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Musculoskeletal pain and smoking in Norway

Sören Brage, Tor Bjerkedal

Abstract

***Objective* – To examine the association between musculoskeletal pain and smoking.**

***Design* – Cross sectional, national interview survey.**

***Setting* – All individuals in a representative sample of households in Norway in 1985.**

***Subjects* – A total of 6681 persons aged 16 to 66 years old. People in institutions were not included.**

***Outcome measures* – Gender specific and age specific prevalence rates for pain in the cervical region/upper limbs, back, and lower limbs.**

***Results* – Current smoking was independently associated with musculoskeletal pain (odds ratio (OR) 1·69; 95% confidence interval (95% CI) 1·45,1·97) after adjustment for gender, age, comorbidity, mental distress, lifestyle factors, and occupation related factors. The association was of similar strength regarding cervical/upper limb pain (OR 1·87; CI 1·56, 2·25) and back pain (OR 1·84; CI 1·50,2·25) but weaker in respect of lower limb pain (OR 1·37; CI 1·10,1·71). Musculoskeletal pain was often present in more than one site.**

***Conclusion* – Smoking was significantly associated with musculoskeletal pain after adjustment for other relevant factors.**

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Several epidemiological studies have shown an association between smoking and back pain.[1–8] A dose-response relationship has also been demonstrated.[6–8] Two different explanations for this association have been suggested. One is founded on biological causal models, and relates back pain to smoking induced pathological changes in the intervertebral discs.[2 3 7 9 10] The other suggests that the association may be due to confounding by mental distress, low socioeconomic status, occupation, or life style factors.[1 4 6–8 11 12]

In recent studies on determinants for neck, shoulder, or leg pain[1 11–13] smoking has been suggested as a possible risk factor for pain in other locations. We wished to test, in a large population survey, the hypothesis that smoking is associated with musculoskeletal pain in general. The purpose of the present study was to investigate the association between smoking and musculoskeletal pain in various sites.

Department of Community Medicine, University of Oslo, PO Box 1130, Blindern, N-0317 Oslo, Norway
S Brage
T Bjerkedal

Correspondence to:
Dr S Brage.

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Methods

The Norwegian health survey 1985 was a nationwide interview survey of all members of a representative sample of households. Residents in institutions were not included. Sampling was performed in a two stage design. Finally, 10 576 individuals were interviewed from a gross sample of 13 438 (response rate 79%).[14] The database of the present study comprises all individuals between 16 and 66 years of age from the data set of the survey (n = 6681).

MUSCULOSKELETAL PAIN

In the interview, all subjects were asked about the presence of disease, as well as somatic or mental complaints during the survey period of 14 days. The questions used written descriptions, no pain drawings were included. Three questions were asked to uncover the presence of pain located in the cervical region/upper limbs (neck, shoulders, arms, or hands), back, or lower limbs (hips or legs). Any episode of pain was considered, by phrasing the questions in the following manner: "Within the last 14 days have you had pain in shoulders, neck, arms, or hands?" In the present study, the responses "not troubled" and "a little troubled" were combined in one category "no pain", and "a lot troubled" and "very much troubled" in a second category "pain". Pain in at least one location was defined as presence of musculoskeletal pain.

INDEPENDENT VARIABLES

Smoking

We grouped the subjects as current, former, or never smokers. Some seventy six subjects had not responded to questions about smoking and were excluded from further analysis.

Co-morbidity

Self reported morbidity was coded according to the *International Classification of Diseases*, 8th revision. In our analysis the presence of non-musculoskeletal disease (ICD-8 codes 000–709, 740–753, 757–786, and 788–999) was used as measure of co-morbidity.

Mental distress

An abridged version of the Hopkin's symptom checklist (HSCL) was used, with 23 questions referring to anxiety and depression.[15] The subjects were asked to rate the severity of their symptoms on a four point scale from "not at all" (1) to "extremely" (4). The mean score for all questions was used as measure of mental distress.

Socioeconomic status
All subjects were grouped according to the Norwegian standard for socioeconomic status[16] and, in our analysis, were aggregated into blue collar workers (unskilled or skilled) and others (salaried employees or self employed).

Type of work and working environment
The survey enquired about type of work and exposure to noise, polluted air, painful working postures, draughts, and high working speed at the workplace. In the analysis, we categorised the type of work as heavy (physically strenuous or requiring much walking and lifting) or light (mostly sedentary or requiring walking but not lifting), and exposure to workplace factors as considerable (answering "a lot") or slight (answering "a little" or "not at all"). Economically non-active people were categorised as having light work with slight exposure to workplace factors.

Marital status, alcohol consumption, and physical activity during leisure time
These factors were dichotomised into married (including cohabitee) or single; frequent alcohol drinkers (consuming alcohol twice weekly or more) or not frequent drinkers (once per week or less); and physically active (exercise at least once per week) or passive (less than once a week).

STATISTICAL ANALYSIS
Gender and age specific prevalence rates for musculoskeletal pain among current, former, and never smokers were calculated. χ^2 tests were used to determine whether differences between groups were statistically significant at the 5% level.

Logistic regression models were built to calculate odds ratios for the association between independent variables and pain; 95% confidence intervals (95% CI) were chosen. Multivariate analyses were performed, using forward stepwise variable selection. Variables which did not improve the fit of the model with a chosen significance level of 5% were discarded. Age and mental distress were entered as continuous variables, and smoking as a categorical one. Since the effect of smoking might depend on gender and age, the interaction with these factors was calculated, and separate logistic regression models were built for men and women, and for individuals below or above 40 years of age.

To investigate a possible causal effect of pain on smoking, the proportion of former smokers was related to former and current smokers combined, in the groups of subjects with and without pain. Data were processed using *SPSS* for MacIntosh, version 4.01.

Table 1 Prevalence of musculoskeletal pain among current smokers, former smokers and never smokers, based on the Norwegian health survey 1985*

Age	*Current smokers*			*Former smokers*			*Never smokers*		
	Subjects	*No*	*(%)*	*Subjects*	*No*	*(%)*	*Subjects*	*No*	*(%)*
Men (n=3245)									
16–19	87	10	(11·5)	16	1	(6·3)	228	7	(3·1)
20–29	272	33	(12·1)	83	12	(14·5)	274	18	(6·6)
30–39	349	59	(16·9)	185	25	(13·5)	274	27	(9·9)
40–49	273	51	(18·7)	182	33	(18·1)	169	28	(16·6)
50–59	227	64	(28·2)	159	29	(18·2)	98	13	(13·3)
60–66	132	45	(34·1)	163	48	(29·4)	74	17	(23·0)
Total	1340	262	(19·6)	788	148	(18·8)	1117	110	(9·8)
Women (n=3360)									
16–19	84	16	(19·0)	21	2	(9·5)	190	19	(10·0)
20–29	338	71	(21·0)	122	21	(17·2)	289	27	(9·3)
30–39	357	95	(26·6)	189	35	(18·5)	303	58	(19·1)
40–49	216	77	(35·6)	111	22	(19·8)	242	47	(19·4)
50–59	145	56	(38·6)	90	27	(30·0)	261	81	(31·0)
60–66	101	44	(43·6)	72	33	(45·8)	229	69	(30·1)
Total	1241	359	(28·9)	605	140	(23·1)	1514	301	(19·9)

* Reporting cervical/upper limb pain, back pain, and/or lower limb pain during the survey period of 14 days.

Results

Altogether 23·9% (807 of 3374) of the women and 16·1% (523 of 3252) of the men experienced pain in at least one site during the survey period of 14 days. Pain in the cervical region/upper limb was more common (12·5%) than back pain (9·9%) and lower limb pain (7·7%). Pain was frequently reported from more than one part of the body: in 50% of subjects with cervical/upper limb and 66% of those with back pain or lower limb pain.

SMOKING AND PAIN
Altogether 41·3% of the men and 36·9% of the women smoked regularly. Among men, 19·6% of current smokers reported at least one type of musculoskeletal pain, compared with 9·8% of never smokers ($p<0·001$). The corresponding figures for women were 28·9% and 19·9%, respectively ($p<0·001$) (table 1).

When smoking was entered into a logistic regression model adjusted for gender and age, the association between smoking and musculoskeletal pain was noticeable and highly significant, regardless of the localisation of pain (table 2). The odds ratios (OR) for pain among former smokers were intermediary in relation to never and current smokers.

Smoking, gender, age, co-morbidity, mental distress, and exposure to workplace factors contributed significantly and were entered into the model (table 3). Type of work, exposure to draught, socioeconomic group, marital status, alcohol consumption, and physical activity were discarded. The OR for musculoskeletal pain were 1·69 (95% CI 1·45,1·97) for current, and 1·22 (1·02,1·47) for former smokers.

The associations between smoking and pain in various sites were examined in separate logistic regression models, adjusting for the above factors (data not shown). Current smoking was associated with pain located in the cervical region/upper limbs (OR 1·87; 95% CI 1·56, 2·25), back (1·84; 1·50,2·25), and lower limbs (1·37; 1·10,1·71). There was no significant interaction between smoking and age/gender on pain outcome.

Of those with a history of smoking, 31·7% in the pain group had stopped smoking, compared with 36·1% in the group without pain ($p<0·05$).

Table 2 Association between smoking and musculoskeletal pain among Norwegians aged 16 to 66 years in 1985, calculated as odds ratios (OR), adjusted for gender and age, with 95% confidence intervals (95% CI), based on the Norwegian health survey 1985

Category	No	Neck/upper limb pain OR (95% CI)	Back pain OR (95% CI)	Lower limb pain OR (95% CI)	Pain in at least one site OR (95% CI)	Pain in at least two sites OR (95% CI)
Never smokers (reference category)	2631	–	–	–	–	–
Former smokers	1393	1·28 (1·03,1·58)	1·57 (1·25,1·98)	1·10 (0·85,1·42)	1·34 (1·13,1·59)	1·35 (1·04,1·75)
Current smokers	2581	2·03 (1·71,2·42)	2·02 (1·67,2·46)	1·46 (1·18,1·82)	1·86 (1·61,2·15)	1·92 (1·55,2·39)

Discussion

Using data from a large, cross sectional interview survey in Norway, relatively strong associations between smoking and musculoskeletal pain in various sites were found, after adjusting for confounding variables. Other studies[4 8 13] have reported adjusted OR for back pain among smokers in the range 1·4–1·5, that is, results close to ours.

Our findings suggest that smoking is associated with both neck pain and back pain. In other studies, the association with neck disorders have been inconsistent.[11 12] Smoking was also associated with pain in lower limbs, supporting recent findings by Boshuizen *et al.*[1]

In the national health survey 1985, non-response bias was small and hardly of any practical importance.[14] By using a short survey period of 14 days, the impact of recall bias on the validity and reliability of data is probably of little importance.[17] The reported prevalence of musculoskeletal pain was lower than in other Scandinavian studies,[18–20] probably because individuals more than 67 years old or living in institutions were excluded from our study.

CONFOUNDING

The association between smoking and pain remained significant when mental distress was entered into the multivariate model. The HSCL has been tested thoroughly.[15] In the Norwegian health survey, however, the original HSCL was amended and used in interviews, making it susceptible to bias and interviewer effects. It seems unlikely, though, that reporting of pain or smoking was systematically biased.

Table 3 Association between risk factors and self reported musculoskeletal pain among Norwegians aged 16 to 66 years in 1985. Odds ratios, adjusted for gender, age, non-musculoskeletal disease, mental distress, workplace factors, and smoking, with 95% confidence intervals (95% CI), based on the Norwegian health survey 1985.*

	Musculoskeletal pain in at least one part		
Category	No of subjects	OR	95% CI
Gender:			
Male (reference category)	3245		
Female	3360	1·89	1·64,2·17
Age per each additional year		1·03	1·03,1·04
Reporting non-musculoskeletal disease	3227	1·86	1·63,2·13
Mental distress per each additional point†		1·58	1·39,1·80
Workplace factors:			
Noise	610	0·76	0·59,0·98
Polluted air	521	1·48	1·15,1·90
Painful working postures	495	2·97	2·37,3·73
Stress	1081	1·43	1·20,1·71
Never smokers (reference category)	2631		
Former smokers	1393	1·22	1·02,1·47
Current smokers	2581	1·69	1·45,1·97

* Reporting cervical/upper limb pain, and/or lower limb pain during the survey period of 14 days.
† For instance, increasing mean score of the abridged version of the Hopkin's symptom checklist from 1·00 to 2·00.

Lower socioeconomic status is associated with smoking and musculoskeletal pain,[19–21] and status associated factors, such as physical job demands or life style, have been claimed to act as confounders.[1 4 6] In the present study, lower status and status related factors were separately associated with musculoskeletal pain. However, when entered into multivariate models, their impact on the association between smoking and pain was small. Socioeconomic status was only weakly associated with pain, in accordance with findings by Croft and Rigby.[4] One reason might be that current classifications of status do not capture the social dimensions that influence the association between pain and smoking.

Recording of workplace factors was based on subjective statements. People suffering from pain probably wish to find external causes – for example working postures – behind their troubles. These mechanisms of attribution would exaggerate the association with workplace factors but not affect the association between pain and smoking. Higher alcohol consumption and lack of physical activity did not confound the association between smoking and musculoskeletal pain.

The present study cannot, however, exclude confounding by other variables we have not examined. Risk factors that were not measured by our instruments, and linked, for example, to social class or mental distress, could be associated with both smoking and pain and cause a spurious relationship.

A CAUSAL RELATIONSHIP?

In cross sectional studies temporal relations between smoking and pain cannot be established conclusively but it seems probable that smoking precedes pain. One study has shown that the age of beginning smoking usually antedates back pain.[6] Furthermore, ill health is probably a poor incentive to start smoking, although patients with chronic pain are known to increase their smoking when they have pain.[22] In our study, however, people with pain did not stop smoking as often as those without pain. Such selection could gradually add more pain ridden individuals to the pain/smoking group. On the other hand, since the group of former smokers had significantly more pain than never smokers, there is reason to assume that this selection effect was very small.

The significant association between smoking and pain of various localisation, can, in our opinion, generate two different hypotheses.

Smoking might have a more general effect on the musculoskeletal system. Smoking induced blood flow reduction, hypoxia, or chemical changes might lead to degeneration in muscles, joints, and discs. Alternatively, a central, nervous effect might be involved. It might be hypothesised that nicotine, through its excitatory effects, alters the perception and threshold for pain, increasing self reporting of pain among smokers.

Conclusion

Smoking was significantly associated with musculoskeletal pain, after adjustment for gender, age, co-morbidity, mental distress, lifestyle factors, and occupation related factors. Smoking might be a contributory cause of musculoskeletal pain.

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