Prevalence and risk factors for joint pain among men and women in the West of Scotland Twenty-07 study

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EXTENDED REPORT

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Objective: To examine the association between three modifiable risk factors (obesity, smoking, and alcohol consumption) and reported joint pain.
Methods: Cross sectional data were collected on 858 people aged 58 years living in the West of Scotland and on the same individuals four years later, aged 62 years.
Results: There was a positive relation between obesity and reported pain in the hips, knees, ankles, and feet. The strongest relation was with knee pain (odds ratio = 2.42 (95% confidence interval, 1.65 to 3.56)). There were no strong consistent associations between smoking habits and pain in any joint after adjusting for sex, alcohol consumption, body mass index, social class, and occupational exposures. Similarly, alcohol was not consistently related to pain in any joint in the fully adjusted models.
Conclusions: Obesity had consistent and readily explained associations with lower limb joint pain. The data suggest that smoking behaviour and alcohol consumption are not consistently associated with joint pain across the body.

Joint pain is common among older people in the community[1 2] and is a major cause of disability.[1–6] Despite not representing a clear diagnostic entity, joint pain is a major public health issue in its own right. Identifying modifiable risk factors for joint pain in older age should therefore be given a high priority. Many studies investigating the relation between potential risk factors and joint problems use osteoarthritis as the major outcome.[7] While many aetiological and associating factors have been described in structurally defined osteoarthritis, corresponding factors in terms of joint pain are less well established.[6] As joint pain is not synonymous with osteoarthritis, its risk factors may differ from those identified for osteoarthritis.[8 9] Joint pain has been an outcome of interest in some studies, but these have concentrated on single anatomical sites.[4 6 8–10] Data on the determinants of musculoskeletal pain at anatomical sites other than shoulder, knee, and back are scarce.[2] In this study we considered the relations of alcohol consumption, smoking, and obesity with reported pain at all the major joints, as there is evidence to suggest these may be important risk factors for joint pain.[2 5 6 8 11]

The West of Scotland Twenty-07 study provided a rare opportunity to examine joint pain at several sites across the body, enabling us to study pain in joints previously well researched alongside those that receive much less attention.

METHODS

The data are from the West of Scotland Twenty-07 study, a longitudinal study that was set up to investigate the social patterning of health among three cohorts, aged around 15, 35, and 55 years when first interviewed in 1987/88. Each of the three cohorts comprised approximately 1000 people. Respondents were drawn from clustered random samples from the Central Clydeside Conurbation, a socially varied but mainly urban area centred on the city of Glasgow. The samples were found to be broadly representative of the populations from which they were drawn, using 1991 census data.[12] The participants are being followed up (approximately every four years) using face to face interviews and postal questionnaires. The interviews are conducted by trained nurses, usually in the participants' homes. Further details on the sample and methods are available elsewhere.[13 14]

This analysis is limited to data from the oldest cohort collected in 1990/91 when 858 individuals were reinterviewed when they were approximately 58 years old. This wave of data collection included a wide range of measures of disability, self reported health, and sociodemographic factors. These measures were repeated at subsequent contact with the respondents in 1995 (aged 62 years). The majority of the results presented are from the 1990/91 data, as this wave of data collection had the greatest number of respondents and the prevalence of joint pain was very similar for respondents at ages 58 and 62 years.

Joint pain

Respondents were presented with a basic diagram of the human skeleton (a stick person) and were asked for each joint 'Do you regularly suffer from any swelling, pain or stiffness?'. Data were collected on the neck, back, and separately for the right and left sides of the body for shoulders, elbows, wrists, hand/fingers, hips, knees, ankle, and feet/toes. Respondents were included as having joint problems if they recorded having slight, moderate, or severe pain in either the left or the right joint.

Body mass index

Nurse interviewers recorded the standing height and weight of participants using a stadiometer and scales which were regularly calibrated. Body mass index (BMI) was calculated (kg/m^2) and obese people were classified as those with a BMI greater than 30 kg/m^2. A categorical variable was also generated for BMI (<20 kg/m^2, >20 to $\leqslant 25$ kg/m^2, >25 to <30 kg/m^2, and $\geqslant 30$ kg/m^2) to assess any dose–response relation between BMI and joint pain.

Smoking

Respondents were asked if they ever smoked tobacco (including pipe, cigars, and roll-ups as well as manufactured cigarettes). Study participants were divided into never smokers, ex-smokers, or current smokers. For some of the

Table 1 Prevalence of reported joint pain

	Men		Women		Total	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Neck pain	87	21.8 (17.8 to 26.2)	168	36.6 (32.2 to 41.2)	255	29.7 (26.7 to 32.9)
Back pain	104	26.1 (21.8 to 30.7)	151	32.9 (28.6 to 37.4)	255	29.7 (26.7 to 32.9)
Shoulder pain	84	21.1 (17.2 to 25.4)	135	29.4 (25.3 to 33.8)	219	25.5 (22.6 to 28.6)
Elbow pain	37	9.3 (6.6 to 12.6)	62	13.5 (10.5 to 17.0)	99	11.5 (9.5 to 13.9)
Wrist pain	26	6.5 (4.3 to 9.4)	64	13.9 (10.9 to 17.5)	90	10.5 (8.5 to 12.7)
Pain in hands	53	13.3 (10.1 to 17.0)	139	30.3 (26.1 to 34.7)	192	22.4 (19.6 to 25.3)
Pain in hips	65	16.3 (12.8 to 20.3)	93	20.3 (16.7 to 24.2)	158	18.4 (15.9 to 21.2)
Knee pain	122	30.6 (26.1 to 35.4)	153	33.3 (29.0 to 37.9)	275	32.1 (28.9 to 35.3)
Pain in ankles	46	11.5 (8.6 to 15.1)	78	17.0 (13.7 to 20.7)	124	14.5 (12.2 to 17.0)
Pain in toes	48	12.0 (9.0 to 15.6)	80	17.4 (14.1 to 21.2)	128	14.9 (12.6 to 17.5)

analyses these categories were collapsed into current versus previous/never smokers.

Alcohol intake

Respondents were asked to report the number of units of alcohol they drank each day over the previous week, reporting separately for beer/lager/cider, wine, fortified wine, spirits, and other forms of alcohol. Overall alcohol intake for the week was calculated for each of the subtypes of alcohol and the total number of units for all forms of alcohol.

Confounding factors

Social class was measured using the Registrar General's occupational social class categories based on the longest held occupation of the head of household (I, professional; II, managerial; IIInm, skilled non-manual; IIIm, skilled manual; IV, semiskilled manual; V, unskilled manual). Common workplace exposures were also measured, including how many years the respondent had undertaken heavy manual work, frequent bending, and exposure to vibrations (for example, drilling). Data were categorised into none compared with one or more years of exposure. More detail on the measurement of workplace exposures has been reported elsewhere.[15]

Analysis

The relation between joint pain and each risk factor was assessed using *t* tests, χ^2 tests, and univariable regression. Multiple logistic regression was used to assess the association between joint pain (any joint pain on either the left or the right side of the body) at each site and obesity, smoking, and total weekly alcohol intake, with adjustment for potential confounding factors (sex, social class, and occupational exposures). All analysis were conducted using STATA 7.

Ethics

Initial ethical approval for the study was given in 1987 by the ethics subcommittee of the West of Scotland Medical Committee. Each subsequent set of contacts has been approved by the University of Glasgow's ethics committee for non-clinical research involving human subjects. The study follows ethical principles as set out in the Medical Research Council's ethics and best practice guidelines.

RESULTS

Joint pain was prevalent among survey respondents in the West of Scotland (table 1). For all joints, pain was more often reported by women than by men, and this was most notable for reported pain in the hands. The most common type of joint pain among women was neck pain (36.6%) and among men was knee pain (30.6%). The prevalence of joint pain in most of the sites considered was largely similar to that found in previous studies, with the exception of neck pain, which was much more prevalent in this cohort.[16]

Obesity and joint pain

Mean BMI in the sample was 26.2 kg/m^2, and over 15% of the respondents were obese (BMI>30 kg/m^2) (table 2). Obesity was more common among women (19.0%) than among men (11.8%). Obesity was associated with joint pain in the lower half of the body but in none of the joints in the upper body (table 3). Obese respondents had twice the odds of reporting hip pain (odds ratio (OR) = 2.03 (95% confidence interval (CI), 1.32 to 3.13)) and more than twice the odds of reporting knee pain (OR = 2.42 (1.65 to 3.56)) after adjusting for sex, smoking, alcohol intake, and social class. Further adjustment for occupational exposures had little effect on the strength of these associations. Data from 1995 showed similar results for most of the joints, although there was no strong association between hip pain and obesity (unadjusted OR = 1.37 (0.92 to 2.03)). The 1995 data also showed an association between ankle pain and obesity; in the fully adjusted model, obese respondents were 60% more likely to report ankle pain than those not obese (OR = 1.60 (1.02 to 2.50), p = 0.041). When BMI was examined as a categorical variable, for those joints where an association was noted between BMI and joint pain there was evidence of a dose–response relation—that is, as BMI increased the strength of the association between joint pain and BMI also increased.

Smoking and joint pain

Two thirds of the sample were either current or previous smokers (table 2); current smoking was more common among men (43.1%) than among women (35.3%). After adjustment for sex, alcohol intake, BMI, and social class, smoking was associated with reported pain in the back and pain in the shoulder (table 4). However, further adjustment for occupational exposures attenuated these relations further (OR for back pain = 1.32 (95% CI, 0.97 to 1.82), p = 0.078; OR for shoulder pain = 1.34 (0.97 to 1.86), p = 0.080), though an increased risk of pain among smokers did remain. Results were very similar using data from 1995. Other studies have noted a relation between smoking and upper limb pain[17 18] which is consistent with the mechanical stress associated with posture and repetition of movement.[18] Explanations based on the generalised pharmacological effect of tobacco smoke[11] are not borne out in this data.

Alcohol consumption and joint pain

Mean weekly alcohol consumption was higher amongst men than women, for all alcohol types (table 2). Beer/lager/cider was the favoured alcohol type among men (mean weekly consumption 6.5 units) and spirits for women (mean weekly consumption 1.8 units).

Table 2 Prevalence of potential risk factors and confounding factors

	Men		Women		Total	
Reported alcohol intake in previous week (mean (SD) and range)						
All drinks	12.8 (16.6)	0 to 189	2.9 (4.7)	0 to 44	7.5 (12.8)	0 to 189
Beer	6.5 (10.7)	0 to 56	0.2 (1.3)	0 to 13	3.1 (8.0)	0 to 56
Wine	1.0 (4.5)	0 to 72	0.6 (1.6)	0 to 10	0.8 (3.3)	0 to 72
Spirits	5.2 (12.6)	0 to 189	1.8 (4.1)	0 to 44	3.4 (9.3)	0 to 189
Smoking behaviour (n and % (95% CI)						
Current smoker	172	43.1% (38.2 to 48.1)	162	35.3% (30.9 to 39.9)	334	38.9% (35.6 to 42.3)
Body mass index (mean (SD) and range)						
BMI (kg/m^2)	26.0 (3.4)	17.8 to 40.3	26.3 (4.9)	13.1 to 48.1	26.2 (4.3)	13.1 to 48.1
Obese (BMI>30 kg/m^2)*	46	11.5% (8.6 to 15.1)	87	19.0% (15.5 to 22.8)	133	15.5% (13.1 to 18.1)
Intermediaries and potential confounders (n and % (95% CI))						
Manual social class	253	63.4% (58.5 to 68.1)	244	53.2% (48.5 to 57.8)	497	57.9% (54.5 to 61.3)
Occupation, vibrations	170	42.7% (37.8 to 47.7)	88	19.5% (16.0 to 23.5)	258	30.4% (27.3 to 33.6)
Occupation, bending	180	45.2% (40.3 to 50.3)	89	19.7% (16.1 to 23.7)	269	31.7% (28.5 to 34.9)
Occupation, arduous	227	57.0% (52.0 to 62.0)	151	33.4% (29.1 to 38.0)	378	44.5% (41.1 to 47.9)

*Values are n and % (95% CI).
CI, confidence interval.

In the univariable analysis alcohol intake was negatively associated only with reported pain in the elbow, wrist, and hand joints (table 5). For each unit increase in alcohol consumption (over the previous week) there was a *reduced* risk of having reported painful joints in either elbow, wrist, or hand. For all other joints considered, the 95% confidence intervals for the odds ratios calculated included 1. After adjustment for smoking, social class, sex, and BMI, only reported pain in the elbow remained associated with alcohol intake. For each unit increase in alcohol consumption in the previous week a 3% reduction in risk of reporting pain in the elbow joints was observed (OR = 0.97 (95% CI, 0.94 to 0.99), p = 0.025). However, when the analysis was conducted using data from 1995, there were no associations between alcohol consumption and joint pain at any site.

DISCUSSION

In this study we found that of the three risk factors examined only obesity had strong, specific, and biologically plausible relations with joint pain in the lower limbs, while neither smoking nor alcohol intake was consistently associated with pain in any of the joints examined.

Obesity and joint pain

Obesity is more likely to be associated with joint pain in the lower half of the body. Data from both waves of data collection in this study showing a strong relation between obesity and knee pain. Data from 1990/91 also showed an association with hip pain, and in data from 1995 an association with ankle pain was observed. These data confirm previous reports of the relation between obesity and joint pain.[5 8] Obesity is a strong risk factor for osteoarthritis of the hip and knee, which obviously may be the underlying explanation for lower body joint pain.[19–22] It has been speculated that obesity may act by increasing the mechanical stress in weight bearing joints.[23] This is supported by the finding that cumulative workplace and leisure time mechanical load is associated with hip pain, independent of a diagnosis of osteoarthritis.[24] The data showed some evidence of a negative relation between obesity and back pain. We considered whether this observed relation was related to height, as some studies indicate that tallness is a risk factor for back pain[25]; however, we did not find evidence for an association between back pain and height.

Smoking and joint pain

Our data suggest that there is no strong consistent relation between smoking (current or previous) and joint pain at any of the joints examined. Previous research examining the association between joint pain and smoking behaviour has been inconsistent, with some studies showing a positive association[18 26] and others suggesting no association.[8] The data using osteoarthritis as an outcome are equally contested, with some studies showing a modest protective effect of smoking,[27 28] thought to act by preventing cartilage destruction. However, other studies have shown no such associations.[29 30]

Alcohol and joint pain

Alcohol intake has several effects on bone, and increased alcohol consumption has been shown to be associated with high bone density.[24] Therefore, it might be expected that increased alcohol consumption might be associated with increased reporting of joint pain among respondents, through an increase in bone density). However, there was no strong consistent association between alcohol consumption and reported pain in any of the joints examined, so this hypothesis was not borne out.

Table 3 Odds ratio of reporting joint pain for obese compared to not obese

	Unadjusted OR (95% CI)	p Value	OR adjusted for sex, smoking, alcohol consumption, SOC	p Value
Neck	0.82 (0.54 to 1.24)	0.351	0.74 (0.48 to 1.14)	0.178
Back	1.02 (0.68 to 1.53)	0.922	1.00 (0.66 to 1.51)	0.987
Shoulder	0.96 (0.62 to 1.47)	0.838	0.91 (0.58 to 1.41)	0.660
Elbow	0.58 (0.29 to 1.15)	0.118	0.57 (0.28 to 1.15)	0.119
Wrist	1.31 (0.75 to 2.30)	0.349	1.22 (0.68 to 2.18)	0.506
Hand	1.29 (0.85 to 1.98)	0.237	1.14 (0.73 to 1.77)	0.559
Hip	2.11 (1.39 to 3.22)	0.001	2.03 (1.32 to 3.13)	0.001
Knee	2.43 (1.67 to 3.54)	<0.001	2.42 (1.65 to 3.56)	<0.001
Ankle	1.55 (0.96 to 2.51)	0.071	1.49 (0.91 to 2.43)	0.111
Feet	1.76 (1.11 to 2.80)	0.016	1.73 (1.07 to 2.78)	0.025

CI, confidence interval; OR, odds ratio; SOC, social class.

Table 4 Odds ratio of reporting joint pain for current smokers compared to ex-smokers/non-smokers

	Unadjusted OR (95% CI)	p Value	OR adjusted for sex, alcohol, BMI, SOC	p Value
Neck	1.20 (0.89 to 1.61)	0.236	1.21 (0.88 to 1.65)	0.243
Back	1.38 (1.02 to 1.85)	0.036	1.39 (1.02 to 1.90)	0.036
Shoulder	1.42 (1.04 to 1.94)	0.028	1.40 (1.01 to 1.93)	0.044
Elbow	1.23 (0.81 to 1.87)	0.329	1.19 (0.77 to 1.85)	0.437
Wrist	1.05 (0.67 to 1.64)	0.825	1.11 (0.69 to 1.77)	0.670
Hand	1.16 (0.84 to 1.61)	0.377	1.28 (0.91 to 1.81)	0.166
Hip	1.12 (0.79 to 1.59)	0.528	1.19 (0.82 to 1.72)	0.349
Knee	1.00 (0.74 to 1.34)	0.994	1.07 (0.79 to 1.46)	0.649
Ankle	0.91 (0.62 to 1.35)	0.651	0.94 (0.62 to 1.42)	0.771
Feet	1.01 (0.69 to 1.48)	0.973	1.02 (0.68 to 1.52)	0.941

BMI, body mass index; CI, confidence interval; OR, odds ratio; SOC, social class.

Table 5 Odds ratio of reporting joint pain for each increase unit of alcohol consumption

	Unadjusted OR (95% CI)	p Value	OR adjusted for sex, smoking, BMI, SOC	p Value
Neck	0.99 (0.97 to 1.00)	0.079	1.00 (0.99 to 1.01)	0.980
Back	0.99 (0.98 to 1.00)	0.185	1.00 (0.98 to 1.01)	0.507
Shoulder	0.99 (0.97 to 1.00)	0.131	1.00 (0.98 to 1.01)	0.529
Elbow	0.97 (0.94 to 0.99)	0.013	0.97 (0.94 to 0.99)	0.029
Wrist	0.96 (0.94 to 0.99)	0.014	0.98 (0.95 to 1.01)	0.172
Hand	0.97 (0.95 to 0.99)	0.002	0.99 (0.97 to 1.01)	0.340
Hip	1.00 (0.99 to 1.01)	0.949	1.00 (0.99 to 1.02)	0.585
Knee	1.00 (0.98 to 1.01)	0.458	1.00 (0.98 to 1.01)	0.603
Ankle	0.98 (0.96 to 1.00)	0.105	0.99 (0.97 to 1.01)	0.362
Feet	1.00 (0.98 to 1.01)	0.819	1.00 (0.99 to 1.02)	0.536

BMI, body mass index; CI, confidence interval; OR, odds ratio; SOC, social class.

Study limitations

Pain is a subjective experience and is most commonly measured by self report questionnaire. In this study the measurement of pain was not intended as a proxy for the presence of osteoarthritis or other disorders. However, it is acknowledged that joint pain is reported more often by those with musculoskeletal disorders than those without, yet does not explain all of the observed variation.[9 31]

Measures of both smoking behaviour and alcohol consumption were based on self report. It might be expected that respondents would underreport these activities, given the social implications of being a smoker or a heavy drinker. While it is unlikely that any misreporting of these activities is associated with joint pain, this does mean that any of the observed associations between smoking and joint pain or alcohol use and joint pain may have been driven towards the null, resulting in false negative associations. At the time of data collection the nurses were blind to the hypothesis being tested here, so it is unlikely that differential misclassification of BMI would have occurred. Given the specificity of the observed associations between obesity and pain of the joints in the lower half of the body, information bias is unlikely.

While there are dangers in attempting to consider several hypothesis simultaneously (an increased chance of finding false positive associations), a strength of this study is that it is possible to consider the associations between the lifestyle factors and joint pain at two time points. Therefore, those observed associations that remain consistent across analysis at both time points provide stronger evidence for a true association, and we are able to dismiss possible spurious relations with more certainty.

Conclusions

Of the lifestyle risk factors tested in this analysis, patterns of smoking and drinking behaviour do not appear to be

consistently associated with joint pain in any of the sites considered. However, obesity was associated with joint pain experienced in the lower half of the body.

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