Do the socioeconomic context and the European geographical area modify parental influences on smoking experimentation among adolescents?

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Abstract

Adolescent smoking is a major public health problem. While the socioeconomic status (SES) of the neighbourhood and that of the family are known to play a role in smoking onset and progression, it is not clear whether it modifies the association between parental influences and adolescent behaviour. The purpose of this study is to investigate family correlates of adolescent smoking experimentation and to explore the modifying role of socioeconomic context and European geographical area in a sample of European adolescents. This is a secondary analysis of the baseline survey of the European Drug Addiction Prevention (EU-Dap) trial which took place in seven European countries and involved 7079 students. School SES was used as indicator of socioeconomic context. European countries were aggregated in two geographical areas: North-Central and South. The associations between parental, family factors, and adolescents smoking experimentation were analysed through multilevel mixed-effect logistic regression models, stratified by school SES and European geographical area. Parental smoking, permissiveness towards tobacco, family conflicts, problematic relationships, low connectedness, and low parental control were significantly associated with adolescent smoking experimentation. Paternal smoking was a stronger correlate of adolescent smoking in low SES schools, while maternal smoking in high SES schools. Parental permissiveness was a stronger correlate in low SES schools. Family conflicts and low parental control were correlates only in low SES schools. The associations did not substantially differ between European geographical areas, with the exception of parental smoking that was a stronger correlate in the North, and parental control that was a correlate only in the South of Europe. To reduce inequalities in tobacco-related outcomes, prevention efforts in low socioeconomic contexts appear to be a public health priority. Parental smoking, permissiveness, family relationships, and connectedness should be addressed in preventive programs.

Introduction

Adolescent tobacco smoking is a major public health problem [1, 2].
Tobacco smoking usually starts in young age [3, 4]. Early experimentation may lead to regular smoking through adolescence and adulthood [5, 6]. Therefore, to prevent thetransition to regular smoking, it is of great importance to identify factors associated with smoking initiation [7, 8].
Social influences, especially within the family, represent strong determinants of smoking initiation among youths. For instance, parents can influence adolescent smoking through their own smoking behaviour, but also through parenting style and monitoring behaviours. Children of smokers have a significantly higher risk of smoking initiation, with a dose–response effect, i.e., the risk is increased if both parents are smokers [9–16]. Gender-specific influences may also be at stake: mother's smoking influences children's smoking initiation but also the uptake of regular smoking [17]; and the influence seems to be stronger on their daughters than on their sons [18]. However, in general, parental influences appear to be stronger on girls than on boys [19–23]. Parental attitudes towards smoking, for instance conveyed by parental disapproval or permissiveness, affect the risk of adolescent smoking in the predicted direction [24–28].
Also other factors related to the climate in the family can influence adolescent's smoking behaviour. Positive parent–child relationships such as parental attachment, connectedness, positive identification, amount of time spent together, support, monitoring, and authoritative parental style are also protective factors towards adolescent smoking [22, 23, 25, 29–36]. On the contrary, negative family interactions, lack of parental control, and family conflicts were found to be risk factors [20, 29, 32, 37, 38]. Probably because of a mixture of the factors mentioned above, for instance history of family conflicts, lack of monitoring, and psycho-social adversities, one-parent adolescents are more likely to smoke than those living with both parents [14, 16, 23, 25, 28, 29, 39].
While the socioeconomic status (SES) of the neighbourhood and the family is known to play a role in smoking onset and progression, it is not clear whether it modifies the association between parental influences and adolescent behaviour [15, 23, 40–48]. Since the socioeconomic environment can modify the effects of health-promoting interventions, a better understanding of the interplay between family influences and the broader socioeconomic environment could generate important insights for preventive strategies.
Finally, the influence of parental behaviours and attitudes on the smoking behaviours of children may differ by European geographical area because of the cultural and social characteristics of family environments. The responsibility of families for the welfare and care is greater in South European countries where the well-being of family members depends on family arrangements and relations, while in North European countries, the responsibility for the provision of family welfare is transferred on institutions and public services [49, 50]. To our knowledge, there are no studies comparing family correlates of adolescent smoking experimentation in different geographical areas of Europe.
The purpose of this study is to investigate family correlates of adolescent smoking experimentation, and to explore the modifying role of socioeconomic context and of European geographical areas in a sample of European adolescents.

Methods

Study design and population

We conducted a secondary analysis of the baseline survey of the European Drug Addiction Prevention (EU-Dap) trial that evaluated the effectiveness of a school curriculum (Unplugged) in preventing the use of tobacco, alcohol, and illicit drugs among adolescents. The trial took place in nine centres from seven European countries (Austria, Belgium, Germany, Greece, Italy, Spain, and Sweden) and involved 7079 students aged 12–14 years. The study design and the results of the trial have been described in detail elsewhere (www.eudap .net). The analytical sample of the present study included 7026 students participating in the baseline survey and answering a question on lifetime cigarette smoking.

Data collection

Most information was collected through a self-administered anonymous questionnaire. Questions were derived or adapted from the EDDRA data bank (http://eddra .emcdda.eu.org).

Individual socio-demographic information included gender, age (based on date of birth), and type of cohabitation (living with "both parents", "one parent", and "other relatives"). School SES was used as indicator of socioeconomic context, categorized as high, middle, and low. This classification was performed independently by each centre participating in the trial. Population-based indicators of the catchment area of the school (e.g., proportions with different educational attainments) were used in Greece and Sweden. Type of school (theoretical or vocational) was used in Germany, Belgium, and in the two Italian centres of Turin and Novara. A combination of area-level and school-level indicators was used in Austria, Spain, and in the Italian centre of L'Aquila [51].

Centres participating in the study were aggregated into two European geographical areas: North-Central including Sweden, Germany, Belgium, and Austria; and South including Spain, Italy and Greece. The aggregation was based on the differences between South and North/Central Europe in the role of family on the welfare and care of its members (as explained in introduction).

Adolescents' cigarette smoking was investigated by asking students "How many times (if any) have you smoked cigarettes in your lifetime?" with responses ranging from 0 to 30 and more. Responses were collapsed generating the dichotomous variable "Ever smoking" vs. "Never smoking".

The smoking behaviour of mother and father was reported by the adolescents by answering the question "Does any of the following persons smoke cigarettes?". A single item assessed the perceived parents' permissiveness towards tobacco smoking, with possible responses "would allow to smoke", "wouldn't allow smoking at home", "wouldn't allow smoking at all", and "don't know".

Family conflicts, relationships, connectedness, rules, and parental control were investigated through multi-items questions. All items allowed response alternatives on a 4-point Likert scale (strongly agree/agree/disagree/strongly disagree). Answers were scored 1–4 and summed up, means were calculated, and categories of high, middle, and low levels of each indicator were created using tertiles. An indicator of family conflicts was derived from the items: "We don't often fight in my family", "We hardly ever lose our tempers", and "We don't often criticize each other". Family relationships were derived from the items: "We help and support one another", "We are full of life and good spirit", "In my family it's important for everyone to express their own opinion", "My family always does things together", and "We get along well with each other". Connectedness with parents was derived from the items: "I can easily get support from my father/mother", "It is very important for me not to disappoint my parents", "My parents know where I am in the evenings", and "My parents set clear rules". The indicator of family rules was derived from the items: "Each person's duties are clearly set out in my family", "There is strict punishment for anyone breaking the rules in my family", and "Work before play is the rule in my family". An indicator of parental control was derived from the items: "In my family you can get away with almost anything", "We can do whatever we want in my family", "In my family we aren't punished or told off when we do something wrong", and "We come and go as we want in my family".

Statistical analysis

We conducted two sets of analyses, separating factors conveying direct smoking influences (i.e., parental smoking and parental permissiveness towards smoking, Table 2) from factors that may represent potential mediators of parental influences (i.e., connectedness to parents, rules, control, family conflicts, and relationships, Table 3). The associations between factors and adolescents self-reported ever smoking were evaluated in bivariate and multivariate analyses, adjusting for age and type of cohabitation, and stratifying by school SES and European geographical area. Multilevel mixed-effect logistic regression modelling was used to control for the hierarchical nature of the data, with three grouping levels: country, school, and student. Models stratified by school SES were run with three levels (country, school, and student), while models stratified by European geographical

areas were run with two levels (school and student). Co-linearity between variables was checked before building the multivariate models. Due to missing values, applying listwise deletion, the final model was run on 6370 subjects. Statistical analyses were carried out using STATA software release 12.0 (Stata Corporation 2007, College Station, TX, USA).

Results

About 35% of the students participating in the survey smoked at least one cigarette in their life. About 12% of the students smoked only once or twice during their lifetime, whereas about 10% of them smoked 30 or more times during the lifetime. The prevalence of lifetime smoking was 29.1% in North/Central Europe, and 40.1% in South Europe.
In bivariate analysis, gender was not associated with the probability of ever smoking (Table 1). Statistically significant bivariate associations were shown for all other studied factors. The prevalence of ever smoking was higher among older adolescents (52.1% among 14 years old vs 28.0% among 13 years old, and 17.2% among 12 years old). Attending a low or middle SES school was associated with a higher risk of smoking experimentation compared with attending a high SES school, as well as living with only one parent or other relatives compared with living with both parents.

Parental smoking behaviour and attitudes towards smoking
Both father's smoking and mother's smoking were associated with adolescent smoking experimentation, as was parents' perceived permissiveness towards tobacco (Table 2). After adjusting for age and for living conditions (cohabiting with both parents or not), paternal smoking was associated with adolescent smoking experimentation in middle and low SES schools. Maternal smoking was associated with adolescent smoking in all SES groups, with stronger association in high SES schools. Paternal smoking and maternal smoking were weaker correlates of adolescent smoking in South Europe than they were in North Europe (Table 2).
Children who perceived that their parents would not allow smoking at home or would allow it right away had two-tothree times higher probability to report ever smoking than children perceiving that their parents would not allow smoking at all. These associations were stronger in low SES than in high SES schools, but did not differ substantially by geographical area of Europe.

Family relationships

In the whole sample, high family conflicts, problematic relationships, low connectedness with parents, and low parental control (but not unclear rules) were all associated with the condition of ever smoker, after adjustment for attained age and type of cohabitation (Table 3).
In a separate analysis by school SES, low connectedness and problematic relationships between adolescents and their parents were uniformly associated with two-to-three times higher likelihood of ever smoking. However, the presence of family conflicts and low parental control were associated with adolescent smoking experimentation only among students in low SES schools (Table 3).
The associations above did not substantially differ between geographical areas of Europe, with the exception of parental control, that was a correlate of adolescent smoking experimentation in the South of Europe, but not in the North-Central Europe.
Family rules did not correlate with adolescent smoking in any of the subsamples above.
Mutually adjusting factors related to parental influences on smoking and those related to family relationships did not reveal different association patterns with respect to those reported above, in the whole sample or in subsamples defined by school SES and geographical areas (data not shown).

Discussion

This study aimed to examine family correlates of adolescent smoking experimentation, and to explore the modifying role of the school SES and the geographical location in Europe, issues that were not

extensively studied so far. In fact, most studies in this domain were conducted in USA, while our study involved more than 7000 students of seven European countries, thus adding insights specifically on the European context. We also analysed a large number of family factors, not directly representing pro- or anti-smoking influences, but likely to be correlated with adolescent smoking experimentation through an impact on general psychological well-being.

Our results were largely confirmatory of previous observations, for instance the association of parental smoking and adolescent smoking uptake [9–16]. It is recognized that parental smoking increases the acceptance of the behaviour and reduces risk perceptions and negative attitudes towards smoking [52]. In line with previous studies, mother's smoking seemed to be more strongly associated with offspring's behaviour than father's smoking, particularly so in high SES schools [11, 13, 53]. However, when adjusting for indirect influences referred to family relationships and parenting style, the differences between paternal and maternal influences tended to level off, probably indicating different common antecedents for mother and father smoking and for their children's initiation with cigarettes. Examples of these common antecedents may be general educational influences due to the higher amount of time mothers usually spend with their children, and to their stronger involvement in norm setting and child rearing [11].

Along with behavioural influences, perception of parental norms was strongly correlated with adolescent smoking experimentation. In line with previous studies, parental disapproval of smoking revealed the expected association with lower prevalence of ever smoking, while adolescents with more permissive parental norms were more likely to report any smoking [24–28]. While these associations of parental smoking-specific norms did not differ between South and North-Central Europe, in schools characterized by low SES, they appeared to be stronger than in middle or high SES schools. Parents of low social status, especially fathers, are more likely to smoke, and to have weak negative attitudes towards smoking, so that children living in low-income or low-literacy areas with smoking parents are less likely to have stringent restrictions on smoking [[54–58], and Table 4]. This finding deserves attention, because it may explain the differential effectiveness in low SES contexts of school-based anti-smoking programs that target adolescents' behaviour ignoring the familial influences.

Harmonious relationships of a child with parents and satisfaction for family life have been reported as important predictors of adolescents' well-being as well as desirable health outcomes [22, 23, 25, 29–36].

To our knowledge, this is the first time that family correlates of tobacco initiation among adolescents are investigated according to the indicators of socioeconomic circumstances and geographical area of Europe. Several studies showed higher risk of smoking among pupils of lower SES [15, 23, 40–48]. Our analyses confirmed this association in an ecologic perspective. At the area level, SES also modified some of the associations described above. Due to stressful living conditions, low SES families may be more involved in conflicts. This may motivate adolescents to spend more time out of the family environment without adults monitoring their social network or activities. Economically disadvantaged parents may have more difficulties in monitoring children's behaviour, because they may be more concerned in ensuring a decent level of living standards in their family [59]. Low parental control is associated with high risk of children engaging in risk behaviours [32, 38, 60]. Consistently, in our sample, low parental control was significantly related with smoking behaviour only among pupils of low SES schools. It is to be noted that a lower level of parental control was reported by these pupils compared to their peers of higher SES groups (Table 4). It may be inferred that preventive interventions specifically targeting families in low SES neighbourhoods could have a large impact on smoking prevalence among adolescents than programs only targeting adolescents' knowledge, skills, and behaviours.

The modifying role of geographical area of Europe in the initiation of cigarette smoking in adolescence, assumedly exerted through family norms, cultural influences, and specific smoking norms, is also a novel contribution of this study. Contrary to expectations, the data did not reveal important differences in this regard. Thus, most of the familial factors under study probably constitute

a “core set” of potential host-related determinants of adolescent smoking experimentation independent of cultural and structural characteristics of European geographical area. A noteworthy exception was the association of adolescent smoking experimentation with low parental control that remained significant only in the three centres of the South of Europe. This may indicate that in this part of Europe, the importance of family as “monitoring agency” on children’s behaviour is still greater compared with other institutional settings [50]. Indeed, in our sample, a significantly higher parental control was detected among adolescents of South Europe than among those of North/Central Europe (Table 4).

This study had some limitations. First, the cross-sectional design prevented conclusions about causal pathways, which we tried to render by avoiding wording inferring causality. Some of the factors investigated such as school SES, type of cohabitation, and father and mother smoking should theoretically precede the outcome, therefore, limiting the risk of reverse causation or report bias.

However, for other factors, such as family relationships, connectedness with parents, family rules, control, and permissiveness, we cannot completely exclude report bias, i.e., a re-appraisal of parents’ norms and relationships among children who tried or adopted smoking. Missing values reduced the sample available for the adjusted analysis and may have introduced selection bias if the missing information were not distributed at random. Parents’ information was collected through children reports, thus reflecting rather children’s perceptions than parental behaviour. As described above, this may have introduced some degree of report bias, since children testing smoking may have biased perceptions due to a posteriori inference on their parents’ approval. All information was self-reported, and this raise questions on its reliability; however, the anonymous administration of the questionnaire is likely to have attenuated this risk. Different methods were used across the centres to define the socioeconomic level of the schools, so the homogeneity of the schools within the strata cannot be assured. Moreover, socioeconomic setting was assessed at the school level, thus limiting the information to an ecologic perspective, which cannot be generalized to individuals. Finally, the stratified analysis tested whether the effect was significant within each subgroup, but not the difference between subgroups.

This study also had some strong features, such as the geographically diverse sample, involving students of seven European countries. The surveys were conducted according to a standardised protocol and a standardised questionnaire, minimizing possible misclassification related to data collection. The information accrued in the survey was very comprehensive, allowing the analysis of a large set of correlates. In the statistical analysis, we adopted an approach respectful of the “non-independence” of the individual reports according to higher order clustering (student, school, and country).

In conclusion, the present study contributes to clarify the role of the family context in tobacco smoking initiation among European adolescents. To reduce inequalities in tobacco-related outcomes, prevention efforts in low SES contexts appear to be a public health priority. Parental smoking, permissiveness toward their children’s smoking, family relationships, and connectedness should be addressed with high priority in preventive programs.

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Author Contribution

Fabrizio Faggiano and Maria Rosaria Galanti designed the EU-Dap trial. Federica Vigna-Taglianti and Maria Rosaria Galanti conceived the present study and coordinated the statistical analysis. Emina Mehanović, Federica Vigna-Taglianti, and Maria Rosaria Galanti drafted the paper. Emina Mehanović, Federica Mathis, and Romeo Brambilla carried out the statistical analysis. All authors provided critical revision, contributed to, and approved the final manuscript.

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Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical standards

The study was conducted following the principles of the Declaration of Helsinki.

Informed consent

A general policy on parental informed consent was not adopted. Each centre followed the practice required locally to obtain permission from the corresponding Ethical Boards. Three centres adopted a passive consent procedure, informing families of the administration of the program, while others asked for individual active consent. Only one centre needed a local permission from the national educational authority.

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Table 1 Socio-demographic characteristics and family correlates of ever smoking vs never smoking

Characteristic	Overall ($n=7026$)		Ever smoking ($n=2469$)		Never smoking ($n=4557$)		Crude Odds Ratios[1] (95% CI)	*P*
	N	%	*N*	%	*N*	%		
Gender								
Girls	3270	47.3	1136	46.6	2134	47.6	1	
Boys	3651	52.7	1301	53.4	2350	52.4	0.98 (0.87–1.10)	0.706
Age								
Mean ± SD	13.3 ± 1.0		13.7 ± 1.1		13.0 ± 0.9		1.74 (1.58–1.91)	< 0.001
School SES								
High	2372	33.8	712	28.8	1660	36.4	1	
Middle	2221	31.6	737	29.9	1484	32.6	1.34 (1.01–1.76)	0.039
Low	2433	34.6	1020	41.3	1413	31.0	1.80 (1.38–2.36)	< 0.001
Type of cohabitation								
Both parents	5476	78.0	1819	73.8	3657	80.3	1	
One parent	636	9.1	297	12.0	339	7.4	1.78 (1.49–2.14)	< 0.001
Other relatives	909	12.9	350	14.2	559	12.3	1.29 (1.10–1.52)	0.002
Father smoking								
No	3800	56.6	1154	49.6	2646	60.2	1	
Yes	2919	43.4	1172	50.4	1747	39.8	1.65 (1.47–1.85)	< 0.001
Mother smoking								
No	4295	62.9	1315	55.3	2980	66.9	1	
Yes	2537	37.1	1064	44.7	1473	33.1	1.87 (1.67–2.10)	< 0.001
Parental permissiveness to smoke								
Wouldn't allow at all	5136	74.4	1506	62.2	3630	81.0	1	
Wouldn't allow at home	694	10.1	401	16.6	293	6.5	2.81 (2.36–3.35)	< 0.001
Would allow	392	5.7	262	10.8	130	2.9	3.70 (2.91–4.69)	< 0.001
Don't know	682	9.9	251	10.4	431	9.6	1.24 (1.03–1.48)	0.022
Family conflicts								
Low/Middle	4631	66.7	1411	57.8	3220	71.6	1	
High	2307	33.3	1028	42.2	1279	28.4	1.59 (1.42–1.78)	< 0.001
Family relationships								
Good/Middle	5420	77.9	1631	66.6	3789	84	1	
Bad	1538	22.1	816	33.4	722	16.0	3.37 (2.06–2.72)	< 0.001
Connectedness with parents								
High/Middle	5758	82.9	1704	70.2	4054	89.8	1	
Low	1184	17.1	725	29.9	459	10.2	3.03 (2.62–3.49)	< 0.001
Family rules								
Clear/middle	5785	83.3	1925	79.0	3860	85.7	1	
Unclear	1156	16.7	512	21.0	644	14.3	1.45 (1.26–1.67)	< 0.001
Parental control								
High/middle	4873	70.5	1624	66.7	3249	72.5	1	
Low	2039	29.5	810	33.3	1229	27.5	1.41 (1.24–1.61)	< 0.001

[1]Multilevel models with three levels (country, school, and student)

Table 2 Associations between parental smoking-specific influences and cigarette smoking experimentation among adolescents, by school SES and European geographical area[a]

Characteristic	Overall sample[1] ($n=6502$)		High SES schools[1] ($n=2230$)		Middle SES schools[1] ($n=2053$)		Low SES schools[1] ($n=2219$)		South Europe[2] ($n=3606$)		North/Central Europe[2] ($n=2896$)	
	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*
Age	1.62 (1.47–1.79)	<0.001	2.11 (1.70–2.61)	<0.001	1.81 (1.51–2.17)	<0.001	1.37 (1.20–1.58)	<0.001	2.32 (2.03–2.67)	<0.001	1.35 (1.17–1.57)	<0.001
Type of cohabitation												
Both parents	1		1		1		1		1		1	
One parent	1.48 (1.19–1.82)	<0.001	1.51 (1.05–2.16)	0.025	1.79 (1.20–2.67)	0.004	1.28 (0.89–1.82)	0.179	1.27 (0.92–1.74)	0.145	1.61 (1.21–2.13)	0.001
Other relatives	1.19 (0.99–1.42)	0.058	1.32 (0.96–1.80)	0.083	1.12 (0.80–1.56)	0.503	1.11 (0.84–1.49)	0.458	1.14 (0.91–1.44)	0.246	1.21 (0.91–1.61)	0.182
Father smoking												
No	1		1		1		1		1		1	
Yes	1.30 (1.15–1.48)	<0.001	1.08 (0.86–1.34)	0.509	1.38 (1.11–1.73)	0.005	1.42 (1.15–1.75)	0.001	1.16 (0.98–1.37)	0.076	1.53 (1.26–1.85)	<0.001
Mother smoking												
No	1		1		1		1		1		1	
Yes	1.55 (1.36–1.76)	<0.001	1.74 (1.39–2.18)	<0.001	1.37 (1.09–1.72)	0.007	1.49 (1.20–1.84)	<0.001	1.34 (1.13–1.60)	0.001	1.77 (1.47–2.14)	<0.001
Parental permissiveness to smoke												
Wouldn't allow at all	1		1		1		1		1		1	
Wouldn't allow at home	2.58 (2.15–3.10)	<0.001	1.96 (1.44–2.68)	<0.001	2.85 (2.04–3.98)	<0.001	3.31 (2.40–4.57)	<0.001	2.38 (1.86–3.06)	<0.001	2.76 (2.10–3.63)	<0.001
Would allow	2.87 (2.22–3.71)	<0.001	2.36 (1.48–3.77)	<0.001	2.27 (1.44–3.59)	<0.001	4.46 (2.89–6.91)	<0.001	2.74 (1.98–3.78)	<0.001	3.35 (2.20–5.10)	<0.001
Don't know	1.13 (0.93–1.38)	0.205	0.72 (0.49–1.05)	0.084	1.83 (1.31–2.56)	<0.001	1.10 (0.80–1.52)	0.555	1.07 (0.83–1.40)	0.588	1.26 (0.94–1.68)	0.118

[a]Multivariate multilevel mixed-effect logistic regression analysis, adjusted for age and type of cohabitation

[1]Multilevel models with three levels (country, school, and student)

[2]Multilevel models with two levels (school and student)

Table 3 Associations between family relational influences and cigarette smoking experimentation among adolescents, by school SES and European geographical area[a]

Characteristic	Overall sample[1] ($n=6823$)		High SES schools[1] ($n=2318$)		Middle SES schools[1] ($n=2169$)		Low SES schools[1] ($n=2336$)		South Europe[2] ($n=3766$)		North/Central Europe[2] ($n=3057$)	
	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*	Adj Odds Ratios (95% CI)	*P*
Age	1.72 (1.56–1.90)	<0.001	2.19 (1.78–2.68)	<0.001	1.90 (1.58–2.27)	<0.001	1.46 (1.28–1.67)	<0.001	2.27 (1.99–2.58)	<0.001	1.48 (1.28–1.72)	<0.001
Type of cohabitation												
Both parents	1		1		1		1		1		1	
One parent	1.60 (1.32–1.93)	<0.001	1.62 (1.16–2.27)	0.004	1.81 (1.27–2.56)	0.001	1.46 (1.07–2.00)	0.019	1.45 (1.08–1.93)	0.012	1.69 (1.31–2.18)	<0.001
Other relatives	1.19 (1.00–1.41)	0.052	1.31 (0.96–1.78)	0.088	1.17 (0.84–1.61)	0.356	1.09 (0.83–1.43)	0.519	1.17 (0.94–1.46)	0.168	1.20 (0.91–1.58)	0.189
Family conflicts												
Low/Middle	1		1		1		1		1		1	
High	1.22 (1.07–1.39)	0.002	1.15 (0.92–1.43)	0.235	1.10 (0.87–1.39)	0.448	1.46 (1.18–1.81)	0.001	1.26 (1.07–1.49)	0.006	1.23 (1.00–1.51)	0.052
Family relationships												
Good/Middle	1		1		1		1		1		1	
Bad	1.65 (1.40–1.93)	<0.001	1.84 (1.41–2.41)	<0.001	1.66 (1.24–2.23)	0.001	1.48 (1.13–1.93)	0.004	1.46 (1.19–1.80)	<0.001	1.75 (1.37–2.24)	<0.001
Connectedness with parents												
High/Middle	1		1		1		1		1		1	
Low	2.37 (2.03–2.77)	<0.001	2.72 (2.07–3.58)	<0.001	2.92 (2.19–3.88)	<0.001	1.80 (1.40–2.33)	<0.001	2.38 (1.96–2.88)	<0.001	2.54 (1.95–3.32)	<0.001
Family rules												
Clear/Middle	1		1		1		1		1		1	
Unclear	1.09 (0.94–1.27)	0.272	1.13 (0.86–1.47)	0.380	1.23 (0.94–1.61)	0.129	1.00 (0.77–1.31)	0.979	1.11 (0.90–1.37)	0.335	1.07 (0.85–1.34)	0.576
Parental control												
High/Middle	1		1		1		1		1		1	
Low	1.31 (1.14–1.50)	<0.001	1.16 (0.88–1.51)	0.293	1.16 (0.91–1.49)	0.233	1.46 (1.18–1.80)	0.001	1.46 (1.19–1.79)	<0.001	1.09 (0.90–1.31)	0.380

[a]Multivariate multilevel mixed-effect logistic regression analysis, adjusted for age and type of cohabitation

[1]Multilevel models with three levels (country, school, and student)

[2]Multilevel models with two levels (school and student)

Table 4 Parental smoking-specific influences and family relational influences, by school SES and European geographical area

Characteristic	High SES schools ($n=2379$)		Middle SES schools ($n=2243$)		Low SES schools ($n=2457$)		P	South Europe ($n=3887$)		North/Central Europe ($n=3192$)		P
	N	%	*N*	%	*N*	%		*N*	%	*N*	%	
Age												
Mean ± SD	13.2 ± 0.89		13.1 ± 0.98		13.5 ± 1.14		< 0.001	13.7 ± 1.06		12.7 ± 0.64		< 0.001
Type of cohabitation												
Both parents	1876	78.9	1782	79.6	1851	75.5		3023	77.9	2486	78.0	
One parent	218	9.2	186	8.3	235	9.6		281	7.2	358	11.2	
Other relatives	285	12.0	272	12.1	366	14.9	0.004	578	14.9	345	10.8	< 0.001
Father smoking												
No	1442	63.0	1162	54.2	1212	51.9		2002	53.5	1814	60.1	
Yes	846	37.0	981	45.8	1122	48.1	< 0.001	1743	46.5	1206	39.9	< 0.001
Mother smoking												
No	1603	68.7	1352	62.1	1368	57.8		2380	62.9	1943	62.8	
Yes	731	31.3	826	37.9	998	42.2	< 0.001	1403	37.1	1152	37.2	0.909
Parental permissiveness to smoke												
Wouldn't allow at all	1811	77.0	1633	74.3	1725	71.9		2780	72.7	2389	76.5	
Wouldn't allow at home	234	10.0	209	9.5	254	10.6		399	10.4	298	9.5	
Would allow	97	4.1	119	5.4	178	7.4		267	7.0	127	4.1	
Don't know	210	8.9	237	10.8	243	10.1	< 0.001	380	9.9	310	9.9	< 0.001
Family conflicts												
Low/Middle	1484	62.9	1504	67.8	1674	69.5		2379	61.8	2283	72.7	
High	874	37.1	714	32.2	736	30.5	< 0.001	1468	38.2	856	27.3	< 0.001
Family relationships												
Good/Middle	1808	76.6	1770	79.7	1880	77.6		2796	72.5	2662	84.5	
Bad	552	23.4	452	20.3	544	22.4	0.040	1059	27.5	489	15.5	< 0.001
Connectedness with parents												
High/Middle	2013	85.4	1851	83.4	1930	80.1		3005	78.2	2789	88.6	
Low	345	14.6	369	16.6	481	19.9	< 0.001	837	21.8	358	11.4	< 0.001
Family rules												
Clear/Middle	1959	83.2	1831	82.5	2034	84.2		3227	83.9	2597	82.6	
Unclear	397	16.8	388	17.5	381	15.8	0.286	620	16.1	546	17.4	0.161
Parental control												
High/Middle	1729	73.7	1593	72.1	1582	65.9		2763	71.9	2141	68.6	
Low	618	26.3	618	27.9	819	34.1	< 0.001	1077	28.1	978	31.4	0.003