

# Influence of Motion Picture Rating on Adolescent Response to Movie Smoking



**WHAT'S KNOWN ON THIS SUBJECT:** The US Surgeon General has determined that the relationship between movie smoking exposure (MSE) and youth smoking is causal; however, it is not known whether movie rating influences how adolescents respond.



**WHAT THIS STUDY ADDS:** The response to PG-13-rated MSE was indistinguishable from R-rated MSE. An R rating for smoking could reduce smoking onset in the United States by 18% (by eliminating PG-13 MSE), an effect similar to making all parents maximally authoritative in their parenting.

## abstract



**OBJECTIVE:** To examine the association between movie smoking exposure (MSE) and adolescent smoking according to rating category.

**METHODS:** A total of 6522 US adolescents were enrolled in a longitudinal survey conducted at 8-month intervals; 5503 subjects were followed up at 8 months, 5019 subjects at 16 months, and 4575 subjects at 24 months. MSE was estimated from 532 recent box-office hits, blocked into 3 Motion Picture Association of America rating categories: G/PG, PG-13, and R. A survival model evaluated time to smoking onset.

**RESULTS:** Median MSE in PG-13-rated movies was ~3 times higher than median MSE from R-rated movies, but their relation with smoking was essentially the same, with adjusted hazard ratios of 1.49 (95% confidence interval [CI]: 1.23–1.81) and 1.33 (95% CI: 1.23–1.81) for each additional 500 occurrences of MSE respectively. MSE from G/PG-rated movies was small and had no significant relationship with adolescent smoking. Attributable risk estimates showed that adolescent smoking would be reduced by 18% (95% CI: 14–21) if smoking in PG-13-rated movies was reduced to the fifth percentile. In comparison, making all parents maximally authoritative in their parenting would reduce adolescent smoking by 16% (95% CI: 12–19).

**CONCLUSIONS:** The equivalent effect of PG-13-rated and R-rated MSE suggests it is the movie smoking that prompts adolescents to smoke, not other characteristics of R-rated movies or adolescents drawn to them. An R rating for movie smoking could substantially reduce adolescent smoking by eliminating smoking from PG-13 movies. *Pediatrics* 2012;130:228–236

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### KEY WORDS

adolescent smoking, motion picture rating, movie smoking

### ABBREVIATIONS

CI—confidence interval

MPAA—Motion Picture Association of America

MSE—movie smoking exposure

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Almost 50 years since the 1964 Surgeon General's Report on Smoking and Health, smoking remains the number 1 cause of preventable death in the United States, responsible for >400 000 deaths per year, prompting a need to know more about what fuels this epidemic. In March 2012, a new Surgeon General's Report was released, entitled "Preventing Tobacco Use Among Youth and Young Adults," and in which the Surgeon General stated: "The evidence is sufficient to conclude that there is a causal relationship between depictions of smoking in movies and the initiation of smoking among young people."<sup>1</sup> Thus, much is known about the relation between exposure to movie smoking and youth smoking, but studies are only beginning to examine whether the context in which movie smoking is presented modifies its association with adolescent smoking. In a recently published experiment,<sup>2</sup> exposure to movie clips portraying smoking as relaxing was associated with a significantly stronger desire to smoke compared with exposure to clips without a motive for the smoking. Although experimental studies allow the researcher to control exposure and serve to tease out underlying cognitive mechanisms, it is difficult to study actual smoking behavior in an experimental setting, and therefore it is hard to judge what the behavioral implications of the findings would be.

Another way to assess context is to consider movie rating. Movie ratings are a marker for the presence of contextual elements considered to be "adult" by the ratings board. To the extent that sex, violence, profanity, and illicit drug use are considered in the Motion Picture Association of America (MPAA) ratings system,<sup>3</sup> smoking in movies with an adult rating (eg, R [restricted to individuals aged  $\geq 17$  years unless accompanied by a parent or guardian]) would depict characters who model these behaviors, along with



**FIGURE 1**

Examples of different contextual treatments of movie smoking, clockwise from top left: Cruella de Vil, an uncomplicated villain in *101 Dalmatians* (rated G; Walt Disney Productions, 1961); Gwyneth Paltrow smoking in the context of a sexually provocative scene in *Great Expectations* (rated R; 20th Century Fox Film Corporation, 1998); Ethan Hawke blowing smoke into a backlit wine glass to show what the planet Titan looks like in *Gattaca* (rated PG-13; Columbia Pictures Corporation, 1997); and Brad Pitt smoking after a brutal fight scene from *Fight Club* (rated R; Fox 2000 Pictures, 1999).

smoking. Indeed, a content analysis found that MPAA ratings can reliably distinguish levels of sex, violence, and profanity but not tobacco use.<sup>4</sup> Figure 1 depicts several examples of movie smoking by rating and a range of contexts that might be seen with movie smoking according to rating category: simple villainy (G [appropriate for general audiences]), visually stimulating (PG-13 [parents are strongly cautioned, content may not be suitable for children aged <13 years]), and violence and sex (R).

Examining how movie ratings affect the movie smoking–behavior association could have important implications on ratings for movie smoking,<sup>5</sup> especially given that 60% of the movie smoking exposure (MSE) comes from youth-rated (almost entirely PG-13) movies.<sup>6</sup> In the United States, an R rating for smoking would serve to effectively eliminate smoking from movies marketed to youths, based on the current business model for movie production, in which the rating is negotiated between production company and the director before movie production.<sup>7</sup> The implication is that a production company intending to include the youth market would have to eliminate smoking in the production

process, as is currently done with sex and violence to obtain the PG-13 rating. However, the hypothetical benefits of limiting MSE in youth-rated movies depends partly on how strongly the smoking in them is linked with adolescent smoking. Importantly, limiting smoking to R-rated movies would have little impact if the dose-response between smoking in youth-rated movies and adolescent smoking was small.

In addition, if only R-rated movie smoking was linked with behavior, it would seriously undermine the idea that it is movie smoking specifically, as opposed to the sex, violence, profanity, and illicit drug use that prompts smoking onset. Indeed, a recent essay speculated that the movie smoking–youth smoking relationship might not be causal because MSE is "inextricably entangled with a host of other variables in movies... such as alcohol or recreational drug portrayal, violence, coarse language, and sexual content,"<sup>8</sup> raising concerns about specificity. The essay went further, suggesting that it may not be the movies at all that prompt adolescents to smoke. Instead, adult movies may attract risk-taking adolescents who come to see the proscribed behaviors

(ie, adolescents who end up smoking for other reasons). In this scenario, R-rated MSE would be hypothesized to be overwhelmingly strong in its ability to predict youth smoking, because R-rated MSE picks up the effect of seeing “adult” behaviors relegated to these movies and identifies unmeasured risk factors among the adolescents that see them.

The current study examined smoking onset in a cohort of US adolescents followed up for 4 waves over a 2-year period. Exposure to smoking in movies at study onset was divided into 3 categories (G/PG, PG-13, and R) to assess the prospective relationship between each type of exposure and onset of smoking. Based on the idea that it is primarily the movie smoking that prompts adolescents to smoke (with the adult context being secondary), we hypothesized that R-rated movie smoking would have only a slightly stronger association with adolescent smoking than PG-13-rated movie smoking and that PG-13-rated movie smoking would still be an important predictor of smoking, given that it accounts for a large share of the exposure.

## METHODS

### Participants and Procedure

Participants were 6522 adolescents, ages 10 to 14 years, recruited in 2003 by using random digit dial methods described previously.<sup>9</sup> After verbal parental consent and adolescent assent were obtained, participants were surveyed via telephone about media exposures, tobacco and alcohol use, sociodemographic characteristics, and other risk factors. Subjects were resurveyed every 8 months 3 more times, with the last follow-up at 24 months. The study procedures were approved by the Dartmouth College Committee for Protection of Human Subjects. The completion rate for the survey was 66%; distributions of age, gender, ethnicity, household income, and census region

in the unweighted sample were comparable to those of the 2000 US Census.<sup>9</sup> Missing data/attrition increased from 7 adolescents at baseline to 2451 at 24 months. Attrition analyses indicated that adolescents lost to follow-up were more likely to be nonwhite; were from families with lower parental education/income and lived in rented versus parent-owned residences; had poorer school performance; and scored higher on sensation-seeking scales. To minimize attrition bias, estimation was carried out after multiple imputation using the missing at random assumption (missing data are missing at random conditional on covariates included in the model).<sup>10</sup> The MICE procedure in R was used to stochastically impute missing data.<sup>11</sup> To improve the quality of the imputations, baseline auxiliary variables that were predictive of missing data (but not necessarily the outcomes) were also included in the imputation. All variables were treated as numeric, and the predictive mean matching procedure was used to create 15 imputed values for each missing score. Convergence was assessed by checking plots of the mean and variance of the imputations for each variable across the 15 streams for signs of problems, such as trends or lack of proper mixing. No problems were apparent. For descriptive statistics, we averaged across the 15 imputations to obtain a single best estimate for each missing data point.

### Assessment of MSE Dose

Adolescents' exposure to movie smoking was estimated by using previously validated methods.<sup>12</sup> The top 100 movies with highest US gross revenues each year were selected for each of the 5 years preceding the baseline survey (1998–2002,  $N = 500$ ) and 32 high earners during the first 4 months of 2003. Older movies were included because adolescents often watch these

movies on video/DVD. The survey randomly selected 50 movie titles from the larger pool of 532 movies for each adolescent interview. Movie selection was stratified according to the MPAA rating so that the distribution of movies in each list reflected the distribution of the full sample of movies (19% G/PG, 41% PG-13, and 40% R). Respondents were asked (no/yes) whether they had ever seen each movie title on their unique list.

Trained coders counted the number of smoking occurrences in each of the 532 movies by using previously validated methods.<sup>13</sup> A smoking occurrence was counted whenever a major or minor character handled or used tobacco in a scene or when tobacco use was depicted in the background (eg, brands present or “extras” smoking in a bar scene), irrespective of the scene's duration or how many times the tobacco product appeared. We summed the number of smoking occurrences each adolescent had seen from his or her unique list of 50 movies, stratifying counts by rating blocks (G/PG, PG-13 and R categories), and scaling these counts to reflect exposure to that of the full sample of 532 movies, given the adolescent's reported viewing habits by rating.<sup>12</sup> To limit extreme values and reduce the effect of outliers, MSE measures were Winsorized<sup>14</sup> at the second and 98th percentiles (values more extreme were recoded back to the second or 98th percentile value). To assess equivalent doses of exposure, the response to each increment of 500 movie smoking occurrences was modeled, which would approximate the median overall dose of MSE.

### Outcome Assessment

Smoking initiation was assessed by asking: “Have you ever tried smoking a cigarette, even just a puff?” Those who answered “yes” were classified as having tried smoking. This measure

was used rather than current (30-day) smoking because current smoking is infrequent in the early stages of cigarette use.<sup>15</sup> Smoking initiation is an important outcome because approximately one-third of initiators go on to become addicted smokers.<sup>16,17</sup> For the US sample, confidentiality in responses was assured in the adolescent assent statement, and subjects indicated their answers to sensitive questions by pressing numbers on the telephone.

### Covariates

In addition to the movies viewed, other information was collected from the adolescents, including age, gender, race, parent education, household income, school performance, involvement in extracurricular activities, weekly spending money, television watching (hours per day), personality characteristics (rebelliousness, sensation-seeking propensity), parent/sibling/peer smoking, cigarette availability at home, and adolescent-reported parenting practices.<sup>18</sup> Authoritative parenting style describes parents that are both responsive and effective in monitoring their children<sup>19</sup>; this construct has a strong and consistent track record in predicting lower levels of substance use.<sup>18,20–32</sup> The current study used a 10-item version of the Authoritative Parenting Index,<sup>18</sup> in which we combined results for questions about responsiveness (“he/she makes me feel better when I’m upset/listens to what I have to say”) and monitoring (“he/she asks me what I do with my friends/knows where I am on the weekend” [ $\alpha = .79$  survey 1,  $.81$  survey 2]) and referenced questions to the person the adolescent viewed as the main caregiver. The assessment of other covariates and their reliabilities has been described previously.<sup>9,33</sup> The sensation-seeking scale used here has been validated in longitudinal research and has  $\alpha$  reliabilities comparable to other accepted scales for sensation

seeking.<sup>34</sup> To prevent problems due to outliers, covariates were Winsorized at the second and 98th percentiles.<sup>14</sup>

### Statistical Analysis

Onset of smoking was ascertained at the 8-, 16-, and 24-month surveys. An incident case was defined as an adolescent who became a smoker from the pool of those who were not smokers at the previous survey. As a first step, generalized additive logistic models were fit to show the crude dose-response relation between the MSE according to MPAA rating and probability of smoking initiation. In addition to strong linear trends, both PG-13– and R-rated MSE had significant negative quadratic trends (significantly stronger response at lower dose ranges); however, only the negative quadratic effect for R-rated MSE remained significant after adjusting for all covariates in the full model. For ease of interpretation and because conclusions did not change, only the linear effects for all MSE measures were used (quadratic estimates available on request from the first author). For the models, MSE was entered as a continuous variable and scaled so that each 1-point increment represented an increase in dose of 500 movie smoking occurrences. To determine the association between exposure to movie smoking according to MPAA rating and time to smoking initiation, discrete time hazard survival models<sup>35–37</sup> were fit to each of the 15 imputed complete data sets following standard procedures for pooling the estimates and obtaining SEs.<sup>11</sup> The hazard model assessed time to onset based on data from all 3 intervals over the 24-month period. For all models, results for main effects were judged significant for  $P$  values  $< .05$ .

Attributable fraction calculations were conducted after model fitting by obtaining the model-predicted number of events with the observed data and the model-predicted number of events when

levels of MSE in our sample were altered to a low level (ie, the fifth percentile) to indicate what might happen if smoking was largely removed from movies the adolescents had watched. The attributable fractions were compared with similar assessments for sensation seeking (setting all adolescents at the lowest level), or authoritative parenting (setting all parents at the most authoritative level). For each of the 15 imputations, estimates and SEs were obtained for the attributable fractions using 100 bootstrap replications. The bootstrap estimates and SEs were then pooled across the 15 multiple imputation models using standard procedures.

## RESULTS

### Description of the Sample

Table 1 describes the predictor variables for the study sample at baseline. Age was equally represented and ranged from 10 to 14 years at baseline; male and female genders were also equally represented. Race/ethnicity was broadly reflective of the US population, with 11% black and 19% Hispanic ethnicity. Some 18% of families were classified as low-income, with 7% having incomes of  $\leq \$20\,000$  and 11% having income between  $\$20\,000$  and  $\$29\,000$  per year. At baseline, 83%, 88%, and 69% of adolescents reported having no friends, siblings, or parents, respectively, who smoked, and 14% thought there was at least some chance that they could obtain cigarettes from home without their parent’s knowledge. With respect to media use, 28% watched  $\geq 3$  hours of television per day. Only 15% reported no weekly spending money, and 10% reported having  $> \$20$  per week to spend.

### Dose of MSE by MPAA Rating and Its Relation With Smoking Onset

Table 1 also displays the median and interquartile range for MSE according to MPAA rating category. High-dose

(95th percentile) MSE was similar for PG-13- and R-rated movies (894 and 1002 occurrences, respectively) and ~5 times that of the 95th percentile for G/PG-rated MSE. However, the typical (median) dose to adolescents for PG-13-rated MSE was much higher than for R-rated MSE (275 and 93 occurrences, respectively), reflecting higher viewership of PG-13-rated movies overall. The correlation between the 3 MSE variables was .53 for PG-13-rated versus R-rated movies, .18 for PG-13-rated versus G/PG-rated movies, and .15 for R-rated versus G/PG-rated movies.

Figure 2 shows the dose-response relation of MSE according to rating category with the 8-month probability of trying smoking using all three 8-month observation periods; the unadjusted probability of trying smoking was not significantly different across the 3 periods. The null hypothesis is represented by the horizontal line set at the average probability of trying smoking (6.4%). Figure 2 illustrates the markedly larger exposure to PG-13-rated and R-rated movie smoking compared with G/PG-rated movies, for which dose did not extend past 200 occurrences, even for the most highly exposed adolescents. The relation for G/PG-rated MSE and adolescent smoking (dotted green line) was not significantly different from zero. The unadjusted hazard ratio associated with a 500-smoking occurrence dose of G/PG-rated MSE was 1.47 (95% CI: 0.65–3.36). Restricting G/PG-rated MSE to the observed range (0–165 occurrences) made the unadjusted hazard ratio even lower: 1.14 for the 95th percentile compared with fifth percentile of actual G/PG-rated MSE. In contrast, PG-13-rated (dashed red line) and R-rated (solid blue line) MSE had much larger exposure ranges and crude relations with youth smoking that were similar to each other and strongly divergent from the null hypothesis. The

**TABLE 1** Description of the Never Smoker Sample at Baseline (*N* = 5830)

	<i>N</i>	Proportion
Age, y		
10	1160	.2
11	1244	.21
12	1238	.21
13	1213	.21
14	975	.17
Race/ethnicity		
White	3619	.62
Black	619	.11
Hispanic	1095	.19
Other	497	.09
Gender		
Male	2970	.51
Female	2860	.49
Family income (×1000), \$		
<20	401	.07
20–29	625	.11
30–49	693	.12
50–74	1183	.2
75–99	1180	.2
≥100	1748	.3
Parent education		
≤9th grade	353	.06
9th–11th grade	414	.07
12th grade	229	.04
High school diploma	1274	.22
Vocational/technical school	199	.03
Some college	1004	.17
Associate degree	501	.09
Bachelor degree	1116	.19
Postgraduate	740	.13
Either parent smokes		
No	3999	.69
Yes	1831	.31
Cigarettes available at home		
Definitely no	5005	.86
Probably no	487	.08
Probably yes	251	.04
Definitely yes	87	.01
Sibling(s) smoke		
No	5115	.88
Yes	715	.12
Peers smoke		
None	4854	.83
Some	879	.15
Most	97	.02
Television viewing		
None	318	.05
<1 h/d	1151	.2
1–2 h/d	2760	.47
3–4 h/d	1139	.2
>4 h/d	462	.08
School performance		
Below average	126	.02
Average	1340	.23
Above average	2479	.43
Excellent	1885	.32
Weekly spending money, \$		
None	854	.15
1–5	1907	.33
6–10	1362	.23
11–15	359	.06

TABLE 1 Continued

	<i>N</i>	Proportion	
16–20	796	.14	
21–50	458	.08	
>50	94	.02	
	Median	Interquartile Range (25th–75th)	
Continuous variables			
Responsive parenting	2.4	2	2.8
Demanding parenting	2.3	2	2.8
Sensation seeking	0.8	0.5	1.3
Rebelliousness	0.2	0	0.4
Extracurricular activities	1.8	1.5	2.2
Movie Smoking Exposure			
G/PG-rated	61	15	123
PG-13–rated	275	97	514
R-rated	93	0	393

unadjusted hazard ratios for each 500 occurrences of PG-13–rated and R-rated MSE were 3.44 (95% CI: 2.74–4.32) and 3.14 (95% CI: 2.58–3.83), respectively.

Table 2 shows the adjusted hazard ratios for MSE according to MPAA rating. There was no significant relation between exposure to G/PG-rated MSE and adolescent smoking. The adjusted hazard ratios for a 500-occurrence dose of PG-13– and R-rated MSE were 1.49 (95% CI: 1.23–1.81) and 1.33 (95% CI: 1.13–1.57), respectively. Wald tests showed that the MSE–youth smoking relation for PG-13– and R-rated movies was not significantly different from each other but both were significantly higher than the G/PG-rated MSE–youth smoking relation.

This study was designed to detect a main effect of MSE on adolescent smoking and powered to detect an overall odds ratio of 1.4 for the relation between smoking in movies and smoking onset with a power of 0.97. Power for these analyses was considerably reduced when MSE was subdivided by MPAA rating into 3 correlated variables, especially considering the small range of G/PG-rated MSE. However, additional power calculations indicated that, even with this small range, the power of the study to detect an effect similar to PG-13 MSE (an

adjusted hazard ratio of 1.5 for a 500-occurrence dose) was 0.71.

#### Attributable Fraction Estimation

The attributable fraction estimate for setting all PG-13– and R-rated MSE to the fifth percentile was 0.26 (95% CI: 0.23–0.29), indicating that largely removing the risk factor would reduce smoking onset over the period by 26%. Setting PG-13-rated MSE alone to the fifth percentile (which approximates the probable impact of an R rating for smoking) was associated with an attributable fraction of 0.18 (95% CI: 0.14–0.21). For comparison, the attributable fractions for setting authoritative parenting to the highest level or sensation seeking to the lowest level were 0.16 (95% CI: 0.19–0.12) and 0.30 (95% CI: 0.35–0.25), respectively. Thus, eliminating smoking from youth-rated movies would reduce smoking by as much as making all parents maximally authoritative in their parenting.

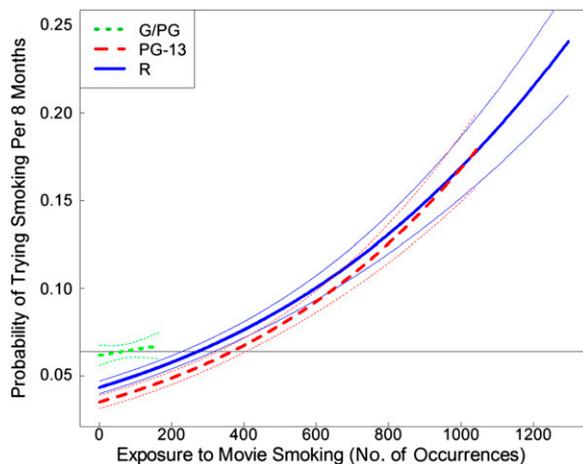
#### DISCUSSION

This study provided a test of whether it is primarily the smoking in movies, not the other adult behaviors that go along with it, that affects adolescents' behavior. The dose-response between PG-13–rated MSE and youth smoking is

indistinguishable from that of R-rated MSE, a finding that directly refutes speculation<sup>8</sup> that it is other adult-oriented content or some yet-to-be-identified individual risk factor that attracts youths to R movies which causes the response. Combined with recently published experimental data that show a movie smoking effect on susceptibility to smoke using a randomized design,<sup>38</sup> the results strongly support the idea that it is the movie smoking in PG-13- and R-rated movies that stimulates youths to smoke.

Because exposure to PG-13–rated movies is large,<sup>39</sup> the smoking in these movies accounts for about two-thirds of the population effect. Thus, an unambiguous R rating for smoking could reduce adolescent smoking onset by almost one-fifth, as newly produced smoke-free PG-13–rated movies come into the market and old ones lose the adolescent audience. The attributable fraction estimate for PG-13– and R-rated MSE is smaller than previous estimates in predominantly white adolescents<sup>40–42</sup> (the pooled estimate for those studies from an earlier meta-analysis<sup>5</sup> was 0.44 [95% CI: 0.34–0.58] compared with 0.26 [95% CI: 0.23–0.29] for this study), in part because the response to movie smoking among minority adolescents was less strong than among whites.<sup>43,44</sup> Regardless of what the final attributable risk is, however, the public health impact of PG-13 smoking is important: it ranks on the order of the impact of parenting effectiveness.

Not only was exposure to G/PG MSE-rated small, the relation for G/PG-rated MSE was not significantly different from zero. Low responsiveness to smoking in G/PG movies is consistent with the results of an experimental study that failed to find an effect of cartoon and G/PG movie smoking on attitudes in elementary school-aged children.<sup>45</sup> Another similarly designed



**FIGURE 2**

The unadjusted relation between exposure to G/PG-, PG-13-, and R-rated MSE and the 8-month hazard probability of smoking onset for US adolescents. The unadjusted probability (hazard) of trying smoking was not significantly different across each of the three 8-month follow up periods and was equal to 0.064, shown in the plot as a thin horizontal line. All 3 exposures (G/PG [dotted green line], PG-13 [dashed red line], and R [solid blue line]) were entered as linear effects. The small lines on either side of each curve represent the 95% CIs for the estimate. The model was estimated on the log odds scale by using logistic regression as is standard for discrete time survival analysis. Because the log odds scale is difficult to interpret, however, the fitted relations were converted to the probability scale. The change of scaling of the y-axis from log odds to probability creates the apparent curvilinearity.

**TABLE 2** Association Between MSE According to MPAA Rating and Time to Trying (Hazard of) Smoking

	Adjusted Hazard Odds Ratio	95% CI	
		Low	High
MSE <sup>a</sup> according to movie rating			
G/PG-rated	0.49	0.22	1.09
PG-13-rated	1.49	1.23	1.81
R-rated	1.33	1.13	1.57
	Test	df	P
Wald tests			
G/PG versus R and PG-13	6.53	2	.038
G/PG versus PG-13	-2.55	1	.11
G/PG versus R	-2.37	1	.18
PG-13 versus R	0.74	1	.458

<sup>a</sup> MSE entered as a continuous variable and scaled so that each 1-point increment represents 500 movie smoking occurrences.

experimental study found an effect for smoking in a PG-13-rated movie.<sup>46</sup> These 2 experimental studies, combined with our population-level results, suggest that the explanation is that smoking images delivered by G/PG cartoons and other family-oriented films fail to effectively communicate favorable expectancies or utilities for smoking. Thus, the emphasis afforded to cartoon smoking in previous studies<sup>47,48</sup> may be misplaced from a public health standpoint.

This finding also suggests that only eliminating smoking from G/PG-rated films would not reduce the effects of smoking in movies on youth smoking; there is little MSE in G/PG-rated films<sup>6,49</sup> and what imagery is there is not particularly salient. Thus, the only effective ratings option for the MPAA in limiting the impact of MSE is an R rating for smoking. The causal inference for movie smoking and youth smoking mentioned earlier<sup>1</sup> cannot be made from 1 study alone, but

the findings of this study and a related publication<sup>50</sup> are consistent with this causal interpretation. Our conclusion that it is the smoking in PG-13- and R-rated movies that prompts adolescents to smoke is strengthened theoretically on the parsimonious notion of a social modeling effect and supported by social cognitive theory.<sup>51</sup> Our study was not powered to detect a small effect, such as that seen in the unadjusted relation between G/PG-rated MSE and adolescent smoking in this study (but it is adequate to rule out an effect similar to that of PG-13-rated movies). It also does not empirically test what might be found if smoking in G/PG movies was increased to the point that it was provided similar to exposure in other types of movies. Thus, the study cannot be used as a justification for adding more smoking to G/PG-rated movies. Finally, this study cannot tell us exactly what contextual situations are most problematic, as the study by Shadel et al<sup>2</sup> was able to do.

With the elimination of image-based tobacco marking, the epidemic of smoking is maintained, in part, by movie images of smoking. This study suggests that it is the depiction of smoking in movies, not other contextual variables, that matters for the onset of youth smoking. It suggests greater emphasis on reducing exposure to smoking in PG-13-rated movies through an unambiguous R rating for smoking<sup>52</sup> and less emphasis on images of smoking commonly found in G- and PG-rated movies, which contribute little to exposure. Finally, even if the MPAA agrees to modernize its voluntary film rating system to eliminate smoking from youth-rated films, youth will still receive some exposure to smoking from R-rated movies, so it is also important to motivate and assist parents in restricting access to these movies, which would further reduce adolescent exposure to onscreen smoking.<sup>53-59</sup>

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