

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 2.71 (95% CI 1.73–4.25) 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, 52.2% (30.0–67.3) 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.

Published online June 10, 2003

<http://image.thelancet.com/extras/03art1353web.pdf>

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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 cross-sectional 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 box-office 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 non-participants 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 17.1 movies (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% CI)
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			
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			
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.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 long-term 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.

Acknowledgments

This study was funded by the National Cancer Institute (CA-77026). We thank E Robert Greenberg for his input on the analysis and presentation of the data, Daniel Nassau and Ezra Hays for coding the movies, Bill Harper for building the CATI system, Susan Martin for providing administrative support for the study, and Anna Adachi-Mejia and Susan Remacle for preparing the report.

References

- Pierce JP, Gilpin EA. A historical analysis of tobacco marketing and the uptake of smoking by youth in the United States 1890–1977. *Health Psychol* 1995; **14**: 500–08.
- Choi WS, Ahluwalia JS, Harris KJ, Okuyemi K. Progression to established smoking: the influence of tobacco marketing. *Am J Prev Med* 2002; **22**: 228–33.
- Biener L, Siegel M. Tobacco marketing and adolescent smoking: more support for a causal inference. *Am J Public Health* 2000; **90**: 407–11.
- Sargent JD, Dalton MA, Beach ML, Bernhardt AM, Heatherton TF, Stevens M. Effect of cigarette promotions on smoking uptake among adolescents. *Prev Med* 1999; **30**: 320–27.
- Schooler C, Feighery E, Flora JA. Seventh graders' self-reported exposure to cigarette marketing and its relationship to their smoking behavior. *Am J Public Health* 1996; **86**: 1216–21.
- Altman DG, Levine DW, Coeytaux R, Slade J, Jaffe R. Tobacco promotion and susceptibility to tobacco use among adolescents aged 12 through 17 years in a nationally representative sample. *Am J Public Health* 1996; **86**: 1590–93.
- Evans N, Farkas A, Gilpin E, Berry C, Pierce JP. Influence of tobacco marketing and exposure to smokers on adolescent susceptibility to smoking. *J Natl Cancer Inst* 1995; **87**: 1538–45.
- Basil M. The danger of cigarette "special placements" in film and television. *Health Commun* 1997; **9**: 190–98.
- Dalton MA, Tickle JJ, Sargent JD, Beach ML, Ahrens MB, Heatherton TF. The incidence and context of tobacco use in popular movies from 1988–1997. *Prev Med* 2002; **34**: 516–23.
- Sargent JD, Tickle JJ, Beach ML, Dalton MA, Ahrens MB, Heatherton TF. Brand appearances in contemporary films and contribution to global marketing of cigarettes. *Lancet* 2001; **357**: 29–32.
- Escamilla G, Craddock AL, Kawachi I. Women and smoking in Hollywood movies: a content analysis. *Am J Public Health* 2000; **90**: 412–19.
- Goldstein AO, Sobel RA, Newman GR. Tobacco and alcohol use in G-rated children's animated films. *JAMA* 1999; **281**: 1131–36.
- Everett SA, Schnuth RL, Tribble JL. Tobacco and alcohol use in top-grossing American films. *J Community Health* 1998; **23**: 317–24.
- McIntosh WD, Bazzini DG, Smith SM, Wayne SM. Who smokes in Hollywood? Characteristics of smokers in popular films from 1940 to 1989. *Addict Behav* 1998; **23**: 395–98.
- Hazan AR, Lipton HL, Glantz SA. Popular films do not reflect current tobacco use. *Am J Public Health* 1994; **84**: 998–1000.
- Terre L, Drabmen RS, Speer P. Health-relevant behaviors in the media. *J Appl Soc Psychol* 1991; **21**: 1303–19.
- Pechmann C, Shih CF. Smoking scenes in movies and antismoking advertisements before movies: effects on youth. *J Mark* 1999; **63**: 1–13.
- Distefan JM, Gilpin EA, Sargent JD, Pierce JP. Do movie stars encourage adolescents to start smoking? Evidence from California. *Prev Med* 1999; **28**: 1–11.
- Tickle JJ, Sargent JD, Dalton MA, Beach ML, Heatherton TF. Favourite movie stars, their tobacco use in contemporary movies and its association with adolescent smoking. *Tob Control* 2001; **10**: 16–22.
- Sargent JD, Beach ML, Dalton MA, et al. Effect of seeing tobacco use in films on trying smoking among adolescents: cross-sectional study. *BMJ* 2001; **323**: 1394–97. Available from: URL: <http://bmj.com/cgi/content/full/323/7326/1394> (accessed April 11, 2003).
- Zuckerman M, Bone RN, Neary R, Mangelsdorff D, Brustman B. What is the sensation seeker? Personality trait and experience correlates of the sensation-seeking scales. *J Consult Clin Psychol* 1972; **39**: 308–21.
- Russo MF, Stokes GS, Lahey BB, et al. A sensation seeking scale for children: further refinement and psychometric development. *J Psychopathol Behav Assess* 1993; **15**: 69–85.
- Pierce JP, Farkas A, Evans N. Tobacco use in California 1992: a focus on preventing uptake in adolescents. Sacramento, CA: California Department of Human Services, 1993.
- Carvajal SC, Wiatrek DE, Evans RI, Knee CR, Nash SG. Psychosocial determinants of the onset and escalation of smoking: cross-sectional and prospective findings in multiethnic middle school samples. *J Adolesc Health* 2000; **27**: 255–65.
- Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Berry CC. Tobacco industry promotion of cigarettes and adolescent smoking. *JAMA* 1998; **279**: 511–15.
- Jackson C, Henriksen L, Foshee VA. The Authoritative Parenting Index: predicting health risk behaviors among children and adolescents. *Health Educ Behav* 1998; **25**: 319–37.
- Sargent JD, Dalton MA. Does parental disapproval of smoking prevent adolescents from becoming established smokers? *Pediatrics* 2001; **108**: 1256–62.
- McCullagh P, Nelder JA. Generalized linear models. London: Chapman and Hall, 1989.
- Connors AF Jr, Speroff T, Dawson NV, et al. The effectiveness of right heart catheterization in the initial care of critically ill patients. SUPPORT Investigators. *JAMA* 1996; **276**: 889–97.
- Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Merritt RK, Giovino G. Validation of susceptibility as a predictor of who takes up smoking in the United States. *Health Psychol* 1996; **15**: 355–61.
- Klein JD, Brown JD, Childers KW, Oliveri J, Porter C, Dykers C. Adolescents' risky behavior and mass media use. *Pediatrics* 1993; **92**: 24–31.
- Bandura A. Influence of models' reinforcement contingencies on the acquisition of imitative responses. *J Abnorm Psychol* 1965; **66**: 575–82.
- Bushman BJ, Anderson CA. Media violence and the American public: scientific facts versus media misinformation. *Am Psychol* 2001; **56**: 477–89.

COMMENTARY

Ⓜ Smoking in movies: a major problem and a real solution

Published online June 10, 2003

<http://image.thelancet.com/extras/03cmt159web.pdf>

Smoking depicted in movies is a major and growing public-health problem. Despite a falling prevalence of smoking in the real world, the frequency of smoking in top-grossing movies in the USA has about doubled since 1990, when the US tobacco industry first promised Congress that it would stop paid product-placement in movies.¹ Indeed the frequency of smoking in movies has returned to levels not seen since 1950, well before popular understanding that smoking was a major cause of disease and death.² Concern over smoking in movies led WHO to make "Smoke Free Film" a theme of 2003 World No Tobacco Day.

There is already a strong case, from cross-sectional^{3,4} and experimental studies,⁵ that smoking in movies increases adolescent smoking. Such studies, whilst important, always suffer from the limitation that they represent a snapshot in time that might miss some important factor. Longitudinal studies, which follow up people over time and monitor changes in smoking behaviour while simultaneously measuring exposure (to movies showing smoking, in this case), provide the strongest evidence for causality that can be obtained in a population-based study.

This association between smoking in movies and increased rates of smoking by adolescents makes the report in this issue of *The Lancet* by Madeline Dalton and colleagues especially important. These investigators provide the strongest and most convincing evidence to date that smoking in movies promotes initiation of smoking in adolescents, and show that this effect is very large. After controlling for a wide variety of other effects—grade in school, sex, school, friend smoking, sibling smoking, parent smoking, receptivity to tobacco promotions, school performance, sensation-seeking propensity, rebelliousness, self esteem, parent's education, authoritative parenting, and perception of parental disapproval of smoking—52.2% of smoking initiation in the 10–14-year-olds that were studied was attributed to seeing smoking in movies.

This effect is stronger than the effect of traditional cigarette advertising and promotion, which accounts for "only" 34% of new experimentation,⁶ probably because, as the tobacco industry has known for decades,⁷ the subliminal effects of smoking in movies is a more powerful force than overt advertising.

Smoking in movies nearly triples the relative risk that an adolescent will start smoking. This number, however, does not tell the whole story. Like cigarette advertising and promotion,⁸ the effects of smoking in movies are

strongest in children whose parents are the best role models. Children of non-smoking parents who are in the top quartile of exposure to smoking in movies are 4.1 times as likely to smoke as those in the lowest exposure quartile. This effect is substantially stronger than the increase by 1.6 times between these two exposure groups in children of smoking parents.

Thus smoking in movies is having a major effect on health. In the USA, about 2050 adolescents (age 12–17) start smoking every day and about 32% of these people—660 a day—will die prematurely because of smoking.⁹ Assuming that the 52.2% attributable risk observed by Dalton and colleagues applies to this whole group, smoking in movies is responsible for addicting 1080 US adolescents to tobacco every day, 340 of whom will die prematurely as a result.

The good news is that the effect of smoking in movies shows a clear dose-response relation. So, as Dalton and colleagues note, reducing the exposure to smoking in movies will reduce the effect on smoking and death. This goal could be accomplished easily by simply including smoking (or other tobacco promotions, such as appearance of cigarette billboards) as a reason for rating movies as "adult content", an "R" rating (children under 17 not admitted without a parent) in the USA.^{10,11} In the sample of movies in Dalton's study, about 60% of the total exposure to smoking in movies was in youth-rated films (G, PG, and PG-13 in the USA; J Sargent, personal communication). Eliminating smoking in these movies would reduce the exposure by about 800 occurrences, more than a one-quartile drop in exposure, which would reduce the effect of smoking in movies by about half. Put another way, an R rating for smoking in movies would prevent about 330 adolescents from starting to smoke and ultimately extend 170 lives every day.

These numbers underestimate the true benefits of an R rating because in recent years (after Dalton and colleagues finished their data collection), the number and amount of smoking in youth-rated movies has increased.

An adult content or R rating for smoking in movies would not have much effect on the movies that children see because, unlike sex and violence (the primary other reasons, along with offensive language, that films are rated for adult content), smoking in movies does not sell movie tickets.⁵ Studios would simply stop putting smoking in movies aimed at an adolescent market.

The tobacco-control movement has spent many years and millions of dollars attempting to reduce youth smoking by working to implement policies that restrict youth access to cigarettes—with no effect on youth-smoking prevalence.^{12,13} By contrast, the work by Dalton and colleagues, together with the earlier research in this area, strongly indicates that pushing for policy changes to

reduce youth exposure to smoking in movies will have a rapid and substantial effect on youth smoking—and the subsequent disease and death smoking causes. It is time for health advocates worldwide to join with WHO, the American Medical Association, the American Legacy Foundation, and the Los Angeles Department of Health¹⁰ in insisting that the authorities who rate movies give movies that depict smoking an adult content or R rating.

Every day of delay means more unnecessary addiction and death because of Hollywood's love affair with the tobacco industry.

This work was supported by National Cancer Institute grant CA-61021, the Robert Wood Johnson Foundation, and the Richard and Rhoda Goldman Fund.

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- 1 Kacirk K, Glantz S. Smoking in movies in 2001 exceeded rates in the 1960s. *Tob Control* 2001; **10**: 397–98.
- 2 Glantz S, Kacirk K, McCulloch C. Back to the future: smoking in movies in 2000 returned to 1950 levels. *Am J Public Health* (in press).
- 3 Distefan J, Gilpin E, Sargent J, Pierce J. Do movie stars encourage adolescents to start smoking? Evidence from California. *Prev Med* 1999; **28**: 1–11.
- 4 Sargent J, Beach M, Dalton M, et al. Viewing tobacco use in movies: does it shape attitudes that mediate adolescent smoking? *Am J Prev Med* 2002; **22**: 137–45.
- 5 Pechmann C, Shih C. Smoking in movies and antismoking advertisements before movies: effects on youth. *J Market* 1999; **63**: 1–13.
- 6 Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Berry CC. Tobacco industry promotion of cigarettes and adolescent smoking. *JAMA* 1998; **279**: 511–15.
- 7 Mekemson C, Glantz S. How the tobacco industry built its relationship with Hollywood. *Tob Control* 2002; **11**: i-81–i-91.
- 8 Pierce JP, Distefan JM, Jackson C, White MM, Gilpin EA. Does tobacco marketing undermine the influence of recommended parenting in discouraging adolescents from smoking? *Am J Prev Med* 2002; **23**: 73–81.
- 9 BRFSS Coordinators. Projected smoking-related deaths among youth—United States. *MMWR Morb Mortal Wkly Rep* 1996; **45**: 971–74.
- 10 Glantz S. Smoke free movies: the solution. 2003: <http://www.smokefreemovies.ucsf.edu/solution> (accessed June 5, 2003).
- 11 Glantz S. Rate movies with smoking “R”. *Eff Clin Pract* 2002; **5**: 31–34.
- 12 Fichtenberg CM, Glantz SA. Youth access interventions do not affect youth smoking. *Pediatrics* 2002; **109**: 1088–92.
- 13 Ling PM, Landman A, Glantz SA. It is time to abandon youth access tobacco programmes. *Tob Control* 2002; **11**: 3–6.

Note: 1080 should be 1070 and 330 should be 535 on the previous page.