



Full length article

Use of moist smokeless tobacco (snus) and the risk of development of alcohol dependence: A cohort study in a middle-aged population in Sweden[☆]

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ABSTRACT

Background: Convincing evidence shows that smoking is associated with alcohol dependence (AD) and a positive correlation between snus and alcohol consumption was previously shown in cross-sectional studies. We performed a longitudinal evaluation of the risk of snus users to develop AD.

Methods: A cohort study in Västerbotten County, Sweden, linked individual data on socioeconomic situation and health survey data from 21,037 men and women (46.5% men). AD was defined by the CAGE questionnaire and evaluated at baseline 1991–1997 and again after 10 years. The risk of developing AD was assessed using logistic regression analysis and propensity score matching.

Results: 2370 men and 430 women used snus and were without AD at baseline. Over the 10-year period, 499 men and 257 women developed AD, among whom 191 and 26, respectively, were baseline snus users. The crude relative risks of AD for male and female snus users compared to non-users were 1.8 with 95% CI (1.5, 2.2) and 2.9 (2.0, 4.3), respectively. Adjusted logistic regression showed a positive dose–response relationship between snus use and risk of AD. Analyses involving propensity score matching revealed 33 and 17 new cases of AD in men and women, respectively, after 10 years given 1000 men and 1000 women without AD had been baseline snus users rather than non-users. Results for current, previous and never smokers were similar.

Conclusions: The use of snus is prospectively associated with an increased risk of AD with a dose–response relationship that is independent of smoking status.

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1. Introduction

Smoking is a major cause of disease and death globally, and it is the largest single preventable cause of cardiovascular diseases (Boffetta and Straif, 2009) and several cancers, including lung cancer (Lee and Hamling, 2009), and chronic obstructive pulmonary disease. The key driving force for the use of tobacco is nicotine.

In contrast, for non-smoked tobacco in the form of moist oral tobacco, snus, there is little scientific evidence for any risk of cancer,

myocardial infarction, or stroke, although there are some indications of a slightly increased risk of fatal myocardial infarction (Hansson et al., 2012), fatal stroke (Hansson et al., 2012, 2014) and, for pregnant women, of preterm birth and stillbirth (Wikström et al., 2010). Nicotine in itself has previously been claimed by some researchers not to be harmful (Fagerström and Bridgman, 2014), and it has even been suggested to be comparable to coffee with respect to health effects (Phillips and Heavner, 2009). Accordingly, snus as a substitute for smoked tobacco and as a remedy for nicotine delivery, has also previously been claimed to be suitable for tobacco harm reduction (Fagerström and Bridgman, 2014; Le Houezec et al., 2011; Maki, 2014; Rodu and Godshall, 2006). The idea is that snus would compensate for the pleasure related to the nicotine in smoked tobacco, without causing the harm of combusted tobacco. This is also the general opinion in Sweden. However, if there are negative effects on health due to snus use,

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even if the harm is much smaller compared to smoking, this would be of interest for the general public and of importance for public health and tobacco policies in populations with a high prevalence of snus use.

There is strong evidence for the co-occurrence of smoking and alcohol use and of nicotine and alcohol dependence (AD) (Falk et al., 2006; John et al., 2003a). Among adolescents, snus is associated with smoking and alcohol use (Galanti et al., 2001). Among adults, a Swedish cross-sectional study recently also confirmed a link between snus use and risky alcohol consumption (Engström et al., 2010). To the best of our knowledge, reports on the longitudinal association between snus use and the development of alcohol misuse and dependence among adults are lacking.

Snus has been used in Sweden for a long time, and as smoking has declined, the use of snus has increased. In 2013, the prevalence of daily smoking among middle-aged (aged 45–64 years) Swedish men and women was similar at 15% and 14%, respectively, and 9% of men and 5% of women smoked occasionally. Thus, the overall prevalence of current smokers was 24% among men and 19% among women. At the same time, 20% of men and 4% of women used snus daily and 3% and 1% did so occasionally (Folkhälsomyndigheten, 2013). It must be noted that many snus users, particularly those older than 45 years, also have a history of smoking (Boffetta and Straif, 2009; Folkhälsomyndigheten, 2013) and that the combination of smoking and snus use in Sweden is stable or even increasing (Norberg et al., 2011). During 2010–2013, the highest prevalence of daily snus use in Sweden was seen in Västerbotten County along with the lowest prevalence of daily smoking in both genders (Folkhälsomyndigheten, 2013). Thus, the patterns of tobacco use are complicated, and when possible effects from snus on health are investigated, large study populations are needed to be able to account for confounding by smoking.

In the European Union, the manufacturing and selling of snus is prohibited except in Sweden and this ban has been repeatedly challenged. Outside EU, for example in Norway and the US, the use of snus is currently increasing at a significant rate. Therefore, the evidence of possible harmful effects of snus is of importance, and not only in Sweden. We used a large Swedish cohort of middle-aged persons to investigate the longitudinal relationship between the use of snus and alcohol dependence (AD). Our hypothesis was that the use of snus increased the risk of developing AD.

2. Methods

2.1. Study population

The cohort study was based on the Västerbotten Intervention Programme (VIP) conducted in Västerbotten county. In 2011, the county population was 260,000, about 70% of whom resided in the two major urban areas: The university city of Umeå and the industrial town of Skellefteå. The background, design, and methodology of the VIP has previously been described in detail (Norberg et al., 2010). Since 1990, the VIP has been an integral part of the primary health-care routines, and all residents of Västerbotten county are invited to undergo a health assessment and receive health-promoting counselling in the year in which they turn 40, 50, or 60 years old. Persons aged 30 years were only included until 1996. Thus, participants were again eligible for the VIP after 10 years until the age of 60 years if they still lived in the county. According to the program routine, subjects can participate within a few months before or after the actual year they turn 30, 40, 50, or 60 years, although this happens rarely. As a part of the VIP, cardiovascular risk markers are measured and participants answer a comprehensive questionnaire on their health and lifestyle habits, including tobacco consumption and alcohol-related problems.

Table 1

Drop-out analysis at the 10-year follow-up by baseline characteristics among participants in the Västerbotten Intervention Programme from 1991 to 1997. Subjects classified with alcohol dependence at baseline, i.e. answered yes to 2–4 of the CAGE questions, were excluded from further analysis.

	Did not return for follow-up (%)	Returned (%)
Smoker		
Never	23.5	76.5
Previous	23.6	76.4
Current	29.5	70.5
Use of snus		
No	24.8	75.2
Yes	26.3	73.7
Age		
30 yrs	34.3	65.7
40 yrs	24.0	76.0
50 yrs	21.0	79.0
Sex		
Men	26.6	73.4
Women	23.8	76.2
CAGE, number of yes answers		
0*	24.0	76.0
1	27.3	72.7
2	30.6	69.4
3	33.0	67.0
4	43.8	56.2

* This category includes alcohol abstainers.

We used the Linnaeus database that is maintained by the Ageing and Living Conditions research program at Umeå University. This interdisciplinary research program focuses on the relationship between socioeconomic status (SES) and health in ageing populations (Malmberg et al., 2010). In the Linnaeus database, information from nation-wide administrative registers provided by Statistics Sweden, which contain comprehensive annual data about SES, family situation, and place of residence, and the National Board of Health and Welfare, which contains information on hospitalizations and causes of death, is linked to data from the VIP on an individual level (Norberg et al., 2010). The information obtained is anonymized.

During the time period from 1 January, 1991 to 31 December, 1997, 33,368 persons participated for the first time in the VIP. Annual participation rates increased from 52% in 1991 to 61% in 1997. Of these, 24,972 (74.8%) returned for a second VIP examination (of whom 46.5% were men). The average follow-up time was 10 years \pm 3 months (see above regarding VIP routines). The follow-up time was 9 years for 6.6% of the participants, 10 years for 91.4% of the participants, and 11 years for 2% of the participants. A drop-out analysis revealed that the return rate was 70% or more irrespective of sex and smoking and snus habits (Table 1). The 30-year-olds returned at a rate of 65.9% and subjects with AD returned at a lower rate, especially those who answered yes to all CAGE questions (CAGE is described below).

Individuals with missing values for the CAGE questionnaire and tobacco consumption at baseline were excluded ($n=1855$). Individuals who reported AD according to the CAGE questionnaire at baseline were also excluded from further analysis of the risk of developing AD ($n=1414$). Thus, 21,037 subjects (of whom 44.8% were men) remained in the study population.

The VIP participants provided their informed consent, and the research was approved by the Regional Ethical Committee at Umeå University (Dnr 07-142Ö).

2.2. Study exposure

The study exposure was the use of tobacco with focus on the use of snus. Snus use was assessed using the question “Have you

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