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Comparing the effects of entertainment media and tobacco marketing on youth smoking in Germany

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Abstract

Aims—To examine differential effects of smoking in films and tobacco advertising on adolescent smoking. We hypothesize that movie smoking will have greater effects on smoking initiation, whereas tobacco advertising receptivity will primarily affect experimentation.

Design—Longitudinal observational study of adolescents.

Setting—School-based surveys conducted in Schleswig-Holstein, Germany.

Participants—A total of 4384 adolescents age 11–15 years at baseline and re-surveyed 1 year later; ever smoking prevalence was 38% at time 1.

Measurements—The main outcome variable combined two items assessing life-time and current smoking ($\alpha = 0.87$). Baseline never smokers were analyzed separately from those who had tried smoking (ever smokers). Exposure to smoking in 398 internationally distributed US movies was modeled as a continuous variable, with 0 corresponding to the 5th percentile and 1 to the 95th percentile of exposure. Tobacco marketing receptivity consisted of naming a brand for a favorite tobacco advertisement. Ordinal logistic regressions controlled for socio-demographics, other social influences, personality characteristics of the adolescent and parenting style.

Findings—Whereas 34% of ever smokers were receptive to tobacco marketing at time 1, only 6% of never smokers were. Among time 1 never smokers, exposure to movie smoking was a significantly stronger predictor of higher time 2 smoking level [adjusted proportional odds ratio = 2.76, 95% confidence interval (1.84, 4.15)] than was tobacco marketing receptivity (1.53 [1.07, 2.20]). Among time 1 ever smokers, both tobacco marketing receptivity and exposure to movie smoking predicted higher levels of time 2 smoking [2.17 (1.78, 2.63) and 1.62 (1.18, 2.23), respectively], and the two estimates were not significantly different.

Conclusions—In this longitudinal study, exposure to movie smoking was a stronger predictor of smoking initiation than tobacco marketing receptivity, which was more common among ever smokers. The results suggest that entertainment media smoking should be emphasized in programs aimed at preventing onset, and both exposures should be emphasized in programs aimed at experimental smokers.

Keywords

Adolescent; Germany; longitudinal; marketing; movies; observational study; smoking

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Declarations of interest

None.

INTRODUCTION

The US National Cancer Institute determined recently that there is a causal association between adolescent smoking and two media exposures—tobacco marketing and smoking in movies [1]. The research to date has studied these exposures separately [2], so an open question is: ‘What are the respective roles played by tobacco marketing and entertainment media smoking in encouraging adolescents to smoke?’. The answer to this question is not only important from a theoretical standpoint; it is key to guiding prevention and policy interventions aimed at adolescent smoking.

Another question is how to model smoking uptake among adolescents [3]. Some years ago, Leventhal & Cleary suggested that the developmental history of the smoker goes through several stages [4]. Since then, surprisingly few studies have predicted different stages of uptake separately, making the empirical basis for a stage-based approach to smoking problematic. Of the 28 longitudinal adolescent smoking studies summarized by Mayhew in 2000 [5], only nine treated stages separately and the rest lumped stages into an ordinal or continuous measure. Studies of tobacco marketing have not generally examined stages separately; instead, researchers in this area have modeled adolescent smoking using an uptake index that combines attitudes (susceptibility to smoking), smoking onset and progression of smoking after onset [6–8]. However, as Mayhew and others have argued, it is possible that some exposures are more important in predicting onset of smoking and others important in predicting progression among ever smokers. Applying this analytical approach to media exposures could shed light on the relative importance of different exposures at different stages of smoking.

Comparing media effects requires methods that, effectively, capture each exposure; fortunately, well-validated measures exist for tobacco marketing and movie smoking. Receptivity to tobacco marketing assesses the extent to which the adolescent has been exposed to a tobacco marketing message, has paid attention to that message and has had a cognitive or affective response to it [9]; this measure has a particularly robust track record in showing effects on adolescent smoking. Pierce and colleagues operationalized this measure, emphasizing the cognitive response by asking adolescents if they could remember the brand of the cigarette advertisement that was advertised most (low receptivity), if they could name the brand of their favorite cigarette advertisement or the one that attracted their attention most (moderate receptivity) or whether they owned (or were willing to wear) tobacco-branded merchandise (high receptivity) [10]. Their longitudinal study of Californian adolescents found a dose–response relation between higher levels of tobacco marketing receptivity and higher levels of smoking at follow-up [7]. Receptivity to tobacco marketing items, used singly and in combination, have been linked independently to adolescent smoking in other cross-sectional [10–18] and longitudinal studies [6,8,19–23]. One study found that the relation between exposure to fashion/entertainment magazines and adolescent smoking was mediated partially through higher receptivity to tobacco marketing [24].

Exposure to smoking in movies has also been associated with adolescent smoking. Such exposure may be assessed using the Beach method [25], in which a sample of popular contemporary movies is content-coded and adolescents queried about whether or not they have seen movie titles. Multiple studies have used this method to link movie smoking exposure with adolescent smoking using cross-sectional [25–28] and longitudinal designs [29–31]. In other studies, the effect of exposure to movie smoking on behavior was shown to be mediated through attitudes towards smoking [32] and smoking status of peers [33,34]. Other researchers have linked adolescent smoking with exposure to movies rated for persons aged 17 years and older, in the USA [35–37].

The aim of this report is to examine tobacco marketing and entertainment smoking as longitudinal predictors of adolescent smoking in two groups—young adolescent never and ever smokers.

METHODS

Sample recruitment and follow-up

Forty-two randomly selected secondary schools from Schleswig-Holstein, Germany were invited to participate in a school-based survey; the 27 schools that enrolled did not differ from the schools that declined enrollment in terms of the socio-economic status of the community served by the school. A self-completion written survey was administered in 2005 to adolescents (aged 10–15 years) and repeated 1 year later. Trained research staff administered both confidential surveys during class time, and parental written permission and student assent were obtained to conduct the surveys (85% of enrolled students were eligible and present on the day of the survey). The study was approved by an ethics board at the State Ministry of Cultural Affairs in Schleswig-Holstein. Some 5626 German adolescents were surveyed at time 1 (T1), of whom 4603 (82%) were re-surveyed 1 year later (T2), and of whom 4384 (78%) had complete data for the analysis.

Outcome variable

The main outcome variable combined two items assessing life-time and current smoking ($\alpha = 0.87$). Lifetime smoking was assessed through the question: ‘How many cigarettes have you smoked in your life?’ (none, a few puffs, one to 19 cigarettes, 20–100 cigarettes, more than 100 cigarettes). Current smoking was assessed through the question: ‘How often do you smoke at present?’ (I don’t smoke, less than once a month, at least once a month but not weekly, at least once a week but not daily, every day). The combined variable ranged from 0 to 4 and had the following distribution at T2: 0 (never smoker) 53.3%, 0.5 16.8%, 1.0 7.4%, 1.5 4.7%, 2.0 3.5%, 2.5 1.8%, 3.0 1.8%, 3.5 2.4%, 4.0 8.2%. We stratified the analysis based on smoking status at T1, based on the life-time smoking variable.

Predictor variables

The tobacco marketing variable drew upon the receptivity of tobacco marketing construct, using a 0–1 index [7]; adolescents were considered receptive to tobacco marketing if they provided a tobacco brand in response to the question: ‘What is the name of the brand of your favourite cigarette advertisement? (If you don’t have one, write “none”)’. This variable was set to 1 if they named a cigarette brand and 0 otherwise. Tobacco advertising venues in Germany include advertisements shown in the cinema (before a movie), point-of-sale displays, newspapers and magazines (during the study survey period), billboards and sponsorships of music/racing venues. We did not query the adolescents on whether they owned tobacco-branded merchandise because these items were not distributed in Germany at the time of the survey.

We obtained a population-based estimate of exposure to smoking in international movies that were distributed in Germany using the Beach method [38]. We selected randomly a unique list of 50 movie titles for each adolescent from a sample of 398 popular contemporary movies that were released between 1994 and 2004 in German cinemas. German box-office success was determined by the German Federal Film Board (<http://www.ffa.de>). We selected the top 25 German box-office hits each year from 1994 to 2001 (172 were internationally distributed movies) and the top 100 German box-office hits from 2002 to 2004 (226 were internationally distributed movies). The excluded movies (about 20% of box office hits) were German or European in origin. Trained coders counted the number of occurrences of smoking in each movie using methods described previously.

Exposure to these movies was assessed at baseline by asking each student to indicate which films he or she had seen. We calculated exposure to movie smoking for each respondent by summing the number of smoking occurrences for each movie that the respondent reported seeing [29]. We adjusted for variation in the amount of smoking contained in movie lists by expressing individual exposure to movie smoking as a proportion of the total number of possible smoking occurrences on the student movie list. To allow for comparison with the marketing variable (which was dichotomous), the movie variable was re-scaled so that 0 corresponded to the 5th percentile and 1 to the 95th percentile of exposure. To avoid undue influence of outliers, all values greater than 1 were set to 1, and those less than 0 were set to 0.

The covariates were chosen and modeled in a manner consistent with the previous reports; the questions and response categories, as well as Cronbach's alphas for scaled variables, are described in Appendix I. The analyses controlled for socio-demographic characteristics; smoking by peers, siblings and parents; sensation seeking/ rebelliousness [39,40]; parenting style [41,42]; and school performance. Regarding socio-economic status (SES) of parents, the ethics board (Ministry of Cultural Affairs of Schleswig-Holstein) would not allow us to assess this through surveys of the children. In Germany, family SES is uniform within schools, so school was used as a proxy for family SES. The continuous covariates, sensation seeking/rebelliousness and parenting style were re-scaled similarly to movie smoking, so that their range was 0–1.

Description of the sample

The adolescents were distributed equally by sex, with an age distribution as follows: 11 years 15.2%, 12 years 28.4%, 13 years 30.9%, 14 years 20.4%, 15 years 5.1%. Some 16.8% of adolescents reported the brand for a favorite tobacco advertisement, 46% had friends who smoke, 19% had siblings who smoke and 53% reported that one or both parents smoke. The median and inter-quartile ranges for the three continuous scaled variables were 0.26 (0.09, 0.77) for exposure to movie smoking, 0.67 (0.42, 0.83) for parenting style and 0.35 (0.18, 0.59) for sensation seeking/rebelliousness.

Attrition analysis

Attrition was associated with almost all the predictor variables. Age was a special issue, related to the school-based survey, as older adolescents had a higher likelihood of moving on to another school by T2. Consequently, whereas only 14% of the 12-year-olds were lost to follow-up, some 38% of the 15-year-olds were. Other variables associated strongly with attrition were school SES and smoking status at T1. With respect to key predictor variables, 26% of the adolescents who dropped out could name a favorite cigarette brand, compared with 17% who were retained ($P < 0.000$). Finally, mean exposure to smoking in movies was 28% higher among those who dropped out ($P < 0.000$).

Statistical analysis

We assessed T1 predictors as a function of smoking at T2. A multivariate proportional odds model was used to examine the association with a higher level of life-time smoking and T1 predictor variables. This model gives cumulative or proportional odds ratios (ORs) modeling the probability of being in a higher category of life-time smoking. Using a two-sided test, results were judged significant if $P < 0.05$ for all models.

Based on our previous research [43], we hypothesized that the effects of tobacco marketing receptivity and movie smoking would vary by smoking status at T1, with the movie effect being stronger among never smokers and the marketing effect being stronger among ever smokers. To test this hypothesis, we analyzed the full data set, looking for an interaction

effect between the media variables and T1 smoking status (never versus ever smokers). Finding evidence of an interaction for both variables we conducted a second set of regressions, in which the analyses were stratified by smoking status at T1, using the Wald test to assess whether the movie exposure estimate was significantly different from the marketing estimate for each model.

RESULTS

Correlation analysis

Thirty-eight per cent ($n = 1668$) of adolescents had tried smoking at T1. Whereas 34% of ever smokers were receptive to tobacco marketing, only 6% of never smokers were. Means for exposure to movie smoking were lower for never versus ever smokers [mean $\pm$ standard deviation (SD) 0.25 (0.25) and 0.45 (0.29), respectively]. Table 1 shows correlations among the variables according to T1 smoking status. Among the never smokers, the variables correlated most highly with T2 smoking status were exposure to movie smoking, friend smoking and sensation seeking/rebelliousness. Sensation seeking/ rebelliousness also had a moderate correlation with exposure to movie smoking, with higher sensation seekers tending towards higher exposure to movie smoking. Receptivity to tobacco marketing had a small correlation with T2 smoking.

Among the ever smokers a different picture emerged, in that the correlation between receptivity to tobacco marketing and T2 smoking was much higher (0.30) compared to the correlation for never smokers (0.06). Generally, the correlations between predictor variables and smoking were somewhat higher for this group of adolescents, due possibly to greater variation in the T2 outcome variable.

Does smoking status at T1 modify the effect of movie smoking and marketing receptivity on T2 smoking?

The decision to stratify the analysis on T1 smoking status was based on a hypothesized interaction between the variables of interest and T1 smoking status (hypothesized larger effects of marketing and smaller effects of movie smoking among ever smokers). The interaction analysis was performed on the full sample, first in separate bivariate models to determine which variables had a significant interaction with smoking status; significant interactions with T1 smoking status were found for tobacco marketing receptivity, movie smoking exposure, age, sex and parenting style. The results for the multivariable interaction analyses are shown in Table 2.

In model 1, T1 smoking status interactions were assessed with tobacco marketing receptivity and exposure to movie smoking and no other covariates. The interaction terms between both variables and T1 smoking status were statistically significant and in the direction expected. Among T1 never smokers, receptivity to tobacco marketing was associated with higher T2 smoking levels [adjusted proportional odds ratio (apOR) = 1.73], but among T1 ever smokers the marketing effect was significantly stronger (apOR = 2.72). Among T1 never smokers, movie smoking exposure was associated with higher T2 smoking levels (apOR = 5.12), but among T1 ever smokers the movie smoking effect was significantly weaker (apOR = 2.61). When socio-demographic controls and interaction terms for age and sex were added (model 2) the interaction between tobacco marketing was attenuated somewhat (from 1.57 to 1.33) and no longer statistically significant, but there was little impact on the magnitude or significance of the movie smoking interaction term. The age $\times$ T1 smoking status interaction showed that, whereas there was little effect of age on T2 smoking among never smokers, the effect was marked among smokers, with older adolescents being more likely to progress (by a factor of 1.43 for each additional year of age). With all controls and

an additional interaction term for parenting style (model 3), the same results applied: the interaction estimate for tobacco marketing was attenuated further but still in the hypothesized direction, and movie smoking exposure was still significantly weaker for T1 ever smokers. A review of the results from the correlational analysis, where the correlational association between marketing receptivity and T2 smoking was some five times greater for ever smokers, and the interaction analysis, argues for examining baseline never smokers separately from ever smokers.

Split sample analyses: is the effect of movie smoking stronger than the effect of marketing receptivity among never smokers?

In the analysis of T1 never smokers (Table 3) both receptivity to tobacco marketing and exposure to movie smoking had statistically significant associations, with higher levels of T2 smoking.

However, the apOR for marketing receptivity (apOR = 1.53) was significantly smaller than for exposure to movie smoking (apOR = 2.76) using the Wald test. Other variables associated with higher T2 smoking status among the T1 never smokers included low school SES, friend smoking, sibling smoking (but not parent smoking), sensation seeking/rebelliousness [which had an effect similar to the effect of movie smoking exposure (apOR = 2.53)] and poor school performance.

Split sample analyses: is the effect of marketing receptivity stronger than the effect of movie smoking among ever smokers?

In the analysis of T1 ever smokers (Table 4) the pattern of results was different from the results for never smokers. Again, both receptivity to tobacco marketing and exposure to movie smoking had statistically significant associations with higher levels of T2 smoking, but this time the apOR for receptivity (2.17) was larger than for exposure to movie smoking (apOR = 1.62), a difference in effect size that was not statistically significant using the Wald test.

Other variables associated with higher T2 smoking status among T1 ever smokers included age, sex (higher T2 smoking for girls), school SES (higher T2 smoking for low SES schools), friend smoking, sibling smoking, parenting style, sensation seeking/rebelliousness [the most strongly associated predictor variable (apOR) = 3.99)] and poor school performance.

DISCUSSION

This study provides longitudinal support for the hypothesis that entertainment media smoking (as represented by movie smoking) has stronger effects on smoking onset, and tobacco advertising has stronger effects on smoking experimentation following the initiation event. This study extends the results of a study of US adolescents, which suggested a similar pattern of effects but did not include a longitudinal study of baseline experimenters [43]. Like this one, that study found that relatively few (2%) never smoker adolescents are receptive to a tobacco marketing message, limiting the population effect of tobacco advertising on smoking onset. In contrast, almost one-third of ever smokers could identify the brand of a favorite tobacco advertisement, suggesting that adolescents are more likely to notice and respond to tobacco advertising after smoking onset. Moreover, they were more responsive to having a favorite advertisement in terms of its association with higher levels of smoking in the future. One other longitudinal study [19] examined tobacco marketing receptivity using latent class models to separate adolescents into four groups—never smokers, experimenters, early smoking adopters and late smoking adopters. In that study,

receptivity to tobacco marketing distinguished both classes of smokers (early and late adopters) from never smokers but did not distinguish experimenters from never smokers, again suggesting that receptivity to tobacco marketing plays a role in later rather than earlier smoking transitions.

This study identified other differences between what predicts smoking onset and progression of experimentation. Age was the most striking contrast, with higher age being related strongly and significantly to progression of experimentation, whereas it was not at all related to smoking onset, net covariates. This suggests that experimentation progresses at a faster pace among older adolescents, consistent with the results of another study [44]. Rapid progression among older adolescents might help to explain the attenuation of effects during high school for programs that limited successfully the onset of smoking during middle school years [45]. Sex had an effect on smoking progression only, suggesting that although boys and girls initiate at similar rates, girls are more likely to progress to higher levels of experimental smoking. The literature on gender effects on smoking is mixed, with most studies finding little difference in the prevalence of smoking among boys and girls in developed nations [46,47]. However, three other longitudinal studies have found that being female conferred higher risk for the experimenter to smoker transition [48–50], so it is not clear why a consistent finding in prospective studies does not translate into higher smoking prevalence among females during later adolescence. Another one-way interaction was for parenting style, suggesting a stronger effect for effective parenting on experimental smoking compared with smoking onset. The parenting role has been proposed as an explanation for why African American teenagers in the United States do not progress to current smoking at high rates during adolescence [51]. Smoking cessation programs aimed at teenagers have focused mainly on the teenager as an individual, largely ignoring parents. The present study suggests pursuing a possible intervention role for parents in adolescent ever smokers. The differences found here on media and marketing effects in never versus ever smokers provide a justification for treating these transitions separately in future observational studies, rather than lumping the initiation event together with transitions among experimenters.

The limitations of the study should be noted. Generalizability could be limited by the nature of the sample, which was primarily white and limited to only one country. As mentioned above, another study of US adolescents had similar findings, which suggests similar effects among whites and across two distinct cultures; more research is warranted in minority adolescents. Higher attrition among older adolescents was also an issue. We considered how this attrition effect might have influenced the interaction effect on age. We suspect that the attrition bias was related mainly to date of birth, with older adolescents born later in the year being more likely to belong to a graduating class. If this is true, the bias should have worked against the interaction effect because it selected for relatively younger adolescents in the graduating classes. As with any observational study, measurement error could have limited the effect of any predictor variable, and we are unable to rule out the possibility of an unmeasured confounder of the movie or the tobacco marketing associations. In addition, the receptivity to marketing variable could be criticized as weak, in that it was assessed using only one item; more comprehensive measurement strategies that encompass contemporary advertising inputs, including music and other entertainment venues, are indicated. One final limitation is that the movie and the marketing receptivity measures assessed different aspects of each media exposure. The movie smoking measure assessed exposure, not attention or response to movie smoking, because the survey instrument queried only whether or not a specific movie has been seen without any reference to the smoking contained within it. In contrast, the tobacco marketing receptivity measure assessed attention and response, cognitions and actions that follow exposure. It is possible that a more pure measure of exposure to tobacco marketing could affect smoking onset and it is also possible that an

assessment of response to movie smoking could affect ever smokers. However, there are no data available to clarify this issue.

In summary, our findings show that exposure to entertainment media and tobacco marketing have differential effects on adolescent smoking. Clearly, as factors that promote adolescent smoking, both are worthy of consideration by researchers and public health advocates. Interventions should consider emphasizing one or the other, depending on whether they are addressing smoking onset among never smokers or progression following onset. Finally, researchers need to be careful to analyze predictor effects on early and late smoking transitions separately.

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Appendix

Appendix I

Covariates and their assessment.

Variable	Survey question	Response categories
<i>Socio-demographics</i>		
Age	How old are you?	— — years
Sex	Are you a girl or a boy?	Girl/boy
SES	Assessed by type of school attended	
<i>Social influences</i>		
Parent smoking (yes if either parent smokes)	Does your mother smoke?	Yes/ no/don't know (coded no)
	Does your father smoke?	Yes/ no/don't know (coded no)
Sibling smoking	Do any of your brothers or sisters smoke?	Yes/no/don't know (coded no)/don't have any brothers or sisters (coded no)
Friend smoking	How many of your friends smoke?	None/some/most/all
<i>Adolescent characteristics</i>		
School performance	How would you describe your grades last year?	Excellent/good/average/below average
Tobacco marketing receptivity	Name your favourite cigarette advertisement.	Open-ended answer, with the instruction 'if you have no favourite write none'
Sensation seeking/rebelliousness	I like to do scary things	Not like me
	I get bored being with the same friends all the time	Sort of like me
		A lot like me
12 item index, range 0–3 (re-scaled so that 5th percentile = 0 and 95th percentile = 1)	I like to do dangerous things	Just like me
	I often think there is nothing to do	
	I like to listen to loud music	
Cronbach's alpha = 0.77	I get in trouble in school	
	I argue a lot with other kids	
	I do things my parents wouldn't want me to do	
	I do what my teachers tell me to do	
	I sometimes take things that don't belong to me	
	I argue with my teachers	
	I like to break the rules	
Parenting style [52]	She makes me feel better when I am upset	Not like her
	She listens to what I have to say	Sort of like her
Eight-item index, range 0–3 (re-scaled so that 5th percentile = 0 and 95th percentile = 1)	She is too busy to talk to me	A lot like her
	She wants to hear about my problems	Just like her
	She has rules that I must follow	

Variable	Survey question	Response categories
Cronbach's alpha = 0.64	She tells me what time I have to be home	
	She asks me what I do with my friends	
	She knows where I am after school	

The ethics board would not allow questions on socio-economic status (SES) of parents. Instead, school type was used as a proxy. Schleswig-Holstein has a school system with four types of schools, and type of school is associated strongly with SES. The 'Hauptschule' recruits pupils from low SES, the 'Realschule' recruits students with mid SES, the 'Gymnasium' recruits pupils with mid- to high SES background and the 'Gesamtschule' is a mixed form.

Table 1

Correlation among the variables.

Baseline never smokers (n = 2716)	1	2	3	4	5	6	7	8	9	10	11	12
1. Time 2 smoking	1.00											
2. Receptive to tobacco marketing	0.06	1.00										
3. Exposure to movie smoking	0.15	0.12	1.00									
4. Age	0.05	0.02	0.26	1.00								
5. Sex	-0.01	-0.08	-0.23	-0.06	1.00							
6. School SES	0.09	-0.05	0.05	0.06	-0.02	1.00						
7. Friend smoking	0.20	0.06	0.22	0.26	-0.02	0.18	1.00					
8. Sibling smoking	0.11	0.03	0.09	0.06	0.02	0.15	0.11	1.00				
9. Parent smoking	0.04	0.02	0.08	0.04	0.01	0.18	0.13	0.15	1.00			
10. Parenting style	-0.07	-0.05	-0.17	-0.14	0.05	-0.07	-0.16	-0.09	-0.06	1.00		
11. Sensation seeking/rebelliousness	0.14	0.16	0.32	0.13	-0.20	0.09	0.26	0.07	0.11	-0.33	1.00	
12. Grades in school	0.08	0.03	0.13	0.13	-0.06	0.01	0.12	0.07	0.09	-0.19	0.24	1.00
Baseline ever smokers (n = 1668)	1	2	3	4	5	6	7	8	9	10	11	12
1. Time 2 smoking	1.00											
2. Receptive to tobacco marketing	0.30	1.00										
3. Exposure to movie smoking	0.21	0.17	1.00									
4. Age	0.25	0.02	0.14	1.00								
5. Sex	0.03	-0.01	-0.19	0.03	1.00							
6. School SES	0.17	0.09	0.02	0.06	0.00	1.00						
7. Friend smoking	0.33	0.17	0.20	0.23	0.05	0.20	1.00					
8. Sibling smoking	0.23	0.14	0.11	0.09	0.06	0.21	0.15	1.00				
9. Parent smoking	0.17	0.15	0.08	0.05	0.07	0.20	0.16	0.15	1.00			
10. Parenting style	-0.05	-0.09	-0.10	-0.09	0.03	-0.04	-0.10	-0.07	0.00	1.00		
11. Sensation seeking/rebelliousness	0.30	0.25	0.26	0.06	-0.16	0.06	0.24	0.11	0.11	-0.26	1.00	
12. Grades in school	0.18	0.06	0.05	0.13	0.01	-0.03	0.10	0.05	0.06	-0.11	0.20	1.00

SES; socio-economic status.

Table 2

Full sample ordinal logistic model predicting time 2 smoking including interaction terms ($n = 4384$).

Predictor variable	Model 1 ^a			Model 2 ^b			Model 3 ^c		
	Adjusted	proportional odds ratio	95% CI	Adjusted	proportional odds ratio	95% CI	Adjusted	proportional odds ratio	95% CI
Receptive to tobacco marketing	1.73		1.22, 2.44	1.97		1.39, 2.79	1.56		1.09, 2.23
Marketing receptivity × ever smoked	1.57		1.06, 2.33	1.33		0.90, 1.98	1.35		0.90, 2.02
Movie smoking	5.12		3.59, 7.31	4.61		3.14, 6.76	2.85		1.90, 4.26
Movie smoking × ever smoked	0.51		0.32, 0.81	0.52		0.32, 0.85	0.55		0.34, 0.92
Age				1.03		0.94, 1.13	0.93		0.84, 1.02
Age × ever smoked				1.43		1.26, 1.62	1.48		1.30, 1.68
Sex				1.07		0.87, 1.31	1.11		0.90, 1.37
Sex × ever smoked				1.13		0.87, 1.48	1.08		0.82, 1.41
Parenting style							1.00		0.69, 1.46
Parenting style × ever smoked							1.43		0.89, 2.31

^aControls only for variables shown and ever smoked.

^bControls for variables shown and socio-economic status.

^cControls for variables shown, socioeconomic status, friend smoking, sibling smoking, parent smoking, sensation seeking/rebelliousness and grades in school. CI: confidence interval.

Table 3Predicting smoking at time 2 for baseline never smokers ($n = 2716$).

Predictor variable	Proportional odds ratio		
	Crude	Adjusted	95% CI
Receptive to tobacco marketing	2.04	1.53	1.07, 2.20
Exposure to movie smoking	5.16	2.76	1.84, 4.15
Age	1.16	0.93	0.84, 1.03
Sex	0.83	1.09	0.88, 1.34
School SES [reference = Gymnasium (high)]	Ref	Ref	
[Realschule (middle)]	1.84	1.51	1.17, 1.94
[Hauptschule (low)]	2.15	1.49	1.13, 1.97
[Gesamtschule (mixed)]	1.15	1.02	0.69, 1.51
Friend smoking	2.85	1.99	1.59, 2.48
Sibling smoking	2.42	1.88	1.44, 2.47
Parent smoking	1.39	1.00	0.81, 1.23
Parenting style	0.45	0.99	0.67, 1.45
Sensation seeking/ rebelliousness	6.20	2.53	1.61, 3.98
Grades in school (reference = excellent)	Ref	Ref	
Good	1.14	1.03	0.72, 1.47
Average	1.71	1.25	0.87, 1.80
Below average	3.36	2.00	1.09, 3.67

CI: confidence interval; SES: socio-economic status.

Table 4Predicting smoking at time 2 for baseline ever smokers ($n = 1668$).

Predictor variable	Proportional odds ratio		
	Crude	Adjusted	95% CI
Receptive to tobacco marketing	3.12	2.17	1.78, 2.63
Exposure to movie smoking	3.52	1.62	1.18, 2.23
Age	1.56	1.41	1.29, 1.54
Sex	1.13	1.24	1.03, 1.48
School SES [reference = Gymnasium (high)]	Ref	Ref	
[Realschule (middle)]	1.63	1.41	1.11, 1.80
[Hauptschule (low)]	2.44	1.60	1.28, 2.00
[Gesamtschule (mixed)]	1.26	1.28	0.92, 1.80
Friend smoking	4.00	2.13	1.70, 2.65
Sibling smoking	2.29	1.55	1.27, 1.88
Parent smoking	1.70	1.06	0.88, 1.28
Parenting style	0.68	1.49	1.09, 2.04
Sensation seeking/ rebelliousness	8.19	3.99	2.73, 5.82
Grades in school (reference = excellent)	Ref	Ref	
Good	1.04	1.12	0.75, 1.67
Average	1.69	1.56	1.05, 2.31
Below average	2.91	1.74	1.09, 2.77

CI: confidence interval; SES: socio-economic status.