

The development of tobacco use in adolescence among “snus starters” and “cigarette starters”: An analysis of the Swedish “BROMS” cohort

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Whether the use of smokeless tobacco can facilitate the transition to cigarette smoking and/or to prolonged tobacco use in adolescence is unclear. We analyzed data from a cohort of 2,938 Swedish adolescents, with six follow-up assessments of tobacco use between the ages of 11 and 18 years. The majority of tobacco users (70%) started by smoking cigarettes, 11% took up snus before smoking, and 19% used both tobacco types close in time. Ever users of tobacco at baseline had a higher risk of being current smokers and/or smokeless tobacco users at the end of follow-up compared with never users, with the highest excess relative risk for “mixed users.” Adolescents who initiated tobacco use with cigarettes had a non-significantly increased probability to end up as current smokers compared with snus starters (adjusted $OR=1.42$; 95% CI 0.98–2.10). The OR of smoking for “mixed starters” was 2.54 (95% CI 1.68–3.91). The risk of becoming current user of any tobacco was also significantly enhanced for “mixed starters.” Marked sex differences were observed in these associations, as initiation with cigarettes rather than with snus predicted current smoking or tobacco use only among females. Progression of tobacco use in adolescence is not predicted by onset with snus or cigarettes, but rather by initiation with both tobacco types close in time and/or at young age. The proportion of adolescent smoking prevalence attributable to a potential induction effect of snus is likely small.

Introduction

One out of five men in Sweden use snus (the Swedish variety of oral moist snuff) on a daily basis, and the prevalence of use is rising among young women (Boström & Nykvist, 2004). Furthermore, the sale of snus has been steadily increasing in the last three decades. These factors, along with the low and continuously declining smoking rates in the Swedish population, have prompted the interest of the global tobacco control community for a product that apparently fits well the concept of harm reduction (Fagerström, & Schildt, 2003; Henningfield, &

Fagerström, 2001). Snus is made of non-fermented, heat cured, finely grained tobacco of the dark Kentucky or Virginia sort. Additives include water, sodium carbonate, sodium chloride, moisturizers and, in some commercial types, also flavors.

Because of its manufacturing, the content of tobacco specific nitrosamines is relatively low compared with other types of oral smokeless tobacco (Nilsson, 1998). Although not completely studied, the overall harmful effects of snus are probably on a lower scale of magnitude compared with tobacco smoking (Asplund, 2003; Foulds, Ramström, Burke, & Fagerström, 2003; Hatsukami, Lemmonds, Zhang, et al., 2004). In addition, smokers motivated to quit may find snus appealing as an aid to smoking cessation or reduction, because of its low price, wide availability, and unrestricted consumption (Gilljam, & Galanti, 2003).

Including smokeless tobacco into smoking reduction strategies, however, might entail adverse public health effects. Among these, the possibility that presenting snus as a relatively safe tobacco product

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may promote experimentation, and eventual transition to regular cigarette smoking, among young people that would otherwise never have smoked or tried tobacco (Hatsukami, Lemmonds, & Tomar, 2004; Nordgren, & Ramström, 1990). This behavioral process has commonly been labelled as a gateway effect of smokeless tobacco. Although the conceptual model underlying this expression is not always explicit, a causal relationship is usually implied (Foulds et al., 2003; Henningfield, Moolchan, & Zeller, 2003; Kandel, Yamaguchi, & Klein, 2006; Martin, Warner, & Lantz, 2004). Custom designed snus, such as the mini-portion and the flavored sorts, are probably successfully targeting young people in Sweden, particularly women (Stjerna, Lauritzen, & Tillgren, 2004). Some evidence in support of smokeless tobacco being a possible gateway to cigarette smoking has been provided by longitudinal studies conducted in the United States (Haddock et al., 2001; Tomar, 2003a). In contrast, this question has not been addressed by prospective longitudinal studies in Sweden. We describe patterns of initiation of snus use and cigarette smoking in a cohort of Swedish adolescents, in which complete assessment of tobacco use was conducted almost every year between 11 and 18 years of age.

Methods

The BROMS cohort study was approved by the Karolinska Institutet Ethical Board at Huddinge University Hospital.

Subjects

The characteristics of the design and of the study cohort at baseline have been described in detail elsewhere (Galanti, Rosendahl, Post, & Gilljam, 2001; Post, Galanti, & Gilljam, 2003). Briefly, the BROMS cohort encompasses 3020 adolescents of both sexes who in 1998 participated in a school-based survey of tobacco use and related putative risk factors. At the time of recruitment, all participants resided in the urban area of the Stockholm region of Sweden. After the baseline assessment, conducted in grade 5, the adolescents were invited to participate in a similar annual survey up to grade 9 (four follow-up waves during compulsory school education). Thereafter, two follow-up surveys were conducted, during the second and the third year after completion of the compulsory school, respectively. The participation rate ranged from 96% (at follow-up wave 1, in grade 6) to 82% (at follow-up wave 6, corresponding to the third year post-compulsory school, PCS 3). The study sample in this analysis consists of 2,938 adolescents (97% of those recruited) who provided valid information on their lifetime smoking and snus

use at baseline, including 1,494 males and 1,444 females. The mean age at baseline was 11.6 years ($SD=0.32$, median=11.6, range 10.3–13.1) among boys, and 11.6 years ($SD=0.34$, median=11.6, range 10.1–13.0) among girls. Very few subjects were younger than 11 years ($n=67$, 2.3%) or older than 12 years ($n=3$, 0.1%).

Information on tobacco use

At each wave, past and current cigarette smoking and snus use were investigated with a set of almost identical questions, covering the following dimensions: use ever in life (even a single cigarette puff and/or snus portion); number of cigarettes/snus dips in life; regular use (defined as weekly use for at least three months in row); frequency of current use, coded in five mutually exclusive response alternatives (not at all, less than once a month, monthly/weekly/daily use). Among past and current weekly or daily users, intensity of use was assessed as the average number of tobacco pieces (cigarettes and/or snus portions) consumed in a week. Questions in the survey instrument were adapted from previous surveys conducted in Sweden or in other European countries (Berg, Haglund, & Wallin, 1991; Currie, Hurrelmann, Settertobulte, Smith, & Todd, 2000). High concordance between self-reported tobacco use and saliva cotinine level was found when validity of self-reported tobacco use was investigated in a subsample of the cohort (Post et al., 2005).

Statistical methods

For the purpose of the present analysis, initial tobacco use was defined as self-reported use of cigarettes and/or snus at any wave among adolescents who were lifetime non-users during the preceding wave. Participants, who at any wave reported having at least tried smoking, but never having used snus, were labelled "cigarette starters," while "snus starters" were those reporting having only used snus. Participants who reported having started the use of both products during the same time period were labelled "mixed starters." If the order of product use could not be assessed at a certain time point because of missing data, subjects were categorized as "order unknown" at that time. If their initial use could be assessed at a later time, this latter time was considered as probable time of initiation. Otherwise, the subjects were considered as "missing information on order of product" throughout the study time.

When reports were inconsistent between waves, we counted as initiation the first report of use of either type of tobacco. Inconsistencies (ever users subsequently denying use) were found among 18% of ever

smokers and 24% of ever snus users. In summary, the numbers of starters with cigarettes, snus, or both, at each time point correspond to the sum of those having certainly started with either product during any year before that time. "Ever users" at baseline (grade 5) were children reporting having puffed from a cigarette and/or having tried snus. "Current use" was defined as self-reported use of cigarettes and/or of snus at least once a month. When estimating weekly consumption of cigarettes and/or snus we assigned "0" consumption to subjects reporting monthly, but not weekly, use. In addition, we disregarded a few reports that appeared unreliable (consumption above 45 cigarettes or snus dips per day).

We calculated incidence of tobacco use initiation during each follow-up year by product order (i.e., smoking, snus or both products contemporarily) using as denominators the person-years of observation among susceptible subjects (i.e., those who did not previously start the use of either product). Unconditional logistic regression was used to estimate the association between tobacco product first used, or tobacco use at baseline, and current use of tobacco at end of follow-up (corresponding to the last year of senior high school, or 3 years after the completion of the compulsory school). The association is expressed as odds ratio (*OR*), while the corresponding 95% confidence intervals (*CI*) are used to measure precision. Adjustments were made for sex, age at baseline, and age at initiation of tobacco use. The different adjustments presented in the tables reflect whether or not these variables were deemed to be actual confounders of the association with product order, on the basis of their association with the outcome variable and amount of modification of the crude *ORs* (Normand et al., 2005). The Wald

statistics was used to determine the departure of the estimate from the value of 0 expected under the null hypothesis. In tabular analyses, expected and observed distributions of outcomes across predictors were compared by means of the chi-square statistic. In all analyses, the conventional limit of 5% ($p < .05$) was used to determine the statistical significance. The analysis was conducted with the SAS software v. 9.1 (SAS Institute Inc., Cary, NC, USA).

Results

The prevalence of tobacco use increased over time in both sexes (Table 1). Girls appeared to start cigarette use somewhat later than boys, as already reported in earlier analyses of this cohort (Galanti, Rosendahl, et al., 2001). By the 7th grade, however, girls had progressed to the same level as boys (not shown), and by the 9th grade, they had become current and regular smokers more often than boys. On the other hand, the prevalence of current use of snus among boys was 4 to 10 times higher than among girls.

Among those who started using tobacco up to the end of follow-up, whose product order could be determined, 69.5% (1,582) started by smoking cigarettes, 11.2% (256) by using snus, and 19.3% (439) started by using snus and cigarettes during the same year. For 169 subjects, (about 6% of the study sample) the initiation status or the product order at the end of follow-up could not be determined. There were significant sex differences in product order of initiation, with a much higher proportion of snus starters among boys (15.5%) than among girls (6.8%), while the reverse was true for initiation with cigarettes (57.3% among boys and 82.0% among girls). The peak incidence of snus initiation was seen

Table 1. Prevalence (%) of ever and current use of cigarettes and snus at baseline and in selected follow-up years, by age at entry and gender.

Tobacco use, Age at entry	Males (n=1,494)			Females (n=1,444)		
	Grade 5 (baseline)	Grade 9	PCS 3 ^a (end of follow-up)	Grade 5 (baseline)	Grade 9	PCS 3 ^a (end of follow-up)
Ever smoking						
≤ 11	21.7	65.1	81.1	15.0	66.5	79.6
≥ 12	23.3	65.9	80.3	17.3	71.8	79.7
All ages	21.9	65.2	81.0	15.3	67.2	79.6
Current smoking						
≤ 11	0.4	13.0	20.9	0.1	22.0	30.0
≥ 12	0.5	16.2	19.9	0.5	27.0	33.3
All ages	0.4	13.5	20.7	0.1	22.7	30.5
Ever use of snus						
≤ 11	8.2	53.5	71.2	3.3	31.8	55.4
≥ 12	7.0	61.0	73.1	2.6	35.7	58.9
All ages	8.0	54.6	71.5	3.2	32.3	55.9
Current use of snus						
≤ 11	0.2	17.7	24.5	0.0	1.9	5.6
≥ 12	0.0	20.9	28.1	0.0	1.7	5.6
All ages	0.2	18.2	25.0	0.0	1.9	5.6

^aPCS 3, third year post-compulsory school, 18 years of age.

for both sexes between grade 8 and 9 (age 14–15), with higher rates of snus initiation among males compared with females (Figure 1). In both sexes, a slight rise in the incidence of first tobacco use, especially cigarettes, was observed during the year preceding the last follow-up, when most subjects reached the age of 18 years, i.e., the legal age for purchasing tobacco in Sweden.

Among adolescents with known tobacco history and at least 1 year follow-up, i.e., those who initiated tobacco use up to the 2nd year post-compulsory

school, initiation with the other product occurred before the end of follow up for 79% of the “snus starters” and for 70% of the “cigarette starters” ($p < .05$). This difference was mainly related to a much lower proportion of girl smokers than boy smokers later taking up snus (64% vs. 78%, $p < .05$).

All ever users of tobacco at baseline, compared with never users, had a higher probability to end up as current smokers and current users of any tobacco 3 years after leaving the compulsory school, with the lowest excess relative risk for those who only had

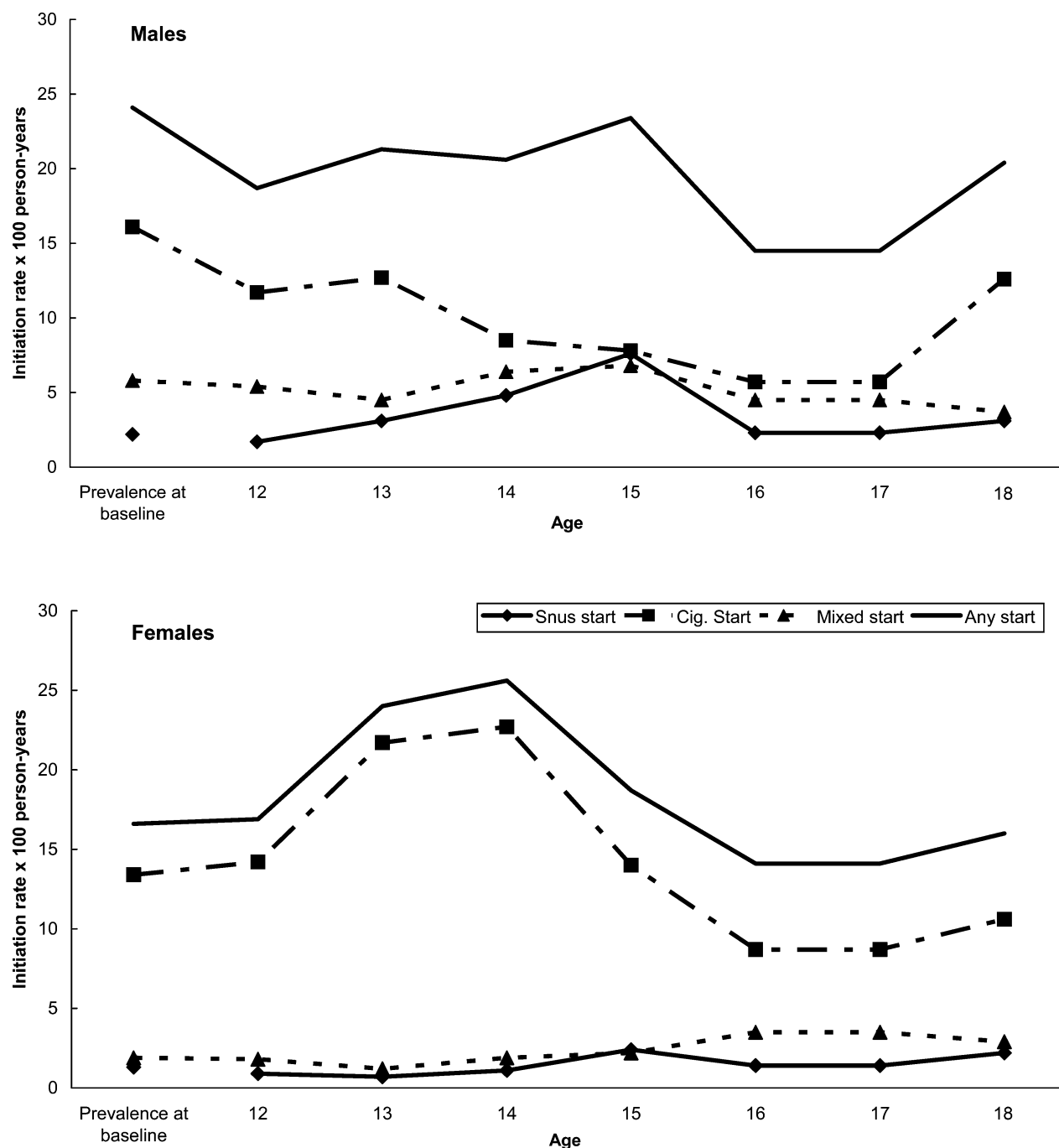


Figure 1. Initiation of tobacco use between age 11 and 18 years for males and females. Incidence averaged over 2 years; the annual survey was not conducted in the first year post-compulsory school, which was between ages 16 and 17 for both males and females.

used snus and the highest among those who had already experimented with both products (Table 2).

It should be observed that about 18% of the study sample failed to report current tobacco use at the end of follow-up, the majority (96%) because of non-participation at the last wave of data collection, while only 4% deliberately chose to skip these particular questions. The proportion lost to follow-up or non-responding was higher among ever users of tobacco than among never users of tobacco at baseline (26 vs. 16%, $p < .01$), but did not differ according to type of tobacco among users. Also, the proportion missing because of active refusal to continue participation did not differ according to lifetime use at baseline (data not shown).

An analysis of product order at initiation among subjects for whom this order could be assessed showed that 19.5% of the snus starters up to the end of follow-up were currently smoking at that time, while the corresponding proportions among cigarette starters and mixed starters were 33.1% and 38.2%, respectively. The same gradient was observed for current use of any tobacco (31.7%, 41.7% and 55.0%). The *OR* of being a current smoker at the

end of follow-up (Table 3) was not significantly increased for cigarette starters compared with snus starters (adjusted *OR*=1.42; 95% *CI* 0.98–2.10), while mixed starters had a significantly higher risk (adjusted *OR*=2.54; 95% *CI* 1.68–3.91). The adjusted *OR* of current smoking for ever tobacco users whose product order could not be assessed was 2.66 (95% *CI* 1.18–5.76).

Initiation with cigarettes was not a significant predictor of being a current user of any tobacco at the end of follow-up compared with initiation with snus, while contemporary initiation with both cigarettes and snus remained a strong and significant predictor (Table 3). Being female was a significant predictor of current smoking, but not of current use of any tobacco, while increasing age at initiation was negatively correlated to current use (Table 3).

A separate analysis by sex revealed very different association patterns. Among male cigarette starters, the risk of current smoking (adjusted *OR*=1.18; 95% *CI* 0.73–1.97) or of use of any tobacco (adjusted *OR*=1.00, 95% *CI* 0.66–1.52) was not different from that of snus starters. Among females, the risk of being a current smoker (adjusted *OR*=1.85, 95% *CI*

Table 2. Odds ratios (*OR*) and 95% confidence interval (*CI*) of current smoking and current tobacco use at end of follow-up, according to lifetime use at baseline.

Ever use of tobacco reported at baseline	Current smoking			Current tobacco use		
	<i>n</i> ^a	<i>OR</i> ^b	<i>CI</i>	<i>n</i> ^a	<i>OR</i> ^b	<i>CI</i>
Never	Yes/No 424/1536	Ref.	—	Yes/No 576/1375	Ref.	—
Snus only	13/26	1.95	0.96–3.80	18/21	2.07	1.08–3.91
Cigarettes only	137/181	2.89	2.25–3.71	173/145	2.83	2.23–3.61
Both snus and cigarettes	46/42	4.81	3.09–7.50	59/29	4.83	3.08–7.72

^aNumbers do not sum up to the total because of missing information. ^bAdjusted for sex and age at entry.

Table 3. Odds ratios (*OR*) and 95% confidence intervals (*CI*) of current smoking or any current tobacco use at end of follow-up, by product order of initiation.

	Current smoking					Current tobacco use				
	<i>n</i> ^a	<i>OR</i> ^b	<i>CI</i>	<i>OR</i> ^c	<i>CI</i>	<i>n</i> ^a	<i>OR</i> ^b	<i>CI</i>	<i>OR</i> ^c	<i>CI</i>
	Yes/No					Yes/No				
Product order										
Snus first	41/169	Ref.	—	Ref.	—	66/142	Ref.	—	Ref.	—
Cigarette first	432/873	2.04	1.44–2.96	1.42	0.98–2.10	543/758	1.54	1.13–2.12	1.28	0.93–1.79
Snus and cigarettes same time	135/218	2.55	1.72–3.85	2.54	1.68–3.91	193/158	2.63	1.84–3.78	2.70	1.85–3.97
Sex										
Male	235/663	Ref.	—	Ref.	—	395/498	Ref.	—		
Female	373/597	1.76	1.45–2.15	2.08	1.67–2.58	407/560	0.92	0.76–1.10		
Age at initiation (years)										
≤ 10	163/215	Ref.	—			208/170	Ref.	—	Ref.	—
10.5–11.5	158/190	1.10	0.82–1.47	1.05	0.78–1.42	206/141	1.19	0.89–1.61	1.20	0.89–1.62
12.0–12.5	118/218	0.71	0.53–0.97	0.66	0.48–0.90	149/184	0.66	0.49–0.89	0.69	0.51–0.93
13.0–14.5	124/346	0.47	0.35–0.63	0.44	0.33–0.59	180/287	0.51	0.39–0.67	0.52	0.39–0.69
≥ 15	45/291	0.20	0.14–0.29	0.18	0.12–0.26	59/276	0.18	0.12–0.25	0.16	0.11–0.23

^aNumbers do not sum up to the total because of missing information. ^bUnadjusted. ^cMutually adjusted for all predictors in the column.

1.03–3.49) or tobacco user (adjusted $OR=2.13$, 95% CI 1.18–4.04) was increased if they initiated with cigarettes rather than with snus. In both sexes, however, the risk of current smoking or tobacco use was significantly higher for “mixed starters” compared with “snus starters” (not shown).

A categorical analysis comparing intensity of tobacco use at end of follow-up (cumulated number of cigarettes and snus portions per week), in three groups defined by product order (Table 4), did not show significant differences in tobacco consumption, although mixed starters were over-represented in the highest category of tobacco consumption, i.e., 85 or more cigarettes and/or snus portions per week.

Discussion

Wide availability of smokeless tobacco and social tolerance towards its use do not prevent most Swedish adolescents from initiating tobacco use with cigarettes. In this cohort, snus was chosen as the initial tobacco product by a minority, even if the prevalence of lifetime use was high. At first glance, this fact may appear counterintuitive, since some characteristics of snus, such as its relatively low price, easily concealed use, and virtually no environmental contamination, would theoretically make it very appealing to adolescents wanting to try tobacco. Other factors must therefore be postulated to explain the order of first use. For instance, the cultural and social environment in which initiation occurs deserves consideration in future studies. A strong tendency to initiate tobacco use with cigarettes was seen both among females and among males (in practice, the only group of current snus users), indicating that the choice of the product for continued use is not likely to be dictated by the product order, but is a dynamic choice. On the other hand, switches between cigarettes and snus were common for all initiators, as already reported in an earlier analysis of the same cohort (Galanti, Rosendahl, et al., 2001).

We analyzed the “gateway model” in early adolescence using longitudinal data collected over 7 years. Our operative hypothesis was that product order is a determinant of future regular smoking and tobacco use. In fact, if using snus would hook adolescents to nicotine, and facilitate their transition to cigarette smoking (Henningfield et al., 2003), adolescents using snus before cigarettes would have a risk of becoming regular cigarette smokers, or tobacco users, comparable with that observed when smoking precedes snus use. Obviously, the question of what the “tobacco career” of snus starters in this population would have been like if snus was not available cannot be answered, because such counterfactual outcomes cannot be estimated in real-life conditions (Greenland & Brumback, 2002). We started our analysis by looking at baseline tobacco use as predictor of later current use. Alike Tomar (Tomar, 2003a, 2003b), we found that ever users of tobacco at baseline had a higher probability than never users to progress in intensity of tobacco use, the risks for those who only had used snus or only cigarettes being of comparable magnitude. Since baseline lifetime users are by definition those initiating at very young age (in our study, before the age of 11), the most appropriate conclusion would be that early age at initiation of tobacco use is an important predictor of future use, irrespective of product order. We also compared the development of tobacco use among these youths according to starter product across the entire study time. Following this approach, cigarette starters and snus starters did not have a different probability of ending up as tobacco users, although there was an indication that cigarette starters had a higher probability of becoming current smokers. Also, the intensity of tobacco consumption in late adolescence was not significantly correlated with product order at initiation.

Because of the low rates of initiation with snus and the relatively low rates of smoking progression among snus starters, at the most, 6% of the final smoking prevalence in this cohort could theoretically

Table 4. Consumption of cigarettes and/or snus among current tobacco users at the end of follow-up, by product order of initiation.

Product order	Cumulated number of cigarettes and/or snus portions /week							
	<20		20–49		50–84		85+	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Snus first	14	23.0	14	23.0	20	32.8	13	21.3
Cigarettes first	126	23.9	130	24.8	142	26.9	129	24.5
Snus and cigarettes same time	34	19.4	42	24.0	46	26.3	53	30.3
All starters	174	22.8	186	24.4	208	27.3	195	25.6

$\chi^2_{df=6}=4.20$, $p=0.6$.

be attributable to a gateway effect of snus. In this respect, our results are broadly similar to several others, for instance, those reported by two American studies (Kozlowski, O'Connor, Edwards, & Flaherty, 2003; O'Connor, Kozlowski, Flaherty, & Edwards, 2005). In recent years, two Swedish studies (Furberg et al., 2005; Ramström, & Foulds, 2006) and one Finnish study (Haukkala, Vartiainen, & de Vries, 2006) have also taken up the question of product order in relation to transition to established tobacco use. Although the data in the Swedish studies allowed a retrospective analysis of product order, both studies were cross-sectional and based on an adult population. In one study (Ramström, & Foulds, 2006), only daily use of tobacco was analyzed while the study by Furberg et al. (2005) only included males. Despite these differences, there was a substantial homogeneity of findings, supporting two conclusions. First, the smoking induction or gateway effect of snus use concerned a minority of all smoking experience (at the most between 3% and 8%). Second, snus use is associated rather to the condition of being a non- or a former smoker than a current smoker.

Compared with these studies, this cohort provided substantial advantages. First, we could employ a thoroughly prospective design, where the almost annual detailed assessment of exposure (i.e., initiation with either type of tobacco) preceded the measurement of the outcome, a feature that minimizes the risk of biased or imprecise recall. Secondly, the young age of the cohort made it possible to study early events and transitions. The Finnish study (Haukkala et al., 2006) also employed a cohort of middle adolescents, an age group fairly comparable with our cohort. Despite profound differences in study design, tobacco use assessment and analysis, the conclusions of this study were very similar to ours, i.e., order of product does not represent a very strong predictor of future progression among boys. However, the association might be different among girls, as our separate analysis by sex revealed. The tiny minority of girls starting tobacco use with snus may be a selected group, with higher health awareness and generally healthier lifestyles than cigarette starters, thence a lower probability of transition to regular smoking and tobacco use than girls starting with cigarettes. Our observations are also in agreement with the latest 5-year trends of tobacco use prevalence among Swedish adolescents, generally showing reduction of cigarette smoking among both sexes, with increase in snus use among females (Hvitfeldt & Rask, 2005).

The most noteworthy finding in this analysis was perhaps the high rate of progression in tobacco use among subjects who initiated with both cigarettes and snus within a short time interval (1 year). These

"mixed starters" constituted almost one-fifth of all lifetime users in adolescence. This finding adds to those from cross-sectional studies (Coogan, Geller, & Adams, 2000; Everett, Malarcher, Sharp, Husten, & Giovino, 2000; Galanti, Wickholm, & Gilljam, 2001; Wickholm, Galanti, Söder, & Gilljam, 2003), that observed unfavorable patterns of substance use and conduct disorders among adolescents who combine smokeless tobacco with cigarette smoking. Also, dual users are likely to be heavier tobacco consumers than either snus or cigarette users (Haukkala et al., 2006; Post et al., 2005). The link between snus use and cigarette smoking may thus consist of increased vulnerability (Jamner et al., 2003), and predisposition to addicted behavior rather than causal use. Early onset with and/or frequent switches between smokeless and smoked tobacco may therefore be tackled to identify high-risk adolescents, clearly a priority group for both preventive and treatment programs (Stockwell et al., 2004). Psychosocial predictors of future tobacco use (O'Connor, Flaherty, Quinio Edwards, & Kozlowski, 2003; Tomar, 2003b) are perhaps more relevant to the effort of identifying these subgroups, than they are to refute or support the gateway model. To this end, it would be desirable to obtain even more detailed history on tobacco use than we investigated in this study. At this young age, a 1-year interval may still be too long to elicit reliable reports concerning order of starter products, as well as multiple switches between products, or variation in the frequency of use (Wellman, DiFranza, Savageau, & Dussault, 2004). However, it is unlikely that any misclassification would occur according to the actual starter product, and it is therefore unlikely to bias the associations away from the null hypothesis.

Some features of this study may hamper the extrapolation of the conclusions to all adolescent populations. Although the retention of the cohort was high, some selection occurred at recruitment, since children of parents with high education were more likely to participate (Post et al., 2003) and during follow-up (selective drop-out of baseline tobacco users). Furthermore, the young age of the cohort members at the end of follow-up prevents the generalization of the results to post-adolescence. A Swedish study (Furberg, Lichtenstein, Pedersen, Bulik, & Sullivan, 2006) indeed presents evidence that the uptake of snus occurs later in the life course than the uptake of smoking, and is not rare even in adulthood. More importantly, one should avoid the trap to infer minimal risk of the gateway effect in countries with less comprehensive and enforced anti-smoking policy than Sweden. Snus is not only a peculiar tobacco product: it also happens to have been nested into peculiar tobacco control measures and trends of smoking prevalence (Pierce, 1989).

Even if marketing snus may not entail large effects of smoking induction in an uninitiated population, the problem of making an additional recreational drug, with high potential for addiction and dependence, available to vulnerable individuals should be regarded as a serious one from a public health perspective.

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Conflicts of interest: Maria Rosaria Galanti and Ingvar Rosendahl have tenure positions at the Centre for Tobacco Prevention; Seppo Wickholm has a tenure position as Sr. Medical Advisor at McNeil Sweden AB.

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