

# Smoking in movies and adolescent smoking: cross-cultural study in six European countries

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## ABSTRACT

**Aim** To investigate whether the association between exposure to smoking in movies and smoking among youth is independent of cultural context.

**Method** Cross-sectional survey of 16 551 pupils recruited in Germany, Iceland, Italy, the Netherlands, Poland and Scotland with a mean age of 13.4 years (SD=1.18) and an equal gender distribution. School-based surveys were conducted between November 2009 and June 2010. Using previously validated methods, exposure to movie smoking was estimated from the 250 top-grossing movies of each country (years 2004–2009) and related to ever smoking.

**Results** Overall, 29% of the sample had tried smoking. The sample quartile (Q) of movie smoking exposure was significantly associated with the prevalence of ever smoking: 14% of adolescents in Q1 had tried smoking, 21% in Q2, 29% in Q3 and 36% in Q4. After controlling for age, gender, family affluence, school performance, television screen time, number of movies seen, sensation seeking and rebelliousness and smoking within the social environment (peers, parents and siblings), the adjusted ORs for having tried smoking in the entire sample were 1.3 (95% CI 1.1 to 1.5) for adolescents in Q2, 1.6 (95% CI 1.4 to 1.9) for Q3 and 1.7 (95% CI 1.4 to 2.0) for Q4 compared with Q1. The adjusted relationship between ever smoking and higher movie smoking exposure levels was significant in all countries with a non-linear association in Italy and Poland.

**Conclusions** The link between smoking in movies and adolescent smoking is robust and transcends different cultural contexts. Limiting young people's exposure to movie smoking could have important public health implications.

## INTRODUCTION

Overwhelming evidence indicates that smoking is a major cause for a number of life-threatening diseases, including various cancers and cardiovascular and lung diseases.<sup>1–2</sup> Adolescence is the developmental period in which smoking experimentation usually first occurs.<sup>3</sup> Smoking uptake is a behavioural process that is to a large extent triggered by social risk factors.<sup>4</sup> These social risk factors not only include peer and parental smoking but also a number of other factors such as tobacco marketing and media exposure. One prominent theory that is used to understand the smoking initiation process is social learning theory.<sup>5</sup> This theory basically suggests that people learn by watching others. Generally, any person can function as a role model, but most likely, role models are

## Key messages

### What is the key question?

► There is a well-documented association between exposure to movie smoking and trying smoking among the youth in the USA and Germany. Does this apply to youths in other European countries?

### What is the bottom line?

► Movie smoking exposure is associated with youth smoking, regardless of country. Much exposure comes from youth-rated movies. Given the harms of smoking, there seems to be little reason not to limit smoking in movies marketed to youth through movie ratings systems.

### Why read on?

► Including more than 16 000 adolescents from Germany, Iceland, Italy, Poland, Scotland and the Netherlands, this is the largest study ever conducted on this topic, and it provides some of the first evidence on the specificity of the movie smoking–youth smoking association and detailing differences in the dose-response by country.

significant social agents such as family members, peers or movie stars.<sup>6</sup>

From this perspective, it is perhaps not surprising that a number of cross-sectional,<sup>7–14</sup> longitudinal<sup>15–24</sup> and experimental studies<sup>25–28</sup> have found an association between exposure to movie smoking and smoking among adolescents. The evidence base seems so strong that a US National Cancer Institute report,<sup>29</sup> and one from WHO,<sup>30</sup> concluded that the association is “causal.”

Other research has examined what share of movie smoking exposure comes from youth-rated movies; the reports have found it to be larger than half among US adolescents<sup>31–32</sup> and even higher among adolescents in the UK.<sup>33</sup> These facts have prompted public health advocates to call for an adult rating for smoking in movies, which is also one recommendation in the implementation guidelines of WHO's Framework Convention on Tobacco Control (FCTC). However, up to now, no country has adopted this recommendation.

The indecision of a country to change their movie ratings system may be because of lack of evidence linking movie smoking to youth smoking in that particular country. The present study

addresses this for six European countries by reporting the results of a large-scale cross-sectional survey of young adolescents living there. These countries differ substantially in their rankings on the 2010 Tobacco Control Scale, which can be seen as an indicator for denormalising smoking in society in 30 European countries.<sup>34</sup> The countries selected for the current study rank 1st (UK), 4th (Iceland), 12th (Italy), 13th (the Netherlands), 19th (Poland) and 26th (Germany) on this scale. Based on data collected in 2007, the 30 day smoking prevalence among 15–16-year-olds ranged from 16% in the country with the lowest prevalence (Iceland) to 37% in the country with the highest prevalence (Italy).<sup>35</sup>

This paper aims to investigate whether the association between exposure to movie smoking and youth smoking occurs independently of cultural contexts, for example, prevalence of smoking, tobacco control policy, attitudes towards smoking in the population, culture-specific parental and peer influences.

## METHODS

### Study sample and procedure

The study was conducted from six study centres, in Germany (Kiel), Iceland (Reykjavik), Italy (Turin and Novara), Poland (Poznan), the Netherlands (Nijmegen) and UK (Glasgow). The six study samples were all recruited from state-funded schools (see appendix 1 for sample details). Overall, a total of 19 268 students from 114 schools and 865 classes were examined for eligibility. One thousand fifty-nine students (5.5%) could not be included in the study because of missing parental consent; 1561 students (8.1%) were absent on the day of assessment and could not be reached by mail; 99 students (0.5%) refused to participate, resulting in a final overall sample of 16 551 students (85.9% response rate). Within this final sample, the number of reached students per school ranged from 14 to 603, the number of reached students per class ranged from 1 to 45 students.

### Survey

In each country, data were collected through self-completion questionnaires, administered by trained research staff. Each completed questionnaire was placed in an envelope and sealed in front of the class. Students were assured that their individual data would not be seen by parents or school administrators. Study implementation was approved in all six study centres by the respective ethical boards and data protection agencies.

## Measures

### Exposure to movie smoking

Exposure to smoking in movies was assessed using a variable data survey method developed by researchers of Dartmouth Medical School, which relies on the recall of seeing movies presented to respondents as a list of titles.<sup>36</sup> For this procedure, each participating study centre provided a list of 250 box-office hits of their countries based on publicly available data on movie revenues. Each of the six lists of 250 movies contained the 50 most successful movies of the years 2005–2008 and the 25 most successful movies of the years 2004 and 2009. Students in each country received a random selection of 50 movies (20%) of their country-specific list of 250, creating an individual movie list for each student. To minimise subject-to-subject disparities in movie composition, selection of movies was stratified by year of release and by country-specific age rating so that each randomly generated list of 50 titles had the same distribution with regard to year and country-specific age ratings. Students were asked to indicate how often they had seen each movie (from 0='never' to 3='more than two times'). For the present analysis, answers were dichotomised into 'seen' and 'not seen'.

In a parallel procedure, all included movies were content coded with regard to tobacco occurrences. Owing to a high overlap of box-office hits between countries, the complete sample of 1500 movies (6 countries×250 movies) contained 655 unique movies. Fifty-six per cent of these movies (n=368) were included within the top 100 box-office hits in the USA and had already been content coded at the Dartmouth Media Research Laboratory. The remaining 44% (n=287) were content coded in the six European study centres. In this coding process, trained coders review each movie and count the number of occurrences of on-screen tobacco. A tobacco occurrence is counted whenever a major or minor character handles or uses tobacco in a scene or when tobacco use is depicted in the background (eg 'extras' smoking in a bar scene). Occurrences are counted each time the tobacco use appears on the screen. Inter-rater reliability was studied via two types of correlations: (1) between the coding results of the European coders and the European trainer on a selected number of training movies and (2) between the European trainer and the Dartmouth coders, based on a blinded European re-coding of a random sample of 40 Dartmouth-coded movies. European coder–trainer correlations ranged between  $r=0.92$  (Iceland) and  $r=0.99$  (Italy); the European re-counts of tobacco occurrences in the random movie selection correlated  $r=0.95$  with the Dartmouth counts.

Exposure to movie smoking was calculated for each student by summing the number of tobacco occurrences in each movie they had seen. The measure was adjusted for possible variation in the movie lists by expressing individual exposure to movie smoking as a proportion of the total number of possible tobacco occurrences each student could have seen on the basis of the movies included in his/her questionnaire. The final exposure estimate was the proportion of seen tobacco occurrences multiplied by the total number of tobacco occurrences in the respective movie population (the number of tobacco occurrences in the 250 movies of each country).

### Lifetime smoking

Students were asked "How many cigarettes have you smoked in your life?" Response categories were 0="none", 1="just a few puffs", 2="1–19 cigarettes", 3="20–100 cigarettes" and 4="more than 100 cigarettes". Students who reported "none" were classified as "never smokers" and all others as "ever smokers".<sup>37</sup>

### Covariates

We included a number of covariates that could confound the relation between exposure to smoking in movies and trying smoking, including socio-demographics, behavioural and personality characteristics and smoking of peers, parents and siblings (see appendix 2). The list of covariates mirrored that of previous studies on movie smoking,<sup>7 10 14</sup> with the exception of an additional control for the number of movies seen. The control of general movie exposure strengthens the idea that the reported associations are specific to the smoking imagery because the amount of movie smoking exposure might only be a marker variable, indicating students that have high movie exposure in general.

### Statistical analysis

All data analyses were conducted with Stata V.11.0 (Stata Corp, College Station, TX, USA). Bivariate associations between all study variables were analysed with Spearman rank correlation coefficients, multiple mean comparisons with Tukey test. Locally weighted scatterplot smoothings were used to graphically represent the relationship between movie smoking

exposure and adolescent smoking for each country. For the multivariate analysis, the exposure to movie smoking was parsed into country-specific quartiles, and the dependent variable was dichotomised into ever and never smokers. The use of quartiles enabled us to directly compare the results with previous studies on movie smoking that have also used this analytic strategy. Because the data were clustered at the country, school and classroom level, associations between amount of movie smoking and lifetime smoking were analysed with multilevel mixed-effects logistic regressions with random intercepts for country, school and class in the overall analysis and random intercepts for school and class in the country-specific models (uncentred data in all analyses). In a first step,

unadjusted models were specified, with movie smoking exposure as the only fixed effect. In the adjusted models, all covariates were included as fixed effects. In each model, the first (lowest) quartile of exposure to movie smoking served as the reference category.

## RESULTS

### Descriptive statistics

Descriptive statistics for lifetime smoking and all covariates are presented in table 1. The final sample consisted of 16 551 students, of whom 51% were male. The mean age was 13.4 (SD=1.18) years, with an age range of 10 to 19 years. Overall, 29% of subjects had ever tried smoking, but this varied

**Table 1** Descriptive statistics for lifetime smoking and covariates

	n (%)*						
	Overall	Germany	Iceland	Italy	Poland	The Netherlands	UK
Students	16 551 (100)	2754 (100)	2664 (100)	2668 (100)	4105 (100)	1423 (100)	2937 (100)
Lifetime smoking							
Never	11 691 (71)	2004 (73)	2412 (91)	1615 (61)	2377 (58)	970 (69)	2313 (79)
A few puffs	2104 (13)	386 (14)	144 (5)	411 (15)	700 (17)	153 (11)	310 (11)
1–19 cigarettes	1059 (6)	175 (7)	46 (2)	198 (7)	393 (10)	115 (8)	132 (4)
20–100 cigarettes	661 (4)	88 (3)	29 (1)	146 (6)	268 (7)	64 (5)	66 (2)
>100 cigarettes	947 (6)	81 (3)	19 (1)	288 (11)	349 (8)	102 (7)	108 (4)
Socio-demographics							
Gender							
Female	8088 (49)	1338 (49)	1272 (48)	1179 (44)	2153 (53)	708 (51)	1438 (49)
Male	8390 (51)	1410 (51)	1378 (52)	1485 (56)	1944 (47)	677 (49)	1496 (51)
Age, mean (SD)	13.4 (1.18)	12.7 (1.06)	13.1 (0.89)	13.6 (1.37)	14.2 (0.79)	13.8 (1.36)	13.0 (0.89)
Family affluence							
Low	1637 (10)	231 (8)	40 (2)	364 (14)	687 (17)	29 (2)	286 (10)
Medium	6029 (36)	1010 (37)	556 (21)	1210 (45)	1728 (42)	385 (27)	1140 (39)
High	8885 (54)	1513 (55)	2068 (77)	1094 (41)	1690 (41)	1009 (71)	1511 (51)
Personal characteristics							
School performance							
Below average	1253 (8)	171 (6)	113 (4)	390 (15)	368 (9)	122 (9)	89 (3)
Average	5493 (33)	1212 (44)	652 (25)	1042 (39)	1576 (39)	407 (29)	604 (21)
Good	6934 (42)	1107 (40)	1146 (43)	1040 (39)	1452 (35)	695 (49)	1494 (51)
Excellent	2790 (17)	256 (10)	735 (28)	187 (7)	693 (17)	178 (13)	741 (25)
TV screen time							
≤half an hour	3763 (23)	679 (25)	777 (29)	523 (20)	791 (19)	331 (24)	662 (22)
1–2 h	8424 (51)	1434 (52)	1449 (55)	1271 (48)	2011 (49)	803 (57)	1456 (50)
3–4 h	3190 (19)	454 (17)	332 (13)	617 (23)	969 (24)	232 (17)	586 (20)
>4 h	1099 (7)	173 (6)	83 (3)	252 (9)	328 (8)	35 (2)	228 (8)
No. of movies seen, mean (SD), range 0–50	21.21 (9.04)	16.46 (8.34)	24.84 (8.51)	20.54 (8.42)	22.81 (9.47)	16.74 (7.93)	22.88 (7.75)
Sensation seeking and rebelliousness, mean (SD), range 0–4	1.31 (0.74)	1.21 (0.72)	1.0 (0.69)	1.43 (0.75)	1.53 (0.74)	1.01 (0.59)	1.40 (0.73)
Social environment							
Peer smoking							
None	6790 (41)	1545 (57)	2084 (79)	534 (20)	446 (11)	582 (41)	1599 (54)
A few	4467 (27)	723 (26)	395 (14)	637 (24)	1496 (36)	366 (26)	850 (29)
Some	2970 (18)	311 (11)	123 (5)	759 (29)	1182 (29)	313 (22)	282 (10)
Most/all	2247 (14)	159 (6)	41 (2)	727 (27)	971 (24)	148 (11)	201 (7)
Mother figure smoking							
No	11970 (73)	1812 (67)	2191 (83)	2007 (75)	2715 (66)	1165 (83)	2080 (71)
Yes	4499 (27)	908 (33)	456 (17)	655 (25)	1384 (34)	247 (17)	849 (29)
Father figure smoking							
No	10949 (66)	1692 (62)	2077 (79)	1669 (63)	2352 (57)	1125 (80)	2034 (69)
Yes	5541 (34)	1052 (38)	567 (21)	991 (37)	1748 (43)	289 (20)	894 (31)
Any sibling smoking							
No	13583 (82)	2276 (83)	2220 (84)	2199 (83)	3220 (79)	1246 (88)	2422 (83)
Yes	2885 (18)	456 (17)	418 (16)	463 (17)	875 (21)	165 (12)	508 (17)

\*Variations in n are owing to missing values.

substantially between countries. For example, 9% of the Icelandic students were ever-smokers, compared with 42% in the Polish sample. Differences in ever-smoking rates remained after controlling for age and gender, with age- and gender-adjusted prevalences of 0.11, 0.26, 0.26, 0.33, 0.35 and 0.36 for Iceland, the Netherlands, UK, Poland, Germany and Italy, respectively.

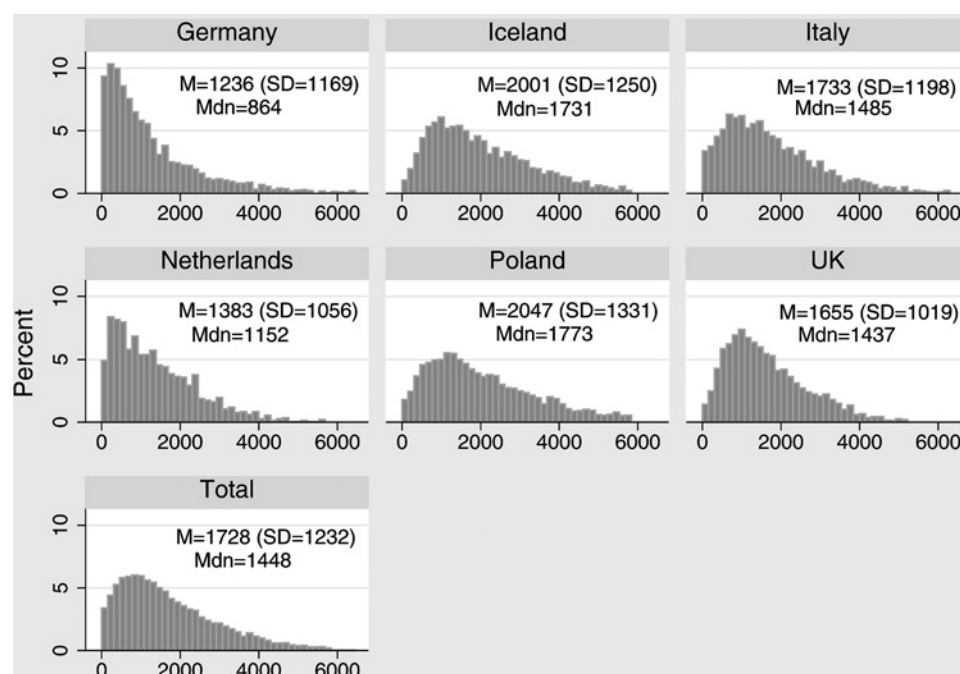
### Exposure to smoking in movies

Overall, 71% of the total 655 movies included at least 1 tobacco occurrence, with a range of 0 to 423 and a mean of 28.5 occurrences. On average, adolescents had seen 21 (SD=9) of the 50 movies on their individual list (table 1), which translated into an estimated mean exposure to on-screen tobacco of 1727 (median=1448) occurrences, based on an extrapolation to the respective 250 movies.

Figure 1 shows the distributions for the estimated exposure to smoking in movies. All histograms are positively skewed, with some differences between the countries with regard to the mean amount of exposure (all pairwise comparisons'  $p < 0.05$ , with the exception of Iceland vs Poland and Italy vs UK). The lowest exposures occurred among German and Dutch adolescents and the highest among those from Iceland and Poland.

We tried to approach the influence of country-specific age ratings on exposure by separating all included movies into "youth-rated" movies (rated for audiences  $< 16$  years) and "adult-rated" movies (rated for audiences  $\geq 16$  years). There were profound differences in the proportion of adult ratings in the country lists of 250 movies with 18% adult ratings in Iceland, 14% in the Netherlands, 11% in Germany, 7% in the UK, 1% in Poland and 0% in Italy, mostly reflecting different rating practices in the countries. In overall tobacco occurrences by age rating, 55% of the tobacco occurrences in the Icelandic box-office hits were in youth-rated movies, 67% in the Netherlands, 80% in the UK, 81% in Germany and 99.9% in Poland, and by definition, all tobacco occurrences in Italy were counted in youth-rated movies. Looking at the actual mean exposure from youth-rated movies, the lowest mean was found for Iceland with 74%, followed by the Netherlands with 80%, Germany with 92%, UK with 93% and Poland and Italy with 100%.

**Figure 1** Exposure to smoking in movies among adolescents from six European countries (total  $n=16\,551$ ). Estimation based on tobacco occurrences in each country's 250 most successful movies of the years 2004–2009. Number of seen tobacco occurrences displayed in the X-axes. M, mean, Mdn, median.



### Associations between study variables

Table 2 displays the zero-order correlations between the study variables, demonstrating significant crude associations between the central constructs. Ever smoking was positively correlated with exposure to movie smoking ( $r=0.20$ ) and also significantly correlated with all other study variables, particularly age ( $r=0.33$ ), school performance ( $r=-0.27$ ), sensation seeking/rebelliousness ( $r=0.41$ ), peer smoking ( $r=0.54$ ) and sibling smoking ( $r=0.23$ ).

### Association between exposure to smoking in movies and adolescent smoking

The smoothed lowess curves in figure 2 illustrate the association between exposure to movie smoking and adolescent ever smoking for each country. These show a consistent monotonic increasing relationship between exposure to movie smoking and ever smoking. The shapes of the curves look very similar, showing a generally steeper relationship for lower exposure levels, with the exception of the Icelandic curve that shows a lower slope for lower exposure values and gets a similar slope only for higher exposure values. Different intercepts mirror differences in lifetime smoking prevalence of the countries. For example, in Germany, prevalence of ever smoking rises from 0.1 for low-exposure adolescents to up to 0.5 for high-exposure adolescents, whereas in Iceland, the prevalence rises from 0.02 for low-exposure adolescents to up to approximately 0.18 for high-exposure adolescents.

### Multivariate analysis

Table 3 shows crude and adjusted ORs (AORs) for the relationship between movie smoking exposure and ever smoking. In the crude models, and for all countries, exposure to smoking in the movies was significantly associated with youth ever smoking, as already indicated by the lowess curves. In frequencies, this association translates to 14% ever smoking in quartile 1 (Q1) compared with 21% in Q2, 29% in Q3 and 36% in Q4. Furthermore, in the overall (all countries) adjusted model, adolescents with higher exposure to smoking in movies were significantly more likely to have ever smoked, after controlling



**Table 2** Zero-order correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12
1. Movie smoking exposure	—											
2. Lifetime smoking	0.20	—										
3. Age	0.23	0.33	—									
4. Gender (0=male, 1=female)	−0.20	−0.05	−0.03	—								
5. Family affluence	0.05	−0.09	−0.07	−0.04	—							
6. School performance	−0.09	−0.27	−0.16	0.12	0.16	—						
7. TV screen time	0.11	0.09	0.06		−0.09	−0.08	—					
8. No. of movies seen	0.82	0.14	0.14	−0.15	0.09	−0.04	0.12	—				
9. Sensation seeking/rebelliousness	0.32	0.41	0.18	−0.22	−0.03	−0.23	0.13	0.28	—			
10. Peer smoking	0.23	0.54	0.46		−0.15	−0.25	0.14	0.15	0.41	—		
11. Mother smoking	0.05	0.18	0.05		−0.15	−0.15	0.07	0.05	0.14	0.17	—	
12. Father smoking	0.06	0.17	0.06		−0.17	−0.15	0.09	0.05	0.12	0.18	0.34	—
13. Sibling smoking	0.09	0.23	0.10		−0.10	−0.14	0.07	0.07	0.14	0.19	0.19	0.15

All displayed coefficients are significant at  $p < 0.001$ .

for age, gender, family affluence, school performance, television screen time, number of movies seen, sensation seeking and rebelliousness and smoking within the social environment (peers, parents and siblings). In the adjusted model, predicted frequencies were 25% ever smoking in Q1 to 28% in Q2, 31% in Q3 and 32% in Q4.

The adjusted relationship with ever smoking was found for higher exposure levels in all countries with some between-country differences in the strength of the relationship; for example, the AOR for Polish youths with high exposure (Q3) compared with that for students in the lowest exposure category (Q1) was 1.4 (95% CI 1.1 to 1.8), whereas the AOR for Scottish students in the highest exposure category (Q4) was 2.8 (1.7 to 4.6) compared with that for students in the lowest exposure category (Q1).

## DISCUSSION

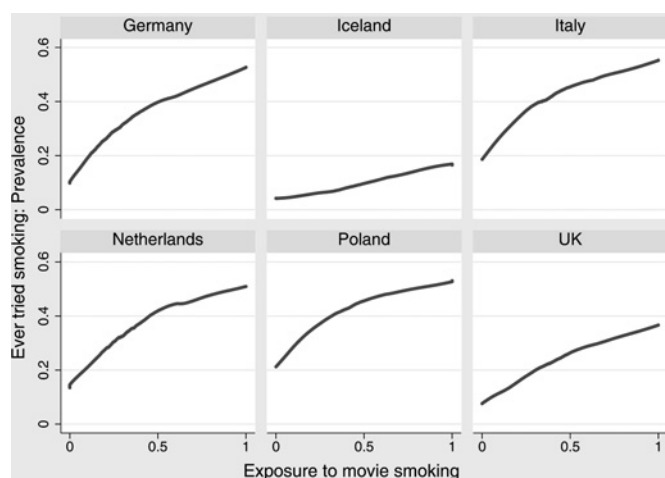
This paper presented the results of a cross-cultural study examining the association between exposure to smoking in movies and youth smoking. The association with ever smoking is remarkably similar to the findings among US,<sup>10</sup> German,<sup>7</sup> New Zealand<sup>9</sup> and Mexican<sup>13</sup> adolescents, with a similar dose-response curve and with adjusted odds of ever smoking being 1.1–2.8 times greater for adolescents with higher exposure. Moreover, the adjusted relationship between movie

smoking exposure and ever smoking was found in each country-specific model. This is remarkable because the countries differ greatly in their tobacco control policies<sup>34</sup> and therefore also in the process of denormalising smoking in the society.<sup>38</sup> The findings suggest a consistent movie–youth smoking association regardless of culture or tobacco control approach.

Policies aimed at movie smoking have been addressed by the FCTC. Parties to this agreement have ratified to undertake a comprehensive ban on tobacco advertising, promotion and sponsorship according to Article 13. The implications of Article 13 are that the depiction of tobacco use in films represents a form of tobacco advertising, and Article 13 guidelines recommend that “Parties should take particular measures concerning the depiction of tobacco in entertainment media products, including requiring certification that no benefits have been received for any tobacco depictions, prohibiting the use of identifiable tobacco brands or imagery, requiring anti-tobacco advertisements and implementing a ratings or classification system that takes tobacco depictions into account.”<sup>39</sup> Based on the results of this six-country study, it seems there is little reason for a delay in changes to incorporate smoking into the movie ratings systems in European countries. The study revealed a high variation in the rating practices between the countries and confirmed that the clear majority of exposure to movie smoking in European adolescents comes from youth-rated movies, with a range of 55% (Iceland) to 100% (Italy and Poland).

There are, of course, several limitations to the current study, the most important one being the cross-sectional design. Cross-sectional data do not inform about the temporal sequence of events, that is, if exposure to smoking in movies preceded smoking experimentation or uptake. Temporal antecedence is seen as an important determinant of a causal relationship, but it is not the only one, and there are already a number of longitudinal studies in this area that clearly demonstrate that movie smoking exposure happens before behaviour onset and predicts it.

The present study contributes to the causality question from another direction—unmeasured confounding. First, one advantage of cross-cultural studies is that unmeasured confounding is accounted for by the country-level random effect. In the present context, movie smoking exposure is the constant on a background of many other between-country differences. The consistent finding of a movie smoking effect after the control of country variance is a very important contributor to the causal argument. The second way this study contributes to causality is that the multivariate analyses included the number of movies



**Figure 2** Crude association between exposure to movie smoking and ever-smoking, by country.

ORs (95% CIs)																
Movie smoking exposure	Ever tried smoking: no/yes															
	Overall			Germany			Iceland		Italy		Poland		The Netherlands		UK	
	n=16 099 students	n=2663 students	n=2548 students	n=2620 students	n=4036 students	n=1338 students	n=2894 students									
	n=865 classes	n=149 classes	n=138 classes,	n=134 classes	n=226 classes	n=65 classes	n=153 classes									
	n=114 schools	n=21 schools	n=20 schools	n=26 schools	n=35 schools	n=5 schools	n=7 schools									
	n=6 countries															
Quartile 1	Crude Ref.	Adjusted† Ref.	Adjusted† Ref.	Crude Ref.	Adjusted† Ref.	Crude Ref.	Adjusted Crude Ref.	Adjusted† Ref.	Crude Ref.	Adjusted† Ref.	Crude Ref.	Adjusted Crude Ref.	Adjusted† Ref.	Crude Ref.	Adjusted Crude Ref.	Adjusted Crude Ref.
Quartile 2	1.6*** (1.4 to 1.8)	1.3** (1.1 to 1.5)	1.6** (1.1 to 2.2)	1.6 (1.0 to 2.6)	1.4 (0.8 to 2.5)	1.6*** (1.2 to 2.1)	1.2 (0.9 to 1.7)	1.4** (1.1 to 1.7)	1.7*** (1.4 to 2.0)	1.4* (1.1 to 1.8)	1.4 (0.9 to 1.7)	1.0 (0.6 to 1.7)	1.5* (1.1 to 2.0)	1.3 (0.9 to 2.0)	1.5* (1.1 to 2.0)	1.3 (0.9 to 2.0)
Quartile 3	2.4*** (2.1 to 2.7)	1.6*** (1.4 to 1.9)	3.4*** (2.5 to 4.6)	1.7* (1.1 to 2.8)	1.3 (0.7 to 2.6)	2.5*** (1.9 to 3.2)	1.5* (1.1 to 2.2)	1.4* (1.1 to 1.8)	2.1*** (1.8 to 2.6)	1.4* (1.1 to 1.8)	2.4*** (1.6 to 3.6)	1.8* (1.1 to 3.0)	2.5*** (1.8 to 3.3)	2.0** (1.3 to 3.0)	2.5*** (1.8 to 3.3)	2.0** (1.3 to 3.0)
Quartile 4	3.4*** (3.0 to 3.8)	1.7*** (1.4 to 2.0)	5.9*** (4.4 to 7.9)	3.8*** (2.5 to 6.0)	2.2* (1.1 to 4.8)	2.8*** (2.1 to 3.6)	1.3 (0.8 to 2.1)	1.1 (0.8 to 1.6)	2.6*** (2.1 to 3.2)	1.1 (0.8 to 1.6)	3.6*** (2.4 to 5.4)	2.1* (1.2 to 4.0)	3.6*** (2.7 to 4.8)	2.8*** (1.7 to 4.6)	3.6*** (2.7 to 4.8)	2.8*** (1.7 to 4.6)

a student had seen as a covariate. This control targets the specificity of the exposure–behaviour link, another key feature of causal arguments in epidemiological research.<sup>40</sup> High exposure to movie smoking might only be an indication of high movie exposure in general, which in turn might be the actual cause or another marker variable. That general movie exposure did not eliminate the movie smoking exposure–youth smoking association adds weight to the claim that it is really something about smoking in the movies that is associated with youth ever smoking, adding empirical evidence to the argument that it constitutes a social influence.

Other limitations relate to the assessment of movie smoking exposure that was based on student recall and hence open to error and biases. However, there is no obvious reason for memory distortions to be systematically related to the amount of movie smoking exposure. The same is possible for ever smoking that might also have been misreported but should nevertheless unlikely interact with the non-reactive exposure assessment used in the present study. A further source of imprecision is the content coding of the movies that was performed by different study centres. However, high inter-rater reliabilities ensured that the coding information could be validly used in our correlational analysis. There might also be sporadic variations in the actual content of movies due to country-specific cuts of scenes. A final issue is the potential bias due to the 14% unsurveyed students because of absence or missing parental consent. However, response rates varied between countries, from 78% in Germany to 95% in Iceland, without any systematic differences in pattern of results.

In summary, the consistency of the association between movie smoking and adolescent smoking in six European countries, despite their substantial differences in culture and tobacco policy, and after covariate control for the number of movies seen, adds further weight to the argument that smoking in movies is an independent risk factor for smoking uptake in youth. Germany, Iceland, Italy, the Netherlands, Poland and the UK have all ratified the WHO FCTC.<sup>41</sup> Reducing on-screen smoking is one key recommendation in the implementation guidelines of Article 13 of the Framework Convention. The current research findings support this recommendation and provide further scientific evidence in favour for measures to limit on-screen smoking.

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**Patient consent** Obtained

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**Contributors** All authors fulfil the authorship criteria as defined by the Uniform Requirements for Manuscripts Submitted to Biomedical Journals.

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# APPENDIX 1

## Study sample details

	Germany	Iceland	Italy	Poland	The Netherlands	UK
Setting	Public schools, 4 school types: Gymnasium, Gemeinschaftsschule, Regional schule, Hauptschule	Public schools	Public schools, 2nd class of secondary school and 1st class of high school	Public schools, 1 school type (Gymnasium)	Public schools, 4 different school types: VMBO, HAVO, Atheneum, Gymnasium	Mainstream (state-funded) schools
Locations	Schleswig-Holstein, Germany District of Kiel, Flensburg, Schleswig-Flensburg, and Rendsburg-Eckernförde	Schools from each region (north, south, east and west) of Iceland in addition to the capital area (Reykjavik and surrounding municipalities)	Piedmont region, Italy schools with head office in Turin and Novara provinces	Wielkopolska region	Gelderland, Limburg, Brabant	Central belt of Scotland
Time of data assessment	Nov–Dec 2009	Jan–Feb 2010	March–June 2010	April–June 2010	Dec 2009–June 2010	Jan–Mar 2010
Eligibility criteria for schools	Location Number of classes >8 No special pedagogic education centre No participation in other studies of IFT-Nord	Number of participating students >100	Location in Turin and Novara provinces	Location in Wielkopolska region No special pedagogic education centre	No special pedagogic education centre No current participation in other studies of the Behavioural Science Institute, Radboud University	Location in either Midlothian or East Dumbartonshire Not providing special education Not providing private (non-state-funded) education
No. of schools potentially eligible	n=104	Not known	n=578	n=253	Not known	n=14
No. of schools invited	n=60	n=23	n=31	n=253	n=43	n=7
Invitation criteria for schools	Random	Convenience sampling	Convenience sampling	All eligible schools	Random	Selected on the basis of deprivation, based on the most recent (2007–2008) nationally available data relating to the proportion of free school meals
No. of schools that agreed to participate	n=21	n=20	n=26	n=35	n=5	N=7
Eligibility criteria for students	Active ('opt-in') parental consent Presence on the day of assessment or, if absent, willing to complete a questionnaire and return by post Willingness to participate	Passive ('opt-out') parental consent Students' presence on the day of assessment Willingness to participate	Active or passive parental consent Willingness to participate or, if absent, willing to complete a questionnaire and return by post	Active ('opt-in') parental consent Presence on the day of assessment Willingness to participate	Passive parental consent Presence on the day of assessment Willingness to participate	Passive ('opt-out') parental consent Presence on the day of assessment or, if absent, willing to complete a questionnaire and return by post Willingness to participate
No. of students examined for eligibility	n=3544	n=2798	n=2953	n=5078	n=1706	n=3189
Confirmed eligibility	n=2754	n=2662	n=2668	n=4105	n=1423	n=2937
Reasons for non-participation	No parental consent (n=515) Absence (n=264) Refusal (n=11)	No parental consent (n=19) Absence (n=104) Refusal (n=13)	No parental consent (n=100) Absence (n=175) Refusal (n=10)	No parental consent (n=396) Absence (n=527) Refusal (n=50)	No parental consent (n=18) Absence (n=265) Refusal (n=0)	No parental consent (n=11) Absence (n=226) Refusal (n=15)
Participated in the study	n=2754	n=2662	n=2668	n=4105	n=1423	n=2937
Analysed	n=2754	n=2662	n=2668	n=4105	n=1423	n=2937
Response rate	78%	95%	90%	81%	83%	92%



## APPENDIX 2 Covariates and their assessment

Variable	Survey question	Response categories
Socio-demographics		
Age	How old are you?	Years
Sex	Are you a girl or a boy?	Boy/girl
Family Affluence Scale (Cronbach $\alpha=0.44$ )	Does your family own a car, van or truck? Do you have your own bedroom for yourself? During the past 12 months, how many times did you travel away on holiday with your family? How many computers does your family own?	No/yes, one/yes, two or more No/yes Not at all/once/twice/more than twice None/one/two/more than two
Personal characteristics		
School performance	How would you describe your grades last year?	Excellent/good/average/below average
TV screen time	On a school day, how many hours a day do you usually spend watching TV?	None/<1 h/1–2 h/3–4 h/more than 4 h
Number of movies seen	Below is a list of film titles. Please mark if, and how often, you have seen each film.	Never/once/twice/more than twice
Sensation seeking/rebelliousness (Cronbach $\alpha=0.70$ )	How often do you do dangerous things for fun? How often do you do exciting things, even if they are dangerous? I believe in following rules (recoded). I get angry when anybody tells me what to do.	Not at all/once in a while/sometimes/often/very often Not at all/once in a while/sometimes/often/very often Not at all/a bit/quite well/very well Not at all/a bit/quite well/very well
Social environment		
Peer smoking	How many of your friends smoke cigarettes?	None/a few/some/most/all
Mother smoking	Does your mother/female guardian smoke cigarettes?	Yes/no/don't know (coded 'no')/don't have (coded 'no')
Father smoking	Does your father/male guardian smoke cigarettes?	Yes/no/don't know (coded 'no')/don't have (coded 'no')
Sibling smoking	Do any of your brothers or sisters smoke cigarettes?	Yes/No/don't have (coded 'no')

## Journal club

### A potential role for tiotropium bromide as an added therapy for adults with uncontrolled asthma

In this study, the addition of tiotropium bromide to an inhaled glucocorticoid was evaluated as compared with doubling the dose of the inhaled glucocorticoid (primary superiority comparison) or the addition of salmeterol (secondary non-inferiority comparison) in 210 patients with asthma.

Tiotropium use showed a superior primary outcome, as compared with doubling of the inhaled glucocorticoid dose, as assessed by measuring the morning peak expiratory flow rate (PEF), with a mean difference of 25.8 l/min, and superiority in most secondary outcomes, including evening PEF, with a difference of 35.3 l/min, the proportion of asthma-control days, the FEV<sub>1</sub> before bronchodilation and daily symptom scores. The addition of tiotropium was also non-inferior to the addition of salmeterol for all assessed outcomes and increased the prebronchodilator FEV<sub>1</sub> more than salmeterol.

The study showed that tiotropium, when added to an inhaled glucocorticoid, improved symptoms and lung function in patients with inadequately controlled asthma. Its effects appeared to be equivalent to those with the addition of salmeterol. Additional studies that have sufficient statistical power to evaluate exacerbations and safety events are required to further establish the clinical efficacy of tiotropium in asthma.

► **Peters SP**, Kunselman SJ, Icitovic N, *et al*, for the National Heart, Lung, and Blood Institute, Asthma Clinical Research Network. Tiotropium bromide step-up therapy for adults with uncontrolled asthma. *N Engl J Med* 2010;**363**:1715–26.

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