

# Primary care referrals for lumbar spine radiography: diagnostic yield and clinical guidelines

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## SUMMARY

**Background:** Primary care requests for radiographs of the lumbar spine have come under increasing scrutiny. Guidelines aiming to reduce unnecessary radiographs by limiting referrals to patients at high risk of serious disease have been widely distributed. Trial evidence suggests that guidelines can reduce radiography referrals. It is not clear whether this reduction has been achieved in routine practice.

**Aim:** This study, using routine data, was conducted to measure trends in primary care referrals for lumbar spine radiography at two hospitals between 1994 and 1999.

**Design of study:** Analysis of primary care requests for lumbar spine radiography from computerised records.

**Setting:** Addenbrooke's Hospital, Cambridge (1 July 1994 to 30 June 1999), and Ipswich General Hospital (1 July 1995 to 30 June 1999), United Kingdom.

**Method:** All primary care requests for lumbar radiography were identified electronically from computerised information systems. A random sample of 2100 radiography reports were classified according to clinical importance. These classifications were used to examine whether the proportion of radiographs demonstrating potentially more serious findings had increased between 1994 and 1999.

**Results:** There was no evidence that primary care referrals for radiography of the lumbar spine had decreased between 1994 and 1999 at either hospital. General practitioners did not progressively refer more high-risk patients for lumbar radiography. Only a small proportion of patients had important radiographic findings that might warrant specialist referral or specific therapy.

**Conclusion:** The implementation of diagnostic guidelines offers much to the NHS. However, in these two hospitals, the reduction in radiograph utilisation evident in trials was not achieved. Guideline development is a resource intensive process; distribution must be supported by more effective implementation strategies.

**Keywords:** guideline adherence; spine; radiography; low back pain; utilisation review.

## Introduction

ON any single day, 15% to 19% of UK adults report experiencing symptoms of low back pain.<sup>1,2</sup> During each year 36 to 48% of adults recall having low back pain.<sup>1,3</sup> Lifetime prevalence has been estimated to be in the range of 58% to 62%.<sup>1,3,4</sup> An accurate diagnosis is important, since low back pain is occasionally an early symptom of serious systemic disease or remediable neurological impairment.<sup>5</sup> A central task for the primary care physician is to identify cases of serious disease among the majority of patients with non-specific low back pain.

Plain radiographs are commonly used to aid the diagnostic process. However, lumbar spine radiographs are neither sensitive nor specific in the detection of many serious conditions and identify many minor abnormalities that may be coincidental to the patient's symptoms. Furthermore, radiography involves a cost to the NHS, in terms of resources, and to the patient, in terms of radiation exposure.

In the UK, the first set of national guidelines specifying referral criteria for radiography of the lumbar spine were published by the Royal College of Radiologists in 1989.<sup>6</sup> Subsequent guidelines, aimed specifically at general practice, were published by the Clinical Standards Advisory Group<sup>7</sup> and the Royal College of General Practitioners.<sup>8,9</sup> The guidelines aim to reduce the number of 'unnecessary' radiographs by limiting referrals to patients with 'red flags' for serious disease (Box 1). Deyo and Diehl report that 7% of patients with red flags have therapeutically important radiography findings. In comparison, radiographs performed on patients without red flags revealed no therapeutically important findings (0%).<sup>5</sup>

In general, evidence that clinical guidelines can improve the process and outcome of healthcare is limited.<sup>10,11</sup> However, randomised trials have demonstrated that distribution of guidelines for spine radiography can reduce utilisation by 20%.<sup>12,13</sup> Furthermore, educational reminder messages attached to radiography reports have been shown to reduce the number of requests by more than guideline distribution alone.<sup>14</sup> Beyond the experimental setting, it is not known to what extent these guidelines have changed practice. Recent research suggests that general practitioners (GPs) are moving towards the guideline recommendations in the management of low back pain, by recommending increased activity and less bed rest.<sup>15</sup> However, there is no comparable information about the use of diagnostic imaging.

This study used routine data collected at two hospitals to:

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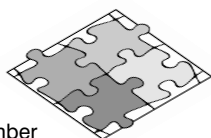
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**HOW THIS FITS IN**

*What do we know?*

Randomised trials have shown that guideline distribution can reduce the number of inappropriate lumbar spine radiography referrals. It is unclear whether this effect has been replicated in routine practice.



*What does this paper add?*

In this observational study, conducted at two hospitals, there was no reduction in the lumbar spine radiography referral rate between 1996 and 1999 and no increase in the proportion of radiographs demonstrating clinically significant findings.

- Presentation under age 20 or onset over 55
- Past history — carcinoma, steroids, HIV
- Unwell, weight loss
- Non-mechanical pain
- Thoracic pain
- Widespread neurological symptoms or signs
- Structural deformity

*Box 1. Examples of red flags for potentially serious spinal pathology*

- assess the changing volume of referrals for lumbar spine radiography between 1994 and 1999; and,
- review radiography reports to examine whether the proportion of radiographs demonstrating clinically significant disease has increased in recent years.

**Method**

*Objective 1*

All primary care requests for lumbar spine radiography were identified from computerised systems at Addenbrooke's Hospital, Cambridge and Ipswich General Hospital. In Cambridge, referrals over a five-year time interval were available (1 July 1994 to 30 June 1999), and in Ipswich over a four-year interval (1 July 1995 to 30 June 1999). Although both hospitals serve populations of approximately 300 000, it is difficult to define the exact population size as some practices have a choice of two or more equidistant radiography departments. We therefore performed a sub-group analysis selecting only referrals from the most local primary care groups (PCGs) (Cambridge city PCG and Ipswich PCG), that were served entirely by the two radiology departments in this study. For these PCGs, referral rates were calculated as the number of yearly referrals divided by the registered population of the PCG<sup>16</sup> adjusted for projected population growth.

*Objective 2*

A random sample of 2100 radiography reports, stratified by year, was drawn from the pool of referrals identified at Addenbrooke's Hospital. Two consultant radiologists and two GPs each independently reviewed 500 radiography reports in a random order. In addition, all reviewers categorised a core sample of 100 reports to assess inter-observer variability. A subsample of 20 reports was categorised

twice by each reviewer to examine reliability. Besides the report itself, the reviewers only knew the patient's age; the date of the report was concealed. From the report, the reviewers were asked to categorise the most important findings into one of ten categories: 1) normal; 2) disc degeneration; 3) facet joint degeneration; 4) other degeneration; 5) osteoporotic fracture; 6) traumatic fracture; 7) infection; 8) tumour; 9) inflammatory disorder; and 10) other diagnoses.

To estimate the diagnostic yield, radiography reports were categorised as follows: (a) normal findings; (b) relatively minor findings probably requiring symptomatic treatment only; and (c) potentially more serious findings possibly requiring specialist referral, specific investigation and/or treatment. The linear-by-linear  $\chi^2$  statistic was used to examine trends in the proportion of films demonstrating potentially more serious findings. The sample size provides 80% power to demonstrate equivalence to within 2.5% in the proportion of potentially more serious radiographic findings between early (1994–1996) and later (1997–1999) referrals, assuming a baseline value of 5%.<sup>5</sup> Percentage agreement and  $\kappa$ -statistic were used to assess reviewer agreement.

**Results**

There was no evidence that primary care referrals for radiography of the lumbar spine had decreased between 1994 and 1999 at either centre (Figure 1). The publication of the RCGP guidelines in September 1996 coincided with a dip in X-ray referrals. However, at both centres, the number of referrals increased again in 1997 to equal or exceed pre-guideline levels. Similar trends were observed for the local PCG annual referral rate (Figure 2). The average annual referral rate from the local PCG in Ipswich was higher (10.10 per 1000 patients, 95% CI = 9.84 to 10.36) than the equivalent PCG in Cambridge (4.64 per 1000 patients, 95% CI = 4.48 to 4.81). A higher proportion of patients at Ipswich was referred by practitioners outside of the most local PCG (56% versus 43% in Cambridge).

The mean age of the 2100 patients whose radiography reports were selected for review was 53.6 years (range = 7 to 94 years), 57.9% were female. Intra-observer agreement for the 20 repeated reviews was generally good (Table 1) with  $\kappa$  values indicative of moderate to substantial agreement.<sup>17</sup> Most inconsistencies concerned the classification of minor degeneration as either 'normal' or 'disc degeneration'.

Inter-reviewer agreement among the two GPs and the two radiologists was comparable to intra-reviewer agreement (Table 1). Comparison between GP reviewers and radiologists yielded slightly lower agreement. Important disagreements in interpretation were found in only two of the 100 reports reviewed by all reviewers. The radiological report for a 29-year-old patient with scoliosis indicated a sclerotic right L1 pedicle. However, the reporting radiologist observed that the findings 'may be simply artifactual due to rotation'. Two of the four reviewers (one radiologist and one GP) categorised this report as indicating the possible presence of tumour. Another report on a 27-year-old patient described a normal lumbar spine with sclerosis in both sacro-iliac joints as 'radiologically quite suggestive of sacro-iliitis'. Both GPs classified this report as an inflammatory disorder, while both radiologists classified it as normal.

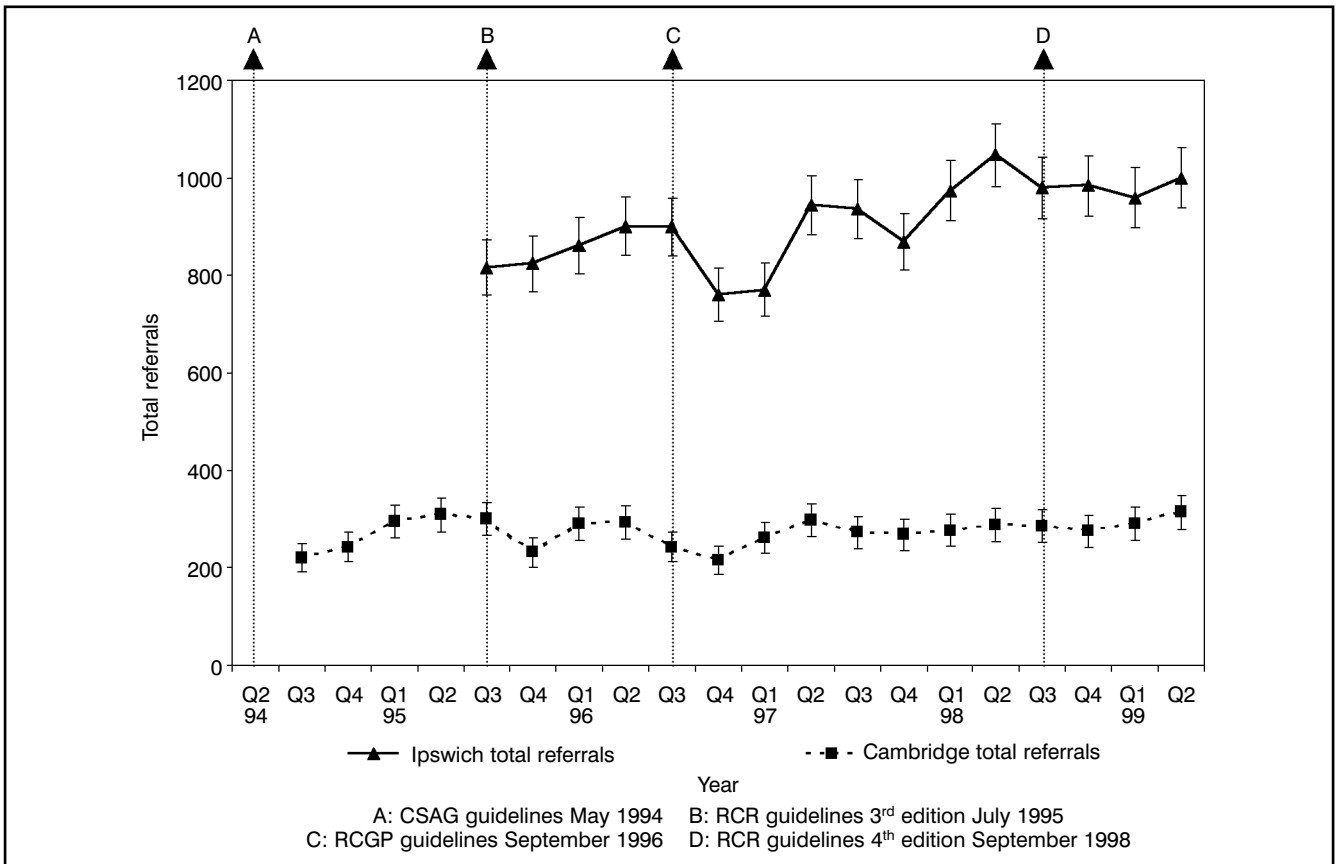


Figure 1. Trend in primary care lumbar spine radiography referrals 1994–1999.

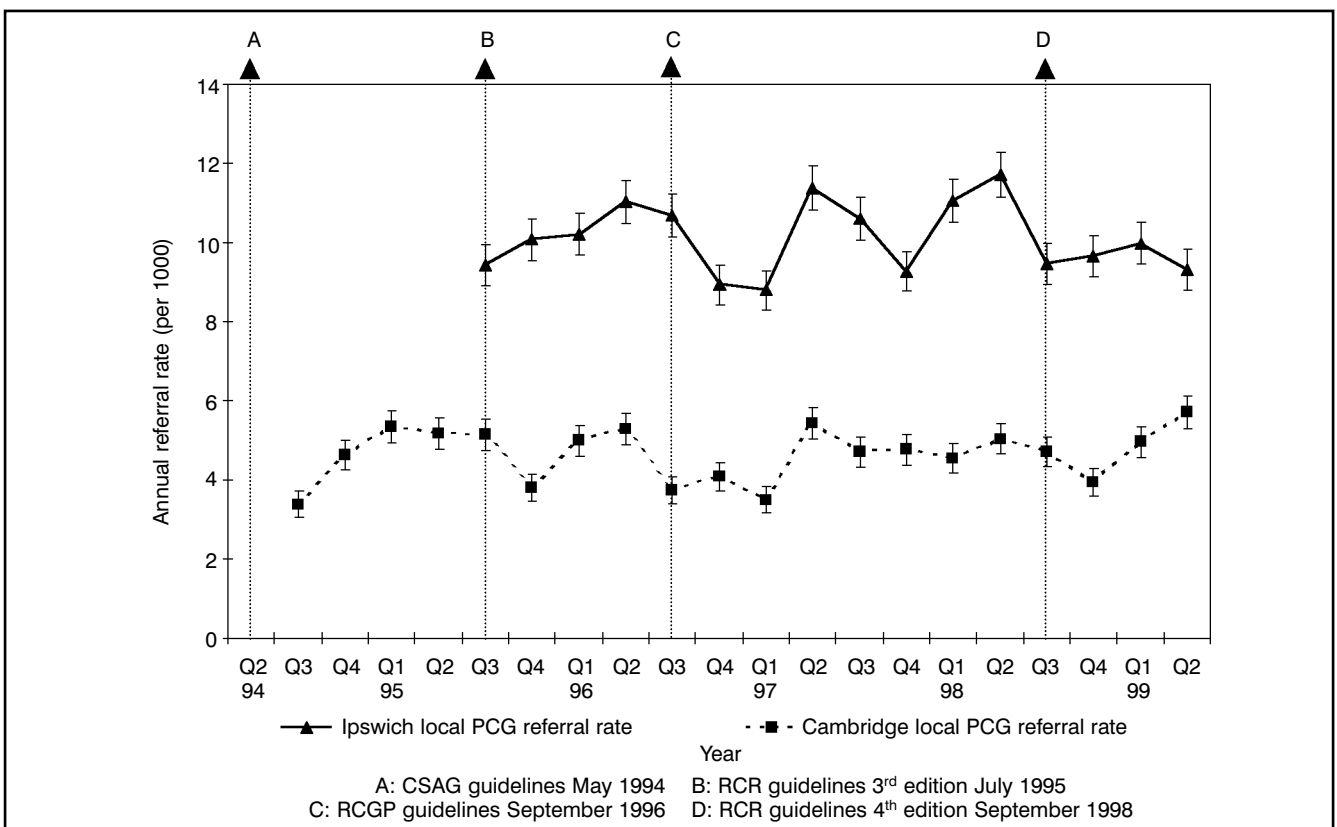


Figure 2. Trend in referral rates in 1994–1999.

Table 1. Intra- and inter-rater reliability of report classification.

Intra-reviewer test-retest ( <i>n</i> = 20) (SE)	Agreement	Kappa
GP 1	80%	0.70 (0.13)
GP 2	75%	0.63 (0.13)
Radiologist 1	70%	0.57 (0.13)
Radiologist 2	80%	0.69 (0.15)
Inter-reviewer test-retest ( <i>n</i> = 100)		
GP 1 versus GP 2	78%	0.68 (0.05)
Radiologist 1 versus Radiologist 2	78%	0.68 (0.06)
GP 1 versus Radiologist 1	64%	0.48 (0.05)
GP 1 versus Radiologist 2	64%	0.51 (0.05)
GP 2 versus Radiologist 1	72%	0.60 (0.05)
GP 2 versus Radiologist 2	66%	0.54 (0.05)

Normal findings were reported in over 40% of lumbar spine radiographs (Table 2). In a further 1012 (48%) patients, reports documented degeneration, mild spondylolisthesis, mild loss of lordosis, spondylolysis or Scheuermann's disease. Only a small proportion indicated the possible presence of tumour (0.7%), traumatic fracture (0.7%), inflammatory disorder (0.6%) or infection (0.2%). Often these more serious findings were reported tentatively, accompanied by recommendations for more definitive diagnostic studies.

There was no evidence that GPs were increasingly referring high risk patients over time (Table 3). Throughout the study period, approximately 40% of patients had no significant abnormality reported. Similarly, there was no significant change in the proportion of patients with more serious radiological findings. This result was confirmed when the analysis was restricted to the most serious radiographic findings (tumour, infection, inflammatory disorder).

## Discussion

In the two hospitals studied, we found no evidence that the rate of primary care referrals for lumbar spine radiography had fallen between 1994 and 1999. This trend contrasts with experimental evidence demonstrating that guidelines can reduce radiography requests by as much as 20%.<sup>12,13</sup> It is possible that other concomitant factors could have influenced referrals and swamped any effect of guideline dissemination. For example, changes in access to radiological services, general practice funding arrangements, and the prevalence of low back pain might have combined to negate the impact of guidelines. Nevertheless, time series analysis is one of the few methods available for determining whether the benefits predicted in intervention studies have transferred into routine practice. The absence of a long-term reduction in referrals during the past five years should lead us to question whether guidelines have significantly altered primary care use of lumbar spine radiography at these centres.

Several authors have questioned whether the introduction of radiography guidelines will reduce referrals.<sup>18,19</sup> They argue that where current utilisation is low, strict adherence to the guideline criteria may increase the number of requests for lumbar spine radiography. Therefore guidelines might alter the nature of referrals without necessarily reducing the rate of referrals. We investigated this by examining the pro-

Table 2. Radiography findings (the most serious disease suggested by the radiography report).

Findings	<i>n</i> (%)
Normal findings	855 (40.8)
Minor findings probably indicating symptomatic treatment only	
Disc degeneration	605 (28.9)
Facet joint degeneration	106 (5.1)
Other degeneration	234 (11.2)
Spondylolisthesis — mild	40 (1.9)
Spondylolysis	11 (0.5)
Scoliosis/loss of lordosis — mild	7 (0.3)
Scheuermann's disease	9 (0.4)
Previous surgery	6 (0.3)
Potentially more serious findings possibly indicating specialist work-up/treatment	
Spondylolisthesis — moderate/severe (>25%)	15 (0.7)
Scoliosis/loss of lordosis — marked/severe	10 (0.5)
Osteoporosis/osteopenia	50 (2.4)
Fracture (osteoporotic)	70 (3.3)
Fracture (traumatic)	14 (0.7)
Fracture (unspecified)	16 (0.8)
Infection	4 (0.2)
Tumour	15 (0.7)
Inflammatory disorder	12 (0.6)
Other <sup>a</sup>	7 (0.3)
Total <sup>b</sup>	2094 (100)

<sup>a</sup> Paget's disease (2), diffuse idiopathic skeletal hyperostosis (2), congenital fusion L2/L3 (1), renal calculi (1), and abdominal aortic aneurysm (1). <sup>b</sup> Six reports could not be classified, three were found not to relate to the lumbar spine and three referred to previous (unspecified) X-ray reports.

portion of reports that highlighted potentially serious disease. Guidelines target referrals at high-risk patients and should result in a higher proportion of reports recording potentially serious findings. Our results suggest that this has not happened to any significant extent. The percentage of more serious findings was consistent with other large cohorts<sup>5,20</sup> and remained stable throughout the study period. This implies either that physicians have not changed referral thresholds since 1994, or that the diagnostic triage specified in the guidelines has been no more effective at identifying high-risk patients than the *status quo*. The presumption that compliance with the guidelines will necessarily lead to a higher rate of positive radiography findings should be investigated further.

This study was restricted to two hospitals, therefore the generalisability of our findings is limited. Our choice of study period was constrained by the availability of data and we were unable to cover the period when the first guidelines were published. This study only measures the incremental effect of the later guidelines. It is possible that the number of inappropriate referrals had already been minimised before 1994 when our data commence. However, the large inter-hospital variation observed in this study suggests that there are still a significant number of inappropriate referrals.

In part, the higher number of referrals observed in Ipswich might be explained by a larger catchment area. However, comparison of the referral patterns among the PCGs closest to each hospital revealed that differences in referral rates

Table 3. Radiography findings by year of referral.

Findings	Year					
	1994 n (%)	1995 n (%)	1996 n (%)	1997 n (%)	1998 n (%)	1999 n (%)
Normal findings indicating symptomatic treatment only	93 (44.5)	161 (38.5)	175 (41.8)	166 (39.6)	170 (40.5)	88 (42.1)
Minor findings probably indicating symptomatic treatment only	90 (43.1)	218 (52.2)	195 (46.5)	214 (51.1)	215 (51.2)	94 (45.0)
More serious findings possibly indicating specialist work-up and treatment	26 (12.4)	39 (9.3)	49 (11.7)	39 (9.3)	35 (8.3)	27 (12.9)

$\chi^2$  statistic = 0.008 ( $P = 0.93$ ) for the linear-by-linear association between X-ray findings and year.

remained after adjustment for population size. The number of patients per registered GP is similar for both PCGs;<sup>16</sup> however, primary care access to radiography was easier in Ipswich. GPs could refer patients directly to radiography sessions without the need for a prior appointment. In aggregate, the referral rates reported in this study are similar to those from a recent trial conducted at radiology departments in the north east of England and Scotland.<sup>14</sup> Large variations in radiography utilisation have previously been reported between hospitals<sup>21</sup> and between regions.<sup>4</sup>

A number of factors may have limited the efficacy of the guidelines. The distribution of guidelines has been problematic; the RCGP guidelines were intended for every general practitioner in England, but only about 20% initially received them.<sup>22</sup> This has hampered dissemination; however, local initiatives based on the national work have served to amplify the message. There is also increasing evidence that merely distributing guidelines without an implementation or reinforcement strategy is of limited effectiveness and might only lead to guideline fatigue.<sup>10,23</sup> Educational reminders, the use of opinion leaders or outreach visits might help to maximise the size and duration of changes in practice. In some cases, radiographs are requested primarily for the patients' satisfaction or reassurance.<sup>12,24</sup> Other factors, such as the fear of missing important diagnoses, the need to curtail the consultation, or the belief that the results will expedite subsequent referrals may also play a role. In combination, these psychosocial pressures may confound attempts to refer on purely medical indications.

Approximately 10% of patients in this study had potentially more serious findings reported. This is likely to overestimate the diagnostic yield of radiography. In many cases the report was tentative, recommending further imaging to establish a definitive diagnosis. Equally, some findings when combined with the overall clinical picture, for example, osteopenia in the very elderly, may have a limited impact on management.

Potentially, the NHS has much to gain from the implementation of guidelines. If, as has been estimated, 600 000 lumbar spine radiographs are performed on primary care patients in Britain each year, then the 20% decrease in utilisation estimated in trials<sup>13</sup> would result in an estimated saving of £3.6 million in test costs alone.<sup>4</sup> However, if our findings are representative, then the potential reduction evident in trials has not been achieved in practice. Guideline development is an important but resource intensive process. It is essential to test dissemination and implementation policies as well as distribution in routine care.

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