



Effect of seeing tobacco use in films on trying smoking among adolescents: cross sectional study

James D Sargent, Michael L Beach, Madeline A Dalton, Leila A Mott, Jennifer J Tickle, M Bridget Ahrens and Todd F Heatherton

BMJ 2001;323:1394-
doi:10.1136/bmj.323.7326.1394

Updated information and services can be found at:
<http://bmj.com/cgi/content/full/323/7326/1394>

These include:

References

This article cites 22 articles, 6 of which can be accessed free at:
<http://bmj.com/cgi/content/full/323/7326/1394#BIBL>

17 online articles that cite this article can be accessed at:
<http://bmj.com/cgi/content/full/323/7326/1394#otherarticles>

Rapid responses

3 rapid responses have been posted to this article, which you can access for free at:
<http://bmj.com/cgi/content/full/323/7326/1394#responses>

You can respond to this article at:
<http://bmj.com/cgi/eletter-submit/323/7326/1394>

Email alerting service

Receive free email alerts when new articles cite this article - sign up in the box at the top right corner of the article

Topic collections

Articles on similar topics can be found in the following collections

[Smoking](#) (965 articles)
[Adolescents](#) (420 articles)
[Other Pediatrics](#) (1689 articles)

Notes

To order reprints of this article go to:
<http://www.bmjournals.com/cgi/reprintform>

To subscribe to *BMJ* go to:
<http://bmj.bmjournals.com/subscriptions/subscribe.shtml>

Effect of seeing tobacco use in films on trying smoking among adolescents: cross sectional study

James D Sargent, Michael L Beach, Madeline A Dalton, Leila A Mott, Jennifer J Tickle, M Bridget Ahrens, Todd F Heatherton

Abstract

Objective To test the hypothesis that greater exposure to smoking in films is associated with trying smoking among adolescents.

Design Cross sectional survey of 4919 schoolchildren aged 9-15 years, and assessment of occurrence of smoking in 601 films.

Setting Randomly selected middle schools in Vermont and New Hampshire, USA.

Main outcome measure Number of schoolchildren who had ever tried smoking a cigarette.

Results The films contained a median of 5 (interquartile range 1-12) occurrences of smoking. The typical adolescent had seen 17 of 50 films listed. Exposure to smoking in films varied widely: median 91 (49-152) occurrences. The prevalence of ever trying smoking increased with higher categories of exposure: 4.9% among students who saw 0-50 occurrences of smoking, 13.7% for 51-100 occurrences, 22.1% for 101-150, and 31.3% for > 150. The association remained significant after adjustment for age; sex; school performance; school; parents' education; smoking by friend, sibling, or parent; and receptivity to tobacco promotions. The adjusted odds ratios of ever trying smoking for students in the higher categories of exposure, compared with students exposed to 0-50 occurrences of smoking in films, were 1.7 (95% confidence interval 1.2 to 2.4), 2.4 (1.7 to 3.4), and 2.7 (2.0 to 3.8). These odds ratios were not substantially affected by adjustment for parenting style or for personality traits of the adolescent.

Conclusion In this sample of adolescents there was a strong, direct, and independent association between seeing tobacco use in films and trying cigarettes, a finding that supports the hypothesis that smoking in films has a role in the initiation of smoking in adolescents.

Introduction

Adolescents start smoking in response to social influences, emulating the behaviour of friends, family members, and other people they admire.¹ The influence of smoking by friends and family members has been extensively studied, but less attention has been given to influences of the media other than

tobacco advertising. Yet the typical adolescent spends 2-3 hours per day watching television and films.²⁻⁴

Movie channels and home videos have greatly increased children's access to films.³⁻⁵ A recent survey found that American adolescents watch an average of three films a week (150 a year).² Although cigarette smoking is infrequent on primetime television,⁶ it is depicted in almost all films.⁷⁻¹⁰ Adolescents see film stars smoking in the context of sexuality (Sharon Stone in *Basic Instinct*), toughness (John Travolta in *Broken Arrow*), romance (Charlie Sheen in *The Chase*), and adolescent rebellion (Leonardo DiCaprio in *Romeo and Juliet*) and as a way to relieve stress (Winona Ryder in *Girl Interrupted*).¹¹ Not surprisingly, smoking by adolescents' favourite film stars has been linked with smoking among adolescents.^{12 13}

The movie industry has been criticised for its depictions of smoking on screen,⁹⁻¹⁶ but industry representatives are typically sceptical that viewing smoking influences behaviour.¹⁷ Refuting this response has been difficult because no studies have empirically tested the hypothesis that exposure to tobacco use in films is associated with smoking in adolescents. To inform this debate we carried out a cross sectional survey to evaluate young adolescents' exposure to smoking in films and its association with having tried cigarettes. The study was approved by the human subjects committee at Dartmouth College.

Methods

Recruitment of sample—We sent letters to 30 randomly selected middle schools in New Hampshire and Vermont with at least 150 students (fig 1). Half the schools agreed to participate. The socioeconomic profiles of participating and non-participating schools did not differ. About half (52%) of the schools were in rural communities of less than 10 000 residents. In September 1999 proctors administered the confidential survey during class time (parents were informed by mail beforehand). The average participation by school was 92.5%; 128 (2.1%) parents or students refused participation, and 380 (6.3%) students were absent. We excluded 571 surveys for missing (n=565) or inconsistent (n=15) responses. Excluded students were likely to be younger (for example, fifth grade), to report poorer school performance, and to have seen

Department of Pediatrics, Dartmouth Medical School, One Medical Center Drive, Lebanon, NH 03756, USA

James D Sargent
associate professor
Madeline A Dalton
research assistant professor
M Bridget Ahrens
program manager

Department of Anesthesia, Dartmouth Medical School

Michael L Beach
associate professor

Department of Community and Family Medicine, Dartmouth Medical School

Leila A Mott
senior analyst

Department of Psychological and Brain Sciences, Dartmouth College, Hanover, NH 03755, USA

Todd F Heatherton
professor

Jennifer J Tickle
program manager

Correspondence to: J D Sargent
James.D.Sargent@Hitchcock.org

BMJ 2001;323:1-6

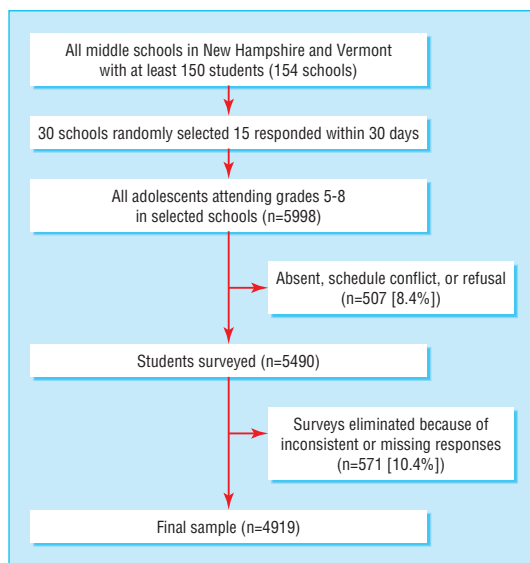


Fig 1 Selection of student sample

fewer films than those with usable surveys, but smoking behaviour did not differ between included and excluded students.

Exposure to smoking in films—Figure 2 illustrates our procedure for determining exposure to smoking in films. We counted occurrences of smoking in each of 601 popular contemporary films. We estimated exposure to these films by asking respondents whether they had seen 50 films randomly selected from the larger pool. On the basis of the films that adolescents reported seeing, we calculated the number of occurrences of smoking seen by each survey respondent.

Primary outcome—We determined whether students had ever tried smoking by asking the question “How many cigarettes have you smoked in your life?” We cat-

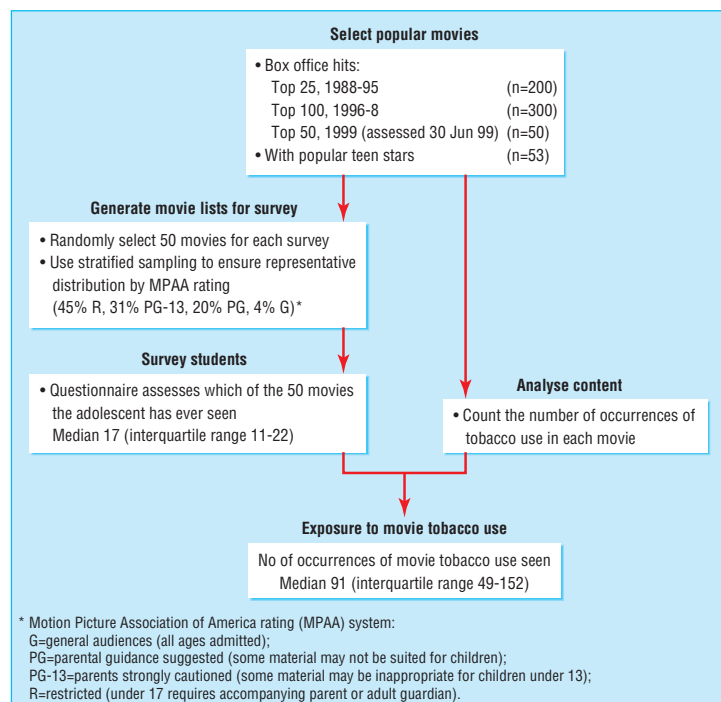


Fig 2 Assessment of exposure to tobacco use in movies

egorised a response of none as “never smoked” and all other responses (just a few puffs, 1-19 cigarettes, 20-100 cigarettes, > 100 cigarettes) as “tried smoking.”

Potential confounders—We measured the following categories of factors that might be associated with trying smoking: sociodemographic characteristics (for example, school, age, sex, parents’ education), social influences (parent smoking, sibling smoking, friend smoking, receptivity to tobacco promotions¹⁸⁻¹⁹), and other characteristics of the child and family (self reported school performance, propensity to sensation seeking,²⁰⁻²¹ rebelliousness,²² self esteem,²³ two measures of authoritative parenting,²⁴ and students’ perception of parental disapproval of smoking). We measured reliability by using Cronbach’s α .²⁵ Table 1 lists the questions used in the survey to assess these variables, with their reliability.

Validity of responses to film questions—To evaluate the validity of adolescents’ recollection of films they had seen, we re-contacted 49 adolescents who had participated in a longitudinal study in which they reported each month the films they had seen in the past week. Adolescents had excellent recognition of the films they reported seeing during the previous year, identifying films correctly 88% of the time. In addition, the adolescents rarely reported seeing false film titles with false actors (3.0%) or false film titles with real actors (2.7%).

Statistical analysis—We used the χ^2 test or analysis of variance to evaluate the association between trying smoking and each of the confounding variables. We used logistic regression to determine the crude odds ratios, adjusted odds ratios, and 95% confidence intervals. Firstly, we used a crude model in which exposure to smoking in films was entered as four categories that corresponded to fourths of exposure in the student population. Next, we added controls for socio-demographic characteristics only. Then we added social influence variables, and finally we added other characteristics of the child and family. Age and indexed variables (sensation seeking, rebelliousness, self esteem, and the authoritative parenting measures) were entered as continuous variables. We did not include the number of R rated (restricted) films seen as a covariate because of its high correlation with occurrences of tobacco use ($r=0.89$). All tests were considered significant at the 0.05 level.

Sensitivity analysis—We conducted a sensitivity analysis to determine whether an unmeasured confounder could explain our results.²⁶ We considered the effect of adding a missing confounder (independent of other covariates) on the relation between seeing tobacco use in films and smoking in adolescents. The results of this analysis indicate how strongly an unmeasured confounder would have to be associated with exposure and outcome in order to lead to false reporting of an association.

Results

Characteristics of the sample—The ages of the 4919 adolescents ranged from 9 to 15 years. Younger adolescents were under-represented because some schools did not include grade 5 (table 2). The students were primarily white, and most reported that their parents had completed high school. Thirty nine per cent

Table 1 Measures for characteristics of child and parenting

Variable	Questions	Responses
School performance	How would you describe your grades last year?	Excellent Good average Below average
Sensation seeking (6 item index, range 0-18, Cronbach's $\alpha=0.69$)	I like to do scary things I get bored being with the same friends all the time I would like to try drinking alcohol or beer I like to do dangerous things I often think there is nothing to do I like to listen to loud music	Not like me Sort of like me A lot like me Just like me
Rebelliousness (7 item index, range 0-21, Cronbach's $\alpha=0.73$)	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	Not like me Sort of like me A lot like me Just like me
Self esteem (8 item index, range 0-24, Cronbach's $\alpha=0.74$)	I will be successful when I grow up I wish I was someone else I like myself the way I am I am happy with how I look I wish I was better looking I worry that other kids don't like me I feel tired all the time I often feel sad	Not like me Sort of like me A lot like me Just like me
Authoritative parenting: responsive (4 item index, range 0-12, Cronbach's $\alpha=0.77$)	She makes me feel better when I am upset She listens to what I have to say She is too busy to talk to me She wants to hear about my problems	Not like her Sort of like her A lot like her Just like her
Authoritative parenting: demanding (4 item index, range 0-12, Cronbach's $\alpha=0.60$)	She has rules that I must follow 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	Not like her Sort of like her A lot like her Just like her
Parental disapproval of smoking	If you were smoking cigarettes and your mother knew about it, what would she say? If you were smoking cigarettes and your father knew about it, what would he say?	She (he) would tell me to stop She (he) would not tell me to stop Don't know Don't have a mother (father) or stepmother (stepfather)

had at least one parent who smoked, and 37% had friends who smoked. Overall, 17.5% of adolescents had tried smoking, and trying smoking was significantly associated with all the variables in table 2 (all $P \leq 0.01$).

Smoking in films—The 601 films included 23 films rated G, 120 rated PG, 186 rated PG-13, and 272 rated R (see fig 2 for explanation of ratings). The number of occurrences of smoking increased by rating, with medians of 1 in films rated G, 3 in films rated PG, 4 in films rated PG-13, and 8.5 in films rated R. The difference was significant only for R rated films (only two of these films contained no smoking).⁷ Only 10% of films rated PG or PG-13 contained no smoking.

Exposure to smoking in films—On average, adolescents had seen 17 of the 50 films on their list, which translated to a median "exposure" of 91 occurrences of smoking (interquartile range 49-152). Exposure to smoking in films was strongly and significantly associated with all of the risk factors for smoking (all $P < 0.001$). Exposure increased with age and was higher for boys (boys averaged 126 (SD 88) occurrences of smoking *v* 95 (72) for girls; $P < 0.0001$). Students with poorer school performance had higher exposure to smoking in films, as did those with higher levels of sensation seeking and rebelliousness.

Association between exposure to tobacco use and trying smoking—The cut-off values used to group exposure to smoking in films for further analysis were 0-50 occurrences (26.4% of the student sample), 51-100 (28.7%), 101-150 (19.5%), and > 150 (25.4%). Table 2 shows that the proportion of adolescents who had tried smoking increased with higher categories of exposure to tobacco use in films. As illustrated in figure 3, this association was independent of age (test for trend $P < 0.0001$

for each age group). For example, 9-11 year olds in the highest category of exposure to movie tobacco use had the same prevalence of trying smoking as 14-15 year olds in the lowest exposure category.

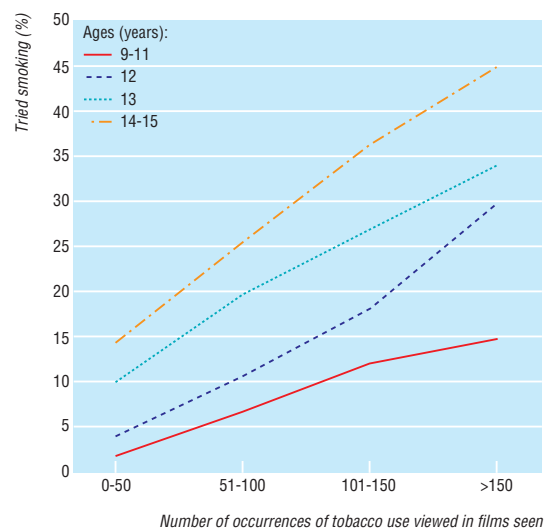
Multivariate association—Adolescents with higher exposure to tobacco use in films had a significantly higher odds of trying smoking (table 3). Although adjustment for sociodemographic factors and social influences weakened these associations, the odds ratios were unchanged when other characteristics were added, suggesting very little confounding by personality and parenting characteristics. Our final model included all covariates; those that had a significant association with trying smoking included age; parents' education; school; smoking by friends, siblings, or parents; school performance; sensation seeking; rebelliousness; and receptivity to tobacco promotions. The effect of moving to a higher category of exposure to movie smoking was similar to the effect of having parents who smoke (odds ratio 1.5) or siblings who smoke (1.9). The results did not change when exposure to smoking in films was entered as a continuous or log transformed variable. The association between seeing smoking in films and trying smoking was significantly weaker for adolescents whose parents smoked.

Sensitivity analysis—An unmeasured covariate would be unlikely to change our findings. With a dichotomous film variable (below median exposure *v* above median exposure), the product of the odds ratio for the association between an unmeasured covariate and smoking in films with the odds ratio for the unmeasured covariate and adolescent smoking would have to be ≥ 22 to invalidate our results. For the strongest measured confounder (friend smoking) this

Table 2 Association of trying smoking with other variables. Values are numbers (percentages) unless stated otherwise

	Total sample	Ever tried smoking	P value
Total	4919 (100.0)	861 (17.5)	
Exposure to smoking in movies			
Occurrences of tobacco use in movies seen:			
0-50	1296 (26.4)	64 (4.9)	<0.0001
51-100	1412 (28.7)	194 (13.7)	
101-150	960 (19.5)	212 (22.1)	
>150	1251 (25.4)	391 (31.3)	
Sociodemographics			
Sex:			
Male	2427 (49.3)	460 (19.0)	0.01
Female	2492 (50.7)	401 (16.1)	
Age (years):			
9-11	1434 (29.2)	104 (7.3)	<0.0001
12	1464 (29.8)	212 (14.5)	
13	1524 (31.0)	375 (24.6)	
14-15	497 (10.1)	170 (34.2)	
Parents' education:			
Neither graduated from high school	257 (5.2)	92 (35.8)	<0.001
One graduated from high school	847 (17.2)	238 (28.1)	
Both graduated from high school	3815 (77.6)	531 (13.9)	
Social influences			
At least one parent smokes:			
No	3004 (61.3)	332 (11.1)	<0.001
Yes	1896 (38.7)	527 (27.8)	
Any siblings smoke:			
No	4133 (84.3)	564 (13.7)	<0.0001
Yes	769 (15.7)	293 (38.1)	
Any friends smoke:			
No	3053 (62.9)	131 (4.3)	<0.0001
Yes	1804 (37.1)	721 (40.0)	
Receptive to tobacco promotions:			
No	3727 (76.1)	439 (11.8)	<0.001
Yes	1170 (23.9)	418 (35.7)	
Other characteristics of child and parenting			
School performance:			
Excellent	1769 (36.0)	137 (7.7)	<0.0001
Good	1839 (37.5)	270 (14.7)	
Average or below average	1303 (26.5)	453 (34.8)	
Sensation seeking behaviour:			
Lowest third	1847 (38.0)	109 (5.9)	<0.0001
Middle third	1466 (30.2)	211 (14.4)	
Highest third	1542 (31.8)	526 (34.1)	
Rebelliousness:			
Lowest third	1176 (24.2)	38 (3.2)	<0.0001
Middle third	1991 (41.0)	194 (9.7)	
Highest third	1694 (34.9)	615 (36.3)	
Self esteem:			
Lowest third	1484 (30.7)	402 (27.1)	<0.001
Middle third	1789 (37.1)	285 (15.9)	
Highest third	1555 (32.2)	160 (10.3)	
Authoritative parenting (responsive):			
Lowest third	1619 (33.5)	419 (25.9)	<0.001
Middle third	1817 (37.6)	272 (15.0)	
Highest third	1401 (29.0)	152 (10.9)	
Authoritative parenting (demanding):			
Lowest third	1379 (28.6)	337 (24.4)	<0.001
Middle third	1812 (37.6)	291 (16.1)	
Highest third	1625 (33.7)	212 (13.1)	
Parental disapproval of smoking:			
Neither disapproves	98 (2.0)	51 (52.0)	<0.0001
Don't know or mixed messages	1001 (20.5)	254 (25.4)	
Both disapprove	3778 (77.5)	550 (14.6)	

product was 11.2, making such an important unmeasured covariate very unlikely.

**Fig 3** Association between exposure to use of tobacco in films and prevalence of trying smoking by age

Discussion

We found a strong, direct, independent association between higher exposure to tobacco use in films and smoking in adolescents. The magnitude of the association suggests that influence from films is as strong as other kinds of social influence, such as smoking by a parent or sibling. These results extend the findings of cross sectional studies showing that adolescents whose favourite film stars smoke are more likely to smoke themselves^{12 13} and those of a study that showed that seeing smoking in just one film may affect attitudes to smoking.²⁷

Exposure to tobacco use

Among these adolescents the exposure to smoking in films was high—almost half of the students had seen 100 or more depictions of tobacco use in the films on their list. Yet this represents only a small portion of the films these adolescents have seen. Many had seen films that were released when they were infants (for example, half of the 460 students asked about the 1988 movie *Die Hard* had seen it), which shows how home viewing of videotapes has expanded film options for adolescents. A typical adolescent watching 150 films a year will be exposed to about 800 depictions of smoking. Given this high level of exposure to films, the typical adolescent could see more smoking in films than in the real world. In addition, movie tobacco use has greater relevance to adolescents than smoking in the real world. Adolescents whose parents smoke were less responsive to the influence of films, possibly because seeing their parents smoking gave them a more reality based perception of cigarette smoking.

Limitations of the study

Exposure to smoking in films is highly correlated with watching adult movies (R rated films). Children more likely to see R rated films may be more likely to smoke, regardless of exposure to smoking in films. This is unlikely to explain our finding, as controlling for personality traits such as sensation seeking and parenting factors had little effect on our findings.

Table 3 Odds ratios (95% CI) for trying cigarettes by selected characteristics

Occurrences of tobacco use in movies seen	Adjusted odds ratio			
	Crude odds ratio (n=4919)	Sociodemographic factors* (n=4919)	Sociodemographic factors and social influences† (n=4815)	Sociodemographic factors, social influences, and characteristics of child and parenting‡ (n=4569)
0-50	1	1	1	1
51-100	3.1 (2.3 to 4.1)	2.4 (1.8 to 3.3)	1.7 (1.2 to 2.4)	1.9 (1.3 to 2.7)
101-150	5.5 (4.1 to 7.3)	4.0 (2.9 to 5.4)	2.4 (1.7 to 3.4)	2.6 (1.8 to 3.7)
>150	8.8 (6.6 to 11.6)	6.1 (4.5 to 8.1)	2.7 (2.0 to 3.8)	2.5 (1.7 to 3.5)

*Age, sex, parents' education, and school.

†Friend smoking, sibling smoking, parent smoking, receptivity to tobacco promotions.

‡School performance, propensity to sensation seeking, rebelliousness, self esteem, two measures of authoritative parenting, and perception of parental disapproval of smoking.

Another possibility is that other aspects of R rated films (besides the tobacco content) are associated with smoking. The occurrence of smoking in R rated films is so common that it may not be possible to separate out the independent effects of tobacco use (almost all R rated films distributed over the past decade contain smoking).⁷ None the less, we believe that the most theoretically reasonable explanation for the association is exposure to smoking in films.

Our study has other limitations. Its generalisability is limited, as adolescents from urban areas and minority ethnic groups were not included. The findings need to be confirmed in other adolescents in the United States and in other countries (as films are distributed internationally).²⁸ As cross sectional studies cannot determine the temporal sequence of events, prospective studies are needed to show whether seeing tobacco use in films precedes smoking. This study should not be interpreted by itself as evidence that watching tobacco use in films causes smoking—the results are the first step towards determining causation.

Conclusions

We developed a survey method that allowed us to obtain population based estimates of exposure to smoking in films and tested it in a sample of rural American adolescents. The results indicate that exposure to tobacco use in films is pervasive. More importantly, such exposure is associated with trying smoking, which supports the hypothesis that films have a role in the initiation of smoking.

What is already known on this topic

Smoking is often depicted in films, and watching films is a favourite activity of adolescents

Adolescents whose favourite actors smoke in films are more likely to have tried smoking

What this study adds

Adolescents' exposure to smoking in films varies widely

Adolescents with higher exposure are significantly more likely to have tried smoking, even when other factors linked with adolescent smoking have been taken into account

This study supports the hypothesis that depictions of smoking in films influence adolescents to smoke

We thank Dan Nassau and Ezra Hays for coding the films, Susan Martin for her assistance in conducting the surveys and preparing the manuscript, and Lisa Schwartz and Steve Woloshin for their editorial comments.

Contributors: JDS developed the idea for the study, led the investigative team, and is primary author of the paper. MLB had the idea for the survey method and directed the statistical analysis. MAD provided critical input for all aspects of the study and was responsible for survey development and data management. LAM developed the presentation of the data and conducted the analysis. MBA developed the personality trait and parenting measures, carried out the survey work, and directed data entry. TFH developed the behaviour theory underlying the study and supervised the analysis of movie content. JTT managed the content analysis and gave careful thought to measurement of tobacco use exposure. The paper was written jointly by all authors. JDS will act guarantor.

Funding: National Cancer Institute grant CA-77026.

Competing interests: None declared.

- Lynch B, Bonnie R. *Growing up tobacco free—preventing nicotine addiction in children and youths. A report of the Institute of Medicine.* Washington, DC: National Academy Press, 1994.
- Rideout VJ, Foehr UG, Roberts DF, Brodie M. *Kids and media at the new millennium: a comprehensive national analysis of children's media use.* Menlo Park, CA: Kaiser Family Foundation, 1999.
- Strasburger VC, Donnerstein E. Children, adolescents, and the media in the 21st century. *Adolesc Med* 2000;11:51-68.
- Roberts DF. Media and youth: access, exposure, and privatization. *J Adolesc Health* 2000;27(suppl):8-14.
- Krugman DM, Sharp SA, Johnson KE. Video movies at home: are they viewed like film or like television? *Journalism Quarterly* 1991;68:1-2.
- Christenson PG, Henriksen L, Roberts DF. *Substance use in popular prime-time television.* Washington, DC: Office of National Drug Control Policy, 2000.
- Dalton MA, Tickle JJ, Sargent JD, Beach M, Ahrens B, Heatherton TF. The incidence and context of tobacco use in popular movies from 1988-1997. *Prev Med* (in press).
- Roberts DF, Henriksen L, Christenson PG. *Substance use in popular movies and music.* Washington, DC: Office of National Drug Control Policy, 1999.
- Russo Hazan A, Levens Lipton H, Glantz SA. Popular films do not reflect current tobacco use. *Am J Public Health* 1994;84:998-1000.
- Everett SA, Schnuth RL, Tribble JL. Tobacco and alcohol use in top-grossing American films. *J Community Health* 1998;23:317-24.
- McCool JP, Cameron LD, Petrie KJ. Adolescent perceptions of smoking imagery in film. *Soc Sci Med* 2001;52:1577-87.
- Distefan JM, Gilpin E, 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 T. Favourite movie stars, their tobacco use in contemporary movies and its association with adolescent smoking. *Tob Control* 2001;10:16-22.
- Chapman S, Davis RM. Smoking in movies: is it a problem? *Tob Control* 1997;6:269-71.
- Goldstein AO, Sobel RA, Newman GR. Tobacco and alcohol use in G-rated children's animated films. *JAMA* 1999;281:1131-6.
- 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;23:395-8.
- Shields DL, Carol J, Balbach ED, McGee S. Hollywood on tobacco: how the entertainment industry understands tobacco portrayal. *Tob Control* 1999;8:378-86.
- Pierce JP, Choi WS, Gilpin EA, Farlos AJ, Berry CC. Tobacco industry promotion of cigarettes and adolescent smoking. *JAMA* 1998;279:511-5.
- Sargent JD, Dalton M, Beach M, Bernhardt A, Heatherton T, Stevens M. Effect of cigarette promotions on smoking uptake among adolescents. *Prev Med* 2000;30:320-7.
- 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.

- 21 Russo MF, Stokes GS, Lahey BB, Christ MA, McBurnett K, Loeber R, et al. A sensation seeking scale for children: further refinement and psychometric development. *J Psychopathol Behav Assess* 1993;15:69-85.
- 22 Pierce J, Farkas A, Evans N. *Tobacco use in California 1992: a focus on preventing uptake in adolescents*. Sacramento, CA: California Department of Human Services, 1993.
- 23 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 Adolescent Health* 2000;27:255-65.
- 24 Jackson C, Henriksen L, Foshee VA. The authoritative parenting scale: predicting health risk behaviors among adolescents. *Health Educ Behav* 1998;25:319-37.
- 25 Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika* 1951;16:297-334.
- 26 Lin DY, Psaty BM, Kronmal RA. Assessing the sensitivity of regression results to unmeasured confounders in observational studies. *Biometrics* 1998;54:948-63.
- 27 Pechmann C, Shih CF. Smoking scenes in movies and antismoking advertisements before movies: effects on youth. *J Marketing* 1999;63(3): 1-13.
- 28 Sargent JD, Tickle JJ, Beach ML, Dalton MA, Ahrens MB, Heatherton TF. Brand appearances in contemporary cinema films and contribution to global marketing of cigarettes. *Lancet* 2001;357:29-32.

(Accepted 29 August 2001)