@ Effect of viewing smoking in movies on adolescent smoking initiation: a cohort study

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Summary

Background Exposure to smoking in movies has been linked with adolescent smoking initiation in cross-sectional studies. We undertook a prospective study to ascertain whether exposure to smoking in movies predicts smoking initiation.

Method We assessed exposure to smoking shown in movies in 3547 adolescents, aged 10–14 years, who reported in a baseline survey that they had never tried smoking. Exposure to smoking in movies was estimated for individual respondents on the basis of the number of smoking occurrences viewed in unique samples of 50 movies, which were randomly selected from a larger sample pool of popular contemporary movies. We successfully re-contacted 2603 (73%) students 13–26 months later for a follow-up interview to determine whether they had initiated smoking.

Findings Overall, 10% (n=259) of students initiated smoking during the follow-up period. In the highest quartile of exposure to movie smoking, 17% (107) of students had initiated smoking, compared with only 3% (22) in the lowest quartile. After controlling for baseline characteristics, adolescents in the highest quartile of exposure to movie smoking were $2 \cdot 71$ (95% Cl $1 \cdot 73 - 4 \cdot 25$) times more likely to initiate smoking compared with those in the lowest quartile. The effect of exposure to movie smoking was stronger in adolescents with non-smoking parents than in those whose parent smoked. In this cohort, $52 \cdot 2\%$ ($30 \cdot 0 - 67 \cdot 3$) of smoking initiation can be attributed to exposure to smoking in movies.

Interpretation Our results provide strong evidence that viewing smoking in movies promotes smoking initiation among adolescents.

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Introduction

Many studies have linked tobacco marketing with an increased risk of smoking uptake in adolescents.¹⁻⁷ For example, owning tobacco promotional items and being able to recall cigarette advertisements can double the odds that an adolescent will become an established smoker.³ Movie images, like commercial advertising, associate smoking with celebrities and depict it as an attractive behaviour.⁸ In popular contemporary movies, smoking is frequently associated with characteristics many adolescents find appealing—such as toughness, sexiness, and rebelliousness.⁹ Endorsement of cigarette brands in movies by actors has also increased substantially over the past decade.¹⁰

Several studies have described how smoking is portrayed in movies,^{9,11–16} but only a few have specifically assessed whether viewing smoking in movies affects adolescent smoking behaviour. In an experimental study, Pechmann and Shih¹⁷ showed that adolescents were more likely to report positive attitudes toward smoking after seeing smoking portrayed in movies. Results of two crosssectional studies^{18,19} indicated that adolescents were more likely to have tried smoking if their favourite movie stars smoked on screen. In our previous study of adolescents in New England, USA, exposure to smoking in movies was associated with smoking experimentation, even after controlling for the effects of other social influences, parenting, and personality characteristics of the child.²⁰

Collectively, these results suggest that movie smoking influences adolescent smoking behaviour. However, the cross-sectional design of these studies precludes establishment of a temporal relation. To determine whether exposure to movie smoking predicts smoking initiation in adolescents, we did a longitudinal study of adolescents in New England, USA, who had never previously tried smoking.

Methods

Participants

In 1999, we distributed a self-administered written survey to adolescents (aged 10–14 years) enrolled in grades 5 through 8 at 14 schools in Vermont and New Hampshire, USA. The purpose of this baseline survey was to assess exposure to smoking in movies and investigate its association with lifetime smoking experience. Details of the methods for the survey have been published previously.²⁰

Through the baseline survey, we identified 3547 adolescents who had never tried smoking cigarettes and were thus eligible for a follow-up 13–26 months later to assess risk factors for smoking initiation. The follow-up telephone interviews, accomplished for 2603 (73%) eligible baseline participants, were done by trained interviewers using a computer-assisted telephone interview system. To protect confidentiality, students indicated their answers by pressing numbers on the telephone. We used a PC Telecom digit grabber

(Metrotel, Milpitas, CA) so that every time a student pressed a number, the answer was automatically entered into the database. The protocol for this study was approved by the Dartmouth committee for the protection of human subjects.

Procedures

We assessed lifetime smoking experience at baseline and follow-up by asking "How many cigarettes have you smoked in your life?", to which respondents could answer "none", "just a few puffs", "one to 19 cigarettes", "20 to 100 cigarettes", or "more than 100 cigarettes". Only students who answered "none" at baseline were eligible for follow-up. Students who reported any cigarette smoking (just a few puffs, one to 100 cigarettes, more than 100 cigarettes) on the follow-up survey were classified as having initiated smoking during the follow-up period.

Adolescents' exposure to smoking in movies was assessed at baseline by asking each student to indicate which films he or she had seen from a unique list of 50 movies. A list of 50 movies was randomly selected for each individual survey from a sample of 601 popular contemporary movies released between 1988 and 1999. The 601 movies included the top 25 box-office hits every year from 1988 to 1995 (n=200); the top 100 box-office hits per year from 1996 to 1998 (300); the top 50 boxoffice hits from the first half of 1999; and 51 additional movies selected because they featured stars popular among adolescents. We stratified the random selection of movies so that each list of 50 had the same distribution of ratings as the larger sample of top box-office hits: 45% R (restricted, younger than 17 years requires accompanying parent or adult guardian), 31% PG-13 (parents strongly cautioned, some material might be inappropriate for children younger than 13 years), 20% PG (parental guidance suggested, some material might not be suited for children), 4% G (general audiences, all ages admitted). On average, every movie title was included in 470 questionnaires. Trained coders counted the number of occurrences of smoking in each movie using methods previously described.9 We calculated exposure to movie smoking for each respondent by summing the number of smoking occurrences for each movie the respondent had seen. We adjusted for possible variation in the movie lists by expressing individual exposure to movie smoking as a proportion of the total number of possible smoking occurrences each student could have seen on the basis of the movies included in their survey. Exposure to movie smoking was classified in quartiles with the following cutoffs: 0-531 occurrences for the 1st quartile, 532-960 for the 2nd quartile, 961-1664 for the 3rd quartile, and 1665–5308 for the 4th quartile.

We also measured at baseline, through questions adapted from previously validated questionnaires, variables that could potentially confound the association between movie exposure and adolescent smoking initiation. These variables included child characteristics (sex, age, school, self-reported school performance, sensation seeking,^{21,22} rebelliousness,²³ and self-esteem²⁴), social influences (parent, sibling, and friend smoking; receptivity to tobacco promotions^{4,25}), and parenting characteristics (parent education, two measures of authoritative parenting,²⁶ and adolescents' perception of parental disapproval of smoking²⁷). Individual items used to measure student personality and parenting characteristics have been reported previously.²⁰ Students used a four-point response scale to indicate how well specific statements described themselves or their mothers (or primary caregiver if they did not have a mother). Summary measures were created by adding their responses to each of the individual items, so that higher scores signify more of each characteristic. We then divided the scores into quartiles.

Statistical analysis

Preliminary analyses consisted of descriptive frequencies, χ^2 tests to compare differences in proportions, and t tests to compare mean differences by group. We used generalised linear models²⁸ to assess smoking initiation as a function of both movie exposure and baseline covariates. We used a log link, rather than a logistic regression, so that relative risks could be estimated directly. An overdispersion variable was used to account for possible clustering by schools. Exposure to movie smoking was treated as a categorical variable. The dependent variable was whether the respondent had initiated smoking during the follow-up period. We did multivariate analyses with both minimally adjusted (age, sex, and school) and fully adjusted models. The fully adjusted models included all terms for child characteristics, social influences, and parenting characteristics as described above, as well as the time elapsed between the baseline and follow-up surveys. We assessed model fit and interaction terms with changes in deviances and standard diagnostic plots. Results were judged significant if p < 0.05, in a two-sided test. Simulation methods, similar to those used by Connors and colleagues,²⁹ were used to test whether an unmeasured confounder could falsely implicate movie exposure. Attributable risk was estimated by the probability of initiating smoking for each adolescent, assuming varying degrees of movie exposure and holding measured covariates constant.

Role of the funding source

The sponsor of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

Our final sample of 2603 adolescents was mainly white (94%, n=2392), as was the underlying population (96%); equally distributed by sex; with a mean age at baseline of 12 years (SD 1·1). Participants who were followed up were much the same as non-participants in age, sex, grade, and exposure to movie smoking, but nonparticipants were more likely than participants to have parents who smoke (41% [383] vs 30% [773], respectively) and slightly more likely to be susceptible to smoking³⁰ at baseline (27% [257] vs 23% [592]); report average or below average school performance (25% [237] vs 19% [484]); have friends who smoke (30% [282] vs 26% [671]); and have siblings who smoke (14% [134] vs 10% [267]). Reasons for non-participation included refusal to provide contact information at baseline (35%, 326), refusal to participate in the interview at the time of follow-up (31%, 288), and lost-to-follow-up (35%, 330).

On average, students had seen 16 of the 50 movies they were asked about, from which they were exposed to an average of 98.5 (SD 75.1) smoking occurrences. Exposure to movie smoking increased with age and was higher in boys than in girls. Girls saw a mean of 14.6 movies (7.4), from which they viewed a mean of 85.1 smoking occurrences (66.4), whereas boys saw a mean of 17.1movies (8.2), from which they viewed 113.5 smoking occurrences (81.2). Exposure to movie smoking was positively associated with sensation seeking (p<0.0001) and rebelliousness (p<0.0001), and inversely associated with school performance and measures of authoritative parenting (p<0.0001)).

10% (259) of participants initiated smoking during the follow-up period. Most (80%, n=208) of those who initiated smoking reported that they had smoked "just a few puffs" of a cigarette. Only 2% (six) of those who initiated smoking had smoked more than 100 cigarettes during follow-up. Analyses adjusted for age, sex, and

school showed significant associations between baseline characteristics, including exposure to movie smoking, and smoking initiation (table 1). Relative to the lowest quartile of movie smoking exposure, the risk for smoking initiation increased with each successive quartile of exposure (table 1). Although the relative risks were attenuated, the relation between exposure to movie smoking and smoking initiation remained significant after adjustment for all

Characteristic	Total (n=2603)	Tried smoking	Relative risk* (95% Cl)
Sociodemographic			
Age			
10 to <12 years	809	50 (6%)	1.00
12 to <13 years	804	68 (8%)	1.40 (0.98–2.01)
13 to <15 years	990	141(14%)	2.31 (1.67–3.19)
Sex			
Male	1234	119 (10%)	1.00
Female	1369	140 (10%)	1.09 (0.87–1.38)
Social influences			
Either parent smokes			
No	1830	133 (7%)	1.00
Yes	773	126 (16%)	2.25 (1.77–2.86)
Any friends smoke			
No	1932	147 (8%)	1.00
Yes	671	112 (17%)	1.87 (1.46–2.41)
Any siblings smoke			
No	2336	210 (9%)	1.00
Yes	267	49 (18%)	1.91 (1.42–2.59)
Receptive to tobacco promotions	04.04		1.00
No	2161	179 (8%)	1.00
Yes	442	80 (18%)	2.09 (1.62–2.71)
Child characteristics			
School performance			
Excellent	1113	53 (5%)	1.00
Good	1006	114 (11%)	2.29 (1.67-3.13)
Average/below average	484	92 (19%)	3.65 (2.62–5.09)
Sensation seeking			
First quartile	792	40 (5%)	1.00
Second quartile	709	59 (8%)	1.60 (1.09–2.35)
Third quartile	484	55 (11%)	2.21 (1.49–3.27)
Fourth quartile	618	105 (17%)	3.27 (2.28–4.68)
Rebelliousness			
First quartile	771	37 (5%)	1.00
Second quartile	549	39 (7%)	1.48 (0.96–2.27)
Third quartile	668	71 (11%)	2.24 (1.53–3.29)
Fourth quartile	615	112 (18%)	4.10 (2.84–5.91)
Self-esteem			4.00
First quartile	676	100 (15%)	1.00
Second quartile	747	68 (9%)	0.64 (0.48–0.86)
Third quartile	760	71 (9%)	0.68 (0.51–0.92)
Fourth quartile	420	20 (5%)	0.35 (0.22–0.56)
Parent characteristics			
Maternal demandingness			
First quartile	617	68 (11%)	1.00
Second quartile	666	71 (11%)	0.97 (0.70-1.33)
Third quartile	755	74 (10%)	0.86 (0.63-1.18)
Fourth quartile	565	46 (8%)	0.72 (0.50-1.04)
Maternal responsiveness			
First quartile	526	78 (15%)	1.00
Second quartile	571	60 (11%)	0.76 (0.55–1.05)
Third quartile	679	63 (9%)	0.69 (0.50–0.94)
Fourth quartile	827	58 (7%)	0.55 (0.39–0.76)
Parent education			
Both completed high school	2223	206 (9%)	1.00
Neither or one completed high school	380	53 (14%)	1.55 (1.15–2.08)
Parental disapproval of smoking			
Both disapprove	2157	197 (9%)	1.00
Neither or one disapproves	446	62 (14%)	1.53 (1.16–2.01)
Movie smoking exposure†			
First quartile	651	22 (3%)	1.00
Second quartile	651	56 (9%)	2.39 (1.49–3.83)
Third quartile	651	74 (11%)	2.99 (1.89-4.72)
Fourth quartile	650	107 (16%)	4.31 (2.76-6.75)

*Relative risk for age at baseline is adjusted for sex and school. Relative risk for sex is adjusted for age and school. All other relative risks are adjusted for age at baseline, sex, and school. †First quartile, 0–531 occurrences of smoking; second quartile, 532–960 occurrences; third quartile, 961–1664 occurrences; and fourth quartile 1665–5308 occurrences.

Table 1: Predictors of smoking initiation

	Quartile of movie smoking exposure*				
	1	2	3	4	
All participants	1.00	2.02 (1.27–3.20)	2.16 (1.38–3.40)	2.71 (1.73-4.25)	
Parental smoking					
Non-smoker	1.00	2.32 (1.21-4.45)	2.64 (1.39-5.01)	4.08 (2.19-7.61)	
Smoker	2.84 (1.28-6.29)	4.77 (2.41–9.44)	4.64 (2.43-8.87)	4.74 (2.49-9.02)	

Values are relative risks (95% CI) adjusted for time between surveys and the following baseline characteristics: grade, sex, school, friend smoking, sibling smoking, parent smoking, receptivity to tobacco promotions, school performance, sensation-seeking propensity, rebelliousness, self esteem, parent education, authoritative parenting, and perception of parental disapproval of smoking. "First quartile, 0–531 occurrences of smoking; second quartile, 532–960 occurrences; third quartile, 961–1664 occurrences; and fourth quartile 1665–5308 occurrences.

Table 2: Effect of movie smoking exposure on smoking initiation in all participants, and the interaction between movie smoking exposure and parental smoking in relation to smoking initiation

baseline covariates. Compared with the lowest exposure level, adolescents in the second, third and fourth quartiles were two to three times more likely to initiate smoking during follow-up (table 2).

We assessed potential interactions between exposure to movie smoking and age, sex, and social influences (friend, sibling, and parent smoking) on smoking initiation and identified a significant interaction between exposure and parental smoking behaviour (p=0.003). In adolescents with non-smoking parents, the risk of smoking initiation increased substantially with greater exposure to movie smoking. Those with smoking parents had an overall higher risk of smoking initiation, but were less influenced by exposure to movie smoking than those whose parents did not smoke (table 2).

Even after controlling for all other covariates, 52.2%(95% CI 30.0–67.3) of smoking initiation in this cohort can be attributed to exposure to smoking in movies. If the observed association with smoking initiation is assumed to be causal, reducing movie smoking exposure in this study to the lowest quartile would have reduced the proportion who initiated smoking during follow-up from 10.0% to 4.8%. Reducing movie exposure for all children by just one quartile (eg, moving a child from the fourth to the third quartile) would correspond to an attributable risk reduction of 21.4% (12.0-29.8), which would have reduced the proportion who initiated smoking in this study from 10.0% to 7.8%.

Our simulation studies indicate it is unlikely that an unmeasured covariate was responsible for the association between exposure to movie smoking and smoking initiation. To raise the relative risk to the magnitude we recorded, a potential confounder would need to be associated with both movie exposure (with a minimum correlation of 0.2) and smoking initiation (minimum relative risk of 1.2) and be independent of all other covariates we measured. An unmeasured independent covariate would have to have p values of less than 0.00001 associated with both movie exposure and smoking initiation. This is unlikely because any covariate we did not measure would almost certainly be associated with at least one of the measured covariates, so that a substantial proportion of the variability would already be accounted for.

Discussion

Our results suggest that viewing smoking in movies strongly predicts whether or not adolescents initiate smoking, and the effect increases significantly with greater exposure. Adolescents who viewed the most smoking in movies were almost three times more likely to initiate smoking than those with the least amount of exposure. The magnitude of this association is consistent with the results of our cross-sectional study of adolescents in New England, USA.²⁰ It is also consistent with the results of other cross-sectional studies that have linked actor smoking with adolescent smoking^{18,19} and visual media exposure with high risk behaviour in adolescents. $^{\scriptscriptstyle 31}$

The data suggest that children with non-smoking parents are especially susceptible to the effect of movie smoking exposure. Children with parents who smoke might have a more realistic view of smoking, so they are less likely to be influenced by the glamorous portrayal of smoking in movies. However, an equally plausible explanation is that children with parents who smoke are already at a higher risk for smoking initiation, so their risk is less likely to be raised by other social influences. Further research is needed to understand this interaction fully.

Although it is not feasible to completely measure an adolescents' total lifetime exposure to smoking in movies, every survey in our study contained 50 randomly selected movies from a larger sample of 601 films, stratified by rating. Thus, our assessment is an unbiased estimate of adolescents' exposure to smoking in popular, contemporary movies. Unlike most measures of exposure to tobacco marketing, this assessment reflects actual exposure rather than adolescents' attention, attitudes or predispositions to smoking. However, because almost all R-rated movies contain smoking,9 we could not separate the effects of an R-rating and smoking content. Consequently, we cannot exclude the possibility that some other aspect of R-rated movies influences smoking initiation. However, more than 40 years of research shows that observers imitate specific behaviours they see modelled.32,33 Thus, our inference that adolescents imitate smoking behaviour seen in movies seems reasonable. The generalisability of our findings might be restricted because our sample included a mainly white, rural population.

The effect of exposure to movie smoking is important, both because the effect on smoking initiation is moderately strong and because the exposure is almost universal. Based on the lists of 50 randomly selected movies, only five (0.2%) participants were unexposed to movie smoking. If the link between exposure to smoking in movies and smoking initiation proves to be causal, our data suggest that eliminating adolescents' exposure to movie smoking could reduce smoking initiation by half. However, we recognise that the equation might not be that simple, since many factors affect movie exposure and its effect on adolescent behaviour. We controlled for as many of these factors as possible, and our sensitivity analysis suggests that an unmeasured variable is unlikely to account for the association between exposure to movie smoking and smoking initiation. Because the follow-up period for this study was brief, we could not assess the possibly greater effects of longer term exposure. Consequently, the effect of reducing exposure to smoking in movies over many years could be larger than that we recorded. Nonetheless, it is important to point out that this study links movie smoking exposure with smoking initiation, and not all initiators will become established smokers. Further research is needed to assess the effect of exposure to smoking in movies on longterm smoking behaviour.

Contributors

M Dalton, J Sargent, M Beach, J Tickle, and T Heatherton designed the study, developed the surveys and content analysis, and directed the research. L Titus-Ernstoff provided input on the analytical approach and co-wrote the report. M Ahrens contributed to survey development and coordinated survey administration. M Beach and J Gibson did the statistical analysis. All authors contributed to the interpretation of the data and reviewed the final report.

Conflict of interest statement None declared.

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