How do GPs use x rays to manage chronic knee pain in the elderly? A case study

J Bedson, K Jordan, P Croft

Objectives: To determine whether clinical signs and symptoms of osteoarthritis influence general practitioners’ (GPs) decisions about x ray examination of older patients with knee pain and whether x ray reports alter their initial treatment or referral plan.

Methods: A cross sectional survey of 1000 GPs in England and Wales using “paper cases” in three questionnaires mailed at two-weekly intervals. The first questionnaire assessed GPs’ management of patients with knee pain using four case scenarios, two with features of clinical knee osteoarthritis. The second questionnaire contained the same scenarios with information on x ray findings added. The third questionnaire considered management of knee pain in general.

Results: 447 GPs responded to questionnaire 1, 316 (71%) to questionnaire 2, 287 (64%) to questionnaire 3. 106 responders (25%) would have x rayed all four patients and 64 (15%) none. Choosing to carry out an x ray examination was not influenced by the presence of clinical signs and symptoms of osteoarthritis but was linked to other management choices, such as referral to orthopaedists (odds ratio (OR) 2.13; 95% confidence interval (CI) 1.62 to 2.81). The strongest predictor in questionnaire 2 of a treatment or referral was whether it had been chosen in the first survey. However, the x ray report was associated with a significant change in treatment and referrals. Where radiographic osteoarthritis was present, GPs were less likely to refer to a physiotherapist (OR 0.64; 95% CI 0.50 to 0.83) or rheumatologist (OR 0.15; 95% CI 0.08 to 0.28), and more likely to refer to an orthopaedic surgeon (OR 31.34; 95% CI 21.51 to 45.66). Questionnaire 3 showed that GPs’ general views on the use of x rays correlated with the frequency of their choosing to x ray in the four individual case scenarios.

Conclusions: A GP’s choice to x ray older people with knee symptoms is linked with decisions on treatment and referral even before the x ray result is known, but it does not appear to be influenced by clinical features of osteoarthritis. The presence of radiographic osteoarthritis has a marked impact on the decision to refer to secondary care. More evidence on the outcome of management without x rays is needed to help GPs in decision making.

Chronic knee pain affects an estimated 25% of people over 50 years,¹ and is a common presentation among elderly patients in primary care.² Osteoarthritis is the most frequent diagnosis associated with this symptom but general practitioners (GPs) can make this diagnosis either as the clinical syndrome (pain, stiffness, restricted movement) or on the basis of the radiographic appearance (joint space narrowing, bony sclerosis, osteophytes). However, clinical osteoarthritis is not necessarily equivalent to radiographic disease because patients in this age group with knee pain will have x ray changes consistent with osteoarthritis in about 47% of cases,³ whereas only about 50% of patients with x ray evidence of knee osteoarthritis complain of pain.

The issue for primary care in establishing the place of x rays is whether routinely determining the radiographic status of older patients with knee pain leads to changes in treatment, referral, and outcome compared with management based on clinical presentation only.

Although the United Kingdom Royal College of Radiologists’ recommendation is that the routine use of x rays to investigate knee pain in primary care is inappropriate,⁴ little is known about the actual policies and practices of GPs when managing this common condition, particularly the factors that influence their decisions about treatment and referral. We have therefore carried out a study among GPs to estimate how x rays are used in the management of knee pain in older people, and how their decisions about treatment and referral might be separately influenced by the patient’s clinical presentation and the results of x rays.

METHODS
The study took the form of a cross sectional survey of GPs working either full or part time in England and Wales. The study group was chosen by randomly sampling 1000 doctors from a comprehensive list of 37 000 registered GPs held by Beechwood House Publishing Ltd, specialists in the publication and distribution of information about the NHS and local government in the United Kingdom.⁶ All questionnaires were piloted for comprehensibility and relevance on a group of 36 GPs in North Staffordshire, and on a group of five clinical and non-clinical researchers with experience in this type of survey.

Three questionnaires were mailed at two-weekly intervals to the selected GPs. The first two questionnaires (see appendix) included four clinical scenarios that the GPs might encounter in day to day practice. Each scenario revolved around a syndrome of knee pain. Each patient was aged in their mid-60s, when knee pain and osteoarthritis are generally known to be more common. Two of the scenarios described signs and symptoms consistent with clinical osteoarthritis as characterised by chronic knee pain associated with joint stiffness, crepitus, soft tissue swelling, and quadriceps weakness. The other two described chronic knee pain in the absence of these associated signs and symptoms, and as such represented “chronic simple knee pain”. For each scenario the GPs had a choice of treatments and referrals to each of which they could respond positively or negatively (advice on joint exercises, analgesia, review the patient, order an x ray of the knee, physiotherapy, a steroid joint injection, or referral to secondary...
care). Because all the scenarios contained patients of the same age and had the same management options, differences in management could be attributed either to the presence or absence of clinical osteoarthritis, possibly to the sex of the patient, to subtle differences in the brief social content provided, or to differences in standard treatment policies between GPs.

Questionnaire 2 was identical to the first but included the result of a knee x-ray examination for each patient. The scenarios made it clear that the x-ray examinations did not originate at the request of the GP. Two x-ray findings described classic radiographic osteoarthritis and the other two showed no such changes. The x-ray results were allocated so that one of the patients with “clinical osteoarthritis” had radiographic osteoarthritis and the other did not; correspondingly one of the patients with “chronic simple knee pain” had radiographic osteoarthritis and the other did not. The same management choices were available except for the option to x-ray. This allowed us to study changes in management between the first and second questionnaires, on the basis that any changes were likely to be due to the influence of the x-ray report.

The third questionnaire contained no vignettes and asked the GP directly about their perceived actions in managing chronic knee pain. A visual analogue scale was used where 1=never, and 10=always, and the GPs were asked several questions about their personal management of this problem. Examples were: how often they would make a diagnosis of osteoarthritis with or without an x-ray examination; how often they would order an x-ray; how often a patient would be reviewed; how often they would inject and refer to physiotherapy, orthopaedic clinics, and rheumatologists.

Conditional logistic regression, with patients matched with respect to GP was also used to model the data from questionnaire 1. This gave similar ORs and confidence intervals (CIs) to multilevel modelling and so has not been reported here.

### RESULTS

A hundred and forty seven (46%) GPs responded to questionnaire 1. Of questionnaire 1 responders, 316 (71%) responded to questionnaire 2, and 287 (64% of questionnaire 1, 91% of questionnaire 2) responded to questionnaire 3. There was no difference in response across the regions of England and Wales surveyed. Responders tended to come from slightly larger partnerships (median number of partners: responders 5.0, non-responders 4.0), with larger list sizes (median: responders 8275, non-responders 7617).

Table 1 shows the distribution of management choices for each patient in questionnaire 1. One hundred and six (25%) of the GPs would have x-rayed all four patients, 64 (15%) would have x-rayed none, and 249 (59%) would have x-rayed one or more, but not all. Of the 249 GPs who would x-ray some but not all patients, there was no consistent pattern choice. Only 15 (4% of all GPs) would have x-rayed both of the patients with clinical osteoarthritis and neither of the other two. Another 15 (4% of all GPs) would have x-rayed the two patients with simple knee pain but not the other two. Overall, the presence of clinical osteoarthritis did not appear to influence the decision to x-ray (OR 0.88; 95% CI 0.66 to 1.17). It did, however, increase the likelihood of offering advice on joint exercises and referral to a rheumatologist or to an orthopaedic clinic (table 2). By contrast, it was associated with a reduced chance of referral to physiotherapy or joint injections.

### Table 1: Number (%) of GPs who would choose a particular option (questionnaire 1)*

<table>
<thead>
<tr>
<th></th>
<th>Patient 1 Clinical OA</th>
<th>Patient 2 No clinical OA</th>
<th>Patient 3 Clinical OA</th>
<th>Patient 4 No clinical OA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 1 Clinical OA Female</td>
<td>330 (76)</td>
<td>318 (73)</td>
<td>287 (66)</td>
<td>256 (59)</td>
</tr>
<tr>
<td>Patient 1 Clinical OA Male</td>
<td>439 (&gt;99)</td>
<td>437 (99)</td>
<td>435 (99)</td>
<td>441 (99)</td>
</tr>
<tr>
<td>Review in few weeks</td>
<td>381 (87)</td>
<td>366 (84)</td>
<td>359 (83)</td>
<td>391 (89)</td>
</tr>
<tr>
<td>x Ray knee</td>
<td>229 (52)</td>
<td>224 (51)</td>
<td>249 (58)</td>
<td>284 (65)</td>
</tr>
<tr>
<td>Refer to physiotherapy</td>
<td>194 (44)</td>
<td>209 (48)</td>
<td>208 (48)</td>
<td>233 (54)</td>
</tr>
<tr>
<td>Inject knee with corticosteroid</td>
<td>31 (7)</td>
<td>32 (7)</td>
<td>15 (3)</td>
<td>52 (12)</td>
</tr>
<tr>
<td>Refer to rheumatologist</td>
<td>45 (10)</td>
<td>9 (2)</td>
<td>16 (4)</td>
<td>20 (5)</td>
</tr>
<tr>
<td>Refer to orthopaedic surgeon</td>
<td>17 (4)</td>
<td>75 (17)</td>
<td>184 (42)</td>
<td>84 (20)</td>
</tr>
</tbody>
</table>

*Maximum number=447.

Jonckheere-Terpstra tests were used to compare scores from questionnaire 3 with the x-ray decision making status of GPs. For this analysis, GPs were split into three groups from questionnaire 1: those wishing to x-ray all four patients, those wishing to x-ray some patients, and those GPs not wishing to x-ray at all. The Jonckheere-Terpstra test, unlike the Kruskal-Wallis test, takes into account the ordered nature of these groups (x-ray status). This analysis was performed using SPSS for Windows 10.0.11
initial management choice in questionnaire 1. In the presence of radiographic osteoarthritis, the GPs were less likely to opt for advice on joint exercises, to review, or to refer to physiotherapy or rheumatology. By contrast, there was a substantially greater willingness, if the x rays showed osteoarthritis, to refer to orthopaedics (OR 3.13; 95% CI 21.51 to 45.66). These findings hold true whether the GP had previously indicated he or she would refer to orthopaedics or not. If the x ray findings indicated radiographic osteoarthritis, the absolute proportion of GPs who would refer to orthopaedics increased, independently of patient type (clinical osteoarthritis or not). In patient 2 (radiographic osteoarthritis, no clinical osteoarthritis), this increase was from 17% to 74%. In patient 3 (radiographic osteoarthritis and clinical osteoarthritis), orthopaedic referrals increased from 38% to 62%. In other words, irrespective of the clinical presentation or the intended management plan based on that presentation, an x ray result was significantly likely to alter those plans.

Questionnaire 3 revealed consistencies between what the GPs had actually chosen to do about x rays in the clinical scenarios and how they reported that they would use x rays in general when making a diagnosis of osteoarthritis of the knee (table 4). Those choosing to x ray all the patients in the scenarios subsequently scored higher in questionnaire 3 for preferring to make a diagnosis of osteoarthritis only after x raying the knee, and lower when asked if they would make a diagnosis of osteoarthritis on clinical grounds alone. Those who had x rayed in the scenarios were also more likely to carry out an x ray examination in response to patient distress and patient request. Stipulating a particular view on the request form if they did order an x ray was scored very low regardless of x ray status.

**DISCUSSION**

Our study has demonstrated that GPs vary in their decision to x ray when managing chronic knee pain. The presence of the

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Associations between management decisions by the general practitioner and (a) clinically defined osteoarthritis (OA), (b) sex of the patient, and (c) general practitioner choice to x ray (questionnaire 1), summarised by the odds ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action taken on questionnaire 1</strong></td>
<td>**Advis on knee</td>
</tr>
<tr>
<td><strong>joint exercises</strong></td>
<td>weeks**</td>
</tr>
<tr>
<td><strong>Number</strong></td>
<td>1724</td>
</tr>
<tr>
<td><strong>No clinical OA</strong></td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Clinical OA</strong></td>
<td>1.37 (1.09 to 1.73)</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>0.90 (0.71 to 1.13)</td>
</tr>
<tr>
<td><strong>Chooses not to x ray</strong></td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Chooses to x ray</strong></td>
<td>0.55 (0.42 to 0.74)</td>
</tr>
</tbody>
</table>

* Number of observations, with each GP responder included between one and four times.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Effects of decision from questionnaire 1 and presence of radiographic OA on actions of GP in questionnaire 2, measured by odds ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action taken on questionnaire 2</strong></td>
<td>**Advis on knee</td>
</tr>
<tr>
<td><strong>joint exercises</strong></td>
<td>weeks**</td>
</tr>
<tr>
<td><strong>Number</strong></td>
<td>1222</td>
</tr>
<tr>
<td><strong>Chose action on questionnaire 1?</strong></td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>4.99 (3.48 to 7.16)</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>0.69 (0.51 to 0.93)</td>
</tr>
</tbody>
</table>

* Number of observations, with each GP responder included between one and four times.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Median (IQR) VAS* scores for options on questionnaire 3 classified by category of GP x ray choice across the four patients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>x ray status</strong></td>
<td>**n</td>
</tr>
<tr>
<td><strong>All responders</strong></td>
<td>273</td>
</tr>
<tr>
<td><strong>x ray all</strong></td>
<td>65</td>
</tr>
<tr>
<td><strong>x ray some</strong></td>
<td>161</td>
</tr>
<tr>
<td><strong>x ray none</strong></td>
<td>47</td>
</tr>
<tr>
<td><strong>p Value†</strong></td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Scale runs from 1=never to 10=always; † p values using Jonckheere-Terpstra test.

www.annrheumdis.com
clinical features of osteoarthritis appears to have little effect on this decision. However, the initial decision to x ray a patient is associated with a particular management strategy. Subsequent treatment and referral choices might have further influenced a GP’s decision about an individual patient. However, this should not undermine our overall findings. Confirmation of this comes from questionnaire 3: those GPs who indicated a general tendency to use radiology if the patient was distressed or if the patient requested an x ray were more likely to have used an x ray in the individual vignettes. It was also beyond the scope of our study to identify GPs’ knowledge of current guidelines for the use of x rays in knee pain, such as those of the United Kingdom Royal College of Radiologists. Further study of the more detailed management strategies used by GPs and their knowledge of current evidence based guidelines would be a useful area for future research.

The four clinical scenarios had only a limited amount of clinical information in them. We recognise that GPs make complex clinical decisions based on many factors, and the global changes in management that we have reported here must therefore be taken in the context of the information provided. Because demonstrable change is evident, however, the factors we have included can be taken on their own merits as representing some of the influences on the decision making process. Furthermore, our study was specifically concerned with the effect of x ray examinations on decision making, regardless of the other factors.

The wide variation in the choice to x ray among the GPs in our study has been previously observed in a “paper case” study from the Netherlands of the management of hip osteoarthritis in primary care. In our case, this variation did not seem to be influenced by the presence of clinical osteoarthritis or sex of the patient. Overall, x ray examinations were ordered in 58% of the clinically osteoarthritic cases. This compares with 88.5% in a study by Glazier et al using one knee “paper case”, in which the patient already had previously received high dose anti-inflammatory drugs.

GPs appeared consistent within themselves in their management of knee pain. A strong predictor of selecting a treatment or action in questionnaire 2 was whether they had chosen the same option when first presented with the clinical case in questionnaire 2. This compares with a two year Canadian study of knee pain management by Canadian family doctors, general internists, and rheumatologists, which indicated that each group adhered to a particular management strategy, different from the others, after all groups had all made the same diagnosis of osteoarthritis of the knee.

Although the presence or absence of clinical features of osteoarthritis did not appear to affect the choice to x ray, choosing to x ray does appear to be linked to other treatment or referral choices, including an increased likelihood of reviewing, referring to physiotherapy and rheumatology or an orthopaedic clinic. This suggests that the choice to x ray or not is a part of an overall way of managing certain patients.

It might be assumed that the rationale for an orthopaedic referral is for an opinion on active intervention such as arthroplasty, and that an x ray examination would be requested in advance to confirm the presence and severity of osteoarthritis. X Ray changes alone, however, do not reflect clinical severity, hence the recommendation by United Kingdom Royal College of Radiologists that the routine use of x rays in knee pain is inappropriate. Although our study was not an audit of actual practice, it does suggest that GPs are not necessarily following these guidelines and may be using x rays regularly in their practice. In each of the cases presented here, more than half of our sample of GPs opted for an x ray in the first questionnaire. For the GP this may be a logical thing to do. Finding osteoarthritis on an x ray gives a definite diagnosis, even if it were not to alter management or lend itself then to further appropriate action.

However, our study further shows that the x ray result can influence management decisions, the presence or absence of radiographic osteoarthritis had an impact on treatment and referral choices regardless of whether the GP would have chosen to x ray that patient or not. The most notable feature was the marked increase in referral to orthopaedics when radiographic osteoarthritis is found on x ray. This reflects the finding of an audit of GPs’ referral for imaging of the knee, in which their main reason for using x rays was to assist in making decisions about management. Coyte et al., however, found that among family doctors and rheumatologists in Canada there was no agreement about the value of grading the severity of radiographic knee osteoarthritis in helping to decide whether to refer for a knee replacement. Radiographic severity has only a minor role when applying the New Zealand priority criteria for joint replacement. This illustrates the lack of consensus on how knee x ray examinations contribute to the accurate identification of patients who would benefit from specific interventions. Furthermore, two recent population studies from Rotterdam indicate that age, pain in the knee, morning stiffness, and weakness are the most important independent determinants of functional impairment in knee and hip pain. X Ray examinations appeared to add little to the prediction of locomotor disability. To advance our management strategies in chronic knee pain, and to prevent the x ray examination superseding pain, disability, and clinical features in decision making, further research into the clinical classification of chronic knee pain is required. In particular, a study to test whether the most appropriate basis for decision making is symptoms and activity, as in the Rotterdam studies, rather than radiographic results, would be helpful.

GPs themselves appear to be aware of the influences on their decision to x ray. In questionnaire 3, when they were asked to consider referral to an orthopaedic surgeon, they scored a median of 8 of a possible 10 for the strength of their likelihood to request an x ray examination. By contrast they scored a median of 5 for their willingness to diagnose osteoarthritis only after an x ray.

Our study confirms that GPs vary in their use of x rays and that clinical decision making in older patients with chronic knee pain is not only linked to the findings on x ray but also to the decision to x ray an individual in the first place. This seems partly to reflect a facet of their character (those who would x ray a patient and those who would not). Regardless of whether a doctor is a habitual or occasional x rayer, the decision to x ray a particular patient appears bound up with other aspects of management. However, clinical decision making in older people with knee pain will also be influenced by the subsequent availability and result of an x ray examination. Given that x rays are considered in the guidelines to be an unreliable guide to taking clinical action, and that the Rotterdam studies suggest that the clinical picture is more
important in predicting disability than x ray findings, future research might usefully examine whether the x ray has any influence on the outcome of managing chronic knee pain in the elderly.

ACKNOWLEDGEMENTS

Thanks to George Peat who has contributed comments and background material to the developing paper. Thanks are also due to other members of the Primary Care Sciences Research Centre at Keele University who helped in the administration and data collection for the study, including Rhian Hughes, Joanne Bailey, Tracy Whitehurst, Jackie Gray, Christine McKinnell, Wendy Clow, Mark Pocheret, and Umesh Kadam. We would also like to thank all the GPs who took part in the survey, giving freely of their time to complete the questionnaires.

APPENDIX: CASE SCENARIOS USED IN QUESTIONNAIRES 1 AND 2

Patient No 1

Mrs Wainwright is 64 years old and presents to you for the first time with knee joint pain that she has suffered with for some time. The pain is associated with stiffness in the mornings and after resting. Examination reveals joint pain with crepitus and soft tissue swelling. She appears to have quadriceps weakness in the same leg.

*An x ray of the knee taken at the Casualty Department following a minor injury to her knee indicates slight joint space narrowing but no other features.

Patient Number 2

Mr Allan is a 63 year old ex-cricketer who now plays bowls and is 2 stones over weight. He injured his right knee 20 years ago, but it settled with conservative treatment. His complaint today is of pain in the same knee, which is worse after a weekend game of bowls. Examination reveals only joint tenderness. He feels he can’t go on like this since his bowling average is declining and would like something done to put it right.

*Mr Allan has private medical insurance and prior to consulting you, attended the local private clinic for an x ray of his knee. The report indicates marked ostearthritic change with loss of joint space and osteophyte formation.

Patient Number 3

Mr Wooley is 65 years old and presents to you the first time with knee joint pain and swelling following a holiday in Benidorm. He has had the pain for some time and complains of the knee “giving way” and after resting finds it difficult to get the joint moving. Examination reveals joint pain with crepitus and soft tissue swelling. Knee extension in this leg is weaker when compared with the other.

*On holiday Mr Wooley had seen a local doctor about his knee. Because the doctor had on site imaging he took an x ray of Mr Wooley’s knee, which shows marked ostearthritic change, loss of joint space, and osteophyte formation.

Patient Number 4

Mrs Bytheway is an old patient of yours nearing her 67th birthday. On a home visit you find she has become less mobile due to pain in her left knee. Mrs Bytheway is on the point of taking x rays on her left knee before coming to see you.

*An x ray of her knee taken the month before as part of a University study was reported as normal.

Box 1 shows the options available to the GP.

Authors’ affiliations

J Bedson, K Jordan, P Croft, Primary Care Sciences Research Centre, Keele University, Keele, Staffs ST5 5BG, UK

REFERENCES

How do GPs use x rays to manage chronic knee pain in the elderly? A case study

J Bedson, K Jordan and P Croft

doi: 10.1136/ard.62.5.450

Updated information and services can be found at:
http://ard.bmj.com/content/62/5/450

These include:

References
This article cites 15 articles, 10 of which you can access for free at:
http://ard.bmj.com/content/62/5/450#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections
Articles on similar topics can be found in the following collections

Degenerative joint disease (4641)
Musculoskeletal syndromes (4951)
Osteoarthritis (931)
Pain (neurology) (883)

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/