

# 9 Analysis of imaging orders for selected problems

This section investigates the pattern of imaging orders for selected problems. The problems were selected on the basis of:

- the relatively high number of imaging orders associated with its management (e.g. fracture, joint sprains and strains), or
- the high proportion of contacts with that problem that generate a pathology test order (e.g. breast lump, shoulder syndrome and abdominal pain), or
- for their intrinsic interest after the discussions with professional bodies and government earlier mentioned (peripheral vascular disease/leg pain, headaches and head injury).

For each selected problem type, the following data are provided:

- the codes, terms and rubrics included in the problem group and their relative frequency within the total dataset
- the number and relative rate of imaging tests ordered for this problem type
- the age and sex distribution of the patients at encounters where this problem type was managed
- the age-sex-specific imaging order rate for this problem type
- the distribution of imaging tests ordered by MBS group for this problem type, and
- the most common individual imaging test types ordered for this problem type.

Where appropriate further analyses are provided to investigate the relationship between test ordering and problem status (new/old) and/or the extent to which the tested problems were thought work-related by the GP.

## 9.1 Fracture

This group excludes fractures of the head and skull. There were 1,026 fractures managed at 1,009 encounters. The fracture problem group includes the following ICPC-2 codes and rubrics:

- L72 – Fracture; radius/ulna ( $n=180$ )
- L73 – Fracture: tibia/fibula ( $n=104$ )
- L74 – Fracture; hand/foot bone ( $n=300$ )
- L75 – Fracture: femur ( $n=35$ )
- L76 – Fracture: other ( $n=399$ )

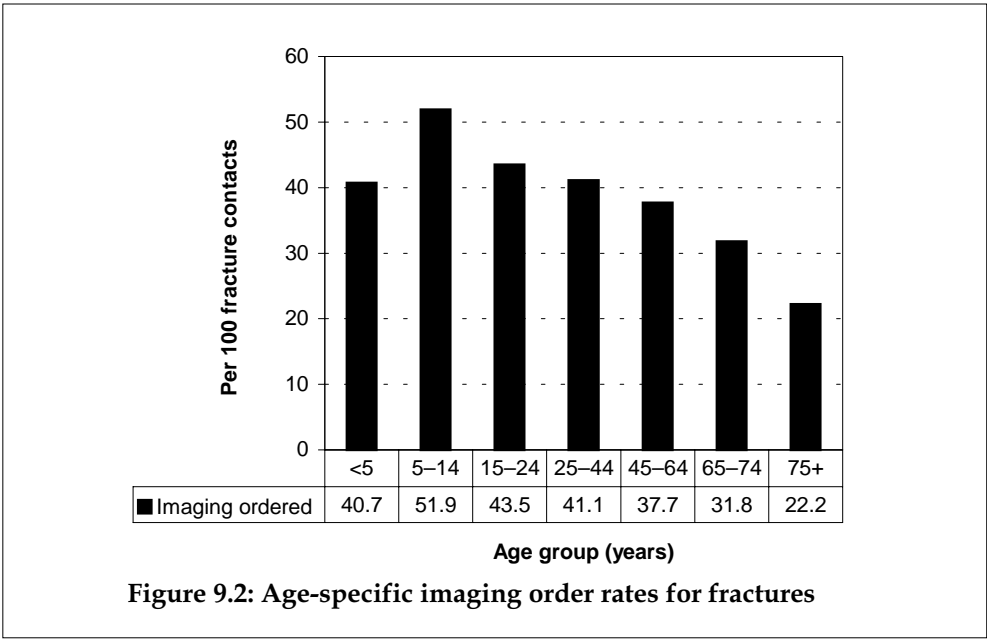
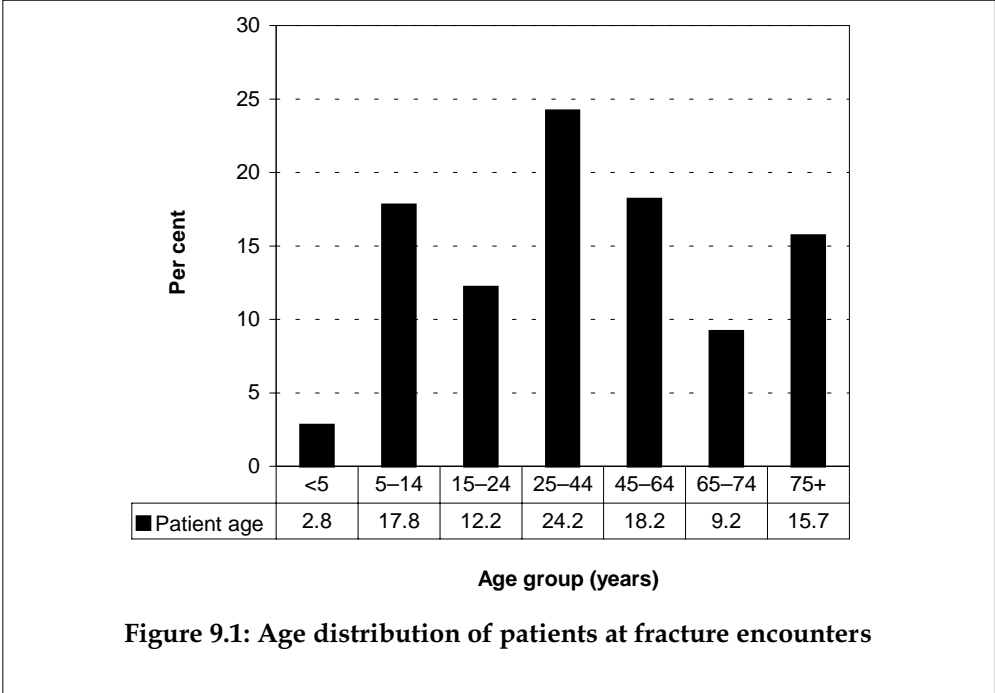
and the following ICPC-2 PLUS codes and rubrics:

- L99017 – Fracture: non-union ( $n=1$ )
- L99018 – Fracture: pathological ( $n=5$ )
- L99019 – Fracture: malunion ( $n=2$ ).

For 389 fractures (38.0%) at least one imaging test was ordered. In total 424 tests were ordered, accounting for 5.4% of total imaging, being placed at a rate of 109 per 100 tested fractures (Table 7.5).

### Age- and sex-specific imaging order rates for fracture

At half the encounters involving fracture, the patient was male. An imaging order was placed at only 40.7% of the encounters with male patients compared with 36.5% of those with females. These rates were not statistically different



The age distribution of the patients at fracture encounters is provided in Figure 9.1, which demonstrates that one in four were aged between 25 and 44 years and a further 18% were between 45 and 64 years old.

The age-specific rates of imaging orders are presented graphically in Figure 9.2. The likelihood of having an imaging test ordered for fracture was highest for children aged 5–14 years (51.9%) and decreased steadily with age to 22.2% for the elderly.

### Imaging tests ordered for fracture by MBS group

Almost all (97.7%) of the imaging tests ordered for fracture fell into the diagnostic radiology MBS group. Computed tomography accounted for a further 1.6% of tests for fracture (Table 9.1).

**Table 9.1: Distribution of imaging tests ordered for fracture by MBS group**

MBS imaging group	Number of tests	Per cent of tests for fracture
Diagnostic radiology	414	97.7
Computed tomography	7	1.6
Ultrasound	1	0.3
Magnetic resonance imaging	1	0.3
Other	1	0.5
<b>Total</b>	<b>424</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

### Imaging test order rates by problem status of fracture

New presentations of fracture made up one-third of the total contacts and an imaging test order was far more likely in these cases. Tests were ordered at a rate of 61.5 per 100 contacts with new fractures compared with a rate of 31.2 tests per 100 old fracture encounters (Table 9.2).

**Table 9.2: Imaging order rate by problem status of fracture**

Problem status	Number of problem contacts <sup>(a)</sup>	Per cent	Number of imaging tests ordered	Imaging order rate per 100 problems
New fracture problems	343	33.4	211	61.5
Old fracture problems	683	66.6	213	31.2
<b>Total</b>	<b>1,026</b>	<b>100.0</b>	<b>424</b>	<b>52.1</b>

(a) Total contacts with this problem in the full dataset.

### Most common imaging tests ordered for fracture

The tests most commonly ordered in the management of fracture were plain x-rays of specific body parts. X-rays of the wrist accounted for 14.8% of imaging ordered for fractures, followed by those of the hand (9.8%), the foot/feet (9.2%) and the finger(s) or thumb (7.8%) (Table 9.3).

**Table 9.3: Most common imaging tests ordered for fracture**

<b>Test type ordered</b>	<b>Number of tests</b>	<b>Per cent of tests for fracture</b>	<b>Per cent of tests for new fractures (n=211)</b>	<b>Per cent of tests for old fractures (n=213)</b>
X-ray; wrist	63	14.8	12.2	17.3
X-ray; hand	42	9.8	11.2	8.4
X-ray; foot/feet	39	9.2	8.0	10.3
X-ray; finger(s)/thumb	33	7.8	8.6	6.9
X-ray; ankle	25	5.9	4.9	6.8
X-ray; chest	22	5.1	4.9	5.3
Scan; bone(s)	18	4.2	4.4	3.9
X-ray; forearm	14	3.3	2.8	3.9
X-ray; toe(s)	14	3.2	2.8	3.7
X-ray; elbow	14	3.2	3.0	3.4
X-ray; ribs	14	3.2	3.8	2.6
X-ray; arm	13	3.0	4.3	1.7
x-ray; clavicle	11	2.6	0.6	4.6
Test; bone marrow density	11	2.6	3.1	2.0
X-ray; nose	10	2.4	3.6	1.3
X-ray; knee	7	1.7	2.3	1.0
X-ray; shoulder	7	1.6	2.3	1.0
<i>Sub-total</i>	<i>357</i>	<i>84.2</i>	<i>82.8</i>	<i>84.1</i>
<b>Total</b>	<b>424</b>	<b>100.0</b>	100.0	100.0

*Note:* Columns may not add to column total due to rounding.

## Discussion

The results described in this section are discussed in association with those for sprains and strains (see 'Discussion') in Section 9.2.

## 9.2 Joint sprain and strain

This group includes the following ICPC-2 codes and rubrics:

- L77 – Sprains and strains of ankle (*n*=220)
- L78 – Sprains and strains of knee (*n*=64)
- L79 – Sprains and strains of other joints (*n*=830).

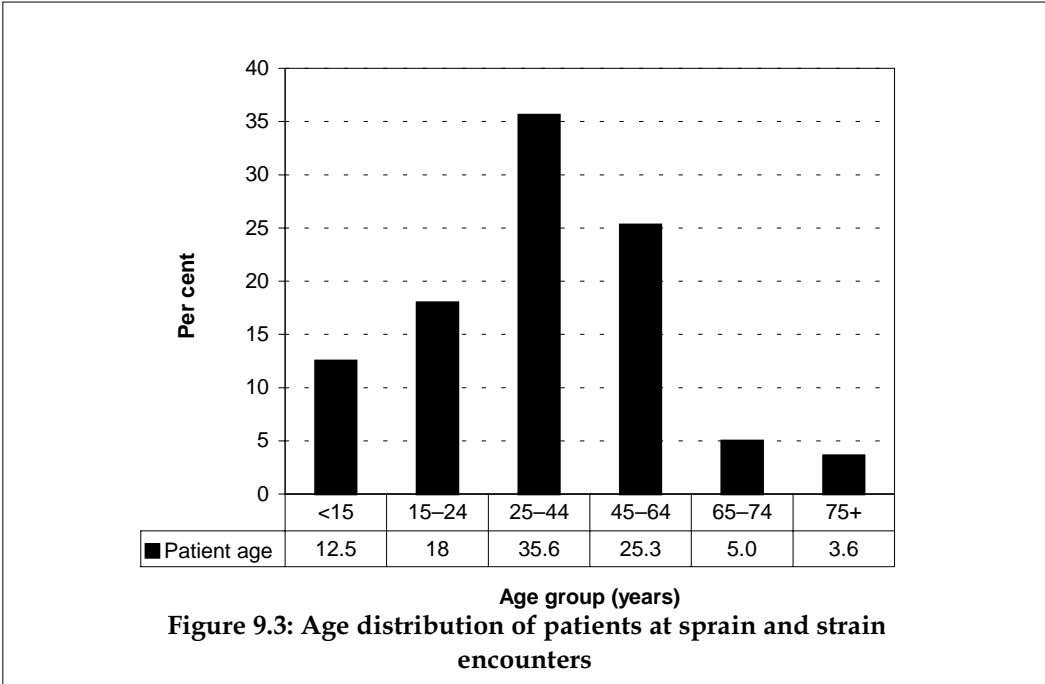
There were 1,114 joint sprains and strains managed at 1,009 encounters. For 239 joint sprains and strains (21.5%) at least one imaging test was ordered. In total 253 tests were ordered and these accounted for 3.2% of total imaging. These orders were placed at a rate of 106 per 100 tested joint sprains and strains.

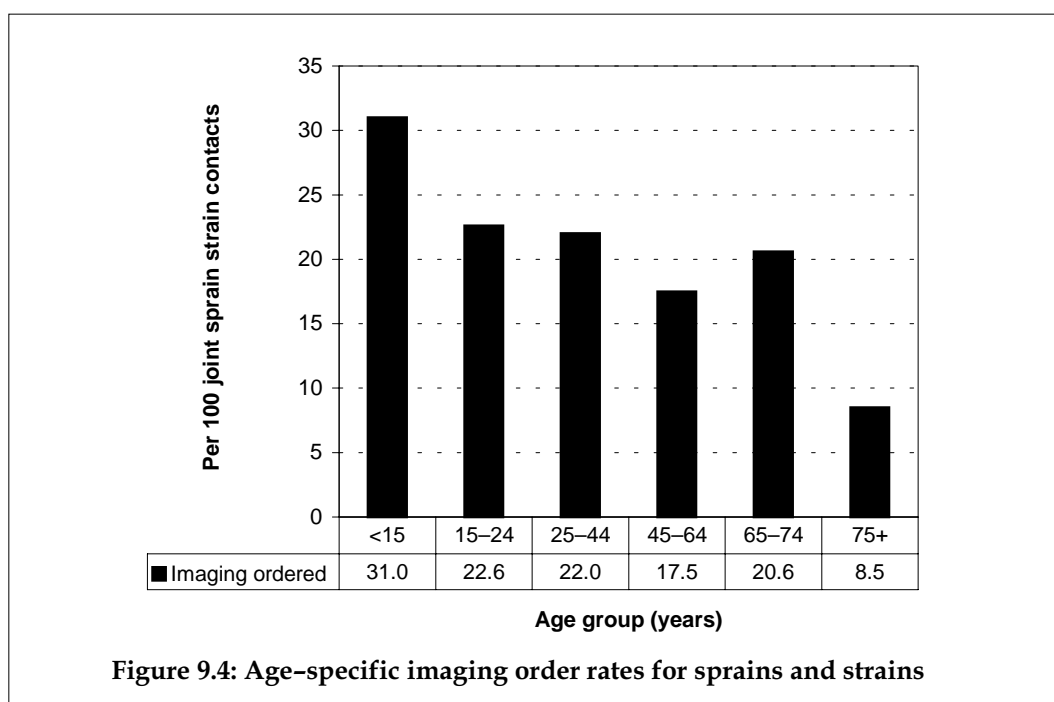
### Age- and sex-specific imaging order rates for joint sprain and strain

At half the encounters involving joint sprains and strains, the patient was male. The likelihood of imaging orders for joint sprain or strain did not differ significantly between the sexes, imaging being ordered at 19.2% of encounters with males and 24.0% of those with females.

The age distribution of the patients at joint sprain and strain encounters is provided in Figure 9.3, which demonstrates that one in three were aged between 25 and 44 years and a further 25% were between 45 and 64 years old. The management of joint sprains and strains was relatively infrequent at encounters with elderly patients and young children.

The age-specific rates of imaging orders are presented graphically in Figure 9.4. The likelihood of having an imaging test ordered for joint sprains and strains was highest for children aged less than 15 years (31.0%) and decreased with age to 8.5% for the elderly. The small sample sizes involved rendered the differences between the age-specific rates not statistically significant.





### Imaging tests ordered for joint sprains and strains by MBS group

By far the majority (87.9%) of the imaging tests ordered for joint sprains and strains fell into the diagnostic radiology MBS group. However, there were 24 ultrasounds ordered for these problems, accounting for almost 10% of imaging orders for these problems (Table 9.4).

**Table 9.4: Distribution of imaging tests ordered for joint sprain and strain by MBS group**

Imaging class	Number of tests	Per cent of tests for joint sprains and strains
Diagnostic radiology	222	87.9
Ultrasound	24	9.6
Computed tomography	5	1.9
Other	2	0.7
<b>Total</b>	<b>253</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

### Imaging test order rates by problem status of joint sprains and strains

New presentations of joints sprains and strains accounted for 45% of all joint sprains and strains managed. As shown in Table 9.5 imaging was ordered for one in four new cases and at one in five follow-up consultations for this problem type.

**Table 9.5: Imaging order rates by problem status of joint strain and sprain**

Problem status	Number of problem contacts <sup>(a)</sup>	Number of imaging tests ordered	Imaging order rate per 100 problems
New joint sprains and strains	503	129	25.6
Old joint sprains and strains	611	124	20.2
<b>Total</b>	<b>1,114</b>	<b>253</b>	<b>22.7</b>

(a) Number of contacts with this problem in the total dataset.

## Most common imaging ordered for joint sprains and strains

The tests most commonly ordered in the management of joint sprains and strains were plain x-rays of specific body parts. X-rays of the ankle were most common, accounting for almost one-third (32.8%) of the imaging orders, followed by those of the knee (10.8%), the wrist (8.5%) and the shoulder (7.7%). Orders for an ultrasound of the shoulder (7.5%) were as frequent as orders for plain x-rays of this site (7.7%) where the problem was described as a joint sprain or strain (Table 9.6).

The tests most often ordered at follow-up encounters for the problem were x-rays of the ankle (37.5%) and of the knee (12.7%), which, together, made up more than half of all tests ordered. Where imaging was ordered for new presentations of a joint sprain or strain the most common was also x-ray of the ankle (28.2%). This was followed by x-ray of the knee (9.1%), the wrist and the shoulder.

**Table 9.6: Most common imaging tests ordered for joint sprain and strain**

Test type ordered	Number of tests	Per cent of tests	Per cent of tests for new sprains/strains (n=129)	Per cent of tests for old sprains/strains (n=124)
X-ray; ankle	83	32.8	28.2	37.5
X-ray; knee	27	10.8	9.1	12.7
X-ray; wrist	22	8.5	10.7	6.3
X-ray; shoulder	20	7.7	10.7	4.7
Ultrasound; shoulder	19	7.5	7.9	7.0
X-ray; foot/feet	16	6.3	8.7	3.8
X-ray; spine; lumbar	14	5.4	5.8	5.0
X-ray; lumbosacral	12	4.7	4.4	5.0
<i>Sub-total</i>	<i>213</i>	<i>84.2</i>	<i>85.5</i>	<i>82.0</i>
<b>Total</b>	<b>253</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

## Rates of testing for selected fractures and sprains/strains

The difference in relative rates of imaging orders for fractures (52.1 orders per 100 contacts, Table 9.2) and for joint sprains and strains (22.7 per 100 contacts, Table 9.5) led to an investigation of the extent to which this difference in ordering rates was apparent in the more frequent specific fractures and sprains/strains. The fractures managed most frequently in general practice are those of the wrist/arm (n=180 contacts in this BEACH data year) and the ankle (n=56).

The parallel frequencies for sprain/strain were 220 contacts with sprain/strain of the ankle and 86 for sprain/strain of the wrist. Sprains and strains of the knee were also relatively common ( $n=65$ ).

GPs ordered imaging at a rate of 44.8 per 100 contacts with fractured ankle and 37.7 per 100 contacts with sprain/strain of the ankle. For fractured wrist, they placed 42.2 orders per 100 contacts but where the problem was labelled as strain/sprain of the wrist the ordering rate was somewhat lower (25.6 per 100 contacts). Sprains and strains of the knee generated a somewhat higher imaging order rate of 41.9 tests per 100 contacts (results not presented).

## Discussion

Problem labels of fracture and sprain/strain are both applied to the results of blunt trauma to joints and may reflect different levels of certainty regarding the diagnosis in patients referred for imaging studies. Overall, 61.5 imaging tests were ordered per 100 new fracture contacts (Table 9.2) but for new problems labelled as sprain/strain, the order rate was 25.6 (Table 9.5). Presumably these tests were ordered to exclude fracture.

In the case of ankle injury, the well-validated Ottawa decision rules for imaging have been adopted by the American College of Radiology as appropriate guidelines for the diagnosis of fracture (Anis et al. 1995; Dalinka et al. 2000; Pigman et al. 1994; Stiell et al. 1992c; Stiell et al. 1992a; Stiell et al. 1992b; Stiell et al. 1993; Stiell et al. 1994; Stiell et al. 1995a; Verbeek et al. 1997). Stiell et al. reported that more than 92% of ankle injuries were x-rayed in an Emergency Department setting. As indicated above, in this study GPs ordered at the rate of 44.8 per 100 problems labelled as fractured ankle and at the rate of 37.7 per 100 problems labelled as sprain/strain. This difference is not statistically significant. Although GPs order x-ray of the ankle at a lower rate than Emergency Department staff, it may still be appropriate to familiarise GPs with the Ottawa guidelines. The RANZCR guidelines do not provide any guidance on the selection of patients for x-ray for suspected fracture of the ankle.

X-ray of the wrist/arm was the most common x-ray for fracture and occurred at 42.2 per 100 contacts with problems labelled as fracture and 25.6 per 100 contacts for sprain/strain. ACR and RANZCR guidelines both suggest plain x-ray as the investigation of choice for fracture to the hand and wrist but make no comment on patient selection except for suspected scaphoid fracture. No literature on guidelines for patient selection for imaging to detect wrist fracture was found.

In a study of knee injuries managed in Emergency Departments in Canada, Stiel et al. found that 74.5% of patients had an x-ray and 5.2% had fractures. Knee x-rays have the lowest yield for diagnosing clinical significant fractures (Stiell et al. 1995c). The ACR Appropriateness Criteria for acute trauma to the knee synthesises the research of several developers of decision rules for knee imaging including Stiell, Seberg and Bauer (Bauer et al. 1995; Nichol et al. 1999; Seaberg et al. 1998; Seaberg & Jackson 1994; Stiell et al. 1995b; Stiell et al. 1996; Stiell et al. 1997). If the criteria were applied in the Australian context they have the potential to significantly reduce the need for knee radiology without losing sensitivity of fracture detection. The current level of 41.9 knee x-rays per 100 problem contacts for sprain/strain of knee, while well below North American Emergency Department levels, could probably be significantly reduced.

### 9.3 Back pain

This group contains the following ICPC-2 codes and rubrics:

- L02 – Back symptom complaint (*n*=1,029)
- L03 – Low back symptom/ complaint (*n*=804)

and the following ICPC-2 PLUS codes and rubrics:

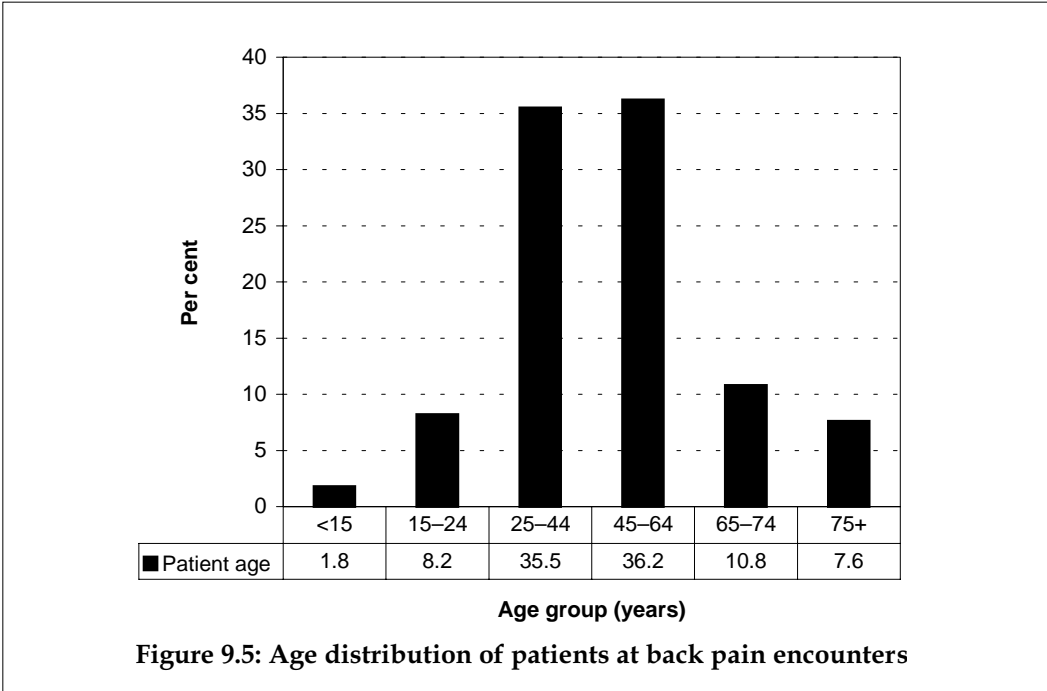
- L84020 – Strain; back (*n*=252)
- L84021 – Sprain; back (*n*=49)
- L86002 – Lesion; intervertebral disc; lumbosacral (*n*=24)
- L86003 – Neuritis; lumbosacral (*n*=2)
- L86009 – Sciatica (*n*=336)
- L86036 – Backpain; radiating; lumbosacral (*n*=7).

There were 2,502 GP contacts with back pain and 379 of these (15.2%) generated an order for imaging. In total 433 imaging test orders were placed. For every 100 contacts with back pain, GPs ordered 17.3 tests, and when they did order there were 114 tests per 100 contacts (Table 7.5).

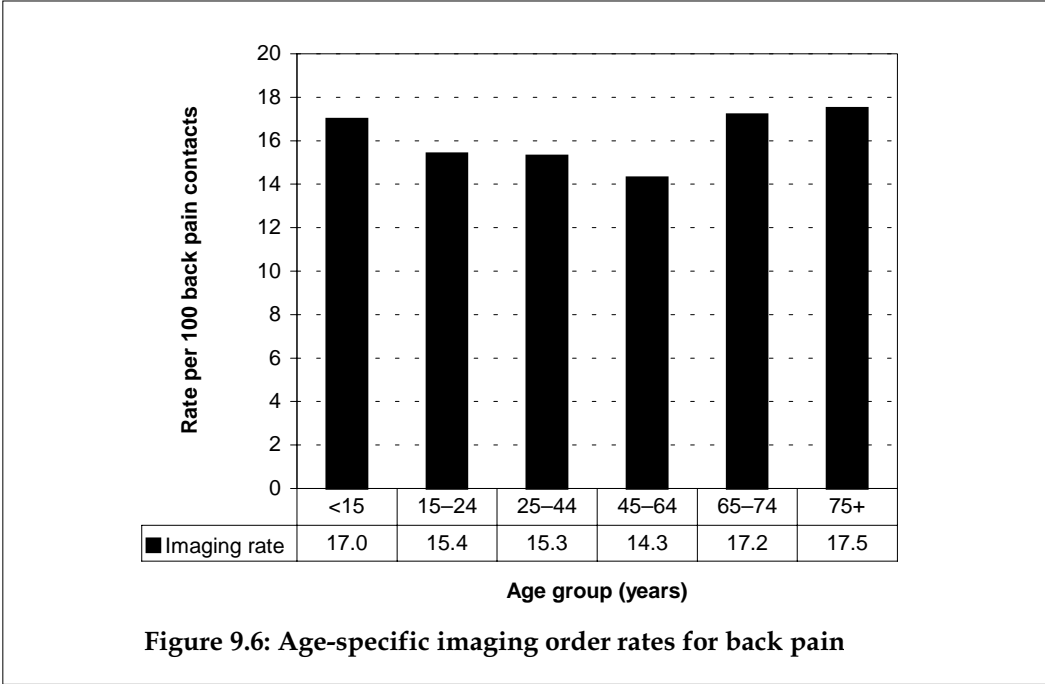
#### Age- and sex-specific imaging order rates for back pain

Half the back pain contacts were with male patients. There was no significant difference in the relative frequency of imaging orders for back pain by patient sex, tests being ordered at a rate of 15.9 per 100 male back pain contacts and 14.7 per 100 female back pain contacts.

By far the majority of patients for whom back pain was managed were aged between 25 and 64 years, with 18.4% being 65 years or more and 10.0% aged less than 25 years (Figure 9.5).



The age-specific rate of imaging orders is presented graphically in Figure 9.6. It demonstrates little variance in imaging order rates across age groups. The lowest ordering rate was 14.3 orders per 100 back pain contacts with patients aged 45–64 years, and the highest, 17.5 per 100 back pain contacts with patients aged 75 years or more.



### Imaging tests ordered for back pain by MBS groups

Almost three-quarters (73.8%) of all imaging tests ordered for back pain were classified as diagnostic radiology and most of the remainder (21.4%) were classed as computed tomography. Ultrasounds were rarely ordered (3.7%), as were magnetic resonance imaging tests (1.1%) (Table 9.7).

**Table 9.7: Distribution of imaging tests for back pain by MBS groups**

Imaging class	Number of tests	Per cent of tests for back pain
Diagnostic radiology	319	73.8
Computed tomography	92	21.4
Ultrasound	16	3.7
Magnetic resonance imaging	5	1.1
<b>Total</b>	<b>433</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

### Imaging test order rates by problem status of back pain

Almost three-quarters of the GP contacts with back pain were follow-up consultations. However, the relative rate of imaging orders for this problem was greater at first presentations of back pain (28.7% of contacts generating an order) than at follow-up consultations (13.3%) (Table 9.8).

**Table 9.8: Imaging order rates by status of back pain problem**

Problem status	Number of problem contacts <sup>(a)</sup>	Per cent	Number of imaging tests ordered	Imaging order rate per 100 problems
New back pain problems	656	26.2	188	28.7
Old back pain problems	1,846	73.8	245	13.2
<b>Total</b>	<b>2,502</b>	<b>100.0</b>	<b>433</b>	<b>17.3</b>

(a) The number of contacts with this problem in the total dataset.

## Most common imaging tests ordered for back pain

The imaging tests most frequently ordered for back pain are listed in Table 9.9, which also presents the distribution of tests ordered for new and old back pain problems. Lumbosacral x-rays were the preferred option, accounting for 28.6% of all imaging ordered for back pain. X-rays of the lumbar spine accounted for a further 15.0% of all imaging ordered, and spinal x-rays another 8.0%. The most common types of CT scans were those of the lumbosacral spine (9.6%) and the lumbar spine (5.4%). The major difference in the distribution of test types for new and old problems was that lumbosacral x-rays were the more popular choice for new presentations (37.4%) than for old problems (21.9%).

**Table 9.9: Most frequent imaging tests ordered for back pain**

Test type ordered	Number of tests	Per cent of tests for back pain	Per cent of tests for new back pain (n=188)	Per cent of tests for old back pain (n=245)
X-ray; lumbosacral	124	28.6	37.4	21.9
X-ray; spine; lumbar	65	15.0	16.6	13.8
CT scan; spine; lumbosacral	42	9.6	9.9	9.3
X-ray; spinal	35	8.0	5.7	9.8
CT scan; spine; lumbar	23	5.4	4.9	5.8
X-ray; thoracic	16	3.7	2.7	4.5
X-ray; back	15	3.6	3.4	3.7
CT scan; spine	12	2.8	2.4	3.1
X-ray; back lower	10	2.2	0.9	3.2
<i>Sub-total</i>	342	79.2	83.9	75.1
<b>Total</b>	<b>432</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

## Discussion

A comprehensive analysis of the scientific literature regarding low back pain by the Quebec Task Force on Spinal Disorders in 1987 revealed that, on the evidence, spinal x-ray was contraindicated within seven days of onset of uncomplicated back pain with or without radiation. There was no scientific evidence to support the use of x-ray short of seven weeks from onset and even then the return was poor (Quebec Task Force on Spinal Disorders 1987). Subsequently developed guidelines all support the proposition that uncomplicated low back pain without 'red flags' (such as > 70 years old, osteoporosis, weight loss, malignancy, fever, IV drug use or immunosuppression) will settle within 6–12 weeks in 90% of cases without investigation and with little more than supportive therapy (Agency for Health Care Policy and Research 1994; Anderson et al. 2000; RANZCR 2001).

In this study, GPs ordered spinal imaging at the rate of 28.7 per 100 new back pain problems seen and 13.2 per 100 old back problems. While some of the patients with new back problems may have had symptoms for some time before presentation, these data suggest that an appropriate intervention could reduce the spine x-ray rate without decreasing the quality of patient care.

There is evidence in the literature that the supply of guidelines, when combined with feedback to the clinician, can reduce spinal x-ray use by GPs (Kerry et al. 2000; Oakeshott et al. 1994). However, a Canadian study found that some guidelines had the potential to increase usage if they were not sufficiently rigorous (Suarez-Almazor et al. 1997).

Wilson et al. studied the effect of patient factors on the use of radiology in rural practice in the United States and found a significant correlation between patient preference and ordering. They suggest that these patient factors need to be addressed in any strategy to reduce ordering of spinal x-rays (Wilson et al. 2001).

## 9.4 Osteoarthritis

This group includes the following ICD-10 codes and rubrics:

- L83011 – Osteoarthritis; spine; cervical ( $n=48$ )
- L84009 – Osteoarthritis; spine; thoracic ( $n=7$ )
- L84010 – Osteoarthritis spine; lumbar ( $n=74$ )
- L84011 – Osteoarthritis; lumbosacral ( $n=31$ )
- L84012 – Osteoarthritis; sacroiliac ( $n=1$ )
- L89001 – Osteoarthritis; hip ( $n=186$ )
- L90001 – Osteoarthritis; knee ( $n=527$ )
- L91001 – Osteoarthritis; degenerative ( $n=6$ )
- L91003 – Osteoarthritis ( $n=1,270$ )
- L92007 – Osteoarthritis; shoulder ( $n=59$ ).

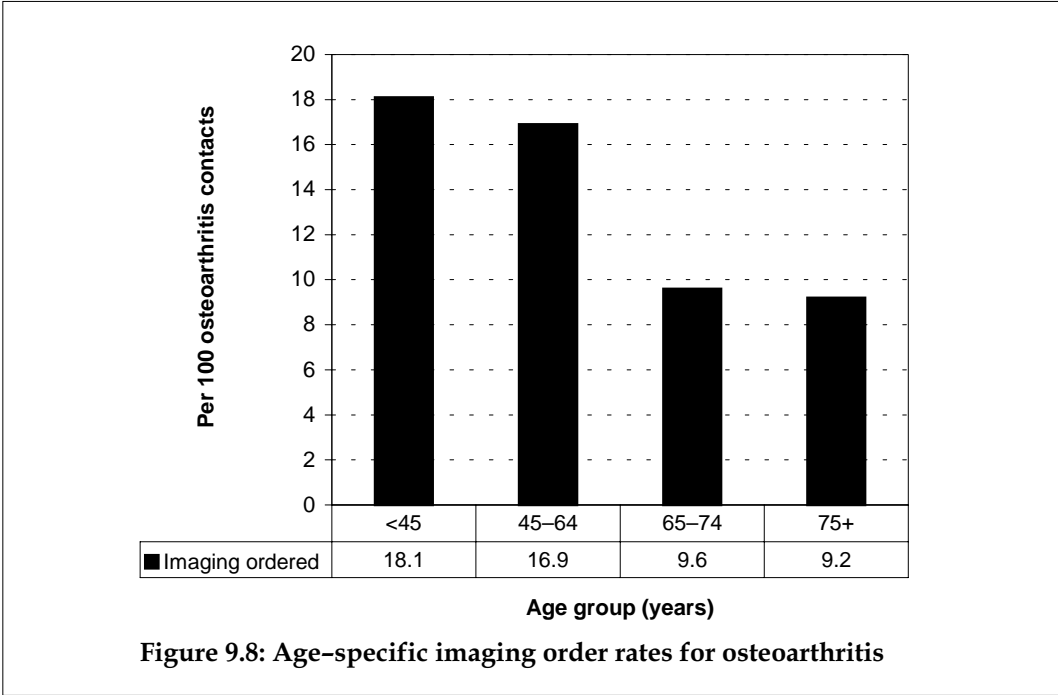
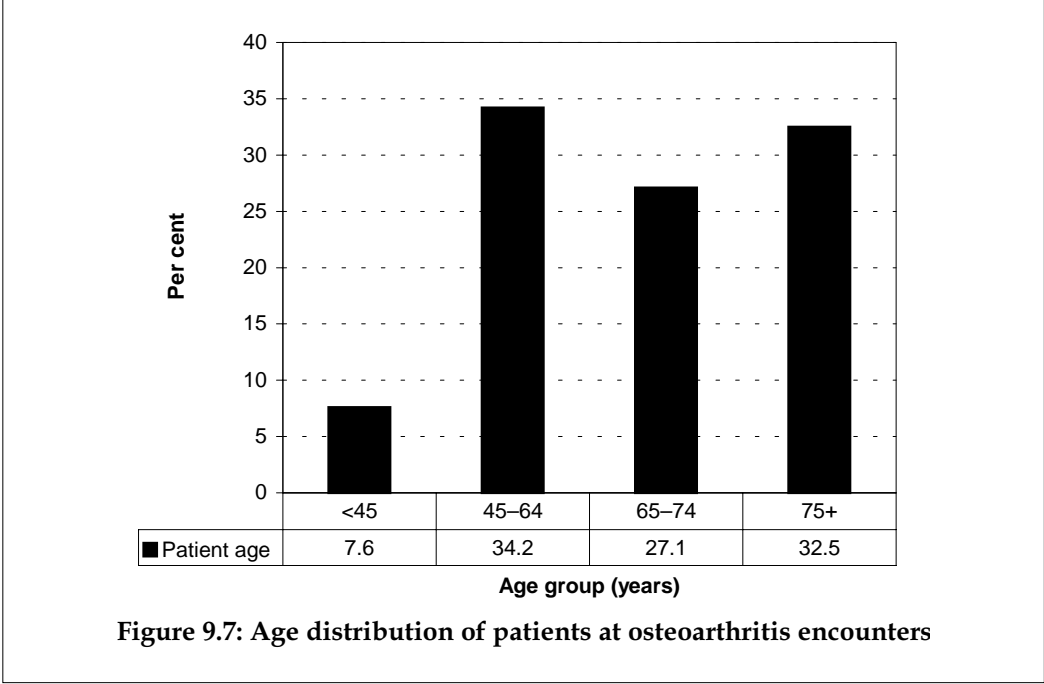
There were 2,346 cases of osteoarthritis managed at 2,332 encounters. For 296 osteoarthritis contacts (12.6%), at least one imaging test was ordered. In total, 326 tests were ordered and these accounted for 4.1% of total imaging. These orders were placed at a rate of 110 per 100 tested cases of osteoarthritis or 10 per 100 contacts with osteoarthritis (Table 7.5).

### Age- and sex-specific imaging order rates for osteoarthritis

Women accounted for the majority (59.0%) of osteoarthritis contacts. However, the likelihood of an imaging order being placed in the management of osteoarthritis was almost identical for men (13.0%) and women (12.5%).

The age distribution of the patients at osteoarthritis encounters is provided in Figure 9.7. Elderly patients (65 years and over) accounted for 59.6% of the GP contacts with osteoarthritis and those aged less than 45 years, 7.9% of contacts.

The age-specific rates of imaging orders are presented graphically in Figure 9.8. The likelihood of having an imaging test ordered at an osteoarthritis, contact was highest at 18.1% for patients aged less than 45 years and then decreased with patient age group to 9.2 per 100 osteoarthritis contacts in patients aged 75 years or more. However, the small sample sizes rendered the differences between the age-specific rates not statistically significant.



## Imaging tests ordered for osteoarthritis by MBS group

Diagnostic radiology accounted for almost all the imaging tests ordered by the GPs for osteoarthritis. There were only nine ultrasounds ordered (2.7%) (Table 9.10).

**Table 9.10: Distribution of imaging tests ordered for osteoarthritis by MBS group**

Imaging class	Number of tests	Per cent of tests for osteoarthritis
Diagnostic radiology	312	95.7
Ultrasound	9	2.7
Computed tomography	4	1.2
Magnetic resonance imaging	1	0.4
<b>Total</b>	<b>326</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

## Imaging test order rates by problem status of osteoarthritis

Table 9.11 demonstrates that the vast majority of contacts with osteoarthritis were follow-up consultations (84.3%), reflecting the ongoing nature of its management in general practice. However, the relative rate of imaging test orders was three times higher at new contacts with osteoarthritis (33.4 tests per 100 contacts) than at follow-up consultations (10.3 per 100). However, the distribution of test types for new and old cases of osteoarthritis was very similar (Table 9.12).

**Table 9.11: Imaging order rates by status of osteoarthritis**

Problem status	Number of problem contacts <sup>(a)</sup>	Per cent	Number of imaging tests ordered	Imaging order rate per 100 problems
New osteoarthritis problems	369	15.7	123	33.4
Old osteoarthritis problems	1,977	84.3	203	10.3
<b>Total</b>	<b>2,346</b>	<b>100.0</b>	<b>326</b>	<b>13.9</b>

(a) Number of contacts with this problem in the total dataset.

## Most common imaging tests ordered for osteoarthritis

The tests most commonly ordered in the management of osteoarthritis were plain x-rays of specific body parts. X-rays of the knee were most common, accounting for almost one-third (32.5%) of the imaging orders, followed by those of the hip (13.7%) and the lumbosacral region (7.7%). Each of the remaining test types ordered for osteoarthritis accounted for less than 5% of the total tests ordered (Table 9.12). The shoulder was the most likely site for an order for an ultrasound, accounting for 1.1% of all tests for osteoarthritis.

**Table 9.12: Most common imaging tests ordered for osteoarthritis**

Test type ordered	Number of tests	Per cent of tests for osteoarthritis	Per cent of imaging tests ordered for new osteoarthritis	Per cent of imaging tests ordered for old osteoarthritis
X-ray; knee	106	32.5	34.1	31.5
X-ray; hip	45	13.7	15.3	12.8
X-ray; lumbosacral	25	7.7	4.2	9.8
X-ray; hand	16	4.9	6.2	4.1
X-ray; spine; lumbar	15	4.7	6.8	3.4
X-ray; shoulder	14	4.3	5.9	3.4
X-ray; foot/feet	13	4.1	7.9	1.8
X-ray; neck	12	3.6	3.9	3.3
X-ray; ankle	11	3.5	0.2	5.5
X-ray; cervical	10	3.2	1.5	4.2
X-ray; spinal	8	2.3	2.0	2.5
<i>Sub-total</i>	<i>275</i>	<i>84.4</i>	<i>88.0</i>	<i>82.3</i>
<b>Total</b>	<b>326</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note:* Columns may not add to column total due to rounding.

## Discussion

Osteoarthritis is a common disease in Australia and costs between 1–2.5% of gross national product (March & Bachmeier 1997). Osteoarthritis is the third most common problem for which imaging is ordered by GPs although the frequency of ordering per 100 problems is relatively low at 13.9 per 100 problem encounters. While diagnostic guidelines exist for painful hips and knees, there are few reports of research into the use of radiology to measure progress and outcomes of this condition. There is a perceived need for randomised controlled trials of osteoarthritis imaging in general practice to better assess therapeutic effect of interventions and outcomes in this common condition (Balint et al. 1998).

Osteoarthritis is a very heterogeneous condition and therefore the development of guidelines is a complex process. There is also evidence in the literature of variance in the management of osteoarthritis by GPs (Bierma-Zeinstra et al. 2000; Saag 1997). American College of Rheumatology guidelines for the assessment of patients with musculoskeletal pain indicate that plain x-ray of the affected joint may reveal evidence of osteoarthritis; however, they may be negative in the presence of disease (American College of Rheumatology Ad Hoc Committee on Clinical Guidelines 1996). Considerable research has been undertaken to develop more accurate quantitative assessment of joint changes in osteoarthritis, particularly in relation to assessment of the benefit of non-steroid anti-inflammatory drugs in clinical trials (Bellamy 1995; Bellamy 1999; Dougados 1995; Hart & Spector 1995; Hochberg 1996; Ravaud 1996; Vignon et al. 1999; Watt 2000). These latter guidelines do not assist the decision process of GPs monitoring the progress or control of patients in the practice setting as access to these very specialised research techniques is very limited.

## 9.5 Abdominal pain

Abdominal pain is the twelfth most common patient reasons for encounter in general practice. Many of these presentations result in a defined diagnostic label but many also remain ill-defined at the end of the consultation. As a result, it was decided that the investigation of imaging associated with abdominal pain should centre both on those encounters at which it was presented as a reason for encounter and those at which the problem was labelled by the GP in this manner.

### Abdominal pain as a patient reason for encounter

A reason for encounter (RFE) was classified as 'abdominal pain' if the patient described his or her reason for the encounter in terms of any of the labels classified under the ICPC-2 rubric D01 (Pain/cramps, abdominal general) or D06 (Pain, abdominal localised, other). In ICPC-2 PLUS these rubrics include a number of more specific symptom and complaint codes such as 'cramps; abdominal' and 'intestinal colic'. As multiple ICPC-2 PLUS codes fall into the general abdominal pain group, in cases where a patient used more than one of these terms at an encounter, the RFE would have been counted twice.

Abdominal pain was described on 2,172 occasions, represented 1.4% of all RFEs and occurred at a rate of 2.1 per 100 encounters. Encounters involving at least one RFE of this type numbered 2,168 (2.1% of all encounters).

Figure 9.9 illustrates the relationship of an RFE of abdominal pain with other information collected at that general practice encounter. The RFE of abdominal pain can be directly linked to patient characteristics such as age and sex (solid arrows). However, RFEs can only be indirectly linked (dotted arrows) to the problems and their management, including the imaging tests ordered at these encounters.

### Age and sex distribution of patients presenting with an RFE of abdominal pain

Over two-thirds of these 2,168 encounters were with female patients. Patients presenting with abdominal pain tended to be somewhat younger than the total sample. Only 16% of these patients were aged 65 years and over (compared with about 24% of patients at all encounters).

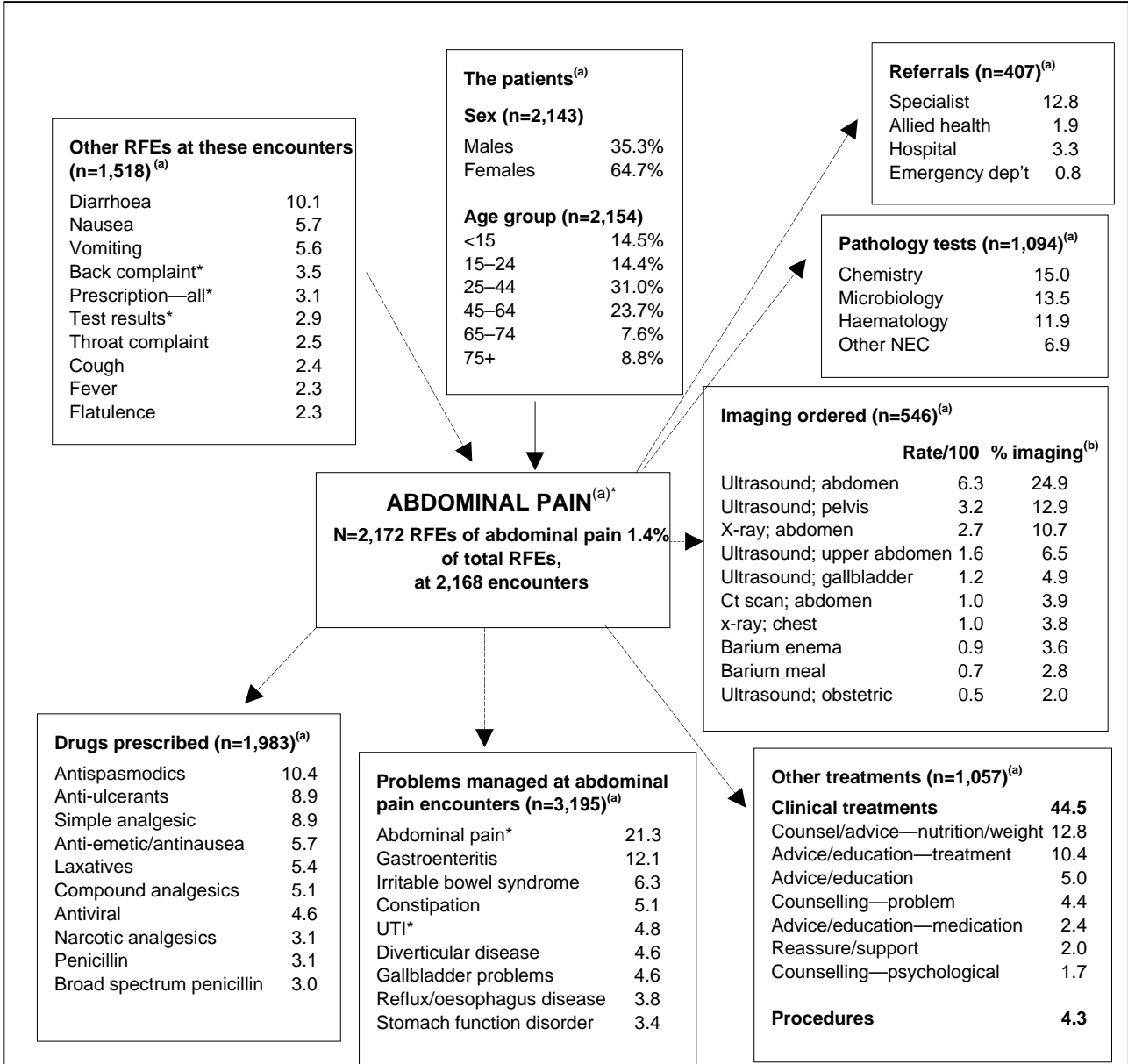
### Other reasons for encounter

A total of 1,518 other RFEs were described at these encounters. At one in 10 diarrhoea was concurrently described with the abdominal pain, while some patients described nausea (5.7 per 100 abdominal pain encounters) and/or vomiting (5.6 per 100). Other symptoms described included throat complaints, cough, fever and flatulence. Requests for a prescription and for test results were also relatively common (Figure 9.9).

### Problems managed

Multiple problems could be managed at an encounter, some of which may have been unrelated to the RFE of abdominal pain. However, while there is not a direct link between a single RFE and a single diagnosis, certain diagnostic groups stand out at these encounters and a relationship between the demand for care and the diagnostic label can be generally assumed (Britt 1994).

There were 3,195 problems managed at these encounters and the most common were described in the same symptomatic terms. That is, at 461 encounter (21.3%) no further definition of the underlying problem could yet be determined. Problems with more specific labels included gastroenteritis (12.1 per 100 encounters), irritable bowel syndrome (6.3) and constipation (5.1).



**Figure 9.9: Inter-relationship of RFEs of abdominal pain with other variables**

(a) Expressed as rates per 100 encounters at which abdominal pain was given as an RFE (N=2,168).  
 (b) The percentage of total imaging tests ordered at encounters which included an RFE of abdominal pain.  
 \* Includes multiple ICPC-2 or ICPC-2 PLUS codes (see Appendix 3).  
 Note: UTI—urinary tract infection, NEC—not elsewhere classified, US—ultrasound, CT—computed tomography.

## **Prescriptions, other treatments and referrals**

Medications were prescribed at these encounters at a rate of 91.5 per 100 encounters, a similar rate to the average for all encounters (93.8 per 100). Clinical treatments were recorded at a rate of 44.5 per 100 encounters, a higher rate than in the total dataset (33.5 per 100). Procedures were rarely undertaken. Referrals (18.8 per 100 abdominal pain encounters) were made at almost double the overall average rate (7.3 per 100 encounters) and over two-thirds of these were to specialists.

## **Pathology tests ordered**

Encounters involving an RFE of abdominal pain generated relatively high pathology test ordering rates. There were 1,094 pathology test orders (or groups of tests such as FBC) at these encounters, a rate of 50.5 per 100 encounters. This compares with an overall rate of 26.3 orders per 100 encounters.

## **Most frequent imaging tests ordered at encounters involving an RFE of abdominal pain**

Orders for imaging were made at a rate of 25.2 per 100 encounters (compared with the overall rate of 7.5 per 100). There were 57 different imaging test types ordered and some would be associated with co-morbidity presented rather than to a problem associated with the presenting abdominal pain. The inclusion of chest x-rays in the top 10 imaging test types is likely to be a result of the high rate of chest x-rays in the total sample rather than a result of the presenting abdominal pain. The 10 imaging tests most frequently ordered at encounters involving an RFE of abdominal pain are presented in Figure 9.9. Together they made up 76.0% of all imaging ordered at these encounters. Abdominal ultrasounds were most often ordered and these accounted for one-quarter of all imaging at these encounters. They were followed by pelvic ultrasounds (12.9%) and abdominal x-rays (10.7%) and ultrasounds of the upper abdomen (6.5%).

## **Abdominal pain as a problem under management**

This problem group includes the following ICPC-2 rubrics

- D01 – Abdominal pain/cramps, general ( $n=509$ )
- D06 – Abdominal pain, localised NEC ( $n=111$ ).

There were 620 encounters at which abdominal pain was recorded as the problem under management (0.6 cases per 100 encounters). From the RFE data described above, it can be deduced that at 461 of these (74.4%) the patient described the abdominal pain as one of the reasons for attending the GP. At the remaining 159 they did not.

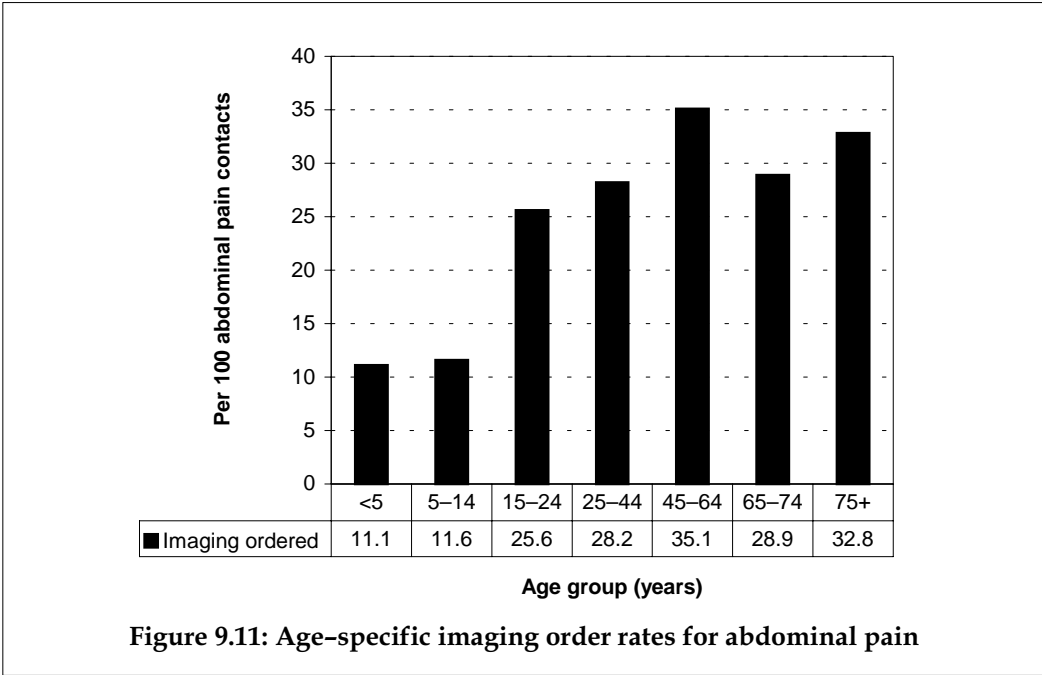
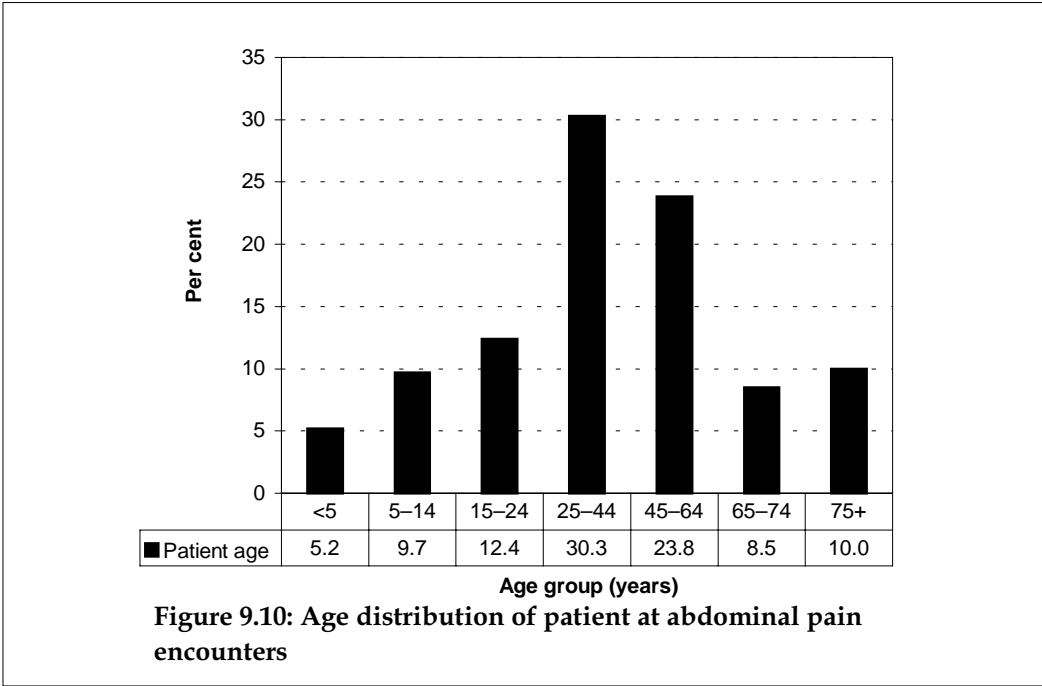
At least one imaging test was ordered for 172 of these cases (27.7%). A total of 192 separate tests were ordered at a rate of 116 per 100 tested abdominal pain contacts and an overall rate of 31.0 tests per 100 contacts with the problem abdominal pain (Table 7.5).

## **Age- and sex-specific imaging order rates for abdominal pain**

Female patients made up 65.1% of those for whom abdominal pain was managed. There was no significant difference in the relative rate of imaging orders for males (28.2 per 100 contacts) and females (27.7 per 100).

Thirty per cent of the patients at abdominal pain encounters were aged between 25 and 44 years. A further 23.8% were 45–64 years old (Figure 9.10). However, the extent to which GPs ordered imaging tests for this problem was heavily influenced by the age of the patient.

Figure 9.11 demonstrates a steady increase in age-specific imaging order rates from 11 tests per 100 abdominal pain contacts with children to a peak of 35 tests per 100 contacts with patients of 45–64 years. There was a slight decrease in ordering rates for older patients.



## Imaging tests ordered for the problem abdominal pain by MBS group

The test types ordered for the problem of abdominal pain differed markedly from the pattern in earlier subjects of interest. Ultrasounds accounted for over two-thirds (67.5%) of all imaging ordered for this problem, followed by diagnostic radiology which accounted for a further 25.1% of all imaging ordered (Table 9.13).

**Table 9.13: Distribution of imaging tests ordered for abdominal pain by MBS group**

Imaging class	Number of tests	Per cent of tests for abdominal pain
Diagnostic radiology	48	25.1
Ultrasound	129	67.5
Computed tomography	13	7.0
Other	1	0.5
<b>Total</b>	<b>192</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

## Imaging order rates by problem status of abdominal pain

More than half (57.3%) of these abdominal pain contacts were follow-up encounters and 42.7% were new presentations. The test ordering rate was somewhat higher for new presentations (39.1 tests per 100 contacts) than at follow-ups (24.7 per 100) (Table 9.14). The distribution of test types ordered for abdominal pain was similar for new and old problems though there was a trend for increased use of ultrasounds and decreased use of plain x-rays at follow-up consultations when compared with first presentations (Table 9.15).

**Table 9.14: Imaging order rates by status of abdominal pain**

Problem status	Number of problem contacts <sup>(a)</sup>	Per cent of total problems	Number of imaging tests ordered	Imaging order rate per 100 problems
New abdominal pain* problems	265	42.7	104	39.1
Old abdominal pain* problems	355	57.3	88	24.7
<b>Total</b>	<b>620</b>	<b>100.0</b>	<b>192</b>	<b>31.0</b>

(a) The number of contacts with this problem in the total dataset.

\* Includes multiple ICPC-2 and/or ICPC-2 PLUS codes (see Appendix 4).

## Most common imaging tests ordered for abdominal pain

Ultrasound of the abdomen was the test most often ordered for abdominal pain, accounting for 36.0% of all tests. These could be considered in combination with orders for ultrasounds of the upper abdomen (8.0%) and, together, these two test types accounted for half of all tests ordered. This was followed by pelvic ultrasounds (13.2%) and plain abdominal x-rays (10.1%). Abdominal CT scan was the single test that accounted for almost all CT scans ordered for this problem.

**Table 9.15: Most common imaging tests ordered for abdominal pain**

Test type ordered	Number of tests	Per cent of tests for abdominal pain	Per cent of tests for new abdominal pain ( <i>n</i> =104)	Per cent of tests for old abdominal pain ( <i>n</i> =88)
Ultrasound; abdomen	69	36.0	33.9	38.6
Ultrasound; pelvis	25	13.2	11.0	15.8
X-ray; abdomen	19	10.1	12.3	7.6
Ultrasound; abdomen; upper	15	8.0	6.3	10.0
CT scan abdomen	12	6.5	4.3	9.0
Barium enema	8	4.1	4.6	3.4
Barium meal	5	2.6	1.9	3.5
<i>Sub-total</i>	<i>153</i>	<i>79.7</i>	<i>86.8</i>	<i>92.3</i>
<b>Total</b>	<b>192</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

## Discussion

Both the RANZCR and the ACR guidelines advocate the use of ultrasound in elucidating the diagnosis in right upper and lower abdominal pain. Additional imaging is indicated when a negative examination is accompanied by high clinical suspicion. The common cause in left lower abdominal pain in older patients is diverticulitis and CT is the most discriminating investigation. In women of child-bearing age, gynaecological causes are the most common cause of left lower abdominal pain and ultrasound is the investigation of choice (Balfe et al. 2000; Bree et al. 2000; Ralls et al. 2000; RANZCR 2001).

The limited literature on ultrasound orders for abdominal pain by GPs indicates reasonable discrimination in ordering and high appreciation of the value of the test in patient management (Charlesworth & Sampson 1994; Geitung et al. 1998).

The results of this study indicate that an appropriate range of modalities appear to be used by Australian GPs.

## 9.6 Breast lump

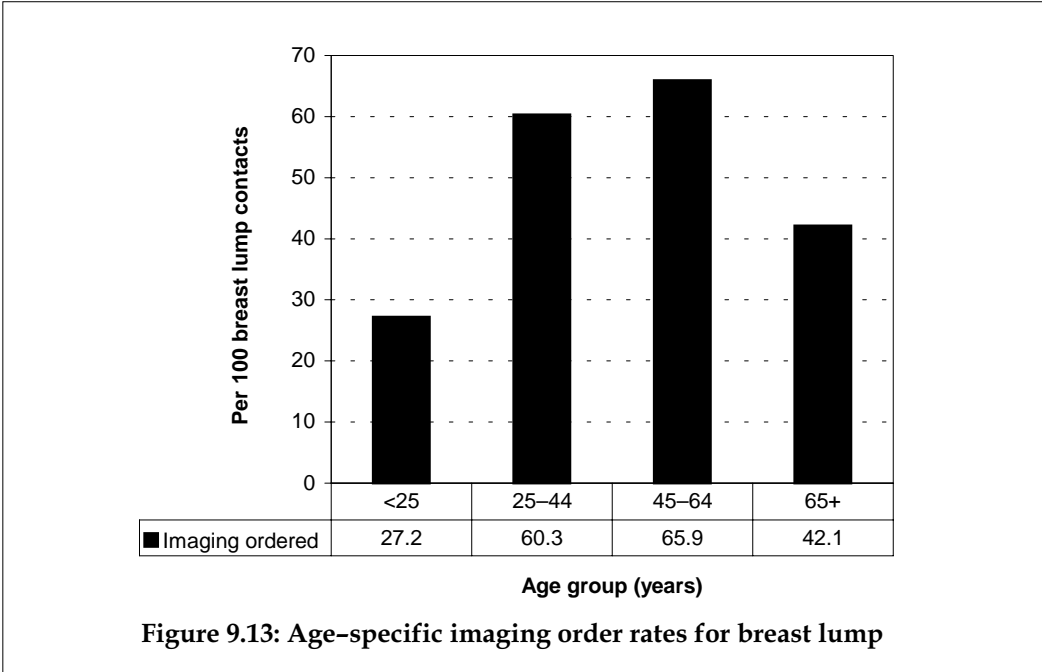
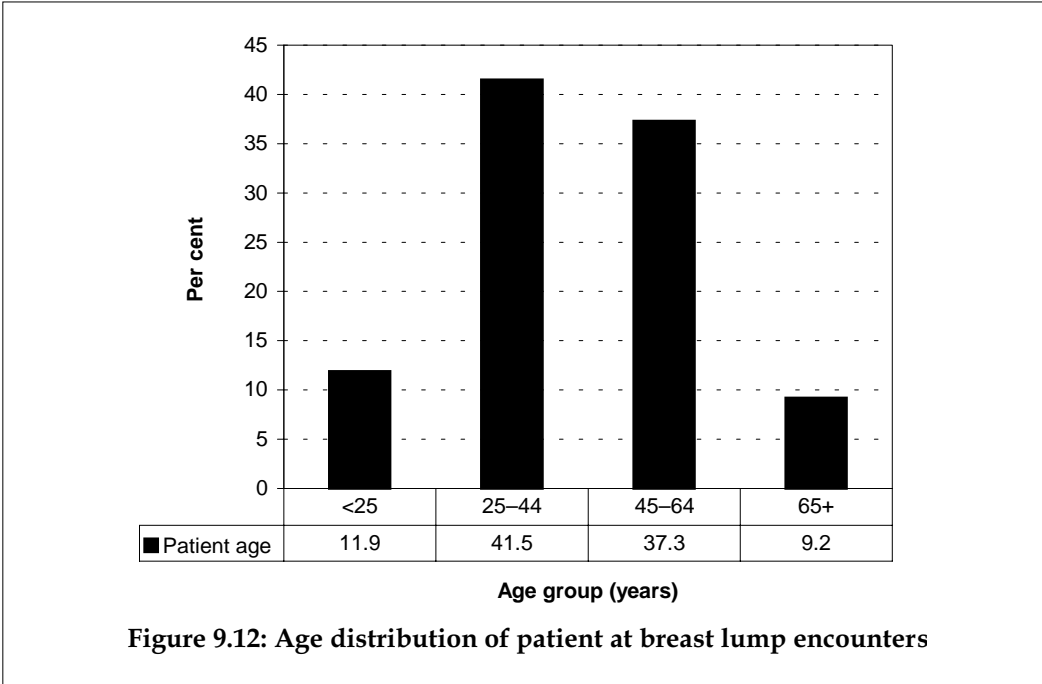
The problem breast lump includes the following ICPC-2 and ICPC-2 PLUS codes and rubrics:

- X19 – Breast lump/mass (*n*=178)
- Y16001 – Mass; breast; male (*n*=12)
- Y16009 – Gynaecomastia (*n*=17).

There were 207 contacts for breast lump and, for the majority of these contacts (85.9%), the patient was female. Females managed for a breast lump were far more likely to have imaging ordered (63.3% of breast lump contacts) than males (16.5%). More than half (56.8%) of all contacts with breast lump generated at least one imaging test order. There were a total of 163 tests ordered at a rate of 139 per 100 tested breast lump contacts (data not presented).

### Age- and sex-specific imaging order rates for breast lumps

The patient was male at 2.4% of the breast lump contacts. Patients at encounters at which breast lump was managed were most often aged between 25 and 44 years (41.5%) or between 45 and 64 years (37.3%). Only about one in 10 of these patients was less than 25 years old, or over 64 years old (Figure 9.12). As shown in Figure 9.13, the relative rate of tests ordered for breast lump was highest for patients in the middle ages (60.3 to 65.9 per 100 contacts) and far lower for younger patients (27.2 per 100).



## Imaging tests ordered for breast lump

Approximately half the imaging tests ordered for breast lump were mammographies (51.4%) and half were ultrasound (48.6%) (Table 9.16).

As shown in Table 9.17, contacts with breast lumps were more commonly follow-up consultations ( $n=112$ , 54.1%). The imaging order rate was very high for all breast lump contacts (78.7 per 100 problem contacts) but particularly high at new presentations of this problem (92.6 per 100). The status of the problem had little influence on the choice of imaging test to be done although there was a trend for GPs to select mammography in the first instance (54.9% of tests for new presentations) and to select ultrasound (52.8% of tests ordered) at follow-up.

**Table 9.16: Distribution of imaging tests ordered for breast lump**

MBS Imaging class	Most common test type	Number of tests	Per cent of tests for breast lump
Diagnostic radiology:	Mammography	84	51.4
Ultrasound:	Ultrasound breast	79	48.6
<b>Total</b>		<b>163</b>	<b>100.0</b>

**Table 9.17: Imaging order rates and type by problem status**

Problem status	Number of problems	Number of tests	Imaging order rate	Mammographies per 100 contacts ( $n=84$ )	Breast ultrasounds per 100 contacts ( $n=79$ )
New cases of breast lump	95	88	92.6	50.5	36.8
Old cases of breast lump	112	75	66.5	35.7	35.7
<b>Total</b>	<b>207</b>	<b>163</b>	<b>78.7</b>	<b>92.6</b>	<b>70.0</b>

**Table 9.18: Breast imaging for breast lump by problem status**

Problem status	New problems ( $n=64$ )		Old problems (follow-up) ( $n=53$ )		Total problems	
	Number	Per cent of new problems	Number	Per cent of old problems	Number	Per cent
No imaging	31	32.6	59	52.6	90	43.5
Mammography only	24	25.3	14	12.5	38	18.4
Ultrasound only	16	16.8	17	15.2	33	15.9
Both mammography and ultrasound	24	25.3	22	19.6	46	22.2
<b>Total (row per cent)</b>	<b>95</b>	<b>45.9</b>	<b>112</b>	<b>54.1</b>	<b>207</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

However, Table 9.18 demonstrates that at almost one in four contacts with breast lumps the GP chose to order both a mammography and an ultrasound. At one in five, the mammography was ordered alone and in the remaining 15.9% the patient was sent for an ultrasound but not for a mammography. There was a very slight trend for GPs to rely only on mammography in new cases of breast lump and to order both tests at follow-up consultations for an old breast lump problem when deciding to test at follow-up.

## Discussion

Overall imaging of the breast is discussed in detail in Section 8.2.

The imaging guidelines for the management of breast masses by both the American College of Radiology and the Royal Australian New Zealand College of Radiologists recommend the use of x-ray mammography for the primary diagnosis of breast masses and the use of ultrasound to differentiate between cysts and solid masses and to further define the nature of the mass (D'Orsi et al. 2000; Evans, III et al. 2000; RANZCR 2001).

In approximately 40% of problem contacts with breast lump both x-ray and ultrasound were ordered. There is a trend for this combination to be used more frequently in the assessment of previously managed breast lumps.

Assessment of breast lumps by Australian general practitioners appears consistent with these guidelines.

## 9.7 Shoulder syndrome

Shoulder syndrome includes most of the ICPC-2 PLUS terms classified in the ICPC-2 rubric L92 – shoulder syndrome, with the exception of arthritis and osteoarthritis of the shoulder, which have been included in other groupings. The following ICPC-2 PLUS codes and terms therefore make up the shoulder syndrome group:

- L92001 – Bursitis; shoulder ( $n=23$ )
- L92002 – Fibrositis; shoulder ( $n=1$ )
- L92003 – Rotator cuff syndrome ( $n=157$ )
- L92004 – Shoulder syndrome ( $n=26$ )
- L92005 – Synovitis; shoulder ( $n=1$ )
- L92008 – Capsulitis; adhesive ( $n=10$ )
- L92009 – Capsulitis; shoulder ( $n=41$ )
- L92010 – Frozen shoulder ( $n=42$ )
- L92011 – Humeroscapular peri-arthritis ( $n=1$ )
- L92012 – Rheumatism; shoulder ( $n=2$ )
- L92013 – Tendonitis; shoulder ( $n=104$ )
- L92014 – Epicondylitis; shoulder ( $n=10$ )
- L92016 – Tendonitis; supraspinatus ( $n=86$ ).

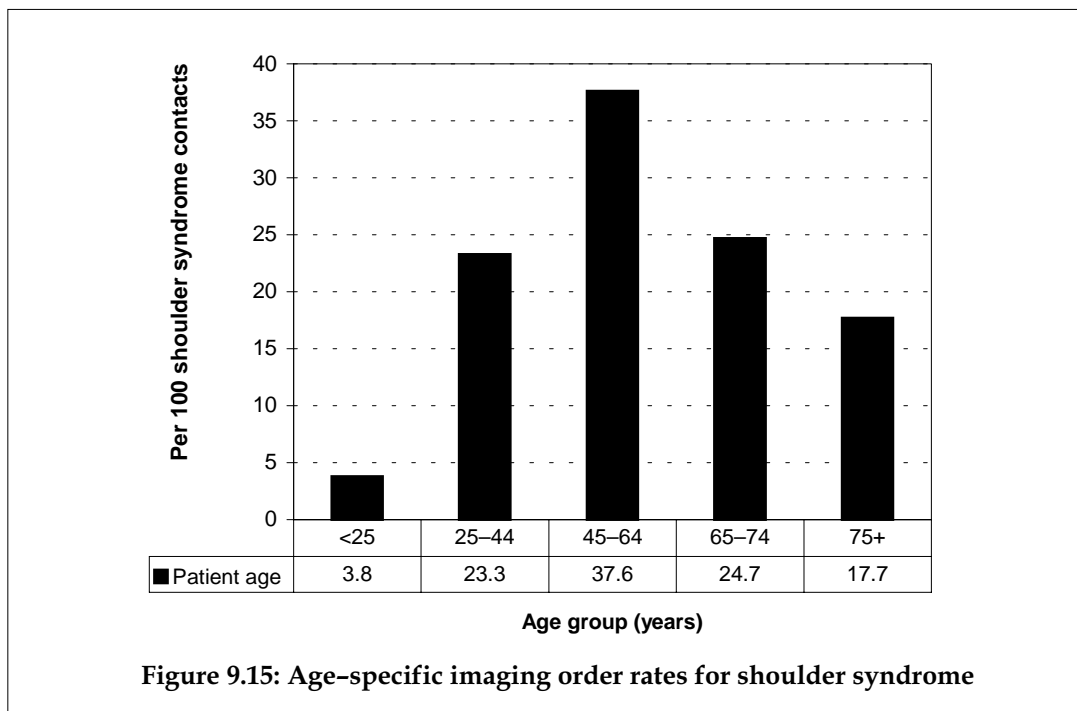
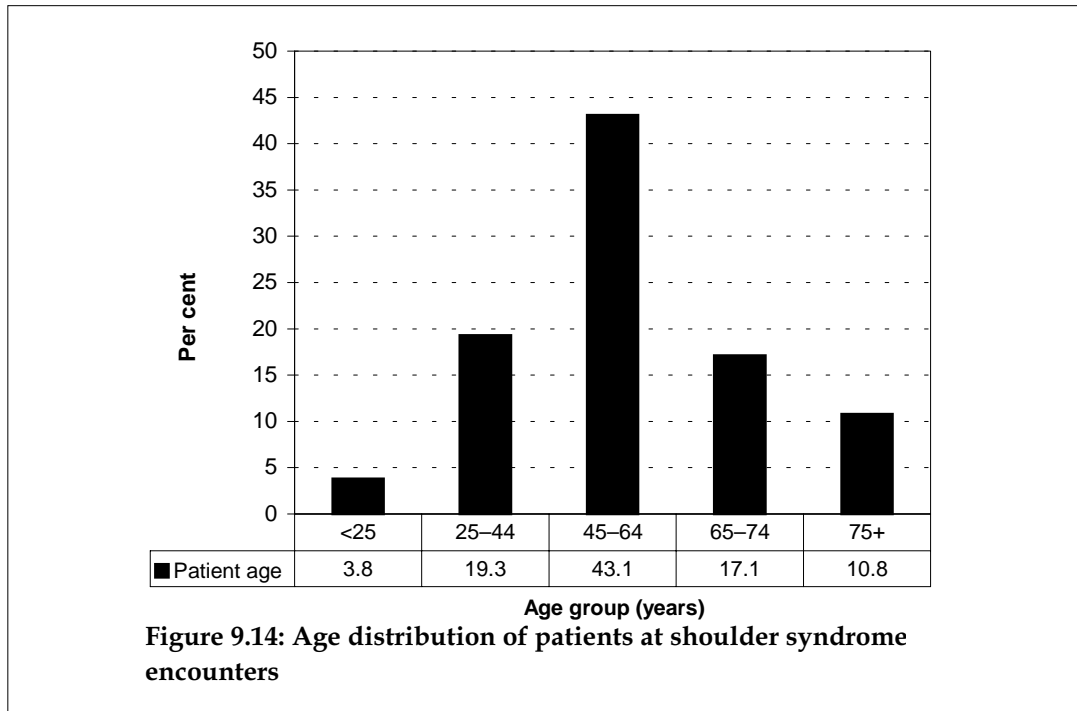
There were 504 contacts with shoulder syndrome and 122 of these (24.2%) generated at least one imaging order. In total, 155 imaging tests were ordered at a rate of 30.8 per 100 contacts with shoulder syndrome and a rate of 127 per 100 tested shoulder syndrome contacts. These tests represented 2.0% of all imaging tests ordered (Table 7.5).

### Age- and sex-specific imaging order rates for shoulder syndrome

At about half (48.9%) of the 503 encounters at which shoulder syndrome was ordered, the patient was male. Imaging was ordered in the management of 23.4% of these male encounters and at 25% of female encounters with shoulder syndrome.

At almost half (43.1%) these encounters the patient was aged between 45 and 64 years. A further 19.3% were aged between 25 and 44 years and 27.9% were elderly (65+ years) (Figure 9.14).

As demonstrated in Figure 9.15, imaging orders associated with shoulder syndrome were most likely in the 45–64 years age range, where more than one-third (37.6%) of contacts generated such an order. In the 25–44 and 65–74 age groups, about one in four shoulder syndrome contacts resulted in an imaging order. The relative likelihood of ordering was less for those over 75 years and rare for young people.



## Imaging tests ordered for shoulder syndrome by MBS group

Of the 155 imaging tests ordered for shoulder syndrome, about half (51.4%) fell into the MBS group diagnostic radiology and half (48.4%) into ultrasounds (Table 9.19).

**Table 9.19: Distribution of imaging tests ordered for shoulder syndrome by MBS group**

Imaging class	Number of tests	Per cent of tests for shoulder syndrome
Diagnostic radiology	75	48.4
Ultrasound	80	51.4
Computed tomography	1	0.1
<b>Total</b>	<b>155</b>	<b>100.0</b>

Note: Columns may not add to column total due to rounding.

## Imaging order rates by problem status of shoulder syndrome

New cases/ diagnoses of shoulder syndrome represented about one-third of the total, and these new presentations generated a far higher number of imaging test orders (50.3 per 100 encounters) than did follow-up consultations (19.4 per 100) (Table 9.20).

**Table 9.20: Imaging order rates by problem status of shoulder syndrome**

Problem status	Number of problem contacts <sup>(a)</sup>	Number of imaging tests ordered	Imaging order rate per 100 problems
New shoulder syndrome problems	186	93	50.3
Old shoulder syndrome problems	319	62	19.4
<b>Total</b>	<b>505</b>	<b>155</b>	<b>30.7</b>

(a) The number of contacts with this problem in the total dataset.

## Most common imaging tests ordered for shoulder syndrome

The variance in tests selected for some of the earlier problems investigated was not apparent in the management of shoulder syndrome. Half the test orders were for an ultrasound of the shoulder and 44.0% were for a plain x-ray of the shoulder (Table 9.21).

**Table 9.21: Most common imaging tests ordered for shoulder syndrome**

Test type ordered	Number of tests	Per cent of tests for shoulder syndrome	Per cent of tests for new shoulder syndrome (n=93)	Per cent of imaging tests for old shoulder syndrome (n=62)
Ultrasound; shoulder	79	51.0	52.4	48.2
X-ray; shoulder	68	43.8	43.6	44.6
<i>Sub-total</i>	<i>147</i>	<i>94.8</i>	<i>96.0</i>	<i>92.8</i>
<b>Total</b>	<b>155</b>	<b>100.0</b>	<b>100</b>	<b>100</b>

## Discussion

The RANZCR guidelines and some of the literature suggest that plain x-ray of the shoulder is the first investigation of choice in patients with shoulder pain (Peh 1998; RANZCR 2001). While plain x-ray accurately depicts bone damage following trauma, it does not provide accurate information regarding soft tissue injury (King & Healy 1999). On the other hand, ultrasound has a high predictive value for soft tissue injury, similar to that for MRI when both are judged against the 'gold standard' of arthroscopy (Swen et al. 1999; Teefey et al. 1999; Teefey et al. 2000). GPs in this study used both these modalities in the imaging of shoulder syndrome. They tended to select ultrasound more frequently. The test rate of 127 per 100 tested problem contacts indicates that ultrasound and x-ray are sometimes ordered together.

These data indicate broad compliance with the published guidelines for the selection of imaging modalities.

## 9.8 Headache

This problem label includes the following ICPC-2 codes:

- N01 – Headache ( $n=480$ )
- N89 – Migraine ( $n=917$ )
- N90 – Cluster headache ( $n=20$ )
- N95 – Tension headache ( $n=291$ ).

There were 1,708 contacts with headache. A total of 103 imaging tests were ordered at 97 encounters, a rate of 106 per 100 tested headaches. The overall test rate was 6.0 imaging tests per 100 headache contacts (Table 7.5).

### Age- and sex-specific imaging order rates for headache

More than two-thirds (70.4%) of patients for whom headache was managed at the encounter were female. The largest proportion were aged between 25 and 44 years (41.9%) with a further 30.7% being 45–64 years old. Together, these age groups accounted for over 70% of all patients seen for headache (Figure 9.16). Imaging was most likely to be ordered for patients aged between 65 and 74 years (10.9 tests per 100 encounters) and least likely for those aged 25–44 years (4.4 per 100). In the remaining age groups, approximately six imaging tests were ordered per 100 contacts (Figure 9.17).

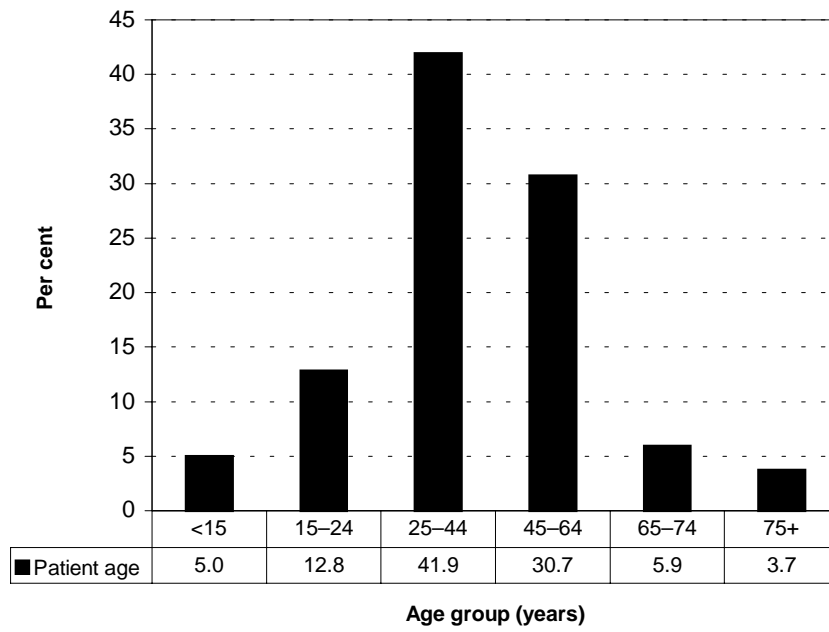


Figure 9.16: Age distribution of patients managed for headache

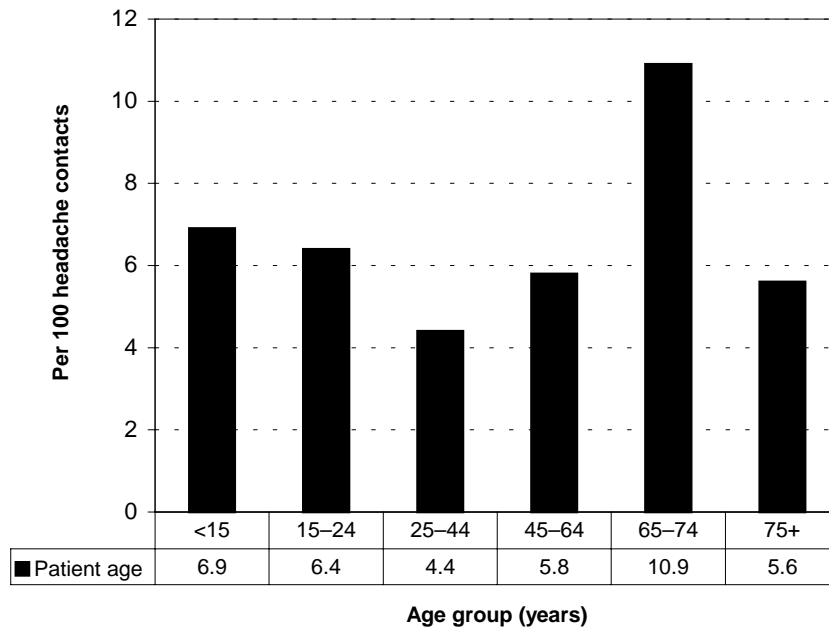


Figure 9.17: Age-specific imaging order rates for headache

## Imaging tests ordered for headache by MBS group

Computed tomography accounted for 78.6% of all imaging tests ordered for headache. A further 14.6% of tests were diagnostic radiology and 6.8% were ultrasounds (Table 9.22). CT scans of the brain and the head were the most frequently ordered imaging tests, together making up three-quarters (74.6%) of all tests ordered (Table 9.23).

**Table 9.22: Distribution of imaging tests ordered for headache by MBS group**

Imaging class	Number of tests	Per cent of tests for headache
Diagnostic radiology	15	14.6
Ultrasound	7	6.8
Computed tomography	81	78.6
<b>Total</b>	<b>103</b>	<b>100.0</b>

## Most common tests ordered by problem status of headache

The vast majority of headache contacts were follow-up consultations ( $n=1,276$ , 74.8%). The test ordering rate was higher for new problems (11.0 per 100 contacts) than for old (4.4 per 100). However, Table 9.23 demonstrates that orders for CT scans of the brain made up a somewhat larger proportion of the tests ordered for old cases of headache than for new presentations.

**Table 9.23: Most common imaging tests ordered for headache**

Test type ordered	Number of tests	Per cent of tests for headache	Per cent of tests for new headache ( $n=47$ )	Per cent of tests for old headache ( $n=56$ )
CT scan; brain	46	44.8	36.6	51.8
CT scan; head	31	29.8	32.7	27.3
X-ray; cervical	7	6.8	9.5	4.4
<i>Sub-total</i>	<i>84</i>	<i>81.6</i>	<i>78.8</i>	<i>83.5</i>
<b>Total</b>	<b>103</b>	<b>100.0</b>	<b>100</b>	<b>100</b>

## Discussion

The well-researched Appropriateness Criteria on when to image a traumatic isolated headache, indicate that the yield of CT scans of the brain in these patients in the absence of neurological signs, altered mental state, nausea or vomiting, or other 'at risk' features such as HIV infection, is between 0.4 and 0.5% (Masdeu et al. 2000). Clinical discrimination by Family Physicians in the United States resulted in higher yields from a mixed group of patients (Becker et al. 1993a; Becker et al. 1993b). Imaging was ordered at the rate of 11 per 100 headache problem contacts, the large majority being CT scans. The guidelines suggest that for other than suspected intracranial bleeding, MRI is the modality of choice for investigating suspected underlying pathology. The previously mentioned lack of access by GPs to MRI may be causing substitution of a less satisfactory method.

The possibility of ‘missed’ sub-arachnoid haemorrhage needs to be placed in the perspective of the low incidence of this condition. If the United States’ yearly incidence of 9 per 100,000 population (Masdeu et al. 2000) applies in Australia, and assuming all were seen in general practice rather than in emergency departments, only 13.5% of Australia’s 23,000 GPs could expect to see a case in any one year. Many GPs will not see a case in their professional lifetime. The positive predictive value of a CT scan in this circumstance is virtually zero. The findings of a recent Dutch study challenge the concept of a ‘warning leak’ causing headache in patients who have a subsequent sub-arachnoid haemorrhage (Linn et al. 2000). The ACR criteria are possibly just as applicable for ‘thunderclap’ headache as for other headaches in the particular circumstances of general practice. An English study demonstrated the criteria have 100% sensitivity in an Emergency Department population.

## 9.9 Head injury

The ICPC-2 rubrics included in this group were:

- N79 – Concussion ( $n=36$ )
- N80 – Head injury, other ( $n=106$ ).

There were 142 contacts with head injury and 22 of these (15.5%) generated an order for an imaging test. Only one test was ordered in each case (Table 7.5). CT scans were most common (16 of the 22), plain x-rays being few (3 of the 22) (Table 9.24).

### Types of imaging tests ordered for head injuries

The order was placed as ‘CT scan of the brain’ in 12 of these cases and as ‘CT scan of the head’ in a further 4 cases.

**Table 9.24: Most common imaging tests ordered for head injury**

Test type ordered	Number of tests	Per cent of tests for head injury
CT scan; brain	12	54.5
CT scan; head	4	18.2
x-ray skull	3	13.6
Other	3	13.6
<b>Total</b>	<b>22</b>	<b>100.0</b>

## Discussion

Head injuries present infrequently to general practitioners, only 142 contacts with patients with head injury occurred in the 1999–00 *BEACH* year. In 22 cases, imaging was ordered and in 16 cases the test ordered was a CT scan. Skull x-ray was ordered in only three cases. A literature review by Hofman et al. concluded that there was little value in the use of plain skull x-ray in mild head injury (Hofman et al. 2000).

The literature review for the ACR Appropriateness Criteria on Head Trauma supports the use of CT scanning as the modality of choice in most circumstances for head injury, a conclusion also supported in the RANZCR guidelines (Davis et al. 2000; RANZCR 2001).

Both these guidelines and those produced by the American Academy of Family Physicians and the American Academy of Paediatrics suggest that, on occasions, it may be appropriate to use CT scan to triage head injury in emergency departments and to use a negative CT scan as a substitute for observation in hospital.

While the numbers are small, the practice of Australian GPs appears consistent with established guidelines.

## 9.10 Leg pain and peripheral vascular disease

### Leg pain

There were 79 contacts with undiagnosed leg pain (ICPC-2 PLUS code L14006) and 15 of these (18.9%) generated an imaging test order (Table 7.5). Only one test was ordered in each case. The majority of leg pain contacts (75.9%) were follow-up consultations. Test orders were less likely at these contacts (12.9 per 100) than at new presentations of leg pain (41.6 test orders per 100 contacts). Thirteen different imaging tests were ordered across the 15 problem contacts. No pattern of GP behaviour emerged in this small sample.

### Peripheral vascular disease

This problem includes ICPC-2 PLUS codes

- K92003 – Disease; peripheral vascular ( $n=170$ )
- K92017 – Claudication; intermittent ( $n=36$ ).

There were 206 occasions on which peripheral vascular disease was managed and these contacts generated only 23 imaging test orders (11.2 per 100 contacts). Where imaging was ordered, only one test was ordered in every case.

### Age- and sex-specific imaging order rates for peripheral vascular disease

The patient was male at 63.9% of encounters in which peripheral vascular disease was managed. Only two patients were aged less than 45 years, with one in five being aged between 65 and 74 years and the majority (59.4%) being 75 years of age or older (Figure 9.18). Imaging test orders were most likely for patients of 75 years or more (12.9 per 100 encounters) than for those 65–74 years old (5.9 per 100) or the younger age group (7.9 per 100) (Figure 9.19).

### Types of imaging tests ordered for PVD

Ultrasounds made up more than 80% of the tests ordered by GPs for peripheral vascular disease while almost all of the remaining tests ordered were classed as diagnostic radiology (Table 9.25). Doppler test orders accounted for 16 of the 19 ultrasounds ordered.

## Discussion

The use of Doppler imaging in peripheral vascular disease was discussed in Section 8.7. Although the numbers are small, this analysis from a problem perspective supports the conclusion that the ordering pattern is consistent with established guidelines.

**Table 9.25: Distribution of imaging tests for peripheral vascular disease by MBS group**

Imaging class	Number of tests	Per cent of tests for PVD
Diagnostic radiology	3	13.3
Ultrasound	19	82.4
Computed tomography	1	4.4
<b>Total</b>	<b>23</b>	<b>100.0</b>

