

# Tobacco Use in Relation to Chronic Pain: Results from a Swedish Population Survey

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## ABSTRACT

*Objective.* To study the relationship between tobacco use and pain intensity.

*Design.* An age-stratified cross-sectional study was carried out in southern Sweden in 2005.

*Sample.* The population study consists of 384 people, aged 18–102 years, with chronic pain.

*Measurement.* Data collection took place by means of a postal questionnaire. Comparisons of pain intensity were made between smokers and nonsmokers, and between users and nonusers of moist snuff. A multiple linear regression analysis was carried out in order to identify the determinants of pain intensity.

*Results.* Among respondents with chronic pain, smokers experienced a higher pain intensity than nonsmokers, although there was no evidence of such a difference among snuff users. The regression analysis revealed that gender (i.e., women) and smoking significantly increased pain intensity.

*Conclusions.* Pain intensity was highest among daily smokers and those who had quit. Thus, interventions to prevent smoking (to stop smoking and in particular not to start smoking) among people with chronic pain may not only be considered a method to improve health but also to reduce pain.

*Key Words.* Pain; Smoking; Moist Snuff; Tobacco; Epidemiology

## Introduction

The use of tobacco adversely affects people's health, and is an established risk factor for many diseases such as cancer and cardiovascular disorders. Previous research has also linked it to several conditions such as rheumatoid arthritis, fibromyalgia, and musculoskeletal pain in general [1–5]. A positive association with pain has been found in both current and former smokers (i.e., both higher prevalence of pain and higher pain intensity than nonsmokers) [1,6,7]. However, literature reviews have also shown inconsistency in terms of the statistically significant association between smoking and low back pain [8,9]. In addition, the association between smoking and chronic

pain seems to be more common among women than men, although there are few studies that confirm this [6]. Thus, more research is needed on gender differences in the association between chronic pain and smoking.

Although smoking is the most common form of tobacco use, snuff accounts for a large proportion of tobacco consumption in Sweden [10], and is a generic term for fine-ground, smokeless tobacco products. In Sweden, moist snuff ("snus") comes either in loose powder form or packaged in small bags, both of which are placed behind the upper lip. Epidemiological studies have shown lower rates of cancer and other tobacco-related health problems among users of moist snuff compared with cigarette smokers [10,11]. However, moist snuff is still a major health problem that increases the risk of cancer (especially in the lip and throat) as well as other tobacco-related health problems. The relationship between chronic pain and moist snuff has been poorly investigated, and few studies focusing on oral pain have been found (cf. [12]).

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The aim of the present research was to investigate the relationship between tobacco use and the prevalence of chronic pain among men and women. An additional aim was to contribute to the knowledge about the association between tobacco use and pain intensity.

## Methods

### Sample

This cross-sectional population study comprised 384 persons living in southern Sweden and reporting chronic pain (i.e., pain for a duration of at least 3 months). It was carried out in 2005 and had a randomly selected sample (from the Swedish population register), which was stratified into six age groups (300 persons in each stratum): 18–29, 30–44, 45–59, 60–74, 75–89, and 90+ years. The response rate was 38%, 18–29; 43%, 30–44; 54%, 45–59; 58%, 60–74; 51%, 75–89; and 36%, 90+. Of the 1,800 respondents, 25 were (1.4%) too ill to participate, 24 (1.3%) could not be contacted as their address was unknown, while 2 (0.1%) respondents had died. Thus, 824 completed questionnaires were returned. A one-page questionnaire was sent to a random sample ( $N = 25$  in each stratum) of those who did not respond to the initial questionnaire. This second questionnaire included questions about age, gender, self-reported health, the presence of chronic pain, and contact with healthcare services during the previous 12 months. These questions were selected from the initial questionnaire. When comparing the respondents and nonresponders, no significant difference was found in any of the variables included in the second questionnaire.

### Ethics

The study was conducted in accordance with the basic ethical principles of medical research [13] and was approved by the Ethics Committee at Lund University (Reg. no. 150/2005).

### Measurement

The questionnaire contained items about variables such as demographic data, subjective health, chronic pain (e.g., intensity, duration, and location), and pain management. The prevalence of chronic pain was assessed by means of a single question, "Have you been troubled by pain for the last three months or more?" Those who reported chronic pain were requested to answer other questions about pain intensity, duration,

localization, and pain management. Pain intensity was measured with one question, "Rate the average level of your pain during the last week" (numeric rating scale, ranges from "no pain" [0] to "very intense pain" [6]). One question concerned smoking habits and had four response alternatives: "no, I have never smoked," "yes, but have quit," "yes, occasionally," and "yes, daily." In this study, nonsmokers were defined as those who had never smoked. Another question was about moist snuff, and also had four response alternatives: "no, I have never used snuff," "yes, but have quit," "yes, occasionally," and "yes, daily." Unfortunately, there was no question about how long ago the respondents had ceased smoking or using snuff. Subjective health was measured by means of two questions: "In general, how do you rate your health status?" and "Compared with one year ago, how would you rate your health status today?"

### Statistics

Data were analyzed and compared across gender as well as for the total sample. The analyses were performed using the Mann–Whitney  $U$ -test and chi-square test. The chi-square test was used for comparisons of nominal data, while the Mann–Whitney  $U$ -test was employed for ordinal and skewed interval/ratio data. The Kruskal–Wallis one-way analysis of variance test was used to analyze differences in pain intensity among the various types of tobacco users. The Mann–Whitney  $U$ -test was used as a post hoc test. Due to multiple comparisons, a reduced value (Bonferroni method) of  $P < 0.008$  was employed in order to reduce the risk of mass significance [14]. Multiple linear regression (enter) was carried out to identify variables that explained the variance in pain intensity. Each of the smoking and snuff-use variables had four response alternatives, which were treated as dummy variables, with "no, I have never smoked" and "no, I have never used moist snuff" as references. Age, gender, smoking, and using snuff were included in the regression analysis as independent variables. Collinearity tests (tolerance, VIF) were conducted to probe for a high intercorrelation and revealed no such problems. An analysis of the residuals was made using the one-sample Kolmogorov–Smirnov test, and no significant differences ( $P = 0.249$ ) were found compared with the normal distribution. All data were analyzed using SPSS (release 13.0) for Windows (SPSS Inc., Chicago, IL).

**Table 1** Description of the sample and comparison between genders

	Total Sample (N = 384)	Men (N = 139)	Women (N = 245)	P Value (Comparisons Across Gender)
Age, mean (SD)*	62.5 (20.8)	61.5 (19.6)	63.0 (21.5)	0.06
Overall health, %*				0.2
Very bad	3.0	0.8	4.3	
Bad	19.4	17.3	20.6	
Neither bad nor good	21.0	22.6	20.2	
Good	48.9	52.6	46.8	
Very good	7.7	6.8	8.2	
Your health today compared with 1 year ago, %*				0.06
Much better	4.8	2.3	6.1	
Better	10.8	14.0	9.2	
The same	41.8	51.2	36.8	
Worse	27.3	22.1	30.1	
Much worse	15.3	10.5	17.8	
Smoking tobacco? (%)†				0.010
No, I have never smoked	47.8	33.7	55.2	
Yes, but have quit	34.9	46.5	28.8	
Yes, occasionally	5.6	5.8	5.5	
Yes, daily	11.6	14.0	10.4	
Using moist snuff? (%)†				<0.001
No, I have never used snuff	87.4	68.6	97.5	
Yes, but have quit	4.0	11.6	—	
Yes, occasionally	1.6	2.3	1.2	
Yes, daily	6.9	17.4	1.2	
Pain intensity (last week), mean (SD)*‡	3.3 (1.3)	3.1 (1.2)	3.4 (1.3)	0.2
Received a diagnosis for the pain				0.5
Yes, %†	57.6	55.1	59.0	
Pain duration (years), mean (SD)*	7.4 (9.7)	6.7 (8.5)	7.8 (10.3)	0.2

\* Mann–Whitney *U*-test; † chi-square test; ‡ scale range between 1 and 6 (1 = no pain).  
SD = standard deviation.

## Results

Of the total sample (N = 384; age range 18–102 years), 64% were women. The average pain intensity was 3.3 (95% CI: 3.2–3.4), and the average pain duration was 7.4 years (95% CI: 6.3–8.5). Forty-two percent reported that they had not received any diagnosis or did not know the reason for their pain (Table 1). The most commonly reported reason for pain was osteoarthritis, followed by cardiovascular diseases and back injuries. Other causes included rheumatoid arthritis, whiplash, polymyalgia rheumatica, fibromyalgia, and chronic pain as a consequence of various operations. The most common locations were the upper extremities, shoulders and neck (32%), lower extremities (29%), back and pelvis (19%), and thorax and abdomen (11%). Twenty-two percent of the respondents reported that their overall health was bad or very bad, 42% rated their health was the same as 1 year ago, while 43% rated it as worse than 1 year ago (Table 1). No significant difference in self-reported health was found between men and women. Seventeen percent smoked occasionally or on a daily basis, while 48% had never smoked (Table 1). Significantly more

men than women were current or former tobacco users (Table 1). Among those who used moist snuff, 18% reported smoking occasionally, while among those who had quit smoking, 13% used moist snuff. Ten percent who gave up using moist snuff smoked on a daily basis. Four percent both smoked and used moist snuff.

## Smoking

There was a significantly higher pain intensity among smokers in general as well as among women (Table 2). When comparing pain intensity among the four groups of smokers (1 = never smoked, 2 = smokers who had quit, 3 = occasional smokers, and 4 = daily smokers), an overall significant ( $P = 0.002$ ) difference was found. The post hoc test revealed differences between groups 1 and 2 ( $P = 0.008$ ), and 1 and 4 ( $P = 0.008$ ), but not between 2 and 3 ( $P = 0.011$ ). Those who smoked occasionally had the lowest pain intensity (mean = 2.62; 95% CI: 2.03–3.20), and those who smoked on a daily basis had the highest pain intensity (mean = 3.86; 95% CI: 3.34–4.37). Those who had never smoked had the second lowest pain intensity (mean = 3.12; 95% CI: 2.89–3.35), and



**Table 3** Variables associated with pain intensity among people with chronic pain

	Model	B	95% CI for Regression Coefficient	P Value
Pain intensity (N = 338)	Age	0.004	−0.002 to 0.011	0.181
	Gender (women = 0; men = 1)	−0.363	−0.657 to −0.070	0.016
	Smoking, dummy_1 (yes, but have quit)	0.365	0.016 to 0.714	0.040
	Smoking, dummy_2 (yes, occasionally)	−0.500	−1.234 to 0.235	0.182
	Smoking, dummy_3 (yes, daily)	0.657	0.136 to 1.178	0.014
	Moist snuff, dummy_1 (yes, but have quit)	0.959	0.063 to 1.856	0.036
	Moist snuff, dummy_2 (yes, occasionally)	1.282	−0.065 to 2.628	0.062
	Moist snuff, dummy_3 (yes, daily)	−0.039	−0.740 to 0.661	0.912

Adjusted  $R^2$  = 0.059.

(N = 221, age: 19–62 years, 42% women) reporting a low back pain with a duration for  $\geq 6$  months, and in this present study (N = 384, age: 18–102 years, 64% women), only people with chronic pain (duration  $\geq 3$  months) were included. Thus, it seems that the studies, whose samples did not focus on a specific pain condition, included a high share of women, and included older people, found that smoking increased pain intensity. However, the number of studies is sparse, leading to no firm conclusions about the association between tobacco use and pain intensity can be drawn, and hence more research is needed to further elucidate this relationship.

The study also identified gender differences regarding pain intensity related to tobacco use. There was a significantly higher pain intensity among smokers and women, but not among men (Table 2). The nonsignificant difference between smoking and nonsmoking men in this study might be due to too few respondents (N = 29, nonsmokers), giving a low power in the analysis. If the analysis was to be carried out again with a larger sample, a significant difference may be seen also among men (i.e., the descriptive data indicate this). However, this may not be so. Previous research has shown that pain tolerance seems to be higher among men, compared with women, and among both smokers and nonsmokers [15,17]. Whether the gender differences are due to the insufficient number of included respondents or differences in nociception (may be hormone related, cf. [15]) is unclear, but it seems fair to conclude that gender differences do exist. It may also be so that the association between tobacco use and pain intensity solely lies among women (and not among men), and the association between smoking and pain intensity found in the total sample is due to the large number of included women (cf. the comparison of studies in the previous paragraph).

One thing that is important to consider is that the regression analysis gave a rather low adjusted  $R^2$  value. This indicates that the model only explains a minor part of the variance in pain intensity, which might be a logical result/conclusion. It cannot be expected that tobacco use has a major role in explaining the pain intensity, and hence cannot be seen as an effective pain management method. However, smoking seems to increase pain intensity, and this knowledge should be given to both healthcare professionals and people with chronic pain.

The relationship between moist snuff and pain intensity was unclear. No significant differences were found between users and nonusers of moist snuff, although the result from the regression analysis indicated that there may be some relationship between chronic pain and the use of snuff. This may be explained by the fact that the smoking variable is a confounder in this result because some people both smoke and use snuff, while others who quit smoking had started using snuff, and vice versa. In fact, 10% who ceased using moist snuff were smoking on a daily basis at the time of the study. Thus, there was no clear evidence of any association between the use of moist snuff and pain intensity.

There seems to be an association (even if there is no firm evidence yet) between tobacco use and pain intensity. One possible explanation for the association is that long-term tobacco use often leads to decreased blood flow and local hypoxia, and affects the nervous system in various ways, which in turn influences the experience of pain, as it impacts on the transmission of nociceptive information. However, the impact on the nociception most likely varies among individuals, which can explain the discrepancies in the results from various studies and gender differences. Another explanation for the association between tobacco use and pain intensity may be that tobacco use



(especially smoking) leads to illness, which then causes the pain. The reason why pain intensity is higher among smokers and not among users of moist snuff, as shown in this study, remains unclear. Nevertheless, although no significant association was detected between snuff use and pain intensity in this study, there may still be some link with chronic pain, as snuff use is related to other pain variables (e.g., duration and localization). Thus, further research focusing on such relationships is important.

Tobacco is often used for coping with stressful situations, and intense pain may cause occasional smokers to resort more often to tobacco and end up as daily smokers. Furthermore, a high pain intensity may make it more difficult for daily users to quit or reduce their tobacco consumption. Thus, interventions to reduce or prevent tobacco use among people with chronic pain are important not only to improve their health but also to ease the pain.

### *Methodological Considerations*

The result showed that women reported a higher pain intensity than men (Table 3). The fact that women more often report chronic pain and higher pain intensity has been seen in previous research [18–20]. Conclusions about whether the prevalence and degree of pain increase or decrease with age differ between studies, but previous research indicates that age may play an important role [20,21]. Thus, both age and gender were included as independent variables in the regression analysis to control for possible confounding effects.

Threats to validity in this study mostly refer to external validity. One such threat may be the low response rate, which, however, was of an acceptable magnitude based on experience of similar population studies. Furthermore, the analysis of those who declined participation did not show any significant difference compared with the respondents, which indicates that dropout was not systematic. Thus, the results can probably be deemed representative of the population.

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