



ORIGINAL ARTICLE

Adolescent tobacco use practices and user profiles in a mature Swedish moist snuff (snus) market: Results from a school-based cross-sectional study

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*Department of Drug Policy, Norwegian Institute of Public Health, Norway***Abstract**

Aims: The aim of this work was to study the diversity of tobacco use among Norwegian adolescent tobacco users and to investigate how different user groups compared with each other in terms of lifestyle and risk correlates. Swedish moist snuff (snus) use has increased dramatically in Norway over the last few years and is now more prevalent than smoking in younger age groups. **Methods:** The participants were 736 15-year-old tobacco users obtained from a large school-based cross-sectional survey (response rate 73%). Leisure time activity and risk behaviour factors were extracted by principal components analysis. Associations between tobacco use, leisure activities, risk behaviours, alcohol use and sex were studied bivariately and by logistic regression. **Results:** In total, 41.5% of the tobacco users were dual users (smokers and snus users). Problem behaviour and risk-taking lifestyles were associated with tobacco use frequency and high-frequency dual use, with a low risk profile for all types of occasional users (snus, cigarettes or dual users), a medium risk profile for all types of daily single-product users, including those who occasionally used the other product (i.e. dual users) and a high-risk profile for those who used both products daily (daily dual users). **Conclusions: Fragmented use patterns in adolescence undermine the dichotomy often applied between smokers and snus users. For associations with lifestyle and risk correlates, use frequency and high-frequency dual use seem to be more important than the choice of product.**

Key Words: *Adolescents, tobacco use practices, dual use, risk behaviour*

Introduction

Smoking has decreased dramatically in Norway, while the use of Swedish moist snuff (snus) has increased. This shift in tobacco use preferences has been aided by stricter smoke-free laws, a large increase in the choice of snus products [1] and increasingly negative public attitudes towards smoking [2]. The transition has been particularly rapid in younger age groups, where, for several years, snus use has been more widespread than cigarette use, with the proportion of users increasing to 36% of men and 22% of women in the 16–24 year age group in 2013 [3] (proportion of men smoking 20%; proportion of women smoking 19%). Only Sweden has a similar level of snus use. The sale of snus is illegal in the rest of the European Union

and the prevalence of snus use is low in other countries where the product is marketed, such as the USA [4,5]. Similar to tobacco cigarettes, snus is sold in regular shops, no form of advertising is allowed, including point of sale advertising, and the minimum purchasing age is 18 years. Warning labels are mandatory for both products, although for snus a smaller-sized, non-graphic version with a more moderated textual content is used.

Snus is a non-combustible oral tobacco product that carries no environmental risk. Although the long-term health effects of snus are still debated, scientific evidence leaves little doubt that it is dramatically less dangerous than cigarettes [6–11]. This suggests that a

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(Accepted 28 May 2016)

shift from cigarette to snus use might have a beneficial effect on individual health and even on public health. As reported previously, snus has been used as a smoking cessation aid by many adult smokers [12] and smokers and ex-smokers comprise the majority of adult snus users [12,13]. However, this is not true for adolescents, where larger groups of snus users have no, or very limited, previous tobacco experience [14]. A requirement for any positive public health effect for this group would therefore be that the uptake of snus (mostly) happens in groups that would otherwise have taken up smoking [15,16]. Whether this is the case is a very difficult question to answer, not least because of the changing tobacco environment in which the increase in snus use is taking place. That snus is not needed for smoking reduction to occur is evident from the fact that the prevalence of smoking is declining, even in countries where snus is not available [17]. However, some results indicate that smoking has declined more rapidly in Norway and Sweden due to the availability of snus [18–20].

The question of who the young tobacco users are has received much attention from both researchers and public health workers. Similarities and differences between snus users and smokers have been discussed and studied at length, not least in efforts to investigate whether young snus users are individuals who would have started to smoke if snus had not been available [21,22]. Much of this research indicates that snus users and smokers are recruited from different social strata. According to previous Norwegian studies, adolescents with a lower socio-economic status and less ambitious educational plans are more likely to be smokers [21]. Snus users, on the other hand, have been found to have a higher level of academic achievement than smokers [23] and some studies have shown a tendency for snus users to be more physically active than smokers [22, 23], although not more than non-users of tobacco [22]. Adolescent snus users tend to be socially integrated and have high levels of self-esteem [22]. The overall impression is therefore that typical snus users differ from typical smokers, and that snus users seem to be recruited from more resourceful groups.

However, the popularity of cigarettes and snus is now much more equal than it was previously among young people in Norway and present day adolescents are subject to a tobacco environment distinctly different from that of past generations. Although a central feature of much of the previous research is a tendency to apply a binary interpretation to the situation, typically defining snus users and smokers as two distinct groups with different user profiles, an important question to answer in the current situation is to what extent the established maturity of the snus

market has affected the typologies observed earlier, and to what extent other dividing lines may have become more important.

A limitation of the binary approach is the lack of consideration given to the complexity of use practices among young tobacco users. For example, despite supposedly short tobacco use careers, dual use has been shown to be increasingly common among Norwegian adolescents. Among 16–17-year-old non-daily smokers, a three-fold increase in dual use was demonstrated between 2002 and 2010, at which point the proportion was 56.8% [22]. When all snus users and smokers were included in the calculation, 28.1% of adolescents were found to be dual users in 2010 [22]. High levels of dual or multiple use are not unique to Norway, but have also been found in other countries such as Finland [24] and the USA [25]. Research has indicated that young dual users might be more prone to risk behaviours such as alcohol consumption and truancy [23] and more addicted to nicotine [26] than both exclusive smokers and snus users, but to fall between smokers and snus users in terms of participation in sports and in academic orientation [23].

The aim of the current study was to provide an up-to-date map of the pattern of tobacco use among young Norwegian tobacco users. To investigate more closely the situation with respect to typologies, we examined how different adolescent tobacco user groups compared with each other in terms of lifestyle choices and risk correlates.

Methods

Participants

Data were obtained from a cross-sectional school-based survey among Norwegian tenth grade adolescents (15-year-olds) as part of a larger European study (ESPAD). The survey was exempt from approval by the Norwegian Social Science Service as only anonymous data were registered. In total, 3196 adolescents participated in the survey and it was assumed that the respondents were representative of their age group in the study year (response rate 73% of eligible pupils). In addition to information on tobacco use, this study made use of variables on leisure time activities, various problem behaviours or experiences and alcohol use. This was a cross-sectional sample, unlikely to offer new insights about transitions between tobacco user categories. Given our research question, non-users were also less relevant. Consequently, and to enable a more in-depth discussion of adolescent tobacco use practices and user profiles, all current non-users of tobacco were excluded from the analysis.



Figure 1. Leisure time activities and risk profile by (a) snus use status, (b) smoking status and (c) single and dual snus and cigarette use. *The 'no current snus' group in (a) consists only of exclusive smokers (all use frequencies combined), whereas the 'no current smoke' group in (b) consists only of exclusive snus users (all use frequencies combined).

**Last-month drinking episodes is divided by ten.

ANOVA: (a) n.s. for social orientation, cultural orientation, relational risk, otherwise $p < 0.001$; (b, c) n.s. for cultural orientation, otherwise $p < 0.001$.

Variables

To measure tobacco use, the respondents were asked to rate their smoking during the last 30 days according to a list of seven different frequencies, with four frequencies applying to daily smoking (1–5, 6–10, 11–20 and >20 cigarettes per day), one to no smoking last month, and two to occasional smoking ('less than one cigarette per day' and 'less than one cigarette per week'). For the purpose of this analysis, the categories were collapsed into daily smoking, occasional smoking and no current smoking, although the separation of occasional smoking into less than weekly (occasional

low) and weekly or more (occasional high) was kept when looking specifically at the lifestyle choices of smokers (Figure 1b). Snus use was measured using a question about ever-use, with four answer categories: 'Yes, every day', 'Yes, occasionally', 'Yes, but have quit' and 'Never'. The last two categories were collapsed into one to create the groups 'daily snus use', 'occasional snus use' and 'no current snus use'.

Leisure time activity was measured by seven items (Table I), each formulated as the question 'how often do you ...', and with the five answer categories: 'never', 'a few times a year', 'once or twice a month', 'at least once a week' and 'almost every day'.

Table I. Leisure time activity components for adolescent tobacco users (N=736).

	Social orientation	Cultural orientation	Gambling
Spend evenings out with friends (e.g. in cafés, discos, parties)	0.818	0.042	-0.098
Wandering around just for fun (e.g. in shopping centres, on the street)	0.788	0.027	0.184
Read books because you want to (not counting school books)	-0.079	0.680	0.011
Engage in hobby activities (e.g. play an instrument, sing, draw)	0.221	0.652	-0.049
Gamble on gambling machines	0.220	0.078	0.751
Exercise or take active part in sports	0.130	0.434	-0.609
Play computer games	-0.113	0.443	0.453
Eigenvalue	1.544	1.244	1.100

Extraction method: principal components analysis; rotation method: varimax with Kaiser normalization, rotation converged in six iterations; KMO = 0.55; Cumulative explained variance: 55.5%; Bartlett's test of sphericity: $p < 0.001$.

Table II. Risk-taking behaviour and experience components for adolescent tobacco users (N=736).

	Legal risk	Relational risk
Had intercourse that you regretted the next day	0.737	0.190
Had unprotected intercourse	0.727	-0.087
Had problems with the police	0.642	0.406
Fist fights	0.610	0.342
Been the victim of robbery or theft	0.591	0.476
Been to hospital or casualty clinic	0.440	0.413
Done badly at school or at work	0.005	0.728
Serious problems in relation to your friends	0.288	0.719
Serious problems in relation to your parents	0.168	0.718
Had an accident or injury	0.407	0.575
Eigenvalue	4.220	1.070

Extraction method: principal components analysis; rotation method: varimax with Kaiser normalization, rotation converged in three iterations; KMO=0.874; Cumulative explained variance: 52.9%; Bartlett's test of sphericity: $p < 0.001$.

Problem experiences and risk behaviours were measured by ten questions about negative last-year consequences (Table II) framed as: 'How often, during the last 12 months, have you experienced ...'. These items had seven answer categories referring to the number of times they had occurred, ranging from zero to 40 or more.

Alcohol consumption is a well-known type of risk behaviour associated with a range of present day and future negative consequences [27,28]. To measure alcohol consumption, information about the number of times that the respondents had drunk alcohol in the last 30 days was used. The original six-point scale ('not at all' to 'more than 40 times') was transformed to a semi-continuous variable, with 45 as its maximum value. For easy readability, the alcohol variable was divided by 10 in the graphical displays (Figure 1).

Sex was included as a confounder.

Statistical analyses

Analyses was performed using IBM SPSS Statistics, version 23. Principal components analyses were applied to seven leisure time activities items and 10 risk experience items. The principal axis method was used to extract the components and this was followed by a varimax (orthogonal) rotation. Components with eigenvalues >1 were retained for rotation. The bivariate analyses included a description of the frequencies of the various tobacco use practices and a calculation of the mean leisure time and risk experience component scores and mean alcohol consumption episodes within different tobacco user groups. Analysis of variance was applied to test for differences in the group means. The multivariate analysis consisted of a logistic regression on a dummy variable for using both cigarettes and snus daily, with leisure time activities, problem experiences and risk behaviours, last-month alcohol consumption episodes, and sex as explanatory variables.

Results

The study sample consisted of 736 tobacco users, implying a tobacco user proportion of 23% in the original sample, a proportion that is comparable with that found in earlier research (26% of 16–17 year olds in 2010 [22]); 55.4% of the sample were boys.

Principal components analysis on seven leisure time activities resulted in the three components social orientation, cultural orientation and gambling (Table I). The social orientation component was primarily characterized by a tendency to spend time with friends, high scores on the cultural orientation component implied much time spent reading books or engaging in hobby activities, whereas the gambling component included a high tendency to gamble on gambling machines and a lower participation in sports than the other groups. The ten original last-year problem experiences and risk behaviour items were reduced to

Table III. Description of tobacco use practices in adolescents who use tobacco.

	N	Percentage	Percentage of girls
Occasional snus use (exclusive)	196	26.6	47.4
Occasional smoking (exclusive)	105	14.3	55.8
Occasional dual use	106	14.4	53.4
Daily snus use (exclusive)	95	12.9	27.4
Daily snus use and occasional smoking	75	10.2	20.3
Daily smoking (exclusive)	35	4.8	68.6
Daily smoking and occasional snus use	64	8.7	59.0
Daily dual use	60	8.2	29.3
Total	736	100	44.6

two risk behaviour components (Table II). The legal risk component was positively associated with having had sexual experiences that were regretted later and various difficulties in areas relating to the law, e.g. problems with the police, fights or having been the victim of a robbery. The relational risk component was positively associated with problems in close relationships, but also with doing badly at school.

Use patterns

Combining snus users and smokers in an eight-way split of tobacco users revealed large variations in use practices (Table III). In total, 41.5% of the tobacco users were dual users, but with large variations in the frequency of dual use. Focusing only on daily smokers, the occurrence of dual use was 78%, whereas among the daily snus users, 59% also smoked cigarettes.

In total, 21.6% of the sample had smoked daily in the last 30 days, either exclusively or in combination with snus use, whereas 38.8% had smoked occasionally. Among the occasional smokers, the majority (75%, not reported) had smoked less than one cigarette per week. For snus use, the proportions of current use (not related to the last 30 days) were just above 30% for daily users and close to 50% for occasional users. Although 19% of the sample were currently exclusive smokers, and 39.5% were exclusive snus users. There were small sex difference, except for a stronger tendency for boys to use snus daily and a stronger tendency for girls to be daily smokers. However, there were more boys among those who reported smoking more than ten cigarettes a day (not reported).

Lifestyle and risk profiles for smokers, snus users and dual users

The tobacco user groups differed substantially from each other in terms of lifestyle and risk profiles, with

a tendency for a higher occurrence of significant differences between smokers than between snus users. For snus users, the only significant difference in leisure time orientation between groups (Figure 1a) was found for gambling ($p<0.001$). Daily snus users scored higher on the gambling factor. Regarding risk-taking and problem experiences, positive associations was found between snus use frequency and legal risk ($p<0.001$) and between snus use frequency and last-month drinking episodes ($p<0.001$). Daily snus users reported an average of 4.5 drinking episodes in the last month.

Smoking frequency (Figure 1b) was positively associated with the leisure time components social orientation ($p<0.001$) and gambling ($p<0.001$) and the risk behaviour components legal risk ($p<0.001$) and relational risk ($p<0.001$). As for snus, a positive association was found between smoking frequency and last-month drinking episodes ($p<0.001$), with the highest occurrence found for daily smokers who reported on average close to six drinking episodes.

When snus use and smoking were combined (Figure 1c), there were still clear differences between user groups in terms of leisure time activities and risk profile. Occasional snus users, occasional smokers and occasional dual users had low scores on all components. A distinction between daily snus users and daily smokers was that daily snus users scored higher on cultural orientation, and daily smokers scored higher on relational risk. For legal risk, exclusive daily smokers scored low, whereas daily smokers who used snus occasionally scored high. Unlike all other daily users, exclusive daily snus users scored low on social orientation and gambling. As is obvious from visual inspection, with the exception of cultural orientation, daily dual users had much higher leisure time and risk component scores and also reported more last-month drinking episodes than what was seen in the separate snus user and smoker analyses. Statistical testing showed that the differences between

Table IV. Daily dual users versus all other tobacco users. Unadjusted and adjusted odds ratios (ORs) for being a daily dual tobacco user.

	Crude OR	AOR	CI for AOR
Male sex	1.72**	1.44	0.77–2.70
Leisure time components			
Social orientation	1.41*	1.11	0.77–1.59
Cultural orientation	0.81	0.95	0.66–1.36
Gambling	2.70***	1.78***	1.25–2.53
Risk experience components			
Legal risk	2.26***	1.93***	1.38–2.70
Relational risk	1.70***	1.32	0.92–1.88
Last-month drinking episodes	1.15***	1.06*	1.00–1.13
Constant		0.04	0.02–0.069

Pseudo R²= 0.277; group sizes: daily dual users $n=45$, other tobacco users $n=520$.

AOR: adjusted odds ratio; CI: confidence interval; OR: odds ratio. * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

these pooled tobacco user groups were significant ($p<0.001$) for all components except cultural leisure time orientation.

Daily dual users

As shown in Figure 1c, there was a cluster of problem behaviours among adolescents who both smoked and used snus daily. A logistic regression analysis, separating daily dual users from all other tobacco users, gave support to that impression.

In the bivariate analysis (Table IV), the unadjusted odds ratios (ORs) showed a significant positive association between daily dual use and male sex, social orientation, gambling, legal risk, relational risk and last-month drinking episodes. After controlling for all explanatory variables (AOR), a significant positive association remained between daily dual use and the gambling component ($p<0.001$), the legal risk component ($p<0.001$) and the reported number of drinking episodes in the last 30 days ($p<0.001$).

Discussion

In this sample of 15-year-old tobacco users, more people reported current snus use (80%) than current smoking (60%); exclusive snus use (40%) was about twice as common as exclusive smoking (19%). In concurrence with previous research [22], dual use was widespread and among the daily tobacco users the majority were dual users (78% of daily smokers and 59% of daily snus users). Low frequency use was very prevalent, with over half the sample (55%) reporting occasional single or dual use. There were small sex differences, with fewer girls reporting daily

snus use (exclusively or in combination with smoking) and more girls reporting daily smoking (exclusively or in combination with snus use). These results indicate that use practices in adolescents are fragmented and perhaps more so than the traditional separation into snus users and smokers allows for. Dual use practices also varied substantially, ranging from occasional use of both snus and cigarettes all the way to daily use of both, demonstrating that the concept of dual use in itself is not particularly precise.

The 40% dual use found in this tobacco user sample is higher than the 28% found by Pedersen et al. in 2010 [22], but can be said to represent a continuation of the dual use increase reported by them from 2002 to 2010. In addition, the current sample is younger than the sample of Pedersen et al. (15 vs. 16–17 year olds) and this may potentially have affected the proportion of dual users. The risk of smoking has been shown to be higher for snus users who start to use snus earlier than the age of 16 years [29] and we could speculate that because our sample consists of relatively early tobacco starters, a higher than average tendency for experimenting with multiple tobacco products could be expected.

The results revealed some lifestyle and risk profile variations across the product user groups. Daily smokers more often had socially orientated leisure activities, whereas daily snus users more often had culturally orientated activities. Similarly, a high score on the relational risk factor was found for daily smokers, but not for snus users. Importantly, however, many of the differences found in leisure time orientation and risk profiles seemed to be less contingent on the choice between snus and cigarettes and to depend more on use frequency. All occasional users (snus, cigarettes, or both) had negative scores on most leisure time and risk factors, whereas a much more diversified pattern was uncovered for the various groups of daily users, although with an overall tendency for higher scores on several factors. However, the relatively small group of tobacco users that reported daily use of both cigarettes and snus (8%) deviated considerably from other tobacco user groups, including other groups of daily users, by having the highest scores on the leisure time factor gambling and the legal and relational risk factors. Although there were only small differences in the number of last-month drinking episodes between occasional and daily tobacco users, the daily dual user group reported a much higher occurrence of drinking. With the exception of relational risk, these high-risk tendencies also remained significant when adjusting for other factors in a logistic regression. Overall therefore, and somewhat in contrast with earlier findings, the results from this study indicated that although risk and leisure profiles vary between

different groups of tobacco users, use frequency may have become a more important dividing line than choice of product. They also suggest that dual use at higher use frequencies has other connotations than dual use at lower use frequencies.

As reported previously, risk behaviours in adolescence, such as poly-substance use [30] and smoking [31], tend to cluster in individuals. An association between alcohol consumption and dual use of tobacco has been established previously for Norwegian adolescents [23] and research has shown that early onset of tobacco use is a factor associated with an increased risk of such multiple health risk behaviours [32]. It has been argued that this type of clustering may reflect individual vulnerability, such as certain personality traits [30] or adverse home environments [33], although little is known about the mechanisms at work, the temporal ordering of risk factors and behaviours, or whether the various problems are causally related to each other or have a common underlying cause [34]. Whether the high occurrence of other risk factors found for daily dual users in the current study indicates a high occurrence of vulnerable individuals in this group lies outside the scope of this study and is left for future research to answer. However, it may indicate that the daily dual use of cigarettes and snus is a marker for this type of multiple health risk behaviour, implying that this might be a group that warrants special attention in terms of prevention efforts or strategies promoting a healthier lifestyle.

Limitations

The limited sample size means that separation into eight different tobacco user categories gave relatively small groups. There were also some measurement problems in the data because cigarette smoking and snus use were asked about in two different ways. Although the smoking question applied only to the last 30 days, the snus use question referred to 'current' use, with no timespan limitation. In addition, information on the amount of snus per day or week was not available, implying that there might be large unmeasurable variations in use intensity within the snus user groups. This highlights the need for more refined data on use frequency for snus to improve our understanding of how young people use tobacco and to be better able to compare snus users with smokers.

Conclusions

The developments in the tobacco market, and in the overall prevalence of snus use and cigarette use, may have resulted in different use practices in groups of new tobacco users. The current pattern of tobacco

use among young tobacco users in Norway seems to be very fragmented with a high occurrence of dual use. This indicates that the traditional divide between snus users and smokers may no longer be a fruitful approach to understanding tobacco use among adolescents. Instead, use frequency and high-frequency dual use might offer better foundations for examining user profiles, particularly in relation to general risk-taking behaviour.

Conflict of interest

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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