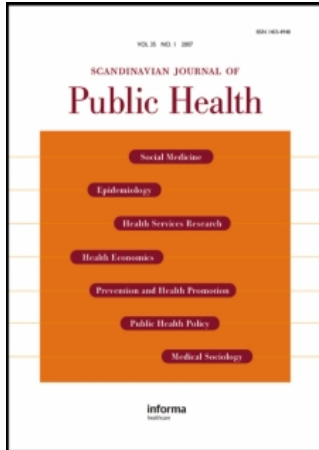


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## Scandinavian Journal of Public Health

Publication details, including instructions for authors and subscription information:  
<http://www.informaworld.com/smpp/title~content=t713684341>

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First Published on: 06 September 2007

To cite this Article: Haglund, Bengt, Eliasson, Mats, Stenbeck, Magnus and Rosén,

Måns (2007) 'Is moist snuff use associated with excess risk of IHD or stroke? A longitudinal follow-up of snuff users in Sweden', Scandinavian Journal of Public Health, 35:6, 618 - 622

To link to this article: DOI: 10.1080/14034940701436949

URL: <http://dx.doi.org/10.1080/14034940701436949>

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ORIGINAL ARTICLE

## Is moist snuff use associated with excess risk of IHD or stroke? A longitudinal follow-up of snuff users in Sweden

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### Abstract

**Background:** The potential risks of Swedish moist snuff (snus) are debated and studies have shown diverging results. **Aims:** The aim of this study is to investigate whether there is any excess risk of ischaemic heart disease (IHD) and stroke from snuff use. **Methods:** The Swedish Survey of Living Conditions from 1988–89 was record-linked to the Swedish Cause of Death Register and the Swedish Hospital Discharge Register to investigate excess mortality and hospitalization from IHD and stroke. A Poisson regression model was used and incidence rate ratios (IRRs) for snuff and smoking were calculated controlling for age, physical activity, self-reported health, number of longstanding illnesses, residential area, and socioeconomic position. **Results:** Among snuff users there were no excess risks of mortality or hospitalization from IHD (IRR 0.8; 0.5–1.2,) or stroke (IRR 1.1; 0.7–1.8), but, as expected, clear excess risks were found for smokers (IRR 1.7; 1.4–2.1 for IHD, and IRR 1.4; 1.0–1.9 for stroke). **Conclusions:** This study has not shown any excess risk among users of snuff for IHD or stroke. If there is a risk associated with snuff it is evidently much lower than those associated with smoking.

**Key Words:** Tobacco, moist snuff, snus, smoking, IHD, stroke

### Introduction

The use of moist snuff or snus has a long historical tradition in Sweden. During recent decades, the smoking rates in Sweden have declined substantially. Sweden was the first country in Europe to reach the WHO's goal of less than 20% daily adult smokers. In 2002, the prevalence of smoking was 16.3% among men and 19.3% among women [1]. Many argue that the low smoking prevalence is due to the use of snuff as an aid to quit smoking, or that the availability of snuff for new tobacco users prevents the alternative choice of starting to smoke.

A cross-section study from the Northern Sweden MONICA study published in this journal suggested a transition from smoking to snuff, since recent data showed that only 3% among men aged 25–34 years smoked [2]. An editorial called for more longitudinal data on the suggested tobacco behaviour transition

and on the health outcomes of snuff [3]. This study adds some evidence on the association between snuff use and IHD or stroke.

The potential risks of snuff use are debated and the scientific literature has shown disparate results. In Sweden, there is one study showing excess IHD risk from using snuff [4] while several others have failed to find any excess risks of IHD [5–9]. Some argue that nicotine may play a greater role in fatal than non-fatal outcomes by creating arrhythmias [10]. This hypothesis is usually based on dose-dependent arrhythmogenicity of nicotine in animal studies [11]. However, one mortality study [4] showed significant excess IHD mortality and some have shown non-significant relative risk estimates above one for fatal IHD [5,9].

The present study attempts to shed some further light on the risks of snuff use. Our analysis uses a longitudinal approach utilizing data on individuals

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(Accepted 2 May 2007)

ISSN 1403-4948 print/ISSN 1651-1905 online/07/060618-5 © 2007 Taylor & Francis  
DOI: 10.1080/14034940701436949

from national surveys of living conditions and data from national registers. One earlier study by Johansson et al. [8] used similar data, i.e. a record linkage between the Swedish surveys of living conditions and the national Patient and Cause of Death Registers. Our study includes a larger sample (5,002 instead of 3,120 persons), three additional years of follow-up (15 years instead of 12), and one additional outcome (stroke in addition to IHD). There are also some other minor differences, and some differences in the interpretation of the results.

### Material and methods

We used data from the Swedish Survey of Living Conditions (ULF) from 1988–89. The survey is based on annual face-to-face interviews with a random sample, representative of the Swedish population. The non-response rate was about 20% during 1988–89. Due to the low prevalence of female snuff users, the study was restricted to men.

All men aged 16 to 74 years who responded to the questions on tobacco use were eligible for the study. Those who reported a longstanding illness related to the circulatory system (ICD9 390–459) were excluded ( $n=610$ ), leaving us with a study population of 5,002 men. From the survey we collected not only information about tobacco use, but also information about potentially confounding factors: age, self-reported health status, number of longstanding illnesses, physical activities, socioeconomic status, and type of residential area.

We followed up the study population from the day after the interview until the end of year 2003, which means at least 14 years and at most 16 years. Outcomes were fatal or non-fatal ischaemic heart disease (IHD) (ICD9 410–414; ICD10 I20–I25) and stroke (ICD9 430–438; ICD10 I60–I69). Information on morbidity and mortality was collected from the Swedish Hospital Patient Register and the National Cause of Death Register. For censoring purposes we also collected information on the date of death. With the exception of one analysis of mortality, we did not differentiate between fatal and non-fatal outcomes.

Tobacco habits were categorized as follows: no tobacco, daily smoke (but not daily snuff), daily snuff (but not daily smoke), daily smoke and snuff, and snuff and/or smoke occasionally. Each form of tobacco use was entered into the analysis as a separate dummy variable, comparing it with the baseline category no tobacco. Incidence rate ratios (IRRs) with 95% confidence intervals were used to

estimate the effect of tobacco use. We used multivariate Poisson regression.

### Results

In 1988–89 17.7% of the male population in Sweden used snuff daily and 27.0% were daily smokers. The prevalence of snuff use was lower at higher ages. Smoking was most common at ages 25–64 years. Both types of tobacco use were lower in higher socioeconomic groups. Smoking was most common in bigger cities, among men with poor health and without physical exercise, while the prevalence of snuff use was higher in rural areas, among men with good health and energetic physical exercise (Table I).

During the follow-up period, 436 persons were affected by IHD. The rate was highest among daily smokers and in the small group of simultaneous users of both tobacco forms (Table II). After controlling for potential confounders, the risk for IHD among daily smokers was estimated at 1.7 times higher than among non-users of tobacco. No increased risk for IHD among snuff users was found (Table III).

The lowest age-standardized incidence of stroke was found among persons who reported no current use of tobacco (see Table II). Daily smokers, but not snuff users, had an increased risk of stroke. All categories of smokers had an increased risk of stroke, while daily users of snuff who did not smoke did not have an increased risk (see Table III). Although the combined use of smoke and snuff had the highest estimated incidence risk ratio, it was not significantly different from the IRR for smokers (estimated effect modification = 1.4,  $0.7 \leq \text{CI}_{95\%} \leq 2.9$ ). The group of simultaneous users was small, which may have contributed to our inability to show an elevated effect for this group.

When restricting the analyses to mortality, the number of events became very small, especially among the small groups of occasional and mixed tobacco users. Nevertheless, we found an increased risk of IHD mortality among smokers. Inspection of the point estimates indicates that with a bigger sample we may also have found elevated risks for IHD mortality among snuff users and combined users (Table IV).

In order to minimize the problem that the users could have changed tobacco habits during the follow-up period, we restricted the follow-up time to five years and recalculated the estimates of IRR. The shorter follow-up time made it possible to include data from the 1996–97 survey. The results

Table I. Sample size and tobacco habits by sociodemographic and health characteristics

	Sample		Smoking		Snuff use	
	No.	%	No.	No. per 100	No.	No. per 100
Age						
16–24	1 000	20.0	163	16.3	232	23.2
25–44	2 113	42.2	640	30.3	466	22.1
45–64	1 392	27.8	419	30.1	140	10.1
65–74	497	9.9	127	25.6	47	9.5
Socioeconomic status						
Unskilled manual	945	18.9	330	34.9	210	22.2
Skilled manual	990	19.8	291	29.4	251	25.4
Non-manual, low	580	11.6	165	28.4	97	16.7
Non-manual, intermediate	944	18.9	202	21.4	129	13.7
Non-manual, high	782	15.6	153	19.6	79	10.1
Self-employed, including farmers	638	12.8	175	27.4	102	16.0
Info missing	123	2.5	33	26.8	17	13.8
Residential area						
Metropolitan areas	1 556	31.1	460	29.6	211	13.6
Cities	2 759	55.2	722	26.2	514	18.6
Rural areas	687	13.7	167	24.3	160	23.3
Self-reported health status						
Good	4 250	85.0	1 065	25.1	761	17.9
Fairly well	633	12.7	231	36.5	105	16.6
Poor	113	2.3	52	46.0	18	15.9
Info missing	6	0.1	1	16.7	1	16.7
Physical exercise						
No	603	12.1	256	42.5	113	18.7
Light	3 493	69.8	968	27.7	585	16.7
Energetically	906	18.1	125	13.8	187	20.6
Total	5 002	100.0	1 349	27.0	885	17.7

Table II. Age-standardized IHD and stroke incidence by tobacco habits.

Tobacco habits	N	IHD		Stroke	
		<i>n</i>	Per 1,000 person-years	<i>n</i>	Per 1,000 person-years
No tobacco	2,579	227	5.0	126	2.7
Smoke	1,185	153	8.9	66	3.8
Snuff	721	28	4.2	19	3.1
Smoke & snuff	164	15	8.8	9	6.0
Tobacco occasionally	353	13	4.6	12	3.4
Total	5,002	436	5.9	232	3.1

Table III. Number of cases (*n*) and incidence rate ratio (IRR) for IHD and stroke, respectively, by tobacco habits.

Tobacco habits	IHD		Stroke	
	<i>n</i>	IRR (95% CI)	<i>n</i>	IRR (95% CI)
No tobacco	227	(ref)	126	(ref)
Smoke	153	1.74 (1.41–2.14)	66	1.40 (1.03–1.91)
Snuff	28	0.77 (0.51–1.15)	19	1.07 (0.65–1.77)
Smoke & snuff	15	1.64 (0.96–2.79)	9	1.98 (1.00–3.95)
Tobacco occasionally	13	0.80 (0.46–1.40)	12	1.52 (0.83–2.75)

Adjusted for age at event, socioeconomic status, residential area, self-reported health, number of longstanding illnesses, and physical activity.

Table IV. Number of cases (*n*) and mortality risk ratio (MRR) for mortality in IHD and stroke, respectively, by tobacco habits.

Tobacco habits	IHD		Stroke	
	<i>n</i>	MRR (95% CI)	<i>n</i>	MRR (95% CI)
No tobacco	64	(ref)	29	(ref)
Smoke	52	1.98 (1.35–2.91)	12	1.02 (0.50–2.05)
Snuff	8	1.15 (0.54–2.41)	4	1.01 (0.35–2.92)
Smoke & snuff	3	1.69 (0.52–5.46)	3	4.30 (1.22–15.1)
Tobacco occasionally	3	0.91 (0.28–2.91)	2	1.33 (0.31–5.64)

Adjusted for age at event, socioeconomic status, residential area, self-reported health, number of longstanding illnesses, and physical activity.

were virtually the same: increased risk for daily smokers, but not for snuff users (data not shown in table).

## Discussion

This study found no excess IHD or stroke risks for snuff users compared with non-tobacco users. In contrast, smokers show increased risks of IHD and stroke. Regarding stroke, the highest estimated risk is shown for those who used smoke and snuff simultaneously. It would have been interesting to know the total amount of tobacco used in this subgroup. Since one is not allowed to smoke in public settings, this may be a very nicotine-dependent group who feel a constant urge to use tobacco and therefore turn to snuff when smoking is not allowed.

However, non-significant estimates in this study indicate that snuff users may have an elevated risk of fatal IHD, but not of fatal stroke. The results of this study therefore speak neither against nor in favour of the hypothesis that nicotine may create arrhythmias [10]. But as our data do not permit us to subdivide current snuff users into those that never smoked or those that quit smoking and started to use snuff, there is probably some residual mortality risk from ex-smokers in the snuff user group. It is well known that smokers retain an increased risk of IHD for at least five years after quitting smoking [12]. A recent nested case-control study did, however, find an increased incidence of MI in current snuff users in the first five years after quitting smoking, but no increase after five years had passed since smoking cessation [13].

The advantages of this study are that the analysis is based on a random sample of the Swedish population, that we could adjust for several confounders, and that the longitudinal follow-up of IHD and stroke events is nearly complete. One of the limitations of this study is that we have only recorded the tobacco use at one point in time. The respondents may have changed their tobacco habits during

the follow-up period. However, there is no evidence of a systematic bias in behaviour changes.

The discussion on the health effects of snuff use is still far from settled. This study adds some new information to the growing knowledge. When it comes to the potential cardiovascular risk of snuff use, there are, besides this study, several other studies [4–9]. All except one have failed to show an excess risk of cardiovascular disease. The advantage of the single study showing an excess risk was the large non-random sample of about 135,000 men [4]. The other studies had the advantage of analysing random samples of men living in northern Sweden [5–7], the counties of Västernorrland and Stockholm [9], and Sweden [8]. Using the present knowledge, it seems fair to say that even if there is an excess cardiovascular risk of snuff use, it is very modest. The risk is also evidently much lower than for smoking.

This discussion leads to the question as to whether snuff is a useful strategy to help smokers to quit or if snuff is a gateway into smoking. This question is beyond the scope of this study, and needs more research. Some preliminary data have been presented in the Swedish public health report indicating that many more smokers use snuff as an aid to quit smoking than the number of snuff users starting to smoke [1]. A crucial question is whether the smokers quitting with the aid of snuff would have stopped anyway or with the help of other interventions such as nicotine gum etc. At any rate, it is evident that snuff use is a much better option than smoking since one also avoids nearly all the increased risk of cancer that is causally linked to smoking.

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