



**THE UNIVERSITY  
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**Faculty of Health Sciences**

## **Final Report**

### **QR03.ii Allied Health Requests**

**Presented to**

**The Royal Australian and New Zealand College of Radiologists**

**Quality Use of Diagnostic Imaging Program**

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### NOTE:

The Project Team was commissioned to undertake this work by the QUDI Program, a program managed by the RANZCR and funded by the Australian Government.

# 1. Executive Summary

In November 2006, the Royal Australian and New Zealand College of Radiologists (RANZCR) Quality Use of Diagnostic Imaging (QUDI) program commissioned the University of Queensland, Centre for Health Innovation and Solutions, to develop a principles framework to apply when determining what diagnostic imaging (DI) services non-medical practitioners should be allowed to request. This project was commissioned in the context of allied health professional bodies advocating expansion of the current list of diagnostic imaging “R” item codes which allied health professionals may request.

Consultation with stakeholders during the project confirmed that stakeholders support the concept that the current system requires review and that evidence-based inquiry must shape such a review. Consideration of these issues is an iterative process requiring ongoing surveillance and revision as new diagnostic imaging techniques enter the health marketplace, patient populations age and require longer-term care and intervention, research continues to inform practice, allied health and medical curricula evolve to meet these demands, and new types of providers or specialists within these fields broaden their scope of practice outside traditional bounds. The principles framework has been devised to underpin policy and decision making on diagnostic imaging referral under Medicare, to shape discourse, and structure that iterative process.

The project was substantially based on qualitative research methodologies, engaging professional and consumer stakeholders, to draw up the framework of principles. A contextual scan included a search of peer-reviewed and “grey” literature, analysis of 2006 Medicare data, and contacting tertiary institutions to gain insight into allied health practitioner training. The literature search informed the development of three test models which, along with a clinical scenario trigger, were used as the basis for semi-structured interviews with 28 professional stakeholders from a wide variety of disciplines. A consumer focus group was subsequently used to engage consumers around the themes identified from the professional stakeholders. Results from the qualitative and quantitative investigations were analysed to develop a framework of principles to apply in determination of appropriateness of non-medical referral for diagnostic imaging.

At all stages of the project, critical issues were identified and explored. Stakeholder commentary and focused research were clustered into seven key domains for inclusion in the principles framework. During the stakeholder engagement process, as anticipated, there was little concordance amongst stakeholders at the detail level (i.e. item numbers). In this context, the framework of principles is a very useful outcome. As it has been drawn from common themes identified at each stage of the qualitative research project, the framework provides a robust, consensus platform upon which to move forward. As such, we recommend that the framework be used to:

1. **Review appropriateness of current item codes on the list in light of principles.** Advocates for change should be prompted to demonstrate evidence of the need for change, the likely impact of the proposed change, and proposals for implementing and monitoring the change against the framework, including future sustainability.
2. **Shape future decision-making on item codes to include on the list or exclude from the list.** Professional bodies and other stakeholders might review their policy, standards and programs to support the principles in practice. For example, working to provide continuing professional development programs to maintain competency for referrers or working with other professional bodies (including RANZCR) to develop curriculum standards and practice standards to support best practice uses of diagnostic imaging.
3. **Establish a process whereby decision-making follows a standard and rigorous review** based on either these or other relevant principles developed. This project identified contentious areas where professionals differ in opinion, where an organised body of evidence could offer critical direction. For example, a universal theme expressed by stakeholders is the need for

competent referrers, and the prerequisites of adequate vocational training and professional development for any clinician referrer; but there was divergence around whether training provided is adequate to guarantee competence in appropriate use of diagnostic imaging.

Table 1. Principles Framework

Domain	Critical issues
<b>Clinical Quality</b>	<ul style="list-style-type: none"> <li>▪ Evidence-based practice of DI modality for anatomy definition or assessment of presenting condition(s)</li> <li>▪ Appropriate indications for DI selection</li> <li>▪ Opportunity for ongoing quality assurance or clinical self-audit</li> <li>▪ Role of quality assessor in the care team (radiologist role)</li> </ul>
<b>Safety</b>	<ul style="list-style-type: none"> <li>▪ Practitioner education with DI modalities</li> <li>▪ Risk of ionising radiation bias vs. ultrasound or other DI modalities</li> <li>▪ Quality assurance that machines are operated with optimal care for patient and practitioner safety (i.e. radiology practice role as operators of DI equipment)</li> </ul>
<b>Access &amp; Efficiency</b>	<ul style="list-style-type: none"> <li>▪ Effect on patient journey or experience</li> <li>▪ Effect of potential workforce shortages or distribution</li> <li>▪ Availability of machines for DI modality</li> <li>▪ Appropriate use of expertise on healthcare team (# steps involved, associated costs incurred to patient, Medicare)</li> </ul>
<b>Informed consumers</b>	<ul style="list-style-type: none"> <li>▪ Patient central to decision-making process</li> <li>▪ Patient education about DI modalities, radiation exposure</li> <li>▪ Awareness of lifetime radiation dose and associated risks</li> </ul>
<b>Integrated care</b>	<ul style="list-style-type: none"> <li>▪ Interprofessional communication</li> <li>▪ Role of GP as point of care integration and co-ordination</li> <li>▪ Medical recordkeeping and record-sharing among healthcare team</li> <li>▪ Electronic register to streamline recordkeeping and accessibility</li> </ul>
<b>Education &amp; Training</b>	<ul style="list-style-type: none"> <li>▪ Curriculum standards</li> <li>▪ Continuing professional development opportunities</li> <li>▪ Focal certification</li> </ul>
<b>Economic</b>	<ul style="list-style-type: none"> <li>▪ Implication to HIC</li> <li>▪ Implication for patient-incurred costs</li> </ul>

Other issues and opportunities were identified during the research, and some of these that relate closely to future considerations of non-medical referral for diagnostic imaging are provided in the report for completeness.

## 2. Introduction

### 2.1 How to use this report

This report is the final document in a series of project deliverables. It describes the principles framework and the project background and aims, methodology, findings, and recommendations. For brevity and clarity, detail related to data collection has been included in the appendices, and some material presented in prior reports has been omitted from this document if not directly germane to the framework development. A list of related project reports has been included in Appendix A; this report can be read in conjunction with these previous reports for completeness.

### 2.2 Abbreviations/Acronyms

AHP	Allied health practitioner
CHIS	Centre for Health Innovation and Solutions, The University of Queensland
CT	Computerised tomography scan
DI	Diagnostic imaging
DIST	Diagnostic imaging services table
GP	General Practitioner
MBS	Medicare Benefits Schedule
MRI	Magnetic resonance imaging
QUDI	Quality use of diagnostic imaging
RANZCR	The Royal Australian and New Zealand College of Radiologists.
RCGP	Royal College of General Practitioners
RCR	Royal College of Radiologists

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### 2.4 Acknowledgements

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### 3. Background to the project

In November 2006, the Royal Australian and New Zealand College of Radiologists (RANZCR), Quality Use of Diagnostic Imaging (QUDI) program, commissioned the University of Queensland, Centre for Health Innovation and Solutions, to develop a broad set of principles that must apply when determining what diagnostic imaging (DI) services non-medical practitioners should be allowed to request.

Radiological images constitute the principal venue through which practitioners visualise patient internal anatomy, providing indelible images of human health and disease that help diagnose problems and define treatment options [1]. Access to requesting rights for diagnostic imaging implies that the health professional has the knowledge and understanding of the imaging procedure and associated patient safety to make an informed decision about the test's clinical appropriateness for an individual patient, and to incorporate the findings of the investigation into the clinical management of the patient. It is therefore important for patient safety and management that these requesting rights are appropriate.

Professional scope of practice and technology are dynamic in the Australian context. Workforce shortages, changing patterns of disease and evolving community expectations feed into the mix, resulting in the need for regular policy review. The challenge in developing policy lies in the difficulty of separating professional dogma from evidence, and sound principles from polemic.

In the current regulatory environment, non-medical practitioners are able to request a restricted number of specific diagnostic imaging items for which Medicare then provides funding. Other than medical practitioners, the professional groups able to request diagnostic imaging funded by Medicare are dentists, chiropractors, osteopaths, physiotherapists and podiatrists. The items are limited to plain X-rays only, with limitations by anatomical region by professional group (based on registration). The current list of these items as per the Medicare Benefits Schedule is included in Appendix B.

Allied health professional associations have been engaged with the Australian government lobbying for additional access to item codes for diagnostic imaging. For example, the Australian Physiotherapy Association has argued that the current Medicare referral arrangement costs taxpayers an additional \$1 million and 9500 hours of unnecessary GP consultations per year, as well as additional time and monetary costs for patients [2]. In September 2006, the Australasian Podiatry Council submitted a proposal for an extension of the benefits to ultrasound examinations of the foot [3].

This project was triggered by the need for a common platform to assess allied health requests for expansion of the current allowance of item codes for diagnostic imaging referral. This project commenced with a philosophy that a principles framework is a necessary prerequisite for rational review of current and future policy decision making on the Medicare Benefits Schedule. Furthermore, such a framework should be articulated, endorsed, and continuously informed by the Australian government, regulatory and registration bodies, health professionals, and consumer stakeholders, for relevance and appropriateness.

### 4. Methodology

The project methodology was designed to distil stakeholder views into the most critical domains, and to represent key issues to address within those domains. Consumer viewpoints were also leveraged to test emergent themes and offer perspective from the patient journey. The methodology followed four phases: contextual scan, model development, stakeholder consultation, and principles framework development/final report.

## 4.1 Contextual scan

The purpose of the contextual scan was to:

- understand the background to the project;
- document relevant policy in Australia and other western health care systems
- identify material to inform the development of domains and critical issues
- scope the nature and extent of peer-reviewed and “grey” literature, and source material not in the public domain;
- understand and compare current usage and cost of specific diagnostic imaging item codes used by allied health clinicians and medical practitioners.

The literature review used search engines Ovid Medline, PubMed, Cochrane Library, Google, and Medscape. Keywords investigated included “diagnostic imaging” matched with iterations of the following keywords (with wildcards): allied health, referral, policy, health, practice, competence, extended practice, scope of practice, quality use, x-ray, and guidelines. The project did not investigate specific research questions about scope of practice or clinical outcomes related to diagnostic imaging by health professionals (e.g. Are physiotherapists as effective as medical practitioners in determining which patients should have an ankle x-ray after injury?)

The contextual scan also reviewed allied health education programs in Australia, to gauge incorporation of radiology principles, techniques, and safety. Allied health programs were contacted to explore the following research areas:

1. Does the coursework identify and teach:
  - appropriate application of imaging modality
  - safety and quality of radiation
  - interpretation of imaging results
  - areas of the body imaging can be used for
  - stage of life for appropriate imaging
2. How much time was spent on these elements of the course?
3. When were these elements added to the course?

Finally, Medicare statistics were analysed for supply and demand trends by medical and allied health practitioners referring patients for diagnostic imaging modalities using the specified item codes. Data was extracted through the Medicare statistics website and a special report fulfilled from Medicare on utilisation and cost of diagnostic imaging types by item code and referring practitioner type [4]. This report specifically focused on those (R) item codes which allied health professions can access with reimbursement. Due to budget considerations, data was only analysed for 2006, precluding analysis of trends over time.

## 4.2 Developing test models

In an environment where most peak bodies for allied health professionals had already published position statements or policy advocacy, development of a principles-based framework required an innovative strategy. A qualitative research approach was employed to investigate themes and parameters that were important to stakeholders, through use of test models accompanied by semi-structured interviews. This technique was chosen to provide a patient-centric rather than a profession-centric starting point for the discourse.

The models were informed by the range of approaches related to non-medical requests for diagnostic imaging evident in Australia and internationally. The models of expanded referral access were predicated on: (1) professional registration, (2) adherence to clinical guidelines, and (3) specific accreditation on appropriate use of diagnostic imaging. A clinical scenario was contrived to augment the test models and to trigger discussion. This scenario was intentionally ambiguous to provide a neutral platform for generating ideas, stopping short of clinical detail.

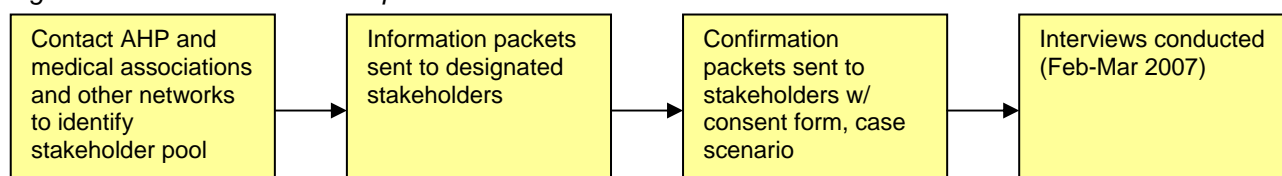
### 4.3 Stakeholder consultation

The stakeholder consultation phase was instrumental for gathering views of consumers and stakeholders within the medical and allied health professions, on themes surrounding referral for diagnostic imaging.

#### 4.3.1 Professional stakeholders

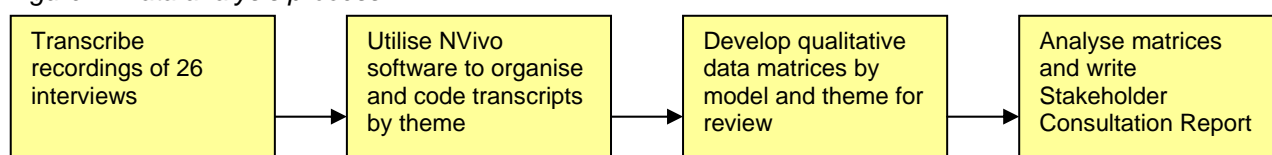
The health professional stakeholder engagement process was designed to investigate diverse viewpoints within the allied health and medical professions:

Figure 1. Stakeholder selection process



Stakeholders were encouraged to present their own views rather than serving as representatives of a professional association so that commentary would be based upon themes emerging from the test models and open-ended questions, rather than on established policy positions. Stakeholder recruitment emphasised diversity, including participation from rural and urban areas; private practice, the public system, and professional associations; and both allied health and medical practitioners. These objectives were achieved in the recruitment process.

Figure 2. Data analysis process



Twenty-six stakeholders participated, with the following backgrounds: Radiology (2), Physiotherapy (6), Podiatry (6), Osteopathy (1), Chiropractic (1), Nursing (3), Radiography (2), General Practice (2), Emergency Medicine (1), Sports Medicine (1), and Other (1).

A survey questionnaire was designed to engage participants and explore:

- Perceptions of current diagnostic imaging referral system
- Impact of three test models on emergent themes
- Factors most important to success of a referral model
- Economic implications of models
- Additional models or combinations of models conceived by the participants

This methodology was not without issues; rich commentary was offered, but several stakeholders were discomforted by the approach and found the clinical scenario unrealistic. Other participants assumed that the test models were policy propositions, and consequently inferred that the project was biased towards expansion of allied health access. Future projects should reflect on this methodological outcome before adopting a similar technique.

#### 4.3.2 Consumers

A focus group was held to gauge consumer views on diagnostic imaging referrals by allied health professionals. The interview guide focused on the patient journey and patient perceptions of the critical issues identified by the professional stakeholders, namely, patient safety, quality of care, access, and healthcare system efficiency. Consumers also linked these themes to their own health outcomes, a connection rarely found in the literature, and essential for further investigation.

Participants were recruited among the general population and through newsletters to University of Queensland staff. Selection criteria for participants included experience with diagnostic imaging

and provision of care by an allied health professional. In total, eight participants engaged in the focus group, and the transcript was coded using QSR NVivo 7 software to group themes and analyse discussion. Participants were provided minimal honoraria to cover expenses incurred for their time and transport. Consumer consultation was limited to a single focus group due to budget constraints; therefore many consumer perspectives were likely not depicted in the study.

## 5. Findings

### 5.1 Contextual scan

The literature search component of the contextual scan detailed the current diagnostic imaging referral models in Australia and other western health systems. The findings of the scan informed the development of test models for the stakeholder consultation phase.

#### 5.1.1 Australian context

In Australia, the Medicare Benefits Scheme (MBS) is the primary driver of who is able to refer for reimbursed diagnostic imaging tests. Section 4AA of the Health Insurance Act 1973 enables the Health Insurance Regulations to prescribe a table of diagnostic imaging services that sets out rules for interpretation of the table, items of diagnostic imaging services and the amount of fees applicable for each item. Management of the Diagnostic Imaging Services Table (DIST) is undertaken cooperatively between the Commonwealth, through the Department of Health and Ageing, and representative diagnostic imaging professions through five-year agreements known as Quality and Outlays Memoranda of Understanding (MoUs).

A diagnostic imaging service is defined in the Act as “an R-type diagnostic imaging service or an NR-type diagnostic imaging service to which an item in the DIST applies”. A diagnostic imaging procedure is defined in the Act as “a procedure for the production of images, for example x-rays, computerised tomography scans, ultrasound scans, magnetic resonance imaging scans and nuclear scans for use in the rendering of diagnostic imaging services” [5].

Except in certain circumstances, Medicare benefits are only payable for a diagnostic service that is rendered following a written request for that service by another medical practitioner. The items of service which are subject to the written request requirement are classified as "R-type" (requested) services and are identified in the DIST with the symbol "(R)" after the item description. The items of service not subject to the written request requirement are classified as "(NR)" or not requested.

Allied health practitioners are able to request specific imaging relegated to x-rays, as outlined in Table 2. For example, physiotherapists are able to request plain x-rays of the ankle and spine, but are not able to request ultrasound scans. In such cases they must refer patients back to a GP who can request the ultrasound. General Practitioners (GPs) can refer for all types of radiology except Magnetic Resonance Imaging (MRI), which requires a specialist referral. Certain conditions must exist before payment of Medicare benefits is authorised for diagnostic imaging practices and services such as diagnostic radiology, computed tomography (CT) scanning, nuclear medicine scanning, and MRI.

Table 2. MBS (R) item codes permitted for referral, for selected allied health practitioners

Item code	Details	Physios	Osteos	Chiros	Pods	Dentists*
57712	Hip joint					
57715	Pelvic girdle					
58100	Spine cervical					
58103	Spine thoracic					
58106	Spine lumbosacral					
58108	Spine, 4 regions-cervical, thoracic, lumbosacral & sacrococcygeal					
58109	Spine sacrococcygeal					
58112	Spine, 2 exams of the kind referred to in items 58100, 58103, 58106, 58109					
58115	Spine, 3 exams of the kind mentioned in items 58100, 58103, 58106, 58109					
57521	Foot, ankle, leg, knee or femur					
57527	Foot & ankle, or ankle & leg, or leg & knee, or knee & femur					

Source: [5]. For additional item code descriptions, see Appendix B. Note that dental practitioners have access to a wider number of item codes for referral; those represented in this table are only those shared with other designated allied health practitioners.

Medicare permits allied health professionals to refer for the above diagnostic imaging “R” item codes. The only two item codes in this table with “NR” options are 57521 and 57527, both foot-related. Pelvic girdle, hip, and all spinal x-rays only have “R” item codes. The current list of item codes permissible for Medicare reimbursement by AHPs reveals incongruities in the inferred rationale for permitting some item codes for referral rather than others. For example:

- all item codes permitted for DI referral by AHPs utilise x-rays (ionising radiation), with no access to ultrasound investigations which are safer in terms of radiation exposure;
- dentists have access to a wide range of item codes despite their training almost entirely limited to dental, oral and mandibular anatomy and pathology;
- multi-region spinal and pelvic x-rays, with their attendant increased ionisation radiation, are readily available to some allied health professionals while limb x-rays are restricted to medical practitioners, podiatrists, and dentists.

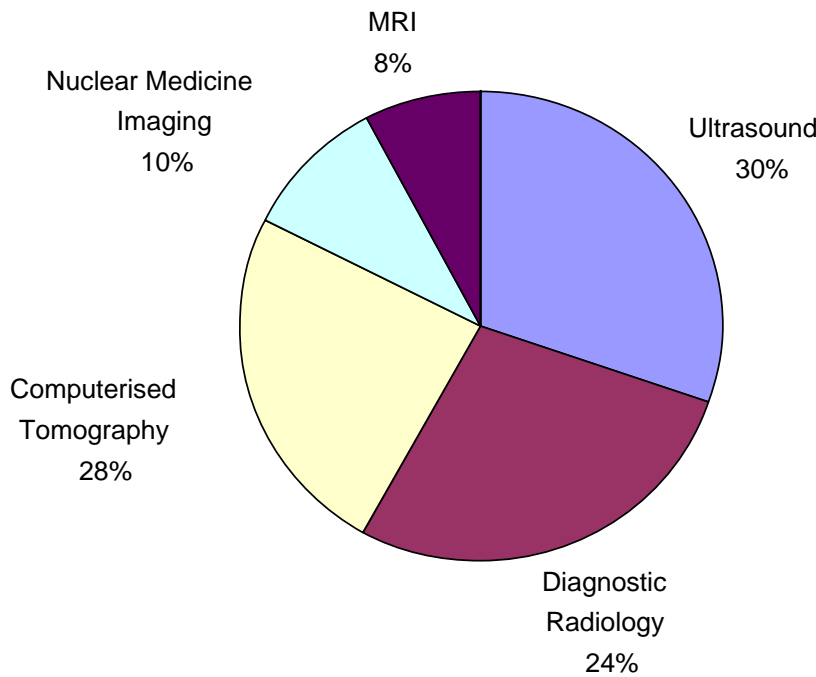
To broaden understanding of diagnostic imaging supply and demand, and implications for safety and appropriateness, future studies should review a larger range of “NR” and “R” item codes that allied health and medical practitioners refer for, as well as diagnostic imaging procedures conducted in the private system and in private offices.

### 5.1.2 Medicare data

In 2006 alone, \$1.65 billion was spent on diagnostic imaging, with 24 percent of this cost reimbursing diagnostic radiology, the area where allied health professionals currently are permitted to refer for imaging under the designated item codes outlined in Table 2.

Diagnostic imaging costs to Medicare are on the rise, increasing by 10 percent between 2004-2005, and 6 percent between 2005-2006. In terms of increased services during those years, there was a steady 5 percent increase per year in the number of diagnostic imaging items performed [6]. Factors that may impact this rise include an increase in population, changing demographics, medico-legal concerns, patient expectations and awareness of new technology, if not detailed knowledge about its application [7]. Figure 3 shows the proportion of each diagnostic imaging modality to total expenditure in 2006:

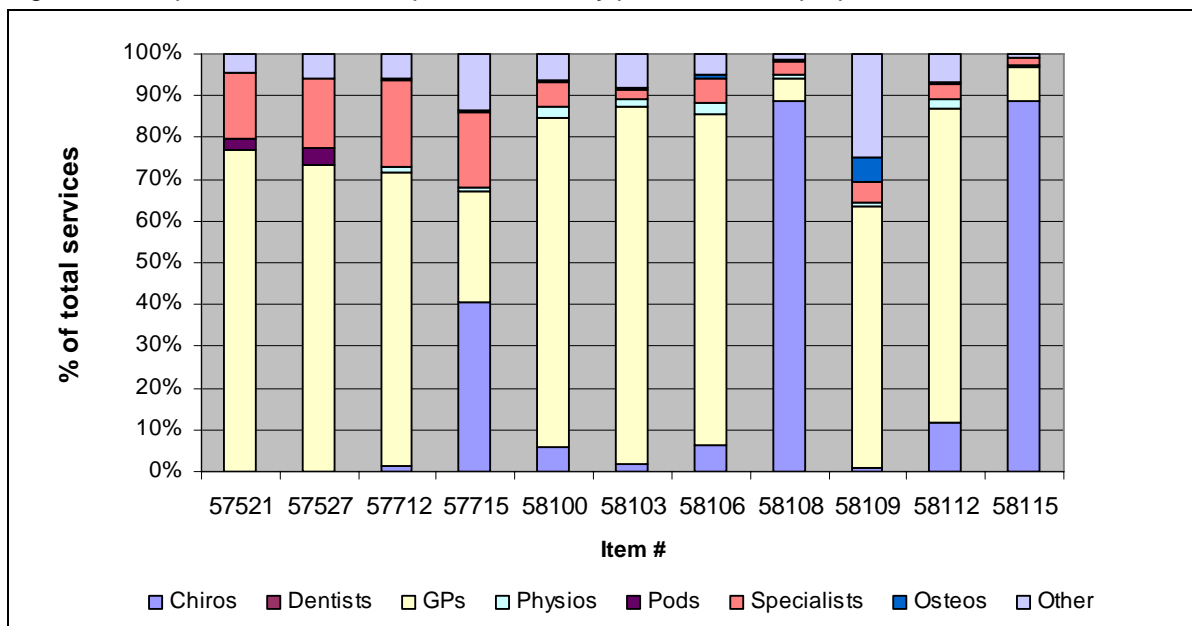
Figure 3. MBS proportion of diagnostic imaging modality to total expenditure, 2006



Source: [6]

In 2006, the specific item codes for which allied health professionals have “R” access accounted for 3,143,127 services, at a cost of \$156 million [8]. The effects of referrals by different referrers can be observed when reviewing the variables of item numbers and percentage of total services or benefits paid by profession. This Medicare data includes DI items which are rebated by Medicare only; it therefore does not include DI undertaken in public hospitals. Nor does it measure DI undertaken by health professionals on their own request (i.e. self-referral), for example, dental x-rays taken by dentists and plain x-rays taken by chiropractors. Hence these figures represent an underestimate of the “radiation burden” to the population as a result of diagnostic imaging.

Figure 4. Composition of referrers per item code by profession and proportion of total services referred

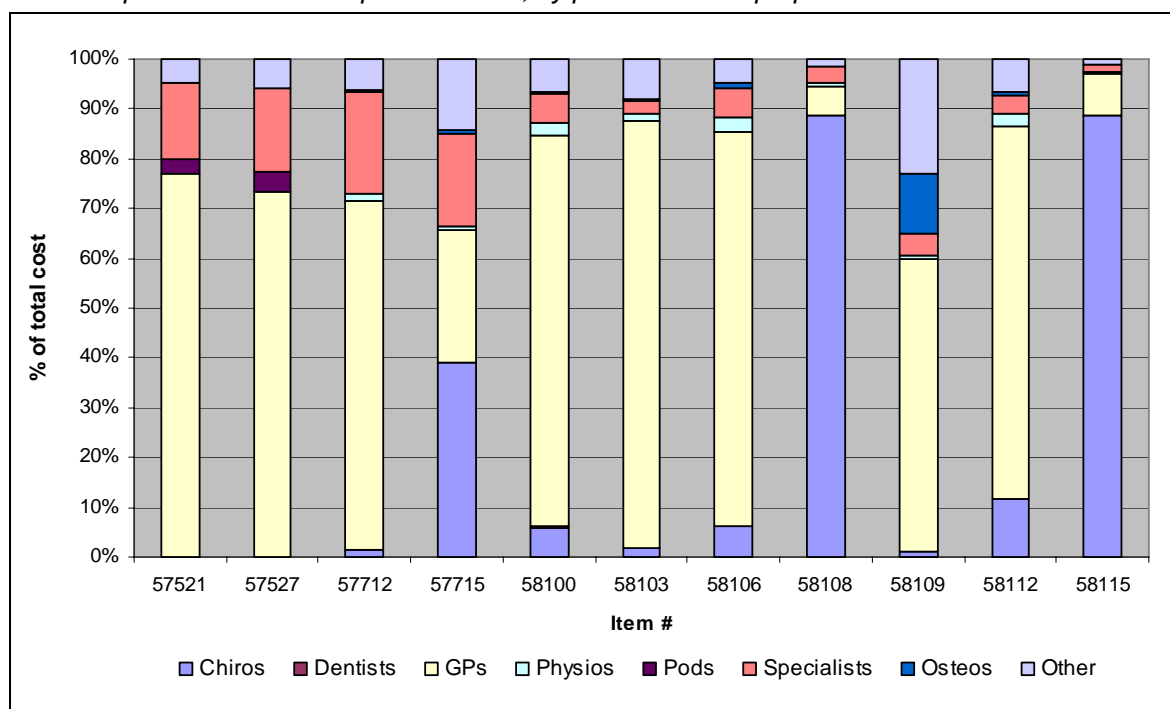


Sources: [4], [8]. Refer to Table 2 for item code descriptions.

Figures 4 and 5 demonstrate referral patterns for allied health professions, GPs, dentists, and specialists. As expected, proportions between graphs are similar as referral impacts services delivered and related costs. Viewed as proportions of the total, GPs account for 61% of all

expenditure on these item codes, followed by Chiropractors (19%), Specialists (11%), Other (6%), Physiotherapists (1%), Podiatrists (1%), and Osteopaths and Dentists accounting for less than 1%.

Figure 5. Composition of referrers per item code, by profession and proportion of total cost referred



Sources: [4], [8] Refer to Table 2 for item code descriptions.

The data clearly show variance between professions in ordering certain types of tests, particularly spinal x-rays. Item codes for imaging of specific sections of the spine are referred most often by GPs compared to other professions (item codes 58100, 58103, 58106, 58109) while chiropractors order over ten times more than other professions for combined images of the whole spine (item codes 58108 and 58115).

This project did not attempt to draw conclusions about appropriateness of ordering or comparison of imaging modalities on health outcomes for patients, but further analysis on these topics would be useful for policy development and education efforts. This is particularly relevant in light of patient safety concerns, as diagnostic imaging modalities involve vastly different amounts of radiation, for example the effect of radiation on an ankle versus the whole spine. Table 3 offers the number of registered practitioners among GPs and AHPs for such analysis.

Table 3. Registered practitioners in Australia per profession

Profession	NSW	QLD	VIC	ACT	WA	TAS	NT	SA	Total
General Practitioners (GPs)	27,918	14,717	19,188	2,056	8,051	2,428	n/r	6511	80,869
Chiropractors	1,305	669	1,020	63	9*	67*	26	500*	3,659
Osteopaths	508	106	543	40	9*	67*	7	500*	1,780
Physiotherapists	6,617	3,440	4711	382	2232	348	155	1643	19,528
Podiatrists	783	438	869	45	299	71	n/r	311	2,816
Dentists	756	2,408	2,328	264	1,100	183	87	846	7,972
<b>Total</b>	<b>37,887</b>	<b>21,778</b>	<b>28,659</b>	<b>2,850</b>	<b>11,700</b>	<b>3,164</b>	<b>275</b>	<b>10,311</b>	<b>116,624</b>

Sources: See Appendix D. \* This number includes both chiropractors and osteopaths due to the way this registration board organises its data.

### 5.1.3 Candidate models for non-medical practitioner referral for diagnostic imaging

The literature search investigated allied health diagnostic imaging referral models implemented nationally and internationally.

In the U.K., the National Health Service (NHS) endorses referrals for clinical imaging by allied health professionals. A guidance document, 'Clinical imaging requests from non-medically qualified staff' was published in 2005 by the Society and College of Radiographers. Building from this work, The Royal College of Nursing (RCN) then took the lead on the collaborative development of this guidance for non-medically qualified professionals. This report provides advice for staff in clinical imaging departments on accepting requests for all modalities of imaging procedures from non-medically qualified health care professionals [9].

Non-medically qualified referrers might include healthcare professionals such as radiographers, chiropractors, physiotherapists, osteopaths, and nurses. The clinical imaging procedures include those using both ionising and non-ionising radiation such as ultrasound and MRI. This guideline is a joint policy of the

- Royal College of Nursing
- Society and College of Radiographers
- General Chiropractic Council
- General Osteopathic Council
- Chartered Society of Physiotherapy
- NHS Alliance

The protocols for implementing the guidelines allow radiographers to accept requests from non-medically qualified referrers. The referrer must be adequately trained and remain competent to refer. Local agreements and protocols have to be written which include specific training, credentialing, and clinical practice guidelines.

The Royal College of Radiologists takes the position that radiological facilities should be sited in properly staffed departments of clinical radiology, under the control of clinical radiologists in response to the European Directive on Ionising Radiation Medical Exposure [10-12]. The Royal College of General Practitioners position statement on clinical radiology advocates devolution of resources to primary care organisations to facilitate imaging for patient care [13]. The paper specifically addresses the value of direct access for modern general practice in shortening time to diagnosis, thus improving quality of care. The statement also stresses the importance of imaging and reporting being undertaken by adequately trained individuals with close alignment to departments of clinical radiology.

In the United States, referring practices for imaging are driven by what private insurance and the national Medicare system will reimburse. In essence, the reimbursement is available in two parts [14, 15]: (1) professional component, including interpretation of the radiological exam/writing the report; and (2) technical component of performing the radiological service. Requests for radiology must be made by a primary care 'physician'. Reimbursement is paid irrespective of the specialty of the referring physician. A 'physician' is defined as:

- a doctor of medicine or osteopathy
- a doctor of dental surgery or dental medicine
- a doctor of podiatric medicine
- a doctor of optometry
- a chiropractor

The Center for Medicare and Medicaid Services' (CMS) policy for Medicare Part B reimbursement for the professional component of diagnostic radiography does not discriminate approval for payment based on specialty [14]. Some nurses can represent the physician as ordering physicians for diagnostic imaging, but are governed by a set of rules laid down in the Medicare Benefit Policy Manual.

The Freedom of Practice in Medical Imaging Act [16] fundamentally opposes efforts for radiology to only be performed in clinical radiology departments. Medicare statistics reveal that 30.8 percent of non-invasive diagnostic imaging and 23.9 percent of general radiology in the U.S. is performed by non-radiologists. A key underpinning guidance document to promote the quality use of diagnostic imaging in the U.S. is the 'American College of Radiology. Appropriateness Criteria™ [17]. This criterion uses a consensus process to complement scientific data, advising the appropriateness of diagnostic imaging tests for the conditions they cover.

#### **5.1.4 Other themes in the literature**

##### **Self-referral**

Data indicate that widespread self-referral for imaging studies occurs in non-radiologist private practices and thereby raises concern about potential for over-utilisation [18]. In self-referral, non-radiologist physicians may refer patients to either external imaging centres in which they have vested financial interests, or to their own on-site imaging services. Self-referral allows the practitioner to control the nature and volume of technologies used in patient care.

Studies conducted over the past three decades show that when non-radiologist physicians operate their own imaging equipment or have the opportunity to self-refer, utilisation is substantially higher than among physicians who refer their patients to radiologists [19]. Some studies have shown that approximately 50% of non-hospital radiology services are performed in non-radiologist offices, and that non-radiologists performing their own imaging are at least 1.7 to 7.7 times as likely to order imaging as non-self-referring physicians in the same specialty who see patients with the same problems [20, 21]. Another study in the U.S. demonstrated that orthopaedists, podiatrists, and rheumatologists use extremity radiography at a higher rate when they self-refer [22].

Levin and Rao estimate that the cost to the American health care system of unnecessary imaging resulting from self-referral by non-radiologists is USD16 billion each year [19]. Diagnostic imaging is also on the rise in hospitals, with imaging costs for inpatient CT scans, MRI, and other imaging technologies increasing at a similar rate as other associated hospital costs [23]. In fact, patients with more imaging had shorter hospital stays, leading to a slight decrease in total cost per patient. This issue highlights the importance of diagnostic imaging as a component of service delivery and patient care, rather than an isolated issue.

In terms of quality related to self-referral, on-site imaging facilities have shown more problems with equipment maintenance and calibration, technical quality of images, radiation shielding, documentation, and records management [20, 24].

##### **Quality**

Quality and best practice are also key areas for the Australian Department of Health and Ageing as they seek to develop minimum accreditation standards for the competent, ethical, and safe provision of diagnostic imaging. The use of radiation for medical examinations and tests is the largest manmade source of radiation exposure, and any review of referral practices should consider the ramifications of diagnostic imaging on improved patient outcomes. Recent studies show that perhaps up to a third of radiological examinations are totally or partially unnecessary [25], exposing patients to risk without benefit and threatening effective allocation of resources [26].

A study in Australia of CT examinations of the chest found that 68% of the scans ordered by GPs were inappropriate, and many CT scans could have been avoided or replaced by cheaper, simpler tests with lower radiation exposure [27]; moreover, the authors assert that radiation exposure of unnecessary chest CT scans alone could be responsible for about 40 fatal cancers a year in Australia.

Most research related to allied health referral relates to nurse-initiated x-rays of outer limbs [28-31]. The Ottawa Ankle Rules are a set of clinical parameters that evaluate the need for ankle and midfoot x-rays. A number of studies have shown that nurses can appropriately request these x-rays based on a strict protocol and structured educational programs, leading to decreased patient

waiting times, increased staff productivity, and improved patient satisfaction with emergency services. In terms of quality referral, several studies have demonstrated a high agreement rate on ordering limb x-rays by both medical staff and nurses [29]. More research on allied health referral for diagnostic imaging is imperative to build an evidence base to shape referral access, undergraduate and continuing education, and opportunities to improve efficiency and patient care.

### **5.1.5 Undergraduate curricula**

The contextual scan yielded useful but incomplete information on diagnostic imaging and radiation safety content of undergraduate curricula in Australian universities providing training for allied health professionals. Most programs were contacted by telephone or email, but descriptions of course offerings and content do not offer an adequate level of detail for systematic analysis or comparison. All of those institutions and programs that provided information included diagnostic imaging in the curriculum, but the amount and topic scope varied widely. Full exploration of curriculum content for allied health and medical professions would be useful for future study.

## **5.2 Emerging themes from stakeholder consultations**

The stakeholder consultation and accompanying survey sought inputs on critical themes used to establish domains in the principles framework. Seven themes were clearly identified, with rich description of the relationships between the themes and application of test models:

### Patient-related

- Patient safety
- Patient quality of care
- Patient access to care

### Provider-related

- AHP competency
- Interprofessional communication

### System-level

- Efficiency of health care system
- Economic impact

Themes are presented with related factors that stakeholders suggested would contribute to making a test model work. These factors can be interpreted as important issues for formulating best practice models. Most stakeholders commented that the test models presented in the case scenario covered the general criteria for review of referral privileges, and some stakeholders conceived of additional models for referral expansion.

Please note that attribution for quotes or ideas from these informants is provided in parentheses after the comment, with a unique identifier number for stakeholders, and pseudonyms for consumers participating in the focus group. The legend is included in Appendix E.

### **5.2.1 Patient-related themes**

#### **5.2.1.1 Patient safety**

Concerns about patient safety centred upon radiation exposure and lack of coordination between providers. An equal proportion of stakeholders felt that all the test models would be “very effective” or “effective” for ensuring patient safety. Stakeholders generally found the test model based on specific accreditation in appropriate use of diagnostic imaging as the most likely to support patient safety, but this model was not considered ideal for patient access and provider education, as the number of qualified providers might be constricted.

### 5.2.1.2 Patient quality of care

Stakeholders defined quality using a variety of measures, including efficiency, accessibility, and safety. Key issues raised for consideration on how to achieve quality of care with any model expanding referrals to AHP included:

- Operating within scope of practice/competence
- Appropriateness of investigations
- Timeliness of access to diagnostic imaging
- Importance of radiologist role in reporting
- Consumer choice of primary care service provider
- Radiation safety

### 5.2.1.3 Patient access to care

The majority of respondents felt that patient access to care would be improved in all test models presented for broadening referral access. Among those who felt access would be improved, they believed such a change would allow fairer access to diagnostic imaging, particularly among groups who find it challenging or costly to attend multiple appointments. Some participants pointed out that diagnostic imaging access block has yet to be proven as a problem, and an increase in the number of referrers could actually decrease access if there was an increase in referrals.

## 5.2.2 Provider-related themes

Performance within scope of practice was discussed by stakeholders and consumers alike. Consumers vocalised their experiences with both allied health and medical professionals in referring for diagnostic imaging, offering diagnoses, and developing treatment plans. Consumers offered divergent viewpoints on the GP as gatekeeper to most diagnostic imaging, dependent on their experiences with various allied health practitioners, judgments on their training, and individual philosophies of care.

### 5.2.2.1 Allied health professional competency

Most stakeholders agreed that AHP competency in DI is critical to the success of any referral model. Respondents were clear that success of a guideline-based model is based upon training and support of practitioners who know their professional boundaries. There was concern for patient safety and appropriate referring if an AHP used a known set of guidelines but without the necessary training and support (20, 24).

A model based on postgraduate qualification in appropriate use of diagnostic imaging was seen by stakeholders to provide AHPs with the necessary qualifications and training (12, 17), but others felt that it would only be effective for AHPs who completed that postgraduate qualification and therefore ineffective in that it would restrict who was able to refer. Many stakeholders felt that this model's efficacy depends on quality, length, and breadth of the educational program (2, 3, 27). Some stakeholders commented that currency is important for practitioners so they are knowledgeable about diagnostic imaging modalities and evidence surrounding appropriate referral.

### 5.2.2.2 Interprofessional communication

Nearly all stakeholders commented on the importance of interprofessional communication for patient care. Viewpoints were framed around those supporting a team approach, stronger involvement of AHPs, patient choice in designating their primary care provider, and maintenance of a medical practitioner in the lead role. The following recommendations were cited as vital to interprofessional communication:

- Good communication with multidisciplinary team (4, 8, 12, 19, 21)
- Strengthened relationships with radiologists to determine or confirm appropriateness of requested imaging (20)
- Continued involvement of referring GP (3, 12, 19) and access to test results by all team members (12)

- Clear pathways for sharing information and findings (4, 5)
- AHP scopes of practice clearly identified (13)
- Professional credibility, development of inter-professional acceptance (13, 22)
- Third party as external radiology provider to provide quality assurance tool, ensuring clinical information provided is relevant to procedure requested (2)
- Referrals to include all information gathered through that procedure so tests not duplicated if AHP referring on to GPs or specialists (13)
- Bureaucrats shouldn't be involved as head of the team (19)

### 5.2.3 System-level themes

#### 5.2.3.1 Efficiency to health care system

Referrals for diagnostic imaging impacts on the health care system and patient journey in terms of efficiency and cost. Stakeholders felt that all test models presented in the interview would increase efficiency of the current health care system. However, concerns were raised about actual criteria for expansion and how the number of DI items for Medicare reimbursement would be increased using evidence-based guidelines (3). Some respondents also described fundamental barriers to the model such as continuity of care, difficulty accessing DI services, and layers of appointments to traverse the system (17).

#### 5.2.3.2 Economic impact

Generally, allied health professionals interviewed felt that increased GP consults required for DI referrals cost the health care system through MBS, and take time when appointments with GPs are already limited (13, 17), while others felt that increasing AHP referral rights would increase costs for no benefit in patient outcomes (11, 22).

In terms of training or adoption costs, a guideline-based model drew out such comments as, "if fairly onerous and restrictive, could take time for practitioners to apply and understand them, then there could be issues that arise in terms of efficiencies" (17). For this model to work, some stakeholders recommended a monitoring and audit system (14), and funding for ongoing support to develop and maintain the clinical guidelines, as practice in such a broad range of areas would need to reflect current practice and resource-intensive research (17). The third model based on postgraduate qualifications in appropriate use of diagnostic imaging raised numerous concerns about feasibility and impact economically on the healthcare system, practitioners, and consumers.

## 6. The outcome: A framework of principles

The project utilised the findings of the qualitative research to draw up the recommended framework. The framework should find broad support from stakeholders as it is drawn directly from the research findings:

Table 4. Principles Framework

Domain	Critical issues
<b>Clinical Quality</b>	<ul style="list-style-type: none"> <li>▪ Evidence-based practice of DI modality for anatomy definition or assessment of presenting condition(s)</li> <li>▪ Appropriate indications for DI selection</li> <li>▪ Opportunity for ongoing quality assurance or clinical self-audit</li> <li>▪ Role of quality assessor in the care team (radiologist role)</li> </ul>
<b>Safety</b>	<ul style="list-style-type: none"> <li>▪ Practitioner education with DI modalities</li> <li>▪ Risk of ionising radiation bias vs. ultrasound or other DI modalities</li> <li>▪ Quality assurance that machines are operated with optimal care for patient and practitioner safety (i.e. radiology practice role as operators of DI equipment)</li> </ul>
<b>Access &amp; Efficiency</b>	<ul style="list-style-type: none"> <li>▪ Effect on patient journey or experience</li> <li>▪ Effect of potential workforce shortages or distribution</li> <li>▪ Availability of machines for DI modality</li> <li>▪ Appropriate use of expertise on healthcare team (# steps involved, associated costs incurred to patient, Medicare)</li> </ul>
<b>Informed consumers</b>	<ul style="list-style-type: none"> <li>▪ Patient central to decision-making process</li> <li>▪ Patient education about DI modalities, radiation exposure</li> <li>▪ Awareness of lifetime radiation dose and associated risks</li> </ul>
<b>Integrated care</b>	<ul style="list-style-type: none"> <li>▪ Interprofessional communication</li> <li>▪ Role of GP as point of care integration and co-ordination</li> <li>▪ Medical recordkeeping and record-sharing among healthcare team</li> <li>▪ Electronic register to streamline recordkeeping and accessibility</li> </ul>
<b>Education &amp; Training</b>	<ul style="list-style-type: none"> <li>▪ Curriculum standards</li> <li>▪ Continuing professional development opportunities</li> <li>▪ Focal certification</li> </ul>
<b>Economic</b>	<ul style="list-style-type: none"> <li>▪ Implication to HIC</li> <li>▪ Implication for patient-incurred costs</li> </ul>

During the stakeholder engagement process, as anticipated, there was little concordance amongst stakeholders at the detail level (i.e. item numbers). In this context, the framework of principles is a very useful outcome. As it has been drawn from common themes identified at each stage of the qualitative research project, the above framework provides a robust, consensus platform on which to move forward. As such, we recommend that the framework be used to:

1. **Review appropriateness of current item codes on the list in light of principles.** Advocates for change should be prompted to demonstrate evidence of the need for change, the likely impact of the proposed change and proposals for implementing and monitoring the change against the framework, including future sustainability.
2. **Shape future decision-making on item codes to include on the list or exclude from the list.** Professional bodies and other stakeholders might review their policy, standards and programs to support the principles in practice. For example, working to provide continuing professional development programs to maintain competency for referrers or

working with other professional bodies (including RANZCR) to develop curriculum standards and practice standards to support best practice uses of diagnostic imaging.

3. **Establish a process whereby decision-making follows a standard and rigorous review** based on either these or other relevant principles developed. This project identified contentious areas where professionals differ in opinion, where an organised body of evidence could offer critical direction. For example, a universal theme expressed by stakeholders is the need for competent referrers and the prerequisites of adequate vocational training and professional development for any clinician referrer; but there was divergence around whether training provided is adequate to guarantee competence in appropriate use of diagnostic imaging.

## 7. Other issues and opportunities

Stakeholders offered further recommendations relevant to quality provision of diagnostic imaging, though not specifically pertinent to the principles framework or its application for assessment of item codes. Issues and opportunities which were identified during the research and which are relevant to referral for diagnostic imaging are included for completeness.

### Consumer information

1. Consideration be given to developing consumer information on radiation safety, risks and benefits of DI in specific clinical situations (e.g. acute low back pain, acute shoulder pain, acute ankle and knee injury)

### Communication and accountability

2. Clear expression by RANZCR of:
  - a. the centrality of the radiologist's role promoting appropriate use of imaging
  - b. the ongoing central role of GP in coordinating patient care, with respect to inter-professional communication, shared patient information, and teamwork between health professions
  - c. the desirability that AHP DI referrers, and indeed all referrers, engage in clinical audit of DI referral practice as part of their commitment to appropriate use of diagnostic imaging

### Education

3. Consideration be given to funding education to support better referral and utilisation practices.
4. Consideration of development of curriculum standards related to DI and modalities across healthcare disciplines as appropriate, and requiring inclusion of evidence-based practice as an essential component.
5. Encourage radiologists in some capacity to teach appropriate use of diagnostic imaging in undergraduate and CPD programs for medical and non-medical referrers. In light of the current academic medical workforce shortages, this may require novel approaches including the development of teaching resources to be made available to educational institutions.
6. Peak professional bodies of all clinicians who request DI should encourage, support and/or mandate a requirement for maintenance of competence and currency in quality use of DI.
7. Encourage the development of electronic decision support services where high quality validated decision tools or guidelines already exist for conditions commonly seen by GPs and AHPs e.g. acute back pain, acute knee and ankle injury, acute cervical spine injury, acute shoulder pain.

8. Consider resourcing the development of continuing professional development modules to support current best practice in light of new evidence of best clinical practice, inclusion of newer DI modalities in MBS schedule, role extension in referral process for DI.
9. Consider resourcing the development of a resource package on radiation safety by DI modality for all training and education institutions.
10. Medical and non-medical practitioners should be encouraged to utilise existing guidelines, especially for specific areas seen as potential “quality use of” problems.

#### Clinical auditing and reimbursement

11. Maintain separation between referrer and radiological provider.
12. Further investigate variance in practice indicated by Medicare data to expose quality issues in DI current referral requests, and target reduction of unnecessary tests.

## 8. Conclusions

This project developed a principles framework for assessment of MBS item codes related to diagnostic imaging.

The project did not endeavour to review the entire MBS in order to recommend which item codes should be added or detracted from current lists available for ordering by allied health and/or medical professionals. Rather, it is recommended that any item code up for review be tested by the principles framework on the basis of available evidence, in order of importance as designated by policymakers.

Changes in referring policy must evolve with the health care workforce and system, and in this context, policy changes should be driven by principles and evidence, rather than politics and opinion. Importantly, there is little literature available on the impact of allied health referrals for diagnostic imaging on patient outcomes, access, or cost, so further study is necessary to meaningfully inform policy development. One of the few areas of substantial relevant evidence is that self-referral increases the usage of diagnostic imaging. Thus, decision making must be based on best practice principles that are endorsed by the Commonwealth and broadly acceptable to stakeholders.

The analysis undertaken for this project has built upon the frameworks set out by both the RANZCR-QUDI program framework and the government’s Diagnostic Imaging Referral Arrangements Review, both of which consider appropriate practice, patient access, service quality and economic issues as paramount in deliberations for access to item codes in the Medicare Benefits Scheme. By scanning the literature, engaging stakeholders and consumers, and analysing the most current data related to diagnostic imaging referrals among the target population of allied health practitioners, this project has developed a series of principles and recommendations to guide future decision making.

## 9. References

1. Gunderman R.B., S.A.R., Heitkamp D.E., Kipfer H.D., *The Vital Role of Radiology in the Medical School Curriculum*. Am J Roentgenol, 2003. **180**: p. 1239-1242.
2. Australian Physiotherapy Association, *Submission to the House Inquiry into Health Funding*. 2006, Australian Physiotherapy Association: St. Kilda.
3. Australasian Podiatry Council, *Australasian Podiatry Council proposal for Podiatry Patients to receive Medicare benefits for certain pathology tests*. 2006.
4. Australian Government Medicare Australia, *Medicare Information Report, Request number: 2007/CO02081*. 2007.
5. Australian Government Department of Health and Ageing. *Medicare Benefits Schedule, Category 5: Diagnostic Procedures Notes (online)*. 2006 Available from: <http://www.health.gov.au/internet/wcms/publishing.nsf/Content/mbsonline-downloads>.
6. Australian Government Medicare Australia. *All Medicare by MBS category processed from January 2002 to December 2006*. Medicare Statistics Database [cited May 15, 2007].
7. MacIsaac Informatics, *Review of diagnostic imaging requests: final report*. 2006, RANZCR: Sydney.
8. Australian Government Medicare Australia. *Requested Medicare items processed from January 2006 to December 2006* Medicare Statistics Database [cited July 17, 2007].
9. Royal College of Nursing, *Clinical imaging requests from non-medically qualified professionals*. 2006, London: Royal College of Nursing.
10. EU Council, *EU Council Directive of 30 June 1997 on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure, and repealing Directive 84/466/EURATOM*. 1997.
11. European Commission Directorate-General for the Environment, *Referral guidelines for imaging*. 2000.
12. Royal College of Radiologists (RCR), *Making the Best Use of a Department of Clinical Radiology: Guidelines for Doctors*. 5th ed. 2003.
13. Royal College of General Practitioners (RCGP) and Royal College of Radiologists (RCR), *Radiology and the Patients of GPs*. 2004.
14. Medicare, *Medicare Claims Processing Manual Chapter 13 - Radiology Services and Other Diagnostic Procedures*. 2006. Section 20.1.
15. American Academy of Family Physicians (AAFP), *Radiology (Position Paper)*. 2006.
16. American Medical Association (AMA). *D-385.974 Freedom of Practice in Medical Imaging*. 2005 Available from: <http://www.ama-assn.org>

17. American College of Radiologists (ACR), *ACR Appropriateness Criteria*®. 2004-2006.
18. Levin, D.C., et al., *Self-referral in private offices for imaging studies performed in Pennsylvania Blue Shield subscribers during 1991*. *Radiology*, 1993. **189**(2): p. 371-5.
19. Levin, D.C. and V.M. Rao, *Turf Wars in Radiology: The Overutilization of Imaging Resulting from Self-Referral*. *J Am Coll Radiol*, 2004. **1**: p. 169-72.
20. Kouri, B.E., R.G. Parsons, and H.R. Alpert, *Physician Self-Referral for Diagnostic Imaging: Review of the Empiric Literature*. *Am J Roentgenol*, 2002. **179**(4): p. 843-50.
21. Sunshine, J.H., S. Bansal, and R.G. Evens, *Radiology performed by nonradiologists in the United States: who does what?* *Am J Roentgenol*, 1993. **161**(2): p. 419-29.
22. Litt, A.W., et al., *Relative procedure intensity with self-referral and radiologist referral: extremity radiography*. *Radiology*, 2005. **235**(1): p. 142-7.
23. MT, B. and Gazelle GS, *Diagnostic imaging costs: Are they driving up the costs of hospital care?* *Radiology*, 2005. **235**(3): p. 934-939.
24. Moskowitz, H., et al., *The Effect of Imaging Guidelines on the Number and Quality of Outpatient Radiographic Examinations*. *Am J Roentgenol*, 2000. **175**(1): p. 9-15.
25. Picano, E., *Sustainability of medical imaging*. *BMJ*, 2004. **328**(1): p. 578-580.
26. Mendelson, R.M. and C.P.J. Murray, *Towards the appropriate use of diagnostic imaging*. *MJA*, 2007. **187**(1): p. 5-6.
27. Simpson, G. and G.S. Hartrick, *Use of thoracic computed tomography by general practitioners*. *MJA*, 2007. **187**(1): p. 43-46.
28. Nugent, P., *Ottawa ankle rules accurately assess injuries and reduce reliance on radiographs*. *J Fam Pract*, 2004. **53**(10): p. 785-8.
29. Tambimuttu, J., R. Hawley, and A. Marshall, *Nurse-initiated x-ray of isolated limb fractures in the emergency department: research outcomes and future directions*. *Aust Crit Care*, 2002. **15**(3): p. 119-22.
30. Wynn-Thomas, S., et al., *The Ottawa ankle rules for the use of diagnostic X-ray in after hours medical centres in New Zealand*. *N Z Med J*, 2002. **115**(1162): p. U184.
31. Bengert, J.R., *Can nurses working in remote units accurately request and interpret radiographs?* *EMJ*, 2002. **19**(1): p. 68-70.

## Appendix A: Related project reports

Report title	Type of report	Date of submission to RANZCR
Contextual scan	Document	Jan 29, 2007
Literature search	Endnote file	Jan 29, 2007
Framework Development and Scenarios	Document	Feb 23, 2007
Stakeholder Analysis	Document	Apr 24, 2007
Final report	Document	Oct 15, 2007

## Appendix B: Medicare schedule item codes for allied health professions

Table 5. Medicare schedule item code for allied health professions

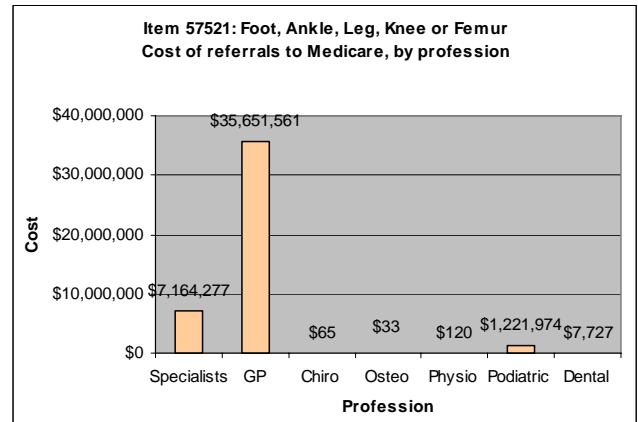
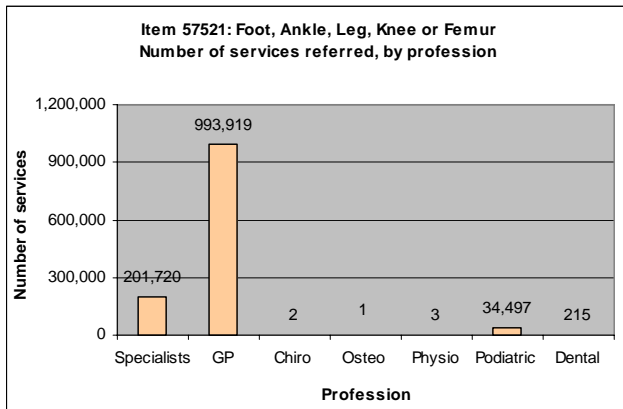
<p><b>Chiropractors</b></p> <p><b>Physiotherapists</b></p> <p><b>Osteopaths</b></p>	<ul style="list-style-type: none"> <li>• Item 57712: HIP JOINT (R)</li> <li>• Item 57715: PELVIC GIRDLE (R)</li> <li>• Item 58100: SPINE CERVICAL (R)</li> <li>• Item 58103: SPINE THORACIC (R)</li> <li>• Item 58106: SPINE LUMBOSACRAL (R)</li> <li>• Item 58108: Spine, four regions, cervical, thoracic, lumbosacral and sacrococcygeal (R)</li> <li>• Item 58109: SPINE SACROCOCCYGEAL (R)</li> <li>• Item 58112: Spine, two examinations of the kind referred to in items 58100, 58103, 58106 and 58109 (R)</li> <li>• Item 58115: Spine, three examinations of the kind mentioned in items 58100, 58103, 58106 and 58109 (R)</li> </ul>
<p><b>Dental practitioners</b></p>	<ul style="list-style-type: none"> <li>• Item 57509: HAND, WRIST, FOREARM, ELBOW OR HUMERUS (R)</li> <li>• Item 57515: HAND AND WRIST OR HAND, WRIST AND FOREARM OR FOREARM AND ELBOW OR ELBOW AND HUMERUS (R)</li> <li>• Item 57521: FOOT, ANKLE, LEG, KNEE OR FEMUR (R)</li> <li>• Item 57527: FOOT AND ANKLE, OR ANKLE AND LEG, OR LEG AND KNEE, OR KNEE AND FEMUR (R)</li> <li>• Item 57901: SKULL, not in association with item 57902 (R)</li> <li>• Item 57902: CEPHALOMETRY, not in association with item 57901 (R)</li> <li>• Item 57903: SINUSES (R)</li> <li>• Item 57906: MASTOIDS (R)</li> <li>• Item 57909: PETROUS TEMPORAL BONES (R)</li> <li>• Item 57912: FACIAL BONES orbit, maxilla or malar, any or all (R)</li> <li>• Item 57915: MANDIBLE, not by orthopantomography technique (R)</li> <li>• Item 57918: SALIVARY CALCULUS (R)</li> <li>• Item 57921: NOSE (R)</li> <li>• Item 57924: EYE (R)</li> <li>• Item 57927: TEMPOROMANDIBULAR JOINTS (R)</li> <li>• Item 57930: TEETH SINGLE AREA (R)</li> <li>• Item 57933: TEETH FULL MOUTH (R)</li> <li>• Item 57939: PALATOPHARYNGEAL STUDIES with fluoroscopic screening (R)</li> <li>• Item 57942: PALATOPHARYNGEAL STUDIES without fluoroscopic screening (R)</li> <li>• Item 57945: LARYNX, LATERAL AIRWAYS AND SOFT TISSUES OF THE NECK, not being a service associated with a service to which item 57939 or 57942 applies (R)</li> <li>• Item 57960: Orthopantomography, for diagnosis and/or management of trauma, infection, tumours, congenital conditions or surgical conditions of the teeth or maxillofacial region (R)</li> <li>• Item 57963: Orthopantomography, for diagnosis and/or management of impacted teeth, caries, periodontal or peripical pathology where signs or symptoms of those conditions are evident (R)</li> <li>• Item 57966: Orthopantomography, for diagnosis and/or management of missing or crowded teeth, or developmental anomalies of the teeth or jaws (R)</li> <li>• Item 57969: Orthopantomography, for diagnosis and/or management of temporomandibular joint arthroses or dysfunction (R)</li> <li>• Item 58100: SPINE CERVICAL (R)</li> <li>• Item 58300: BONE AGE STUDY (R)</li> <li>• Item 58503: CHEST (lung fields) by direct radiography (R)</li> <li>• Item 58903: PLAIN ABDOMINAL ONLY, not being a service associated with a service to which Item 58909, 58912, 58915 or 58924 applies (R)</li> <li>• Item 59733: SIALOGRAPHY, 1 side, with preparation and contrast injection, not being a service associated with a service to which item 57918 applies - (R)</li> <li>• Item 59739: SINOGRAM OR FISTULOGRAM, 1 or more regions, with or without preliminary plain films and with preparation and contrast injection - (R)</li> <li>• Item 59751: ARTHROGRAPHY, each joint, excluding the facet (zygapophyseal) joints of the spine, single or double contrast study, with or without preliminary plain films and with preparation and contrast injection - (R)</li> <li>• Item 60100: TOMOGRAPHY OF ANY REGION (R) (Anaes.)</li> <li>• Item 60500: FLUOROSCOPY, with general anaesthesia (not being a service associated with a radiographic examination) (R) (Anaes.)</li> <li>• Item 60503: FLUOROSCOPY, without general anaesthesia (not being a service associated with a radiographic examination) (R)</li> </ul>
<p><b>Podiatrists</b></p>	<ul style="list-style-type: none"> <li>• Item 57521: FOOT, ANKLE, LEG, KNEE OR FEMUR (R)</li> <li>• Item 57527: FOOT AND ANKLE, OR ANKLE AND LEG, OR LEG AND KNEE, OR KNEE AND FEMUR (R)</li> </ul>

Source: [5]

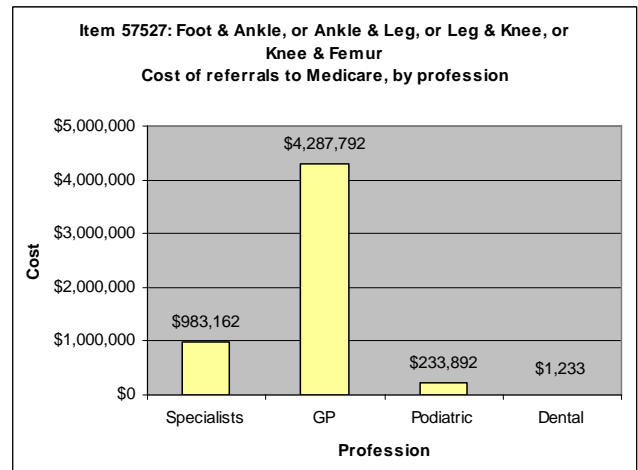
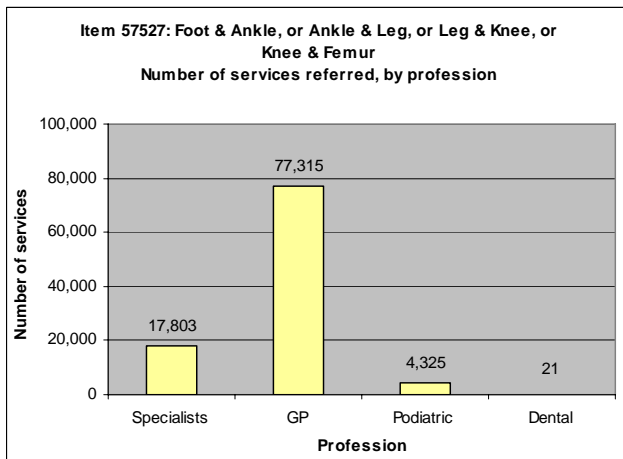
## Appendix C: Graphs of Medicare statistics for specific item codes

from Medicare Australia, Health Statistics. Medicare Information Report 2007/CO02081

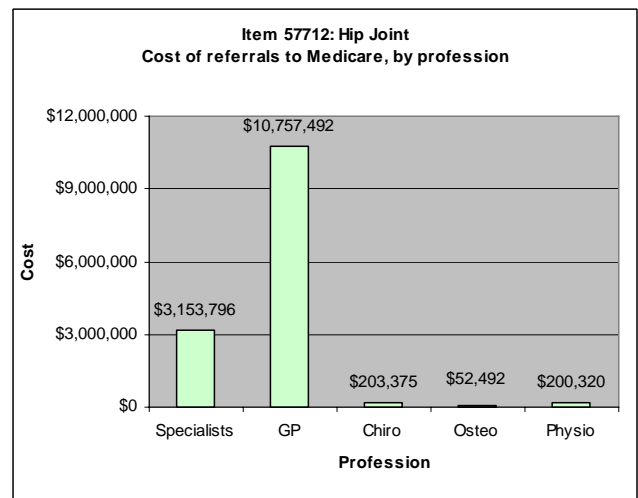
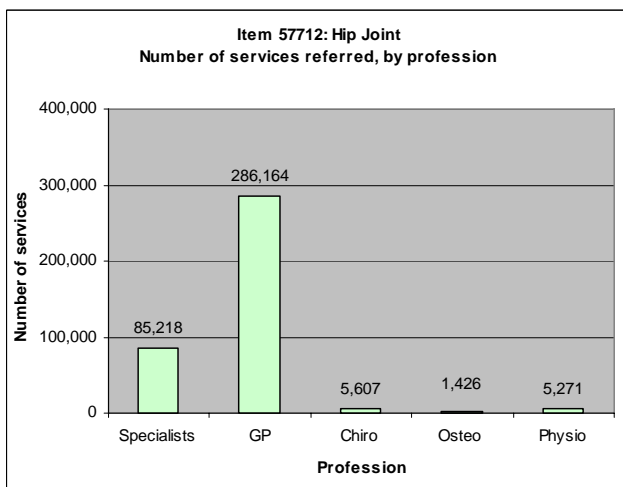
Item 57521: Foot, Ankle, Leg, Knee or Femur



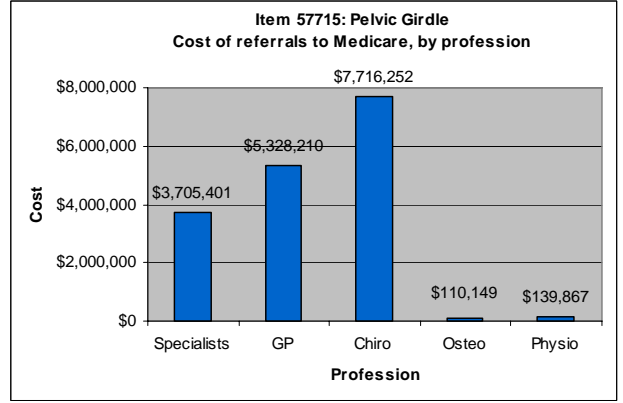
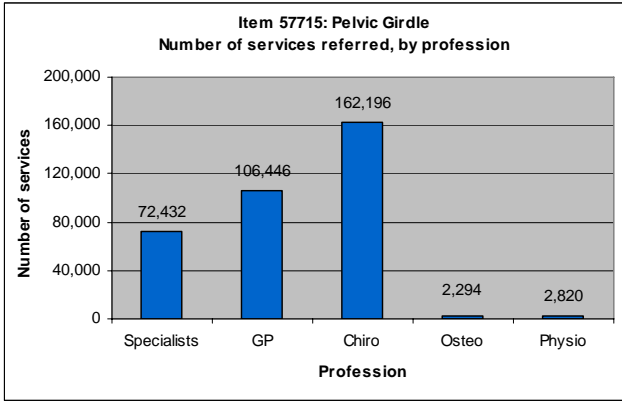
Item 57527: Foot & Ankle, or Ankle & Leg, or Leg & Knee, or Knee & Femur



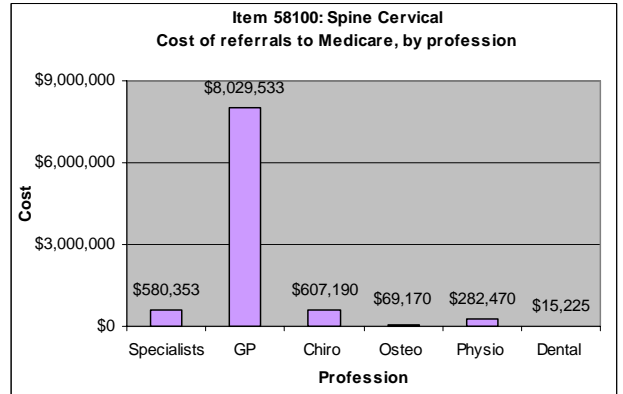
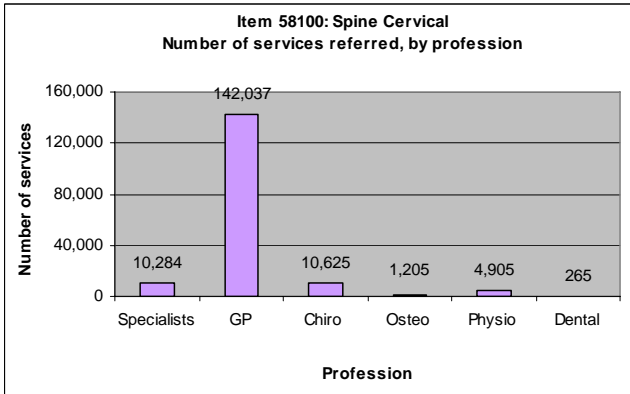
Item 57712: Hip Joint



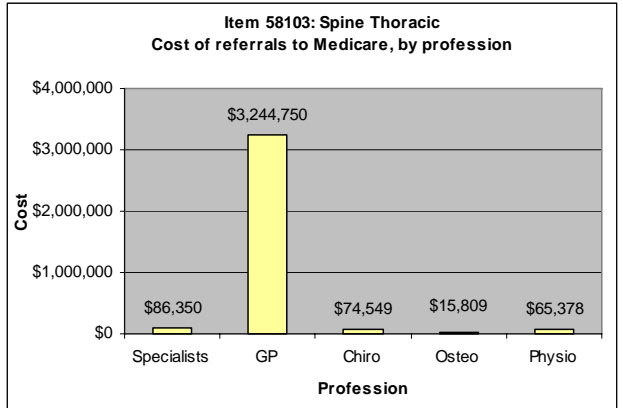
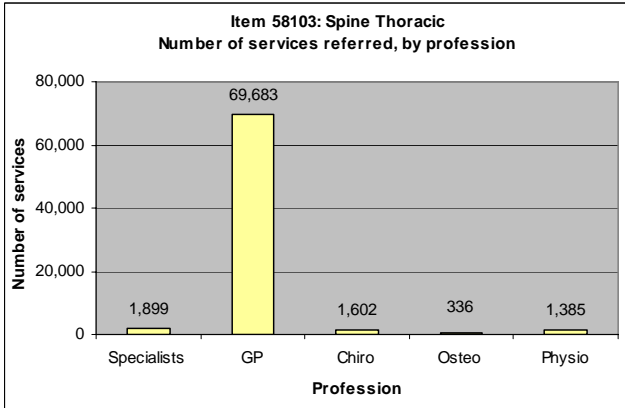
Item 57715: Pelvic Girdle



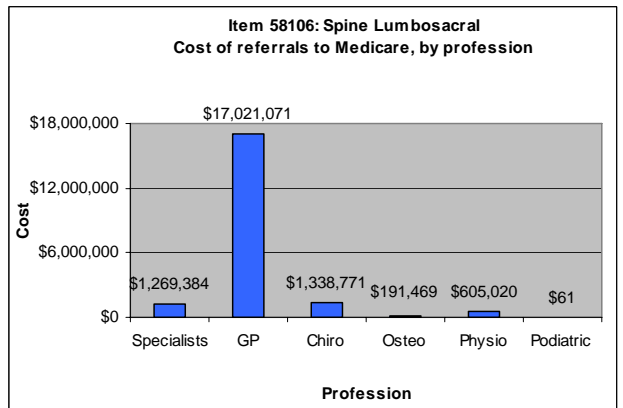
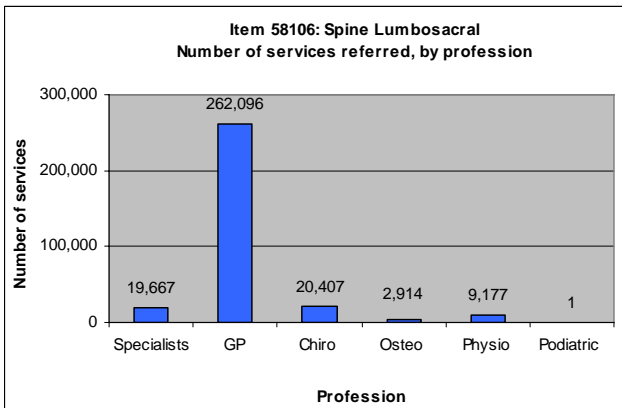
Item 58100: Spine Cervical



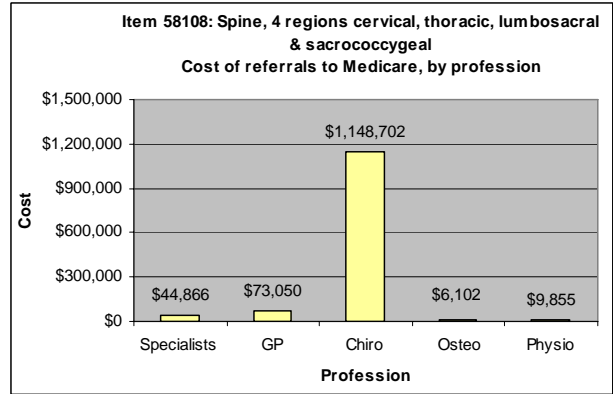
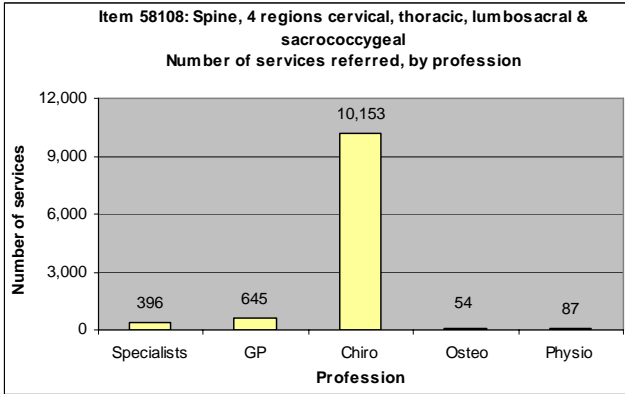
Item 58103: Spine Thoracic



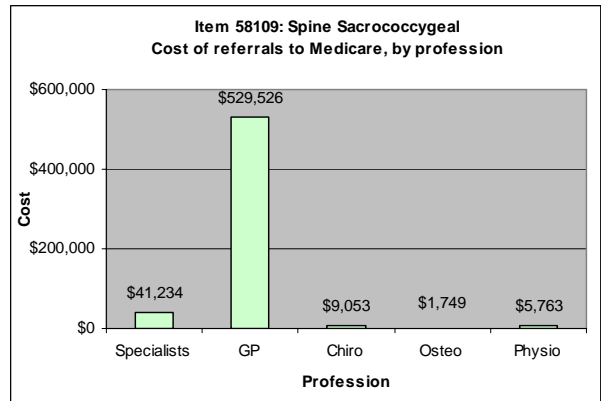
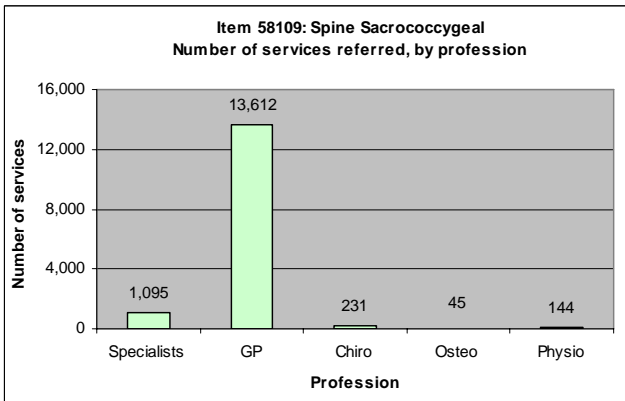
Item 58106: Spine Lumbosacral



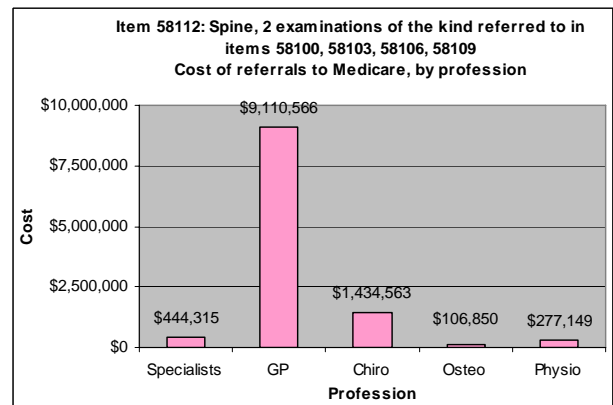
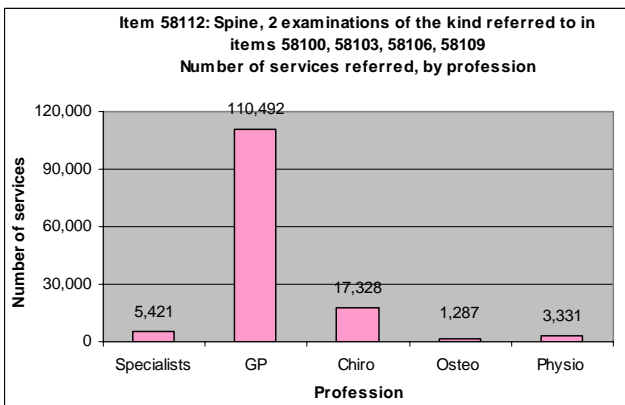
Item 58108: Spine, 4 regions cervical, thoracic, lumbosacral & sacroccygeal



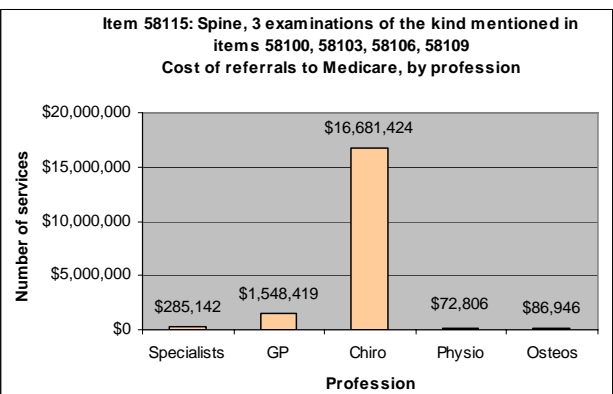
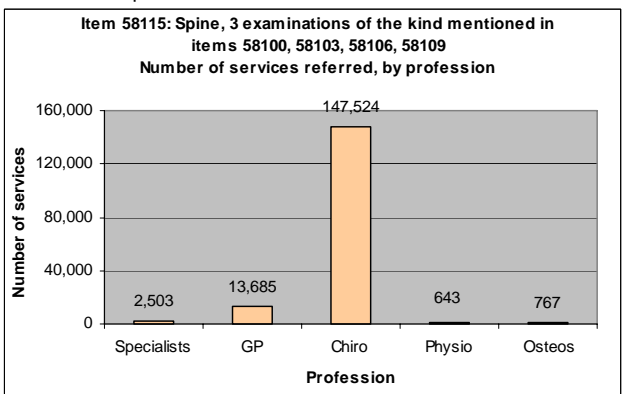
Item 58109: Spine Sacroccygeal



Item 58112: Spine, 2 examinations of the kind referred to in items 58100, 58103, 58106, 58109



Item 58115: Spine, 3 examinations of the kind mentioned in items 58100, 58103, 58106, 58109



## Appendix D: Registered practitioners in Australia per profession, 2006

Table 6. Registered practitioners in Australia per profession (with sources)

Profession	NSW	QLD	VIC	ACT	WA	TAS	NT	SA	Total
GPs	27,918 <sup>1</sup>	14,717 <sup>2</sup>	19,188 <sup>3</sup>	2,056 <sup>4</sup>	8,051 <sup>5</sup>	2,428	n/r	6511 <sup>6</sup>	80,869
Chiropractors	1,305 <sup>7</sup>	669 <sup>8</sup>	1,020	63 <sup>9</sup>	9 <sup>10*</sup>	67 <sup>11*</sup>	26 <sup>12</sup>	500 <sup>13*</sup>	3,659
Osteopaths	508 <sup>14</sup>	106	543	40 <sup>15</sup>	9 <sup>16*</sup>	67 <sup>17*</sup>	7 <sup>18</sup>	500 <sup>19*</sup>	1,780
Physiotherapists	6,617 <sup>20</sup>	3,440	4711	382 <sup>21</sup>	2232 <sup>22</sup>	348 <sup>23</sup>	155 <sup>24</sup>	1643 <sup>25</sup>	19,528
Podiatrists	783 <sup>26</sup>	438 <sup>27</sup>	869	45 <sup>28</sup>	299 <sup>29</sup>	71 <sup>30</sup>	n/r	311 <sup>31</sup>	2,816
Dentists	756 <sup>32</sup>	2,408 <sup>33</sup>	2,328 <sup>34</sup>	264 <sup>35</sup>	1,100 <sup>36</sup>	183 <sup>37</sup>	87 <sup>38</sup>	846 <sup>39</sup>	7,972
<b>Total</b>	<b>37,887</b>	<b>21,778</b>	<b>28,659</b>	<b>2,850</b>	<b>11,700</b>	<b>3,164</b>	<b>275</b>	<b>10,311</b>	<b>116,624</b>

\* This number includes both chiropractors and osteopaths due to the way this registration board organizes its data.

<sup>1</sup> New South Wales Medical Board. *Annual Report 2006*. Gladesville, NSW. [www.nswmb.org.au](http://www.nswmb.org.au)

<sup>2</sup> Medical Board of Queensland. *Annual Report 2005-2006*. Accessed online [www.medicalboard.qld.gov.au/publications/Publications.htm](http://www.medicalboard.qld.gov.au/publications/Publications.htm) on May 28, 2007.

<sup>3</sup> Medical Practitioners Board of Victoria. *Annual Report 2005-2006*. Accessed online [medicalboardvic.org.au/content.php?sec=67](http://medicalboardvic.org.au/content.php?sec=67) on May 28, 2007.

<sup>4</sup> ACT Health. *Annual Report 2005-06*. Publication no. 06/1166 (350). Australian Capital Territory, Canberra, Sept 2006.

<sup>5</sup> Medical Board of Western Australia. Personal communication, May 2007.

<sup>6</sup> Medical Board of South Australia, *Annual Report 2005/2006* Accessed online

<sup>7</sup> New South Wales Chiropractors Registration Board. *Annual Report for the Year Ended June 30, 2005*. Accessed online [http://www.chiroreg.health.nsw.gov.au/hprb/chiro\\_web/annualrep.htm](http://www.chiroreg.health.nsw.gov.au/hprb/chiro_web/annualrep.htm) on May 28, 2007.

<sup>8</sup> Chiropractors Board of Queensland. *Annual Report 2005-2006*. Accessed online <http://www.chiroboard.qld.gov.au/publications/annual%20reports/Annual%20Reports.htm> on May 28, 2007.

<sup>9</sup> ACT Health. *Annual Report 2005-06*. Publication no. 06/1166 (350). Australian Capital Territory, Canberra, Sept 2006.

<sup>10</sup> Physiotherapists Registration Board of Western Australia, Personal communication, May 2007

<sup>11</sup> Chiropractors and Osteopaths Registration Board of Tasmania, personal communication, July 2007

<sup>12</sup> NT Health Professions Licensing Authority, Personal communication, May 2007.

<sup>13</sup> Chiropractors Board Of South Australia, *Annual Report 2005-2006*. Accessed online

<sup>14</sup> New South Wales Osteopaths Registration Board. *Annual Report for the Year Ended June 30, 2005*. Accessed online [www.osteoreg.health.nsw.gov.au/hprb/oste\\_web/pdf/annualreport2005.pdf](http://www.osteoreg.health.nsw.gov.au/hprb/oste_web/pdf/annualreport2005.pdf), May 28, 2007

<sup>15</sup> ACT Health. *Annual Report 2005-06*. Publication no. 06/1166 (350). Australian Capital Territory, Canberra, Sept 2006.

<sup>16</sup> Physiotherapists Registration Board of Western Australia, Personal communication, May 2007

<sup>17</sup> Chiropractors and Osteopaths Registration Board of Tasmania, personal communication, July 2007

<sup>18</sup> NT Health Professions Licensing Authority, Personal communication, May 2007

<sup>19</sup> Chiropractors Board Of South Australia, *Annual Report 2005-2006*. Accessed online

<sup>20</sup> New South Wales Physiotherapists Registration Board. *Annual Report for the Year Ended June 30 2006*. Accessed online [http://www.physioreg.health.nsw.gov.au/hprb/physio\\_web/annual\\_report.html](http://www.physioreg.health.nsw.gov.au/hprb/physio_web/annual_report.html) on May 28, 2007.

<sup>21</sup> ACT Health. *Annual Report 2005-06*. Publication no. 06/1166 (350). Australian Capital Territory, Canberra, Sept 2006.

<sup>22</sup> Physiotherapists Registration Board of Western Australia, Personal communication, May 2007

<sup>23</sup> Physiotherapists Registration Board of Tasmania, Personal communication, July 2007

<sup>24</sup> NT Health Professions Licensing Authority, Personal communication, May 2007

<sup>25</sup> The Physiotherapy Board of South Australia, *Annual Report 2006*

<sup>26</sup> New South Wales Podiatrists Registration Board. *Annual Report for the year ended June 30 2005*. Accessed [http://www.podreg.health.nsw.gov.au/hprb/pod\\_web/anreport.htm](http://www.podreg.health.nsw.gov.au/hprb/pod_web/anreport.htm) on May 28, 2007.

<sup>27</sup> Podiatrists Board of Queensland. *Annual Report 2005-06*. Accessed online

<http://www.podiatryboard.qld.gov.au/Docslibrary/Publications.htm>, May 28, 2007

<sup>28</sup> ACT Health. *Annual Report 2005-06*. Publication no. 06/1166 (350). Australian Capital Territory, Canberra, Sept 2006.

<sup>29</sup> Podiatrists Registration Board, Personal communication, May 2007

<sup>30</sup> The Podiatrists Registration Board of Tasmania. *Annual Report for the year ended 30 June 2006*. Accessed online [www.podregtas.com/annualreports.htm](http://www.podregtas.com/annualreports.htm), May 28, 2007

<sup>31</sup> Podiatry (Chiropody) Board of South Australia. *Annual Report Year Ended 30 June 2006*. Accessed online

<http://www.pbsa.saboard.com.au/annualreport.htm>, May 28, 2007.

<sup>32</sup> New South Wales Dental Technicians Registration Board. *Annual Report for the Year Ended 30 June 2006*. Accessed online [http://www.dtechreg.health.nsw.gov.au/hprb/dtech\\_web/pdf/annualreportdt2006.pdf](http://www.dtechreg.health.nsw.gov.au/hprb/dtech_web/pdf/annualreportdt2006.pdf), May 28, 2007.

<sup>33</sup> Dental Board of Queensland. *Annual Report 2005-06*. Accessed online

<http://www.dentalboard.qld.gov.au/publications/Annual%20Reports/Annual%20Reports.htm>, May 28, 2007

<sup>34</sup> Dental Practice Board of Victoria. *Annual Report 2005-2006*. Accessed online <http://www.dentprac.vic.gov.au/publications.asp?doc=3>, May 28, 2007.

<sup>35</sup> ACT Health. *Annual Report 2005-06*. Publication no. 06/1166 (350). Australian Capital Territory, Canberra, Sept 2006.

<sup>36</sup> Dental Board of Western Australia, Annual Report for the year ended 30 June 2004. Accessed online

<http://www.dentalboard.wa.gov.au/>, July 17, 2007

<sup>37</sup> Dental Board of Tasmania, *Annual Report 2005-2006*. Accessed online <http://www.dentalboard.tas.gov.au/annual.html>, July 17, 2007.

<sup>38</sup> NT Health Professions Licensing Authority, Personal communication, May 2007

<sup>39</sup> Dental Board of South Australia, Personal communication, May 2007