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## **SMOKELESS TOBACCO USE IN SWEDEN AND OTHER 17 EUROPEAN COUNTRIES**

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## ABSTRACT

**Introduction:** The purpose of this study is to report prevalence and determinants of use of smokeless tobacco in a representative sample of men and women from Sweden, where Swedish snus sales are legal, and from 17 other European countries, where sales of smokeless tobacco are restricted.

**Methods:** In 2010, a face-to-face survey including information on current smokeless tobacco use was conducted in a representative sample of around 1000 individuals aged  $\geq 15$  years per country in Albania, Austria, Bulgaria, Czech Republic, Croatia, England, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Poland, Portugal, Romania, Spain and Sweden.

**Results:** In Sweden, the overall prevalence of smokeless tobacco use was 12.3% (20.7% in men, 3.5% in women). The corresponding estimate for other European countries combined was 1.1% (1.2% in men, 1.1% in women). Compared to never smokers, former smokers in Sweden were significantly more likely to use smokeless tobacco (odds ratio, OR: 2.67), whereas no difference in use was observed in other countries (OR: 1.04). Use of smokeless tobacco was similarly likely among current smokers in Sweden (OR: 1.96) and in other countries (OR: 2.40) when contrasted to never smokers. In Sweden there were no differences in the number of cigarettes/day between smokers who also use smokeless tobacco (13.3 cigarettes/day) and exclusive cigarette smokers (12.9 cigarettes/day;  $p=0.785$ ).

**Conclusions:** Excluding Sweden, current oral tobacco use was not commonly reported in the European countries surveyed and was similarly rare both in men and in women. In Sweden, however, use of smokeless tobacco was about ten-fold higher than the rest of Europe and more prevalent in men than in women.

**Keywords:** snus; smokeless tobacco; Europe; Sweden; cross-sectional survey

## INTRODUCTION

Smokeless tobacco includes a wide variety of tobacco products which do not involve combustion and that can be used orally or nasally. Oral tobacco is predominantly sucked (dry or moist snuff) or chewed (chewing tobacco), while tobacco for nasal use is sniffed (dry snuff). Chewing tobacco contains dark, air- or fire-cured tobacco leaves processed with flavouring and other additives. Dry snuff consists of fire- or air-cured fermented powdered tobacco and moist snuff is produced with fire- or air-cured tobacco including stem and seeds, and manufactured into fine particles (fine-cut) or strips (long-cut).<sup>1</sup> The Swedish oral tobacco product known as “*snus*” is a type of moist snuff containing different aromas, salt, and other constituents giving a moist texture and confectioned loose or into small sachets that are typically positioned between the gum and the lip. Smokeless tobacco can be retained in the mouth for many hours and the saliva can be swallowed or spat.

Smokeless tobacco is addictive due to its nicotine content and a large variation in the type and concentration of toxic substances exists in different products available worldwide.<sup>2</sup> Use of the smokeless products more commonly found in countries outside of Europe has been associated with higher risk of cancer of the oral cavity, oesophagus and pancreas,<sup>1</sup> as well as other chronic illnesses, in comparison to non-users<sup>3</sup>. However, steps in the production and retailing of Swedish *snus* limit the formation of most toxic substances, resulting in reduced concentrations of tobacco specific nitrosamines, an important group of carcinogens present in tobacco products.<sup>1</sup> Snus has therefore been proposed as an alternative to smoking to satisfy established nicotine needs given its reduced content of carcinogens and other toxicants compared to tobacco smoke<sup>4,5</sup>. Nevertheless, it is important to stress that there is no carcinogen-free smokeless tobacco product available and concerns exist that use of smokeless tobacco in non-smoking youth can lead to cigarette smoking.<sup>6</sup>

The European Council Directives 89/622/EEC and 92/41/EEC, and the recently ratified Tobacco Products Directive (2014/40/EU) ban the sale and marketing of certain types of smokeless tobacco in European Union (EU) Member States (MS) with the exception of Sweden.<sup>7</sup> These rules refer to Swedish *snus*, and are intended to prevent dissemination in the EU of a product that is

addictive and not harmless to health.<sup>7</sup> Current provisions do not cover other smokeless tobacco products (chewing tobacco, dry snuff and other) manufactured in a smaller scale and traditionally used by a minority of the population but nevertheless also associated with adverse effects to health.

Little information is available on the use of smokeless tobacco in Europe, with the exception of Sweden and Norway, where Swedish *snus* is legally sold and socially accepted. Estimates from Sweden in 2004-2005 showed that 27% of male and 5% of female adults used *snus*.<sup>8</sup> The 2012 Eurobarometer survey showed a prevalence of regular use of smokeless tobacco of 12% among Swedish adults (both sexes combined).<sup>9</sup> In Norway, in 2013, 9% of the adult population used snuff daily and 4% occasionally.<sup>10</sup> In those Nordic countries, *snus* was more frequently used by younger generations.<sup>8,10</sup> In the rest of Europe the 2012 Eurobarometer showed a prevalence of regular smokeless tobacco users ranging between 0% and 2%. Estimates by sex were only provided for all-countries combined.<sup>9</sup>

The purpose of this study is to estimate prevalence rates of smokeless tobacco and determinants of use in a representative sample of European men and women from Sweden and other 17 countries who participated in a 2010 survey conducted within the “Pricing Policies And Control of Tobacco in Europe” (PPACTE) project.<sup>11</sup>

## **METHODS**

### **Survey**

Between January and July 2010, using standardized methods, a face-to-face survey on smoking was conducted in 18 European countries: Albania, Austria, Bulgaria, the Czech Republic, Croatia, England, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Poland, Portugal, Romania, Spain and Sweden.<sup>11</sup> Data collection was coordinated by DOXA, the Italian branch of the Worldwide Independent Network/Gallup International Association (WIN/GIA). In each country, a sample of around 1000 individuals was collected, thus the survey included a total of 18,056

participants (8653 men and 9403 women) aged 15 years and older. Participants were representative, for each of the 18 selected European countries, of the general population aged  $\geq 15$  years in terms of age, sex, geographic area and socio-economic characteristics. Therefore, the present survey is representative of 311 million inhabitants aged 15 years or over from 18 European countries.

Sampling methodologies used in each country were in some cases different. In several countries (Albania, Croatia, Hungary, Italy, Poland and Romania) a multi-stage methodology was used. In the first stage, the primary unit of selection was a geographic area or voting centre. In the second stage, households or municipalities were selected. In the last stage, respondents were chosen randomly, in order to be representative of the population in terms of sex, age, geographic area and socio-economic characteristics (working status, occupation and income). For other countries (Austria, England, Finland, France, Ireland and Spain) we used a quota method for the selection of the entire sample, stratifying the population according to selected variables including age, sex, and alternatively geographic area and/or occupation, in order to obtain a representative sample of the country population. For other countries, we used other sampling methodologies, including a stratified random method for Bulgaria, the Czech Republic and Latvia, a simple random method for Greece and a cluster sampling for Sweden. Given the different sampling methodologies used, various surveys had heterogeneous response rates. Full details of the survey methodology are reported elsewhere.<sup>11,12</sup> Most of the countries used statistical weights in order to assure the representativeness of the sample according to age, sex, geographic area and socio-economic characteristics.

The study protocol was approved by the Institutional Review Board of the Istituto di Ricerche Farmacologiche “Mario Negri”. The procedures for recruitment of subjects, informed consent, data collection, storage and protection (based on anonymous identification code) are in accordance with the current country specific legislations.

Data were collected by trained interviewers through a standardized questionnaire translated into various languages. Besides general information on socio-demographic characteristics,

information was gathered on smoking and smokeless tobacco use. Specifically, data on smoking habits, including smoking status and age at starting smoking, were collected. Ever smokers were participants who smoked 100 or more cigarettes in their lifetime. Former smokers were participants who smoked 100 or more cigarettes in their lifetime but did not smoke at the time the survey took place. Smokeless tobacco users were participants who reported using any smokeless tobacco when the survey took place, and were identified through response to the following question: “Do you currently use any smokeless tobacco (including snuff, *snus* or chewing tobacco)?” Smokeless tobacco users were asked to report age at starting their regular use of smokeless tobacco. They had the possibility either to provide age of initiation (defined as “regular users”) or to specify they had never started a regular use (“occasional users”). Those individuals that did not report this information were classified as “unknown users”. No information was collected on the specific type of products used.

### **Statistical analyses**

P-values for comparisons were derived using t-test for continuous variables and  $\chi^2$  test for categorical ones.

Due to the known difference in smokeless tobacco use between Sweden and the other countries included in the survey, the analysis was conducted separately for Sweden and the other countries combined. For Sweden, odds ratios (OR) and the corresponding 95% confidence intervals (CI) for smokeless tobacco use vs no use for individual-level characteristics were estimated using unconditional multiple logistic regression models after adjustment for sex, age, level of education and smoking status. For the other countries combined, ORs were obtained using the same unconditional logistic regression model, after further allowance for country. The analyses were conducted in SAS 9.2 (SAS Institute).

## **RESULTS**

Figure 1 and Table 1 show the country and sex-specific prevalence estimates of current smokeless tobacco users. Sweden showed the highest overall prevalence of smokeless tobacco use (12.3%; 95% CI: 9.3%-15.3%), revealing marked differences between men (20.7%) and women (3.5%;  $p < 0.001$ ). Excluding Sweden, the prevalence of smokeless tobacco use was 1.1% (95% CI: 1.0%-1.3%) overall, 1.2% (95% CI: 0.9%-1.4%) in men and 1.1% (95% CI: 0.9%-1.3%;  $p = 0.560$ ) in women. Among the latter countries, those with the highest prevalence of smokeless tobacco use were Poland (5.5%), Spain (2.5%), the Czech Republic (2.1%) and Finland (2.0%).

Among current smokeless tobacco users across all countries, 65% were regular, 12% were occasional users and 23% provided no information (Table 1). The corresponding estimates for Sweden were 92%, 5% and 3%, respectively. Mean age at starting regular consumption was 23.6 years (SD 11.0), with similar estimates for men (23.1, SD 10.4) and women (24.7, SD 12.9). In Sweden mean age at starting was also 23.6 years (23.1 years for men and 26.1 years for women).

In Sweden, men were significantly more likely to use smokeless tobacco than women (OR: 7.65, 95% CI: 4.46-13.11), after taking into account age, education and smoking status (Table 2). No gender difference was observed when considering the population sampled from all other countries (OR for men vs. women: 0.99, 95% CI: 0.74-1.33). According to age, an inverse trend was observed for Sweden ( $p$  for trend=0.007), but no significant trend was observed in the other countries combined ( $p$  for trend=0.084). However, in both Sweden and other countries the rates of smokeless tobacco were similar in various age groups, but not among the elderly (i.e.,  $\geq 65$  years) who were less likely to use smokeless tobacco, compared to the young (OR: 0.39; 95% CI: 0.17-0.88 in Sweden and OR: 0.55; 95% CI: 0.31-0.98 in other countries). No significant pattern was observed with reference to level of education, either in Sweden ( $p$  for trend=0.083), or in the other 17 countries ( $p$  for trend=0.273). As compared to never smokers, in Sweden, former smokers (OR: 2.67, 95% CI: 1.66-4.29) and current smokers (OR: 1.96, 95% CI: 1.15-3.34) were more likely to be current users of smokeless tobacco. In other countries use of smokeless tobacco was more likely reported in current (OR: 2.40, 95% CI: 1.75-3.28) but not in former smokers (OR: 1.04, 95% CI:

0.63-1.73). In Sweden, among current smokers, no significant difference in number of cigarettes per day was observed between smokeless tobacco users (13.3 cigarettes/day) and non-users of smokeless tobacco (12.9 cigarettes/day;  $p=0.785$ ).

Excluding Sweden, no significant relationship was observed between smokeless tobacco use and geographic area (northern, southern, western and central, and eastern Europe) and per capita gross domestic product (data not shown).

## **DISCUSSION**

Representative survey data from 18 European countries in 2010 showed that smokeless tobacco was used by 1.7% of Europeans aged  $\geq 15$  years. This is consistent with the overall result found in the Eurobarometer survey conducted in 2012, including respondents of the extended Union (EU-27), which showed a 1% of regular and an additional 1% of occasional use of smokeless tobacco products.<sup>9</sup>

In Europe, smokeless tobacco is commonly used in Sweden and Norway, where Swedish *snus* is legally sold and socially admitted.<sup>13,14</sup> The PRACTE survey included Sweden, showing an overall *snus* use of 12.3%, with men reporting use 6 times more frequently than women. A similar disparity by sex has been reported by the Västerbotten Intervention Programme survey (2010) in Northern Sweden, showing a prevalence of *snus* users of 26.3% among men and of 5.3% among women.<sup>15</sup>

We confirmed that wherever sales and marketing of *snus* are illegal in Europe, smokeless tobacco use is relatively rare.<sup>9</sup> Thus, excluding Sweden, smokeless tobacco use was reported in 1.1% of adults from 17 European countries. The prevalence of users exceeded 2% in the Czech Republic, Spain and Poland. Some of these estimates are in contrast to those reported in the Eurobarometer (approximately 1,000 responders per country) where, in 2012, no participants declared using smokeless tobacco regularly or occasionally in Spain or regularly in Poland.<sup>9</sup> Among

the few other European studies providing data in European countries other than the Scandinavian region, the Global Youth Tobacco Survey (GYTS) showed a relatively low prevalence of smokeless tobacco use (i.e., less than 2%) in adolescents aged 13-15 years from Croatia and Hungary, but more than 10% in Latvia, among those countries also reached by the PPACTE survey.<sup>16</sup> The relatively high youth prevalence reported in Latvia is surprising when compared to those reported in other countries in Europe or when compared to estimates in adults obtained in the Eurobarometer (no regular use<sup>9</sup>) or in our survey (around 1%). However, higher prevalence among Latvian youth is possibly explained by its geographic closeness with Sweden and is consistent with our results indicating smokeless tobacco use being most common among middle-aged adults (25-64 years) in Sweden and the young (15-24 years) in all other countries, while least common among the elderly ( $\geq 65$  years). Previous surveys reported a much higher use among the younger Swedish population (33% in men and 11% in women of 16-24 years of age)<sup>8</sup> as compared to our study (12% for young of both sexes combined). Our multiple logistic regression results indicated that no significant difference was observed according to sex, except in Sweden.

Low education was associated with *snus* use both in men and women in studies conducted in different parts of Sweden.<sup>13,15</sup> Even though our data suggested a somewhat similar pattern in Sweden, but not in other countries, no statistically significant relation with education was observed either in Sweden or in the other countries combined.

In Sweden we observed a prevalence of *snus* use of 8.7% in never smokers, and a similarly high prevalence of use among current (16.6%) and former smokers (18.3%). These estimates appeared to be systematically lower than those observed in a cross-sectional study conducted in northern Sweden between 2002 and 2007.<sup>17</sup> Use of *snus* in Sweden has been reported to increase smoking cessation and to decrease the likelihood of daily cigarette smoking.<sup>18</sup> Nevertheless, among current smokers in Sweden the prevalence of *snus* use in our data was still appreciably high (17%). Among current smokers, *snus* users had a similar cigarette consumption compared to non *snus* users, in contrast with a study from Norway showing that dual users smoked less than exclusive

smokers.<sup>14</sup> A prospective Norwegian study in young men has shown snus use at baseline to be associated with dual use (snus and cigarette smoking) three years later.<sup>19</sup> More importantly, among never smokers in Sweden, regular *snus* use was not negligible in our survey (i.e., prevalence 9%), suggesting that smokeless tobacco use may represent a gateway for nicotine addiction. Actually, 42% of *snus* users in Sweden are never smokers. In all the other European countries combined, smokeless tobacco use was significantly higher among current smokers. This could imply either that it does not represent a substitute to smoking but may instead serve as an additional nicotine delivery system, particularly in those places regulated by comprehensive smoke-free laws, or that smokeless use is still relatively new and consequently smokers have not yet quit using smokeless tobacco.

Limitations of the present study include the small number of items related to smokeless tobacco use in our questionnaire. Thus, information on type of product (chewing, dry snuff, moist snuff, other products used by immigrant populations), level of consumption, frequency (daily or other) or duration of use were not available. More importantly, although the sample size per country (around 1000) is comparable to that of other surveys (e.g., the Eurobarometer), the rarity of the behaviour under study generated very small numbers, which did not allow us to stratify smokeless tobacco use by various individual level characteristics in specific countries other than Sweden. For practical reasons, the sampling methodologies were not identical in all countries, and we were not able to understand the possible impact on the prevalence of smokeless tobacco use of the different procedures used in each country. However, we kept particular attention to the representativeness of the country-specific sample and employed the same questionnaire across various samples. Among the other strengths, we generated prevalence estimates by sex per country, and this information is not available in other pan-European surveys.

In conclusion we confirmed that, except for Sweden where *snus* use is very frequent, smokeless tobacco use is rare in the other European countries included in the survey. Our cross-sectional survey is not able to determine whether use of smokeless tobacco has reduced cigarette consumption in current smokers or has contributed to smoking cessation in former smokers. Our

study gives therefore only a limited contribution to the debate on whether to consider smokeless tobacco as a safer alternative to tobacco smoking, or another way to make nicotine addiction socially acceptable.

## **CONFLICT OF INTERESTS**

None to declare

## KEY POINTS

- In the representative “Pricing Policies And Control of Tobacco in Europe” (PPACTE) survey, conducted in 2010 in 18 European countries and including 8653 men and 9403 women, smokeless tobacco use was rare in 17 of 18 countries (average prevalence in both sexes 1.1%), but substantial in Sweden (12.3%).
- In Sweden the use was much higher in men (20.7%) than in women (3.5%), whereas in other countries smokeless tobacco use was similar in men (1.2%) and in women (1.1%).
- In Sweden, smokeless tobacco use was similarly higher in both former and current smokers as compared to never smokers. In other countries combined only current smokers were more likely to use smokeless tobacco in comparison to never smokers.
- Results from the PPACTE survey, reported in this paper, include country-specific smokeless tobacco prevalence estimates by sex for 18 nations in Europe using standardized sampling methodology and employing the same questionnaire across countries, estimates rarely reported in other European surveys with as large a geographic coverage.
- All tobacco products are addictive and none is carcinogen-free and thus it is necessary to monitor prevalence and determinants of use at the population level.

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**Table 1:** Prevalence of smokeless tobacco users, and corresponding 95% confidence intervals (CI), by type of reported use in the European population  $\geq 15$  years of age (n=18,056) from 18 European countries. PPACTE, 2010.

	Percent (%) prevalence of smokeless tobacco users (95% CI)	Proportion (%) of type (regular/occasional) on total smokeless tobacco users		
		Regular	Occasional	Unknown
		users	users	users
		(n=204)	(n=42)	(n=69)
Sweden	<u>12.3 (9.3-15.3)</u>	91.9	4.9	3.3
Poland	<u>5.5 (4.5-6.5)</u>	27.3	10.9	61.8
Spain	<u>2.5 (1.9-3.1)</u>	0.0	100.0	0.0
Czech Republic	<u>2.1 (0.9-3.3)</u>	61.9	0.0	38.1
Finland	<u>2.0 (0.3-3.8)</u>	100.0	0.0	0.0
France	<u>1.4 (1.0-1.9)</u>	14.3	0.0	85.7
Ireland	<u>1.3 (0.0-2.8)</u>	76.9	15.4	7.7
England	<u>1.1 (0.7-1.5)</u>	81.8	18.2	0.0
Latvia	<u>0.8 (0.0-2.4)</u>	25.0	25.0	50.0
Greece	<u>0.6 (0.0-1.2)</u>	16.7	0.0	83.3
Hungary	<u>0.6 (0.0-1.3)</u>	100.0	0.0	0.0
Italy	<u>0.6 (0.4-0.9)</u>	100.0	0.0	0.0
Croatia	<u>0.4 (0.0-1.3)</u>	50.0	0.0	50.0
Albania	<u>0.3 (0.0-1.2)</u>	100.0	0.0	0.0
Austria	<u>0.2 (0.0-0.7)</u>	50.0	0.0	50.0

Romania	<u>0.1 (0.0-0.3)</u>	100.0	0.0	0.0
Bulgaria	<u>0</u>	-	-	-
Portugal	<u>0</u>	-	-	-
Total	<u>1.7 (1.6-1.9)</u>	64.7	11.8	23.5

**Table 2:** Odds ratios (OR)\* for smokeless tobacco use vs non-use and corresponding 95% confidence intervals (CI), according to selected individual-level characteristics. PPACTE, 2010.

	Sweden			Other countries		
	N	% smokeless tobacco use	ORs for smokeless tobacco use (95% CI)	N	% smokeless tobacco use	ORs for smokeless tobacco use (95% CI)
<b>Total</b>	1000	12.3	-	17,056	1.1	-
<b>Sex</b>						
Women	489	3.5	<u>1<sup>^</sup></u>	8914	1.1	<u>1<sup>^</sup></u>
Men	511	20.7	<u>7.65 (4.46-13.11)</u>	8142	1.2	<u>0.99 (0.74-1.33)</u>
<b>Age</b>						
<25	125	12.0	1 <sup>^</sup>	2735	1.4	<u>1<sup>^</sup></u>
25-44	279	16.1	1.51 (0.78-2.95)	6144	1.2	<u>0.66 (0.44-1.00)</u>
45-64	285	15.4	1.25 (0.63-2.47)	5417	1.2	<u>0.71 (0.47-1.09)</u>
≥65	311	6.1	0.39 (0.17-0.88)	2760	0.7	<u>0.55 (0.31-0.98)</u>
P for trend			0.007			<u>0.084</u>
<b>Education</b>						
Low	300	11.0	1 <sup>^</sup>	5495	1.1	<u>1<sup>^</sup></u>
Intermediate	471	15.1	0.92 (0.54-1.57)	7818	1.0	<u>1.11 (0.78-1.59)</u>
High	229	8.3	0.55 (0.28-1.08)	3739	1.3	<u>1.27 (0.83-1.93)</u>
P for trend			0.083			<u>0.273</u>
<b>Smoking status</b>						
Never smoker	596	8.7	1 <sup>^</sup>	9428	0.8	<u>1<sup>^</sup></u>

Current smoker	163	16.6	1.96 (1.15-3.34)	5105	1.8	<u>2.40 (1.75-3.28)</u>
Former smoker	241	18.3	2.67 (1.66-4.29)	2523	0.8	<u>1.04 (0.63-1.73)</u>

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\* ORs were estimated using unconditional multiple logistic regression models, after adjustment for sex, age, level of education and smoking status. ORs for other countries were further adjusted for country.

^ Reference category.

PPACTE, Pricing Policy and Control of Tobacco in Europe, a European Commission funded project

**Title Figure 1:**

Sex-specific prevalence, overall and by country, of smokeless tobacco use in the European population  $\geq 15$  years of age (n=18,056) from 18 European countries. PPACTE, 2010.

**Legend Figure 1:**

PPACTE, Pricing Policy and Control of Tobacco in Europe, a European Commission funded project