

Original investigation

# Lifestyle Correlates of Female Snus Use and Smoking: A Large Population-Based Survey of Women in Norway

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## Abstract

**Introduction:** While smoking in Norway has become less prevalent, snus use has increased, including among women. The aims of this study were to describe female snus use and its correlates, and to contrast patterns of snus use and smoking.

**Methods:** In 2011–2012, data on tobacco use, age, education, alcohol consumption, sexual behaviors, and physical activity were collected from a population based sample of 13 756 Norwegian women aged 18–45 years, using a self-administered questionnaire.

**Results:** Ever-use prevalence of snus ranged from 29.6% to 4.5% among those aged 18–19 years and 40–45 years, respectively. In contrast, the corresponding figures for smoking were 24.1% and 44.1%. Among snus users, 54.1% and 22.8% of 18–19 and 40 to 45-year-olds had never smoked, respectively. Debut age for snus use increased markedly with age, and was higher than debut age for smoking. Female snus use was positively associated with intermediate education, alcohol consumption, number of sexual partners, and hard physical activity. Smoking was also positively associated with alcohol consumption and number of sexual partners, but negatively associated with physical activity and education.

**Conclusion:** While most snus users among older women were former or current smokers, this was not the case among younger women. Low snus debut age and extensive snus use among younger women suggest that measures to reduce snus use should be targeted at young adolescents. The correlates of female snus use and smoking were not identical, and were similar to those previously documented for men.

## Introduction

Snus is an oral smokeless tobacco product (low-nitrosamine Swedish-type moist snuff), in recent years typically contained in small sachets to be placed behind the upper lip. Snus contains several harmful substances, including low levels of tobacco-specific, carcinogenic nitrosamines, and delivers nicotine on a level similar to that of smoking cigarettes.<sup>1</sup> A recent review concluded that there are some adverse health effects associated with snus use, but these effects are much smaller than those associated with smoking

tobacco.<sup>2</sup> Snus creates nicotine dependence, and there might be a small increased risk of oral and pancreatic cancer from snus use; although, the evidence for an association between snus use and pancreatic cancer is weak.<sup>2</sup> Snus use may affect the survival rate from cancer and increase the risk of fatal acute myocardial infarction.<sup>1,2</sup> In addition, snus use causes some nonmalignant and reversible oral diseases.<sup>2</sup> Lastly, snus use during pregnancy may be associated with low birth-weight, preeclampsia, and premature delivery.<sup>1</sup>

In Norway, snus was traditionally a product used almost exclusively by men.<sup>3–5</sup> Since the early 1990s, male snus use has escalated,

and after 2005, increased snus use has been evident in women.<sup>4,5</sup> For both genders, much of the increase has occurred in younger age groups, and today snus use is as common as smoking among 16 to 24-year-old females and more common than smoking in young males.<sup>3</sup>

At the same time, there has been a declining trend in smoking,<sup>5</sup> possibly associated with changes in smoking legislation<sup>6,7</sup> and higher public awareness of the health hazards from cigarettes.<sup>8,9</sup> Large proportions of adult male snus users are former smokers,<sup>10,11</sup> and adult dual users (ie, persons who smoke cigarettes and use snus) smoke less than exclusive smokers.<sup>10</sup> Thus, for some individuals, snus may be a substitute for cigarettes. Snus use is perceived as trendier than smoking among young people aged between 16 and 20 years,<sup>12</sup> and snus users tend to be less negative about their tobacco habit than smokers.<sup>13</sup> Nevertheless, snus use in adolescence may be a risk factor for smoking later on.<sup>14,15</sup>

The social, demographic, and lifestyle profile of snus users has been mainly studied in males. Results from these studies show that male snus users are more likely to drink alcohol<sup>16–19</sup> and to participate in sports.<sup>16,20–22</sup> The association between male snus use and educational achievement appears to be inconsistent.<sup>18,23–26</sup> Because snus use among females is a recent phenomenon, we know far less about the characteristics and correlates of snus use among females. In a study from Sweden, Engström et al.<sup>27</sup> found that snus use was associated with an intermediate educational level (10–12 years of education) among 18 to 84-year-old women, while Norberg et al.<sup>28</sup> reported that snus use was associated with a high educational level (13 years or more of education) in 40 to 60-year-old women. The study by Engström et al.<sup>27</sup> also found that both risky alcohol consumption and binge drinking were positively associated with snus use among both women and men, but there was no association between physical activity and snus use for either gender. Sexual risk behavior has been found to be associated with nonsexual risk behaviors, such as smoking and binge drinking.<sup>29–31</sup> It is not known whether snus use may also be associated with sexual risk behavior.

To our knowledge, no studies have assessed correlates of snus use among women in Norway. Using population-based survey data, the aims of the current study were: (1) to describe female snus use, (2) to investigate sociodemographic and lifestyle correlates of female snus use, and (3) to contrast patterns of snus use and smoking among females.

## Methods

The study population and data collection have been described previously.<sup>32</sup> Briefly, 26 803 women aged 18–45 years were randomly sampled from the National Registry in Norway, which contains demographic data about all Norwegian citizens, and were assigned a de-identified study number. All women in this population-based sample received an invitation letter with information about the study, as well as a self-administered structured questionnaire on lifestyle and health. Response modes for the questionnaire were paper, web, or phone. Overall, 1570 women were not able to be reached and were therefore not included in the gross sample. Among the 25 233 eligible women, 13 756 answered the survey, resulting in a participation rate of 54.5%. Data were collected between October 2011 and October 2012. Answering the questionnaire was considered to be informed consent to study participation. The Regional Committee for Medical and Health Research Ethics granted approval for the study.

We performed multinomial logistic regression to assess correlates of cigarette smoking and snus use. The dependent variable was

individual tobacco use status, categorized as: (1) never-user of both snus and cigarettes; (2) ever-user of snus only; (3) ever-user of cigarettes only, and (4) ever-user of both snus and cigarettes. Model estimates were given as odds ratios with corresponding 95% confidence intervals and two-tailed significance for being an ever-user (categories 2, 3, or 4) versus being a never-user (category 1). Independent variables were age group (18–19 years, 20–24 years, 25–29 years, 30–34 years, 35–39 years, and 40–45 years), educational level (less than 13 years, 13 to 16 years, and more than 16 years of education), average number of units of alcohol consumed per week (never, less than 1 unit, 1 unit, 2–3 units, 4–7 units, and more than 7 units of alcohol), lifetime number of sexual partners (less than 3, 4–9, and more than 9 partners), and physical activity level during leisure time (sedentary was defined as mostly reading, watching television, and other sedentary activities; moderate as walking, cycling, or other forms of activity at least 4 hours per week; hard as participation in recreational sports, heavy gardening, snow clearing, etc. at least 4 hours a week; and very hard physical activity was defined as participation in hard training or sports competitions several times a week on a regular basis, see Emaus et al. 2010<sup>33</sup>). All variables referred to the value at the time that the participant responded to the questionnaire. A participant with a missing answer to a question was excluded from the analysis of that question. Arithmetic means were reported with the corresponding standard deviations. Statistical computing was done with the R software package.<sup>34</sup>

## Results

There were sharp and opposing age gradients in current snus use and current smoking in this sample of females (Table 1). Among 18 to 19-year-olds, about 30% ever used snus (daily, occasional, and former users), compared with about 4% among 40 to 45-year-olds. In contrast, ever smoking increased from 24% among 18 to 19-year-olds to 51% among 40 to 45-year-olds. More than half of the 18 to 19-year-olds who were current snus users had never smoked. The proportion of current exclusive snus users declined with age. In contrast, former smoking was more common in the older than in the younger groups of current snus users. Current dual use of snus and cigarettes (ie, smoking among current snus users) did not show a clear trend with age (Table 1).

Average snus use-debut age increased markedly with current age, ranging from 16 years among the youngest women to 34 years among daily users in the oldest age group. In contrast, the average smoking-debut age varied far less with age and remained below 19 years for all age groups. For all age groups, age at smoking debut was lower than age at snus debut. Moreover, a distinct difference between snus use and smoking was a longer duration of the habit for smokers in all age groups and a much sharper increase in duration of use with increasing age for smoking than for snus use.

In a multiply adjusted multinomial logistic regression, contrasting three groups of tobacco users against a reference group of never tobacco users, exclusive ever snus use was negatively associated with age and positively associated with alcohol consumption and number of lifetime sexual partners (Table 2). Moreover, compared with women with less than 13 years of education, women with a higher educational level were more likely to be snus users but significantly so only for women with 13–16 years of education. Relative to a moderate leisure time activity level, snus users were also more likely to engage in very hard physical activity than were never tobacco users.

Exclusive ever smoking was positively associated with age, number of lifetime sexual partners, and alcohol consumption, while negatively associated with educational level and physical activity.

**Table 1.** Patterns of Snus Use, Smoking, and Dual Use in Adult Women

Age	18–19 y	20–29 y	30–39 y	40–45 y	Total
Snus use prevalence	%	%	%	%	%
Never	70.4	78.1	93.5	95.6	87.9
Former	3.6	4.8	2.2	1.5	2.9
Occasional <sup>a</sup>	8.5	5.9	1.6	1.2	3.2
Daily	17.5	11.1	2.7	1.8	5.9
N	823	4185	5074	3532	13 614
Current snus use and smoking <sup>b</sup>	%	%	%	%	%
Exclusive snus user <sup>c</sup>	54.1	47.5	27.6	22.8	43.4
Former smoker <sup>d</sup>	15.5	26.5	45.9	40.2	28.9
Current dual user <sup>e</sup>	30.4	25.9	26.5	37.0	27.7
N	207	667	196	92	1162
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age at snus debut					
Former	16.1 (3.1)	19.9 (3.2)	26.6 (4.7)	25.3 (9.7)	21.9 (5.9)
Occasional	17.1 (1.3)	21.0 (3.3)	29.5 (5.5)	33.9 (10.7)	23.4 (7.2)
Daily	16.3 (1.3)	19.9 (3.4)	28.9 (4.8)	34.2 (8.1)	21.9 (6.6)
Duration (y) of snus use					
Former	2.6 (2.3)	3.8 (2.1)	4.8 (3.8)	8.1 (6.8)	4.4 (3.7)
Occasional	2.5 (1.3)	3.8 (2.2)	5.8 (5.9)	9.5 (10.6)	4.6 (5.0)
Daily	3.2 (1.3)	4.5 (2.4)	5.6 (4.4)	9.0 (7.5)	4.8 (3.6)
Smoking prevalence	%	%	%	%	%
Never	75.8	61.7	52.8	49.0	55.9
Former	7.6	18.1	26.4	26.4	22.7
Occasional	9.4	8.2	6.2	5.6	6.9
Daily	7.1	12.0	14.5	19.0	14.5
N	799	4046	4928	3439	13 212
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age at smoke debut					
Former	15.2 (1.4)	16.1 (2.2)	17.3 (3.1)	17.1 (3.1)	16.9 (3.0)
Occasional	15.9 (1.6)	16.8 (2.7)	17.6 (3.8)	18.5 (5.1)	17.4 (3.8)
Daily	14.5 (1.7)	15.6 (2.3)	16.6 (3.2)	16.8 (4.0)	16.3 (3.3)
Duration (y) of smoking					
Former	3.2 (1.5)	7.4 (3.4)	12.2 (5.5)	16.5 (7.4)	12.2 (6.7)
Occasional	3.6 (1.7)	8.8 (3.8)	17.8 (4.6)	24.4 (6.1)	15.0 (8.1)
Daily	5.2 (1.8)	10.4 (3.4)	19.3 (4.3)	27.0 (4.4)	19.2 (7.9)

<sup>a</sup>Occasional use of snus/smoking is defined as using snus/smoking less than daily.

<sup>b</sup>Daily or occasional.

<sup>c</sup>Current snus users who never smoked.

<sup>d</sup>Current snus users who quit smoking.

<sup>e</sup>Current user of both snus and cigarettes, daily or occasional for both substances.

Similar to exclusive snus use, ever dual use was less common in older age groups, and there was a positive association between ever dual use and alcohol consumption as well as number of lifetime sexual partners. In contrast to exclusive snus use, dual use was in general negatively associated with educational level and physical activity, although the only significant comparison with the moderate activity reference level was with the sedentary activity level.

## Discussion

The present study showed that female snus use was negatively associated with age, with prevalence ranging from about 30% among the youngest to 4% among the oldest women. In all age groups, about one-third of the women who currently used snus used it occasionally. While ever and current exclusive snus use was more common among

the young, current and ever smoking was more common among older women. Similar to ever snus use, ever dual use of tobacco decreased with age.

Female snus use was positively associated with an intermediate educational level, alcohol consumption, number of sexual partners, and hard physical activity. Smoking was similarly associated with alcohol consumption and number of sexual partners but, in contrast to snus use, negatively associated with both physical activity and educational level.

Overall, the patterns documented for women in this study are comparable with those documented for men.<sup>20–22,27</sup> The basis for comparison with other studies of female snus use is limited because few such studies exist. However, our finding that snus use was more prevalent in younger age groups of women is in accordance with recent national statistics in Norway<sup>5</sup> and Swedish

**Table 2.** Adjusted Odds Ratios for Three Modes of Tobacco Use, With Never Tobacco Users<sup>a</sup> as the Reference Group. Multinomial Logistic Regression, *N* = 11 858

	<i>N</i>	Ever snus use <sup>b</sup>		Ever smoking <sup>c</sup>		Ever dual use <sup>d</sup>	
		OR	95% CI	OR	95% CI	OR	95% CI
Current age (y)							
18–19	580	1.00	Ref.	1.00	Ref.	1.00	Ref.
20–24	1740	0.65	0.49% to 0.86%	1.45	1.07% to 1.96%	0.61	0.45% to 0.81%
25–29	1871	0.35	0.25% to 0.48%	2.88	2.14% to 3.87%	0.47	0.34% to 0.64%
30–34	2096	0.10	0.07% to 0.16%	3.51	2.62% to 4.71%	0.31	0.22% to 0.42%
35–39	2446	0.06	0.04% to 0.09%	3.47	2.60% to 4.65%	0.18	0.13% to 0.25%
40–45	3125	0.05	0.03% to 0.07%	3.92	2.94% to 5.22%	0.17	0.12% to 0.24%
Education (y)							
<13	2602	1.00	Ref.	1.00	Ref.	1.00	Ref.
13–16	5505	1.40	1.05% to 1.86%	0.54	0.49% to 0.60%	0.71	0.58% to 0.86%
≥17	3751	1.25	0.91% to 1.73%	0.32	0.29% to 0.36%	0.51	0.41% to 0.64%
Units of alcohol/wk							
Never	1787	0.39	0.25% to 0.61%	0.58	0.49% to 0.68%	0.64	0.46% to 0.89%
<1	1416	0.69	0.53% to 0.90%	0.92	0.82% to 1.05%	0.72	0.57% to 0.91%
1	5006	0.87	0.56% to 1.37%	1.07	0.88% to 1.31%	0.83	0.55% to 1.23%
2–3	690	1.00	Ref.	1.00	Ref.	1.00	Ref.
4–7	1919	1.31	0.98% to 1.76%	1.16	1.00% to 1.35%	1.42	1.11% to 1.83%
≥8	1040	2.09	1.51% to 2.88%	1.84	1.52% to 2.23%	3.04	2.32% to 3.99%
Lifetime sexual partners							
0–3	4080	0.57	0.46% to 0.71%	0.42	0.38% to 0.47%	0.35	0.28% to 0.43%
4–9	4007	1.00	Ref.	1.00	Ref.	1.00	Ref.
≥10	3771	1.44	1.15% to 1.80%	1.96	1.77% to 2.18%	2.82	2.38% to 3.35%
Physical activity (leisure)							
Sedentary	6093	1.15	0.89% to 1.49%	1.22	1.09% to 1.37%	1.38	1.14% to 1.68%
Moderate	2208	1.00	Ref.	1.00	Ref.	1.00	Ref.
Hard	2585	1.07	0.85% to 1.35%	0.78	0.70% to 0.87%	0.89	0.73% to 1.08%
Very hard	972	1.51	1.18% to 1.94%	0.60	0.51% to 0.72%	0.80	0.61% to 1.03%

CI = confidence interval; OR = odds ratio.

<sup>a</sup>Never used snus, never smoked (*N* = 5948).

<sup>b</sup>Ever used snus, never smoked (*N* = 592).

<sup>c</sup>Ever smoked, never used snus (*N* = 4407).

<sup>d</sup>Ever smoked and ever used snus (*N* = 911).

findings.<sup>27</sup> For educational level, our findings seem to be in line with Swedish data covering females aged 18 years and above<sup>27</sup> but slightly at odds with findings for age groups older than those investigated in the present study.<sup>28</sup> Note, however, that the Swedish studies used a different categorization of education than the present study. Generally, differences between our findings and findings from Sweden might be attributed to differing age groups participating in the studies. With regard to female health behaviors, the observed associations are in line with Swedish findings for alcohol consumption but only partially so for physical activity,<sup>27</sup> for which we show a stronger positive association between snus use and physical activity than the Swedish study. However, our results are in agreement with earlier studies for men, showing that sport participation or hard physical activity is positively associated with male snus use.<sup>20–22</sup> The number of sexual partners was positively associated with both snus use and smoking in our study. While an association between smoking and sexual behavior is well established,<sup>30,35</sup> we are not aware of studies that have addressed sexual behavior and snus use, irrespective of gender. Tobacco use, alcohol consumption, and certain sexual practices may be examples of risk-taking behaviors with common predictors. Earlier research has shown some degree of clustering of risk-taking behaviors,<sup>29,31,36,37</sup> which our results support.

As previously found for men,<sup>10</sup> female snus users included a high proportion of former smokers in our study, particularly in the older age groups, suggesting that snus may also have been used as a smoking cessation aid among women. Further supporting this notion, our analyses show large discrepancies in debut age and duration for snus use and smoking, with a younger debut age and a longer duration of the habit among smokers than among snus users. However, among current snus users in the youngest age group, more than half exclusive snus users who had never smoked, showing that smoking cessation is not the main reason for using snus among young women.

Our results reveal similarities as well as differences in the user profiles of female snus users and female smokers. With regard to alcohol consumption and number of sexual partners, the patterns were quite similar for smoking, snus use, and dual use, with a higher likelihood of being a tobacco user by increasing number of partners and by increasing alcohol consumption. However, dual users often showed the strongest associations, in agreement with other studies.<sup>25,27</sup> On the other hand, we documented opposing associations between smokers and snus users in terms of age, educational level, and physical activity. Hence, even though snus and cigarettes to some extent appeal to the same group of women, there appear to be some sociodemographic as well as behavioral differences between female users of these two tobacco products. The opposing

associations between snus use and smoking in terms of education might indicate that snus use is more socially acceptable than smoking.<sup>38</sup> It is well known that snus use and smoking have different effects on aerobic performance as well as on fitness, and because of the adverse effect of smoking, sportsmen prefer smokeless tobacco to cigarettes.<sup>39,40</sup> This might also apply to women and help to explain the different associations in terms of physical activity between snus use and smoking.

### Strengths and Weaknesses

The present study is one of very few that has addressed snus use among females specifically, and it is the first study on correlates of female snus use in Norway. A large sample was randomly drawn from the total Norwegian female population aged 18–45 years. Also, unlike the Swedish studies,<sup>27,28</sup> which were based on regional random samples limited to Stockholm or Västerbotten county, ours was a national sample. A further strength of the present study is the sample size, with a relatively high number of snus users (1645 ever-users), allowing multivariate analyses. The participation rate was relatively high for a study of this nature (54.5%), and only small sociodemographic differences have been documented between participants and nonparticipants.<sup>32</sup> However, there was a somewhat higher proportion of women with high education, with high income and who were married/cohabitating among participants than among nonparticipants, suggesting that the representativeness of the study sample was slightly weakened. Hence, self-selection bias may still limit the generalizability of the present study somewhat. Since non-respondents tended to be of slightly lower socioeconomic status than respondents, and socioeconomic status may be inversely associated with snus use,<sup>23–25</sup> the snus use prevalence presented here might slightly underestimate the real population prevalence. Note, however, that a negative association between snus use and socioeconomic status has not been found in all studies,<sup>26–28</sup> and consequently the association between socioeconomic status and snus use is presently unresolved. Moreover, self-reports of health-related behaviors may be prone to social desirability and recall bias,<sup>41,42</sup> which could affect the validity of the point estimates presented. However, self-reporting of snus use has been shown to be reliable.<sup>43</sup> Another limitation of this study is the relatively low number of snus users in some of the predictor levels, which reduced the statistical power and limited the opportunities for sub-analyses. Lastly, educational level alone was used to represent socioeconomic status, leaving out other aspects such as income and occupation. However, education has been shown to be a valid proxy for socioeconomic status.<sup>44,45</sup>

### Conclusion

The sociodemographic and behavioral characteristics of female snus users reported here were generally similar to those previously reported for male snus users. A plausible higher social acceptability of snus compared with cigarettes, indicated by the positive association between snus use, educational level, and physical activity in this study, suggests that snus has gained the position that cigarettes used to have in earlier generations of women. The tobacco user profile of the youngest women in our study, including the low debut age for snus use, was similar to that of smokers in previous generations.<sup>46</sup> The high proportion of former smokers among women 30 to 45 years who use snus further suggests that snus may be used as a smoking cessation aid, indicating awareness among women of the difference in harmfulness of cigarettes and snus. This study provides us with a better understanding of female

snus use and can be used to inform new measures to reduce the increasing use of snus in Norway, especially among young people who have not smoked before. The snus debut age of 16–17 years found among younger women and the extensive snus use among women younger than 30 years, which has also been documented for males,<sup>5</sup> suggest that initiatives to reduce the initiation of snus use should be targeted at the youngest adolescents, irrespective of sex.

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### Declaration of Interests

None declared.

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EK and IL contributed equally.

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