



Risk and protective factors of adolescent exclusive snus users compared to non-users of tobacco, exclusive smokers and dual users of snus and cigarettes

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HIGHLIGHTS

- Snus use was compared with non-use, smoking and dual use on psychosocial factors.
- Compared to non-use, snus use was associated with risk factors.
- Snus use was associated with protective factors compared with smoking.

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ABSTRACT

The use of snus is increasing in Norway. In this study we examined differences between adolescents who were exclusive snus users, and adolescent non-users, smokers and dual users of snus and cigarettes on a number of psychosocial factors, categorized as risk variables and protective variables associated with involvement in health compromising behavior. We applied separate logistic regression models, where exclusive snus users ($n = 740$) were compared with non-users ($n = 904$), smokers ($n = 219$), and dual users ($n = 367$). Compared to non-users, the group of exclusive snus users was associated with variables traditionally predicting health risk behavior, such as smoking friends ($OR = 1.74$, $SD 1.27$ – 2.38) and truancy ($OR = 2.12$, $SD 1.65$ – 2.78). Compared to smokers, exclusive snus users were related to variables traditionally associated with protection against involvement in health risk behavior, e.g. higher academic orientation ($OR = 1.66$, $SD 1.12$ – 2.45). Associations with protective factors were also observed when exclusive snus users were compared with dual users. While the group of exclusive snus users was associated with a pattern of psychosocial risk compared to non-users, they showed a more conventional pattern when compared to smokers and dual users. The group of exclusive snus users may be described on a continuum varying from psychosocial risk factors to protective factors of risk involvement depending on the group of comparison.

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1. Introduction

During the last decade, there has been a sharp increase in the use of snus in Norway, especially among young men. This trend coincides with a reduction in the prevalence of smoking. Current statistics in Norway show that while 31% of young people between 18 and 30 years use snus daily or sometimes, the corresponding figure for smoking is 25% (Bretteville-Jensen, 2011). In 2006, smokeless tobacco in the form of snus was introduced onto the market in the USA (Biener & Bogen, 2009), where sales of smokeless tobacco at the same time increased (Connolly & Alpert, 2008), and where snus products are heavily promoted among young users (Mejia & Ling, 2010).

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A growing number of studies and overviews have acknowledged that snus is less hazardous to health than smoking (Bates et al., 2003; Lee & Hamling, 2009; Levy et al., 2004). However, the use of snus is not without health risks, and empirical research has suggested that the use of snus for example is a risk factor for pancreatic cancer (Luo et al., 2007). In addition, as a relatively new behavior, the possible long-term health hazards of snus use have not yet been fully accounted for. Furthermore, dual use of snus and cigarettes is becoming more prevalent among youth in Norway (Lund & Lindbak, 2007) and in the USA (Tomar, Alpert, & Connolly, 2010). The possible role of dual use for health has been debated and it is not clarified if dual use results in continued use of cigarettes among youth (Tomar, Fox, & Severson, 2009) or if dual users are more likely to quit smoking (Frost-Pineda, Appleton, Fisher, Fox, & Gaworski, 2010; O'Hegarty, Pederson, Asman, Malarcher, & Mirza, 2012). If the use of snus results in continued use of cigarettes among those who otherwise would have quit, this could

be negative for the public health. Furthermore, it has been argued that the concurrent use of snus and cigarettes among youths could result in a high risk profile of tobacco consumption and addiction (Rosendahl, Galanti, & Gilljam, 2008) thus representing a challenging group from a public health perspective.

Although snus continues to be popular, and preferences for tobacco in the form of cigarettes or snus among young people have changed, only a few studies have tried to describe snus users and identify who they are by comparing adolescents who use snus with non-users of tobacco and adolescents who smoke cigarettes either exclusively or in addition to the use of snus. For example, it may be that snus attracts another segment of adolescents than smoking, and it may thus be of interest to explore the relation with variables traditionally associated with involvement in health risk behavior, and to provide a basis for developing interventions targeting tobacco behaviors among youth.

In a study among adolescents in the USA, snus users were more involved in health risk behaviors such as alcohol use and smoking cigarettes as compared to non-users of tobacco, and it was argued that snus use may be part of a constellation of health compromising behaviors (Loukas et al., 2012). Previous studies in Norway and Sweden which compared snus users with non-users of tobacco found associations between snus use and factors which instigate risk behaviors, such as lower educational ambitions (Grøtvedt, Stigum, Hovengen, & Graff-Iversen, 2008; Hagquist, 2007). In a Norwegian study among adolescents, low socioeducational status was associated with smokers, while there was no association between socioeducational status and snus users (Øverland, Tjora, Heltand, & Aarø, 2010). Furthermore, two Swedish studies found that known risk factors for the uptake of tobacco influenced patterns of snus use (Rosendahl et al., 2008), and compared to non-use of tobacco, snus use was associated with unhealthy behaviors and health risk behaviors such as drinking (Engstrom, Magnusson, & Galanti, 2010). On the other hand, in the study by Engstrom et al. (2010) snus users were associated with a more conventional drinking behavior profile compared to both smokers and dual users of snus and cigarettes, and a study from Finland suggests that the use of snus is associated with youths who are active in sports, who are less likely to initiate smoking (Haukka, Vartiainen, & de Vries, 2006). To summarize, these findings may indicate that snus users are associated with different health risk factors when compared to non-users of tobacco, smokers and dual users of snus and cigarettes.

In Norway the use of snus has a long tradition. Although any tobacco marketing has been banned since 1975, the use of snus started to increase after 1990. This rise was first observed among men, but from 2005 also among women. Currently, snus use is at a relatively advanced stage in Norway in contrast to the situation in the USA, where the sale of snus only recently has started to increase. The mature market situation for snus makes Norway an interesting case for studying the characteristics of adolescent exclusive snus users in relation to other groups, such as non-users of tobacco, cigarette smokers and dual users of snus and cigarettes.

To explore these issues, we draw upon Problem Behavior Theory (Jessor & Jessor, 1977), in which a problem behavior is a behavior which is socially defined as a problem, usually eliciting some form of social control response, which includes snus use, as noted above. The theory included in its original formulation three major systems of explanatory variables for involvement in problem behaviors: the perceived environment system (e.g. peer models for snus use, parental support), the personality system (e.g. beliefs and values), and the behavior system (problem and conventional behaviors). Jessor (1991) has reformulated the theory to accommodate health-risk and health enhancing behaviors, organizing the explanatory factors into risk factors, serving as factors instigating involvement in health-risk behaviors (e.g. smoking friends), and protective factors which serve as factors controlling involvement in health-risk behaviors (e.g. higher academic orientation) (Jessor, 1991; Jessor & Jessor, 1977). The theoretical role

of risk factors is to increase the probability of involving in health-risk behavior (use of snus), while that of protective factors is to decrease the involvement in health-risk behaviors. The theory posits that it is the balance between instigating and controlling factors which determines psychosocial proneness for involving in a health risk behavior.

In this context our primary concern was with those who only use snus, that is, not in combinations with smoking, and we explored the idea that the description of exclusive snus users, i.e. who they are like in terms of possible psychosocial risk and protective factors, may differ depending on which group one uses for comparison. We thus compared a group of exclusive snus users with three groups: non-users of snus and cigarettes, exclusive smokers, and dual users of snus and cigarettes, on a number of risk and protective variables thus extending prior research on the description of young snus users (e.g. Engstrom et al., 2010; Grøtvedt et al., 2008; Loukas et al., 2012). It should be noted that due to the cross-sectional nature of the study, risk and protective factors serve as descriptive labels in the comparison of exclusive snus users with the other groups.

2. Method

2.1. Data collection and participants

The data were collected in a telephone survey during January–March 2006. In 2006, 97% of Norwegians between 13 and 18 years reported that they had their own mobile phone (Norwegian Media Authority, 2008), and the sample was drawn from a mobile phone register incorporating adolescents. As the distributions of snus use varied greatly among the 19 counties of Norway, 11 counties with a high prevalence of snus use among youth were selected for data collection. Since the use of snus was low among Norwegian women at that time (1.4% compared to 16% among men aged 16–74) (Lund & Lindbak, 2007), the respondents were exclusively male adolescents.

Age (15 to 18) and gender (being male) were set as inclusion criteria, together with nicotine preference. The data collection was carried out for 6 weeks, and to secure a sufficient number of respondents with different tobacco experience, the groups of respondents were set to include approximately 1500 snus users, 500 smokers and 1000 non-users of tobacco. The group of snus users consist of exclusive snus users and double users of snus and cigarettes if the respondents reported that their use of snus was more extensive than smoking (e.g. “daily snus use” and “weekly smoking”). If dual users reported their cigarette smoking as more extensive than their use of snus, they were included in the smoking category together with exclusive smokers. Of the 62,027 digits which were called up, the great majority were not willing to participate, did not fit the inclusion criteria or did not respond to the call. Thus a total of 2896 respondents between 15 and 18 years of age ($M_{\text{age}} = 16.6$, $SD\ 1.1$) participated, of which 1186 were snus users (836 exclusive snus users), 625 were smokers (291 exclusive smokers) and 905 were non-users of snus and cigarettes. In addition, 180 respondents reported to use snus and cigarettes with similar intensity (e.g. daily snus use and daily smoking). Participation was voluntary and the project was reported to the Norwegian Social Data Service. The survey was administered by the research agency Norfakta.

The final groups of respondents in the present study consisted of regular (daily or weekly) exclusive users of snus ($N = 740$), regular (daily or weekly) exclusive smokers ($N = 219$), regular (daily or weekly) users of both snus and cigarettes (dual users) ($N = 367$), and non-users of snus and cigarettes ($N = 904$). Some of the respondents reported that they used snus or cigarettes less than weekly ($N = 666$), and were excluded from further analysis (Table 1).

Table 1
Separate logistics regression analyses comparing the group of exclusive snus users (1) with non-users of snus and cigarettes (0), exclusive smokers (0) and dual users of snus and cigarettes (0) in relation to different variables. Unadjusted ORs and adjusted ORs for all other variables in the model.

Variables	Exclusive snus users vs non-users		Exclusive snus users vs exclusive smokers		Exclusive snus users vs dual users	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
<i>Demographic variables</i>						
Age						
15	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
16	2.81*** (2.10–3.76)	1.60* (1.19–2.29)	0.79 ns (0.45–1.40)	1.06 ns (0.55–2.02)	1.31 ns (0.86–1.99)	1.84* (1.11–3.10)
17	4.28*** (3.19–5.75)	1.67** (1.16–2.41)	0.77 ns (0.44–1.34)	0.94 ns (0.50–1.78)	1.16 ns (0.78–1.74)	1.74* (1.07–2.84)
18	6.32*** (4.57–8.74)	2.29*** (1.53–3.42)	0.53* (0.31–0.92)	0.66 ns (0.34–1.26)	0.94 ns (0.63–1.42)	1.29 ns (0.78–2.13)
Living situation						
Living with both parents	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Living with one parent	1.21 ns (0.98–1.50)	0.99 ns (0.75–1.30)	0.58** (0.41–0.82)	0.64* (0.43–0.96)	0.61*** (0.46–0.80)	0.78 ns (0.56–1.10)
Living alone/other	1.51*** (1.11–2.07)	0.64* (0.44–0.94)	0.35*** (0.23–0.52)	0.53* (0.33–0.86)	0.53** (0.37–0.76)	0.72 ns (0.47–1.10)
<i>Risk variables</i>						
Parents smoking						
Non-smoking	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Smoking daily/occasionally	1.44*** (1.18–1.75)	1.24 ns (0.97–1.58)	0.63** (0.45–0.84)	0.84 ns (0.58–1.22)	0.69** (0.53–0.89)	0.83 ns (0.61–1.13)
Siblings smoking						
Non-smoking	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Smoking daily/occasionally	1.85*** (1.45–2.34)	1.34 ns (0.99–1.80)	0.60** (0.44–0.82)	0.74 ns (0.51–1.07)	0.59*** (0.45–0.77)	0.77 ns (0.56–1.05)
Numbers of smoking friends						
Low	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Moderate	2.03*** (1.61–2.55)	1.41* (1.10–1.87)	0.26*** (0.09–0.44)	0.23*** (0.10–0.50)	0.24*** (0.14–0.43)	0.25*** (0.14–0.44)
High	3.16*** (2.44–4.90)	1.74*** (1.27–2.38)	0.05*** (0.02–0.10)	0.06*** (0.03–0.14)	0.06*** (0.03–0.09)	0.06*** (0.04–0.11)
Alcohol experience						
Never/tried	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Drunk several times	14.32*** (10.99–18.67)	10.33*** (7.73–13.80)	1.05 ns (0.66–1.68)	1.16 ns (0.67–2.02)	0.38*** (0.22–0.65)	0.34*** (0.18–0.61)
Truancy						
No	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Yes	3.63*** (.68–1.02)	2.14*** (1.65–2.78)	.85 ns (.63–1.15)	1.06 ns (0.74–1.52)	0.51*** (0.39–0.66)	0.61** (0.45–0.83)
<i>Protective variables</i>						
Academic orientation						
Lower	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Higher	.78* (.64–.95)	0.66*** (0.51–0.84)	2.43*** (1.75–3.37)	1.66* (1.12–2.45)	1.63*** (1.26–2.11)	1.11 ns (0.82–1.51)
School motivation						
Low	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Moderate	.57*** (.39–.67)	0.99 ns (0.71–1.40)	1.88*** (1.20–2.95)	1.47 ns (0.87–2.50)	2.18*** (1.51–3.17)	1.16* (1.04–2.47)
High	.61*** (.49–.77)	0.98 ns (0.75–1.30)	1.82*** (1.29–2.56)	1.39 ns (0.93–2.06)	2.64*** (1.96–3.55)	2.05*** (1.46–2.88)
Involvement in organized sports						
No	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Yes	.92 ns (.76–1.12)	1.22 ns (0.95–1.60)	4.99*** (3.41–7.32)	3.70*** (2.45–5.59)	2.34*** (1.80–3.06)	1.78*** (1.31–2.42)

* <.05.

** <.01.

*** <.001.

2.2. Measures

Current smoking status was measured by asking the question “Do you smoke”. Those of the respondents who answered that they smoked were given the response categories “daily”, “weekly”, and “less than weekly”.

Current snus use status was measured by asking the question “Do you use snus”, and those who answered “yes” were given the response categories “daily”, “weekly”, and “less than weekly”.

2.2.1. Demographic variables

2.2.1.1. Living situation. The respondents were asked: “Do you live with both your mother and father?” with eight response categories (1) “yes”, (2) “only with my mother”, (3) “only with my father”, (4) “just as much with my mother as with my father”, (5) “with my mother and another person who is not my father”, (6) “with my father and another person who is not my mother”, (7) “I live alone”, and (8) “other”. The response categories were collapsed into three: (1) “living with both parents” (2) “living with one parent” (living with mother or father/with one parent and another adult), and (3) “living alone or in other arrangements”.

Age was measured in years ranging from 15 to 18.

2.2.2. Risk factors

2.2.2.1. Parents' smoking behavior. The respondents were asked “Does your mother smoke?” and “Does your father smoke?”. The three response categories were: 1) “yes, daily”, 2) “yes, occasionally” and 3) “no, does not smoke”. We merged the response categories into two: 1) “mother/father do(es) not smoke” and 2) “mother/father smoke(s) daily or occasionally”.

2.2.2.2. Siblings' smoking behavior. The respondents were asked “Do you have a brother or a sister who smokes?” with the response categories: 1) “yes, a brother or a sister who smokes daily”, 2) “yes, a brother or a sister who smokes occasionally” and 3) “no, I have no brother or a sister who smokes”. We created a variable with two categories: 1) “no brother or sister who smokes” and 2) “a brother or a sister who smokes daily or occasionally”.

2.2.2.3. Numbers of friends who smoke. The respondents were asked “What proportion of your friends smoke either daily or occasionally?” Response categories were divided into 10% brackets ranging from 0 to 100%. Based on the sample distribution, the respondents were divided into tertiles: 1) “low”, 2) “moderate” and 3) “high”.

Alcohol experience was assessed by asking “Have you ever drunk alcohol, more than just a few sips?” using the response categories

(1) “never”, (2) “once”, and (3) “several times”. The respondents who had drunk alcohol were asked “have you ever been drunk?” with the response categories 1) “never”, 2) “once” and 3) “several times”. Some experimentation with alcohol during adolescence is common and these were included in the never drunk and tried drinking category, and the response categories were merged into two: 1) “has never drunk alcohol/has tried drinking alcohol” (never drunk alcohol, those who had drunk alcohol without being drunk, or had been drunk once), and (2) “been drunk several times” (those who had been drunk several times).

Truancy was measured using one question “Have you played truant during the last 12 months?” with the six response categories (1) “once”, (2) “2–4 times”, (3) “5–10 times”, (4) “11–20 times”, (5) “more than 20 times”, (6) “never”. The response categories were merged into (1) “yes” and (2) “no”.

2.2.3. Protective factors

Academic orientation was measured by asking “What is the highest education you are planning to complete?” The six response categories were (1) “lower secondary school”, (2) “upper secondary school”, (3) “vocational training”, (4) “university college”, (5) “university”, and (6) “other plans after upper secondary school”. The response categories were collapsed into two: (1) “lower academic orientation” (lower secondary school, upper secondary school, vocational training or other plans after upper secondary school), and (2) “higher academic orientation” (university or university college).

School motivation was measured using three statements: “I pay attention in class”, “I am serious about school”, and “I wish to do well in school” reported on 7-point scales and added into a sum-score (Cronbach's alpha = 0.84). Based on the sample distribution the respondents were divided into tertiles: “low”, “moderate” and “high”.

Involvement in organized sports. The respondents were asked “Do you exercise frequently with a sports club or a sports organization?” with the response categories “yes” and “no”.

3. Analyses

We conducted three separate logistic regression analyses in which (1) exclusive snus users were compared with non-users of snus and cigarettes, (2) exclusive snus users were compared with exclusive smokers, and (3) exclusive snus users were compared with dual users of snus and cigarettes on the demographic variables, risk and protective variables listed above. The results are presented as odds ratios (OR) and their 95% confidence intervals (CI). A *p* value of <0.05 was used as a criterion for evaluating differences in ORs between the groups.

All analyses were conducted using SPSS version 19.0.

4. Results

4.1. Exclusive snus users versus non-users of tobacco

Comparing exclusive snus users with non-users of snus and cigarettes, increasing age was associated with being a snus user, and e.g. in contrast to those who were 15 years old, being 18 years old were associated with using snus, OR = 2.29 (95% CI 1.53 to 3.42). Furthermore, in contrast to those who lived with both parents, living alone was inversely associated with exclusive snus use compared to non-use of tobacco OR = 0.64 (95% CI 0.44 to 0.94).

Among the risk factors, having a “moderate” number of friends who smoke OR = 1.41 (CI 1.10–1.87) compared to having a “low” number of friends who smoke, was associated with being an exclusive snus user. The same pattern emerged when having a “high” number of friends who smoke, OR = 1.74 (95% CI 1.27 to 2.38) were contrasted against those who were classified as having a “low” number of friends who smoke.

Moreover, “being drunk several times” in contrast to “never tried drinking or tried drinking” was associated with using snus, OR = 10.33 (95% CI 7.73–13.80). Also, “playing truancy” was associated with being an exclusive snus user compared to non-users of snus and cigarettes, OR = 2.14 (95% CI 1.65–2.78).

Of the protective factors, having a “higher” academic orientation in contrast to having a “lower” academic orientation was inversely associated with being an exclusive snus user compared to non-users of snus and cigarettes, OR = 0.66 (95% CI 0.51–0.84).

4.2. Exclusive snus users versus exclusive smokers

In the model, comparing the group of exclusive snus users with exclusive smokers, living with one parent in contrast to both parents was inversely associated with being a snus user, OR = 0.64 (95% CI 0.43–0.96). Also, living alone or in other arrangements in contrast to living with both parents was inversely associated with being an exclusive snus user, OR = 0.53 (95% CI 0.33–0.86).

Furthermore, those who were classified as having a “moderate” OR = 0.23 (95% CI 0.10–0.50) or “high” OR = 0.06 (95% CI 0.03–0.14) proportion of smoking friends in contrast to “low”, was inversely associated with being an exclusive snus user compared to being an exclusive smoker. On the other hand, being engaged in organized sports was associated with being a snus user, OR = 3.70 (95% CI 2.45–5.59). Also, those who were classified as having a “higher” academic orientation in contrast to a “lower” academic orientation was associated with exclusively using snus compared to smoking, OR = 1.66 (95% CI 1.12–2.45) in this model.

4.3. Exclusive snus users versus dual users of snus and cigarettes

In the model, comparing exclusive snus users with dual users of snus and cigarettes, increasing age was associated with being an exclusive snus user, e.g. when 16-year-olds were compared with 15-year-olds, OR = 1.84 (95% CI 1.11–3.10). On the other hand, those who were classified as having a “moderate” number of smoking friends OR = 0.25 (95% CI 0.14–0.44), or having a “high” number of smoking friends OR = 0.06 (95% CI 0.04–0.11) compared to having a “low” number of smoking friends, was inversely associated with being an exclusive snus user. Moreover, being drunk several times was inversely associated with using snus, OR = 0.34 (95% CI 0.18–0.61). A similar association was found for truancy, which was inversely associated with being an exclusive snus user compared to being a dual user, OR = 0.61 (95% CI 0.45–0.83). In contrast, being involved in organized sports was associated with being a snus user compared to being a dual user of snus and cigarettes, OR = 1.78 (95% CI 1.31–2.42). Furthermore, those who were classified as having “moderate” school motivation OR = 1.16 (95% CI 1.04–2.47) or “high” school motivation OR = 2.05 (95% CI 1.46–2.88) in contrast to “low” school motivation, were associated with being an exclusive snus user compared to being a dual user.

5. Discussion

The results of the three comparisons will be discussed separately guided by the ideas provided by Jessor (1991), with reference to the distinction between risk factors and protective factors although this does not imply any causal precedence, only that they are associated with or predict snus use.

5.1. Comparison of exclusive snus users with non-users of snus and cigarettes

Among the possible risk factors, we found that exclusive snus users had more experience with alcohol than non-users, which might reflect a proneness among exclusive snus users compared to non-users to violate age-related norms and expectations related to adolescent drinking behavior. A similar association between the use of snus and involvement

in a more pronounced drinking pattern has been found in prior studies in the general population in Sweden (Engstrom et al., 2010), and among youth in the USA (Loukas et al., 2012). Furthermore, truancy was associated with exclusive snus use, revealing deviant norms and possibly low school attachment when compared to non-users (Hallfors et al., 2002). In prior studies among youth, reduced school attendance has also been shown to be associated with involvement in substance use such as cigarettes and alcohol (Donovan, 2004; Hallfors et al., 2002). The negative association with truancy may indicate that, compared to this group of non-users, exclusive snus users have deviant norms related to the school system.

Among proximal risk factors, a higher number of friends who smoke distinguished exclusive snus users from non-users. The influence of friends may occur when adolescents assimilate the behavior through a direct modeling process of risk behavior, as suggested by social learning theory (Bandura, 1977). In this case this might be related to the use of tobacco per se. In the literature of adolescent smoking, peer behavior has consistently been identified as an important predictor (Conrad, Flay, & Hill, 1992; Hoffman, 2006). Another possible explanation, in contrast to peer influence processes and peer pressure, is a selection process (Mercken, Steglich, Sinclair, Holliday, & Moore, 2012). However, the fluctuant nature of peer relations in adolescence, and the role of factors such as the social status of friends, suggests a more complex pattern of the influence of smoking among friends (Eiser, Morgan, Gammage, Brooks, & Kirby, 1991; Ennett et al., 2008). Future studies should examine the specific role of both smoking and snus use among significant others to explore whether the use of tobacco per se, or whether the use of different tobacco products, has a unique influence and works as an instigator of snus use among adolescents.

Possible protective factors in terms of academic orientation were negatively associated with exclusive snus users compared to non-users of tobacco. This finding is in line with that of another Norwegian study (Grøtvedt et al., 2008). The association between snus use and low academic orientation has also been demonstrated in a study among adolescents in Sweden (Hagquist, 2007). This may indicate that, compared to non-users, exclusive snus users are not committed to goals represented in a conventional institution like the school system, which in turn may function as a further protection against involvement in other health risk behaviors (cf. Jessor, Van Den Bos, Vanderryn, Costa, & Turbin, 1995; Stone, Becker, Huber, & Catalano, 2012).

Overall, when the group of exclusive snus users were compared with non-users of tobacco, snus users were associated with a number of psychosocial risk factors. In addition, exclusive snus users were older than non-users. Thus when exclusive snus users were compared with non-users, the former seem to be embedded in a web of psychosocial risk factors consistent with the framework suggested by Jessor (1991).

5.2. Comparison of exclusive snus users with exclusive smokers

In this comparison, the risk factors “not living with both parents” and a “higher” proportion of friends who smoke were negatively associated with exclusive snus use in contrast to exclusive smoking. In addition, factors which are argued to protect against involvement in risk behavior in terms of higher academic orientation and involvement in organized sports, were significantly related to exclusive snus users. Various indicators of academic orientation have been applied as protective factors for tobacco behavior in prior research (LeMaster, Connell, Mitchell, & Manson, 2002). Consistent with this, a cross-sectional study among high school students in the US found that smokeless tobacco users did better in school compared to smokers, and the authors argued that the former is not associated with the same unconventionality as seen for smoking (Chassin, Presson, Sherman, & Margolis, 1988). In addition, physical exercise might work as insulation against risk involvement. A negative association between organized physical activity and smoking has been demonstrated (Aaron et al., 1995; Audrain-McGovern, Rodriguez, Wileyto, Schmitz, & Shields, 2006;

Tomori, Zalar, Plesnicar, Zihlerl, & Stergar, 2001; Wichstrøm & Wichstrøm, 2009). One would thus expect that those who are active in organized sport are less vulnerable for involvement in different tobacco behaviors. However, the results indicate no association between involvement in organized sports and exclusive use of snus. This is in line with the results of the study by Engstrom et al. (2010), which showed that exclusive snus users and non-users did not differ with regard to physical activity, while smokers and dual users were associated with a more sedentary lifestyle than non-users. Also, a recent study from Norway found that unlike smoking, competing in team sport was associated with snus use (Martinsen & Sundgot-Borgen, 2012). A similar result from Finland showed that snus use was related to involvement in sports activities, while smoking was not (Haukkala et al., 2006). One interpretation of this is that exclusive snus users are more health oriented than exclusive smokers and dual users. Another idea is that individuals who engage in sports prefer snus to other drugs because of its relatively low harmfulness (Mattila, Raimo, Pihlajamäki, Mäntysaari, & Rimpelä, 2012).¹ A third possibility is that sport involvement recruits new snus users. Thus the use of snus among athletes has been emphasized as a trajectory for snus use in Finland prior to the sales ban (Huhtala, Rainio, & Rimpelä, 2006) and in Sweden, where the use of snus is especially prevalent in team sports (e.g. hockey and football) (Rodu, Stegmayr, Nasic, Cole, & Asplund, 2003). However, due to the cross-sectional study design, no causal relationships could be established.

Thus when exclusive snus users are compared with exclusive smokers, they may be described as more conventional, in the sense that differences between snus users and smokers in relation to normative transgressions were not evident.

5.3. Comparison of exclusive snus users with dual users of snus and cigarettes

Compared to dual users of snus and cigarettes, exclusive snus users were older and had a lower number of friends who smoke. Exclusive snus users were also less inclined to play truant and to be drunk when compared to dual users. Thus, several of the psychosocial risk variables showed a distinct pattern of differentiations between the two groups. These results are in line with prior studies of polytobacco use in the USA, suggesting that it is more likely that the concurrent use of cigarettes and other tobacco products (e.g. smokeless tobacco, pipe) is related to a different set of risk factors compared to using only one tobacco product (Bombard, Pederson, Nelson, & Malarcher, 2007; Bombard, Rock, Pederson, & Asman, 2008). Finally, being involved in organized sports and having higher school motivation were related to exclusive snus use compared to dual use, clearly indicating that those who only use snus are embedded in a more protective, conventional pattern of factors in this particular comparison. Furthermore, in the comparison of exclusive snus users and dual users, the results suggest that the various systems of risk variables did not apply, indicating that it was difficult to identify exclusive snus users as vulnerable to risk involvement.

6. Conclusion

The present study drew upon the distinction between risk and protective factors as instigations and controls of involvement in health risk behavior, along with the idea that it is the balance between these factors which determine the degree of psychosocial proneness for involvement in such behaviors (Jessor, 1991). This suggests that health risk behaviors may be placed on a continuum of psychosocial proneness ranging from a risky to a protective pole depending on which category of factors dominate as predictors. However, it should be noted that due to the cross-sectional nature of the study, risk and protective factors here serve only as descriptive labels in the comparison of exclusive

¹ This explanation was provided by a reviewer.

snus users with the other groups. The results of the present study indicate that the placement of exclusive snus use on this continuum depends on which comparison group is applied. When exclusive snus users are compared to non-users of tobacco, they tend to be surrounded by risk factors. In contrast, when they are compared to exclusive smokers and dual users of snus and cigarettes, they tend to be surrounded by factors which may protect them from involvement of health risk behaviors. These results suggest that exclusive snus users are recruited from other segments of adolescents than those who start smoking cigarettes. Moreover, exclusive snus behavior may be described as a goal-directed, social behavior with its own determinants, a circumstance which needs to be taken into account when it comes to public interventions intended to change snus behavior.

To our knowledge this is the first study to examine the association between exclusive snus users and various psychosocial risk and protective variables drawing on problem behavior theory. However, the current study has limitations. As emphasized, the role of the different variables as trajectories for the use of snus requires longitudinal studies, and further studies should explore the particular reasons why adolescents get involved in this behavior. Furthermore, the low response rate might have biased the study results. Also, caution should be made about generalizing the results of the absolute level of the variables as the selected counties had a higher prevalence of snus use among youth. However, one should have more confidence in the magnitude of the associations between the different variables being less sensitive to sampling variation. Given that the respondents were young males, the results may not apply for young females. Future studies should have a broader basis of recruitment to ensure a nationwide representative sample, given the steady increase of snus use in Norway.

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Contributors

All three authors took part in the initial planning of the study. Larsen and Rise designed the questionnaire. Larsen and Lund designed the data collection and conducted the statistical analysis. Larsen drafted the manuscript, and Rise and Lund took part in the finalization.

Conflict of interest

All authors ensure that they have no conflicts of interest.

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