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ORIGINAL ARTICLE

Patterns of tobacco use: A 10-year follow-up study of smoking and snus habits in a middle-aged Swedish population

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Abstract

Aims: To study longitudinal patterns of tobacco use over a 10-year period among middle-aged men and women in Västerbotten County, Northern Sweden. *Methods:* The study is based on data from the 16,486 (8800 women and 7686 men) in the Västerbotten Intervention Programme (VIP) where people were invited to a health screening and counselling programme at 30, 40, 50 and 60 years of age. *Results:* Smoking decreased from 22.3% to 15.6% among women and from 18.5% to 12.7% among men. Use of snus (Swedish moist snuff) increased from 3.1% to 6.0% among women and from 24.6% to 26.3% among men. The number of people who used both snus and cigarettes was stable: 0.5% to 0.8% from baseline to follow-up for women, and 4.1% to 3.3% for men. The number of tobacco-free adults increased from 75.2% to 79.2% for women and from 61.1% to 64.3% for men. Of those who became smoke-free during the 10-year follow-up period, 80% of the women and 66% of the men quit smoking without transitioning to snus use. ***Conclusions:*** **The majority of middle-aged Swedish men and women in this cohort that quit smoking did so without becoming snus dependent. In spite of an increasing use of snus, overall there was a decline in the number of people using tobacco products**.

Key Words: *Changing habits, health screening, gender differences, longitudinal study, tobacco use*

Background/Introduction

In Sweden, smoking became common among men in the 1950s and almost half of all men became smokers. The prevalence of daily smoking among women increased from 9% in 1946 to 37% in the mid-1970s. The number of smokers has since then decreased successively, among both men and women. The prevalence was less than 20% for men in 1997 and less than 20% for women about 5 years later. Statistics Sweden showed in 2005 that about 18% of women and 14% of men were smokers [1,2]. From the mid-1970s there has been a gradual increase use of snus in Sweden and in 2007 about 3% of women and 23% of men are daily snus users. Swedish smokeless tobacco or Swedish wet snuff will be termed "snus" in this paper. The prevalence of snus use among women has increased significantly during the last 10-years: from 0.9% in 1997 to 2.8% in 2004 [3].

In 1992 the EU adopted a directive prohibiting the sale of tobacco for "oral use not intended to be smoked or chewed," which included the Swedish snus but not, for example, chewing tobacco or nasal snus. However, when becoming an EU member state in 1994, Sweden was granted an exception from the EU snus ban, and could continue the production and marketing of snus.

The sale of snus follows that of cigarettes, but in an inverted way. In 1919 about 7000 tons of snus was produced in Sweden (1.2 kilograms/capita).

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During the 1950s and 1960s, when cigarette selling was at its highest almost no snus was sold and a complete close down of the snus production was considered. Later, as cigarette use diminished, snus use increased and in 1998 the Swedish snus production again exceeded 5000 tons (0.6 kilograms/capita); (www.swedishsnus.com). The trend with fewer and fewer smokers and more and more snus users is ongoing [3]. In the Västerbotten county, where the prevalence of smokers is lowest in the country and the prevalence of snus users is among the highest, 12% of women and 9% of men use cigarettes, while 9% of women and 27% of men use snus [4]. Even if snus consumption has increased, detailed scientific reports of changes in the longitudinal tobacco use pattern among middle-aged adults are rare.

Snus is composed of ground tobacco leaves, salt and taste additives [5]. It is heated, but not fermented, and contains several carcinogenic substances, for instance tobacco-specific nitrosamines, TSNAs [6]. The concentration of these is, however, mostly lower than that of other brands of smokeless tobacco products. Despite this, the levels of nitrosamines in snus exceed many times the levels allowed in food [7]. Snus is sold in small boxes, either loosely packed, or in small tea bag-like pouches. It is placed under the upper lip with the active ingredients absorbed through the buccal mucosa.

The aim of this paper is to explore different tobacco use patterns over a 10-year period among middle-aged men and women and to assess the frequency with which smokers become snus users, mixed users or manage to quit tobacco use entirely.

Methods

Participants

The study is based on data from the Västerbotten Intervention Programme (VIP). VIP was launched as a pilot municipality study in 1985 in response to Swedish national data from the 1970s that showed Västerbotten County to have the highest cardiovascular disease (CVD) mortality in the country. Gradually experiences from the pilot area were implemented in other municipalities and by 1990 VIP was operational in all Västerbotten County municipalities.

VIP combines an individual strategy, including invitation to a health screening and health counselling at ages 30, 40, 50 and 60 years, with a population strategy [8]. The population strategy is based on different components, such as food labelling, health education, cultural activities and work site information. Health screening is carried out by specially trained district nurses and includes major cardiovascular risk factor assessments as well as a questionnaire on heredity, socioeconomic and psychosocial factors, self-reported health, quality of life, physical activity, alcohol and tobacco habits [9]. Each participant received a health counselling session focusing on the individual's test results. If the screening revealed risk factors of importance (for example smoking, elevated lipid levels, hypertension or impaired glucose tolerance) the VIP Manual advised the nurses to offer the participant a return visit or referral to a family physician. Those who first participated at 30 years of age were invited to a follow-up at 40, and subsequent 10-year intervals. This report is based on five cohorts: those initially participating in 1990, 1991, 1992, 1993 or 1994 and having individual follow-up 10-years later, (Figure 1). Between 1990 and 1994, 23,863 individuals participated in the surveys. Of those, 22,291 were eligible for the longitudinal study and 16,492 participated in the 10-year follow-up survey. The ineligible included 1062 participants who moved out of the county, 503 individuals who died, and seven who could not be located because of assignment of an anonymous civil number. The overall follow-up rate was 68.1%; the response rate among the eligible was 74%.

Measurements

Smoking habits are defined in three categories: non-smoker, ex-smoker and daily smoker. Ex-smokers are those who answered the question of daily smoking with the alternatives "Not now, but used to smoke regularly," while those who responded "Not now, but used to smoke from time to time" were categorized as non-smokers. Smokers are defined as those smoking one cigarette or more per day. Snus users are those who use snus regularly. Snus use is defined as "no use" or "use". Mixed users are those who both smoke and use snus regularly.

Based on this categorization, tobacco use is defined in a tobacco variable with six categories: (1) tobacco-free, (2) tobacco-free but ex-smoker, (3) snus user, (4) snus user but ex-smoker (5) smoker, or (6) both snus user and smoker. At the 10-year follow-up, these categories were reduced to four: (1) tobacco-free, (2) snus user, (3) smoker, or (4) smoker and snus user.

Statistics

Characteristics of subjects are presented as means ±SD. Statistical significance was tested for categorical variables by chi-square tests. Chi-square test for marginal homogeneity was used to test differences in smoking status distribution between baseline and follow-up.

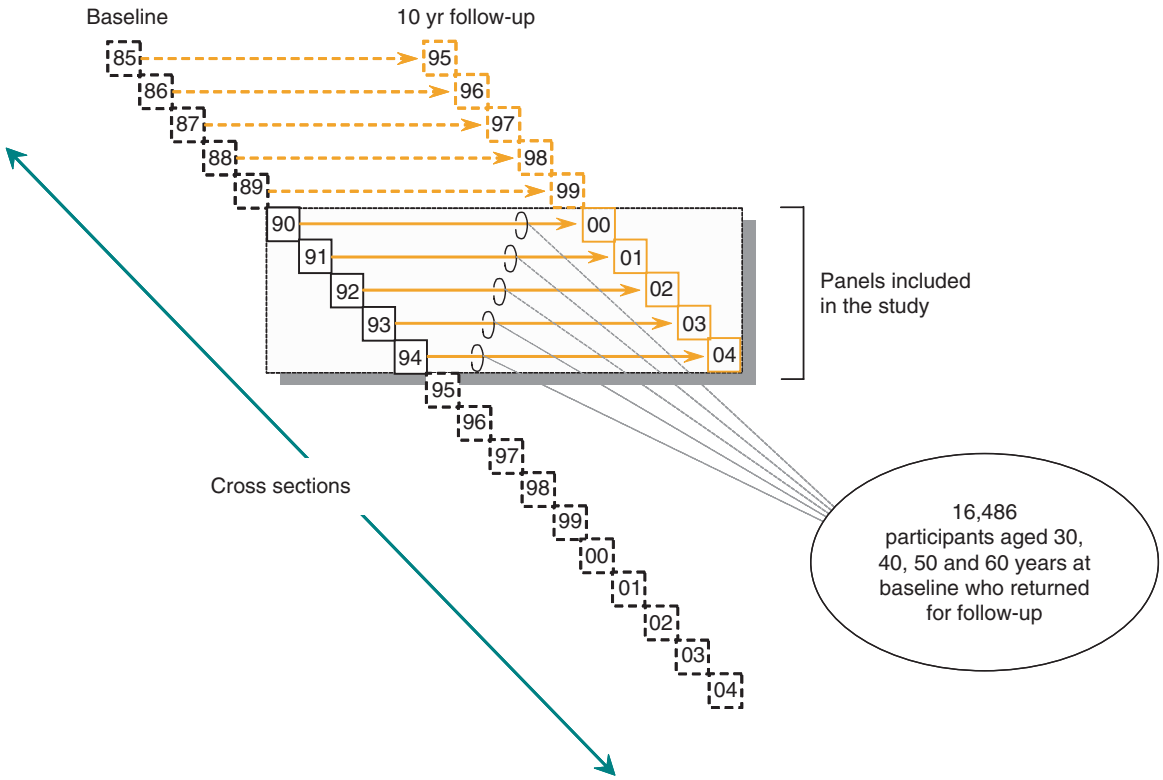

Figure 1. Study design.

Results

The analysis is based on 16,486 participants who were followed over a period of 10-years. An overview of mean age and smoking habits at baseline, for men and women, is presented in Table I.

Table II illustrates the movements during a 10-year period between different patterns of tobacco consumption among men and women in the defined middle-aged population. The difference in marginal distributions was significant ($p < 0.001$).

Figure 2 presents the prevalence of smokers, snus users, combined users and tobacco-free individuals at baseline and 10-year follow-up. The proportion of tobacco-free individuals has increased by 3.1% among men and 4.0% among women. Daily smoking has been reduced by 4.9% among men and 7.0% among women. Among snus users, 7.4% of the women and 6.9% of the men were occasional smokers.

In Figure 3 the patterns of change are further illustrated and show that 34% (150/436) of the smoke-free men at follow-up and 20% (156/788) of the smoke-free women at follow-up had started regular snus use after 10-years, while 66% of the smoking men (286/436) and 80% of the smoking women (632/788) who quit smoking, were able to quit without becoming regular snus users. Mixed users were 7.4% among men and 2% among women.

Table I. Baseline characteristics of the study population by gender.

	Men $n = 7686$		Women $n = 8800$		p-value for gender differences
	Mean	SD	Mean	SD	
Age (years)	41.2	7.66	41.6	7.61	NS
	n	%	*n*	%	
Smoker	1104	14.4	1914	21.8	<0.000
Snus user	965	12.6	131	1.5	<0.000
Snus user and ex-smoker	608	7.9	96	1.1	<0.000
Smoker and snus user	314	4.1	43	0.5	<0.000
Tobacco-free	3596	46.8	5210	59.2	<0.000
Tobacco-free and ex-smoker	1099	14.3	1406	16.0	0.003

n = number; SD = standard deviation; % = proportion.

Among snus users, only a small proportion went from snus to smoking. 39.5% of smoking men and 41.2% of smoking women became smoke-free after 10-years. 13.6% of smoking men at baseline and 8.2% of smoking women at baseline started to use snus. More than half of the men and women remained as daily smokers: 53.1% and 56.8%, respectively. For men it was about twice as common to stop smoking without becoming snus dependent than to switch to

Table II. Overview of study population by gender, displaying how participants have moved between different patterns of tobacco consumption during the 10-years of follow-up.

		At 10-year follow-up				
		Tobacco-free	Snus user	Smoker	Smoker & snus user	Total (%)
Men	Smoker	286	150	586	82	1104 (14.4)
	Snus user	179	746	10	30	965 (12.6)
Baseline	Snus user and ex-smoker	111	467	9	21	608 (7.9)
	Smoker and snus user	39	145	27	103	314 (4.1)
	Tobacco-free	3378	167	44	7	3596 (46.8)
	Tobacco-free and ex-smoker	949	92	49	9	1099 (14.3)
	Total (%)	4942 (64.3)	1767 (23.0)	726 (9.4)	252 (3.3)	7686 (100)
Women	Smoker	632	156	1087	39	1914 (21.8)
	Snus user	24	103	–	4	131 (1.5)
Baseline	Snus user and ex-smoker	22	67	1	6	96 (1.1)
	Smoker and snus user	7	23	4	9	43 (0.5)
	Tobacco-free	5030	59	117	4	5210 (59.2)
	Tobacco-free and ex-smoker	1258	45	96	7	1406 (16.0)
	Total (%)	6973 (79.2)	453 (5.1)	1305 (14.8)	69 (0.8)	8800 (100)

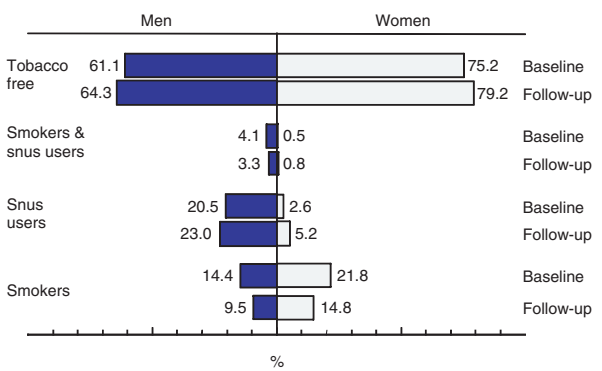

Figure 2. Prevalence (%) of smokers, snus users, mixed users and tobacco-free persons at baseline and 10 years later.

snus (25.9/13.6), and for women it was four times more common to stop smoking without snus than to switch to snus (33/8.2).

Discussion

In this study, we followed more than 16,000 middle-aged men and women for 10-years. The results show a continuous decrease in the number of smokers and increase in the number of snus users. However, the proportion of smokers who were tobacco-free after 10-years exceeded the proportion who became snus users. The number of tobacco users who were tobacco-free at baseline and initiated use during the 10-years was 328 (5.0%) women and 368 (7.8%) men, but some of them were former users (ex-smokers) that had relapsed, 2.2% and 3.2% respectively. There were almost twice as many men as women that were first time snus users (409 men, 260 women) and about twice as many women as men were first time smokers (117 women, 54 men).

Thirty-four percent of men and 20% of women who quit smoking started to use snus during the 10-year follow-up period. We consider these figures quite high for people at middle-age, especially for women. For historical reasons snus has been seen as men's business. It was the stimulus and reward for hard-working men especially in Northern Sweden. What earlier was a habit among manual male workers became during recent years also a habit shared by civil servants, clerks, students, social welfare and health personnel. Middle-aged women who hitherto might have regarded snus as unfeminine [10] seem now to have changed their opinion, possibly as a result of aggressive marketing efforts from tobacco producers. This marketing includes for instance such things as producing small, rounded, coloured snus boxes especially tailored to attract female consumers. Snus is easy to buy, it is found in almost every grocery store, and is cheaper than ordinary nicotine replacement devices which up until now only can be bought in the pharmacies.

Our 10-year follow-up shows that smoking decreased about 4% each year. This percentage is lower than cessation rates in other studies with shorter follow-up periods and might reflect the increasing risk for relapse over time [11]. It could also depend on a greater tendency by time to switch from cigarettes to snus and to start a mixed use. Switching between these nicotine products could lead to a greater possibility of people remaining in a prolonged state of nicotine dependence.

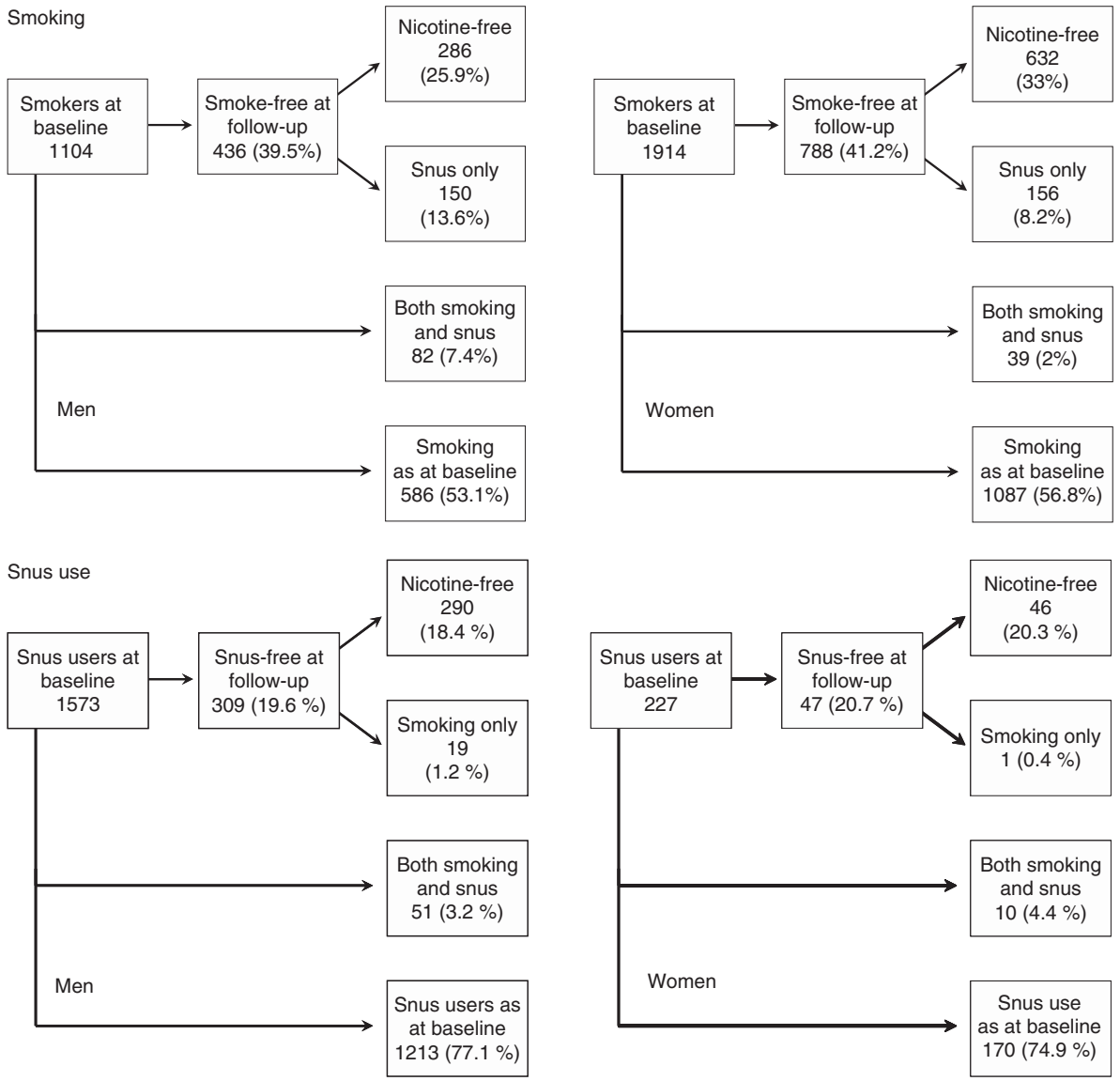

Figure 3. Patterns of change in tobacco use from baseline to 10-year follow-up among smokers and snus users by gender.

As many as about 75% of the snus users remained users after 10-years. This may reflect the widespread opinion that using snus is not as dangerous as smoking. Another explanation could be that the addiction to snus is stronger than that of smoking. The blood concentration of nicotine from snus is higher and remains for a longer period of time when compared to nicotine concentrations from a cigarette [12].

Our study showed that comparatively few people seem to alternate between snus and cigarettes. Other have reported that younger men use snus during specific sports activities when it is difficult to smoke [13]. These sports activities are not as common among middle-aged adults, but it seems reasonable that snus use could complement smoking in many other situations in life. The Swedish smoking ban in cafes and restaurants from June 2005 had not started when our study was performed. However, the general attitude about smoking has become more restrictive over the past 10-years, and this might have been a reason for some to pick up snus use instead of smoking.

One weakness of this study in that it is based on self-reported health survey data.

However, our major results are in accordance with other studies [14]. Under reporting has been discussed especially in situations with a strong social pressure against smoking, like in smoking cessation trials during pregnancy. However in a Finnish community-based study where serum cotinine concentrations were used for control, the validity of self-reported smoking behaviour was high and the

conclusion was that general cotinine measurement is not worth the costs [15].

Another limitation is the possible selection bias of healthy and health interested people in a study of this kind. But as a Västerbotten Intervention Programme evaluation showed non-significant differences between participants and non-participants (those that did not attend the health programme when they were invited), we do not think this is a major issue [16].

When smoking prevalence diminishes many smoking induced diseases gradually decrease [17,18]. In Sweden some authors interpret this to be due to an increased snus use and advocate, based on "the harm reduction theory," snus instead of smoking, in order to save lives [19–21]. However there might be some shortcomings in adopting this theory, as all the consequences of a widespread and long term snus use in the population might not be known yet. In Sweden snus has got a widespread use among men only during the last 20 years, while the induction time for cancer could be 30 years or more. In the 1950s and 1960s only a few believed smoking to be dangerous. It was first after several scientists had confirmed the results of Sir Richard Doll, who published his important epidemiological study on smoking and English health personnel in 1954 [22], that the major risks for developing cancer and cardiovascular diseases became apparent and recognized. Some of the risks with snus use are, however, becoming evident. Studies link snus to, for instance, pancreas cancer [23]. The risk of a fatal outcome of a cardiovascular event seems to increase among snus users [24]. Snus use is also reported to be harmful to the unborn child [25]. Among the middle-aged and elderly, who may have accumulated a number of other CVD risk factors, such as obesity, overuse of alcohol and a sedentary lifestyle, snus might increase the risk, as snus is also reported to be an independent risk factor for metabolic syndrome [26].

Addiction to snus is at least as strong as to cigarettes [27]. Several snus addicts ask for help to stop using snus, and more may do so if more health risks are recognized. Whether the same cessation methods will work for those addicted to cigarettes and those who use snus is not sufficiently studied. The fundamentals of pharmacotherapy directed against nicotine dependence and psychological supports are presumed to be the same. However we do not know exactly why so many more were so successful in their efforts to stop smoking as in our study. Satisfactory social support increases the chances to quit smoking. Nicotine replacement therapy and support from health- and dental-care authorities could also be crucial.

There are many other opportunities to get support for quitting nicotine dependence in society, but so far it is not exactly known what kind of support is most frequently used and most appreciated by tobacco consumers. The role of snus in this context is still doubtful [28] and further studies are needed to elucidate this.

In conclusion, the study confirms that the majority of middle-aged Swedish men and women who quit smoking did so without becoming snus dependent. Switching to snus use might have helped some individuals to quit smoking, but from a public health perspective a tobacco-free strategy remains the goal [29].

Acknowledgement

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