

Summary

Background

Between 1994–95 and 1998–99 the number of diagnostic imaging services provided in Australia increased by 1.5 million, or 15%. About 60% of expenditure on imaging is for investigations initiated by GPs. Between 1991–92 and 1995–96 the value of imaging services ordered by ‘non-specialists’ rose from \$349 million to \$537 million per year, an increase of 54%. Data from the Health Insurance Commission (HIC) lack linkage to patient morbidity, limiting exploration of the reasons general practitioners (GPs) order imaging services.

Aims

This study aims to describe the patterns of imaging ordering by general practitioners in Australia, and investigate the relationship of orders to GP characteristics and patient characteristics and to the morbidity under management. It also aims to assess the relationships between GP behaviour, the available evidence and current guidelines.

Literature review

The literature regarding assessment of the value of diagnostic imaging is large and varied. However, the poor progress in radiology outcomes research makes the development of meaningful guidelines difficult. In light of the poor scientific evidence available for meta-analysis, the American College of Radiology (ACR) developed appropriateness criteria using a consensus process to complement the scientific data. In the absence of better evidence, the ACR Appropriateness Criteria™ probably represent the state-of-the-art advice on appropriateness of diagnostic imaging tests for the conditions that they cover.

The Royal Australian and New Zealand College of Radiologists (RANZCR) released the fourth edition of its imaging guidelines in April 2001. These guidelines use an algorithm approach to illustrate the diagnostic choices in a wide range of circumstances. Unlike the ACR criteria, no quantification of ‘appropriateness’ is provided in *Imaging Guidelines* (RANZCR 2001).

This report includes an appraisal of the relationship between the available guidelines and current GP practice for each of a series of specific imaging types and selected problems managed. The evidence on which to judge the appropriateness of GP ordering behaviour and to assess the impact of supplying imaging guidelines to GPs, is scanty and equivocal. Equally, the evidence base for the guidelines in terms of their applicability to general practice is sometimes open to question.

Methods

This study of general practitioner orders for imaging is a secondary analysis of data from the *BEACH* (Bettering the Evaluation and Care of Health) program, a continuous national study of general practice activity. *BEACH* relies on a random sample of approximately 1,000 recognised GPs per year. Each records details about 100 doctor–patient encounters of all types. The information is recorded on structured paper encounter forms. It is a rolling sample, about 20 GPs participating each week, 50 weeks a year.

This study utilises information about 104,700 GP-patient encounters from a random sample of 1,047 GPs who participated in the second year of the program, April 1999–March 2000. After post-stratification weighting there were 104,856 encounters in the final dataset.

Four care processes were defined for imaging tests ordered: investigative imaging, management imaging, monitoring imaging, and undefined imaging. Definitions were based on the status of the problem to the patient (new or old) and the level of diagnostic certainty represented by the label recorded by the GP to describe the tested problem.

Results

At least one imaging test was ordered by the GP at 6,979 (6.7%) of the 104,856 encounters. Tests were ordered at a rate of 7.6 per 100 encounters, or 5.1 per 100 problems managed. Extrapolated to the total GP-patient encounters across Australia, this suggests there were approximately eight million orders for imaging placed by GPs over the 12-month period.

At least one imaging order was placed in relation to 7,218 problems (4.7%). The mean number of imaging tests ordered was 6.9 tests per 100 encounters, with a standard deviation of 4.9 per 100. The ordering rates for the majority of GPs therefore fell between three and 11 tests with a minimum of no tests and a maximum of 62 per 100 encounters.

GP characteristics and imaging orders

The GPs were divided into three groups according to imaging order rate: the low ordering group (< three test orders per 100 encounters), the medium ordering group (3–11 tests per 100 encounters); and the high ordering group whose test rate was above this range.

GPs in the high ordering group were more likely to be female and more likely to work in small rural areas than those in the low ordering group. They were also less likely to be in solo practice. Those in the low ordering group were more likely to be male and to work in metropolitan areas and in solo practices.

Using analysis of variance and linear regression, the factors that affect GP imaging rates were explored. GPs from practices with 11–15 GPs had significantly higher imaging order rates than did solo GPs, and those from small rural/remote practices had higher rates than did urban GPs.

The strongest independent predictor of imaging order rates was the rate of encounters with new patients. Other significant predictors were:

- higher rates of management of musculoskeletal, urinary and female genital problems
- higher rates of problems described in symptomatic terms
- lower rates of patients aged 25–44
- lower rates of health card holders
- lower rates of management of psychological, skin and general/unspecified problems.

Characteristics of imaging encounters

The characteristics of the 6,979 imaging encounters were compared with those of the 97,878 non-imaging encounters. There were four significant differences between imaging encounters and non-imaging encounters. Imaging encounters were more likely than non-imaging encounters to be direct consultations (patient seen), and more likely to be charged to Medicare, less likely to be standard surgery consultations and more likely to be a long surgery consultation.

Patients at imaging encounters were more likely to be aged between 25 and 44 years and between 45 and 64 years than those at non-imaging encounters and far less likely to be children. There were no further significant differences between patients attending imaging encounters and those attending non-imaging encounters.

At imaging encounters there were significantly more patient reasons for encounter and more problems managed. Further, the problems were more likely to be new problems to the patient than those at non-imaging encounters. Orders for pathology tests were ordered at almost double the rate of non-imaging encounters

Imaging tests ordered by MBS groups

Diagnostic radiology tests numbered 5,042 and accounted for the majority of imaging tests ordered (63.7%). At least one was ordered by 96.1% of GPs. The most common were chest x-rays (21.0% of all imaging ordered); plain x-rays of the knee (7.9%); mammograms (7.2%); and plain x-rays of the lumbosacral region (5.3%), the ankle (4.2%) and shoulder (4.2%).

Orders for ultrasound numbered 2,035 and accounted for one-quarter (25.7%) of the total. More than three-quarters (78.5%) of the GPs ordered at least one. The most common were those of the pelvis (17.7% of all ultrasounds), the abdomen (12.5%), the breast (9.5%) and the shoulder (7.6%). However, obstetric ultrasounds (10.5%) took third place in this group.

The 674 computed tomography tests (CT scans) were ordered by less than half of the GPs. Seven tests accounted for 79.1% of all CT scans, including CTs of the brain, the head, the lumbosacral spine and the abdomen. There were only 24 magnetic resonance imaging tests ordered among 23 GPs and 16 nuclear medicine tests ordered among 16 GPs over the 12 months.

The distribution of the Health Insurance Commission imaging data across MBS major groups was similar to the distribution of the GP imaging test orders found in *BEACH*, with approximately two-thirds of the test falling onto the diagnostic radiology group. The gender distributions of the patients for whom the imaging tests were ordered/undertaken were also similar, as was the distribution by patient age group.

The imaging tests most often ordered

The top 30 individual test types ordered by GPs in *BEACH* accounted for almost two-thirds (61.9%) of all tests ordered. Chest x-rays were by far the most common, accounting for 13.3% of total imaging orders, followed by x-rays of the knee (5.1%). Mammography and pelvic ultrasound each accounted for 4.6% of imaging, and lumbosacral x-rays, 3.4%. Abdominal ultrasounds were slightly less common (3.2%) as were obstetric ultrasounds and plain x-rays of the ankle (each accounting for 2.7%).

Care process of imaging orders

More than one-third (35.6%) of all imaging orders were classed as investigative, 28.1% as management of new diagnoses, 30.7% as monitoring of old problems and 5.6% as undefined. The high proportion of investigative imaging is supported by the literature.

Imaging ordering by problem type

In the total dataset there were 153,857 problems managed, at an average rate of 147 per 100 encounters. About 5% of all problems managed generated an order for imaging.

Musculoskeletal problems accounted for the greatest proportion (40.4%) of imaging tests and were the problems most likely to be tested (16.0% generating at least one imaging test order). About one in 10 female genital problems were tested (9.4% of all imaging tests). 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 pregnancy and family planning. Digestive and neurological problems came next in terms of the proportion of problems being tested (6.2%). However, digestive problems accounted for 8.9% of all imaging tests while neurological problems accounted for only 3.6%. Imaging test orders were most commonly associated with problems given a symptom/complaint label (7.5% being tested). Less than 5% of contacts with problems given a diagnosis/disease label generated imaging test orders. The 20 specific morbidity types generating the most imaging orders accounted for 44.5% of all imaging ordered. Back pain, fractures, osteoarthritis and joint sprain/strain accounted for the highest number of test orders but varied in the extent they were tested.

The problems most likely to generate an order for one or more imaging tests were breast lump (56.4% of contacts tested), followed by symptoms of the hip (44.8%), fibrocystic disease of the breast (44.7%), urinary calculus (44.1%) and cholecystitis (40.3%).

Investigation of selected specific imaging test types

More specific examination was undertaken of eight selected imaging test types including: chest x-ray, mammography and breast ultrasound, imaging of the lower back, imaging of the shoulder, imaging of the pelvis, imaging of the brain/head, Doppler tests and imaging of the kidney.

Investigation of selected specific problems for which imaging was ordered

More detailed study of the pattern of imaging orders for selected problems was then undertaken. The topics include fractures, joint sprains and strains, back pain, osteoarthritis, abdominal pain, breast lump, shoulder syndrome, headache, head injuries, leg pain and peripheral vascular disease.

Conclusion

This study has demonstrated that GP ordering behaviour appears to follow the available guidelines in the majority of areas but that there could be improvements in both the guidelines and GP test selection in some areas. In some areas a reduction in ordering of specific imaging types may be possible without affecting outcomes. There are others in which the current system blocks improved performance.

The literature suggests that co-ownership of primary care and imaging facilities may result in higher test ordering and this study suggests a relationship between higher ordering rates and larger practice size. It could therefore be postulated that if corporatisation results in increases in both practice size and co-ownership of imaging facilities and general practices, higher imaging order rates might be expected in the future.

The review of available guidelines suggest the RANZCR guidelines could benefit from the inclusion of the evidence for each guideline, the introduction of the ACR scoring system, consideration of the systemic limitations on specific test ordering by GPs. They could also place more focus on testing of problems rather than use of specific test types, and address the lack of guidelines in some areas. The impact of guidelines on performance also needs further research. This report provides a baseline against which future practice can be compared and a means by which the impact of the recently distributed revised RANZCR guidelines can be tested in the future.