

# Smoking and associated factors among adolescents in Tallinn, Helsinki and Moscow: a multilevel analysis

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*Aims:* To investigate variations in smoking and associated factors on individual and aggregate level among adolescents in Tallinn (Estonia), Helsinki (Finland) and Moscow (the Russian Federation). *Methods:* The data was collected in Tallinn ( $N=1268$  in Estonian and  $N=901$  in Russian schools), in Helsinki ( $N=1396$ ) and in Moscow ( $N=618$ ) from pupils aged 13–18 by self-administered questionnaire. Multilevel analysis was used to estimate the possible effects of background characteristics, of the proximity of other smokers and the school context on the tobacco use of pupils. *Results:* The prevalence rate of smoking among girls in Russian schools in Tallinn (34.6%), among girls in Helsinki (39.5%), and in Moscow (32.1%) was higher than that among girls in Estonian schools in Tallinn (17.6%). Smoking was slightly less prevalent among boys in Helsinki (27.5%), compared to boys in Estonian (33.6%) and Russian (35.6%) schools in Tallinn, and to boys in Moscow (32.8%). Smoking increased with age. Multilevel analysis showed that smoking differed by school among pupils. Individual determinants of smoking as study site, grade, friends', siblings' and parental smoking behaved differently depending upon school. Friends and siblings' smoking showed interaction with study site to the smoking among girls. *Conclusions:* Strategies aimed at influencing smoking behaviour need to be directed not only towards the individual, but also towards the influences within the child's school environment.

*Key words:* smoking, adolescents, associated factors, multilevel analysis, Estonia, Finland, Russia.

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## INTRODUCTION

Smoking is the largest single cause of preventable serious ill health and premature death (1, 2). Most adult cigarette smokers begin smoking during adolescence. Individuals who begin smoking at a younger age have an increased risk of becoming regular smokers, of becoming heavy smokers, and of falling ill or dying from cigarette-attributable causes (1, 3). Given that regular users find cessation very difficult, interventions to prevent adolescents from initiating tobacco use are a primary focus of public health efforts to reduce overall smoking (1).

To develop and implement effective measures of smoking control, one must understand the patterns of tobacco use and factors associated with smoking (3). Most reviewers conclude that experimentation with smoking, as a symbol of 'adult' behaviour, is associated with peer pressure (4, 5). Family influence

is typically the second most important determinant (3, 5, 6).

Until recently, most studies of tobacco use have focused on contributing factors of smoking of individuals, and the wider social context which can be associated with smoking among adolescents has been largely ignored (7, 8). One channel through which social context can influence smoking is sub-cultural effect. This is the case when in a school situation smoking of friends encourages smoking among schoolmates (7). In other words, smoking behaviour of adolescents is highly dependent upon membership of a social group (9, 10).

Multilevel methods that include both individual-level and aggregate-level data, can contribute new knowledge to a current understanding of public health issues by allowing for the inclusion of macro-level factors in a current explanatory models, thereby bridging the micro-macro gap by increasing an

understanding of how contextual factors translate into differences individual-level risk. Further these methods may eliminate potential confounding of individual-level explanatory models due to the omission of macro-level factors (11).

The present article addresses smoking and associated factors on individual and school level among young people and is based on a comparative survey of adolescents of ages between 13 and 18 years, in Tallinn (Estonia), Helsinki (Finland), and Moscow (the Russian Federation).

#### *Smoking situation in study sites*

Estonia, Finland and Russia have close historical ties. The cities and countries, however, are quite different regarding their cultural, economic, social, and political conditions.

The report of a WHO cross-national study in 1998 showed that among 15-year old girls, in Estonia 8%, in Finland 20%, and in Russia 14% were smokers; among boys the figures were 17%, 19%, and 20%, respectively (12, 13). Every country has adopted tobacco legislation consisting prevention of addiction among children. Tobacco legislation in Estonia (in 2000) and in Finland (amendment in 1994) prohibited sale of tobacco to persons less than 18 years and in Russia (the law from the period of Soviet Union in 1981) to persons less than 16 years (14–16).

In 1998 the percentage of adult daily smokers in Estonia was 20 for women and 42 for men (17); in Finland it was 20 and 30, respectively (18). In Russia (1999) 21% of women and 58% of men were occasional or regular smokers (19).

Historical data for Western countries indicates that, in general, more men than women used tobacco, although in a few situations tobacco use was nearly similar for both men and women. By the Second World War gender differences in smoking prevalence were decreasing. This decrease has been particularly striking for teenagers and young adults; in this age range, women have been as, or more, likely to have tried smoking than men, in many Western countries in recent years (20). In Finland, from the early 1960's the percentage of regular smokers among men has dropped from 60 to below 30. In the same time period the percentage of women smokers has increased to somewhat below 20 (15). The relative absence of historical data in Eastern European countries makes it impossible to determine long-term trends in smoking in Estonia and Russia (16).

The objectives of this study were to determine the prevalence of smoking and to evaluate the factors associated with tobacco use among 13–18 year old adolescents in Tallinn, Helsinki and Moscow. The

main focus was on multilevel analysis to find out whether the school context is related to adolescent smoking, as well as the extent to which it modifies the relationship between individual factors associated with smoking among adolescents in different study sites.

#### DATA AND METHODS

The study sites were the capitals of three countries. The data was collected in schools in Tallinn, Moscow and Helsinki by almost identical (one question not used in this paper was different) self-administered questionnaire.

As about 50% of the population in Tallinn is predominantly Russian speaking, both Estonian-speaking and Russian-speaking schools were included in the research in Estonia. In Tallinn the data was collected in grades 8, 10, and 12 (aged 13–14, 15–16 and 17–18 years, respectively) in ten Estonian ( $N=1268$ ) and seven Russian ( $N=901$ ) secondary schools, in the autumn of 1995. All specialised schools were excluded. The schools were selected at random from the telephone catalogue.

In Helsinki, 1396 pupils from the eighth grade (aged 14) of six lower-secondary schools and from grades 1 and 3 (school year 10 and 12; aged 16 and 18 years, respectively) of the respective upper-secondary schools (gymnasium) participated in the survey in the autumn of 1994. The sample areas were selected on the basis of socio-economic information of the city districts. Schools from extreme districts, by income level, were excluded.

In Moscow, the data, which was collected in the spring of 1995, comprised of 618 pupils from grades 9, 10 and 11 (aged 15, 16 and 17 years, respectively) from nine schools that were randomly selected from different administrative areas of Moscow.

The results of each of the Estonian, Finnish, and Russian surveys have been reported separately elsewhere (21–23).

All surveys were administered during 1994–1995. Pupils completed the questionnaire in the classroom under the supervision and guidance of a member of the study team. The teachers in the schools were requested not to inform their pupils about the forthcoming survey, in order to try to exclude preformed answers. In order to avoid information about the survey spreading, the survey was conducted in the course of one day in one school. The pupils were assured of anonymity and of the confidentiality of their responses, and of the inviolability of their status at school by their honest answers. The time limit for responding was 45 minutes.

Only pupils present on the day of the survey were

eligible to participate. Participation was voluntary. The response rate in school surveys was generally high. Non-response consisted mainly of those pupils who were absent on the day of the survey. In Tallinn and Moscow participated all pupils present on the day of the survey (response rate 100%). In Helsinki four pupils refused to fill in the questionnaire and six questionnaires were rejected, because they were completed in a joking manner (response rate 99.3%). In Tallinn and Moscow that kind of non-response did not appear.

The data was obtained using a questionnaire consisting mainly of structured multiple-choice questions. The questionnaire included sections on social background, future hopes and fears, tobacco and alcohol use, perceived health status, and attitudes towards the environment and society.

The questions used in this paper were intended to estimate the prevalence of tobacco use and to elicit information on the effect of factors that contribute to smoking among adolescents.

*Smoking status* was determined from pupil responses to an item asking about current and past smoking. Four categories (never/have tried, but do not smoke now/smoke every now and then/smoke regularly) of self-reported smoking status were used. For the analysis on current smoking, pupils who answered "I smoke now and then" or "I smoke regularly" were considered as smokers; those who answered "I have never tried" or "I have tried, but do not smoke now" were classified as current non-smokers.

From among *the major determinants of smoking* (possible associated factors) *on individual level*, background characteristics and the proximity of other smokers were examined:

- (1) *Gender*:
- (2) *Age*: The grades (8 or 9/10/11 or 12) were used as age groups.
- (3) *Religion*: very important/important/not so important/not at all important. Religion was dichotomised: important and not important.
- (4) *Family type*: living with mother and father/mother and stepfather/father and stepmother/only mother/only father/some other caretaker. Family type was dichotomised: nuclear families (both parents alive and live together) and non-nuclear families, comprising mostly of single parent and neo-families (families with stepfather or stepmother).
- (5) *Education of the head (father or someone else of the family)*: Education was coded as basic (up to 8–9 grades)/secondary (up to 12 grades)/higher (university degree)/unknown

(respondent did not know the education of the supporter).

(6–8) Friends', siblings', parental (either mother or father or both) smoking.

Among *determinants of smoking on aggregate level* the variable 'school' was examined.

The primary data analysis involved the determination of prevalences and 95% confidence intervals (CI) for tobacco use and associated factors. A secondary analysis involved a multilevel modelling approach, for dichotomised smoking level as the dependent variable.

This present paper focuses on a two-level logistic regression model offering simultaneous consideration of individual as the first unit level, and school as the second unit level. There is a considerable variability in smoking prevalence at school level seen among participating schools in each country. Two-level approach accounts for this source of variation to obtain more precise estimates of the effects of individual characteristics for pupils in each school. At the same time, by including study site as a second level predictor variable, it allows for estimation of the effect of country and ethnicity (Estonian/Russian schools in Tallinn) on the school-level prevalence. Separate models for girls and boys were fitted.

The fact whether one's friends or siblings are smoking is certainly an important factor influencing the smoking status, but at the same time could itself be influenced by respondents' smoking level. Thus, smoking may occur in clusters of friends and/or siblings. Since those clusters are not known, but may be present in this dataset (friends from the same school), proper (multilevel) modelling of such effects is not possible.

Therefore, first, a model including only the covariates that themselves cannot be influenced by respondent's smoking level (gender, grade, parental smoking, etc.) was fitted. In this model, all significant effects have a causal interpretation. By including the effects of friends' and siblings' smoking in the second model, it became possible to draw conclusions about the presence of the clustering effect mentioned above. Odds ratios (OR) of smoking and the corresponding 95% CI were computed. For the analysis, the statistical packages Stata and SAS were used.

Among a total of 4183 respondents, 103 (2.5%) had serious inconsistencies in responses to items on smoking and were excluded from the analysis. This percentage was lowest among pupils in Russian schools in Tallinn (0.2%) and highest among Finnish adolescents (4.6%). For the gender-stratified analyses, it was necessary to exclude an additional 12 questionnaires (0.3%) that lacked information on the gender of the respondent. The final data set used in

this article was 4068 questionnaires. Before the multivariate regression analysis, an additional 19 (0.5%) questionnaires that lacked information on questions related to associated factors were excluded from further analysis. In all, 4049 questionnaires were used in the model.

## RESULTS

### Smoking status

Table 1 shows smoking prevalence in study samples stratified by gender and grade. Tobacco use among girls in Russian schools in Tallinn, among girls in Helsinki and in Moscow was statistically significantly higher than that among girls in Estonian schools in Tallinn. Smoking was slightly less prevalent among boys in Helsinki than among boys in Estonian and Russian schools in Tallinn and boys in Moscow. Estonian schools in Tallinn that reported low rates of tobacco use among girls in grade 8 tended to be the same as those that reported the lowest levels through grade 10 and 12.

Reported mean age for starting smoking among girls ranged from 13.4 (95% CI 13.2–13.6) in Helsinki to 13.8 (13.5–14.1) in Estonian and Russian schools in Tallinn and to 13.8 (13.5–14.0) in Moscow. Whereas among boys it was 12.9 (12.6–13.5) in Estonian schools in Tallinn, 13.0 (12.6–13.4) in Helsinki and Moscow, 13.1 (12.6–13.5) in Russian schools in Tallinn. Therefore, girls in Tallinn and Moscow started with their first cigarette significantly later than boys. The median age of starting smoking for boys in different study samples and for girls in Helsinki was 13 years, versus 14 years for girls in Tallinn and Moscow.

### Smoking and associated factors

The distribution of major determinants of smoking is shown in the Table 2. Religion was more important among girls in Estonian schools in Tallinn and among girls in Moscow compared to the respondents in other study sites. In Moscow, more than half of the pupils reported their head of the family to have higher education, while in Helsinki this was nearly one fifth. In Helsinki one third of respondents did not know their supporter's education. In Helsinki, the proportion of respondents having smoking friends was highest, but the proportion of those having smoking parents was lowest. Siblings' smoking was highest among girls in Moscow.

Multilevel analysis (Table 3) indicated that school effect accounted for an important source of variation in smoking prevalence. In the first model adjusted odds ratios for smoking differed by country among

Table 1. Smoking prevalence rate (%) and 95% CI.

Gender/grade	Estonian schools in Tallinn		Russian schools in Tallinn		Helsinki		Moscow	
	No of smokers	Prevalence rate (95% CI)	No of smokers	Prevalence rate (95% CI)	No of smokers	Prevalence rate (95% CI)	No of smokers	Prevalence rate (95% CI)
<i>Girls</i>								
8 <sup>th</sup> or 9 <sup>th</sup> grade	24	11.3 ( 7.4–16.3)	50	26.9 (20.7–33.9)	81	32.3 (26.5–38.4)	41	28.9 (21.6–37.1)
10 <sup>th</sup> grade	55	20.8 (16.1–26.2)	54	33.1 (26.0–40.9)	126	46.0 (40.0–52.1)	24	23.3 (15.5–32.7)
11 <sup>th</sup> or 12 <sup>th</sup> grade	45	19.9 (14.9–25.7)	81	43.5 (36.3–51.0)	72	39.6 (32.4–47.1)	39	49.4 (37.9–60.9)
<i>Total</i>	124	17.6 (14.9–20.7)	185	34.6 (30.6–38.8)	279	39.5 (35.8–43.2)	104	32.1 (27.0–37.5)
<i>Boys</i>								
8 <sup>th</sup> or 9 <sup>th</sup> grade	55	25.2 (19.6–31.5)	48	30.4 (23.3–38.2)	65	23.2 (18.4–28.6)	53	34.2 (26.8–42.2)
10 <sup>th</sup> grade	57	31.5 (24.8–38.8)	52	43.7 (34.6–53.1)	53	28.3 (22.0–35.4)	20	23.0 (14.6–33.2)
11 <sup>th</sup> or 12 <sup>th</sup> grade	72	48.6 (40.4–57.0)	28	33.7 (23.7–45.0)	52	34.4 (26.9–42.6)	17	53.1 (34.7–70.9)
<i>Total</i>	184	33.6 (29.7–37.8)	128	35.6 (30.6–40.7)	170	27.5 (24.0–31.2)	90	32.8 (27.3–38.8)

Table II. Distribution of personal and interpersonal factors among respondents.

Characteristic	Estonian schools in Tallinn				Russian schools in Tallinn				Helsinki				Moscow			
	Girls		Boys		Girls		Boys		Girls		Boys		Girls		Boys	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Total	703	56.2	547	43.8	535	59.8	360	40.2	707	53.4	618	46.6	324	54.2	274	45.8
<i>Grade</i>																
8 <sup>th</sup> or 9 <sup>th</sup>	213	30.3	218	39.9	186	34.8	158	43.9	251	35.5	280	45.3	142	43.8	155	56.6
10 <sup>th</sup>	264	37.6	181	33.1	163	30.4	119	33.1	274	38.8	187	30.3	103	31.8	87	31.7
11 <sup>th</sup> or 12 <sup>th</sup>	226	32.1	148	27.0	186	34.8	83	23.0	182	25.7	151	24.4	79	24.4	32	11.7
<i>Religion</i>																
important	294	41.8	120	21.9	175	32.7	121	33.6	230	32.5	127	20.6	191	59.0	92	33.6
not important	404	57.5	413	75.5	352	65.8	234	65.0	473	66.9	487	78.8	132	40.7	178	64.9
missing answer	5	0.7	14	2.6	8	1.5	5	1.4	4	0.6	4	0.6	1	0.3	4	1.5
<i>Type of family</i>																
nuclear	468	66.6	375	68.6	363	67.8	264	73.3	497	70.3	444	71.8	232	71.6	214	78.1
non-nuclear	235	33.4	171	31.2	171	32.0	96	26.7	204	28.9	169	27.4	92	28.4	60	21.9
missing answer	0	0	1	0.2	1	0.2	0	0	6	0.8	5	0.8	0	0	0	0
<i>Education of the head of family</i>																
higher	223	31.7	195	35.6	194	36.3	150	41.7	128	18.1	125	20.2	157	48.5	148	54.0
secondary	344	48.9	240	43.9	237	44.3	145	40.3	152	21.5	141	22.8	133	41.0	96	35.0
basic	31	4.4	19	3.4	33	6.2	16	4.4	176	24.9	121	19.6	13	4.0	13	4.8
unknown	102	14.5	92	16.9	66	12.3	39	10.8	238	33.7	200	32.4	21	6.5	13	4.8
missing answer	3	0.5	1	0.2	5	0.9	10	2.8	13	1.8	31	5.0	0	0	4	1.4
<i>Friends' smoking</i>																
no	293	41.7	208	38.0	233	43.5	170	47.2	189	26.7	212	34.3	137	42.3	132	48.2
yes	405	57.6	330	60.3	302	56.5	190	52.8	518	73.3	402	65.1	187	57.7	141	51.4
missing answer	5	0.7	9	1.7	0	0	0	0	0	0	4	0.6	0	0	1	0.4
<i>Siblings' smoking</i>																
no	568	80.8	451	82.5	422	78.9	301	83.6	600	84.9	547	88.5	249	76.9	232	84.7
yes	130	18.5	87	15.9	113	21.1	59	16.4	107	15.1	67	10.8	75	23.1	41	14.9
missing answer	5	0.7	9	1.6	0	0	0	0	0	0	4	0.7	0	0	1	0.4
<i>Parental smoking</i>																
no	290	41.3	244	44.6	227	42.4	153	42.5	416	58.8	377	61.0	145	44.7	138	50.4
yes	408	58.0	294	53.8	308	57.6	207	57.5	291	41.2	237	38.4	179	55.3	135	49.3
missing answer	5	0.7	9	1.6	0	0	0	0	0	0	4	0.6	0	0	1	0.3

girls, but not among boys. Odds ratio for tobacco use was lowest among girls in Estonian schools in Tallinn compared to girls in the other study sites. Smoking increased by age in both genders. Parental smoking was linked to the tobacco use among pupils with slightly more prevalent effect among girls than among boys.

In the second model, both, the effects of friends' and siblings' smoking appeared to be significant, confirming the fact that smoking indeed occurs in clusters of friends and siblings with the effect of friends' smoking being strongest. Among girls who had smoking friends, the odds for tobacco use was twice as high as among boys. Friends' and siblings' smoking showed interaction with study sites among girls, but not among boys. The effect of friends' smoking was strongest among girls in Helsinki and weakest among girls in Russian schools in Tallinn. The association between siblings' smoking and the tobacco use was strongest among girls in Moscow.

Religion, education of the head of the family and

family type did not correlate with smoking among the pupils by school.

## DISCUSSION

Before discussing the results, the limitations of the study must be considered. The data in the three capitals was collected in different years and time periods of the year (in Tallinn in the autumn 1995, in Helsinki in autumn 1994 and in Moscow in the spring 1995), which may influence the comparability of the results. Furthermore, the weakness of the design of the study is somewhat different age of the adolescents in Moscow compared to the pupils in Tallinn and Helsinki, what requires carefulness in making conclusions in our study.

With this caveats, however, this study provides information on the prevalence of tobacco use, and the relationship between pupils' smoking behaviour and associated factors on individual and school level in Tallinn, Helsinki and Moscow.

Table III. Multilevel modeling results for association between smoking and different factors on individual and school level. Fixed effect estimates expressed as adjusted odds ratios (OR) and 95% CI.

Factor	I Model (Excluding friends' and siblings' smoking)		II Model (Including friends' and siblings' smoking)	
	Girls Odds ratio (95% CI)	Boys Odds ratio (95% CI)	Girls Odds ratio (95% CI)	Boys Odds ratio (95% CI)
<b>School level</b>				
<i>Study site</i>				
Estonian schools in Tallinn	1	1	1	1
Russian schools in Tallinn	2.4 (1.7–3.5)	1.0 (0.6–1.7)	6.8 (3.4–13.9)	1.2 (0.7–1.8)
Helsinki	3.5 (2.4–5.0)	0.7 (0.4–1.2)	2.0 (0.9–4.6)	0.7 (0.5–1.1)
Moscow	2.4 (1.6–3.6)	1.0 (0.6–1.7)	3.8 (1.7–8.5)	1.2 (0.7–1.9)
<b>Individual level</b>				
<i>Grade</i>				
8 <sup>th</sup> or 9 <sup>th</sup>	1	1	1	1
10 <sup>th</sup>	1.6 (1.2–2.0)	1.3 (1.0–1.7)	1.3 (1.0–1.7)	1.1 (0.9–1.5)
11 <sup>th</sup> or 12 <sup>th</sup>	1.9 (1.5–2.4)	2.0 (1.6–2.7)	1.5 (1.2–2.0)	1.6 (1.2–2.0)
<i>Parental smoking</i>				
No	1	1	1	1
Yes	1.8 (1.5–2.2)	1.3 (1.1–1.6)	1.7 (1.4–2.1)	1.3 (1.0–1.6)
<i>Siblings' smoking</i>				
No			1	1
Yes			1.5 (0.9–2.3)	1.7 (1.3–2.3)
<i>Friends' smoking</i>				
No			1	1
Yes			8.4 (4.6–15.5)	4.0 (3.1–5.1)
<b>Interaction</b>				
<i>Siblings' smoking * study site</i>				
Estonian schools in Tallinn			1	–
Russian schools in Tallinn			0.9 (0.5–1.7)	
Helsinki			1.4 (0.7–2.7)	
Moscow			2.0 (1.0–4.2)	
<i>Friends' smoking * study site</i>				
Estonian schools in Tallinn			1	–
Russian schools in Tallinn			0.3 (0.1–0.6)	
Helsinki			1.5 (0.7–3.5)	
Moscow			0.5 (0.3–1.1)	
<b>Covariance parameters</b>				
Between schools	0.073 (p=0.07)	0.198 (p=0.01)	0.074 (p=0.07)	0.116 (p=0.03)
Residual	0.983	0.986	0.963	0.984

In our study it was found that tobacco use is increasing with age, in all countries, and for both genders, which confirms the findings of other studies (12, 24).

The prevalence of smoking among girls in Estonian schools in Tallinn was much lower than among girls in other study samples, but not such difference existed when comparing boys. In relation to gender, the smoking rates for boys substantially exceeded those for girls, at different age levels in Estonian schools in Tallinn, but only slightly exceeded those for girls in

Moscow and in Russian schools in Tallinn. Notable exceptions included Finnish girls, whose smoking exceeded that of boys. According to the WHO survey on health behaviour in school-aged children (2, 8), in many Western countries (Wales, Denmark, Canada, Germany, Spain) the smoking prevalence for girls in the 11–15 age group was higher than that for boys. However, in Baltic countries, as well as in the Russian Federation, the differences were similar to those found in the other European countries in the 1960s: less girls than boys were smoking. Following the break-up of

the eastern-block countries, the western tobacco industry has tried in a more determined fashion to conquer the market, targeting young women and girls, and, indeed, smoking rates among girls in these countries are rising and are approaching those among boys (2, 16). At the same time, compared to WHO cross-national study in Estonia (1998) smoking prevalence among girls and boys in Tallinn in our study (1994–1995) was higher (12, 13). It could be explained by using of the capital as the study sample in our study, where the smoking is more distributed than in the rest of the country (18).

Interestingly, compared with other European countries, the proportion of adult smokers in Finland is among the lowest, but among adolescents one of the highest. There are at least two possible explanations. On the one hand, the high proportion of adolescents smoking may be due to the exceptionally early onset of smoking among girls and the milder social control and family coherence in Finland compared to other European countries. On the other hand the low proportion of adult smoking may be due to active international collaboration with smoking cessation programs and well-organised systems to monitor smoking among adolescents in Finland (15).

In relation to ethnic groups in Estonia, smoking was significantly higher among girls in Russian schools in Tallinn than among their counterparts in Estonian schools, but not such difference existed when comparing boys in Tallinn. Dissimilarities in smoking status between girls in Estonian and Russian schools in Tallinn may reflect the socially and culturally prescribed gender role norms and expectations, as well as different socialisation among girls and boys, and that the youth of these two cultures do not attend the same schools (25).

The current study contributes to the findings of Lucas & Lloyd (26) about the significant gender difference in age at first cigarette, with the average for boys lower than that for girls. The median age of commencement of smoking in our study was 13 years among boys in all study samples, and among girls in Helsinki, but 14 years among girls in Tallinn and Moscow. This may partly explain the higher prevalence of smoking among girls in Helsinki compared to their counterparts in other study samples. Clearly, the age at first cigarette demonstrates that the legislation that attempts to control cigarette availability in all the countries is either not fully enforced or is not effective.

Multilevel analysis showed that smoking differed by school in our study. On the one hand, an understanding of how school as contextual factor influences smoking behaviour of individuals could be useful to equip us with better designing of effective intervention

strategies in the future. On the other hand, the detailed nature of this relationship remains unclear. The fruitful way might be to use the school class as contextual level of measurement in future analysis. The school class as smaller unit could determine smoking even more strongly and probably helps to understand the causal mechanisms that are likely to facilitate between aggregate characteristics and individuals' smoking.

According to worldwide literature there is a plenty of evidence that the proximity of other smokers (friends, siblings, parents) is associated with the tobacco use of pupils (3, 5, 6, 24, 27). These studies do not, however, adjust for aggregate variable.

Having a friend who smokes was one of the main and strongest factors associated with smoking by school in every study site of our study. In present study the influence of smoking friends to the tobacco use was stronger among girls compared to boys. In other words, even in the same school girls had stronger social pressure than boys. It could be explained by hypothesising that girls are more sensitive than boys to the social pressures to smoke (20). The finding that the effect of friends' smoking among girls differed by countries might be related to the cultural differences (e. g., with whom and where is preferable to smoke). According to the results of the current study, adolescents with siblings that smoke and with one or both parents who use tobacco were more likely to smoke. This fact underlines once again the important role of the family in the development of health behaviours of the child. The girls in Moscow seemed to be most sensitive toward the siblings' smoking.

Other background characteristics as religion, type of family, education of the head of the family were not associated with smoking among adolescents by school. Religion can influence people's orientation and behaviour regarding use of tobacco, which restricts the consumption of health-damaging substances, but the strong protective effect of adolescent religious involvement and its contribution to lower rates of tobacco use is more often found in the countries with long and strong religious traditions (28). According to Waldron (29), pupils who had less educated parents are more likely to try cigarettes, more likely to adopt cigarette smoking, and less likely to quit smoking. In addition, the pupils with less educated parents appear to be more rebellious against adult authority and more predisposed towards adopting "adult" behaviour, such as smoking. One possible explanation to the fact that smoking was not linked to the education of the head of the family in our study could be in the great number of respondents who did not know the education of their supporter.

Additionally, there seems to be some bias by education in Moscow data, although it is noteworthy that having higher education (30% of the population of 15 years and older and 37% of employed population) is quite common in Moscow (30).

## CONCLUSIONS

International comparison of adolescents in Tallinn (Estonia), Helsinki (Finland) and Moscow (the Russian Federation) reveals differences in smoking between countries and also between genders inside countries. A school as indicator of sub-cultural environment for adolescents is related to the smoking in study sites. Despite the vast political, social, economic, and cultural differences between pupils in Tallinn, Helsinki and Moscow, a remarkably similar factors are associated with smoking in each city. However, the association of friends' and siblings' smoking with tobacco use by school among adolescents is modified by the study site.

Current data can guide the design of interventions to prevent the uptake of tobacco use and to reduce smoking among adolescents. The observations suggest that strategies to influence smoking behaviour need to be focussed not only on the individual child but also on the child's school environment. Efforts to resist peer pressure represent a key element in the success of any future smoking control policies.

Finally, more detailed conceptualisation of the local environment (e.g., school class) that stronger influence the adoption and maintenance of smoking in future is required.

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