RESEARCH

Does comorbid disease influence consultation for knee problems in primary care?

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Aim: Knee pain affects 25% of the population aged over 55 years and is the most common complaint of pain among those consulting for primary care. However, a large proportion do not seek help, with up to 50% of those with the most severe form of pain not consulting. Little is known about why this appears to be happening. Our aim was to examine whether consultations for concurrent comorbid disease had any influence on an individual's likelihood of consulting for knee-related problems in primary care. **Methods:** This was a case–crossover control study of patients aged over 50 years from three North Staffordshire practices with knee pain followed over a three-year period. All comorbid consultations for the same period were identified. The date of knee consultation cases were identified, and within-subject control days for the same individual were determined for 12 months previously or later where there was no knee consultation. McNemar's test for matched pairs was then carried out to assess whether consultation for either a chronic or acute condition in the preceding three months was associated with knee consultation. **Results:** A total of 281 participants were included in the case–crossover analysis. There was a lower frequency of chronic comorbid consultations in the three months preceding knee consultation than in either the previous (OR = 0.30; 95% CI 0.11, 0.74) or later control windows (OR = 0.56; 95% CI 0.27, 1.09). There was no difference in the frequency of acute comorbid consultations. **Findings:** This study suggests that consultations for knee problems are preceded by a period of relatively fewer consultations for other chronic comorbid conditions. Patients might choose to consult for their knee problem when comorbid issues are not a priority. Future research might investigate whether certain comorbid conditions have a greater effect than others, and whether a proactive approach such as screening for knee disorders might improve prognosis?

Key words: co-morbidity; consultation; knee pain; primary care

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Introduction

Knee pain affects an estimated 25% of the UK population aged 55 years and over (Peat *et al.*, 2001), of whom up to a third consult their general

practitioner (GP) in any given year (Bedson *et al.*, 2005; Jordan *et al.*, 2006), making it one of the commonest pain complaints presented by older adults to primary care. Patients who have a previous history of consultation for knee problems, report more severe knee pain and associated functional limitation, and who regard their knee problem as a current health priority (even in the presence of other comorbid illness) are more likely to consult (Jordan *et al.*, 2006; Bedson *et al.*, 2007; Jinks *et al.*, 2008; Bedson *et al.*, 2009). Yet a large proportion of people with severe knee pain do not appear to consult their GP for prolonged periods, and the presence of comorbid illness may be a factor behind this. The prevalence of most chronic diseases increases with age (van den Akker *et al.*, 1998) such that older adults with knee pain are highly likely to experience other illness (Schellevis *et al.*, 1993; Kadam *et al.*, 2004; Caporali *et al.*, 2005). As a consequence, patients have competing medical problems. This is an important issue since any potential delay in managing knee pain can lead to a decreased quality of life for the patient, particularly pain associated with osteoarthritis (Barron *et al.*, 2007). In particular to prevent progression of knee disease, there is evidence that the specific knee problem an individual has needs to be determined in detail rather than simply advocating generic exercise programmes for knee problems (Lim *et al.*, 2008). This can only be done when patients are afforded the opportunity to discuss their knee problem with their doctor.

In this study, therefore, we focus on the events preceding knee-related consultation. In particular, we hypothesized that patients would consult for their knee-related problem during a relatively 'quiet' period in their overall health. In other words, there would be evidence of fewer comorbid consultations in the period preceding a knee-related consultation than in a corresponding period of time where no knee-related consultation occurred.

Methods

Participants were members of a larger observational cohort study of 819 adults aged 50 years and over with current or recent knee pain recruited between August 2002 and September 2003. This study was approved by the local

Research Ethics Committee and details of the study protocol and results of recruitment have been published in full (Peat *et al.*, 2004; 2006). Briefly, all participants were recruited from a two-stage postal survey of all adults aged 50 years and over registered with three general practices in North Staffordshire. Participants reporting knee pain within the past 12 months were invited to attend a research assessment clinic. Study participants were eligible for inclusion in the current case–crossover analysis if they provided written informed consent to medical record review and had a record of at least one knee-related consultation in the three years following baseline survey. No prior power calculation was conducted; the sample size was determined by the number of eligible participants within the Knee Clinical Assessment Study (CAS(K)) cohort.

Identification of consultations

A review of consultation data held on the general practice computer system was undertaken for the three years following, and 18 months before, attendance at the baseline research clinic for all consenting participants. Doctors at the practices routinely code and enter details of all patient consultations on computer. Individual problems are coded separately during each consultation. The participating practices are members of the Keele GP Research Partnership and the completeness of consultation coding is subject to annual quality review (Porcheret *et al.*, 2004).

Knee-related consultations

All consultations related to the knee were identified through a search of relevant Read codes (NHS Connecting for Health, 2008) and free text entries (full details of the search strategy are available from the authors). Free text entries were independently assessed by two of the authors (JB and GP). Disagreements were resolved at a consensus meeting.

Comorbid consultations

Kadam *et al.* (2006; 2008) previously developed a classification for allocating morbidity to acute and chronic categories using detailed consultation and validation studies. In this classification, there were 146 morbidities, of which 88 were acute

morbidities and 33 were chronic morbidities. Using this classification, we were able to identify whether a 'case' had had a consultation for either an acute or a chronic morbidity during the study period. All Read-coded consultations (excluding knee-related consultation) that occurred face to face with the GP or nurse and phone consultations were identified in the 18 months before baseline recruitment and the following three years. Read codes were used at the three-digit level and identified as acute or chronic using the definition of Kadam *et al.* (2006; 2008).

Case–crossover design

The case–crossover design is a means of identifying whether an event is preceded by an unusual occurrence or 'trigger' (Eriksson *et al.*, 2004; Smeeth *et al.*, 2006; Maclure, 2008). Each case serves as their own control with the control being the same individual but in a different time period. This type of study removes control selection bias and allows constant within-subject characteristics to be maintained, and thereby reducing confounding effects such as gender and age to a great extent. In addition, this design is useful in that it can allow comparative studies to be performed in relatively short spaces of time and does not require large number of individuals to obtain adequate power (Smeeth *et al.*, 2006). External issues such as seasonal variation can be limited by using a control window 12 months before or after the event of interest.

This case–crossover design allowed us to test whether comorbid consultations were more or less frequent in the period preceding knee-related consultation (the case window) than in another period in which there was no knee-related consultation (the control window). Our hypothesis differed from the usual 'triggering' hypotheses of previous case–crossover studies in which an event, such as developing a headache, triggers an action like taking an analgesic, and therefore, there is a positive association between the two. In our study, the expected direction of effect, if our hypothesis was correct, would be a negative association in that knee-related consultation would be preceded by the relative absence of comorbid consultations.

We defined case windows as the three months preceding the first knee-related consultation to occur after baseline research clinic assessment, the 'event' day. For example, if the event day was 1 April 2005, the 'case' window of time consisted of January, February and March 2005. Knee consultations could not therefore occur during this three-month case window. The three-month time frame was chosen to equate to the length of an 'episode of care' for knee pain or osteoarthritis. A knee consultation occurring before this period would be the start of an on-going 'episode of care' and would spill over into case window. Therefore, the case window needed to be completely clear for three months to ensure that the first knee consultation was a new episode, preferably patient-initiated, and not a review appointment within an on-going episode of care. To avoid multilevel modelling of multiple knee consultations within individuals, only the first knee-related consultation after the baseline clinic attendance was used

Control windows were defined as the same three calendar months as the case window but either in a year before the case window (previous control window) or a year after the case window (later control window). Therefore, in this example, the previous control window could be January, February and March 2004 and the later control window could be January, February and March 2006. Each participant could contribute a maximum of two control windows (one previous, one later; Figure 1), although a later control window could not be obtained for participants whose first knee consultation happened in the last year of follow-up.

Where a knee consultation occurred in the month following the control window, that control window was excluded from the analysis. The influence of what happened in the three-month control window could potentially extend beyond the control 'event day' we were interested in such that a knee consultation up to a month after the control window potentially might be related to that time interval. Therefore, to ensure that we did not erroneously attribute a control window to the subsequent no knee consultation group, we used this 'washout' period of one month to be absolutely certain that the control window had not been associated with a subsequent knee consultation.

Statistical analyses

Demographic and clinical characteristics of the sample overall and by knee consultation status
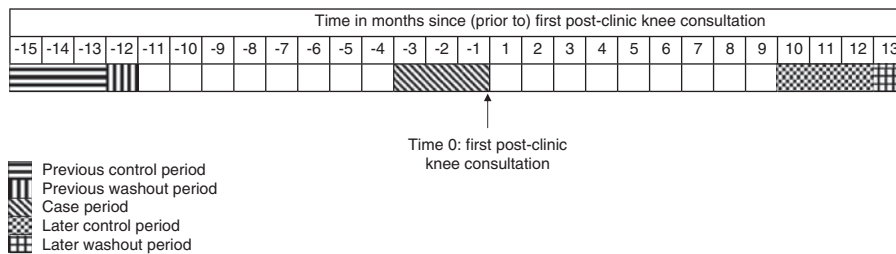
Figure 1 Case and control windows and washout periods used in the study.

were described. This included age, gender, pain severity and self-reported morbidity including chest and heart problems, hypertension and diabetes.

McNemar's test for matched pairs was carried out to assess whether consultation for either a chronic or acute condition in the preceding three months was associated with knee consultation. The extent of any association was expressed as an OR with 95% CI. These analyses were carried out separately for the retrospective and prospective control windows. All analyses were carried out using Stata 9.2. The command 'mcci' (matched case–control immediate) was used to perform McNemar's test and calculate OR and 95% CI.

In order to test the other possibility that other chronic musculoskeletal conditions were potentially linked to 'cases' of knee pain consultation, we used the conservative and rigorous approach to excluding Read code chapter N (musculoskeletal and connective tissue disorders) as a secondary sensitivity test.

Results

A total of 281 cohort participants had at least one knee-related consultation and were included in the case–crossover analysis. Their descriptive characteristics are provided in Table 1. Female participants accounted for 57% of the participants with a mean age of 66 years. A majority of 73% reported relatively mild pain with minimal disability (Chronic Pain Grade I or II), with only 12% recording onset of pain in the past 12 months and 32% for more than 10 years.

In all, 275 participants (98%) provided a previous control window, and 266 (95%) provided a later control window. The frequency of chronic and acute consultations in the case and control

Table 1 Characteristics of knee consulters

Characteristics	Knee consulters
	n or mean (% or SD)
Female	160 (56.9)
Age (years)[a]	66.4 (8.1)
Chronic Pain Grade	
I Low disability–low intensity	120 (42.7)
II Low disability–high intensity	86 (30.6)
III High disability–moderately limiting	38 (13.5)
IV High disability–severely limiting	37 (13.2)
Onset (years)	
<1	34 (12.1)
1–5	94 (33.5)
5–10	63 (22.4)
>10	90 (32.0)

[a] Data are presented as mean and SD.

windows is shown in Table 2. There was a lower frequency of chronic comorbid consultations in the three months preceding knee consultation than in either the previous (OR = 0.30; 95% CI 0.11, 0.74; exact McNemar's significance probability = 0.005) or later control windows (OR = 0.56; 95% CI 0.27, 1.09; exact McNemar's significance probability = 0.09). There was no difference in the frequency of acute comorbid consultations in either previous (OR = 0.95; 95% CI = 0.48, 1.89; exact McNemar's significance probability = 1.00) or later control windows (OR = 1.06; 95% CI = 0.51, 2.27; exact McNemar's significance probability = 1.00). When Read code N (musculoskeletal and connective tissue disorders) was removed from our analysis, the number of comorbid consultations with in the case window fell to 8, and to 0 in the control. These numbers were too small to be useful in interpreting the data, but do suggest that these

Table 2 Frequency of acute and chronic comorbid consultations in the acute and chronic control windows

Type of comorbid consultation	Control window	Number of patients (%) with exposure during case window	Number of patients without exposure during case window	Number of patients (%) with exposure during control window	Number of patients without exposure during control window	OR (95%CI)
Chronic	Previous	23 (8)	252	39 (14)	236	0.3 (0.1, 0.7)
	Later	22 (8)	244	34 (13)	232	0.6 (0.3, 1.1)
Acute	Previous	24 (9)	251	25 (9)	250	0.9 (0.5, 2.0)
	Later	25 (9)	241	24 (9)	242	1.1 (0.5, 2.5)

patients with knee-related problems had in addition a wider consultation pattern for these types of disorders as well as their knee. The most common comorbid consultation type during the study period was for essential hypertension ($n = 155$), osteoarthritis and allied disorders ($n = 108$) and diabetes mellitus ($n = 33$). We did not undertake any analysis to determine whether the frequency of knee consultation was related to any specific comorbid consultation.

Discussion

Principle findings

This study suggests that consultations for knee-related problems are preceded by a period of relatively fewer consultations for other chronic comorbid conditions. There was a significant association between lack of consultation for chronic comorbid disease in the three-month period before a knee consultation than in a matched period of 12 months. This was also seen with the later control window, but this was not significant statistically. However, there appeared to be no relationship between acute consultations for comorbid conditions and consulting for a knee-related problem. We also observed that the majority of comorbid consultations in the case and control windows were for musculoskeletal and connective tissue disorders. A proportion of our knee-related Read codes occur within this group, but not the majority, and hence it would be unlikely that there is a coding issue here in that GPs are using more general codes to cover knee-related consultations. In addition, GPs within the Keele University GP Network undergo training relating to coding, specifically of the problem they are presented with at a three-digit Read code level. The

more likely explanation is that those with knee pain have a complex of wider pain symptoms that would fall under the Read code N category and hence the greater frequency of those conditions occurring within comorbid consulting. One way to investigate this further would be to use longer-time windows before consultation to capture more details relating to consulting, in particular regarding non-musculoskeletal comorbidity.

Strengths and weaknesses

Our findings are based on a relatively modest sample drawn from the registered populations of three general practices located within a geographical region that has higher levels of social deprivation than the national average. The modest sample size of the sample was determined by the size of the CAS(K) cohort within which this analysis was based. It means that while the direction of association between knee-related consultation and preceding consultation for comorbid chronic conditions appeared consistent for previous and later control windows the estimates were quite imprecise and would be prone to change in the presence of only a small degree of misclassification. In addition, we have previously demonstrated a degree of selective participation in this cohort (Peat *et al.*, 2006). As a result of these factors the absolute estimates of consultation frequency may differ in other populations. We must also consider that during the study, some patients may have had periods when they were pain free. This time-related variability is a potential weakness of this study, since this could lead to bias in the results whereby the increased rate of chronic comorbid consultation seen in the control window might be due to the

patient being pain free and unconcerned with their knee. We were unable to adjust for, and therefore rule out the influence of, potential time-varying confounders, notably changes in pain/disability severity between case and control windows. However, both the presence of knee pain and Chronic Pain Grade have been shown to be relatively stable over time (Elliott *et al*., 2002; Bedson *et al*., 2009). Knee pain levels also show some consistency over time, since, in previous work we found that among those who do consult with knee-related problems, the proportion of those who had pain at baseline, 18 months and three years was similar (95%; Bedson *et al*., 2009). Conversely, a major strength of this study is the consistency within participants for sociodemographic factors and other chronic diseases such that we can assume these variables are not influencing our analysis.

Relationship to previous studies

In keeping with other studies, those that did consult for their knee were more likely to be older at baseline and of female gender (Jordan *et al*., 2006). With respect to the inter-relationship of comorbid consultation and knee consultation, one paper found that unlike our study, there appeared to be no correlation between comorbid consultation and knee consultation (Bedson *et al*., 2007). Whereas we considered only those who had consulted for knee pain, this study was concerned with patients who had knee pain, but not all had consulted. One reason, therefore, for this difference might be that the profile of comorbid conditions was different to the group we considered or the knee-related problem among our group was more problematic for the patient.

Study implications

Why patients consult for their knee-related problem at a time when other comorbid conditions do not feature higher on the consultation agenda of patients with knee-related problems is an important issue for general practice. If patients are less inclined to consult for their knee-related problem when comorbid problems predominate, opportunities for effective intervention may be postponed or missed. One implication, therefore, is that general practice should consider a more proactive approach. Screening for knee-related

problems during routine appointments or chronic disease clinics could potentially identify those individuals with knee disorders that might otherwise have not been treated should they have only consulted regarding a comorbid condition.

Future research

Further research is required to more precisely identify why comorbid illness influences a patient's propensity to consult for their knee pain or not. In addition, we need to determine whether certain comorbid conditions have a greater effect than others, and if we could identify such a relationship, would intervening in a proactive way by screening for knee disorders actually have a beneficial effect on the long-term prognosis?

Acknowledgments

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