



Published in final edited form as:

Am J Prev Med. 2013 April ; 44(4): 339–344. doi:10.1016/j.amepre.2012.11.037.

Smoking in Movies and Adolescent Smoking Initiation:

Longitudinal Study in Six European Countries

Matthis Morgenstern, PhD, James D. Sargent, MD, Rutger C.M.E. Engels, PhD, Ron H.J. Scholte, PhD, Ewa Florek, MD, Kate Hunt, PhD, Helen Sweeting, PhD, Federica Mathis, BSc, Fabrizio Faggiano, MD, and Reiner Hanewinkel, PhD

Institute for Therapy and Health Research (IFT-Nord) and the Institute for Medical Psychology and Medical Sociology (Morgenstern, Hanewinkel), University Hospital Schleswig-Holstein, Kiel, Germany; the Geisel School of Medicine at Dartmouth (Sargent), Lebanon, New Hampshire; the Behavioural Science Institute (Engels, Scholte), Radboud University, Nijmegen, The Netherlands; the Laboratory of Environmental Research, Department of Toxicology (Florek), University of Medical Sciences, Poznan, Poland; the MRC Social and Public Health Sciences Unit (Hunt, Sweeting), Glasgow, United Kingdom; the Piedmont Centre for Drug Addiction Epidemiology (Mathis), ASL TO3, Grugliasco, the Department of Translational Medicine (Faggiano), Università del Piemonte Orientale Avogadro, Italy

Abstract

Background—Longitudinal studies from the U.S. suggest a causal relationship between exposure to images of smoking in movies and adolescent smoking onset.

Purpose—This study investigates whether adolescent smoking onset is predicted by the amount of exposure to smoking in movies across six European countries with various cultural and regulatory approaches to tobacco.

Methods—Longitudinal survey of 9987 adolescent never-smokers recruited in the years 2009–2010 (mean age 13.2 years) in 112 state-funded schools from Germany, Iceland, Italy, The Netherlands, Poland, and the United Kingdom (UK), and followed-up in 2011. Exposure to movie smoking was estimated from 250 top-grossing movies in each country. Multilevel mixed-effects Poisson regressions were performed in 2012 to assess the relationship between exposure at baseline and smoking status at follow-up.

Results—During the observation period ($M=12$ months), 17% of the sample initiated smoking. The estimated mean exposure to on-screen tobacco was 1560 occurrences. Overall, and after controlling for age; gender; family affluence; school performance; TVscreen time; personality characteristics; and smoking status of peers, parents, and siblings, exposure to each additional 1000 tobacco occurrences increased the adjusted relative risk for smoking onset by 13% (95% CI=8%, 17%, $p<0.001$). The crude relationship between movie smoking exposure and smoking initiation was significant in all countries; after covariate adjustment, the relationship remained significant in Germany, Iceland, The Netherlands, Poland, and UK.

© 2013 American Journal of Preventive Medicine. Published by Elsevier Inc. All rights reserved.

Address correspondence to: Matthis Morgenstern, Institute for Therapy and Health Research (IFT-Nord), Harmsstrasse 2, 24114 Kiel, Germany. morgenstern@ift-nord.de.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

No financial disclosures were reported by the authors of this paper.

Conclusions—Seeing smoking in movies is a predictor of smoking onset in various cultural contexts. The results confirm that limiting young people’s exposure to movie smoking might be an effective way to decrease adolescent smoking onset.

Introduction

In 2012, the U.S. Surgeon General determined that: “The evidence is sufficient to conclude that there is a causal relationship between depictions of smoking in the movies and the initiation of smoking among young people.”¹

However, robust longitudinal evidence on this relationship derives almost entirely from studies of adolescents in the U.S. Apart from two longitudinal studies (one from the North of Germany, the other from Mexico^{2,3}), studies from elsewhere in the world of the relationship between “movie smoking” and young people’s own smoking have been cross-sectional.^{4–11} It is therefore unclear whether the U.S. Surgeon General’s conclusion about causality is applicable outside the U.S.

Although most European countries have ratified the WHO Framework Convention on Tobacco Control, which recommends modification of the movie rating system so that new movies portraying smoking are classified as appropriate for adults only,^{12,13} there has, with the exception of Great Britain, been almost no discussion or action in Europe.¹⁴ Studies of young people from a number of very different European countries (Germany, Iceland, Italy, The Netherlands, Poland, and UK) have found that all have access to substantially more movies containing smoking than adolescents in the U.S.^{15,16} This lack of action might be due to the limited longitudinal evidence to support policy outside the U.S.

The present study addresses this relative paucity of longitudinal research pertaining to European youth by reporting the results of a large-scale longitudinal survey of young adolescents in six European countries. Exposure to movie smoking was assessed in more than 16,000 adolescents, and the incidence of smoking onset was determined 1 year later to investigate whether exposure to movie smoking predicted smoking onset, overall and separately by country, before and after adjustment for other known risk factors for smoking onset.

Methods

Design, Procedure, and Study Sample

A school-based longitudinal study was conducted in six European countries by research centers in Germany (Kiel); Iceland (Reykjavik); Italy (Turin and Novara); Poland (Poznan); The Netherlands (Nijmegen); and UK (Glasgow). To permit linking of the baseline and follow-up survey, each questionnaire was labeled with a seven-digit individual code generated by the student, following a procedure tested in previous studies.¹⁷ Ethical approval for the research was gained from the relevant ethical body in each country. Additional approvals (e.g., from educational authorities and individual head teachers) were sought as required. Further details are given elsewhere.⁷

Students were recruited from 865 classes in 114 schools. Baseline surveys ($n=16,551$) were conducted between November 2009 and June 2010, and follow-up surveys were conducted between January and May 2011 (mean between-wave interval=12 months; range: 10–14 months). Of these 16,551 students, it was possible to match follow-up data for 13,642 students (82%) from 843 classes in 112 schools, including 9987 students who had never smoked a cigarette at baseline, the sample for this analysis of smoking onset. Country-

specific overall matching rates and other sample details are available in Appendix A (available online at www.ajpmonline.org).

Measures

Exposure to smoking in movies—Research centers in each country compiled a list of the most commercially successful box-office hits in their country, using publicly available data on movie revenues. For each movie, students indicated how often (never, once, twice, more than two times) they had seen it. For the present analysis, answers were dichotomized into *ever seen* and *never seen*.

In a parallel procedure, all included movies were content-coded with regard to tobacco occurrences. A tobacco occurrence was counted each time a major or minor character handled or used tobacco in a scene or when tobacco use was depicted in the background (e.g., “extras” smoking in a bar scene). Exposure to movie smoking was estimated for each student by summing the number of tobacco occurrences in each movie they had seen. Further details regarding the procedure, the sample of movies, and the inter-rater reliability can be obtained elsewhere.⁷

Smoking behavior—The current study assessed lifetime smoking experience at both time points by asking: *How many cigarettes have you smoked in your life?* (never smoked, just a few puffs, 1–19 cigarettes, 20–100 cigarettes, or >100 cigarettes). The sample analyzed here is restricted to those who had never smoked at baseline; hence, any smoking reported at the follow-up survey, even just a few puffs, was considered initiation of smoking.

Covariates—A number of covariates were included (Appendix B, available online at www.ajpmonline.org provides details) that could confound or modify the relationship between exposure to smoking in movies and smoking initiation, including sociodemographics (gender, age, family affluence); personal (school performance, TV screen time, sensation seeking, and rebelliousness); and social environmental (smoking of peers, parents and siblings) characteristics. The list of covariates mirrored that of previous studies on movie smoking.^{4,18,19}

Data Analysis

All data analyses were conducted in 2012 with Stata 12.0. Bivariate associations between the study variables were analyzed with Spearman rank correlation coefficients. The crude and adjusted associations between exposure to movie smoking and smoking initiation were analyzed with multilevel mixed-effects Poisson regressions (uncentered data in all analyses). Poisson regression allows for the presentation of incidence rate ratios (IRRs) and 95% CIs for the relationship between movie smoking occurrences and smoking onset. IRRs were calculated for the exposure to every 1000 smoking occurrences. Because the data were clustered at the country, school, and classroom level, random intercepts for all three levels were included in the crude and adjusted models. Crude models were specified with movie smoking entered as the only fixed effect. In the adjusted models, all covariates were additionally entered as fixed effects. Pairwise comparisons after logistic regression were Bonferroni-adjusted. Missing data were handled by list-wise deletion.

A sensitivity analysis was undertaken to assess the specificity of the association between exposure to movie smoking and smoking initiation. In this separate analysis, a variable assessing the absolute numbers of movies seen by a student was added to the regression model. Adding the measure of general movie exposure allows a test for whether the reported associations are specific to the smoking imagery because the amount of movie smoking

exposure might be only a marker variable, indicating students that have high movie exposure in general.

Results

Descriptive Statistics at Baseline and Attrition Analysis

Table 1 gives descriptive statistics for all never-smokers at baseline, for those lost to follow-up, and for the final analyzed sample of baseline never-smokers, allowing comparisons of differences due to attrition. Never-smokers lost to follow-up were significantly older; more often male; had lower scores on the family affluence scale; rated their school performance more poorly; had higher scores in sensation-seeking/rebelliousness; had more friends, siblings, and parents who smoked; and were more often recruited from schools in Poland or Iceland.

Smoking Initiation During the Observation Period

Overall, 17% of the sample initiated smoking during the observation period. The incidence rate was 6% in Iceland, 17% in Germany, 18% in UK, 20% in Italy, 22% in The Netherlands, and 23% in Poland, with significant pair-wise comparisons for Germany vs Poland ($p<0.001$); UK vs Poland ($p=0.001$); and Iceland vs all other countries (all five p -values <0.001). After adjustment for between-country age and gender differences, the only remaining significant difference in smoking initiation was between Iceland and all other countries (all five p -values <0.001). The predicted age- and gender-adjusted incidence rates were 6% for Iceland; 19% for Germany, Italy, and UK; 20% for Poland; and 21% for The Netherlands, respectively.

Exposure to Smoking in Movies

Overall, 71% of the total 655 movies included at least one tobacco occurrence, with a range of 0–423 and a mean of 28.5 occurrences per movie. On average, the analyzed sample had seen 20 (SD=9) of the 50 movies on their movie list, which translated into an estimated mean individual exposure to on-screen tobacco of 1560 (median=1269, SD=1169) occurrences with a range of 0–6429 occurrences, based on the extrapolation to the respective 250 movies. The highest exposure was found for Icelandic students (M=1942 occurrences); followed by Polish (M=1850); Italian (M=1548); Scottish (M=1538); Dutch (M=1209); and German students (M=1014).

Association Between Exposure to Smoking in Movies and Adolescent Smoking Initiation

Figure 1 shows the unadjusted and adjusted association between exposure to movie smoking and adolescent smoking initiation for each country, and in the overall sample. The curves illustrate a monotonic increasing relationship through the exposure range for each country. The intercepts illustrate the different initiation rates in the six countries. Figure 1 also reports the crude and adjusted IRRs associated with exposure to 1000 tobacco occurrences, overall and by country. There was a significant crude association between exposure to movie smoking and smoking onset in the overall sample and in each country model, with the highest risk increase in Iceland (50% higher smoking incidence per 1000 occurrences) and the lowest risk increase in Italy (15%).

After adjustment for age, gender, family affluence, school performance, TV screen time, sensation-seeking/rebelliousness, and smoking in the social environment, exposure to movie smoking was still significantly related to smoking onset in the overall sample and in five of the six country-specific models (Germany, Iceland, The Netherlands, Poland, and UK).

Overall, the adjusted IRR was 1.13 (95% CI=1.08, 1.17, $p<0.001$) for each additional 1000 occurrences of movie smoking exposure. The strongest adjusted association was found in the Scottish sample (adjusted IRR = 1.21 per 1000 occurrences, 95% CI=1.09, 1.34, $p<0.001$); there was no adjusted association found for Italy (IRR = 1.03, 95% CI=0.93, 1.15, nonsignificant).

Sensitivity Analysis

A sensitivity analysis was conducted by additionally controlling for the absolute numbers of movies a student reported having seen. The correlation between exposure to movie smoking and number of movies seen was $r=0.77$. Despite this high correlation, exposure to movie smoking was still associated with smoking onset (adjusted IRR = 1.11, 95% CI=1.04, 1.19, $p=0.003$), whereas number of movies seen was not (adjusted IRR = 1.05, 95% CI=0.98, 1.13, $p=0.156$). To have comparable IRRs in this analysis, both variables were parsed into quartiles, with IRRs indicating the risk of smoking onset for each quartile of movie smoking exposure and number of movies seen, respectively.

Discussion

The results show that an exposure to 1000 smoking depictions increases the relative risk of initiating smoking by about 13%. To our knowledge, this is the largest cross-cultural longitudinal study on the association between smoking in movies and smoking onset in youth. The study fills a gap in current understanding, showing that the well documented longitudinal finding among U.S. adolescents also applies in European countries. The association holds despite (1) controlling for a number of confounding influences, including the propensity to watch many movies, suggesting that the effect is specific to smoking in movies; and (2) the various cultural and regulatory environments in the six studied European countries.

The only exception was Italy, where no association was found after covariate control. From a theoretic perspective, there is no immediate explanation for this result, aside from random variation. However, from a more empirical perspective, the result is in line with the earlier work on movie smoking showing that effects are dependent on risk status.^{2,20} The rate of non-analyzed students was higher in Italy than the average (35% vs 25%) due to a higher rate of ever-smokers at baseline. There were also differences in the (analyzed) Italian never-smokers who were (compared to the average never-smokers of the other five countries) significantly more often males, reported lower family affluence, lower school performance, higher TV screen times, were higher in sensation-seeking and more often reported having fathers and friends who smoke. Further studies are needed to shed light on reasons for these differences.

Limitations

This study is subject to limitations inherent in any observational study. Loss to follow-up can affect generalizability, especially if there is selective attrition. In the present study, adolescents at higher risk of smoking were more likely to be lost to follow-up, which might have led to an overestimation of the “true” association. However, the follow-up retention rate was high, more than 80%, cushioning the attrition effects. In addition, there was control of a large number of variables known to be important confounders, as identified in other studies. The fact that general movie exposure did not eliminate the association between movie smoking exposure and youth smoking initiation adds weight to the claim that it really is the smoking in movies that is associated with smoking onset in adolescents. However, as with any observational study, it is always possible that the results may be biased by unmeasured confounding.²¹

Conclusion

This study provides persuasive evidence of a robust longitudinal association between seeing images of smoking in movies and smoking onset among adolescents in several European nations. This evidence provides further support for the implementation of the policies outlined in the Framework Convention for Tobacco Control aimed at limiting youth exposure to smoking in movies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

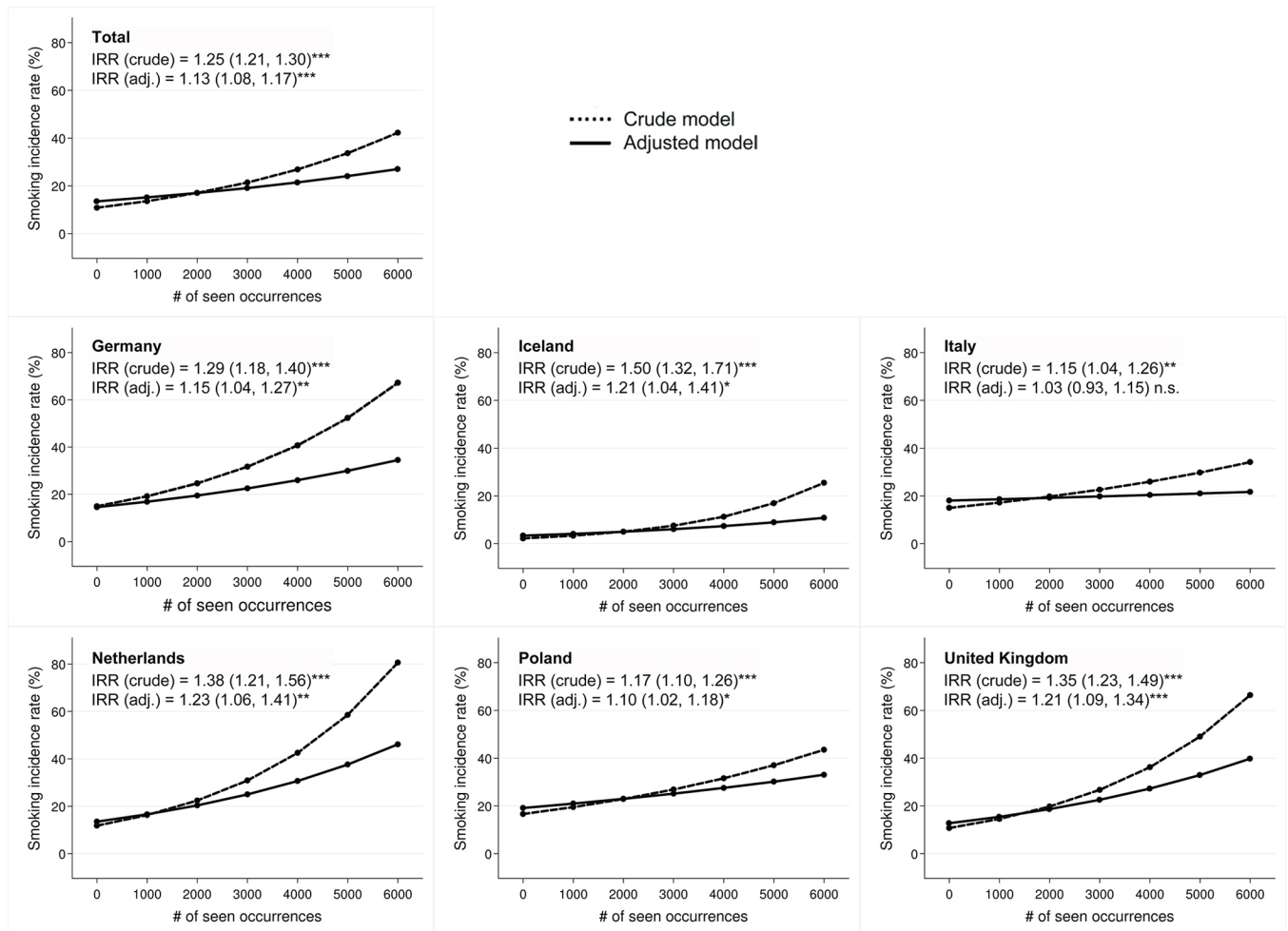
The study was supported by the European Commission and the Ministry of Health of the Federal Republic of Germany. The coding of the U.S. movies was supported by the NIH (AA015591/AA/NIAAA NIH HHS/U.S.). The Scottish fieldwork was supported by additional funds from the UK Medical Research Council (MC_US_A540_0041).

The authors greatly acknowledge the work of Stefan Hrafn Jonsson, Solveig Karlsdottir, and Evelien Poelen of the Smoking in Movies Europe study group. The authors thank Abita Bhaskar, Daria Buscemi, Lars Grabbe, Roberto Gullino, Leonie Hendriksen, Maksymilian Kulza, Martin Law, Dan Nassau, Balvinder Rakhra, Monika Senczuk-Przybylowska, and Tiziano Soldani for coding the movies. The authors are also very thankful to all pupils and staff in participating schools and the survey field forces in each country.

References

1. DHHS. Preventing tobacco use among youth and young adults: A report of the Surgeon General. Atlanta, GA: DHHS, CDC, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2012.
2. Hanewinkel R, Sargent JD. Exposure to smoking in internationally distributed American movies and youth smoking in Germany: a cross-cultural cohort study. *Pediatrics*. 2008; 121(1):e108–e117. [PubMed: 18166530]
3. Thrasher JF, Sargent JD, Huang L, Arillo-Santillan E, Dorantes-Alonso A, Perez-Hernandez R. Does film smoking promote youth smoking in middle-income countries?: A longitudinal study among Mexican adolescents. *Cancer Epidemiol Biomarkers Prev*. 2009; 18(12):3444–3450. [PubMed: 19959694]
4. Hanewinkel R, Sargent JD. Exposure to smoking in popular contemporary movies and youth smoking in Germany. *Am J Prev Med*. 2007; 32(6):466–473. [PubMed: 17533061]
5. Hunt K, Sweeting H, Sargent J, Lewars H, Cin SD, Worth K. An examination of the association between seeing smoking in films and tobacco use in young adults in the west of Scotland: cross-sectional study. *Health Educ Res*. 2009; 24(1):22–31. [PubMed: 18203682]
6. Hunt K, Henderson M, Wight D, Sargent JD. Exposure to smoking in films and own smoking among Scottish adolescents: a cross-sectional study. *Thorax*. 2011; 66:866–874. [PubMed: 21764893]
7. Morgenstern M, Poelen EAP, Scholte RH, et al. Smoking in movies and adolescent smoking: Cross-cultural study in six European countries. *Thorax*. 2011; 66(10):875–883. [PubMed: 21873322]
8. Waylen AE, Leary SD, Ness AR, Tanski SE, Sargent JD. Cross-sectional association between smoking depictions in films and adolescent tobacco use nested in a British cohort study. *Thorax*. 2011; 66(10):856–861. [PubMed: 21933947]
9. Arora M, Mathur N, Gupta VK, Nazar GP, Reddy KS, Sargent JD. Tobacco use in Bollywood movies, tobacco promotional activities and their association with tobacco use among Indian adolescents. *Tob Control*. 2012; 21(5):482–487. [PubMed: 21730099]
10. Thrasher JF, Jackson C, Arillo-Santillan E, Sargent JD. Exposure to smoking imagery in popular films and adolescent smoking in Mexico. *Am J Prev Med*. 2008; 35(2):95–102. [PubMed: 18617078]

11. Laugesen M, Scragg R, Wellman RJ, DiFranza JR. R-rated film viewing and adolescent smoking. *Prev Med.* 2007; 45(6):454–459. [PubMed: 17707897]
12. WHO. Smoke-free movies: from evidence to action. 2nd ed. Geneva: Switzerland: WHO; 2011.
13. WHO. Guidelines for implementation of Article 13 of the WHO Framework Convention on Tobacco Control (Tobacco advertising, promotion and sponsorship). 2011. www.who.int/fctc/guidelines/article_13.pdf.
14. Lyons A, Britton J. Protecting young people from smoking imagery in films: whose responsibility? *Thorax.* 2011; 66(10):844–846. [PubMed: 21933946]
15. Lyons A, McNeill A, Chen Y, Britton J. Tobacco and tobacco branding in films most popular in the UK from 1989 to 2008. *Thorax.* 2010; 65(5):417–422. [PubMed: 20435863]
16. Hanewinkel R, Sargent J, Karlsdottir S, et al. High youth access to movies that contain smoking in Europe compared with the U.S. *Tob Control.* 2011
17. Galanti MR, Siliquini R, Cuomo L, Melero JC, Panella M, Faggiano F. Testing anonymous link procedures for follow-up of adolescents in a school-based trial: The EU-DAP pilot study. *Prev Med.* 2007; 44(2):174–177. [PubMed: 16979751]
18. Sargent JD, Beach ML, Dalton MA, et al. Effect of seeing tobacco use in films on trying smoking among adolescents: cross sectional study. *BMJ.* 2001; 323(7326):1394–1397. [PubMed: 11744562]
19. Sargent JD, Beach ML, Adachi-Mejia AM, et al. Exposure to movie smoking: its relation to smoking initiation among U.S. adolescents. *Pediatrics.* 2005; 116(5):1183–1191. [PubMed: 16264007]
20. Dalton MA, Sargent JD, Beach ML, et al. Effect of viewing smoking in movies on adolescent smoking initiation: a cohort study. *Lancet.* 2003; 362(9380):281–285. [PubMed: 12892958]
21. Chapman S, Farrelly MC. Four arguments against the adult-rating of movies with smoking scenes. *PLoS Med.* 2011; 8(8):e1001078. [PubMed: 21886487]

**Figure 1.**

Crude and adjusted association between exposure to movie smoking occurrences and adolescents' smoking initiation

Note: Crude and adjusted IRRs for being exposed to additional 1000 occurrences; covariate adjustment for age; gender; family affluence; school performance; TV screen time; sensation-seeking and rebelliousness; and smoking in the social environment (friends, siblings, and parents)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

adj., adjusted; IRR, incidence rate ratio

Table 1

Descriptive sample statistics at baseline and attrition analysis

	Baseline never-smokers (n=11691) %	Lost to follow-up (n=1704) %	Analyzed Sample (n=9987) %	<i>p</i> -value
Country				
Germany	17.2	15.7	17.4	
Iceland	20.6	23.9	20.1	
Italy	13.8	8.8	14.7	<0.001
The Netherlands	8.3	6.7	8.6	
Poland	20.3	28.3	18.9	
United Kingdom	19.8	16.6	20.3	
SOCIODEMOGRAPHICS				
Age at baseline, M(SD)	13.19 (1.11)	13.44	13.15 (1.10)	<0.001
Gender				
Female	50.7	47.2	51.3	0.002
Male	49.3	52.8	48.7	
Family Affluence				
Low	8.3	10.7	7.9	
Medium	35.5	34.7	35.7	0.001
High	56.2	54.6	56.4	
PERSONAL CHARACTERISTICS				
School performance				
Below average	4.3	7.2	3.8	
Average	29.2	31.8	28.8	<0.001
Good	46.0	42.0	46.6	
Excellent	20.5	19.1	20.8	
TV screen time per day, hours, M (SD)	1.77 (1.18)	1.79 (1.24)	1.76 (1.17)	0.420
Sensation-seeking and rebelliousness, M(SD), range: 0–4	1.12 (0.66)	1.21 (0.72)	1.10 (0.65)	<0.001
SOCIAL ENVIRONMENT				
Peer smoking				
None	54.5	47.9	55.7	
A few	27.1	29.2	26.8	<0.001
Some	13.2	15.1	12.9	
Most/all	5.1	7.9	4.6	
Mother figure smoking				
No	77.6	73.3	78.3	<0.001
Yes	22.4	26.7	21.7	
Father figure smoking				
No	71.4	67.7	72.1	<0.001
Yes	28.6	32.3	27.9	
Any sibling smoking				

	Baseline never-smokers (n=11691)	Lost to follow-up (n=1704)	Analyzed Sample (n=9987)	p-value
	%	%	%	
No	87.8	83.4	88.6	<0.001
Yes	12.2	16.6	11.5	