'reference standard' OR 'index test' OR 'reference test' OR 'gold standard'/exp OR 'gold standard' OR 'validation study')) OR ('cost effectiveness analysis'/exp OR 'cost effectiveness analysis' OR 'economic evaluation'/exp OR 'economic evaluation' OR 'health economics'/exp OR 'health economics' OR 'cost minimization analysis'/exp OR 'cost minimization analysis' OR 'cost minimisation analysis' OR 'cost utility analysis'/exp OR 'cost utility analysis' OR 'quality adjusted life year'/exp OR 'quality adjusted life year' OR 'qaly'/exp OR 'qaly' OR 'life year saved') OR ('practice guideline'/exp OR 'practice guideline') <i>Study type</i> (('meta analysis'/exp OR 'meta analysis' OR 'systematic review'/exp OR 'systematic review' OR 'pooled analysis' OR ('review'/exp OR 'review' AND (systemat* OR pool*))) OR ('comparative study'/exp OR 'comparative study' OR 'clinical trial'/exp OR 'clinical trial' OR 'randomized controlled trial'/exp OR 'randomization'/exp OR 'single blind procedure'/exp OR 'single blind procedure' OR 'double blind procedure'/exp OR 'double blind procedure' OR 'triple blind procedure'/exp OR 'triple blind procedure' OR 'crossover procedure'/exp OR 'crossover procedure' OR 'placebo'/exp OR placebo* OR random* OR rct OR 'single blind' OR 'single blinded' OR 'double blind' OR 'double blinded' OR 'treble blind' OR 'treble blinded' OR 'triple blind' OR 'triple blinded' OR 'prospective study'/exp OR 'prospective study') OR ('clinical study'/exp OR 'case control study'/exp OR 'family study'/exp OR 'longitudinal study'/exp OR 'retrospective study'/exp OR ('prospective study'/exp NOT | 8769 |

| Search terms | Citations |
|--|---|
| <p>'randomized controlled trials'/exp) OR 'cohort analysis'/exp OR cohort NEXT/1 (study OR studies) OR 'case control' NEXT/1 (study OR studies) OR 'follow up' NEXT/1 (study OR studies) OR observational NEXT/1 (study OR studies) OR epidemiologic* NEXT/1 (study OR studies) OR 'cross sectional' NEXT/1 (study OR studies)</p> <p><i>Limits</i></p> <p>[humans]/lim AND [english]/lim) AND [2000-2015]/py) AND ([article]/lim OR [article in press]/lim OR [conference paper]/lim OR [conference review]/lim OR [erratum]/lim OR [letter]/lim OR [note]/lim)</p> | |
| <p>Cochrane Library – clinical evidence and economic evidence</p> <p><i>Population AND</i></p> <p>("low back" or "lower back" or lumbosacral or lumbar or sacrum or sacral):ti,ab,kw AND pain:ti,ab,kw</p> <p><i>Intervention</i></p> <p>(imaging or "magnetic resonance" or mri or "computed tomography" or (ct and scan) or x-ray or "x-ray" or radiograph*):ti,ab,kw</p> | <p>All 709</p> <p>CDSR 8</p> <p>OR 9</p> <p>CCTR 674</p> <p>Methods 1</p> <p>HTA 8</p> <p>NHSEED 9</p> |
| <p>National Guideline Clearinghouse – guidelines</p> <p><i>Keyword</i></p> <p>Low back pain</p> <p><i>Category</i></p> <p>Diagnosis</p> <p><i>Year</i></p> <p>2000-2015</p> <p><i>Indexing words</i></p> <p>Disease or Condition</p> | 9 |
| <p>Guidelines International Network – guidelines</p> <p>Low back pain</p> | 32 |

Targeted searches of the reference database that contained the EMBASE, Medline and Cochrane Library citations were performed using the terms outlined in Table A4.2.

Table A-Error! No text of specified style in document..2 Targeted reference database searches

| Search terms | Citations |
|--|------------|
| <p>Guideline search</p> <p>"guideline":ti,ab OR "clinical practice":ti,ab OR "recommendation":ti,ab OR "clinical decision making":ti,ab</p> | 287 |
| <p>Clinical search</p> <p><i>Systematic reviews and meta-analyses</i></p> <p>"systematic":ti OR "systematic review":ab OR "systematic search":ab OR "systematic literature"ab OR "meta-analysis":ti,ab OR "pooled analysis":ti,ab OR "critical review":ti,ab OR "CDSR":db OR "Other":db OR "HTA":db</p> | 82 |
| <p>Economic search</p> <p>"cost-effectiveness":ti,ab OR "economic":ti,ab OR "qaly":ti,ab OR "cost analysis":ti,ab OR "ICER":ti,ab OR "cost":ti OR "NHSEED":db</p> | 128 |

Abbreviations: ab, abstract; db, database; ti, title.

An additional search was carried out to identify evidence of the effectiveness of imaging in this population in terms of change in patient management. This search was conducted via PubMed and is presented in Table A-4.3.

Table A-Error! No text of specified style in document..3 Targeted reference database searches

| Search terms | Citations |
|--|------------|
| PubMed (("low back pain" OR "lower back pain") AND (imaging OR MRI OR CT OR x-ray) AND ((therapeutic AND impact) OR (change AND management) OR ("clinical decision making"))) | 110 |

APPENDIX 5 NHMRC tools for assessing the evidence

The levels of evidence hierarchy developed by the NHMRC (Table A-5.1) were used to select studies according to study design. The evidence base was appraised in accordance with the five-component body of evidence matrix recommended by the NHMRC (2009), which considers the evidence base (in terms of quantity, level and quality), the consistency of results, the potential clinical impact, and the generalisability and applicability of the evidence.

The quality of included clinical studies was assessed using a study-specific quality assessment checklist adapted from the NMHRC (NHMRC, 2000). The quality assessment checklists for each included study are presented in Appendix 6.

Table A-Error! No text of specified style in document..1 Designations of levels of evidence for interventional and diagnostic accuracy studies

| Level | Intervention | Diagnostic accuracy ^a |
|----------------|--|---|
| I ^b | A systematic review of Level II studies | A systematic review of Level II studies |
| II | A randomised controlled trial | A study of test accuracy with: an independent, blinded comparison with a valid reference standard, ^c among consecutive persons with a defined clinical presentation ^d |
| III-1 | A pseudo-randomised controlled trial (i.e. alternate allocation or some other method) | A study of test accuracy with: an independent, blinded comparison with a valid reference standard, ^c among non-consecutive persons with a defined clinical presentation ^d |
| III-2 | A comparative study with concurrent controls: <ul style="list-style-type: none"> • Non-randomised, experimental trial^e • Cohort study • Case-control study • Interrupted time series with a control group | A comparison with reference standard that does not meet the criteria required for Level II and III-1 evidence |
| III-3 | A comparative study without concurrent controls: <ul style="list-style-type: none"> • Historical control study • Two or more single arm study^f • Interrupted time series without a parallel control group | Diagnostic case-control study ^d |
| IV | Case series with either post-test or pre-test/post-test outcomes | Study of diagnostic yield (no reference standard) ^g |

Source: National Health and Medical Research Council. NHMRC levels of evidence and grades for recommendations for developers of guidelines. Canberra: National Health and Medical Research Council, 2009.

a These levels of evidence apply only to studies of assessing the accuracy of diagnostic or screening tests. To assess the overall effectiveness of a diagnostic test there also needs to be a consideration of the impact of the test on patient management and health outcomes. The evidence hierarchy given in the 'Intervention' column should be used when assessing the impact of a diagnostic test on health outcomes relative to an existing method of diagnosis/comparator test(s).

b A systematic review will only be assigned a level of evidence as high as the studies it contains, excepting where those studies are of Level II evidence. Systematic reviews of Level II evidence provide more data than the individual studies and any meta-analyses will increase the precision of the overall results, reducing the likelihood that the results are affected by chance. Systematic reviews of lower level evidence present results of likely poor internal validity and thus are rated on the likelihood that the results have been affected by bias, rather than whether the systematic review itself is of good quality. Systematic review quality should be assessed separately. A systematic review should

consist of at least two studies. In systematic reviews that include different study designs, the overall level of evidence should relate to each individual outcome/result, as different studies (and study designs) might contribute to each different outcome.

c The validity of the reference standard should be determined in the context of the disease under review. Criteria for determining the validity of the reference standard should be pre-specified. This can include the choice of the reference standard(s) and its timing in relation to the index test. The validity of the reference standard can be determined through quality appraisal of the study.

d Well-designed population based case-control studies (e.g. population based screening studies where test accuracy is assessed on all cases, with a random sample of controls) do capture a population with a representative spectrum of disease and thus fulfil the requirements for a valid assembly of patients. However, in some cases the population assembled is not representative of the use of the test in practice. In diagnostic case-control studies a selected sample of patients already known to have the disease are compared with a separate group of normal/healthy people known to be free of the disease. In this situation patients with borderline or mild expressions of the disease, and conditions mimicking the disease are excluded, which can lead to exaggeration of both sensitivity and specificity. This is called spectrum bias or spectrum effect because the spectrum of study participants will not be representative of patients seen in practice.

e This also includes controlled before-and-after (pre-test/post-test) studies, as well as adjusted indirect comparisons (i.e. utilise A vs B and B vs C, to determine A vs C with statistical adjustment for B).

f Comparing single arm studies i.e. case series from two studies. This would also include unadjusted indirect comparisons (i.e. utilise A vs B and B vs C, to determine A vs C but where there is no statistical adjustment for B).

g Studies of diagnostic yield provide the yield of diagnosed patients, as determined by an index test, without confirmation of the accuracy of this diagnosis by a reference standard. These may be the only alternative when there is no reliable reference standard.

APPENDIX 6 **Quality assessment of clinical studies****Diagnostic accuracy****Table A-6.1** *Diagnostic accuracy of van Rijn (2012) systematic review*

| Quality criteria | Questions considered | Yes or no | Level |
|---|---|-----------|--------|
| A. Was an adequate search strategy used? | Was a systematic search strategy reported? | Yes | I |
| | Were the databases searched reported? | Yes | III |
| | Was more than one database searched? | Yes | III |
| | Were search terms reported? | No | IV |
| | Did the literature search include hand searching? | Yes | IV |
| B. Were the inclusion criteria appropriate and applied in an unbiased way? | Were inclusion/exclusion criteria reported? | Yes | II |
| | Was the inclusion criteria applied in an unbiased way? | Yes | III |
| | Was only Level II evidence included? | No | I-IV |
| C. Was a quality assessment of included studies undertaken? | Was the quality of the studies reported? | Yes | III |
| | Was a clear, pre-determined strategy used to assess study quality? | Yes | IV |
| D. Were the characteristics and results of the individual studies appropriately summarised? | Were the characteristics of the individual studies reported? | Yes | III |
| | Were baseline demographic and clinical characteristics reported for patients in the individual studies? | Yes | IV |
| | Were the results of the individual studies reported? | Yes | III |
| E. Were the methods for pooling the data appropriate? | If appropriate, was a meta-analysis conducted? | Yes | III-IV |
| F. Were the sources of heterogeneity explored? | Was a test for heterogeneity applied? | Yes | III-IV |
| | If there was heterogeneity, was this discussed or the reasons explored? | Yes | III-IV |

Note: Quality criteria adapted from NHMRC (2000) How to use the evidence: assessment and application of scientific evidence. NHMRC, Canberra.

Assess criterion using Y (yes), N (no), NR (not reported) or NA (not applicable). For this study, no criterion was not reported or not applicable.

Error categories as follows: (I) leads to exclusion of the study; (II) automatically leads to a poor rating; (III) leads to a one grade reduction in quality rating (e.g. good to fair, or fair to poor); and (IV) errors that are may or may not be sufficient to lead to a decrease in rating.

Where applicable, provide clarification for any of the criteria, particularly where it may result in downgrading of the study quality. For quality assessment of systematic reviews, this should include a statement regarding the methodological quality of the studies included in the systematic review.

Quality ratings are good, fair or poor.

Based on the accuracy criteria in Table A-6.1, van Rijn's (2012) systematic review was rated as good. Individual studies included by van Rijn were not given an overall quality rating. Overall, 50% of included studies received a high quality rating for acceptable reference standard, partial verification avoided, differential verification avoided, index test results blinded, relevant clinical information, uninterpretable results reported, withdrawals explained, definition of positive test result, and objective pre-specified. The authors note that the generalisability of the results is limited mainly by

poor reporting in the original studies, which lead to many unclear or inadequate scores on several QUADAS items. This means that the potential influence of bias is difficult to assess.

Table A-6.2 Diagnostic accuracy of Wassenaar (2012) systematic review

| Quality criteria | Questions considered | Yes or no | Level |
|---|---|-----------|--------|
| A. Was an adequate search strategy used? | Was a systematic search strategy reported? | Yes | I |
| | Were the databases searched reported? | Yes | III |
| | Was more than one database searched? | Yes | III |
| | Were search terms reported? | No | IV |
| | Did the literature search include hand searching? | Yes | IV |
| B. Were the inclusion criteria appropriate and applied in an unbiased way? | Were inclusion/exclusion criteria reported? | Yes | II |
| | Was the inclusion criteria applied in an unbiased way? | Yes | III |
| | Was only Level II evidence included? | No | I-IV |
| C. Was a quality assessment of included studies undertaken? | Was the quality of the studies reported? | Yes | III |
| | Was a clear, pre-determined strategy used to assess study quality? | Yes | IV |
| D. Were the characteristics and results of the individual studies appropriately summarised? | Were the characteristics of the individual studies reported? | No | III |
| | Were baseline demographic and clinical characteristics reported for patients in the individual studies? | No | IV |
| | Were the results of the individual studies reported? | Yes | III |
| E. Were the methods for pooling the data appropriate? | If appropriate, was a meta-analysis conducted? | Yes | III-IV |
| F. Were the sources of heterogeneity explored? | Was a test for heterogeneity applied? | No | III-IV |
| | If there was heterogeneity, was this discussed or the reasons explored? | Yes | III-IV |

Note: Quality criteria adapted from NHMRC (2000) How to use the evidence: assessment and application of scientific evidence. NHMRC, Canberra.

Assess criterion using Y (yes), N (no), NR (not reported) or NA (not applicable).

Error categories as follows: (I) leads to exclusion of the study; (II) automatically leads to a poor rating; (III) leads to a one grade reduction in quality rating (e.g. good to fair, or fair to poor); and (IV) errors that are may or may not be sufficient to lead to a decrease in rating.

Where applicable, provide clarification for any of the criteria, particularly where it may result in downgrading of the study quality. For quality assessment of systematic reviews, this should include a statement regarding the methodological quality of the studies included in the systematic review.

Quality ratings are good, fair or poor.

Quality rating [Good /Fair/ Poor]:

Systematic review: Fair. Characteristics of included studies not reported

Included studies: Individual studies were not given an overall quality rating. Overall, 50% of included studies received a high quality rating for acceptable reference standard, partial verification avoided, differential verification avoided, incorporation avoided, index test results blinded, relevant clinical

information, uninterpretable results reported, appropriateness of index test technology, definition of positive test result, and objective pre-specified.

The authors noted that poor reporting of several quality items hindered assessment of the risk of bias and may have affected the validity of the reported sensitivities and specificities.

Table A-6.3 Diagnostic accuracy of Sidiropoulos (2008) systematic review and clinical practice guideline

| Quality criteria | Questions considered | Yes, no, not reported (NR) or not applicable (NA) | Level |
|---|---|---|--------|
| A. Was an adequate search strategy used? | Was a systematic search strategy reported? | Yes | I |
| | Were the databases searched reported? | Yes | III |
| | Was more than one database searched? | No | III |
| | Were search terms reported? | No | IV |
| | Did the literature search include hand searching? | NR | IV |
| B. Were the inclusion criteria appropriate and applied in an unbiased way? | Were inclusion/exclusion criteria reported? | Yes | II |
| | Was the inclusion criteria applied in an unbiased way? | NR | III |
| | Was only Level II evidence included? | NR | I-IV |
| C. Was a quality assessment of included studies undertaken? | Was the quality of the studies reported? | NR | III |
| | Was a clear, pre-determined strategy used to assess study quality? | NR | IV |
| D. Were the characteristics and results of the individual studies appropriately summarised? | Were the characteristics of the individual studies reported? | NR | III |
| | Were baseline demographic and clinical characteristics reported for patients in the individual studies? | NR | IV |
| | Were the results of the individual studies reported? | Yes | III |
| E. Were the methods for pooling the data appropriate? | If appropriate, was a meta-analysis conducted? | NA | III-IV |
| F. Were the sources of heterogeneity explored? | Was a test for heterogeneity applied? | No | III-IV |
| | If there was heterogeneity, was this discussed or the reasons explored? | No | III-IV |

Note: Quality criteria adapted from NHMRC (2000) How to use the evidence: assessment and application of scientific evidence. NHMRC, Canberra.

Assess criterion using Y (yes), N (no), NR (not reported) or NA (not applicable).

Error categories as follows: (I) leads to exclusion of the study; (II) automatically leads to a poor rating; (III) leads to a one grade reduction in quality rating (e.g. good to fair, or fair to poor); and (IV) errors that are may or may not be sufficient to lead to a decrease in rating.

Where applicable, provide clarification for any of the criteria, particularly where it may result in downgrading of the study quality. For quality assessment of systematic reviews, this should include a statement regarding the methodological quality of the studies included in the systematic review.

Quality ratings are good, fair or poor.

Quality rating [Good /Fair/ Poor]:

Systematic review: Poor. The literature search included Medline and PubMed only. Individual study characteristics and quality assessment was not reported.

Included studies: The quality of individual studies was not reported. It is not clear whether any form of quality assessment was undertaken (other than an assessment of level of evidence based on study design).

Table A-6.4 Diagnostic accuracy of Jarvik and Deyo (2002) systematic review

| Quality criteria | Questions considered | Yes, no, not reported (NR) or not applicable (NA) | Level |
|---|---|---|--------|
| A. Was an adequate search strategy used? | Was a systematic search strategy reported? | Yes | I |
| | Were the databases searched reported? | Yes | III |
| | Was more than one database searched? | No | III |
| | Were search terms reported? | Yes | IV |
| | Did the literature search include hand searching? | NR | IV |
| B. Were the inclusion criteria appropriate and applied in an unbiased way? | Were inclusion/exclusion criteria reported? | Yes | II |
| | Was the inclusion criteria applied in an unbiased way? | Yes | III |
| | Was only Level II evidence included? | NR | I-IV |
| C. Was a quality assessment of included studies undertaken? | Was the quality of the studies reported? | No | III |
| | Was a clear, pre-determined strategy used to assess study quality? | No | IV |
| D. Were the characteristics and results of the individual studies appropriately summarised? | Were the characteristics of the individual studies reported? | No | III |
| | Were baseline demographic and clinical characteristics reported for patients in the individual studies? | No | IV |
| | Were the results of the individual studies reported? | Yes | III |
| E. Were the methods for pooling the data appropriate? | If appropriate, was a meta-analysis conducted? | NA | III-IV |
| F. Were the sources of heterogeneity explored? | Was a test for heterogeneity applied? | No | III-IV |
| | If there was heterogeneity, was this discussed or the reasons explored? | No | III-IV |

Note: Quality criteria adapted from NHMRC (2000) How to use the evidence: assessment and application of scientific evidence. NHMRC, Canberra.

Assess criterion using Y (yes), N (no), NR (not reported) or NA (not applicable).

Error categories as follows: (I) leads to exclusion of the study; (II) automatically leads to a poor rating; (III) leads to a one grade reduction in quality rating (e.g. good to fair, or fair to poor); and (IV) errors that are may or may not be sufficient to lead to a decrease in rating.

Where applicable, provide clarification for any of the criteria, particularly where it may result in downgrading of the study quality. For quality assessment of systematic reviews, this should include a statement regarding the methodological quality of the studies included in the systematic review.

Quality ratings are good, fair or poor.

Quality rating [Good /Fair/ Poor]:

Systematic review: Poor. Individual study characteristics and quality assessment was not reported.

Included studies: Quality assessment of individual studies was not undertaken.

Primary diagnostic accuracy studies

Tables A-6.5–A-6.6 provide assessments of the primary diagnostic accuracy studies reviewed for this report, using criteria for assessing the risk of bias in a well conducted diagnostic study.

Table A-6.5 *Moranjkic 2011*

| Domain | Item | Risk of bias criteria | Assessment for study (Yes, no or can't say) |
|-------------------------------|------|--|---|
| Domain 1 – patient selection | 1.1 | A consecutive sequence or random selection of patients is enrolled. | Yes |
| | 1.2 | Case – control methods are not used. | Yes |
| | 1.3 | Inappropriate exclusions are avoided. | Yes |
| Domain 2 – index test | 2.1 | The index test results interpreted without knowledge of the results of the reference standard. | Yes |
| | 2.2 | If a threshold is used, it is pre-specified. | Can't say |
| Domain 3 – reference standard | 3.1 | The reference standard is likely to correctly identify the target condition. | Yes |
| | 3.2 | Reference standard results are interpreted without knowledge of the results of the index test. | Can't say |
| Domain 4 – flow and timing | 4.1 | There is an appropriate interval between the index test and reference standard. | Can't say |
| | 4.2 | All patients receive the same reference standard. | Yes |
| | 4.3 | All patients recruited into the study are included in the analysis. | Yes |

Adapted from the SIGN50 methodology checklist for studies of diagnostic accuracy. Available at: [SIGN Critical Appraisal Notes and Checklist](#)

Moranjkic's (2011) study Included all patients undergoing microdiscectomy between Jan and June 2008; index tests (MRI or CT) carried out prior to determination of status via reference standard (disc extrusion as assessed during surgery by the competence of posterior annulus); unclear how long the interval between the imaging and surgery was.

Overall, the study was assessed as being of fair quality in minimising bias.

Table A-6.6 Shankar 2009

| Domain | Item | Risk of bias criteria | Assessment for study (Yes, no, can't say or poor quality) |
|--|------|---|---|
| Domain 1 – patient selection | 1.1 | A consecutive sequence or random selection of patients is enrolled. | Can't say |
| | 1.2 | Case – control methods are not used. | No |
| | 1.3 | Inappropriate exclusions are avoided. | Can't say |
| Domain 2 – index test | 2.1 | The index test results interpreted without knowledge of the results of the reference standard. | Can't say |
| | 2.2 | If a threshold is used, it is pre-specified. | Yes |
| Domain 3 – reference standard | 3.1 | The reference standard is likely to correctly identify the target condition. | Can't say |
| | 3.2 | Reference standard results are interpreted without knowledge of the results of the index test. | Can't say |
| Domain 4 – flow and timing | 4.1 | There is an appropriate interval between the index test and reference standard. | Can't say |
| | 4.2 | All patients receive the same reference standard. | No |
| | 4.3 | All patients recruited into the study are included in the analysis. | Can't say |
| Domain 5 – overall assessment of the study | 5.1 | How well was the study done to minimise bias? Code as follows: May be subject to substantial selection bias - diagnostic case-control study which has the potential to overestimate accuracy; no thresholds for test reported but description of findings and what they mean provided; reference standard different for cases and controls – for cases, based on clinical findings, while for controls (mechanical LBP), already had established diagnosis which may have already included imaging. | Poor quality |

Adapted from the SIGN50 methodology checklist for studies of diagnostic accuracy. Available at: [SIGN Critical Appraisal Notes and Checklist](#)

Change in patient management

Table A-6.7 Cohort Study Rankine 1998

| Quality criteria | Questions considered | Yes, no, not reported (NR) or not applicable (NA) | Level |
|---|--|---|--------|
| A. Was the selection of subjects appropriate? | Were the two groups being studied selected from source populations that are comparable in all respects other than the factor under investigation? | NA | II-IV |
| | Was the likelihood that some eligible subjects might have the outcome at the time of enrolment adequately accounted for in the analysis? | NA | III |
| B. Were all recruited participants included in the analysis? | Does the study report whether all people who were asked to take part did so, in each of the groups being studied? | Yes | III |
| | Was loss to follow-up and exclusions from analysis reported? | Yes | II |
| | Was loss to follow-up and exclusions from analysis appropriately accounted for in the analysis? | Yes | III-IV |
| C. Does the study design/analysis adequately control for potential confounding variables? | Does the study adequately control for demographic characteristics, clinical features, and other potential confounding variables in the study design or analysis? | NA | II-IV |
| D. Was outcome assessment subject to bias? | Were all relevant outcomes measured in a standard, valid, and reliable way? | No | III-IV |
| | Was outcome assessment blinded to exposure status? | Yes | III |
| | If outcome assessment was not blinded, were outcomes objective and unlikely to be influenced by blinding of assessment? | NA | III |
| E. Was follow-up adequate? | Was follow-up long enough for outcomes to occur? | NA | III |

Note: Quality criteria adapted from NHMRC (2000) How to use the evidence: assessment and application of scientific evidence. NHMRC, Canberra.

Assess criterion using Y (yes), N (no), NR (not reported) or NA (not applicable).

Error categories as follows: (I) leads to exclusion of the study; (II) automatically leads to a poor rating; (III) leads to a one grade reduction in quality rating (eg, good to fair, or fair to poor); and (IV) errors that are may or may not be sufficient to lead to a decrease in rating.

Where applicable, provide clarification for any of the criteria, particularly where it may result in downgrading of the study quality.

Quality ratings are good, fair or poor.

Comments: All patients received both clinical and MRI assessment; only 2 patients excluded from analysis; two different assessors used – no discussion of consistency between the two and their before and after management plans; authors noted an average of 11.9 weeks between clinical

assessment and MRI – seven patients had improved by this point so that MRI findings were not going to influence management.

Quality rating [Good/Fair/Poor]: Fair

Table A-6.8 Randomised controlled trial Gilbert 2004

| Quality criteria | Questions considered | Yes, no, not reported (NR) or not applicable (NA) | Level |
|---|---|---|--------|
| A. Was assignment of subjects to treatment group randomised? | Was the use of randomisation reported? | Yes | I |
| | Was the method of randomisation reported? | Yes | III |
| | Was the method of randomisation appropriate? | Yes | I-III |
| B. Was allocation to treatment groups concealed from those responsible for recruiting subjects? | Was a method of allocation concealment reported? | Yes | III |
| | Was the method of allocation concealment adequate? | Yes | III |
| C. Was the study double-blinded? | Were subjects and investigators blinded to treatment arm? | No | II-IV |
| D. Were patient characteristics and demographics similar between treatment arms at baseline? | Were baseline patient characteristics and demographics reported? | Yes | III |
| | Were the characteristics similar between treatment arms? | Yes | III-IV |
| E. Were all randomised participants included in the analysis? | Was loss to follow-up reported? | Yes | II |
| | Was loss to follow-up appropriately accounted for in the analysis? | Yes | III-IV |
| F. Was outcome assessment likely to be subject to bias? | Were all relevant outcomes measured in a standard, valid, and reliable way? | Yes | III-IV |
| | Was outcome assessment blinded to treatment allocation? | No | III |
| | If outcome assessment was not blinded, were outcomes objective and unlikely to be influenced by blinding of assessment? | NA | III |
| G. Were the statistical methods appropriate? | Were the methods used for comparing results between treatment arms appropriate? | Yes | III |
| | If the study was carried out at more than one site, are the results comparable for all sites? | NR | IV |
| H. If appropriate, were any subgroup analyses carried out? | Were subgroup analyses reported? | Yes | III-IV |
| | Were subgroup analyses appropriate? | Yes | III-IV |

Note: Quality criteria adapted from NHMRC (2000) How to use the evidence: assessment and application of scientific evidence. NHMRC, Canberra.

Assess criterion using Y (yes), N (no), NR (not reported) or NA (not applicable).

Error categories as follows: (I) leads to exclusion of the study; (II) automatically leads to a poor rating; (III) leads to a one grade reduction in quality rating (eg, good to fair, or fair to poor); and (IV) errors that are may or may not be sufficient to lead to a decrease in rating.

Where applicable, provide clarification for any of the criteria, particularly where it may result in downgrading of the study quality.

Quality ratings are good, fair or poor.

Comments: Pragmatic RCT – patients randomised to early imaging or selective imaging and clinicians allowed to order investigative tests according to clinical judgement; results reported here based on subgroup analysis for diagnostic impact, and overall group for therapeutic impact.

Quality rating [Good/Fair/Poor]: Good

Table A-6.9 Randomised controlled trial Dey 2004

| Quality criteria | Questions considered | Yes, no, not reported (NR) or not applicable (NA) | Level |
|---|---|---|--------|
| A. Was assignment of subjects to treatment group randomised? | Was the use of randomisation reported? | Yes | I |
| | Was the method of randomisation reported? | Yes | III |
| | Was the method of randomisation appropriate? | Yes | I-III |
| B. Was allocation to treatment groups concealed from those responsible for recruiting subjects? | Was a method of allocation concealment reported? | Yes | III |
| | Was the method of allocation concealment adequate? | Yes | III |
| C. Was the study double-blinded? | Were subjects and investigators blinded to treatment arm? | No | II-IV |
| D. Were patient characteristics and demographics similar between treatment arms at baseline? | Were baseline patient characteristics and demographics reported? | Yes | III |
| | Were the characteristics similar between treatment arms? | Yes | III-IV |
| E. Were all randomised participants included in the analysis? | Was loss to follow-up reported? | Yes | II |
| | Was loss to follow-up appropriately accounted for in the analysis? | Yes | III-IV |
| F. Was outcome assessment likely to be subject to bias? | Were all relevant outcomes measured in a standard, valid, and reliable way? | Yes | III-IV |
| | Was outcome assessment blinded to treatment allocation? | No | III |
| | If outcome assessment was not blinded, were outcomes objective and unlikely to be influenced by blinding of assessment? | No | III |
| G. Were the statistical methods appropriate? | Were the methods used for comparing results between treatment arms appropriate? | Yes | III |
| | If the study was carried out at more than one site, are the results comparable for all sites? | NR | IV |
| H. If appropriate, were any subgroup analyses carried out? | Were subgroup analyses reported? | No | III-IV |
| | Were subgroup analyses appropriate? | NR | III-IV |

Note: Quality criteria adapted from NHMRC (2000) How to use the evidence: assessment and application of scientific evidence. NHMRC, Canberra.

Assess criterion using Y (yes), N (no), NR (not reported) or NA (not applicable).

Error categories as follows: (I) leads to exclusion of the study; (II) automatically leads to a poor rating; (III) leads to a one grade reduction in quality rating (eg, good to fair, or fair to poor); and (IV) errors that are may or may not be sufficient to lead to a decrease in rating.

Where applicable, provide clarification for any of the criteria, particularly where it may result in downgrading of the study quality.

Quality ratings are good, fair or poor.

Comment: Cluster RCT – randomisation undertaken by Centre for Cancer Epidemiology; one control centre pulled out but adjusted for in multivariate analysis; open-label so may have affected control group adherence to best practice and hence biased comparison.

Quality rating [Good/Fair/Poor]: Fair

Table A-6.10 Cohort Study Li 2011

| Quality criteria | Questions considered | Yes, no, not reported (NR) or not applicable (NA) | Level |
|---|--|---|--------|
| A. Was the selection of subjects appropriate? | Were the two groups being studied selected from source populations that are comparable in all respects other than the factor under investigation? | No | II-IV |
| | Was the likelihood that some eligible subjects might have the outcome at the time of enrolment adequately accounted for in the analysis? | NA | III |
| B. Were all recruited participants included in the analysis? | Does the study report whether all people who were asked to take part did so, in each of the groups being studied? | No | III |
| | Was loss to follow-up and exclusions from analysis reported? | No | II |
| | Was loss to follow-up and exclusions from analysis appropriately accounted for in the analysis? | NR | III-IV |
| C. Does the study design/analysis adequately control for potential confounding variables? | Does the study adequately control for demographic characteristics, clinical features, and other potential confounding variables in the study design or analysis? | No | II-IV |
| D. Was outcome assessment subject to bias? | Were all relevant outcomes measured in a standard, valid, and reliable way? | No | III-IV |
| | Was outcome assessment blinded to exposure status? | No | III |
| | If outcome assessment was not blinded, were outcomes objective and unlikely to be influenced by blinding of assessment? | No | III |
| E. Was follow-up adequate? | Was follow-up long enough for outcomes to occur? | NA | III |

Note: Quality criteria adapted from NHMRC (2000) How to use the evidence: assessment and application of scientific evidence. NHMRC, Canberra.

Assess criterion using Y (yes), N (no), NR (not reported) or NA (not applicable).

Error categories as follows: (I) leads to exclusion of the study; (II) automatically leads to a poor rating; (III) leads to a one grade reduction in quality rating (eg, good to fair, or fair to poor); and (IV) errors that are may or may not be sufficient to lead to a decrease in rating.

Where applicable, provide clarification for any of the criteria, particularly where it may result in downgrading of the study quality.

Quality ratings are good, fair or poor.

Comments: Historical comparison – 2009 cohort compared with 1996 cohort; no comparison of demographic and clinical characteristics between the two cohorts; outcomes likely assessed by different clinicians at different timepoints.

Quality rating [Good/Fair/Poor]: Poor

APPENDIX 7 MBS Information*Services per capita, geographic and temporal trends*

Table A-Error! No text of specified style in document..1 Services per 100,000 population for main X-ray items (58106, 58112 and 58121), 2009-10 to 2013-14

| Item | Attribute | NSW | VIC | QLD | SA | WA | TAS | ACT | NT | Average |
|-----------|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| 58106 | 2009-2010 | 1,653 | 1,432 | 1,499 | 1,384 | 1,285 | 1,604 | 901 | 723 | 1,488 |
| | 2010-2011 | 1,632 | 1,442 | 1,501 | 1,323 | 1,252 | 1,619 | 891 | 690 | 1,475 |
| | 2011-2012 | 1,593 | 1,448 | 1,520 | 1,303 | 1,183 | 1,609 | 849 | 740 | 1,458 |
| | 2012-2013 | 1,546 | 1,412 | 1,501 | 1,232 | 1,093 | 1,669 | 850 | 862 | 1,418 |
| | 2013-2014 | 1,497 | 1,354 | 1,480 | 1,207 | 1,057 | 1,655 | 844 | 926 | 1,377 |
| | % change from average, 2013-14 | 8.7% | -1.7% | 7.5% | -12.3% | -23.2% | 20.2% | -38.7% | -32.8% | – |
| | 4-year growth | -8.3% | -6.1% | -1.4% | -8.8% | -15.6% | 2.2% | -5.3% | 34.2% | -6.6% |
| | 5-year growth | -9.4% | -5.4% | -1.3% | -12.8% | -17.7% | 3.2% | -6.3% | 28.1% | -7.5% |
| 58112 | 2009-2010 | 665 | 553 | 636 | 615 | 412 | 627 | 320 | 271 | 592 |
| | 2010-2011 | 659 | 552 | 641 | 574 | 405 | 569 | 311 | 244 | 585 |
| | 2011-2012 | 672 | 554 | 648 | 572 | 396 | 559 | 325 | 292 | 590 |
| | 2012-2013 | 639 | 538 | 630 | 560 | 389 | 607 | 363 | 330 | 572 |
| | 2013-2014 | 606 | 518 | 648 | 545 | 385 | 618 | 328 | 370 | 558 |
| | % change from average, 2013-14 | 8.6% | -7.2% | 16.1% | -2.3% | -31.0% | 10.8% | -41.2% | -33.7% | – |
| | 4-year growth | -8.0% | -6.2% | 1.1% | -5.1% | -4.9% | 8.6% | 5.5% | 51.6% | -4.6% |
| | 5-year growth | -8.9% | -6.3% | 1.9% | -11.4% | -6.6% | -1.4% | 2.5% | 36.5% | -5.7% |
| 58121 | 2009-2010a | 290 | 275 | 357 | 350 | 308 | 169 | 170 | 124 | 300 |
| | 2010-2011 | 707 | 633 | 755 | 862 | 775 | 377 | 387 | 289 | 700 |
| | 2011-2012 | 711 | 626 | 804 | 911 | 694 | 323 | 408 | 260 | 703 |
| | 2012-2013 | 616 | 539 | 731 | 690 | 564 | 367 | 339 | 382 | 607 |
| | 2013-2014 | 383 | 327 | 647 | 448 | 418 | 266 | 140 | 426 | 424 |
| | % change from average, 2013-14 | -9.7% | -22.9% | 52.6% | 5.7% | -1.4% | -37.3% | -67.0% | 0.5% | – |
| | 4-year growth | -45.8% | -48.3% | -14.3% | -48.0% | -46.1% | -29.4% | -63.8% | 47.4% | -39.4% |
| | | | | | | | | | | |
| All items | 2009-2010b | 2,608 | 2,260 | 2,492 | 2,349 | 2,005 | 2,400 | 1,391 | 1,118 | 2,380 |
| | 2010-2011 | 2,998 | 2,627 | 2,897 | 2,759 | 2,432 | 2,565 | 1,589 | 1,223 | 2,760 |
| | 2011-2012 | 2,976 | 2,628 | 2,972 | 2,786 | 2,273 | 2,491 | 1,582 | 1,292 | 2,751 |
| | 2012-2013 | 2,801 | 2,489 | 2,862 | 2,482 | 2,046 | 2,643 | 1,552 | 1,574 | 2,597 |
| | 2013-2014 | 2,486 | 2,199 | 2,775 | 2,200 | 1,860 | 2,539 | 1,312 | 1,722 | 2,359 |

| Item | Attribute | NSW | VIC | QLD | SA | WA | TAS | ACT | NT | Average |
|------|--------------------------------|--------|--------|-------|--------|--------|-------|--------|--------|---------|
| | % change from average, 2013-14 | 5.4% | -6.8% | 17.6% | -6.7% | -21.2% | 7.6% | -44.4% | -27.0% | – |
| | 4-year growth | -17.1% | -16.3% | -4.2% | -20.3% | -23.5% | -1.0% | -17.4% | 40.8% | -14.5% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

a Services in the 2009-10 financial year are from 1 January 2010 only, when this MBS item was introduced. As a result, only 4-year growth is shown for this item.

b Total services for main X-ray items in 2009-2010 includes only 6 months of data for item 58121. As a result, only 4-year growth is shown.

Table A-Error! No text of specified style in document..2 Services per 100,000 population for main CT item (56223), 2009-10 to 2013-14

| Attribute | NSW | VIC | QLD | SA | WA | TAS | ACT | NT | Average |
|--------------------------------|-------|-------|-------|-------|--------|-------|--------|--------|---------|
| 2009-2010 | 1,331 | 1,231 | 1,164 | 1,300 | 1,053 | 1,177 | 678 | 419 | 1,219 |
| 2010-2011 | 1,230 | 1,083 | 1,076 | 1,153 | 934 | 1,027 | 541 | 375 | 1,102 |
| 2011-2012 | 1,361 | 1,195 | 1,225 | 1,263 | 1,009 | 1,075 | 632 | 386 | 1,220 |
| 2012-2013 | 1,429 | 1,271 | 1,287 | 1,284 | 1,042 | 1,175 | 713 | 540 | 1,284 |
| 2013-2014 | 1,467 | 1,275 | 1,390 | 1,342 | 1,091 | 1,207 | 714 | 636 | 1,328 |
| % change from average, 2013-14 | 10.5% | -4.0% | 4.7% | 1.1% | -17.8% | -9.1% | -46.2% | -52.1% | – |
| 5-year growth | 10.2% | 3.6% | 19.4% | 3.2% | 3.6% | 2.5% | 5.3% | 51.8% | 8.9% |
| 4-year growth ⁷⁸ | 19.3% | 17.7% | 29.2% | 16.4% | 16.8% | 17.5% | 32.0% | 69.6% | 20.5% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month.

Table A-Error! No text of specified style in document..3 Services per 100,000 population for main MRI items (63154, 63204, 63176, 63179, 63167), 2009-10 to 2013-14

| Item | Attribute | NSW/ACT | VIC/TAS | QLD | SA/NT | WA | Average |
|-------|--------------------------------|---------|---------|--------|-------|--------|---------|
| 63154 | 2009-2010 | 23 | 31 | 20 | 24 | 25 | 25 |
| | 2010-2011 | 22 | 29 | 19 | 25 | 25 | 24 |
| | 2011-2012 | 22 | 31 | 20 | 25 | 23 | 24 |
| | 2012-2013 | 25 | 32 | 21 | 21 | 22 | 26 |
| | 2013-2014 | 27 | 36 | 22 | 27 | 23 | 28 |
| | % change from average, 2013-14 | -3.6% | 28.6% | -21.4% | -3.6% | -17.9% | – |
| | 5-year growth | 17.4% | 16.1% | 10.0% | 12.5% | -8.0% | 12.0% |

⁷⁸ Growth from 2010-11 to 2013-14.

| Item | Attribute | NSW/ACT | VIC/TAS | QLD | SA/NT | WA | Average |
|-----------|--------------------------------|---------|---------|--------|--------|--------|---------|
| 63204 | 2009-2010 | 22 | 28 | 29 | 29 | 11 | 24 |
| | 2010-2011 | 21 | 29 | 31 | 33 | 11 | 25 |
| | 2011-2012 | 22 | 30 | 32 | 35 | 12 | 26 |
| | 2012-2013 | 23 | 32 | 34 | 37 | 11 | 28 |
| | 2013-2014 | 26 | 35 | 35 | 36 | 14 | 30 |
| | % change from average, 2013-14 | -13.3% | 16.7% | 16.7% | 20.0% | -53.3% | – |
| | 5-year growth | 18.2% | 25.0% | 20.7% | 24.1% | 27.3% | 25.0% |
| 63176 | 2009-2010 | 212 | 211 | 134 | 165 | 252 | 196 |
| | 2010-2011 | 225 | 210 | 131 | 183 | 265 | 203 |
| | 2011-2012 | 233 | 221 | 138 | 190 | 281 | 212 |
| | 2012-2013 | 247 | 227 | 148 | 189 | 272 | 219 |
| | 2013-2014 | 255 | 231 | 156 | 201 | 266 | 225 |
| | % change from average, 2013-14 | 13.3% | 2.7% | -30.7% | -10.7% | 18.2% | – |
| | 5-year growth | 20.3% | 9.5% | 16.4% | 21.8% | 5.6% | 14.8% |
| 63179 | 2009-2010 | 59 | 91 | 81 | 49 | 43 | 69 |
| | 2010-2011 | 54 | 84 | 80 | 47 | 40 | 65 |
| | 2011-2012 | 63 | 99 | 77 | 46 | 42 | 72 |
| | 2012-2013 | 60 | 110 | 81 | 39 | 36 | 73 |
| | 2013-2014 | 68 | 118 | 79 | 48 | 42 | 79 |
| | % change from average, 2013-14 | -13.9% | 49.4% | 0.0% | -39.2% | -46.8% | – |
| | 5-year growth | 15.3% | 29.7% | -2.5% | -2.0% | -2.3% | 14.5% |
| 63167 | 2009-2010 | 33 | 19 | 58 | 17 | 21 | 32 |
| | 2010-2011 | 35 | 17 | 62 | 16 | 22 | 32 |
| | 2011-2012 | 41 | 23 | 53 | 20 | 23 | 35 |
| | 2012-2013 | 41 | 26 | 50 | 22 | 21 | 35 |
| | 2013-2014 | 43 | 26 | 49 | 17 | 26 | 36 |
| | % change from average, 2013-14 | 19.4% | -27.8% | 36.1% | -52.8% | -27.8% | – |
| | 5-year growth | 30.3% | 36.8% | -15.5% | 0.0% | 23.8% | 12.5% |
| All items | 2009-2010 | 349 | 380 | 322 | 284 | 352 | 346 |
| | 2010-2011 | 357 | 369 | 323 | 304 | 363 | 349 |
| | 2011-2012 | 381 | 404 | 320 | 316 | 381 | 369 |
| | 2012-2013 | 396 | 427 | 334 | 308 | 362 | 381 |
| | 2013-2014 | 419 | 446 | 341 | 329 | 371 | 398 |
| | % change from average, 2013-14 | 5.3% | 12.1% | -14.3% | -17.3% | -6.8% | – |
| | 5-year growth | 20.1% | 17.4% | 5.9% | 15.8% | 5.4% | 15.0% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 30 June 2015

Note: Services per capita (i.e. per 100,000 population) is calculated by dividing the number of services processed in a month by the number of people enrolled in Medicare at the end of that month. Data are combined for some states/territories due to low number of services.

Table A-Error! No text of specified style in document..4 Services per 100,000 population for MRI items for infection (63151, 63201) and cauda equina (63164, 63222), 2009-10 to 2013-14

| Item # | Year | NSW/ACT | VIC/TAS | QLD | SA/NT | WA | Average |
|--------------------|--------------------------------|---------|---------|--------|--------|--------|---------|
| 63151 | 2009-2010 | 10 | 11 | 7 | 7 | 9 | 9 |
| | 2010-2011 | 10 | 11 | 7 | 8 | 9 | 9 |
| | 2011-2012 | 11 | 13 | 8 | 7 | 8 | 10 |
| | 2012-2013 | 11 | 14 | 10 | 7 | 9 | 11 |
| | 2013-2014 | 16 | 16 | 10 | 8 | 10 | 13 |
| | % change from average, 2013-14 | 23.1% | 23.1% | -23.1% | -38.5% | -23.1% | – |
| | 5-year growth | 60.0% | 45.5% | 42.9% | 14.3% | 11.1% | 44.4% |
| 63201 | 2009-2010 | 3 | 3 | 7 | 3 | 1 | 4 |
| | 2010-2011 | 4 | 4 | 6 | 3 | 1 | 4 |
| | 2011-2012 | 4 | 4 | 5 | 3 | 1 | 4 |
| | 2012-2013 | 4 | 4 | 7 | 4 | 1 | 4 |
| | 2013-2014 | 5 | 5 | 6 | 4 | 2 | 5 |
| | % change from average, 2013-14 | 0.0% | 0.0% | 20.0% | -20.0% | -60.0% | – |
| | 5-year growth | 66.7% | 66.7% | -14.3% | 33.3% | 100.0% | 25.0% |
| Infection combined | 2009-2010 | 13 | 14 | 14 | 10 | 10 | 13 |
| | 2010-2011 | 14 | 15 | 13 | 11 | 10 | 13 |
| | 2011-2012 | 15 | 17 | 13 | 10 | 9 | 14 |
| | 2012-2013 | 15 | 18 | 17 | 11 | 10 | 15 |
| | 2013-2014 | 21 | 21 | 16 | 12 | 12 | 18 |
| | % change from average, 2013-14 | 16.7% | 16.7% | -11.1% | -33.3% | -33.3% | – |
| | 5-year growth | 61.5% | 50.0% | 14.3% | 20.0% | 20.0% | 38.5% |
| 63164 | 2009-2010 | 3 | 7 | 2 | 4 | 4 | 4 |
| | 2010-2011 | 4 | 6 | 3 | 4 | 4 | 4 |
| | 2011-2012 | 4 | 7 | 3 | 3 | 4 | 4 |
| | 2012-2013 | 4 | 6 | 2 | 5 | 3 | 4 |
| | 2013-2014 | 4 | 6 | 2 | 4 | 3 | 4 |
| | % change from average, 2013-14 | 0.0% | 50.0% | -50.0% | 0.0% | -25.0% | – |
| | 5-year growth | 33.3% | -14.3% | 0.0% | 0.0% | -25.0% | 0.0% |

| Item # | Year | NSW/ACT | VIC/TAS | QLD | SA/NT | WA | Average |
|-----------------------|--------------------------------|---------|---------|-------|--------|-------|---------|
| 63222 | 2009-2010 | 6 | 7 | 8 | 4 | 9 | 7 |
| | 2010-2011 | 6 | 8 | 9 | 5 | 8 | 7 |
| | 2011-2012 | 7 | 8 | 11 | 5 | 10 | 8 |
| | 2012-2013 | 8 | 8 | 11 | 6 | 11 | 9 |
| | 2013-2014 | 7 | 8 | 14 | 8 | 12 | 9 |
| | % change from average, 2013-14 | -22.2% | -11.1% | 55.6% | -11.1% | 33.3% | – |
| | 5-year growth | 16.7% | 14.3% | 75.0% | 100.0% | 33.3% | 28.6% |
| Cauda equine combined | 2009-2010 | 9 | 14 | 10 | 8 | 13 | 11 |
| | 2010-2011 | 10 | 14 | 12 | 9 | 12 | 11 |
| | 2011-2012 | 11 | 15 | 14 | 8 | 14 | 12 |
| | 2012-2013 | 12 | 14 | 13 | 11 | 14 | 13 |
| | 2013-2014 | 11 | 14 | 16 | 12 | 15 | 13 |
| | % change from average, 2013-14 | -15.4% | 7.7% | 23.1% | -7.7% | 15.4% | – |
| | 5-year growth | 22.2% | 0.0% | 60.0% | 50.0% | 15.4% | 18.2% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 6 July 2015

Services for main items by age and gender

Table A-Error! No text of specified style in document..1 Services for main X-ray items (58106, 58112, 58121) by age group and gender, 2013-14

| Item | Gender | 0-4 | 5-14 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75-84 | ≥85 | Total |
|-------|--------------|------|-------|--------|--------|--------|--------|--------|--------|--------|-------|---------|
| 58106 | Female | 280 | 3,474 | 11,247 | 14,483 | 20,544 | 29,537 | 34,323 | 35,616 | 25,899 | 9,576 | 184,979 |
| | Male | 284 | 3,055 | 11,357 | 14,583 | 18,045 | 20,879 | 24,616 | 24,598 | 17,936 | 5,169 | 140,522 |
| | % difference | -1% | 14% | -1% | -1% | 14% | 41% | 39% | 45% | 44% | 85% | 32% |
| 58112 | Female | 223 | 4,643 | 8,595 | 7,134 | 8,677 | 11,437 | 14,110 | 13,167 | 9,283 | 3,709 | 80,978 |
| | Male | 234 | 3,162 | 6,897 | 6,420 | 6,685 | 7,244 | 7,807 | 6,630 | 4,417 | 1,446 | 50,942 |
| | % difference | -5% | 47% | 25% | 11% | 30% | 58% | 81% | 99% | 110% | 157% | 59% |
| 58121 | Female | 9 | 1,309 | 6,791 | 11,237 | 11,101 | 10,002 | 7,324 | 3,927 | 1,229 | 201 | 53,130 |
| | Male | 10 | 1,197 | 5,606 | 10,531 | 10,213 | 8,310 | 6,270 | 3,648 | 1,166 | 211 | 47,162 |
| | % difference | -10% | 9% | 21% | 7% | 9% | 20% | 17% | 8% | 5% | -5% | 13% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Table A-Error! No text of specified style in document..2
and gender, 2013-14

Services for main CT item (56223) by age group

| Item | Gender | 0-4 | 5-14 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75-84 | ≥85 | Total |
|-------|--------------|------|------|-------|--------|--------|--------|--------|--------|--------|-------|---------|
| 56223 | Female | 3 | 167 | 5,045 | 12,876 | 22,117 | 31,216 | 35,762 | 35,573 | 23,165 | 6,268 | 172,192 |
| | Male | 5 | 202 | 5,676 | 14,550 | 21,498 | 25,369 | 27,903 | 26,020 | 16,584 | 3,847 | 141,654 |
| | % difference | -40% | -17% | -11% | -12% | 3% | 23% | 28% | 37% | 40% | 63% | 22% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Abbreviations: CT, computed tomography.

Table A-Error! No text of specified style in document..3
63176, 63179, 63167) by age group and gender, 2013-14

Services for main MRI items (63514, 63204,

| Item | Gender | 0-4 | 5-14 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-74 | 75-84 | ≥85 | Total |
|-------|--------------|--------|--------|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| 63514 | Female | 9 | 58 | 108 | 205 | 363 | 672 | 812 | 822 | 415 | 66 | 3,530 |
| | Male | 9 | 67 | 107 | 158 | 267 | 428 | 673 | 848 | 455 | 92 | 3,104 |
| | % difference | 0.0% | -13.4% | 0.9% | 29.7% | 36.0% | 57.0% | 20.7% | -3.1% | -8.8% | -28.3% | 13.7% |
| 63204 | Female | 78 | 280 | 267 | 202 | 353 | 574 | 734 | 670 | 322 | 58 | 3,538 |
| | Male | 104 | 422 | 274 | 191 | 247 | 395 | 634 | 737 | 447 | 86 | 3,537 |
| | % difference | -25.0% | -33.6% | -2.6% | 5.8% | 42.9% | 45.3% | 15.8% | -9.1% | -28.0% | -32.6% | 0.0% |
| 63176 | Female | 2 | 156 | 1,166 | 2,355 | 3,920 | 5,576 | 6,429 | 6,528 | 3,676 | 682 | 30,490 |
| | Male | 3 | 113 | 1,058 | 2,019 | 3,351 | 4,006 | 4,671 | 4,473 | 2,600 | 372 | 22,666 |
| | % difference | -33.3% | 38.1% | 10.2% | 16.6% | 17.0% | 39.2% | 37.6% | 45.9% | 41.4% | 83.3% | 34.5% |
| 63179 | Female | 1 | 36 | 273 | 580 | 1,031 | 1,701 | 2,147 | 2,676 | 1,749 | 289 | 10,483 |
| | Male | 3 | 43 | 273 | 507 | 809 | 1,233 | 1,719 | 2,052 | 1,314 | 219 | 8,172 |
| | % difference | -66.7% | -16.3% | 0.0% | 14.4% | 27.4% | 38.0% | 24.9% | 30.4% | 33.1% | 32.0% | 28.3% |
| 63167 | Female | 1 | 67 | 245 | 407 | 735 | 904 | 967 | 938 | 520 | 112 | 4,896 |
| | Male | 2 | 32 | 161 | 314 | 476 | 627 | 753 | 677 | 461 | 59 | 3,562 |
| | % difference | -50.0% | 109.4% | 52.2% | 29.6% | 54.4% | 44.2% | 28.4% | 38.6% | 12.8% | 89.8% | 37.5% |

Source: Department of Human Services, Medicare Australia Statistics. Accessed 22 May 2015

Abbreviations: MRI, magnetic resonance imaging.

Services for all included items by specialty type

Table A-Error! No text of specified style in document..1
type, 2013-14

Services for all included X-ray items, by specialty

| X-ray item | GPs | % of total for GPs | Specialists | % of total for specialists | Allied health | % of total for allied health | Item total | % of all included items services |
|------------|---------|--------------------|-------------|----------------------------|---------------|------------------------------|------------|----------------------------------|
| 58106 | 245,779 | 66.3% | 43,267 | 56.3% | 35,524 | 20.8% | 324,570 | 52.5% |
| 58108 | 904 | 0.2% | 1,773 | 2.3% | 2 | 0.0% | 2,679 | 0.4% |
| 58109 | 15,548 | 4.2% | 1,594 | 2.1% | 671 | 0.4% | 17,813 | 2.9% |
| 58111 | 102 | 0.0% | 2 | 0.0% | 14 | 0.0% | 118 | 0.0% |

| X-ray item | GPs | % of total for GPs | Specialists | % of total for specialists | Allied health | % of total for allied health | Item total | % of all included items services |
|----------------|---------------|--------------------|---------------|----------------------------|---------------|------------------------------|----------------|----------------------------------|
| 58112 | 93,256 | 25.2% | 18,742 | 24.4% | 19,640 | 11.5% | 131,638 | 21.3% |
| 58114 | 11 | 0.0% | 7 | 0.0% | - | 0.0% | 18 | 0.0% |
| 58115 | 14,628 | 3.9% | 9,756 | 12.7% | 4 | 0.0% | 24,388 | 3.9% |
| 58117 | 5 | 0.0% | 1 | 0.0% | - | 0.0% | 6 | 0.0% |
| 58120 | - | 0.0% | - | 0.0% | 15,451 | 9.1% | 15,451 | 2.5% |
| 58121 | - | 0.0% | 8 | 0.0% | 99,171 | 58.2% | 99,179 | 16.1% |
| 58123 | 47 | 0.0% | 5 | 0.0% | 20 | 0.0% | 72 | 0.0% |
| 58126 | - | 0.0% | - | 0.0% | 1 | 0.0% | 1 | 0.0% |
| 59700 | 325 | 0.1% | 1,211 | 1.6% | - | 0.0% | 1,536 | 0.2% |
| 59701 | - | 0.0% | - | 0.0% | - | 0.0% | - | 0.0% |
| 59724 | 7 | 0.0% | 430 | 0.6% | - | 0.0% | 437 | 0.1% |
| 59725 | - | 0.0% | - | 0.0% | - | 0.0% | - | 0.0% |
| Total services | 370,612 | 100% | 76,796 | 100% | 170,498 | 100% | 617,906 | 100% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: GP, general practitioner.

Note: bold indicates the three items that form the main X-ray items group; these are the three items that together constitute at least 90% of the total services for all included X-ray items across all specialties.

Table A-Error! No text of specified style in document..2 Services for all included CT items, by specialty type, 2013-14

| CT item | GPs | % of total for GPs | Specialists | % of total for specialists | Allied health | % of total for allied health | Item total | % of all included services |
|----------------|----------------|--------------------|---------------|----------------------------|---------------|------------------------------|----------------|----------------------------|
| 56223 | 281,771 | 92.9% | 31,669 | 87.1% | 0 | 0.00% | 313,440 | 92.3% |
| 56226 | 1,122 | 0.4% | 538 | 1.5% | 0 | 0.00% | 1,660 | 0.5% |
| 56229 | 151 | 0.0% | 39 | 0.1% | 0 | 0.00% | 190 | 0.1% |
| 56232 | 2 | 0.0% | 2 | 0.0% | 0 | 0.00% | 4 | 0.0% |
| 56233 | 20,136 | 6.6% | 4,128 | 11.3% | 0 | 0.00% | 24,264 | 7.1% |
| Total services | 303,182 | 100% | 36,376 | 100% | 0 | 100% | 339,558 | 100% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: CT, computed tomography; GP, general practitioner.

Note: bold indicates the main CT item; the only item that constitutes at least 90% of the total for all included items across all specialties.

Services for main X-ray items by specialty type for each financial year, 2009-10 to 2013-14

Table A-*Error! No text of specified style in document..1* X-ray services requested by GPs, 2009-10 to 2013-14

| Item | GP requests | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 4-year growth ^a |
|---------------------------|--|----------------|----------------|----------------|----------------|----------------|----------------------------|
| 58106 | Services | 250,328 | 251,402 | 251,549 | 248,837 | 245,779 | N/A |
| | % of 3 items for speciality type | 73.4% | 73.4% | 73.0% | 72.8% | 72.5% | N/A |
| | Annual growth in services | N/A | 0.4% | 0.1% | -1.1% | -1.2% | -2.2% |
| 58112 | Services | 90,838 | 91,147 | 93,179 | 92,959 | 93,256 | N/A |
| | % of 3 items for speciality type | 26.6% | 26.6% | 27.0% | 27.2% | 27.5% | N/A |
| | Annual growth in services | N/A | 0.3% | 2.2% | -0.2% | 0.3% | 2.3% |
| 58121⁷⁹ | Services | 1 ^b | 0 | 0 | 1 | 0 | N/A |
| | % of 3 items for speciality type | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | N/A |
| | Annual growth in services ^c | N/A | N/A | N/A | N/A | N/A | N/A |
| All items | Total services | 341,167 | 342,549 | 344,728 | 341,797 | 339,035 | -1.0% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: GPs, general practitioners.

a 4-year growth is from 2010-11 to 2013-14.

b Services for item 58121 in the 2009-10 period are for 6 months only, from 1 January 2010.

c Due to low number of services, annual growth not reported for this item.

⁷⁹ When Item 58121 started on the MBS on 1 January 2010, a block was in place to restrict use to allied health professionals. The small numbers of requests for this item by GPs and specialists through to 2013-14 are therefore anomalous.

Table A-Error! No text of specified style in document..2 X-ray services requested by specialists, 2009-10 to 2013-14

| Item No. | Specialist requests | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 4-year growth ^a |
|---------------------------|--|----------------|---------------|---------------|---------------|---------------|----------------------------|
| 58106 | Services | 37,163 | 39,439 | 40,881 | 42,482 | 43,267 | N/A |
| | % of 3 items for speciality type | 69.7% | 70.8% | 70.4% | 70.4% | 69.8% | N/A |
| | Annual growth in services | | 6.1% | 3.7% | 3.9% | 1.8% | 9.7% |
| 58112 | Services | 16,148 | 16,282 | 17,121 | 17,797 | 18,742 | N/A |
| | % of 3 items for speciality type | 30.3% | 29.2% | 29.5% | 29.5% | 30.2% | N/A |
| | Annual growth in services | | 0.8% | 5.2% | 3.9% | 5.3% | 15.1% |
| 58121⁷⁹ | Services | 4 ^b | 18 | 29 | 23 | 8 | N/A |
| | % of 3 items for speciality type | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | N/A |
| | Annual growth in services ^c | N/A | N/A | N/A | N/A | N/A | N/A |
| All items | Total services | 53,315 | 55,739 | 58,031 | 60,302 | 62,017 | 11.3% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

^a 4-year growth is from 2010-11 to 2013-14.

^b Services for item 58121 in the 2009-10 period are for 6 months only, from 1 January 2010.

^c Due to low number of services, annual growth not reported for this item.

Table A-Error! No text of specified style in document..3 X-ray services requested by allied health professionals, 2009-10 to 2013-14

| Item No. | Allied Health requests | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 4-year growth ^a |
|------------------|----------------------------------|---------------------|----------------|----------------|----------------|----------------|----------------------------|
| 58106 | Services | 36,464 | 37,724 | 38,697 | 36,392 | 35,524 | N/A |
| | % of 3 items for speciality type | 26.5% | 17.4% | 17.3% | 19.4% | 23.0% | N/A |
| | Annual growth in services | | 3.5% | 2.6% | -6.0% | -2.4% | -5.8% |
| 58112 | Services | 21,662 | 23,348 | 23,277 | 21,289 | 19,640 | N/A |
| | % of 3 items for speciality type | 15.8% | 10.8% | 10.4% | 11.4% | 12.7% | N/A |
| | Annual growth in services | | 7.8% | -0.3% | -8.5% | -7.7% | -15.9% |
| 58121 | Services | 79,244 ^a | 155,884 | 161,575 | 129,510 | 99,171 | N/A |
| | % of 3 items for speciality type | 57.7% | 71.9% | 72.3% | 69.2% | 64.3% | N/A |
| | Annual growth in services | | 96.7% | 3.7% | -19.8% | -23.4% | -36.4% |
| All items | Total services | 137,370 | 216,956 | 223,549 | 187,191 | 154,335 | -28.9% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

^a 4-year growth is from 2010-11 to 2013-14.

^b Services for item 58121 in the 2009-10 period are for 6 months only, from 1 January 2010.

*Services for main MRI item for sciatica by specialty type, 2009-10 to 2013-14***Table A-Error! No text of specified style in document..1** *Services for MRI item 63176 (sciatica) by requesting specialty group, 2009-10 to 2013-14*

| Specialty group | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth |
|-----------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Neurosurgery | 15,557 | 15,577 | 15,606 | 16,243 | 16,317 | 5% |
| Orthopaedic surgery | 12,244 | 12,554 | 12,823 | 13,159 | 14,026 | 15% |
| Rheumatology | 3,372 | 3,834 | 4,114 | 4,624 | 4,716 | 40% |
| Neurology | 2,825 | 2,958 | 3,156 | 3,359 | 3,566 | 26% |
| Sport and Exercise Medicine | 0 | 1,299 | 2,159 | 2,337 | 2,347 | – |
| All other 63176 | 8,248 | 10,380 | 12,300 | 13,582 | 14,226 | 72% |
| Total | 42,246 | 45,303 | 47,999 | 50,967 | 52,851 | 25.1% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Note: The growth in neurosurgery, orthopaedic surgery, rheumatology and neurology was 21% over the 5-year period.

Abbreviations: MRI, magnetic resonance imaging.

*Cascade imaging***Table A-Error! No text of specified style in document..1** *Number of instances where low back X-ray (MBS item 58106) is followed by MRI (any of the five main MRI items) (Sequence 1)*

| Specialty type requesting X-ray | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth |
|---------------------------------|---------|---------|---------|---------|---------|---------------|
| GPs | 3,143 | 4,524 | 5,616 | 6,780 | 8,133 | 159% |
| Specialists | 2,798 | 3,067 | 3,420 | 3,689 | 3,977 | 42% |
| Allied Health | 323 | 667 | 834 | 1,004 | 1,168 | 262% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: GP, general practitioner; MRI, magnetic resonance imaging.

Table A-Error! No text of specified style in document..2 *Number of instances where low back CT (MBS item 56223) is followed by MRI (any of the five main MRI items) (Sequence 2)*

| Specialty type requesting CT | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth |
|------------------------------|---------|---------|---------|---------|---------|---------------|
| GPs | 6,372 | 6,979 | 8,403 | 10,152 | 11,907 | 86.9% |
| Specialists | 842 | 875 | 1,131 | 1,255 | 1,491 | 77.1% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: CT, computed tomography; GP, general practitioner; MRI, magnetic resonance imaging.

Table A-Error! No text of specified style in document..3 *Number of instances where low back X-ray (MBS item 58106) is followed by low back CT (MBS item 56223) and then by MRI (any of the five main MRI items) (Sequence 3)*

| Specialty type requesting X-ray | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth |
|---------------------------------|---------|---------|---------|---------|---------|---------------|
| GPs | 4,635 | 5,987 | 7,550 | 9,111 | 10,789 | 132.8% |

| Specialty type requesting X-ray | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth |
|---------------------------------|---------|---------|---------|---------|---------|---------------|
| Specialists | 362 | 581 | 781 | 941 | 1,299 | 258.8% |
| Allied Health | 712 | 864 | 1,161 | 1,294 | 1,564 | 119.7% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: CT, computed tomography; GP, general practitioner; MRI, magnetic resonance imaging

Table A-Error! No text of specified style in document..4 Number of instances where low back CT (MBS item 56223) is followed by low back X-ray (MBS item 568106) and then by MRI (any of the five main MRI items) (Sequence 4)

| Specialty type requesting CT | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 5-year growth |
|------------------------------|---------|---------|---------|---------|---------|---------------|
| GPs | 3,889 | 4,219 | 5,446 | 7,366 | 9,028 | 132.1% |
| Specialists | 514 | 573 | 712 | 942 | 987 | 92.0% |

Source: Department of Health, Medical Benefits Division, Medicare Financing & Listings Branch, MBS Analytics Section. Accessed 9 June 2015

Abbreviations: CT, computed tomography; GP, general practitioner; MRI, magnetic resonance imaging.

APPENDIX 8 *Characteristics of primary studies included in systematic reviews*

Of the four systematic reviews that assessed the diagnostic accuracy of imaging in patients with LBP (see Section 5.1.2), only one (van Rijn et al, 2012) reported the characteristics of the primary studies included within it. The study characteristics are reproduced below.

Table A-*Error! No text of specified style in document..1* *Characteristics of primary studies included in van Rijn et al (2012)*

| Author | Design and setting | Setting | Patients | Target condition | Level of measurement | Index test | Reference test |
|------------------------|--------------------|-------------------------|--|--|---|---|-------------------|
| Firooznia et al, 1984 | Prospective | Secondary care, Germany | 100 patients who underwent surgery for sciatica, and had CT of lumbar spine before surgery: 61% male, mean age 49 (19–76) years | Disc prolapse (90.5%) | Disc level; 116 levels assessed of 100 patients | CT: GE 8800 CT/T, 25 cm circular calibration, 250–400 mA, 120 kV, 9.6 s speed, 5 mm slice thickness, with a radiation to the patient per slice of 2.5–4.2 rad | Surgical findings |
| Forristall et al, 1988 | Prospective | Secondary care, USA | 25 patients of which clinical findings were consistent with a HNP documented by positive findings on MRI or contrast CT: 78% male, mean age 45 (22–74) years | HNP with neural compression (77.4%) | Disc level; 31 levels assessed of 25 patients | CT: Picker 1200 Synerview, 14 cm, 65 mA, 130 kV, 5 mm slice thickness, 5 ml of Amipaque 180 mg I/ml | Surgical findings |
| Jackson et al, 1989a | Prospective | Secondary care, USA | 124 patients with LBP and leg pain due to degenerative spinal pathology refractory to conservative management: 70% male, mean age 43 (21–76) years | HNP: protruded, extruded, and sequestered disc (54.1%) | Disc level; 231 levels assessed of 124 patients | CT: Siemens Somatom, 5 mm slice thickness with 1 mm overlap using bone and soft tissue settings | Surgical findings |
| Jackson et al, 1989b | Prospective | Secondary care, USA | 59 patients with LBP and leg pain due to degenerative spinal pathology refractory to | HNP: protruded, extruded, and sequestered disc (49.2%) | Disc level; 120 levels assessed of 59 patients | CT: Siemens Somatom, 5 mm slice thickness with 1 mm overlap | Surgical findings |

| Author | Design and setting | Setting | Patients | Target condition | Level of measurement | Index test | Reference test |
|-----------------------|--------------------|-----------------------------|---|---|----------------------|--|---|
| | | | conservative management: 56% male, mean age 40 (18–70) years | | | using bone and soft tissue settings | |
| Schaub et al, 1989 | Retrospective | Secondary care, Switzerland | 29 patients with recurring symptoms after lumbar disk surgery: 48% male, mean age 49 (SD: 13) years | HNP (62.1%) | Patient level | CT | Surgical findings |
| Schipper et al, 1987 | Prospective | Secondary care, Netherlands | 235 patients with radiating leg pain, with or without back pain, with feelings of numbness, or with paresis and referred to the neurosurgical department: 61% male, mean age 43 years | HNP: an asymmetric protruding disk, obliteration of the epidural fat, compression or displacement of the nerve root, indentation of the dural sac (83.8%) | Patient level | CT: Philips Tomoscan 350, 200 As, 120 kV, 3 mm slice thickness | Surgical findings |
| Thornbury et al, 1993 | Prospective | Secondary care, USA | 32 patients with acute LBP and radicular pain in whom the diagnosis of HNPNC was sufficiently probable | HNP with nerve root compression (56.3%) | Patient level | CT: Siemens Somatome, 4 mm slice thickness, 125 kV, 550 mA s | Expert panel: four stages; review clinical material, information of medical record and follow-up survey including details of therapy, blinded reading of results of one of the two radiologic examinations, blinded reading of other radiologic examination |

Source: van Rijn et al (2012), Table 1, p232.

Abbreviations: HNPNC, herniated nucleus pulposus – caused nerve compression.

Appendix C MBS Items under review

Table B1: Diagnostic radiology MBS items under review – Group I3, Subgroup 4 – Radiographic examination of spine

| Item number | Start date | MBS item number description |
|-------------|---|--|
| 58106 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Dec-1991 Schedule Fee: 01-Nov-2004 | SPINE LUMBOSACRAL (R) Bulk bill incentive Fee: \$77.00 Benefit: 75% = \$57.75 85% = \$65.45 (See para DIQ of explanatory notes to this Category) |
| 58108 | <ul style="list-style-type: none"> Item: 01-Nov-2001 Description: 01-Nov-2001 Schedule Fee: 01-Jan-2010 | Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal (R) Bulk bill incentive Fee: \$110.00 Benefit: 75% = \$82.50 85% = \$93.50 (See para DIQ of explanatory notes to this Category) |
| 58109 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Dec-1991 Schedule Fee: 01-Nov-2004 | SPINE SACROCOCCYGEAL (R) Bulk bill incentive Fee: \$47.00 Benefit: 75% = \$35.25 85% = \$39.95 (See para DIQ of explanatory notes to this Category) |
| 58111 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | SPINE LUMBOSACRAL (R) (NK) Bulk bill incentive Fee: \$38.50 Benefit: 75% = \$28.90 85% = \$32.75 (See para DIQ of explanatory notes to this Category) |
| 58112 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Dec-1991 Schedule Fee: 01-Nov-2004 | NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item Spine, two examinations of the kind referred to in items 58100, 58103, 58106 and 58109 (R) Bulk bill incentive Fee: \$97.25 Benefit: 75% = \$72.95 85% = \$82.70 (See para DIQ of explanatory notes to this Category) |
| 58114 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal (R) (NK) Bulk bill incentive Fee: \$55.00 Benefit: 75% = \$41.25 85% = \$46.75 (See para DIQ of explanatory notes to this Category) |
| 58115 | <ul style="list-style-type: none"> Item: 01-Dec-1991 Description: 01-Nov-2002 Schedule Fee: 01-Jan-2010 | NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item Spine, three examinations of the kind mentioned in items 58100, 58103, 58106 and 58109 (R) Bulk bill incentive Fee: \$110.00 Benefit: 75% = \$82.50 85% = \$93.50 (See para DIQ of explanatory notes to this Category) |
| 58117 | <ul style="list-style-type: none"> Item: 01-Jul-2011 Description: 01-Jul-2011 Schedule Fee: 01-Jul-2011 | SPINE SACROCOCCYGEAL (R) (NK) Bulk bill incentive Fee: \$23.50 Benefit: 75% = \$17.65 85% = \$20.00 (See para DIQ of explanatory notes to this Category) |
| 58120 | <ul style="list-style-type: none"> Item: 01-Jan-2010 Description: 01-Jan-2010 Schedule Fee: 01-Jan-2010 | Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal (R), if the service to which item 58120 or 58121 applies has not been performed on the same patient within the same calendar year Bulk bill incentive Fee: \$110.00 Benefit: 75% = \$82.50 85% = \$93.50 |

| Item number | Start date | MBS item number description |
|-------------|---|--|
| 58121 | ▲ Item: 01-Jan-2010 ▲ Description: 01-Jan-2010 ▲ Schedule Fee: 01-Jan-2010 | NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item Spine, three examinations of the kind mentioned in items 58100, 58103, 58106 and 58109 (R), if the service to which item 58120 or 58121 applies has not been performed on the same patient within the same calendar year Bulk bill incentive Fee: \$110.00 Benefit: 75% = \$82.50 85% = \$93.50 |
| 58123 | ▲ Item: 01-Jul-2011 ▲ Description: 01-Jul-2011 ▲ Schedule Fee: 01-Jul-2011 | NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item Spine, two examinations of the kind referred to in items 58100, 58102, 58103, 58105, 58106, 58109, 58111 and 58117 (R) (NK) Bulk bill incentive Fee: \$48.65 Benefit: 75% = \$36.50 85% = \$41.40 (See para DIQ of explanatory notes to this Category) |
| 58126 | ▲ Item: 01-Jul-2011 ▲ Description: 01-Jul-2011 ▲ Schedule Fee: 01-Jul-2011 | Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal, if the service to which item 58120, 58121, 58126 or 58127 applies has not been performed on the same patient within the same calendar year (R) (NK) Bulk bill incentive Fee: \$55.00 Benefit: 75% = \$41.25 85% = \$46.75 (See para DIQ of explanatory notes to this Category) |

Source: MBS Online, accessed 16 May 2014

Note: Bold indicates item start date on MBS is within 5-year period of investigation in this Review (2009-10 to 2013-14).

(NK): the addition of (NK) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older. This equipment must have been first installed in Australia ten or more years ago, or in the case of imported pre-used equipment, must have been first manufactured ten or more years ago.

(R): Imaging services marked with the symbol (R) are not eligible for a Medicare rebate unless the diagnostic imaging procedure is performed under the professional supervision of a:

- (a) specialist or a consultant physician in the practice of his or her specialty who is available to monitor and influence the conduct and diagnostic quality of the examination, and if necessary to personally attend the patient; or
- (b) practitioner who is not a specialist or consultant physician who meets the requirements of A or B hereunder, and who is available to monitor and influence the conduct and diagnostic quality of the examination and, if necessary, to personally attend the patient.

A. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner at the location where the service was rendered and the rendering of those services entitled the payment of Medicare benefits.

B. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner in nursing homes or patients' residences and the rendering of those services entitled payment of Medicare benefits.

Table B2: Diagnostic radiology MBS items under review – Group I3 Subgroup 12 – Radiographic examination with opaque or contrast media

| Item number | Start date | MBS item number description |
|-------------|---|--|
| 59700 | ▲ Item: 01-Dec-1991 ▲ Description: 01-Nov-2001 ▲ Schedule Fee: 01-Nov-2004 | DISCOGRAPHY, each disc, with or without preliminary plain films and with preparation and contrast injection - (R) Bulk bill incentive (Anaes.) Fee: \$96.55 Benefit: 75% = \$72.45 85% = \$82.10 (See para DIQ of explanatory notes to this Category) |
| 59701 | ▲ Item: 01-Jul-2011 ▲ Description: 01-Jul-2011 ▲ Schedule Fee: 01-Jul-2011 | DISCOGRAPHY, each disc, with or without preliminary plain films and with preparation and contrast injection - (R) (NK) Bulk bill incentive (Anaes.) Fee: \$48.30 Benefit: 75% = \$36.25 85% = \$41.10 (See para DIQ of explanatory notes to this Category) |

| Item number | Start date | MBS item number description |
|-------------|--|---|
| 59724 | <p>Δ Item: 01-Dec-1991</p> <p>Δ Description: 01-Nov-2001</p> <p>Δ Schedule Fee: 01-Nov-2004</p> | <p>MYELOGRAPHY, 1 or more regions, with or without preliminary plain films and with preparation and contrast injection, not being a service associated with a service to which item 56219 applies - (R)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$226.45 Benefit: 75% = \$169.85 85% = \$192.50</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 59725 | <p>Δ Item: 01-Jul-2011</p> <p>Δ Description: 01-Jul-2011</p> <p>Δ Schedule Fee: 01-Jul-2011</p> | <p>MYELOGRAPHY, 1 or more regions, with or without preliminary plain films and with preparation and contrast injection, not being a service associated with a service to which item 56219 or 56259 applies - (R) (NK)</p> <p>Bulk bill incentive (Anaes.)</p> <p>Fee: \$113.25 Benefit: 75% = \$84.95 85% = \$96.30</p> <p>(See para DIQ of explanatory notes to this Category)</p> |

Source: MBS Online, accessed 16 May 2014

Note: Bold indicates item start date on MBS is within 5-year period of investigation in this Review (2009-10 to 2013-14).

(NK): the addition of (NK) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older. This equipment must have been first installed in Australia ten or more years ago, or in the case of imported pre-used equipment, must have been first manufactured ten or more years ago.

(R): Imaging services marked with the symbol (R) are not eligible for a Medicare rebate unless the diagnostic imaging procedure is performed under the professional supervision of a:

- (a) specialist or a consultant physician in the practice of his or her specialty who is available to monitor and influence the conduct and diagnostic quality of the examination, and if necessary to personally attend the patient; or
- (b) practitioner who is not a specialist or consultant physician who meets the requirements of A or B hereunder, and who is available to monitor and influence the conduct and diagnostic quality of the examination and, if necessary, to personally attend the patient.

A. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner at the location where the service was rendered and the rendering of those services entitled the payment of Medicare benefits.

B. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner in nursing homes or patients' residences and the rendering of those services entitled payment of Medicare benefits.

Table B3: Computed Tomography MBS items under review – Category 5 – Diagnostic Imaging Services, Group I2 – Computed Tomography

| Item number | Start date | MBS item number description |
|-------------|---|---|
| 56223 | <p>Δ Item: 01-Nov-2001</p> <p>Δ Description: 01-Nov-2001</p> <p>Δ Schedule Fee: 01-Nov-2004</p> | <p>COMPUTED TOMOGRAPHY - scan of spine, lumbosacral region, without intravenous contrast medium, payable once only, whether 1 or more attendances are required to complete the service (R) (K) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$240.00 Benefit: 75% = \$180.00 85% = \$204.00</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 56226 | <p>Δ Item: 01-Nov-2001</p> <p>Δ Description: 01-Nov-2001</p> <p>Δ Schedule Fee: 01-Nov-2004</p> | <p>COMPUTED TOMOGRAPHY - scan of spine, lumbosacral region, with intravenous contrast medium and with any scans of the lumbosacral region of the spine prior to intravenous contrast injection when undertaken; only 1 benefit payable whether 1 or more attendances are required to complete the service (R) (K) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$351.40 Benefit: 75% = \$263.55 85% = \$298.70</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 56229 | <p>Δ Item: 01-Nov-2001</p> <p>Δ Description: 01-Nov-2001</p> <p>Δ Schedule Fee: 01-Nov-2004</p> | <p>COMPUTED TOMOGRAPHY - scan of spine, lumbosacral region, without intravenous contrast medium, payable once only, whether 1 or more attendances are required to complete the service (R) (NK) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$122.50 Benefit: 75% = \$91.90 85% = \$104.15</p> |

| Item number | Start date | MBS item number description |
|--|---|--|
| (See para DIQ of explanatory notes to this Category) | | |
| 56232 | <p>△ Item: 01-Nov-2001</p> <p>△ Description: 01-Nov-2001</p> <p>△ Schedule Fee: 01-Nov-2004</p> | <p>COMPUTED TOMOGRAPHY - scan of spine, lumbosacral region, with intravenous contrast medium and with any scans of the lumbosacral region of the spine prior to intravenous contrast injection when undertaken; only 1 benefit payable whether 1 or more attendances are required to complete the service (R) (NK) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$177.45 Benefit: 75% = \$133.10 85% = \$150.85</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 56233 | <p>△ Item: 01-Nov-2001</p> <p>△ Description: 01-Nov-2001</p> <p>△ Schedule Fee: 01-Nov-2004</p> | <p><i>NOTE: An account issued or a patient assignment form must show the item numbers of the examinations performed under this item</i></p> <p>COMPUTED TOMOGRAPHY - scan of spine, two examinations of the kind referred to in items 56220, 56221 and 56223 without intravenous contrast medium payable once only, whether 1 or more attendances are required to complete the service (R) (K) (Anaes.)</p> <p>Bulk bill incentive</p> <p>Fee: \$240.00 Benefit: 75% = \$180.00 85% = \$204.00</p> <p>(See para DIQ of explanatory notes to this Category)</p> |

Source: MBS Online, accessed 16 May 2014

Note:

(NK): the addition of (NK) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older. This equipment must have been first installed in Australia ten or more years ago, or in the case of imported pre-used equipment, must have been first manufactured ten or more years ago.

(K): the addition of (K) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older, and where equipment is located in a remote area.

(R): Imaging services marked with the symbol (R) are not eligible for a Medicare rebate unless the diagnostic imaging procedure is performed under the professional supervision of a:

- (a) specialist or a consultant physician in the practice of his or her specialty who is available to monitor and influence the conduct and diagnostic quality of the examination, and if necessary to personally attend the patient; or
- (b) practitioner who is not a specialist or consultant physician who meets the requirements of A or B hereunder, and who is available to monitor and influence the conduct and diagnostic quality of the examination and, if necessary, to personally attend the patient.

A. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner at the location where the service was rendered and the rendering of those services entitled the payment of Medicare benefits.

B. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner in nursing homes or patients' residences and the rendering of those services entitled payment of Medicare benefits.

Table B4: Magnetic resonance imaging MBS items under review – Category 5 – Diagnostic Imaging Services, Group I5 – Magnetic Resonance Imaging

| Item number | Start date | MBS item number description |
|-------------|---|--|
| 63151 | <p>△ Item: 01-Aug-2004</p> <p>△ Description: 01-Aug-2004</p> <p>△ Schedule Fee 01-Aug-2004</p> | <p>MAGNETIC RESONANCE IMAGING performed under the professional supervision of an eligible provider at an eligible location where the patient is referred by a specialist or by a consultant physician - scan of one region or two contiguous regions of the spine for:</p> <p>- infection (R) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63154 | <p>△ Item: 01-Aug-2004</p> <p>△ Description: 01-Aug-2004</p> <p>△ Schedule Fee: 01-Aug-2004</p> | <p>- tumour (R) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65</p> <p>(See para DIQ of explanatory notes to this Category)</p> |

| Item number | Start date | MBS item number description |
|-------------|--|--|
| 63157 | <p>△ Item: 01-Jul-2011</p> <p>△ Description: 01-Jul-2011</p> <p>△ Schedule Fee: 01-Jul-2011</p> | <p>MAGNETIC RESONANCE IMAGING performed under the professional supervision of an eligible provider at an eligible location where the patient is referred by a specialist or by a consultant physician - scan of one region or two contiguous regions of the spine for:</p> <p>- infection (R) (NK) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63158 | <p>△ Item: 01-Jul-2011</p> <p>△ Description: 01-Jul-2011</p> <p>△ Schedule Fee: 01-Jul-2011</p> | <p>- tumour (R) (NK) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63164 | <p>△ Item: 01-Aug-2004</p> <p>△ Description: 01-Aug-2004</p> <p>△ Schedule Fee: 01-Aug-2004</p> | <p>- congenital malformation of the spinal cord or the cauda equina or the meninges (R) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63167 | <p>△ Item: 01-Aug-2004</p> <p>△ Description: 01-Aug-2004</p> <p>△ Schedule Fee: 01-Aug-2004</p> | <p>- myelopathy (R) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63176 | <p>△ Item: 01-Aug-2004</p> <p>△ Description: 01-Aug-2004</p> <p>△ Schedule Fee: 01-Aug-2004</p> | <p>- sciatica (R) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63179 | <p>△ Item: 01-Aug-2004</p> <p>△ Description: 01-Aug-2004</p> <p>△ Schedule Fee: 01-Aug-2004</p> | <p>- spinal canal stenosis (R) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63187 | <p>△ Item: 01-Jul-2011</p> <p>△ Description: 01-Jul-2011</p> <p>△ Schedule Fee: 01-Jul-2011</p> | <p>- congenital malformation of the spinal cord or the cauda equina or the meninges (R) (NK) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63188 | <p>△ Item: 01-Jul-2011</p> <p>△ Description: 01-Jul-2011</p> <p>△ Schedule Fee: 01-Jul-2011</p> | <p>- myelopathy (R) (NK) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> <p>Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35</p> <p>(See para DIQ of explanatory notes to this Category)</p> |
| 63191 | <p>△ Item: 01-Jul-2011</p> <p>△ Description: 01-Jul-2011</p> <p>△ Schedule Fee: 01-Jul-2011</p> | <p>- sciatica (R) (NK) (Contrast)</p> <p>Bulk bill incentive</p> <p>(Anaes.)</p> |

| Item number | Start date | MBS item number description |
|-------------|---|---|
| | | Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIQ of explanatory notes to this Category) |
| 63192 | ▲ Item: 01-Jul-2011 ▲ Description: 01-Jul-2011 ▲ Schedule Fee: 01-Jul-2011 | - spinal canal stenosis (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIQ of explanatory notes to this Category) |
| 63201 | ▲ Item: 01-Aug-2004 ▲ Description: 01-Aug-2004 ▲ Schedule Fee: 01-Aug-2004 | MAGNETIC RESONANCE IMAGING performed under the professional supervision of an eligible provider at an eligible location where the patient is referred by a specialist or by a consultant physician - scan of three contiguous regions or two non contiguous regions of the spine for: - infection (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIQ of explanatory notes to this Category) |
| 63204 | ▲ Item: 01-Aug-2004 ▲ Description: 01-Aug-2004 ▲ Schedule Fee: 01-Aug-2004 | - tumour (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIQ of explanatory notes to this Category) |
| 63207 | ▲ Item: 01-Jul-2011 ▲ Description: 01-Jul-2011 ▲ Schedule Fee: 01-Jul-2011 | MAGNETIC RESONANCE IMAGING performed under the professional supervision of an eligible provider at an eligible location where the patient is referred by a specialist or by a consultant physician - scan of three contiguous regions or two non contiguous regions of the spine for: - infection (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |
| 63208 | ▲ Item: 01-Jul-2011 ▲ Description: 01-Jul-2011 ▲ Schedule Fee: 01-Jul-2011 | - tumour (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |
| 63222 | ▲ Item: 01-Aug-2004 ▲ Description: 01-Aug-2004 ▲ Schedule Fee: 01-Aug-2004 | - congenital malformation of the spinal cord or the cauda equina or the meninges (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIQ of explanatory notes to this Category) |
| 63225 | ▲ Item: 01-Aug-2004 ▲ Description: 01-Aug-2004 ▲ Schedule Fee: 01-Aug-2004 | - myelopathy (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIQ of explanatory notes to this Category) |
| 63234 | ▲ Item: 01-Aug-2004 ▲ Description: 01-Aug-2004 | - sciatica (R) (Contrast) Bulk bill incentive |

| Item number | Start date | MBS item number description |
|-------------|---|---|
| | △ Schedule Fee: 01-Aug-2004 | (Anaes.) Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIQ of explanatory notes to this Category) |
| 63237 | △ Item: 01-Aug-2004 △ Description: 01-Aug-2004 △ Schedule Fee: 01-Aug-2004 | - spinal canal stenosis (R) (Contrast) Bulk bill incentive (Anaes.) Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIQ of explanatory notes to this Category) |
| 63258 | △ Item: 01-Jul-2011 △ Description: 01-Jul-2011 △ Schedule Fee: 01-Jul-2011 | - congenital malformation of the spinal cord or the cauda equina or the meninges (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |
| 63259 | △ Item: 01-Jul-2011 △ Description: 01-Jul-2011 △ Schedule Fee: 01-Jul-2011 | - myelopathy (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |
| 63262 | △ Item: 01-Jul-2011 △ Description: 01-Jul-2011 △ Schedule Fee: 01-Jul-2011 | - sciatica (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |
| 63263 | △ Item: 01-Jul-2011 △ Description: 01-Jul-2011 △ Schedule Fee: 01-Jul-2011 | - spinal canal stenosis (R) (NK) (Contrast) Bulk bill incentive (Anaes.) Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIQ of explanatory notes to this Category) |

Source: MBS Online, accessed 16 May 2014

Note: Bold indicates item start date on MBS is within 5-year period of investigation in this Review (2009-10 to 2013-14).

(NK): the addition of (NK) at the end of the item denotes a reduced Schedule fee applies to imaging services performed on equipment that is 10 years old or older. This equipment must have been first installed in Australia ten or more years ago, or in the case of imported pre-used equipment, must have been first manufactured ten or more years ago.

(R): Imaging services marked with the symbol (R) are not eligible for a Medicare rebate unless the diagnostic imaging procedure is performed under the professional supervision of a:

- (a) specialist or a consultant physician in the practice of his or her specialty who is available to monitor and influence the conduct and diagnostic quality of the examination, and if necessary to personally attend the patient; or
- (b) practitioner who is not a specialist or consultant physician who meets the requirements of A or B hereunder, and who is available to monitor and influence the conduct and diagnostic quality of the examination and, if necessary, to personally attend the patient.

A. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner at the location where the service was rendered and the rendering of those services entitled the payment of Medicare benefits.

B. Between 1 September 1997 and 31 August 1999, at least 50 services were rendered by or on behalf of the practitioner in nursing homes or patients' residences and the rendering of those services entitled payment of Medicare benefits.

Explanatory notes DIM and DIQ (from MBS Online, accessed 16 May 2014)

DID

Requests for Diagnostic Imaging Services

Who may request a diagnostic imaging service

The following practitioners may request a diagnostic imaging service:

- Specialists and consultant physicians can request any diagnostic imaging service.
- Other medical practitioners can request any service and specific Magnetic Resonance Imaging Services – see DIO.
- A medical practitioner, on behalf of the treating practitioner, for example, by a resident medical officer at a hospital on behalf of the patient's treating practitioner.
- Dental Practitioners, Physiotherapists, Chiropractors, Osteopaths and Podiatrists registered or licensed under State or Territory laws.
- Participating nurse practitioners and participating midwives.

Physiotherapists, Chiropractors and Osteopaths may request:

57712, 57715, 58100 to 58106 (inclusive), 58109, 58112, 58120 and 58121

DIM

Group I3 – Diagnostic Radiology

Subgroup 4: Radiographic examination of the spine

Multiple regions

Multiple region items require that the regions of the spine to be studied must be specified on any account issued or patient assignment form completed.

Item 58112 - spine, two regions

Where item 58112 is rendered (spine, two regions), the item numbers for the regions of the spine being studied must be specified (i.e. from items 58100, 58103, 58106 and 58109).

Example: for a radiographic examination of the spine where the cervical and thoracic regions are to be studied, item numbers 58100 and 58103 must be specified on any account issued or patient assignment forms completed.

Item 58115 – spine, three region

Where item 58115 is rendered (spine, three regions), the item numbers for the regions of the spine being studied must be specified (items 58100, 58103, 58106 and 58109).

Example: for a radiographic examination of the spine where the cervical, the thoracic and the lumbosacral regions are to be studied, item numbers 58100, 58103 and 58106 must be specified on any accounts issued or patient assignment forms completed.

Item 58115 & 58108 – spine, three and four region

For three and four region radiographic examinations items 58115 and 58108 do not apply when requested by a physiotherapist, chiropractor or osteopath.

Items 58120 and 58121

Items 58120 and 58121 apply to physiotherapists, chiropractors and osteopaths who request a three or four region x-ray and only allow a benefit for one of the items, per patient, per calendar year.

DIQ

Bulk Billing Incentive

To provide an incentive to bulk-bill, for out of hospital services that are bulk billed the schedule fee is reduced by 5% and rebates paid at 100% of this revised fee (except for item 61369, and all items in Group I5 - Magnetic Resonance Imaging). For items in Group I5 - Magnetic Resonance Imaging, the bulk billing incentive for out of hospital services is 100% of the Schedule Fee listed in the table.

MBS items out of scope for the review

Although not within the scope of this review of imaging for low back pain in adults, the below table shows the MBS items that can be requested by GPs for MRI of the head, spine and knee. The associated explanatory note (DIO) is shown.

Table B5: MBS items relating to MRI that can be requested by GPs (out of scope)

| Item number | MBS item number description |
|--------------|--|
| 63510 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient under 16 years following radiographic examination for:</p> <ul style="list-style-type: none"> - significant trauma (R) (Contrast) (Anaes.); or - unexplained neck or back pain with associated neurological signs (R) (Contrast) (Anaes.); or - unexplained back pain where significant pathology is suspected (R) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$448.00 Benefit: 75% = \$336.00 85% = \$380.80 (See para DIO of explanatory notes to this Category)</p> |
| 63511 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient under 16 years following radiographic examination for:</p> <ul style="list-style-type: none"> - significant trauma (R) (NK) (Contrast) (Anaes.); or - unexplained neck or back pain with associated neurological signs (R) (NK) (Contrast) (Anaes.); or - unexplained back pain where significant pathology is suspected (R) (NK) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$224.00 Benefit: 75% = \$168.00 85% = \$190.40 (See para DIO of explanatory notes to this Category)</p> |
| 63551 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of head for a patient 16 years or older for any of the following:</p> <ul style="list-style-type: none"> - unexplained seizure(s) (R) (Contrast) (Anaes.) - unexplained chronic headache with suspected intracranial pathology (R) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$403.20 Benefit: 75% = \$302.40 85% = \$342.75 (See para DIO of explanatory notes to this Category)</p> |
| 63552 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of head for a patient 16 years or older for any of the following:</p> <ul style="list-style-type: none"> - unexplained seizure(s) (R) (NK) (Contrast) (Anaes.) - unexplained chronic headache with suspected intracranial pathology (R) (NK) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$201.60 Benefit: 75% = \$151.20 85% = \$171.40 (See para DIO of explanatory notes to this Category)</p> |
| 63554 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient 16 years or older for suspected:</p> <ul style="list-style-type: none"> - cervical radiculopathy (R) (Contrast) (Anaes.) <p>Bulk bill incentive Fee: \$358.40 Benefit: 75% = \$268.80 85% = \$304.65 (See para DIO of explanatory notes to this Category)</p> |
| 63555 | <p>referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient 16 years or older for suspected:</p> <ul style="list-style-type: none"> - cervical radiculopathy (R) (NK) (Contrast) (Anaes.) <p>Bulk bill incentive</p> |

| Item number | MBS item number description |
|--------------|--|
| | Fee: \$179.20 Benefit: 75% = \$134.40 85% = \$152.35 (See para DIO of explanatory notes to this Category) |
| 63557 | referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient 16 years or older for suspected: - cervical spine trauma (R) (Contrast) (Anaes.) Bulk bill incentive Fee: \$492.80 Benefit: 75% = \$369.60 85% = \$418.90 (See para DIO of explanatory notes to this Category) |
| 63558 | referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of spine for a patient 16 years or older for suspected: - cervical spine trauma (R) (NK) (Contrast) (Anaes.) Bulk bill incentive Fee: \$246.40 Benefit: 75% = \$184.80 85% = \$209.45 (See para DIO of explanatory notes to this Category) |
| 63560 | referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of knee following acute knee trauma for a patient 16 years or older with: - inability to extend the knee suggesting the possibility of acute meniscal tear (R) (Contrast) (Anaes.); or - clinical findings suggesting acute anterior cruciate ligament tear. (R) (Contrast) (Anaes.) Bulk bill incentive Fee: \$403.20 Benefit: 75% = \$302.40 85% = \$342.75 (See para DIO of explanatory notes to this Category) |
| 63561 | referral by a medical practitioner (excluding a specialist or consultant physician) for a scan of knee following acute knee trauma for a patient 16 years or older with: - inability to extend the knee suggesting the possibility of acute meniscal tear (R) (NK) (Contrast) (Anaes.); or - clinical findings suggesting acute anterior cruciate ligament tear. (R) (NK) (Contrast) (Anaes.) Bulk bill incentive Fee: \$201.60 Benefit: 75% = \$151.20 85% = \$171.40 (See para DIO of explanatory notes to this Category) |

Source: MBS Online, accessed 16 May 2014

Explanatory note DIO (from MBS Online, accessed 16 May 2014)

DIO

Itemisation

MRI items in Group I5, items 63001 to 63561, are divided into subgroups defined according to the area of the body to be scanned, (i.e. head, spine, musculoskeletal system, cardiovascular system or body) and the number of occasions in a defined period in which Medicare benefits may be claimed by a patient. Subgroups are divided into individual items, with each item being for a specific clinical indication.

Eligible services

Group I5 items 63507 to 63561 apply only to a MRI service performed:

- on request by a medical practitioner other than a specialist or consultant physician, where the request made in writing identifies the clinical indication for the service;
- under the professional supervision of an eligible provider; and
- with eligible equipment and partial eligible equipment.

[See MBS Online for further information relating to DIO]