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The relationship between snus use and smoking cognitions

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We examined whether use of snus influenced cognitions in terms of smoking expectancies and smoking prototype perceptions in a direction that could promote smoking initiation, thus highlighting potential causal mechanisms between the use of snus and smoking behavior. A telephone-based longitudinal survey among Norwegian adolescents was conducted with two points of measurement during a 1-year period in 2006–2007. The respondents were divided into four groups: Group 1: snus initiators during the period ($N=54$), Group 2: regular snus users ($N=160$), Group 3: non-users of snus and cigarettes ($N=376$), and Group 4: regular smokers ($N=306$). Wilcoxon tests were applied to determine any changes in smoking cognitions from 2006 to 2007. The group of snus initiators (Group 1) reported a significantly higher level of expectancies of smoking to promote negative affect reduction at follow-up, while all other cognitions remained stable. The group of smokers (Group 4) reported on average positive smoking cognitions, and significant changes were observed during the period. However, among regular snus users (Group 2) and non-users (Group 3), there were no significant changes in any of the smoking cognitions. The uptake of snus might influence expectancies of cigarettes to reduce negative affect in a direction facilitating smoking initiation, but the use of snus does not appear to influence the majority of cognitions known to promote smoking initiation among adolescents.

Keywords: Adolescents, snus use, smoking cognitions, gateway

INTRODUCTION

While the popularity of snus (low nitrosamine smokeless tobacco, Swedish type) is rapidly increasing in

Northern Europe and in the USA, the potential role snus might have for public health is unclear. Based on systematic comparative analyses, it is agreed that use of snus is less dangerous than cigarettes for well-known tobacco-related diseases (Gartner et al., 2007; Lee & Hamling, 2009; Royal College of Physicians, 2007; Scientific Committee on Emerging and Newly-Identified Health Risks, 2008). Thus, at a population level, a potential improvement in health can be obtained if adolescents who otherwise would have started to smoke cigarettes take up snus instead (Ramstrom & Foulds, 2006; Rodu & Cole, 2010), see Lund (2009) for a discussion. On the other hand, if the use of snus works as a gateway to later uptake of cigarette smoking so that young people who would otherwise not have moved on to smoking do so based on their experience as snus users, one may risk a substantial adverse effect on public health at an aggregate level. Because of the recruitment of new snus users among adolescents with no prior nicotine experience in Norway, a possible gateway effect of snus use to cigarette smoking could lead to poorer health at the population level.

The gateway hypothesis is rooted in the study of sequential patterns of drug use. It suggests that the use of one drug increases the risk of starting to consume another, possibly more dangerous drug (Kandel, 2002, 1975). Whether the use of snus could serve as a gateway to later uptake of cigarette smoking has been addressed in several longitudinal studies (e.g., Ary, Lichtenstein, & Severson, 1987; Galanti, Rosendal, Post, & Giljam, 2001; Haddock et al., 2001; Haukkala, Vartiainen, & de Vries, 2006; Severson, Forrester, & Biglan, 2006; Timberlake, Huh, & Lakon, 2009; Tomar, 2003) and cross-sectional studies (e.g., Furberg, Lichtenstein, Pedersen, Bulik, & Sullivan, 2006; Kozlowski, O'Connor, Edwards, & Flaherty, 2003; Ramstrom & Foulds, 2006; Rodu & Cole, 2010; Tomar & Loree, 2004). The gateway theory has

received empirical support from a number of studies in the USA (Haddock et al., 2001; Severson et al., 2006; Timberlake et al., 2009; Tomar, 2003), while several studies based on Swedish data do not support the gateway hypothesis (Furberg et al., 2005; Galanti, Rosendahl, & Wickholm, 2008; Ramstrom & Foulds, 2006; Rodu & Cole, 2010). However, the aforementioned studies have focused on the question of causality following the line of substance introduction and have controlled for confounding variables to a varying degree (see Timberlake et al. (2009) for a discussion). The need for illuminating potential mechanisms for a possible gateway effect has been emphasized by several researchers (Kozlowski et al., 2003; O'Connor, Flaherty, Edwards, & Kozlowski, 2003).

The gateway theory, in the sense that the use of snus increases the chance of smoking initiation, implies that use of snus influences cognitions which underlie the initiation of smoking behavior. If snus use influences later uptake of cigarettes, one would expect that the use of snus changes the cognitions in a smoking positive direction. In this study, we wanted to investigate a possible relationship between the use of snus and changes in cognitions known to be of importance for smoking behavior, and thus approach the gateway issue in a novel way. For this purpose, we established four groups, which were followed for a 1-year period. Group 1 consisted of snus initiators, i.e., non-users who started to use snus exclusively during the study period, Group 2 regular snus users with no smoking experience at either time points, Group 3 non-users with no prior experience with cigarettes or snus, and Group 4 regular smokers. The two groups of non-users (Group 3) and smokers (Group 4) acted as control groups. It was thus possible to prospectively study whether the uptake of snus (snus initiators) or prolonged use of snus (regular snus users) influenced psychological processes that may mediate a possible influence of snus use on later uptake of cigarettes. This would appear to provide increased insight into plausible causal mechanisms of the hypothesized gateway effect.

Outcome expectancies of smoking and smoking prototype perceptions constitute two theoretical perspectives that have been studied in relation to the prediction of various behaviors related to smoking. Outcome expectancies represent anticipated negative and positive consequences associated with a given behavior, and positive expectancies associated with smoking of cigarettes have been shown to be associated with initiating smoking (Chassin, Presson, Sherman, & Edwards, 1991), escalation of smoking (Heinz, Kassel, Berbaum, & Mermelstein, 2010; Wahl, Turner, Mermelstein, & Flay, 2005), and predicting nicotine dependency (Heinz et al., 2010). In addition, positive expectancies have been shown to be associated with decisions to quit smoking (Wahl et al., 2005) and negative expectancies with smoking cessation (Hine, Marks, & O'Neill, 2009; Wetter et al., 1994). It has also been emphasized that smoking expectancies can

be acquired and learned not only through one's own smoking experience but also from other people giving information regarding the different effects of cigarettes (Eiser, 1985; Eiser, Morgan, & Gammage, 1987). We could thus expect that non-smokers such as snus users have developed both negative and positive smoking expectancies. In this context, Lewis-Esquerre, Rodrigue, and Kahler (2005) assessed smoking expectancies among young smoking and non-smoking adolescents and suggested a seven-factor model (Adolescent Smoking Consequence Questionnaire, ASCQ), e.g., expectancies of social facilitation and boredom reduction.

Prototypical perceptions of a smoker may work in the direction that favorable prototypical images increase motivation to initiate smoking behavior (Gerrard, Gibbons, Stock, Vande Lune, & Cleveland, 2005; Spijkerman, van den Eijnden, & Engels, 2005; Van den Eijnden, Spijkerman, & Engels, 2006). On the other hand, characteristics of a smoker have presumably changed in a more negative direction throughout the last decade and negative smoking prototypes could discourage smoking (Gerrard et al., 2005). Capturing different prototype perceptions, Skalle and Rise (2006), who based their approach on Gibbons, Gerrard, and McCoy (1995), applied a three-factor solution to study, e.g., perceptions of a prototypical smoker as socially attractive or immature.

Changes in cognitions among snus users in the direction of, e.g., stronger positive expectancies of cigarette smoking could be one underlying mediating mechanism in a possible gateway between the use of snus and later uptake of smoking. The primary purpose of this article was to compare the changes in expectancies and prototype perceptions from T1 to T2 in the four groups: (1) snus initiators, (2) regular snus users, (3) non-users, and (4) regular smokers.

METHODS

Material

A longitudinal telephone survey was conducted among Norwegian male adolescents in 2006 and 2007 with two measurement points 12 months apart. The respondents were between 15 and 18 years of age at the time of the first inclusion, T1 ($M_{age} = 16.6$, $SD = 1.1$) and came from both urban and rural areas of Norway. Participation was voluntary, and the project was approved by the National Committees for Research Ethics in Norway and reported to the Norwegian Social Data Services.

As the use of snus among Norwegian females was low at the start of the survey (1.4% compared to 16% among males aged 16–74) (Lund & Lindbak, 2007), all the respondents were adolescent males ($N = 2896$ at baseline). Nicotine preference was set as the inclusion criterion and at baseline, 30% of the respondents were snus users, 40% cigarette smokers, and 30% non-tobacco users. Due to the relatively low response rate at

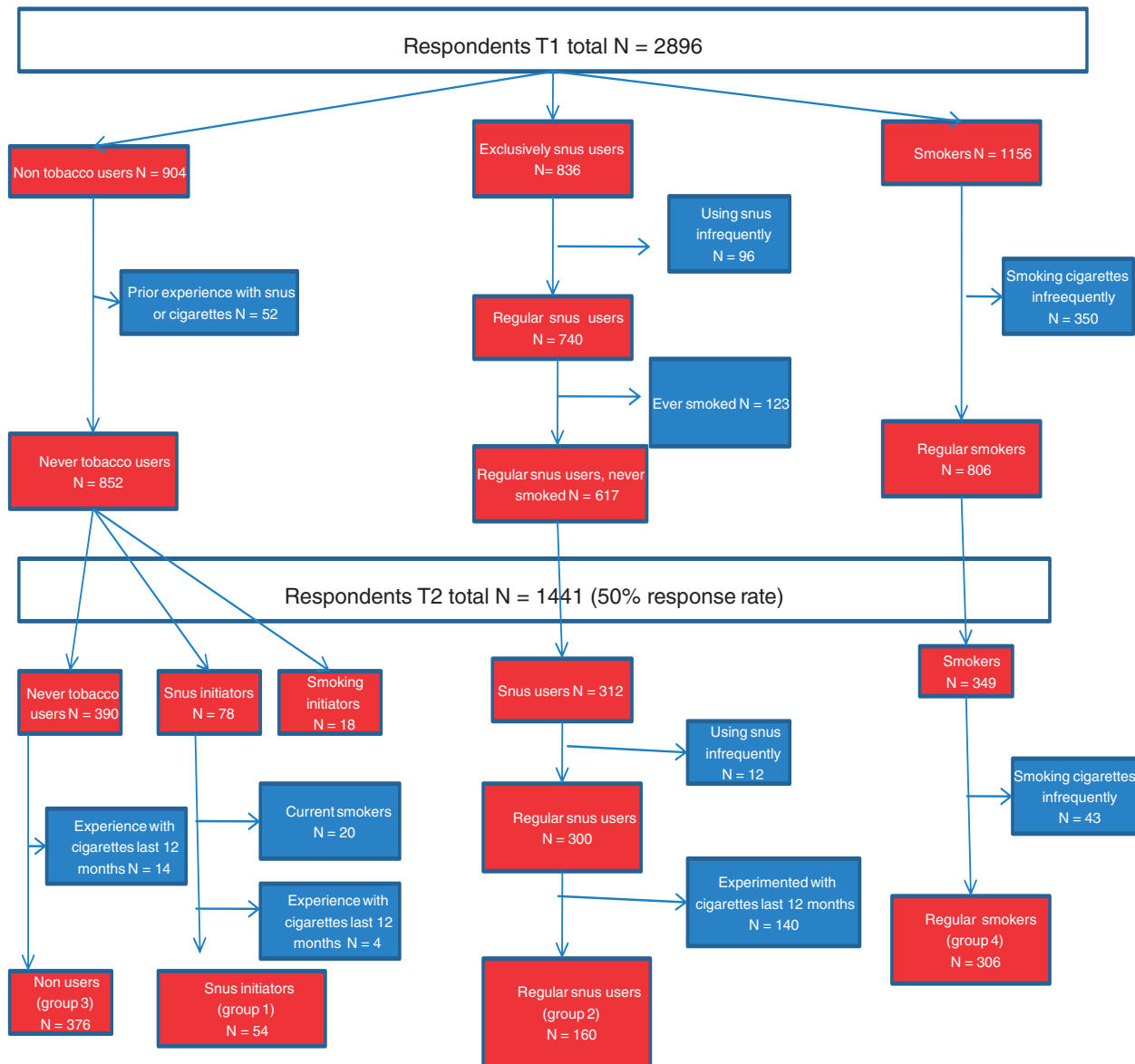


Figure 1. Flow chart respondents T1–T2.

the follow-up study ($N=1441$, 50%), a t -test was run to reveal any significant difference on background variables at T1 between respondents at both time points and those lost to follow-up or non-respondents (Acock, 2005). The respondents who participated at both time points were on average significantly younger at T1 than those who did not (16.5 vs. 16.7; $p<0.00$), but there were no differences in education plans or socioeconomic status. As to the average scores on the different smoking expectancy scales and smoking prototype perception scales, those who participated at both time points had lower expectancies of cigarettes to be socially facilitating (mean = 2.38 vs. 2.49, $t(2894) = 2.08$; $p<0.01$), give a negative social impression (mean = 3.20 vs. 3.40, $t(2894) = 3.14$; $p<0.01$), and reduce boredom (mean = 3.90 vs. 4.10, $t(2894) = 2.60$; $p<0.01$) compared to those who only participating at T1. However, the differences in mean scores between those who participated at both time

points and those lost to follow-up did not exceed 0.2 on any of the expectancies, and it is thus unlikely that these differences should have any effect on the main result. On the other hand, they did not differ on any of the prototype measures.

The composition of the four groups were: (Group 1) those who were non-users of snus at T1 and became snus users at T2, and who had never smoked cigarettes (snus initiators) ($N=54$); (Group 2) those who were regular snus users at both T1 and T2 and had never smoked cigarettes at either time points (regular snus users) ($N=160$); (Group 3) those who had never used snus or cigarettes at T1 and T2 (non-users) ($N=376$); and (Group 4) those who were regular smokers at both T1 and T2 ($N=306$), see Figure 1.

Measures

The smoking expectancies that were assessed in this study were based on the ASCQ developed

by Lewis-Esquerre et al. (2005) (Table I). The ASCQ is a smoking expectancy instrument and the authors provided evidence of a seven-factor structure: (i) “negative affect reduction” (expectancies of cigarettes to reduce negative affect, e.g., “*smoking helps to calm an angry person down*”); (ii) “negative physical feeling” (expectancies of cigarettes to result in a negative physical feeling, e.g., “*smoking burns a person’s throat*”); (iii) negative social impression (expectancies of cigarettes to give a third part a negative impression, e.g., “*People choose not to smoke because their friends won’t like it*”); (iv) social facilitation (expectancies of cigarettes to facilitate social situations, e.g., “*Parties are more enjoyable when a person is smoking*”); (v) taste/sensorimotor manipulation (expectancies of cigarettes to give a positive sensorimotor feeling, e.g., “*cigarettes taste good*”); (vi) boredom reduction (expectancies of cigarettes to kill time, e.g., “*smoking gives a person something to do with his hands*”); and (vii) weight control (expectancies of cigarettes to be an efficient weight watcher, e.g., “*smoking controls a person’s weight or eating habits*”). The response scale ranged from 1 (never) to 7 (always). All scores were coded so that higher scores indicated positive expectancies of smoking.

The items were adapted and adjusted to Norwegian adolescents based on in-depth interviews discussing item clarity and applicability among boys from lower (aged 15) and upper (aged 18) secondary schools. On the basis of this, we made some adjustments from the initial version suggested by Lewis-Esquerre et al. (2005): three of the five items that originally were intended to measure the weight control factor were removed due to doubt of the applicability to adolescent boys (“smoking helps a person stay slim,” “people gain weight when they stop smoking,” and “smoking makes a person less hungry”). Furthermore, one item that was intended to measure sensorimotor stimulation (“the look and feel of a cigarette in the mouth is good”) was divided into two separate items (“the look of a cigarette in the mouth is good” and “the feeling of a cigarette in the mouth is good”). Thus, a modified version of the original ASCQ consisting of 27 items was used in this study, as presented in Table I.

The smoking prototype perception scales were based on a study by Skalle and Rise (2006) and included 11 adjectives adjusted to a Norwegian adolescent context (Table I). The respondents were asked to “Imagine a typical boy who smokes. How would you describe this person using the following characteristics?” The measures were found to represent three separate dimensions: “Social attraction” (e.g., “cool”), “negative” (e.g., “immature”), and “positive” (e.g., “independent”) (Skalle & Rise, 2006). One adjective from the original scale “sexy” was reframed to “attractive” in the final questionnaire, based on the feedback in the interviews. The respondents were asked to reply on a seven-point response scale from 1 (never) to 7 (always). All scores were coded so that higher

Table I. Smoking expectancies and smoking prototype perceptions questionnaire with standardized factor loadings.

Expectancies	
<i>Negative affect reduction (0.84)</i>	
Smoking helps calm an angry person down,	0.478
Cigarettes help with concentration,	0.511
Cigarettes help a person forget about problems at home,	0.608
Smoking helps if a person feels bad about himself,	0.543
When someone is sad, smoking helps him feel better,	0.760
When someone is feeling cranky, smoking will help,	0.733
When a person is upset, a cigarette helps him/her deal with it,	0.743
<i>Taste and sensorimotor stimulation (0.75)</i>	
Cigarettes taste good,	0.757
The feeling of a cigarette in the mouth is good,	0.779
<i>Social facilitation (0.86)</i>	
Parties are more enjoyable when a person is smoking,	0.674
Smoking makes a person feel more comfortable around others,	0.745
People look up to those who smoke,	0.554
Smoking makes a person more friendly or outgoing,	0.674
Smoking makes a person feel older or more mature,	0.552
Hanging out with friends is more fun if everyone is smoking,	0.747
Smoking makes people look tough or cool,	0.618
Most popular people smoke cigarettes,	0.610
<i>Weight control (0.73)</i>	
Smoking controls a person’s weight or eating habits,	0.779
Smoking keeps a person from eating too much,	0.748
<i>Negative physical feelings (0.76)</i>	
Smoking burns a person’s throat,	0.698
Cigarettes make a person’s lung hurt,	0.831
Smoking will make a person cough,	0.635
<i>Boredom reduction (0.69)</i>	
During the day, smoking can help kill time,	0.867
Smoking gives a person something to do with his hands,	0.611
<i>Negative social impression (0.69)</i>	
People choose not to smoke because their friends won’t like it,	0.506
Smoking makes people look ridiculous or silly,	0.745
Smoking makes a person seem less attractive,	0.723
RMSEA = 0.05; CFI = 0.93	
Smoking prototype perceptions	
“Imagine a typical boy who smokes. How would you describe this boy using the following characteristics?”	
<i>Social attraction (0.81)</i>	
Cool,	0.783
Popular,	0.866
Attractive,	0.657
<i>Negative (0.60)</i>	
Immature,	0.338
Confused,	0.562
Self-centered,	0.670
Dull,	0.557
<i>Positive (0.52)</i>	
Sympathetic,	0.663
Self-conceited,	0.317
Smart,	0.414
Independent,	0.414
RMSEA = 0.05; CFI = 0.95	

Notes: Goodness-of-fit statistics. Cronbach’s alpha is given within parentheses ($N = 896$).

scores indicated that a prototypical smoking boy was viewed in a positive direction.

Analyses

The analyses were conducted in three steps. First, we examined the factor structure of the seven-factor expectancy model and the three factor prototype model applying confirmatory factor analyses. We conducted separate analyses for the expectancy and prototype models, respectively, using structural equation modeling in AMOS 17.0, with maximum likelihood estimation. The internal consistency was calculated in terms of Cronbach's alpha. We also explored the theoretical premise of smoking expectancies and smoking prototype perceptions applying logistic regression analysis, of higher levels of positive smoking cognitions among the group of smokers compared to non-smokers at baseline. Second, we studied changes in the smoking expectancy scales in the four groups of respondents from T1 to T2: (Group 1) snus initiators, (Group 2) regular snus users, (Group 3) non-users, and (Group 4) regular smokers. Since Kolmogorov-Smirnov tests suggested non-normal distributions, we applied a Wilcoxon signed-rank test to evaluate any changes in cognitions over time in the four groups. To augment the results, we also applied paired *t*-tests. Third, we assessed changes in smoking prototype perceptions from T1 to T2 in the four groups applying the same procedure. A *p*-level of <0.05 was used to determine any statistically significant differences.

RESULTS

Assessment of the psychometric properties of the two measurement models using confirmatory factor analyses showed acceptable fit to the data for both factor solutions, and the internal consistencies were satisfactory (Table I). In terms of the predictive validity of the scales, logistic regression analyses showed that, as theoretically predicted, smokers held more positive smoking expectancies at T1 compared to non-smokers on all the factors except for "negative affect," "weight control," and "social facilitation," which showed non-significant differences (Table II). Furthermore, smokers also had significantly more positive prototype perceptions of smokers at T1 compared to non-smokers, except for perceptions of smokers as "positive" (Table II). These findings mainly indicate that the differences were in the expected direction of higher level of positive smoking cognitions among the smokers compared to non-smokers, and we thus proceeded with the primary focus in this study, studying changes in cognitions within the four groups of (Group 1) snus initiators, (Group 2) regular snus users, (Group 3) non-users, and (Group 4) regular smokers.

Table II. Summary of logistic regression analyses.

Variables	<i>B</i>	SE	Exp (<i>B</i>)
<i>Expectancies</i>			
Negative affect reduction	-0.016	0.097	0.99
Taste and sensorimotor stimulation	0.695	0.075	2.00***
Social facilitation	0.161	0.102	1.18
Weight control	0.066	0.073	1.07
Negative physical feelings	0.662	0.073	1.94***
Boredom reduction	0.168	0.058	1.18*
Negative social impression	0.161	0.069	1.18*
<i>Prototype perception</i>			
Social attraction	0.491	0.058	1.64***
Negative	0.413	0.065	1.51***
Positive	-0.106	0.067	0.90

Notes: Odds ratios of smoking (1) (*N* = 306) vs. non-smoking (0) (*N* = 590) in relation to smoking expectancies and smoking prototype perceptions.

p* < 0.05; **p* < 0.001.

Changes in cognitions

Smoking expectancies

The results showed that in the group of snus initiators (Group 1), there were significant changes in the direction of higher level of expectancies of cigarettes to reduce negative affect from T1 (median = 2.29) to T2 (median = 2.92), *z* = 2.11, *p* < 0.04, *r* = 0.29 (Table III). The same pattern emerged applying a *t*-test, but the result was non-significant. All other expectancy measures did not change significantly. Furthermore, in the group of regular smokers (Group 4), there were significant changes in the direction of a higher level of expectancies of smoking to reduce boredom from T1 (median = 5.00) to T2 (median = 5.00), *z* = 2.76, *p* < 0.01, *r* = 0.16. Despite equal medians at both time points, the *t*-test showed a significant increase in mean scores from T1 (4.98) to T2 (5.30), and the Wilcoxon test was significant. The results also showed significant changes among the group of regular smokers in the direction of lower level of expectancies of smoking to be social facilitating from T1 (median = 2.87) to T2 (median = 2.62), *z* = -2.18, *p* < 0.03, *r* = -0.12. Furthermore, the group of smokers reported significant changes in the direction of lower level of expectancies of cigarettes to give taste and sensorimotor stimulation from T1 (median = 4.50) to T2 (median = 4.50), *z* = -2.08, *p* < 0.04, *r* = -0.12. Again the medians were equal, but the *t*-test showed a non-significant decrease in mean scores from T1 (4.58) to T2 (4.39), and the Wilcoxon test was significant. The two groups of regular snus users (Group 2) and non-users (Group 3) did not change any of their smoking expectancies from T1 to T2, as presented in Table II. Among these groups, there were no significant changes in either a more positive or negative direction in any of the seven smoking expectancy factors. The results also showed

Table III. Median scores of expectancies at T1 and T2 in the groups of snus initiators, regular snus users, non-users, and regular cigarettes smokers.

	Snus initiators (Group 1) (N = 54)	Regular snus users (Group 2) (N = 160)	Non-users (Group 3) (N = 376)	Regular cigarette smokers (Group 4) (N = 306)
<i>Negative affect reduction</i>				
Median (mean) T1	2.29 (2.70)	2.86 (2.99)	2.71 (2.81)	3.71 (3.84)
Median (mean) T2	2.92 (2.99)	2.86 (2.96)	2.71 (2.85)	3.86 (3.81)
	$p = 0.035$ ($t(53) = -1.39$; $p = 0.17$)	$p = 0.86$ ($t(159) = 0.33$; $p = 0.74$)	$p = 0.21$ ($t(375) = -0.65$; $p = 0.52$)	$p = 0.73$ ($t(305) = -0.34$; $p = 0.74$)
<i>Taste and sensorimotor stimulation</i>				
Median (mean) T1	1.00 (1.69)	1.00 (1.72)	1.00 (1.85)	4.50 (4.58)
Median (mean) T2	1.00 (1.51)	1.00 (1.82)	1.00 (1.78)	4.50 (4.39)
	$p = 0.31$ ($t(53) = 0.97$; $p = 0.34$)	$p = 0.41$ ($t(159) = -0.77$; $p = 0.44$)	$p = 0.27$ ($t(375) = 0.84$; $p = 0.40$)	$p = 0.03$ ($t(305) = 1.88$; $p = 0.06$)
<i>Social facilitation</i>				
Median (mean) T1	1.63 (1.95)	1.50 (1.96)	1.63 (1.99)	2.87 (2.99)
Median (mean) T2	1.50 (1.86)	1.50 (1.88)	1.50 (1.93)	2.62 (2.81)
	$p = 0.49$ ($t(53) = 57$; $p = 0.57$)	$p = 0.20$ ($t(159) = 0.67$; $p = 0.50$)	$p = 0.29$ ($t(375) = 0.91$; $p = 0.36$)	$p = 0.02$ ($t(305) = 2.39$; $p = 0.02$)
<i>Weight control</i>				
Median (mean) T1	1.50 (2.02)	1.75 (2.49)	2.00 (2.40)	2.50 (2.96)
Median (mean) T2	2.50 (2.44)	2.50 (2.63)	2.00 (2.54)	2.50 (2.83)
	$p = 0.10$ ($t(53) = -1.73$; $p = 0.09$)	$p = 0.59$ ($t(159) = -0.86$; $p = 0.39$)	$p = 0.18$ ($t(375) = -1.50$; $p = 0.14$)	$p = 0.15$ ($t(305) = 1.21$; $p = 0.23$)
<i>Negative physical feelings</i>				
Median (mean) T1	3.17 (3.48)	3.33 (3.61)	3.66 (3.48)	6.00 (5.55)
Median (mean) T2	3.67 (3.86)	3.33 (3.61)	3.33 (3.44)	6.00 (5.58)
	$p = 0.11$ ($t(53) = -1.33$; $p = 0.19$)	$p = 0.79$ ($t(159) = 0.02$; $p = 0.98$)	$p = 0.64$ ($t(375) = 0.39$; $p = 0.70$)	$p = 0.65$ ($t(305) = -0.29$; $p = 0.77$)
<i>Boredom reduction</i>				
Median (mean) T1	2.75 (2.93)	3.5 (3.46)	3.50 (3.32)	5.00 (4.98)
Median (mean) T2	1.75 (2.62)	3.5 (3.38)	3.00 (3.26)	5.00 (5.30)
	$p = 0.15$ ($t(53) = 1.11$; $p = 0.27$)	$p = 0.57$ ($t(159) = 0.42$; $p = 0.68$)	$p = 0.70$ ($t(375) = 0.50$; $p = 0.62$)	$p = 0.00$ ($t(305) = -2.72$; $p = 0.01$)
<i>Negative social impression</i>				
Median (mean) T1	2.33 (2.45)	2.33 (2.83)	2.33 (2.66)	4.00 (4.03)
Median (mean) T2	2.33 (2.69)	2.66 (2.79)	2.33 (2.75)	4.00 (3.92)
	$p = 0.25$ ($t(53) = -0.99$; $p = 0.33$)	$p = 0.93$ ($t(159) = 0.29$; $p = 0.77$)	$p = 0.38$ ($t(375) = -0.95$; $p = 0.34$)	$p = 0.19$ ($t(305) = 1.15$; $p = 0.25$)

Notes: Wilcoxon signed-rank test of differences at T1 and T2. Paired t -tests are given within parentheses.

that among the groups of snus initiators (Group 1), regular snus users (Group 2), and non-users (Group 3), the median was below the midpoint of the scale (4) on all the seven expectancy factors at both T1 and T2, with lower scores indicating smoking expectancies in a more negative direction. In contrast, the group of regular smokers (Group 4) reported smoking expectancies in a positive direction (the median above the midpoint of the scale) on several of the expectancy measures.

Prototype perception

As to possible changes in prototype smoking perceptions from T1 to T2, the analyses showed that the group

of non-users reported a higher level of positive prototypical perception of a smoker in relation to “socially attractive” from T1 (median = 1.67) to T2 (median = 2.00), $z = 2.1$, $p < 0.04$, $r = 0.11$. However, there were no significant changes in a positive or negative direction on any of the three prototype factors among the three groups of respondents; snus initiators (Group 1), regular snus users (Group 2), or regular smokers (Group 4) (Table IV). The four groups showed a similar pattern of median scores at both T1 and T2. While it was below the midpoint of the scales for “socially attractive” and “positive” at both time points, the median was above the midpoint of the scale for “negative” at both T1 and T2. Lower scores

Table IV. Median scores of prototype perceptions of a typical smoker at T1 and T2 among snus initiators, regular snus users, non-users, and regular cigarette smokers.

	Snus initiators (Group 1) (N = 54)	Regular snus users (Group 2) (N = 160)	Non-users (Group 3) (N = 376)	Regular cigarette smokers (Group 4) (N = 306)
<i>Social attraction</i>				
Median (mean) T1	1.33 (2.03)	1.67 (1.87)	1.67 (2.16)	2.83 (2.81)
Median (mean) T2	1.67 (2.09)	1.67 (1.96)	2.00 (2.30)	2.67 (2.79)
	$p = 0.74$ ($t(54) = -0.36$; $p = 0.72$)	$p = 0.99$ ($t(159) = -0.87$; $p = 0.38$)	$p = 0.03$ ($t(375) = -1.91$; $p = 0.06$)	$p = 0.85$ ($t(305) = 0.29$; $p = 0.77$)
<i>Negative</i>				
Median (mean) T1	4.25 (4.17)	4.50 (4.57)	4.00 (4.23)	4.75 (4.85)
Median (mean) T2	4.50 (4.50)	4.50 (4.58)	4.25 (4.21)	4.75 (4.82)
	$p = 0.08$ ($t(54) = -1.73$; $p = 0.10$)	$p = 0.68$ ($t(159) = -0.08$; $p = 0.94$)	$p = 0.97$ ($t(375) = 0.25$; $p = 0.81$)	$p = 0.58$ ($t(305) = 0.27$; $p = 0.79$)
<i>Positive</i>				
Median (mean) T1	3.50 (3.30)	3.75 (3.47)	3.25 (3.23)	3.25 (3.19)
Median (mean) T2	3.50 (3.30)	3.75 (3.42)	3.25 (3.17)	3.25 (3.17)
	$p = 0.93$ ($t(54) = -0.03$; $p = 0.98$)	$p = 0.32$ ($t(159) = 0.46$; $p = 0.65$)	$p = 0.58$ ($t(375) = 0.82$; $p = 0.42$)	$p = 0.58$ ($t(305) = 0.22$; $p = 0.83$)

Notes: Wilcoxon signed-rank test of differences at T1 and T2. Paired t -tests are given within parentheses.

indicate cognitions in the direction of negative prototype perceptions of boys who smoke.

DISCUSSION

The two most important findings of this study were first that the group of snus initiators (Group 1) reported significantly higher levels of expectancies of cigarettes to reduce negative affect during a 1-year period, while all other smoking cognitions in terms of both expectancies and prototype perceptions remained stable. Second, the group of regular snus users (Group 2) did not change any of their smoking expectancies or smoking prototype perceptions during the same period.

If the use of snus acts as a gateway to later uptake of smoking, one would expect that snus initiators (Group 1) or those with more experience with snus (Group 2) would change their smoking cognitions in a more positive direction, thus facilitating smoking initiation. The findings that those who initiated snus increased the level of smoking expectancies of affect management implies that the uptake of snus might have influenced expectancies of cigarettes to regulate affective experience in a direction which might facilitate smoking initiation. The role of expectancies of smoking to reduce negative affect has, in prior studies, been found to be an important predictor of smoking behavior and nicotine dependency among adolescents (Heinz et al., 2010).

On the other hand, the use of snus do not seem to change the majority of smoking cognitions in terms of expectancies and prototype perceptions in either a more positive or negative direction. With one exception,

these cognitions did not change along with increasing experience with snus either by prolonged use, or the uptake of snus. Although snus users have been found to develop positive expectancies for the use of snus as demonstrated among smokers (Larsen, Rise, & Astrom, 2011), the present results indicate that they generally do not project such cognitions on to smoking behavior.

Overall, the results suggest that snus might influence expectancies of cigarettes to reduce negative affect in a direction that could facilitate smoking initiation, while all other smoking cognitions in terms of smoking expectancies and prototype perception do not appear to be affected by the use of snus.

Another interesting finding is that the group of smokers (Group 4) in this study had a significantly lower level of social facilitating expectancies of cigarettes at T2 than at T1, which is in accordance with previous studies demonstrating increased stigmatization of smokers (Ritchie, Amos, & Martin, 2010; Scheffels, 2009). Also, in a study among adolescents, snus use was perceived to be trendier than smoking (Wiium, Aarø, & Hetland, 2009), thus the nicotine product in itself could be of motivational significance and might explain why the use of snus does not influence prototype perceptions of smokers in a direction that facilitates the uptake of cigarettes.

One strength of this study is its prospective nature, making it possible to examine changes in smoking expectancies as the respondents developed increased experience with snus. Furthermore, the two groups of snus users (snus initiators and regular snus users) had not any smoking experience, and we were thus able to eliminate the influence of prior smoking on later

expectancies or prototype perceptions of smoking, highlighting any possible causal mechanism of snus as a gateway to smoking. Also, in this study, we were able to identify significant differences at baseline in the direction of more positive smoking cognitions among those who were smokers than among non-smokers, thus supporting the theoretical premises of the study.

This study has contributed to illuminating the possible role of snus in changing smoking cognitions in a direction known to have an impact on adolescents initiating smoking behavior. Establishing causality from observational data is a challenging task. Two important criteria are to demonstrate that the cause precedes the effect and highlight plausible mechanisms of causation. Prior research addressing the gateway question between snus and cigarettes has typically based proof of causality by identifying product succession only (e.g., Tomar, 2003; Walsh et al., 2010). In this respect, the role of snus on young adolescents' later uptake of cigarettes is grounded on an inadequate conceptual model of causality and leaves the question of underlying mechanisms unsettled. By applying a stricter causality requirement than simply focusing on the sequence of introduction, we wanted to identify possible mechanisms of snus use in the hypothesized stage progression to make inference about snus as a gateway product.

One possible shortcoming of this study is that we excluded those who were snus users at T1 and started to smoke at T2. This might have a biasing effect in that those who actually had changed their smoking cognitions due to snus use and eventually started to smoke were omitted from further analysis. However, prior studies have shown that smoking initiation influence smoking cognitions in a more positive direction (Doran, Schweizer, & Myers, 2011), and that those who hold stronger positive expectancies about smoking tend to report higher levels of consumption and nicotine dependence (Brandon & Baker, 1991). In order to evaluate the use of snus as a gateway to smoking, we thus wanted to rule out any influence of smoking experience on possible changes in smoking cognitions.

Also, we did not explore the role of expectancies in relation to nicotine, e.g., expectancies of nicotine craving reduction. It is possible that the development of nicotine dependency among snus users could result in expectancies related to nicotine per se, and thus nicotine-deprived snus users would be more prone to take up cigarettes (Haddock et al., 2001; Tomar, 2003).

Future studies may preferably emphasize a broader perspective of social, psychological, and biological factors that might be associated with a progression from snus to cigarettes, cf Kandel and Jessor (2002). Also, longitudinal studies over an extended period of time would make it possible to investigate whether prolonged experience with snus use would be of importance to understand the effect of snus on smoking

behavior, and whether snus works as a catalyst for later uptake of cigarettes.

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