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# Occupation and knee pain: a community study

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## Summary

*Objective:* To examine the relationship between knee pain and occupation in a community setting.

*Design:* A postal survey was sent to 4057 men and women aged 40–80. Subjects were asked about chronic knee pain. A question concerning job title and industry was included in addition to demographic details. Prevalence of knee pain and odds ratios for pain were calculated for the most common occupational groups.

*Results:* Response was 82% and overall prevalence of knee pain was 28%. Highest prevalence of pain was seen in carpenters and miners. Increased odds for pain (adjusted for age, gender, body mass index, social class, smoking history and psychological distress) were apparent in carpenters (4.6, 95% confidence intervals 1.9–11.1), miners (1.9, 95%CI 1.3–2.8) and construction workers (2.4, 95%CI 1.4–4.1).

*Conclusions:* Increased risk of knee pain is apparent in miners, construction workers and carpenters; occupations which are likely to involve knee bending and possibly heavy lifting. © 2000 OsteoArthritis Research Society International

*Key words*: Occupation, Knee pain, Knee osteoarthritis, Epidemiology.

## Introduction

Certain occupations may predispose to the development of osteoarthritis (OA). Farmers appear to be at particular risk of hip OA[1] and textile work may associate with specific patterns of hand OA.[2] OA of the knee has been reported to be more prevalent in miners,[3] concrete workers[4] and shipyard workers[5] than in men who undertake more sedentary work. More recently this propensity to develop structural OA has been linked to specific occupational activity such as kneeling or squatting.[6] These studies have all required moderate or severe structural change to define osteoarthritis but have not all required the presence of symptoms such as pain. The discordance between radiographic severity and pain is, however, well recognized.[7] This discrepancy is becoming increasingly apparent in terms of risk factors for pain and for radiographic change. The aim of the current study was to examine the association of occupation with reporting of knee pain in the community.

## Subjects and methods

### SUBJECTS

The study population comprised men and women aged 40–79 registered at two general practices in Nottingham. One practice was located in a village which was previously a coal mining community, the other is a city practice. The study population was selected by randomly sampling the practice lists, preserving the age and sex distribution. Subjects were excluded by their general practitioners according to the following criteria: recently diseased ($N$=16), terminally ill ($N$=11), suffering from serious psychiatric illness ($N$=8), severely demented ($N$=18), moved from practice ($N$=200). The final study population consisted of 4057 subjects (2096 women, 1961 men).

### POSTAL SURVEY

Presence of absence of knee pain for this study was defined by the following question:
'Have you ever had pain in or around the knee on most days for at least a month? If so, have you experienced any pain during the last year?'
To be designated knee-pain positive a 'yes' response was required to both parts of the question. Details concerning the relative sensitivity of this question have been published elsewhere.[8] In addition to knee pain, crude data was obtained concerning hip and back pain and other medical conditions.

Detailed questions were included concerning job title, industry in which the subject was employed and the nature of the work undertaken. Both last job undertaken and longest job undertaken were ascertained.

Questions concerning height, weight and smoking history were included. For smoking history, subjects were defined as ever/current smokers or non-smokers. The Anglicized version of the SF-36 health status questionnaire[9] was also incorporated and the mental health dimension was used to give a measure of psychological distress. The relationship of these variables to self-reported knee pain in this population has been previously reported.[10]

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Table I
*Age distribution (%) of study population in comparison to the total Nottingham population aged 40–79*

| Age | Study population *N*=3326 | Nottingham population *N*=101,100 |
|---|---|---|
| 40–44 | 16.7 | 15.3 |
| 45–49 | 17.6 | 12.8 |
| 50–54 | 14.3 | 12.6 |
| 55–59 | 12.4 | 12.7 |
| 60–64 | 12.5 | 13.6 |
| 65–69 | 10.7 | 13.6 |
| 70–74 | 9.8 | 10.6 |
| 75–79 | 5.9 | 8.7 |

All questionnaires were mailed with a covering letter. Non-respondents were sent a reminder letter and further questionnaire after 3 weeks.

### STATISTICAL ANALYSIS

An occupation code was assigned to each subject using the Standard Occupational Classification system.[11] Where last and longest job titles differed, longest job title was used in subsequent analysis. Social class was derived using the same classification. For female subjects, husbands occupational code was used to define social class. Body mass index (BMI) was calculated (BMI=weight (kg)/[height (m)$^2$]. Statistical analysis was performed using SPSS for windows 6.0 (SPSS Inc.). Prevalence of knee pain was calculated for the most common occupational groups. Odds ratios for knee pain for the key manual occupations were calculated using multiple logistic regression adjusted for age, gender, body mass index, social class, smoking history and mental health scores and are in comparison to other non-key occupations.

## Results

Response rate to the postal survey was 82%. Table I shows the age distribution of this population in comparison to the population of Nottingham as a whole. Overall prevalence of knee pain was 28% (28% in men and 29% in women). Data concerning the prevalence of hip pain, back pain and other comorbid conditions have been published elsewhere.[10] Of those with knee pain, the prevalences of co-existent back and hip pain were 54% and 31% respectively. The prevalence of other conditions was not significantly higher in those with knee pain.

Insufficient information to allow occupational coding was apparent in 7% of subjects (3% of men, 12% of women). Variation in prevalence with occupational group for men and women are shown in Table II and Table III respectively. High rates of prevalence in men are apparent for carpenters and miners and in women for sales assistants. Low prevalence in men is apparent for managers and teachers and in women for secretaries, cleaners and teachers. Corresponding adjusted odds ratios for the key manual occupations are presented in Table IV. Risk was significantly increased in carpenters (OR 4.6, 95%CI 1.9–11.1), miners (OR 1.9, 95%CI 1.3–2.8) and construction workers (OR 2.4, 95%CI 1.4–4.1). Overall risk for manual occupation (miners, carpenters, construction workers, fitters) was also significantly increased (OR 1.8, 95%CI 1.4–2.4).

Table II
*Prevalence of knee pain in men in different occupational groups*

| Occupation | Number of subjects with occupation | Mean age (range) | Knee pain prevalence (%) |
|---|---|---|---|
| Carpenter | 24 | 57.6 (41–78) | 60.9 |
| Miner | 148 | 62.2 (41–78) | 45.1 |
| Construction worker | 61 | 53.1 (40–76) | 42.6 |
| Fitter | 86 | 56.0 (40–78) | 35.3 |
| Driver | 82 | 54.7 (40–78) | 27.8 |
| Clerk | 32 | 60.8 (41–79) | 25.0 |
| Manager | 186 | 54.3 (40–77) | 22.0 |
| Police/security officer | 43 | 53.8 (40–79) | 23.8 |
| Teacher | 72 | 50.8 (40–77) | 20.8 |

Table III
*Prevalence of knee pain in women in different occupational groups*

| Occupation | Number of subjects with occupation | Mean age (range) | Knee pain prevalence (%) |
|---|---|---|---|
| Sales assistant | 145 | 56.1 (40–78) | 37.1 |
| Manager | 55 | 50.7 (40–79) | 20.4 |
| Machinist (textiles) | 110 | 60.4 (40–77) | 31.5 |
| Nurse | 79 | 57.0 (40–75) | 31.6 |
| Receptionist | 39 | 51.0 (40–75) | 28.2 |
| Clerk | 213 | 56.8 (40–79) | 24.5 |
| Secretary | 94 | 54.6 (40–79) | 23.4 |
| Cleaner | 117 | 57.6 (40–79) | 21.9 |
| Teacher | 107 | 52.0 (40–78) | 18.9 |

Table IV
*Association between knee pain and occupation*

| Occupation | Numbers exposed | | Odds ratio* | 95% confidence intervals |
|---|---|---|---|---|
| | Pain positive | Pain negative | | |
| Carpenter | 14 | 10 | 4.6 | 1.9–11.1 |
| Miner** | 65 | 79 | 1.9 | 1.3–2.8 |
| Construction worker | 26 | 35 | 2.4 | 1.4–4.1 |
| Fitter | 32 | 55 | 1.6 | 1.0–2.6 |
| Manual occupations*** | 148 | 213 | 1.8 | 1.4–2.4 |
| All other occupations | 757 | 2035 | 1.0 | |

*Odds ratios are adjusted for age, gender, body mass index, social class, smoking history and mental health score, and are comparative to all occupations other than those listed.
**Four miners have been excluded from analysis due to missing data.
***All miners, construction workers, fitters and carpenters.

## Discussion

This study has demonstrated clear associations between occupation and knee pain in this community. Miners, construction workers and carpenters are at greater risk of knee pain. An association between structural OA and coal mining work was first reported in English surveys of the 1950s, with miners having a six-fold increase in prevalence of severe disease compared to sedentary workers.[3] Data on knee pain was limited and did not show a clear association.[12] Other observational studies have reported similar findings with respect to occupations involving heavy labour and prevalence of structural OA.[4,5] Such studies have not, however, adjusted for potential confounders such as BMI and smoking history.

Data from National Health and Nutrition Examination Survey showed an independent cross-sectional association with occupation.[13] This has been confirmed in prospective data from Framingham.[14] Both studies have reported associations with jobs involving knee bending and in the latter study knee bending together with high physical demands. Only Framingham examined symptomatic knee OA. No association was found but numbers were small. One previous community-based study has examined the relationship of occupation with knee pain *per se*.[15] Knee pain was more common in occupations involving moderate physical activity compared to those with light activity, but not more common with heavy activity. The findings, however, are limited by the small numbers with knee pain and the relatively young age of participants.

The association between bending and physical load with knee OA in these studies may serve to explain the findings of the current study. Miners, carpenters and construction workers would be expected to have bending or squatting activities and, for miners and construction workers in particular often with additional lifting. This would be in keeping with animal studies, in which repetitive loading may induce cartilage change consistent with OA.[16] Attempting to extrapolate directly from job title, however, though frequently undertaken in studies, may be problematic. There is evidence for back pain that job title may be a poor surrogate for postural loading, though similar data is not yet available for the knee.[17] One study which has overcome such problems by utilizing a detailed interview, confirmed squatting and kneeling as risk factors for knee OA.[6] This risk was heightened if accompanied by regular heavy lifting.

This study has focused on knee pain rather than structurally defined OA for several reasons. Firstly, there remains contention as to what degree of radiographic change constitutes osteoarthritis, with concern that current radiological methods may be relatively insensitive particularly with regard to early disease.[18] Secondly it is symptoms rather than radiographic disease that provoke the need for temporary or permanent absence from employment and the need for medical intervention.[7] The mechanisms of pain at the knee are unclear. Knee pain may be to some extent be acting as a surrogate for knee OA and include early involvement. Periarticular problems and minor injury may account for some pain reporting, particularly in those still engaged in physically demanding occupations. Serious mechanical derangement has not been assessed in the current study and is difficult to accurately measure from a postal survey. The crude data with respect to hip and back pain suggest that knee pain is not acting merely as a surrogate for chronic widespread pain.

Clearly the associations reported in this community may differ from other populations. General practice lists, however, contain the majority of the local population irrespective of medical needs. This together with the similarity with respect to age distribution, the random selection procedures and good response rate suggest that our population are broadly representative of the Nottingham population. The possibility of other confounding variables must be considered. Psychological distress is an important factor in pain reporting[19] and has been adjusted for in the current study. Participation in leisure activities could have differed between occupations. The effect of such activities is still debated in terms of knee OA and knee pain,[20] and would have been difficult to measure in this study. Recall bias may have occurred but since occupation and knee pain was not the only focus of the questionnaire, it should have been minimal.

This study has demonstrated an independent association between knee pain reporting and occupation in this population. Manual workers such as miners, construction workers and carpenters have an increased risk of pain suggesting that joint loading may be important.

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