

7 Problems managed with imaging test orders

This section investigates the problems to which the imaging tests ordered were related. As earlier stated, there can be a many-to-many relationship between morbidity and imaging tests. While a single test can be ordered for one problem under management at the encounter (a one-to-one relationship), it is also possible for one imaging test to be related to multiple problems under management, or more than one imaging test to be related to a single problem under management. The broad relationships between imaging tests and problems under management were reported in Chapter 4 (Tables 4.3 and 4.4). This many-to-many relationship means that while there were 7,919 imaging tests ordered, there were 7,218 problems (4.7%) managed with at least one imaging test.

7.1 Distribution of problems for which imaging was ordered

Distribution by ICPC–2 chapter of problem managed

In the total dataset there were 153,857 problems managed, at an average rate of 147 per 100 encounters. The distribution of these problems across ICPC–2 chapters is provided in the second column of Table 7.1. The third column gives the proportion of problems in each chapter that was associated with at least one imaging test order. The fourth column demonstrates the extent to which each morbidity chapter contributed to the total imaging orders. The last column states the relative test-ordering rate per 100 tested problems in each chapter.

Only 4.7% of all problems managed generated an order for one or more imaging tests. Musculoskeletal problems accounted for the greatest proportion (40.4%) of imaging tests and these types of problems were the most likely to be tested (16.0% generating at least one imaging test order). Female genital problems were second in the list of those most likely to have an imaging test order placed (9.8% having at least one) accounting for 9.4% of all imaging tests ordered. While 7.2% of urological problems generated an imaging test order these tests accounted for only 3.2% of all imaging tests ordered. A similar pattern was shown for the pregnancy and family planning chapter.

Digestive and neurological problems both came next in terms of the proportion of problems being tested (6.2%) but due to the difference in their overall relative frequency in general practice, accounted for very different proportions of total imaging. Digestive problems accounted for 8.9% of all imaging tests while neurological problems accounted for only 3.6%. Tests for the male genital system were less common (4.5% generating at least one) and they accounted for a very small proportion of total imaging.

The proportion of problems in each of the general, blood and skin chapters that were tested were similar (at about 2.5%) but, while the general and skin chapters each accounted for more than 5% of imaging, the problems associated with the blood generated less than 1% of total imaging.

Together problems associated with the digestive, musculoskeletal, respiratory and female genital systems accounted for almost 70% of all imaging tests ordered.

The chapter-specific imaging order rates demonstrated that while imaging was rarely ordered for eye problems (0.6% tested), multiple tests were most likely to be ordered when a decision for imaging tests was made (131.7 per 100 tested contacts). Problems associated with the blood and blood-forming organs were also likely to generate multiple tests (125.8 tests per 100 tested problems).

Table 7.1: Distribution of problems for which imaging ordered by ICPC-2 chapter

ICPC-2 chapter	Number of problems ^(a)	Per cent of problems with at least one imaging ^(b)	Per cent of total imaging orders (n=7,919)	Chapter-specific imaging order rate ^(c)
General and unspecified	14,622	2.7	5.6	113.4
Blood	1,781	2.6	0.7	125.8
Digestive	10,533	6.2	8.9	108.2
Eye	2,875	0.6	0.3	131.7
Ear	4,679	0.5	0.3	104.7
Cardiovascular	17,074	2.2	5.3	108.7
Musculoskeletal	17,766	16.0	40.4	112.6
Neurological	4,098	6.2	3.6	111.7
Psychological	11,025	0.6	0.9	109.7
Respiratory	25,375	3.0	9.9	104.7
Skin	17,865	2.3	5.8	114.1
Endocrine, nutritional, metabolic	9,572	1.7	2.1	104.2
Urological	3,185	7.2	3.2	108.9
Pregnancy and family planning	4,512	6.8	3.9	100.9
Female genital system	6,461	9.8	9.4	117.2
Male genital system	1,467	4.5	0.8	101.1
Social	968	0.5	0.1	100.0
Total	153,857	4.7	100.0	..

(a) The number of problems in the total dataset that were classified in this chapter.

(b) The percentage of all problems in the chapter that generated at least one imaging test order.

(c) The number of imaging tests associated with problems in that chapter over the number of problems in that chapter for which at least one imaging test was ordered.

Imaging order rates by ICPC-2 component of problems under management

Examination of problems managed across ICPC-2 components provides an alternative way of viewing the types of matters dealt with at general practice consultations (Table 7.2).

GPs were instructed to record problems managed in the most specific terms possible at the time of the encounter. In an ideal world it could therefore be expected that problems managed should fall into three components of ICPC-2, namely the diagnosis/disease, symptoms and complaints, and diagnostic and preventive procedures (e.g. check-up). Although these components were the most frequently recorded, there were a small number of problems described in terms of a prescription, referral, test result or administrative

procedure. In these circumstances, the lack of clinical description of the underlying problem required the label to be coded in terms of the process described (e.g. diagnosis was recorded as referral to dermatologist).

The majority of problems (65.5%) were described in terms of a diagnosis or disease (e.g. hypertension, depression, asthma). Problems described in terms of a symptom or complaint (e.g. febrile) represented almost one-quarter of all problems managed.

Imaging test orders were most commonly made for problems given a symptom/complaint label (7.5% being tested). Only 4.3% of problems with a diagnosis/disease label were associated with imaging tests. The component-specific ordering rate was around 110 tests per 100 problems in most components, the exception being problems with an administrative or referral label for which only one test was ordered for each tested problem.

Table 7.2: Imaging order rates by ICPC-2 component of problems under management

ICPC-2 component	Number of problems ^(a)	Per cent of problems at least one imaging ^(b)	Per cent of total imaging tests	Component-specific imaging order rate ^(c)
Symptoms & complaints	33,491	7.5	35.9	113.0
Diagnosis, diseases	100,788	4.3	59.4	109.9
Diagnostic & preventive procedures	13,700	2.6	4.8	107.2
Medications, treatments & therapeutics	3,257	0.5	0.4	105.3
Referral & other reasons for encounter	1,347	2.0	0.2	114.6
Results and administrative	1,272	1.6	0.3	100.0
Total problems	153,857	100.0	7,919	..

(a) The number of problems in the total dataset that were classified in this chapter.

(b) The percentage of all problems in the chapter that generated at least one imaging test order.

(c) The number of imaging tests associated with problems in component over the number of problems in that component for which at least one imaging test was ordered.

7.2 Care process associated with imaging ordered

A specific interest of this study was the extent to which imaging was ordered for investigative/diagnostic purposes versus monitoring purposes.

Defining the care process involved in orders for imaging

The GPs were asked to indicate for each problem managed at the encounter whether it was a new problem to the patient. A new problem was defined as one that had not been managed for that patient by any medical practitioner or the first consultation for a new episode of an acute problem. The problem status was considered in combination with level of diagnostic certainty. Diagnostic certainty was defined in terms of the structure of the ICPC-2 classification, labels falling into the symptom component being seen as uncertain and those falling into the diagnostic component being regarded as problems already diagnosed. Problems labelled in a manner that placed them in the process components of ICPC-2 could not be defined in terms of symptoms or diagnoses and therefore could not be classified into a care process class.

Table 7.3 shows the relationship between problem status and component type for the 8,001 problems for which imaging was ordered. The problem was described in diagnostic terms in

58.8% of cases and almost half (47.0%) the problems were designated by the GP as new to the patient. The following care classes were then defined according to the status and component of the associated problem:

- *Investigative imaging*: tests ordered to assist in the diagnostic process: included all imaging ordered for problems that fell in ICPC-2 Component 1 (Symptoms and complaints) irrespective of problem status.
- *Management imaging*: tests ordered to assist in decisions about to how best to manage the problem that had already been defined in diagnostic terms by the clinician: included all imaging ordered for problems in ICPC-2 Component 7 (Diagnosis/disease) that were new to the patient.
- *Monitoring imaging*: tests ordered to monitor a patient in the ongoing care of a defined problem: included all imaging orders for problems in Component 7 (Diagnosis/Disease) at follow-up encounters for that problem.
- *Undefined imaging*: included all imaging ordered for problems in Components 2-6 (process codes) irrespective of the status of the problem to the patient

Table 7.3: Problem status by ICPC component of problems for which imaging is ordered.

ICPC component	New problems ^(a)		Old problem follow-up		Total	
	Number	Per cent ^(b)	Number	Per cent ^(b)	Number	Per cent ^(b)
Component 1—Symptoms and complaints	1,437	18.0	1,408	17.6	2,846	35.6
Component 7—Diagnoses, disease	2,248	28.1	2,457	30.7	4,705	58.8
Components 2-6—other ^(c)	79	1.0	371	4.6	450	5.6
Total	3,764	47.0	4,237	53.0	8,001	100.0

(a) The problem is new to the patient or this is the first contact with a medical practitioner for a new episode of an acute problem.

(b) Per cent of total combinations of imaging test orders and problems managed (n=8,001).

(c) Includes Diagnostic, screening and preventive procedures; Medications treatments, procedures; Test results; Administrative, Referrals and other reasons for encounter.

Imaging orders by care process

As shown in Table 7.3, 18.0% of all problem-imaging combinations were for new problems described in symptomatic terms and a further 17.6% were still described in symptomatic terms at the follow-up consultation. These two groups were combined and classed as investigative imaging.

Table 7.4 demonstrates that the problem types with the greatest likelihood of generating an imaging order were those associated with investigative imaging (those problems described in symptomatic terms), 7.5% of which resulted in a test order. These were followed by problems requiring management imaging tests (6.3% generating at least one order) and then by those requiring monitoring (3.3%).

- Investigative imaging accounted for 35.6% of all imaging orders.
- Management imaging tests for new diagnoses accounted for 28.1% of the problem-imaging combinations.
- Monitoring of old problems accounted for 30.7% of all problem-imaging combinations
- Undefined problem-imaging combinations accounted for 5.6% of the total.

The last column in Table 7.4 demonstrates that where a decision was made by the GP to order imaging, there was virtually no difference in the relative number of tests ordered between the imaging classes. The highest ordering rate was 113 tests per 100 tested problems for investigative imaging and the lowest, the tests classed as undefined which were ordered at a rate of 107 tested problems.

Table 7.4: Imaging orders by care process

Care process	Number problems	Number problems 1+ imaging ^(a)	Per cent of class ^(b)	Per cent of problems			Per cent of tests (n=7,919) ^(d)	Test rate per 100 problems tested ^(e)
				1+ imaging (n=7,217) ^(c)	95% LCL	95% UCL		
Diagnostic	33,491	2,518	7.5	34.9	33.2	36.6	35.6	113.0
Management	32,401	2,039	6.3	28.2	26.4	30.1	28.1	110.3
Monitoring	68,387	2,241	3.3	31.1	29.4	32.7	30.7	109.6
Undefined	19,578	420	2.1	5.8	3.7	7.9	5.6	107.4
Total	153,857	7,217	4.7	100.0	100.0	110.9

(a) The number of problems in each care process for which at least one imaging test was ordered.

(b) Percentage of problems in each care process with at least one imaging test.

(c) The distribution of problems for which imaging ordered across care processes.

(d) The percentage distribution of the test/problem combinations in each care process.

(e) The number of imaging tests ordered per 100 problems for which at least one test was ordered in each care process.

Discussion

The results of a German study by Busse et al. are consistent with the finding in this study that new problems, which are likely to have a higher uncertainty of diagnosis, result in higher levels of ordering (Busse et al. 1999). Klinkman found a higher level of general service utilisation associated with diagnostic uncertainty or non-specific diagnosis in patients with abdominal pain in a United States family practice (Klinkman 1996). These findings are not unexpected as GPs working in a 'diagnostic' mode could be expected to utilise more tests.

7.3 Most frequent individual problems for which imaging ordered

Table 7.5 provides a list of the most frequent problem labels (or groups of labels) for which imaging test orders were made, in decreasing order of frequency of imaging tests ordered. Column 2 provides the number of imaging tests ordered, while Column 3 describes the proportion of all imaging test orders accounted for by this problem label. Column 4 gives a proportion of total contacts with the selected problem that resulted in at least one order for imaging. Column 5 describes the relative number of imaging tests ordered in relation to the number of contacts with that problem that had at least one imaging order. Column 6

provides the relative number of imaging tests ordered per 100 contacts with a problem of this type.

These top 20 morbidity types listed in the table accounted for 44.5% of all imaging ordered. Back pain accounted for the highest number of imaging tests ordered ($n=433$) but only 15.2% of contacts with back pain resulted in at least one imaging test. Further, the number of tests per 100 problems, or 100 imaging contacts, was considerably less than for some other types of morbidity.

Fractures followed back pain in terms of the number of imaging tests ordered, and clinical contacts with fractures were more likely to result in an imaging order (38.0%) than did those for back pain. This resulted in a higher relative imaging order rate for contacts with fracture (41.4 per 100 contacts) than for back pain (17.3 per 100). Osteoarthritis was third in the list and this was followed by joint sprain/strain.

Table 7.5: Problems that generate the most imaging orders

Problem type	Number of imaging orders	Per cent of total imaging orders	Per cent of problems 1+ imaging^(a)	Relative order rate per 100 imaging contacts^(b)	Order rate per 100 problems^(c)
Back pain*	433	5.5	15.2	114.1	17.3
Fracture*	424	5.4	38.0	109.0	41.4
Osteoarthritis*	326	4.1	12.6	110.0	13.9
Joint sprain/stain*	253	3.2	21.5	105.5	22.7
Injury musculoskeletal NOS	203	2.6	24.5	111.4	27.3
Abdominal pain*	192	2.4	27.7	111.5	30.9
Breast lump*	163	2.1	56.4	139.1	78.5
Other skin injury	159	2.0	23.5	107.5	25.2
Shoulder syndrome*	155	2.0	24.2	127.1	30.8
Acute bronchitis/bronchiolitis	146	1.8	4.4	100.5	4.4
Pre-postnatal check-up*	145	1.8	12.1	101.0	12.2
Bruise/contusion	121	1.5	18.2	128.3	23.3
Back syndrome with radiating pain	114	1.4	13.8	122.1	16.9
Pneumonia	114	1.4	34.4	100.0	34.4
Bursitis/tendonitis/synovitis NOS	112	1.4	13.5	111.5	15.0
Female genital check-up*	107	1.4	5.6	118.0	6.6
Neck syndrome*	100	1.3	16.4	107.3	17.6
Cholecystitis, cholelithiasis	92	1.2	40.3	103.7	41.7
Menstrual problems*	83	1.1	9.8	100.0	9.8
Chest pain NOS	82	1.0	21.5	128.3	27.5
<i>Sub-total imaging tests for 20 problems types</i>	3,523	44.5	15.8	111.6	17.6
Total imaging (n)	7,919	100.0

(a) The percentage of total problems of each type for which at least one imaging test was ordered.

(b) The rate of imaging tests ordered per 100 problems for which at least one imaging test was ordered.

(c) The rate of imaging tests ordered per 100 problems of each type.

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

Note: NOS—not otherwise specified

The relative ordering rate for problems that resulted in at least one imaging order (Column 5) was lowest for pneumonia, where exactly 100 imaging tests were ordered for every 100 pneumonia cases tested (i.e. where a test was ordered in the management of pneumonia, a single test was always ordered). The highest rate was for breast lump where an average 1.4 tests were ordered per tested case (or 139.1 per 100). This was followed by bruise/contusion (128 tests per tested bruises/contusions and ill-defined chest pain (128.3 per 100).

7.4 Problems most likely to generate imaging orders

The problems most likely to generate an order for one or more imaging tests are presented in Table 7.6. Breast lump was the problem with the highest likelihood of imaging investigation (56.4% of contacts), followed by symptoms of the hip (44.8%), fibrocystic disease of the breast (44.7%), urinary calculus (44.1%) and cholecystitis (40.3%). In contrast (as shown in Table 7.5) an order for imaging was made at only 4.4% of contacts with acute bronchitis, 5.6% of female genital check-ups and at 9.8% of contacts with menstrual problems.

Table 7.6: Problems most likely to generate an imaging order

Problem type	Per cent of problems at least one imaging^(a)	Number of imaging tests ordered	Per cent of total imaging orders	Relative order rate per 100 imaging contacts^(b)	Relative order rate per 100 problems^(c)
Breast lump*	56.4	163	2.1	139.1	78.5
Hip symptom/complaint	44.8	64	0.8	122.8	55.0
Fibrocystic disease breast	44.7	54	0.7	134.7	60.1
Urinary calculus	44.1	39	0.5	107.5	47.5
Cholecystitis, cholelithiasis	40.3	92	1.2	103.7	41.7
Fracture*	38.0	424	5.4	109.0	41.4
Spontaneous abortion	35.9	40	0.5	100.0	35.9
Goitre	34.4	36	0.5	101.6	34.9
Pneumonia	34.4	114	1.4	100.0	34.4
Haematuria	29.8	56	0.7	119.8	35.6
Abdominal pain*	27.7	192	2.4	111.5	30.9
Knee symptom/complaint	26.4	66	0.8	102.9	27.2
Injury musculoskeletal NOS	24.5	203	2.6	111.4	27.3
Shoulder syndrome	24.2	155	2.0	127.1	30.8
Acute internal damage to knee	23.7	69	0.9	109.6	26.1
Other skin injury	23.5	159	2.0	107.5	25.2
Shoulder symptom/complaint	23.0	62	0.8	123.3	28.3
Foot and toe symptom/complaint	22.9	50	0.6	110.5	25.4
Physical injury (excluding fracture; joint sprain/strain)	21.5	253	3.2	105.5	22.7
<i>Sub-total imaging tests for 20 problems types</i>	<i>15.8</i>	<i>3,523</i>	<i>44.5</i>	<i>111.6</i>	<i>17.6</i>
Total imaging (n)	..	7,919	100.0

(a) The percentage of total problems of each type for which at least one imaging test was ordered.

(b) The rate of imaging tests ordered per 100 problems for which at least one imaging test was ordered.

(c) The rate of imaging tests ordered per 100 problems of each type.

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

Note: NOS—Not otherwise specified.