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

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ABSTRACT

Objectives: To examine the concurrent effects of exposure to movie smoking and tobacco marketing receptivity on adolescent smoking onset and progression.

Methods: Cross-sectional study of 4524 northern New England adolescents aged 10–14 in 1999 with longitudinal follow-up of 2603 baseline never-smokers. Cross-sectional outcomes included ever tried smoking and higher level of lifetime smoking among 784 experimenters. The longitudinal outcome was onset of smoking among baseline never-smokers two years later. Movie smoking exposure was modelled as four population quartiles, tobacco marketing receptivity included two levels—having a favourite tobacco advert and wanting/owning tobacco promotional items. All analyses controlled for sociodemographics, other social influences, personality characteristics of the adolescent and parenting style.

Results: In the full cross-sectional sample, 17.5% had tried smoking; both exposure to movie smoking and receptivity to tobacco marketing were associated with having tried smoking. Among experimental smokers, the majority (64%) were receptive to tobacco marketing, which had a multivariate association with higher level of lifetime smoking (movie smoking did not). In the longitudinal study 9.5% of baseline never-smokers tried smoking at follow-up. Fewer never-smokers (18.5%) were receptive to tobacco marketing. Movie smoking had a multivariate association with trying smoking (receptivity to tobacco marketing did not).

Conclusions: The results suggest separate roles for entertainment media and tobacco marketing on adolescent smoking. Both exposures deserve equal emphasis from a policy standpoint.

There is a large body of evidence showing an association between various forms of tobacco marketing and youth smoking.¹ This literature provides the basis for public health campaigns to limit tobacco advertising through voluntary agreements like the Master Settlement Agreement,² regulation by the US Food and Drug Administration, and advocacy efforts through non-governmental organisations. Research assessing the relation between smoking in entertainment media and youth smoking has also resulted in a body of evidence that supports an association between exposure to smoking in movies and smoking onset and forms the basis for a developing public health campaign aimed at the movie industry. Recently, the National Cancer Institute determined that the association between both exposures (tobacco marketing and smoking in movies) and adolescent smoking was causal.³ Because the tobacco and movie industries represent clearly distinguishable sources of pro-smoking

messages, an open question is, “What are the respective roles played by tobacco marketing (for which the tobacco industry is responsible) and entertainment media smoking (for which media conglomerates are responsible) in encouraging adolescents to smoke?” Few studies of adolescents have examined both media exposures at the same time. None, to our knowledge, has attempted to separate the effect of each on trying cigarettes from their effects on progression to established smoking, a distinction that is likely to be important for smoking prevention interventions.

The appropriate comparison requires measurement methods that effectively capture each media exposure; fortunately, well-validated measures exist for both. Receptivity to tobacco marketing has a particularly robust track record in showing effects on adolescent smoking. Such research examines the extent to which the adolescent has been exposed to a tobacco marketing message, has paid attention to that message and had a cognitive or affective response to it.⁴ Pierce and colleagues operationalised this measure, emphasising cognitive response by asking adolescents if they could remember the brand of the cigarette ad that was advertised most (low receptivity), if they could name the brand of their favourite cigarette advert or the one that most attracted their attention (moderate receptivity), or whether they owned (or were willing to wear) tobacco-branded merchandise (high receptivity).⁵ Their longitudinal study of California adolescents found a dose-response relation between higher levels of tobacco marketing receptivity and higher levels of smoking at follow-up.⁶ One cross-sectional study of 5870 young adolescents conducted a factor analysis on multiple measures of tobacco marketing⁷ and found four distinct constructs—perceived pervasiveness of pro-tobacco marketing, perceived pervasiveness of anti-tobacco marketing, recognition of specific anti-tobacco advertisements and receptivity to tobacco marketing (using items similar to Pierce *et al*). Of all the measures, receptivity to tobacco marketing showed the strongest association with higher levels of smoking. Receptivity to tobacco marketing items, used singly and in combination, has been independently linked to adolescent smoking in other cross-sectional^{8–15} and longitudinal studies.^{16–22}

Exposure to smoking in movies has also been linked with adolescent smoking. In an initial study, smoking status of an adolescent’s favourite movie star was linked to attitudes and smoking behaviour.^{23–25} Assessment of exposure to movie smoking using the Beach method,²⁶ in which a sample of popular contemporary movies is content coded and

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adolescents queried about whether or not they have seen movie titles, has successfully linked this media exposure with adolescent smoking in cross-sectional²⁶⁻³⁰ and longitudinal studies.³¹⁻³⁴ In other studies, the effect of exposure to movie smoking on behaviour was shown to be mediated through attitudes towards smoking³⁵ and smoking status of peers.^{36 37}

The aim of this report is to compare the effects of receptivity to tobacco marketing and exposure with movie smoking on two outcomes separately—smoking onset and progression to established smoking.

METHODS

A school-based cross-sectional study was undertaken in September 1999 in 15 New Hampshire and Vermont middle schools. The never-smokers in this study were subsequently followed up 1–2 years later by telephone. The details of study recruitment²⁶ and follow-up³¹ have been previously published. Schools were randomly selected from all middle schools in these states; half of schools that were approached participated. Among schools, the average pupil participation rate was

92.5%. Students were recruited through a passive consent procedure, in which letters were sent to parents informing them of the survey and verbal consent was obtained from students after assurance of confidentiality. In all, 128 (2.1%) parents or students refused participation and 380 (6.3%) students were absent the day of the survey for a total of 5998, of whom 4524 had complete data for all variables included in this analysis. Students were asked to supply their telephone number on the baseline survey; never-smokers who supplied their home phone number (n = 3547) were eligible for follow-up, and 2603 were successfully contacted and had complete data for all variables in this analysis. Baseline smokers were not followed up because of financial constraints. Both the cross-sectional and longitudinal study samples were primarily (>90%) white, with equal representation of girls and boys. The middle schools covered 5th through 8th grades and student ages ranged from 9 to 15 years at baseline. In 75% of households, both parents were high school educated; at follow-up, this percentage increased to 86%, reflecting higher attrition for poor families.

Table 1 Cross-sectional multivariate model for ever tried smoking (n = 4524)

Variable*	Category	No	% Ever tried smoking (%)	Adjusted relative risk (95% CI)
Receptivity to tobacco marketing	No receptivity	3306	(9.4)	Reference
	Moderate receptivity	144	(63.2)	2.21 (1.80 to 2.72)
	High receptivity	1074	(35.5)	1.34 (1.16 to 1.54)
Movie smoking exposure	First quartile	1156	(4.2)	Reference
	Second quartile	1114	(13.1)	1.64 (1.25 to 2.17)
	Third quartile	1129	(20.7)	1.93 (1.48 to 2.52)
	Fourth quartile	1125	(31.6)	2.00 (1.54 to 2.61)
Child gender	Male	2230	(18.7)	Reference
	Female	2294	(16.0)	1.08 (0.94 to 1.22)
Child age	10–11 years	1276	(7.1)	Reference
	12 years	1350	(14.4)	1.45 (1.17 to 1.80)
	13–14 years	1898	(26.3)	1.67 (1.37 to 2.04)
Parent education	Both completed high school	3564	(14.0)	Reference
	Neither/one completed high school	960	(29.8)	1.22 (1.06 to 1.39)
Parent or sibling smokes	No	2536	(9.1)	Reference
	Yes	1988	(27.8)	1.39 (1.21 to 1.60)
Any friends smoke	No	2842	(4.4)	Reference
	Yes	1682	(39.2)	3.49 (2.91 to 4.19)
School performance	Excellent	1649	(7.8)	Reference
	Good	1700	(14.8)	1.05 (0.87 to 1.26)
	Average/below average	1175	(34.5)	1.22 (1.02 to 1.47)
Sensation seeking	Lowest third	1721	(5.9)	Reference
	Middle third	1365	(14.4)	1.17 (0.95 to 1.44)
	Highest third	1438	(33.8)	1.34 (1.09 to 1.65)
Rebelliousness	Lowest third	1110	(3.2)	Reference
	Middle third	1868	(9.9)	1.78 (1.30 to 2.43)
	Highest third	1546	(36.5)	2.94 (2.14 to 4.05)
Self-esteem	Lowest third	1377	(26.7)	Reference
	Middle third	1680	(16.1)	0.96 (0.83 to 1.10)
	Highest third	1467	(10.0)	0.91 (0.76 to 1.09)
Maternal demandingness	Lowest third	1272	(24.3)	Reference
	Middle third	1717	(16.1)	0.98 (0.85 to 1.13)
	Highest third	1535	(12.9)	0.96 (0.82 to 1.13)
Maternal responsiveness	Lowest third	1505	(25.7)	Reference
	Middle third	1702	(14.7)	1.02 (0.89 to 1.18)
	Highest third	1317	(11.1)	1.03 (0.86 to 1.23)
Parental disapproval of smoking	Both disapprove	3467	(14.0)	Reference
	Mixed/mixed disapproval	1057	(28.2)	1.12 (0.98 to 1.28)

*The analysis includes school as a covariate.

Smoking outcomes

Smoking status was assessed at the baseline and follow-up surveys according to responses to the following question: "How many cigarettes have you smoked in your life?" (responses included "None", "Just a few puffs", "One to 19 cigarettes (less than one pack)", "20 to 100 cigarettes (one to five packs)", "More than 100 cigarettes (more than five packs)". For the analysis of smoking onset, the outcome variable was dichotomised to 0 for "None" and 1 otherwise. For the cross-sectional analysis of smoking progression level among smokers, the ordinal variable was 0 for "Just a few puffs" and one higher for each higher category of lifetime smoking.

Predictor variables

The tobacco marketing variable drew on the receptivity of tobacco marketing construct, using a 0–2 index.⁷ Adolescents were considered intermediate with respect to tobacco marketing receptivity if they provided a tobacco brand in response to the following open-ended question, "What is the name of the brand of your favourite cigarette advertisement (if you don't have one, write "none")". Adolescents were defined to be at the highest level of receptivity if they said "yes" to either of the following questions, "Do you own something that has the name of a cigarette brand on it, like a T-shirt, a backpack or a hat?" and "Would you use or wear something that has the name of a cigarette brand on it, like a T-shirt, a backpack or a hat?" At the time of the survey, 1999, the distribution of tobacco-branded merchandise had only just been limited by the Master Settlement Agreement, so many Joe Camel and Marlboro Miles items were still in circulation.

The movie smoking exposure variable involved a two-stage assessment of exposure to movie smoking (Beach method), in which smoking was assessed in 601 popular contemporary movies and each adolescent was asked whether he had seen each of a randomly assigned list of 50 movie titles.³⁸ Based on the movies the adolescent had seen and the amount of smoking in each, the adolescent's exposure to movie smoking was estimated. To be consistent with the previous studies, this continuous exposure variable was divided into quartiles with the first quartile being the reference group. Notably, this grouping underestimates the population effect of the exposure, because there is a dose-response to movie smoking within the first quartile of exposure.²⁷

Covariates were chosen and modelled in a manner consistent with the previous reports.^{26–31} Covariates included socio-demographic characteristics (school, age, sex, parents' education), social influences (parent smoking, sibling smoking, friend smoking) and other characteristics of the child and family (self-reported school performance, sensation seeking level ("I like to do scary things", six items, $\alpha = 0.69$), rebelliousness ("I argue with my teachers", seven items, $\alpha = 0.73$), self-esteem ("I wish I were someone else", eight items, $\alpha = 0.74$), maternal demandingness ("She has rules that I must follow", four items, $\alpha = 0.60$), maternal responsiveness ("She makes me feel better when I'm upset", four items, $\alpha = 0.77$) and students' perception of parental disapproval of smoking). For regression analyses, the scaled variables were divided into terciles and entered as dummy variables with the lowest tercile being the reference group.

Statistical analysis

Crude relative risks for ever tried smoking were calculated by dividing the proportion of (tried) smokers in the exposed group

by the proportion in the unexposed group. In the full cross-sectional and longitudinal samples, the multivariate association with ever tried smoking was analysed using generalised linear models to assess smoking onset as a function of receptivity to tobacco marketing, movie exposure and baseline covariates. We used a log link, rather than a logistic regression, so that relative risks could be estimated directly. The intraclass correlation coefficient among schools was low, only 0.018, so school was added as a fixed effect. Among experimental smokers in the cross-sectional sample, a multivariate proportional odds model was used to examine associations with a higher level of lifetime smoking. This model gives cumulative odds ratios modelling the probability of being in a higher category of lifetime smoking given the exposure. For all models, results were judged significant if $p < 0.05$, in a two-sided test.

RESULTS

Cross-sectional study, full sample, ever tried smoking outcome

Overall, 17.3% of adolescents had tried smoking. The ever smoking rate for the 144 (3.2%) adolescents with moderate receptivity (those who could name a brand for favourite advertisement) was 63.2% (crude relative risk (RR) = 6.7). Among the 23.7% who were receptive to promotional gear, 35.5% had ever tried smoking (crude RR = 3.8). Ever-tried smoking rates increased from 4.2% in the lowest quartile of movie smoking exposure to 13.1, 20.7 and then 31.6% for crude RRs of 3.1, 4.9 and 7.5 in quartiles 2, 3 and 4, respectively. In the multivariate model, both receptivity to tobacco marketing and exposure to movie smoking had a relation with ever-smoking (table 1). The adjusted relative risks for being receptive to promotional gear were in the same range as those for movie smoking exposure. Other variables that had a significant association with ever-smoking included age, parents' education, school, smoking by friends or family, school performance, sensation seeking, rebelliousness and parental disapproval of smoking.

Cross-sectional study, smoking progression level

Among the 784 adolescents who had tried smoking, 450 (57.4%) were puffers, 150 (19.1%) had smoked one to 19 cigarettes, 76 (9.7%) 20 to 100, and 108 (13.8%) more than 100. As shown in table 2, 91 (11.6%) of experimental smokers were moderately receptive and 381 (48.6%) were highly receptive to tobacco marketing; thus, the majority of experimental smokers were receptive to tobacco marketing. There were more smokers represented in the higher exposure quartiles for movie smoking (exposure quartiles were determined using the entire cross-sectional sample). Among experimental smokers, receptivity to tobacco marketing was associated with a higher level of lifetime smoking; the adjusted proportional odds ratios were 3.54 and 2.47 for moderate and high receptivity, respectively. There was no association between seeing smoking in movies and higher levels of lifetime smoking. Other variables associated with higher levels of lifetime smoking included higher age, family smoking, friend smoking, and higher levels of sensation seeking.

Longitudinal study, progression from never-smoker to ever tried smoking

Some 9.8% of baseline never-smokers tried smoking during the observation period. Few (1.6%) of the baseline never-smokers had moderate levels of receptivity to tobacco marketing (compared with 12.5% of experimental smokers), and there was not a higher percentage who tried smoking at follow-up in

Table 2 Cross-sectional ordinal logistic regression model predicting higher lifetime smoking (n = 794)

Variable	Category	Sample size	Proportional odds ratio (95% CI)	
			Crude	Adjusted
Receptivity to tobacco marketing	No receptivity	312	Reference	Reference
	Moderate receptivity	91	4.14	3.58 (2.20 to 5.82)
	High receptivity	381	3.06	2.51 (1.76 to 3.58)
Movie smoking (occurrences seen)	First quartile*	49	Reference	Reference
	Second quartile	146	1.10	0.94 (0.44 to 2.01)
	Third quartile	234	1.35	1.03 (0.50 to 2.09)
	Fourth quartile	355	1.70	1.02 (0.50 to 2.07)
Child gender	Male	418	Reference	Reference
	Female	366	0.98	1.11 (0.79 to 1.57)
Child age	10–11 years	91	Reference	Reference
	12 years	194	2.75	2.90 (1.43 to 5.88)
	13–14 years	499	7.03	7.26 (3.73 to 14.14)
Parent education	Both completed high school	498	Reference	Reference
	Neither or one completed high school	286	1.34	1.21 (0.87 to 1.68)
Parent or sibling smokes	No	231	Reference	Reference
	Yes	553	2.12	1.71 (1.18 to 2.48)
Any friends smoke	No	124	Reference	Reference
	Yes	660	3.81	1.82 (1.07 to 3.07)
School performance	Excellent	128	Reference	Reference
	Good	251	1.23	0.88 (0.54 to 1.45)
	Average/below average	405	2.09	1.08 (0.67 to 1.73)
Sensation seeking	Lowest third	101	Reference	Reference
	Middle third	197	1.29	0.92 (0.51 to 1.65)
	Highest third	486	3.47	1.74 (1.02 to 2.98)
Rebelliousness	Lowest third	35	Reference	Reference
	Middle third	185	1.37	0.91 (0.35 to 2.33)
	Highest third	564	3.66	1.45 (0.57 to 3.66)
Self-esteem	Lowest third	368	Reference	Reference
	Middle third	270	0.86	1.14 (0.81 to 1.62)
	Highest third	146	0.64	1.10 (0.69 to 1.74)
Maternal demandingness	Lowest third	309	Reference	Reference
	Middle third	277	0.60	0.74 (0.52 to 1.05)
	Highest third	198	0.63	1.04 (0.68 to 1.58)
Maternal responsiveness	Lowest third	387	Reference	Reference
	Middle third	251	0.59	0.84 (0.59 to 1.22)
	Highest third	146	0.53	0.64 (0.41 to 1.02)
Parental disapproval of smoking	Both disapprove	486	Reference	Reference
	Neither or mixed disapproval	298	1.79	1.36 (0.99 to 1.88)

*Quartiles of exposure were determined on the entire cross-sectional sample, including never-smokers; school is included as a covariate.

this category compared with non-receptives. We checked for attrition bias by assessing moderate receptivity among all 3547 never-smokers eligible for follow-up; some 2.3% were in the moderate receptivity category, so low prevalence was not largely a function of attrition bias. High receptivity was more common, being present in 17.0% of the baseline never-smokers (but still much lower than among the experimental smokers) and this category of receptivity was associated with higher levels of trying smoking (18.1%) compared with non receptive adolescents (8.3%) for a crude relative risk of 2.2. However, high receptivity was not predictive of trying smoking in the multivariate analysis.

In contrast, exposure to movie smoking was strongly predictive of trying cigarettes in a dose-response fashion from 3.5% of adolescents in the first quartile trying smoking to 8.6, 11.4 and 16.5% (crude relative risks 2.6, 3.4 and 4.9) in quartiles 2, 3 and 4, respectively. The dose-response was less clear in the

multivariate analysis because of attenuation of the crude response for quartiles 3 and 4 after adjustment for confounding. However, the adjusted relative risks for higher exposure adolescents were between 2.0 and 2.7, responses comparable to the adjusted relative risks for the other social influence variables. Other variables the predicted trying cigarettes during the observation period included age, parent smoking, gender, family smoking, friend smoking, school performance and rebelliousness.

DISCUSSION

This study is one of the first to examine the comparative impact of entertainment media and tobacco marketing on adolescent smoking, using well-validated measures of each as predictors of onset and progression. In the cross-sectional study, both measures were associated with ever tried smoking. Among experimental smokers, receptivity to tobacco marketing was

Table 3 Longitudinal multivariate model for trying cigarettes during follow-up (n = 2603)

Variable	Category	No	% Ever tried smoking at follow-up	Adjusted relative risk (95% CI)
Receptivity to tobacco marketing	No receptivity	2110	(8.3)	Reference
	Moderate receptivity	41	(7.3)	0.64 (0.22 to 1.87)
	High receptivity	439	(18.2)	1.12 (0.86 to 1.48)
Movie smoking (occurrences seen)	First quartile	651	(3.4)	Reference
	Second quartile	651	(8.6)	2.00 (1.26 to 3.16)
	Third quartile	651	(11.4)	2.19 (1.40 to 3.43)
	Fourth quartile	650	(16.5)	2.70 (1.72 to 4.22)
Age	10–11 years	809	(6.2)	Reference
	12 years	804	(8.5)	1.21 (0.85 to 1.71)
	13–14 years	990	(14.2)	1.62 (1.17 to 2.25)
Gender	Male	1234	(9.6)	Reference
	Female	1369	(10.2)	1.55 (1.21 to 1.99)
Parent education	Both completed high school	2223	(9.3)	Reference
	Neither or one completed high school	380	(13.9)	1.04 (0.77 to 1.40)
Parent or sibling smokes	No	1694	(6.7)	Reference
	Yes	896	(16.3)	1.70 (1.32 to 2.17)
Any friends smoke	No	1932	(7.6)	Reference
	Yes	671	(16.7)	1.13 (0.88 to 1.46)
School performance	Excellent	1113	(4.8)	Reference
	Good	1006	(11.3)	1.75 (1.28 to 2.39)
	Average/below average	484	(19.0)	2.04 (1.44 to 2.89)
Sensation seeking	Lowest third	1160	(5.9)	Reference
	Middle third	577	(9.0)	1.08 (0.76 to 1.52)
	Highest third	866	(16.1)	1.43 (1.05 to 1.95)
Rebelliousness	Lowest third	771	(4.8)	Reference
	Middle third	1217	(9.0)	1.34 (0.93 to 1.93)
	Highest third	615	(18.2)	1.98 (1.32 to 2.99)
Self-esteem	Lowest third	1030	(12.5)	Reference
	Middle third	903	(9.6)	1.23 (0.95 to 1.61)
	Highest third	670	(6.4)	0.96 (0.68 to 1.36)
Maternal responsiveness	Lowest third	744	(15.1)	Reference
	Middle third	1032	(8.6)	0.79 (0.61 to 1.04)
	Highest third	827	(7.0)	0.89 (0.64 to 1.25)
Maternal demandingness	Lowest third	954	(10.6)	Reference
	Middle third	1084	(10.3)	1.23 (0.95 to 1.59)
	Highest third	565	(8.1)	1.16 (0.82 to 1.64)
Parental disapproval of child smoking	Both disapprove	2157	(9.1)	Reference
	Neither or mixed disapprove	446	(13.9)	1.09 (0.83 to 1.43)

School is included as a control variable.

common and strongly associated with higher levels of lifetime smoking; exposure to movie smoking, although prevalent, was not. In the longitudinal study, which began with never-smokers, only exposure to movie smoking predicted trying cigarettes in the future. Fewer than 2% of never-smoker adolescents identified a favourite tobacco ad and neither this nor promotional item ownership predicted trying cigarettes. The results suggest a one-two punch, with exposure to entertainment media smoking prompting onset of smoking, after which the adolescent becomes attentive to and responsive to tobacco marketing.

This study extends the results of a recently published longitudinal study of German adolescent never-smokers, the only other we found that measured exposure to movies and receptivity to tobacco marketing.³² That study found a dose-response relation between exposure to movie smoking and smoking onset that was similar to the US findings shown in table 3. In the German cohort, having a favourite cigarette

advert was the only marketing receptivity item assessed (tobacco-branded promotional items are not distributed in Germany) and only 6% of never-smoker adolescents had a favourite ad, a prevalence comparable with the present study. Having a favourite ad was modestly predictive of trying cigarettes (adjusted odds ratio 1.38) over and above the significant effect of exposure to smoking in movies. Thus, tobacco-marketing receptivity had a statistically significant effect on smoking onset among German adolescents but the effect on smoking initiation was smaller than the effect of movie exposure and low prevalence limited the population impact of the predictor on smoking onset.

Several factors may explain why movie smoking has a larger effect on smoking onset than tobacco marketing. First, it is hard not to be exposed to movie smoking, as this behaviour permeates entertainment media children watch from an early age^{39 40} and children spend much more time watching movies (children and adolescents average 2–3 movies per week)⁴¹ than

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they do at the checkout line in stores (where they see cigarette displays) and reading magazines (where they encounter tobacco advertising). Second, the star status of the actor provides an aspirational role model for the adolescent, providing a strong prompt from a social-cognitive standpoint.⁴² Third, because smoking is integrated into the entertainment, and the subject is transported into the movie world,⁴³ the smoking message is not viewed with the same scepticism as advertising.

The present results suggest that before initiation only a minority of adolescents pay attention to tobacco marketing. After initiation, as the adolescent develops an interest in the product, tobacco marketing stimulates further experimentation. Remembering that the adolescents in this study were young, with most smokers at baseline being in the early stages of smoking acquisition, the results suggest that tobacco advertising and promotion exerts a strong influence in the early experimental stages of smoking, perhaps as adolescents become interested in exploring cigarette branding in the context of consolidating their smoker self-image. The results also suggest that continued exposure to smoking in entertainment media has a secondary role among experimental smokers.

Our focus on separating exposure effects on initiation from continuation of experimental smoking extends results of past reports that examined the association between tobacco marketing receptivity and youth smoking, because few of those studies examined these smoking outcomes separately. Pierce and colleagues published four longitudinal studies in California adolescents; in three, receptivity to marketing was associated in a dose-response fashion with progression of experimentation or onset of established (>100 cigarettes lifetime) smoking.^{7 43} The fourth study, which examined smoking onset among never-smokers, found no main effect of tobacco marketing receptivity, but found a subgroup effect among adolescents exposed to a more authoritative parenting style.²⁰ One longitudinal study of Massachusetts adolescents²¹ and another of northern New England adolescents²¹ found marketing receptivity-smoking associations for progression of experimentation. Another northern New England study found effects on experimental smoking, but only among girls.¹⁸ Thus, most of the previously published longitudinal studies on receptivity to tobacco marketing conflated the initiation event with progression to higher levels of experimental smoking. It may be important to distinguish these two events when developing interventions for younger children. If initiation of smoking is the target outcome in an intervention, more attention to the role entertainment media has in smoking onset may be warranted. This study also suggests that interventions aimed at experimental smokers should focus on limiting exposure to, or blunting the effects of, tobacco marketing.

This study has some limitations. Generalisability could be limited by the regional nature of the sample, which was primarily rural, white and had parents with higher levels of education compared with what would be expected nationally in the United States. As mentioned above, another study of German adolescents had similar findings, which suggests similarity among white people across cultures. More research is needed on media effects in minority adolescents; for example, one study found no movie smoking effect for African American adolescents.³³ The present study also focuses mainly on behaviour; more studies are warranted on how each exposure affects attitudes towards smoking and how these attitudes mediate the exposure-behaviour relation. 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.

We and colleagues from Germany found that few never-smoker adolescents had a favourite advertisement. This is in contrast with Pierce and colleagues,⁷ who found that in 1993 some 54% of California non-susceptible never-smokers could identify a favourite tobacco ad, which these investigators defined as "moderate receptivity", and which had an intermediate effect on smoking. This difference could be due to lower accessibility of tobacco adverts in 1999 because of the Master Settlement Agreement, differences in the adolescent samples, or could be the result of the differences in how we queried the adolescents. Ours was a paper and pencil survey and asked only if the adolescent could name the brand of a favourite ad. The California survey was a telephone interview and probed non-response with the follow question, "Of all the cigarette advertisements you have seen, which attracts your attention the most?", a procedure that could have increased positive responses compared with ours.

One final limitation is that the movie and the marketing-receptivity measures assessed slightly different aspects of each exposure. The movie exposure 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. In contrast, the tobacco-marketing-receptivity measure assessed attention and response; both are cognitive effects that come after exposure. It is possible that a purer measure of exposure to tobacco marketing could have a larger effect on smoking onset than was found in this study. It is also possible that a measure of response to movie smoking could have an impact on experimental smoking. However, there are no data available to clarify this issue. One longitudinal study used a measure of brand-specific advertising exposure, assessing exposure to magazine tobacco ads in a cohort of 1069 Massachusetts youths followed over four years.⁴⁴ That study showed that brand-specific advertising exposure was highly correlated with the brand selected by adolescents who started smoking but was silent on whether or not the exposure predicted onset of smoking after controlling for other confounding influences. We are not aware of any longitudinal

What this paper adds

- ▶ Receptivity to tobacco marketing and exposure to smoking in entertainment media have been linked with smoking onset in longitudinal studies, but few have examined both. Moreover, few media/marketing studies have treated smoking onset and progression as separate outcomes.
- ▶ In a longitudinal multivariate analysis of smoking onset in northern New England adolescents, exposure to smoking in movies was significantly associated with trying cigarettes and receptivity to tobacco marketing was not. In contrast, among experimental smokers, receptivity to tobacco marketing was associated with higher levels of lifetime smoking and exposure to smoking in movies was not.
- ▶ If replicated, this research suggests that exposure to smoking in entertainment media prompts smoking onset and tobacco marketing affects progression after initiation. Smoking prevention programmes should consider this information, depending on whether they aim to prevent onset or target experimenters. Both exposures deserve equal emphasis from a policy standpoint.

studies that examine receptivity to the entertainment media smoking messages, but this is clearly an important topic for future studies.

This study has important implications for tobacco control policy. It suggests that organisations and governmental bodies concerned with preventing youth smoking should address movie smoking as a key adolescent smoking risk factor and with the same level of emphasis paid to tobacco marketing. As with tobacco marketing, movie smoking is a global problem, because movies and the tobacco brands contained in them are distributed worldwide.⁴⁵ As with tobacco marketing, policy efforts should be aimed at companies that disseminate the smoking entertainment message. Smoke Free Movies offers a public health approach by directing responsibility for movie smoking at the media conglomerates that produce it and by offering voluntary industry measures that would reduce youth exposure without violating free speech. Public health agencies and non-governmental organisations interested in reducing youth smoking can look to the recent actions of New York State Health Commissioner Richard Daines (http://www.health.state.ny.us/press/releases/2008/2008-02-19_health_commissioner_urges_eliminate_smoking_in_youth_rated_movies.htm) as a guide to action.

In summary, our findings indicate that movie smoking exposure may be underappreciated as a factor in adolescent smoking initiation because its effects are probably as powerful as marketing tobacco exposure. Clearly, both are important, although the former may be more important for initiation and the latter for the establishment of long-term smoking. As factors that promote adolescent smoking, both are worthy of public health interventions, although such interventions may more closely align their goals with the available evidence regarding the disparate effects of movie and marketing exposure to smoking.

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