



Factors related to tobacco use among teenagers

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Summary

Aim: To examine tobacco use among teenagers, identify factors related to tobacco use, as well as evaluate the outcome of a smoking prevention program.

Methods: From age 7/8 to 14/15, annual questionnaires about asthma and allergy have been completed in the OLIN paediatric study in Northern Sweden. From 12/13 years, questions about tobacco use, i.e. smoking and snuff, were added. A smoking prevention program was performed during 2 years.

Results: Any tobacco use increased from 5.0% at age 12/13 years, to 14.4% at age 14/15. At age 14/15 years, the prevalence of tobacco use was significantly higher among boys than girls (16.7 and 12.0%, respectively). More girls than boys smoked (8.9 and 2.8%, respectively), while use of snuff was more common among the boys (15.6 and 4.2%, respectively). Significant risk factors for smoking were any of the family members currently smoking, OR 6.1 (95% CI 4.0–9.3) and a physician-diagnosed asthma at the age of 14/15 years, OR 1.9 (95% CI 1.2–3.0). A protective factor against tobacco use was participation in sports, OR 0.3 (95% CI 0.2–0.4). The prevention program did not result in less tobacco use, although it may have delayed smoking initiation.

Conclusion: The patterns of tobacco use differed significantly between boys and girls. Though any tobacco use was more common among boys, girls were more likely to smoke, and boys were more likely to use snuff. Having asthma did not prevent the teenagers from smoking. Since having a smoking family member was the major risk factor for tobacco use, prevention programs should be directed at smoking families in addition to the individuals.

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Introduction

Despite widespread knowledge of the health consequences, tobacco use, especially smoking is common globally.¹⁻⁵ During the last decades efforts have been made in many countries to reduce smoking in the general public, as well as to prevent young people from starting to smoke.^{1,6-9} Studies have reported that young people start experimenting with tobacco as early as 10 years of age,¹ and become regular smokers at approximately 15.⁵

Tobacco use by gender varies between countries and has a complex association with cultures. There are studies reporting a higher prevalence of smoking among girls,^{8,10-12} studies reporting no significant differences between boys and girls,^{5,13-15} and slightly fewer studies showing more smokers among boys.¹⁶ Among Swedish adolescents, more girls than boys smoke regularly by the age of 15,¹⁷ while smokeless tobacco, specifically snuff use, is far more common among boys than girls.^{11,18} The sale of snuff is not permitted in the European Union countries, except Sweden, Finland and Austria.¹⁹ In total, any tobacco use, cigarettes or smokeless, has been reported to be 11–20% among boys and 12–18% among girls in Sweden, by the age of 15.^{11,17} It has been shown that if regular smoking is not initiated in adolescence, it is unlikely to occur during adulthood. Therefore, understanding of who develops a regular tobacco use in adolescence could lead to targeted interventions resulting in decreased tobacco use in adulthood.²⁰

Smoking prevention programs most often address the general population. However, identifying subjects at high risk could make more targeted and extensive efforts possible.²⁰ Prevention programs in which young people were enrolled and committed in the program,^{6,7} and programs that lasted throughout adolescence,⁹ have been successful. Common risk factors for starting to smoke are having family members,^{11,21} or friends that smoke.^{5,8,20-22} Other risk factors are personal factors, such as risk-taking behaviour, stress, depression, and susceptibility to peer influence.²⁰ Good school performance, being a member of a two-parent family, participation in sports and physical exercise, good self-esteem, personal health concerns and good refusal skills have all been negatively associated with smoking.^{9,20,23,24}

The aim of this study was to examine tobacco use in early teenage, identify factors related to tobacco use, and evaluate the outcome of a smoke prevention program.

Methods

In 1996, a longitudinal study of asthma, rhinitis, eczema, and type-1 allergy started among school children in Northern Sweden. The methods have been described previously.²⁵ In short, all 3525 children enrolled in the first and second class in three towns, Luleå, Piteå and Kiruna, were invited to participate in the Obstructive Lung Disease in Northern Sweden (OLIN) paediatric study. From year 1996 to 2000, at ages 7/8 to 11/12 years, a parental questionnaire was distributed annually by the teachers to the parents of the children, and a 95–97% yearly response rate was obtained. The questionnaire used was based on the ISAAC questionnaire and had additional questions about asthma and

possible risk factors including smoking habits in the family.²⁵ From year 2001, when the children were 12/13 years old they completed the questionnaire themselves and a good agreement between parents' and teenagers' answers was found.²⁶ The subsequent annual questionnaires included questions regarding the teenagers' own tobacco use.¹⁷ In addition to the original cohort, all children enrolled in the actual classes each year were invited, i.e. an open cohort. Of the participants from 1996, 2989 (87%) teenagers participated also in 2003.

During 1999 and 2000, a smoking prevention program within the cohort was performed. The prevention program involved half of the schools in Luleå and Kiruna, with the remaining schools and all schools in Piteå serving as controls. The control and intervention schools were randomly selected after stratification by urban/rural setting, number of students in the schools, and proportion of children with asthma and allergy. In total, 26 schools and 1255 children were included in the program, and there were 2681 control children. The initial intervention was a theatre performance in each school, focusing on the health effects of smoking. Professional actors in collaboration with the children created the performance, and the performance was followed by a discussion about the play and about smoking. The prevention schools started educational projects based on supplied material about smoking prevention, smoking costs and health consequences. The prevention program ended in 2000, when the students in the prevention schools were mixed with students from the control schools due to changes in the school organisation.

Definitions

Smokers were defined as subjects answering affirmatively to the question "Do you smoke?". *Non-smokers* were defined as those who never had smoked, only had tried smoking but had quit or only smoked occasionally. *Family history of smoking* was defined as a report of a mother, father, or other family member that smoked at any occasion from 1996 to 2003. *Any family member currently smoking* included mother, father or other family member who smoked in 2003. Snuff is a moist smokeless tobacco, which consists of grinded tobacco, salts, moisturising and flavouring components and it is placed under the lip. *Snuff users* were defined as those who answered affirmatively to the question "Do you use snuff?". The definition *Any tobacco use* included those who reported being either smokers or snuff users. *Participation in sports* was defined as regular participation in sports, not including physical education in school. *Asthma at age 7/8 years, (14/15 years)*, was defined as subjects reported having a physician diagnosis of asthma at age 7/8 when asked in 1996 (age 14/15 asked in 2003).

Analysis

Analyses were made using Statistical Package for Social Sciences (SPSS 10.0). Comparison of proportions were tested using the χ^2 test. Significant ($P < 0.05$) and borderline significant ($P < 0.10$) association were tested in multiple-logistic regression analysis. The dependent variables were *smoking*, *snuff use* and *any tobacco use* at the age of 14/15.

The independent variables included sex, area of domicile (Luleå, Kiruna or Piteå) and current place of residence (house, apartment or both), current smoking habits in the family, physician-diagnosed asthma and participation in sports. In cross-sectional analyses, all children who were enrolled in the school classes under study were included (i.e. open cohort). In analyses including data from 1996 (i.e. longitudinal data), only the original cohort from 1996 constituted the study base, $n = 2989$.

The Ethical Committee at Umeå University and the University Hospital of Northern Sweden in Umeå approved the study.

Results

Prevalence of tobacco use

The prevalence of any tobacco use, either cigarettes or snuff, was 5.0% at 12/13 years and 14.4% at 14/15 years. At ages 12/13 and 13/14 years, there were no differences in any tobacco use between boys and girls, while at 14/15 years more boys than girls used tobacco, 16.7% versus 12.0%, respectively ($P < 0.001$).

The prevalence of smoking increased from 2.7% at age 12/13 years to 5.8% at 14/15 years of age. In all ages, smoking was significantly more common among girls than boys, 8.9% and 2.8%, respectively, at age 14/15 years (Fig. 1). Among the non-smokers, 31.8% of the girls and 32.9% of the boys reported that they had tried smoking at any occasion. Of the smokers, 97.3% smoked daily or almost daily, 57.7% reported smoking between 1–6 cigarettes/day, and 6.8% smoked 16 or more cigarettes/day.

The prevalence of snuff users was 3.2% at age 12/13 years, and increased to 9.9% at 14/15 years of age. Significantly more boys than girls used snuff, 15.6 and 4.2% respectively, at 14/15 years (Fig. 2).

Factors related to tobacco use

A family history of smoking was reported from 41.5% of the teenagers at least one time between 7/8 to 14/15 years. The prevalence of smoking among the teenagers increased significantly with the number of smoking family members (Fig. 3). If none of the family members smoked, only 1.8% of the teenagers smoked themselves at age 14/15 years, and if

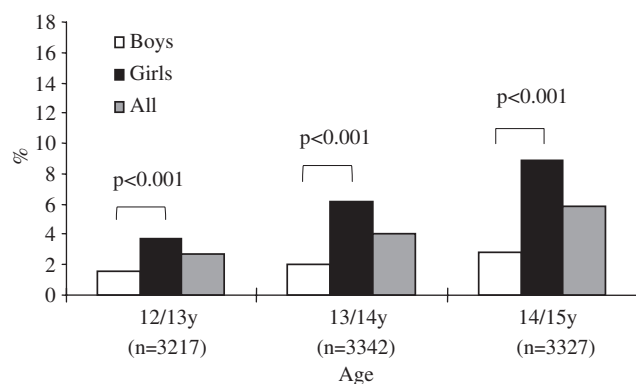


Figure 1 Prevalence of smokers, stratified by sex and age

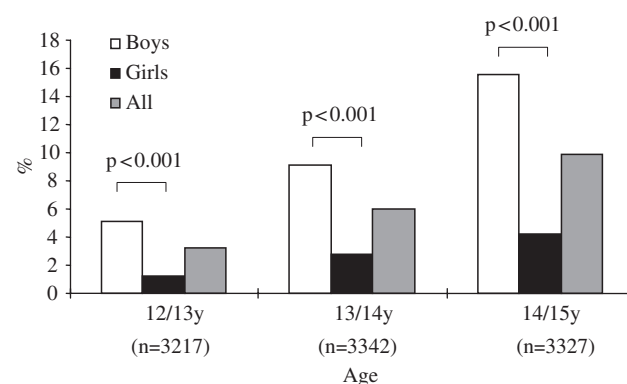


Figure 2 Prevalence of snuff users, stratified by sex and age.

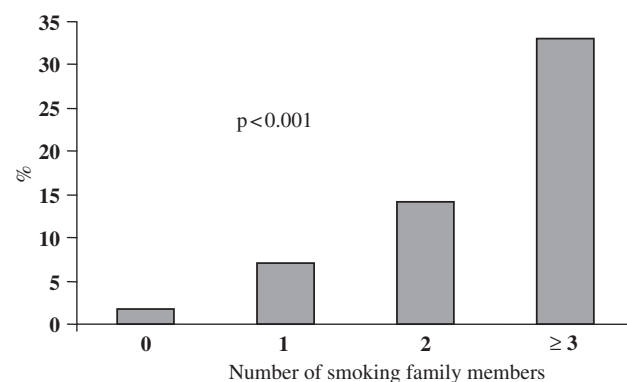


Figure 3 Prevalence of smoking among the teenagers by number of smokers in the family.

three or more family members smoked, 33.0% had started smoking by the age of 14/15 years. The teenagers that at the age of 7/8 were living in a single parent household reported smoking at age 14/15 years significantly more often than others, 9.5% versus 4.8%, respectively ($P < 0.001$). However, when correcting for smoking habits in the family and place of residence (i.e. living in a house or apartment) living with a single parent at 7/8 years was no longer a significant risk factor for tobacco use at 14/15 years, OR for smoking 1.2 (95% CI 0.8–1.8).

Smoking was significantly less prevalent among subjects reporting regular participation in sports compared to non-sport participants, 3.1% versus 11.7%, respectively (Table 1). Also snuff use was less prevalent among sport participants compared to non-participants, 7.4% versus 15.5%, respectively. An exception was found in horseback riding, where smoking was more common among participants than non-participants, 9.1% versus 5.5%, respectively ($P < 0.007$). There were no significant differences in tobacco use, either smoking or snuff use, between teenagers living in urban as compared to a rural setting.

Among children with physician-diagnosed asthma at age 7/8, 5.0% smoked at the age of 14/15, which did not differ from the non-asthmatics in whom 5.4% smoked. Among subjects with physician-diagnosed asthma at age 14/15 years, 9.3% smoked, while only 5.4% among the non-asthmatics smoked, $P < 0.001$ (Table 1). These differences

Table 1 Prevalence of smokers, snuff users and any tobacco users (%) in ages 14/15 years, in relation to sex, domicile, family smoking, asthma and participation in sports.

	Smokers (%)	Difference <i>P</i> -value	Snuff users (%)	Difference <i>P</i> -value	Any tobacco users (%)	Difference <i>P</i> -value
Sex						
Boys	2.8	<0.001	15.6	<0.001	16.7	<0.001
Girls	8.9		4.2		12.0	
Area of domicile						
Luleå	6.1	n.s.	7.2	<0.001	11.9	<0.001
Kiruna	5.5		9.8		14.1	
Piteå	5.6		17.5		21.3	
Current place of residence						
House	4.0	<0.001	8.2	<0.001	11.2	<0.001
Apartment	10.3		13.3		21.6	
Both	15.2		8.1		21.2	
Mother currently smoking						
No	2.4	<0.001	6.4	<0.001	8.4	<0.001
Yes	12.8		17.4		26.4	
Father currently smoking						
No	2.7	<0.001	7.4	<0.001	9.7	<0.001
Yes	12.0		13.7		21.8	
Other family member currently smoking						
No	2.1	<0.001	7.1	<0.001	8.8	<0.001
Yes	18.5		17.2		30.7	
Asthma at 14/15						
No	5.4	<0.001	9.3	0.023	13.4	<0.001
Yes	9.3		13.3		20.4	
Participation in sports						
No	11.7	<0.001	15.5	<0.001	24.6	<0.001
Yes	3.1		7.4		9.6	

between asthmatic- and non-asthmatic teenagers were similar both among the smokers and the snuff users.

Effect of intervention

A non-significant difference in smoking prevalence was observed between the intervention and control groups 2 years after the program. At age 12/13, the prevalence of smokers in the intervention group was lower compared to the control group, 1.9% versus 3.0% ($P = 0.06$). However, at age 14/15 there was a similar prevalence of smokers in the intervention group (5.9%) as in the control group (5.8%).

Multivariate relationships

Significant risk factors from bi-variate analyses were tested in multiple logistic regression analysis (Table 2). If the mother smoked, the teenagers had an increased risk of both smoking and snuff use, OR 2.3 (CI 1.5–3.6) and OR 2.6 (CI 1.8–3.6), respectively. Having a father that smoked increased the risk only for smoking, OR 1.7 (CI 1.1–2.8). Living in apartment, OR 1.5 (CI 1.0–2.2), and living both in an

apartment and in a house, OR 2.4 (CI 1.2–4.8) increased the risk for smoking. The risk for smoking was higher among asthmatics than non-asthmatics, OR 1.9 (CI 1.2–3.0). Participating regularly in sports was a protective factor against both smoking OR 0.3 (CI 0.2–0.4) and snuff use OR 0.5 (CI 0.4–0.6). When the variable *any family member currently smoking* was included in the model the OR for smoking was 6.1 (95% CI 4.0–9.3), snuff use 3.3 (95% CI 2.5–4.4) and any tobacco use 3.8 (95% CI 3.0–4.8), while all other independent variables remained similar.

Discussion

This study describes the tobacco use among teenagers in Northern Sweden in relation to different social factors. The results showed the importance of the smoking habits within the family, mainly that smoking family members significantly increased the risk of initiation of both smoking and snuff use. A cumulative effect was also found, as the prevalence of tobacco use increased with the number of family members that smoked. Regular participation in sports

Table 2 Risk factors and protective factors (OR) for tobacco use among teenagers at 14/15 years by multiple logistic regression analysis.

Independent variables		Dependent variables		
Variables	Categories	Smoking OR (95% CI)	Snuff use OR (95% CI)	Any tobacco use OR (95% CI)
Sex	Boy	1	1	1
	Girl	3.42 (2.37–4.93)	0.20 (0.15–0.27)	0.59 (0.47–0.74)
Area of domicile	Luleå	1	1	1
	Piteå	0.91 (0.62–1.34)	1.49 (1.07–2.05)	1.30 (0.98–1.70)
	Kiruna	0.80 (0.51–1.27)	3.27 (2.38–4.49)	2.25 (1.70–2.98)
Current place of residence	House	1	1	1
	Apartment	1.51 (1.03–2.21)	1.26 (0.91–1.75)	1.44 (1.09–1.88)
	Both	2.44 (1.24–4.77)	0.50 (0.20–1.23)	1.48 (1.03–2.13)
Father currently smoking	No	1	1	1
	Yes	1.74 (1.10–2.76)	1.03 (0.70–1.53)	1.15 (0.83–1.60)
Mother currently smoking	No	1	1	1
	Yes	2.28 (1.45–3.58)	2.56 (1.80–3.64)	2.29 (1.70–3.09)
Other family member currently smoking	No	1	1	1
	Yes	5.26 (3.40–8.14)	2.10 (1.43–3.08)	3.03 (2.22–4.15)
Asthma at age 14/15	No	1	1	1
	Yes	1.91 (1.22–2.98)	1.33 (0.91–1.94)	1.58 (1.15–2.18)
Participation in sports	No	1	1	1
	Yes	0.31 (0.22–0.43)	0.47 (0.36–0.61)	0.38 (0.31–0.48)

served as a protective factor against tobacco use. Further, having asthma did not make the teenagers avoid smoking.

Smoking in the general population in Sweden has decreased from 31% in 1980 to 18% in 2001, while the snuff use has increased from 16% in 1980 to 24% in 1997.²⁷ A common opinion is that snuff is a less unhealthy alternative to cigarettes, and among Swedish adults it is often used as a substitute in smoking cessation.²⁸ However, health consequences due to snuff have not been studied thoroughly, especially not among teenagers. There are studies showing an increased risk for cancer, specifically in the pancreas.²⁹ Epidemiological studies have not shown an increased risk for myocardial infarction among snuff users^{30,31}; however, an increased cardiovascular mortality has been found.³²

It is not only important to prevent young people from starting to use tobacco, it is equally important to prevent adults and parents from smoking. Smoking prevention programs addressed at the general public have managed to decrease smoking in Sweden. New programs aiming to decrease snuff use ought to be the next step, especially in the European countries where snuff is allowed,¹⁹ and particularly among teenagers since snuff use has increased also in these ages.³³

The prevention program in the present study did not result in a decreased use of tobacco among the teenagers. A trend was noticeable at age 12/13 years, when the prevalence of tobacco use was lower among participants in the program. The prevention started early as we wanted to start the program prior to smoke initiation, and the children

were only 10/11 years. The intention of the prevention program was to continue over time, which has been found to be most effective in other studies.^{6,7} Unfortunately the school organisation changed, and children from control schools and prevention schools were mixed. The prevalence of smoking in this cohort of children has steadily increased from 2.7% at 12/13, to 5.8% at 14/15 years of age in year 2003. However, this was still lower than the smoking prevalence among 15-year olds in Sweden as a whole in 2003, 15%.¹⁷ Although the prevention program itself was not a success, the study as a whole with annual questionnaires and information about asthma and allergy might have served as an extensive prevention program. Among young adults in the same northern region of Sweden, the smoking prevalence among 20–29-year olds in 1996 was 16% among the men and 26% among the women.³ Hopefully, the prevalence of smoking among the teenagers of this study will not reach those rates at corresponding age.

In the present study, having a family member that smoked was a significant risk factor for both smoking and snuff use, which has also been found in other studies.^{11,20,21} If the mother smoked, the risk for using any tobacco was greater than if the father smoked. Further, having a family member other than parents, e.g. sibling or stepparent that smoked was also a strong risk factor for smoking. Furthermore, there was an increased risk for tobacco use among those living in an apartment, which may indicate a difference by social group. There was also an increased risk for smoking among subjects living both in an apartment and in a house,

compared to teenagers living only in a house. These groups probably include the teenagers whose parents had divorced, and they lived alternately with either parent. It was clear that smoking family members had a great influence over the tobacco use of the teenagers. In the bi-variate analysis, living with a single parent at age 7/8 years was associated with an increased risk for tobacco use; however, after correction for other variables, such as smoking habits in the family, living with a single parent was no longer associated to smoking. Thus, living with a single parent itself was not related to own smoking. To be able to decrease smoking and snuff use, perhaps future prevention programs should be extended to the whole family. Further, the programs should differentiate between boys and girls. Efforts to encourage and support adult smokers to quit smoking and reduction of smoking initiation among young people would both have an immediate as well as a long-term effect on global smoking related mortality.³⁴

Regular participation in sports turned out to be a protective factor for tobacco use, which has been concluded in other studies.^{23,24} Teenagers that play sports appear to choose a more healthy lifestyle where tobacco is excluded. The choice relies on personality traits and personal health concerns, which have also been found to be protective factors against tobacco use.^{9,20} The exception seen in horseback riding can be explained by the fact that both riding and smoking were more common among the girls. However, a recent study from Finland have reported that among boys active in sports, smoking was less common while snuff use was more common.³³ Thus, tobacco use prevention may be an important task also for sport clubs.

Surprisingly, the subjects with an asthma diagnosis since childhood smoked in the same extent as subjects without asthma. Further, the teenagers reported having asthma at 14/15 years had a significantly higher prevalence of smoking than those without asthma, which also has been found in other studies.^{10,15} These results emphasise the importance of adequate information to teenagers with asthma about the effects of smoking. It has been shown that asthmatics who smoke have less benefit from inhaled steroids,³⁵ and further, smokers with asthma have a worse lung function development compared to smokers without asthma.³⁶

To validate the reported prevalence of tobacco use, the cotinine (a nicotine metabolite) level in blood, urine or saliva can be measured.^{16,18} This was not done in our study, but such a test would further strengthen the results. However, validation studies in which self-reported tobacco use and cotinine measurements were compared have showed few discrepancies.^{16,18} The strength of this study was the high participation rate and the fact that the teenagers completed the questionnaire at school without parents or teachers able to view the answers. Further, the high proportion of daily or almost daily smokers among the smokers indicates a high specificity of our definition of a smoker. On the other hand those who only smoked occasionally may be missing.

In conclusion, the patterns of tobacco use differed significantly between boys and girls. Though any tobacco use was more common among boys, girls were more likely to smoke, and boys were more likely to use snuff. Having asthma did not prevent the teenagers from smoking. Since the major risk for smoking and snuff use was having smoking

family members, prevention programs should be directed at smoking families in addition to the individuals.

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