

ORIGINAL INVESTIGATION

Smoking and Snus Use Onset: Exploring the Influence of Snus Debut Age on the Risk for Smoking Uptake With Cross-Sectional Survey Data

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ABSTRACT

Introduction: Snus use has become increasingly prevalent among young people in Norway, while smoking has declined. Little is known about the transitions between snus and other tobacco products, particularly among younger users. A major concern involves the association between snus initiation and future smoking uptake.

Methods: A total of 409 lifetime snus users who had started with snus before cigarettes or were never-smokers were selected from a national sample of participants in annually repeated cross-sectional surveys (2005–2011) of Norwegian men and women aged 15–74 years. About 30% of them were lifetime smokers, 84% were men, and the mean age was 29.4 years. Logistic regression was applied to investigate the association between age of snus uptake and the risk for becoming a smoker later on.

Results: Respondents who started using snus before the age of 16 years had an odds ratio of 3.1 (confidence interval = 1.98–4.76) of being lifetime smokers compared with those who initiated snus later. The prevalence of current smoking among early snus initiators (22.9%) was comparable to that found among never-snus-users (29.6%). Among late snus initiators, current smoking prevalence was 5.9%.

Conclusion: In this study, snus debut age was an important factor for the association between snus use and smoking.

INTRODUCTION

Since the early 1990s, the use of Swedish moist snuff (snus) has become more prevalent among Norwegian men, while female snus use started to increase after 2005 (Lund & McNeill, 2013). Simultaneously the smoking prevalence has gone down, particularly since the turn of the century (Wiium & Aarø, 2011). Likely contributing factors to this development are strict regulations on where and when smoking is permitted, increasingly negative public opinions on smoking, and a positive change in public opinions on snus (Moshuus, 2010; Wiium, Aarø, & Hetland, 2009). Smokers have come to be seen in a gradually more disapproving and judgmental light (Sæbø, 2012), with connotations of poor health and low socio-economic status (Farrimond & Joffe, 2006). Meanwhile, snus use has remained much less associated with social and psychological problems (Lund, 2006).

Due to the use of snus as a smoking cessation aid, the majority of older snus users are former smokers (Lund, Scheffels, & McNeill, 2011). However, this is not the case for younger users, who often have no previous experience with tobacco (Lund et al., 2011). Still, it is among the young that snus has become most popular, and in Norway, we are presently

in a situation where snus use is more common than smoking among 16–24-year-old men (36% vs. 20%), and as common as smoking among 16–24-year-old women (22% vs. 19%) and 25–34-year-old men (31% vs. 30%; Lindbak & Helleve, 2013).

The rapid increases in adolescent snus use have raised several concerns regarding the future tobacco career and health situation for young snus users. Important in the current context is that relatively little is known about the transitions between snus and other tobacco products, particularly for younger users. An essential issue yet to be fully resolved involves the risk for young snus users future uptake of smoking. Research have focused on the probabilities of snus being a gateway into smoking, or rather a protection against smoking uptake, with divided results. The current status seems to be that snus acts as a deterrent against smoking (Fagerström & Schildt, 2003; Foulds, Ramström, Burke, & Fagerström, 2003; Furberg et al., 2005; Ramström & Foulds, 2006; Rodu & Cole, 2010), although the gateway theory has also found some support (Severson, Forrester, & Biglan, 2007; Tomar, 2003).

Should the gateway effect turn out to be more important than the protective effect, the observed increase in snus prevalence levels among adolescents is likely to result in a net public health loss, in spite the substantially lower risk related to the use

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of snus compared to cigarettes (Royal College of Physicians, 2007; SCENIHR, 2008). Furthermore, if the new snus users are individuals who would otherwise have remained tobacco free, public health will be negatively affected (Mejia, Ling, & Glantz, 2010; Tomar, 2003). In case of a deterrent effect, however, a net public health benefit might ensue contingent, among other things, on a faster reduction in smoking prevalence levels than would otherwise have been achieved (Lund, 2009).

An important question not touched much upon by research is the possibility of an effect of snus debut age on the risk for subsequent smoking uptake. It has been suggested in the literature that early snus initiation might be a marker for a tendency for risk-taking behavior in general (Foulds et al., 2003). Within other risk behaviors, early initiation has repeatedly been shown to be associated with behavior patterns later in life. Early smoking initiation has been related to subsequent daily smoking, heaviness of smoking (Everett et al., 1999), and nicotine dependence (Breslau, Fenn, & Peterson, 1993). Similar associations have been found for other substances and even in other forms of risk behavior (Wu, Witkiewitz, McMahon, & Dodge, 2010). Empirical research has for example consistently associated early onset of alcohol use with increased risk of alcohol problems (DeWit, Adlaf, Offord, & Ogborne, 2000; Pitkanen, Lyyra, & Pulkkinen, 2005), while early onset of drug use has been associated with an elevated risk of drug dependence later in life (King & Chassin, 2007). Furthermore, the association between initiation age and later use behavior is not necessarily substance specific. Early drinkers have been shown to be more likely to engage in other kinds of substance use (Kandel, 1982) and to be at risk for developing drug dependence by young adulthood (Robins & Przybeck, 1985), while adolescents who start to use drugs at an early age have an elevated risk of both alcohol dependence and drug dependence later on (Lynskey et al., 2003; Robins & Przybeck, 1985).

Assuming that snus use behavior follows similar trajectories, one might expect an association between the age of snus uptake and later tobacco use behavior, and an interesting aspect of this concerns how early initiation might influence the probability of a gateway effect between snus and cigarettes. The aim of this study is thus to explore the association between the age of snus uptake and the risk of becoming a smoker later.

METHODS

From annual national representative cross-sectional survey data, collected in the period 2005–2011, and including a total of 8,313 respondents evenly distributed over the years, all lifetime snus users who had started with snus before cigarettes or who were never-smokers, were selected. The total survey is thoroughly described elsewhere (Lund & Scheffels, 2013). The final sample consisted of 409 individuals, evenly distributed over the sampling years, 84% of them were men and 30% were

lifetime smokers. All lifetime smokers were defined as dual users, regardless of whether the snus use and smoking took place concurrently or not. The respondents were between 15 and 74 years of age, although 61% of them were 30 years or younger, and only 5% were 50 years or older at the time of the surveys. The *M* age was 29.4 years (median 27 years).

Snus use status was measured by two separate questions in the survey: “Are you using snus” and “have you used snus earlier.” Additionally, respondents were asked to specify their age of snus initiation, and dual users were also asked to specify their cigarette initiation age and to report whether snus or cigarettes was the first tobacco product they used. All dual users included in the sample responded that they started with snus before cigarettes. Furthermore, those who indicated the opposite (smoking first) when asked specifically about initiation ages were excluded from the analyses.

The *M* age for snus initiation was 17.7 years, while the median was 16 years (Table 1). Initiation age was dichotomized such that those who had experimented with snus before the age of 16 years were defined as early starters (1), while those who waited till they were 16 or older were defined as not early (0). The background for choosing the median as the cutoff value was both technical and substantial: It ensured a reasonable number of individuals in each group, at the same time as it made it possible to single out a group who started at an earlier age than the average snus user. An important factor that was taken into consideration was also the age at which smoking uptake often occur. In Norway, the *M* age for uptake of daily smoking was 17.8 and 18.3 years for men and women, respectively, in 2010–2012 (Lindbak & Helleve, 2013), while in the current sample, the *M* age for the uptake of any smoking was 16.2 years (Table 1). Nobody in our sample took up smoking after the age of 22 years (Table 1). Regardless of snus use, one can assume that the risk of smoking uptake starts to decline in the final years of adolescence and the early 20s, and as this study only included individuals who were never-smokers when they took up snus, it was necessary to use a cutoff below the *M* age of smoking initiation to reduce the risk of skewed results.

The respondents’ lifetime smoking status was calculated by adding together information about current and historic smoking habits (daily, nondaily, former or never-smoker), and dichotomizing into lifetime smoker (1) versus lifetime nonsmoker (0).

In addition, gender and age at the time of the survey were included as control variables. The justification for including gender was based on the idea that early snus initiation might mark a tendency for risk-taking behaviors. Traditionally, snus was much less used by females than males, and early snus initiation might therefore signal a more obvious break with normality, and thus a stronger tendency for risk-taking behaviors, for girls. Age at survey time was included as a response to the increasing prevalence of snus and decreasing prevalence of smoking in recent years, as this might imply a different association between early snus

Table 1. Tobacco Initiation in the Sample of Lifetime Snus Users

	<i>M</i>	Median	Minimum	Maximum	<i>N</i>
Age of snus initiation	17.7	16	10	50	409
Age of smoking initiation	16.2	16	12	22	65 ^a
Years from snus initiation to smoking initiation	1.4	1	0	6	65

Note. ^aHigh item nonresponse for this question.

initiation and smoking in older age groups, who took up snus at a time when snus use was less common than smoking.

Statistical Analysis

Logistic regression was applied to estimate adjusted and unadjusted odds ratios (*ORs*) for smoking uptake among early snus initiators. Gender and age were used as controls.

A nontrivial difference between snus initiation and smoking initiation was that while there was no-one in the sample who had taken up smoking after the age of 22 years, snus initiation could occur at much higher ages, the highest debut age in this sample was 50 years (Table 1). To reduce the risk of biased results due to this characteristic of the data, regressions were performed on three different (sub) sets of the sample. In addition to all lifetime snus users, that is, the entire sample, separate logistic regressions, using the same dependent and independent variables, were performed on only those lifetime snus users who were 30 years or younger at the time of the surveys and on only those who started to experiment with snus before the age of 20 years.

RESULTS

In the entire group of lifetime snus users, those who initiated snus before the age of 16 years had an unadjusted *OR* of 3.1 ($p < .001$) over those who initiated snus later on of being lifetime smokers (Table 2). Some of this effect might be due to the existence of very late snus starters, as snus initiation occurred up to the age of 50 years. However, reducing this bias by including in the analysis only those who started to experiment with snus at the age of 20 years or earlier, or only those who were 30 years or younger at the time of the survey, did not obliterate the association between early snus initiation and subsequent smoking uptake. In both these subsets of snus users, those who started with snus before the age of 16 years had an *OR* of being lifetime smokers of 2.3 ($p < .001/p < .01$), over those who initiated snus use after the age of 16 years.

Controlling for gender and age only led to small changes in these results. Gender was not significantly associated with lifetime smoking, and the respondents' age at the time of the survey was only significantly associated with lifetime smoking in the regression on all snus users (adjusted odds ratio [*AOR*] = 0.97, $p < .05$), and not in the regressions on snus users 30 years or younger, or snus users who initiated snus at age 20 years or younger. The *AORs* for being a lifetime smoker was 2.8 ($p < .001$) for early initiators in the total sample and 2.2 ($p < .01$) for early initiators in samples limited to those who started using snus before or at the age of 20 years, or who were 30 years or younger at the time of the survey.

Contrasting the proportions of current smokers among early and late snus initiators with other available information (Table 3) shows that the prevalence of smoking among early snus initiators is comparable to the prevalence found among never-snus-users in the same survey data from which the snus users were drawn (no significant difference), as well as the prevalence found in the official national statistic. While 5.9% of the late snus initiators were current smokers, this applied to 22.9% of the early initiators, a difference that was statistically significant (chi-square, $p < .001$).

DISCUSSION

Whether snus use functions as a deterrent from, or a gateway to, smoking has been a matter of much debate in the tobacco control community in later years, and research supporting both possibilities has been published (Furberg et al., 2005; Ramström & Foulds, 2006; Rodu & Cole, 2010; Tomar, 2003; Severson, Forrester, & Biglan, 2007). The results from this study indicate that if there is a protective effect of snus, there might be a critical age at which it kicks in. Those who started to experiment with snus before the age of 16 years were significantly more likely to become smokers than those who started with snus later on, and comparisons with additional material indicated that the smoking prevalence in the early initiator group was at the same level as among nonsnus users. Among those who initiate snus at the age of 16 years or later, the smoking prevalence

Table 2. Unadjusted and *AORs* for Being a Lifetime Smoker if Snus Initiation Occurred Early in 3 Different Subsets of Lifetime Snus Users Who Did Not Initiate Smoking Before Snus^a

	Initiated snus at age 20 years or earlier (<i>N</i> = 346)		Snus users 30 years or younger at survey time (<i>N</i> = 250)		All snus users (<i>N</i> = 409)	
	<i>OR</i> ^b	95% CI for <i>OR</i>	<i>OR</i>	95% CI for <i>OR</i>	<i>OR</i>	95% CI for <i>OR</i>
Early snus initiation ^c	2.29***	1.45–3.60	2.30**	1.35–3.94	3.06***	1.98–4.76
	<i>AOR</i> ^d	95% CI for <i>AOR</i>	<i>AOR</i>	95% CI for <i>AOR</i>	<i>AOR</i>	95% CI for <i>AOR</i>
Early snus initiation ^c	2.24**	1.42–3.53	2.18**	1.26–3.75	2.75***	1.76–4.31
Female	0.95	0.48–1.85	0.84	0.42–1.66	0.78	0.41–1.48
Age at survey	0.98	0.96–1.01	0.97	0.91–1.03	0.97*	0.95–0.99
Unadjusted versions	–2 Log likelihood = 431,033 Nagelkerke <i>R</i> ² = 0.051		–2 Log likelihood = 309,699 Nagelkerke <i>R</i> ² = 0.052		–2 Log likelihood = 471,329 Nagelkerke <i>R</i> ² = 0.086	

Note. *AOR* = adjusted odds ratio; CI = confidence interval; *OR* = odds ratio.

^aResults from binary logistic regressions with lifetime smoking as dependent variable.

^b*ORs*.

^cInitiated snus before the age of 16 years.

^d*AORs*.

** $p < .01$, *** $p < .001$.

Table 3. Proportion of Current Smokers (Daily and Nondaily) Among Early and Late Snus Initiators, Never-Snus-Users From the 2005–2011 Original Survey Sample, and According to Official Statistics

	Proportion of current smokers (%)	N
Early snus initiators ^a , 2005–2011	22.9	153
Late snus initiators ^b , 2005–2011	5.9	255
Never-snus-users in original surveys, 2005–2011	26.6	7,442
Norway 2008–2012, 16–74 years ^c	29.0	

Note. ^aStarted before age 16 years.

^bStarted at 16 years or later.

^cSource. Lindbak and Helleve, (2013).

was low in comparison to all other groups. These results did not change after limiting the sample to include only those who started with snus before the age of 20 years, or to respondents who were 30 years or younger at the time of the survey.

This study has some limitations. First, the analyses were based on a series of cross-sectional surveys, with debut ages asked about retrospectively and therefore subject to the risk of erroneous recall. While it is not possible to eliminate the increased uncertainty from such errors, the dichotomization of snus debut age would have worked to reduce the consequences on the results. Second, with Nagelkerke *R* squares ranging from 0.06 to 0.1 in the models with controls (Table 2), it is clear that other factors, not controlled for in the current analyses, also have influenced the choice between smoking and nonsmoking for the participants in these surveys. A possibility discussed in the literature is that early snus initiation could be a marker for a tendency for risk-taking behavior in general (Foulds et al., 2003), and that this is the main factor behind both early snus use and later cigarette smoking in this group (Foulds et al., 2003; Galanti, Wickholm, & Gilljam, 2001). This interpretation was also suggested by Galanti, Rosendahl, & Wickholm (2008), who found that simultaneous uptake of both snus and cigarettes increased the risk for later smoking more than taking up any of the two products alone. Associations between early onset and other risk-taking behavior have also been observed in relation to alcohol, where the effects of early onset of alcohol on later alcohol outcomes such as dependence were greatly diminished when other risk factors were controlled for (Warner & White, 2003).

The question of whether it is the early onset of use of snus that leads to later smoking or whether early initiation could be a marker of underlying vulnerability in itself is highly relevant, and more research on how patterns of snus and cigarette use correspond with those found for other substances is needed in order to illuminate the question of how the availability of snus will impact public health in the years to come.

As shown by earlier research, development of identity is important when adolescents take up a tobacco habit, regardless of whether it is snus (Edvardsson, Troein, Ejlerstsson, & Lendahls, 2012) or cigarettes (Scheffels, 2009). Among adult smokers, it has been shown that a strong smoking identity might prevent substituting snus for cigarettes (Bahreinifar, Sheon, & Ling, 2013), and one could speculate that individuals find it difficult to combine snus use with smoking, given the distinctly different social representations of snus and cigarette

users that have been found in studies among young people in Norway (Wiium et al., 2009). It is possible that the relatively low prevalence of smoking among adolescents who took up snus use at the age of 16 years or later results partly from a protective effect from developing a snus user identity. This would, however, require that resilient snus user identities form more rapidly for this group than is the case for younger people, a question that is also yet to be researched.

CONCLUSION

In this study, snus debut age was an important factor for the association between snus use and smoking. For the group who started with snus before the age of 16 years, snus use did not protect against lifetime smoking. This finding highlights the importance of tobacco control interventions that include efforts to keep adolescents tobacco free for as long as possible.

DECLARATION OF INTERESTS

None declared.

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