Published in final edited form as:
Am J Prev Med. 2010 April ; 38(4): 351–358. doi:10.1016/j.amepre.2009.12.025.

Effect of Smoking Scenes in Films on Immediate Smoking:

A Randomized Controlled Study

Dikla Shmueli, PhD, **Judith J. Prochaska, PhD, MPH**, and **Stanton A. Glantz, PhD**
From the Department of Psychiatry (Shmueli, Prochaska) and Center for Tobacco Control Research and Education and Department of Medicine (Glantz), University of California, San Francisco, San Francisco, California

Abstract

Background—The National Cancer Institute has concluded that exposure to smoking in movies causes adolescent smoking and there are similar results for young adults.

Purpose—This study investigated whether exposure of young adult smokers to images of smoking in films stimulated smoking behavior.

Methods—100 cigarette smokers aged 18–25 years were randomly assigned to watch a movie montage composed with or without smoking scenes and paraphernalia followed by a10-minute recess. The outcome was whether or not participants smoked during the recess. Data were collected and analyzed in 2008 and 2009.

Results—Smokers who watched the smoking scenes were more likely to smoke during the break (OR3.06, 95% CI=1.01, 9.29). In addition to this acute effect of exposure, smokers who had seen more smoking in movies before the day of the experiment were more likely to smoke during the break (OR 6.73; 1.00–45.25 comparing the top to bottom percentiles of exposure) were more likely to smoke during the break. Level of nicotine dependence (OR 1.71; 1.27–2.32 per point on the FTND scale), "contemplation" (OR 9.07; 1.71–47.99) and "precontemplation" (OR 7.30; 1.39–38.36) stages of change, and impulsivity (OR 1.21; 1.03–1.43), were also associated with smoking during the break. Participants who watched the montage with smoking scenes and those with a higher level of nicotine dependence were also more likely to have smoked within 30 minutes after the study.

Conclusions—There is a direct link between viewing smoking scenes and immediate subsequent smoking behavior. This finding suggests that individuals attempting to limit or quit smoking should be advised to refrain from or reduce their exposure to movies that contain smoking.

INTRODUCTION

Smoking remains common in motion pictures.[1–4] Research with adolescents has demonstrated an association between exposure to smoking in movies and increased positive attitudes about smoking and tobacco use,[5, 6] overestimation of the prevalence of smoking,[6] and greater intentions to smoke.[5] Epidemiologic studies consistently demonstrate a dose–response relationship between exposure to smoking in movies and smoking initiation[7–14] controlling

Address correspondence and reprint requests to: Stanton Glantz, PhD, Department of Medicine, University of California, San Francisco, 530 Parnassus Suite 366, San Francisco, CA, 94143-1390. glantz@medicine.ucsf.edu.

No financial disclosures were reported by the authors of this paper.

for peer and family smoking, parenting style, sensation seeking, and demographic characteristics such as gender and ethnicity. These findings have also been replicated in other cultures.[15–19] The National Cancer Institute has concluded that smoking in the movies causes adolescent smoking,[1] a conclusion endorsed by the WHO.[2]

Less study has been directed at young adults, although available research yields similar results as for adolescents. Smoking in movies is associated with increased positive attitudes about smoking,[20] the perception that more people smoke,[21] and an increased desire or intention to smoke.[22–24] Epidemiology also shows that watching films with smoking increased participants' likelihood of established smoking as adults, with a dose–response relationship.[8, 9, 25] A 2009 study examining the urge to smoke among moviegoers exiting the theatre found that the presence of smoking was the best predictor of craving independent of movie rating and violent content.[26] Young adults are particularly important since they constitute the largest segment of U.S. movie goers, with 34% attending a movie at least once a month, compared to 20% in the general population[27, 28] Young adulthood is an important time during the evolution of smoking behavior, when individuals who started experimenting as teens transition to established smoking or, alternatively, quit. In addition, as the tobacco industry increasingly has intensified marketing efforts directed to young adults (the lowest legal age to do so), smoking initiation among this group has increaed.[29] As of 2006, smoking prevalence was highest among this age group, with 25.3% of young adults reporting smoking,[30] many of which are social or nondaily smokers.[31–34] Young adults remain at risk for future smoking dependence; at least 20% of smokers become regular smokers during young adulthood.[29]

While there is a substantial literature demonstrating an effect of long-term exposure to onscreen smoking on whether or not a person initiates or progresses to established smoking, there have not been any controlled studies of the immediate effects of observing onscreen smoking on short-term smoking behavior. The current controlled experiment investigates the effect of exposure to smoking scenes in movies on immediate smoking behavior in a sample of young adult smokers. It was hypothesized that those exposed to more smoking scenes would be more likely to smoke immediately following the exposure. It was also hypothesized that those who reported regularly viewing movies with high numbers of smoking scenes would smoke more than young adults with lower levels of exposure to onscreen smoking.

METHODS

Participants and Recruitment

Data were collected and analyzed in 2008 and 2009. The sample consisted of 100 young adult smokers recruited from the San Francisco Bay Area for a study advertised as one on smoking and cognitive abilities. (The participants were not aware that this was a study of smoking in the movies.) Due to a lack of previous experimental studies with a concrete behavioral outcome, the sample size calculation was based on previous studies using a different laboratory manipulation (food cue exposure task) and measuring the same unobtrusive behavioral smoking outcome.[35, 36] In both studies the experimental group was more likely to smoke (an average of 57%) compared with the control groups (average of 38%), leading us to expect a similar ratio.

Recruitment was done using flyers posted around university campuses and shopping centers, advertisements placed in the community section of Craigslist, an online advertising site, and as in local print and online newspapers. Eligibility was determined with a pre-screening phone interview. Inclusion criteria were smoking a minimum of 7 cig/wk, English fluency, at least an 8th grade education (because of the quantity of questionnaires), bringing cigarettes with them unprompted to the study, and aged 18–25 years. Participants were recruited until the sample size reached 100.

Procedures

Participants were tested individually in sessions lasting approximately 1 hour, and paid $30. Before starting the experiment, participants provided informed signed consent following American Psychological Association ethical standards and approved by the UCSF IRB. Participants first completed a set of pre-experimental questionnaires (detailed below) and a baseline expired air carbon monoxide (CO) sample to assess smoking status.

Participants were then randomly assigned to watch an 8-minute film montage made up of clips that either did (experimental condition) or did not (control condition) contain smoking scenes from five contemporary movies that attracted large audiences: *Stranger than Fiction* (2006), *Elf* (2003), *Bridget Jones' Diary* (2001),, *Hollywoodland* (2006), and *Great Expectations* (1998). Two of the clips were identical in both the experimental and control montage and did not have any smoking (*Stranger than Fiction* and *Elf*), one clip was identical in both groups, but had the smoking instances digitally removed from the control montage (*Bridget Jones' Diary*), and the other two clips were matched on length, depicted the same characters, and were of similar content (e.g., violent, dramatic) other than the presence or absence of smoking behavior and paraphernalia (*Hollywoodland* and *Great Expectations*). To increase the mundane realism of the experiment, the researcher turned the lights off and left the room during the presentation of the film.

Immediately after watching the film montage, participants completed the Minnesota Nicotine Withdrawal Scale[37] to assess a broad range of symptoms associated with nicotine withdrawal (e.g., craving), (Cronbach $\alpha = .86$ in the current sample). The original scale was supplemented for this study to include additional items (e.g., craving for salty food, urge to watch movie) to better conceal the nicotine urge questions.

Participants were then given a 10-mintue break during which they were asked to leave the room so that the experimenter could prepare the next phase of the study, but given no restrictions as to what to do during the break. The laboratory was located on the ground floor of a medical center with a large lobby and easy access to the sidewalk outside, allowing participants to remain in the indoor lobby waiting area or to walk outside in the vicinity of the clinic (where outdoor "No smoking" signs were posted). Unbeknownst to the participants, whether or not they chose to go out and smoke during the break was the primary dependent variable of the study.

On return, participants provided another CO sample and completed additional questionnaires.

Pre-Experimental Questionnaires—Participants were asked to fill out a demographic form, the Impulsive Sensation Seeking Scale[38] (ImpsSS), a 19-item measure adapted from the Zuckerman–Kuhlman Personality Questionnaire assessing impulsivity, the Smoking Stage of Change Scale,[39] a 5-item measure, assessing readiness to quit smoking and used to categorize smokers into one of the three pre-action stages (precontemplation, contemplation, and preparation), and the Fagerström Test for Nicotine Dependence (FTND),[40] a 6-item measure, assessing smoking behaviors indicative of physical dependence. These measures were included because previous literature suggested potential moderation of the effects: previous movie exposure,[5, 6] nicotine dependence,[41, 42] stage of change,[43] and impulsivity.[44]

Each subject also completed an Movies Questionnaire to determine which films participants had seen of a list of 60 motion pictures selected at random from the 500 top-grossing movies (PG, PG-13, and R rated) released between 2000 and 2004.[45] Following the Beach method, the total number of smoking occurrences in the films viewed were then calculated for each participant.[46] The absolute number of smoking occurrences was recoded and a 0–1 scale, with 0 for the bottom 5 percentile of exposure, 1 for the top 5 percentile of exposure and

proportionate values in-between (e.g., 0.80) for the other 90% of the sample. This method for coding exposure to onscreen smoking has been used to demonstrate a dose–response relationship between exposure to smoking in the movies and smoking behavior.[8, 11, 25, 47]

Postbreak Questionnaires—On returning, participants completed the Questionnaire of Smoking Urges Brief Version[48] (QSU-Brief), a 10-item measure assessing smoking urges, rated on a 7-point scale ranging from (1) strongly disagree to (7) strongly agree. The QSU-Brief has been shown to have good validity and reliability,[49] with Cronbach $\alpha = .94$ in the current sample. Participants also filled out a movie manipulation check assessing how interesting and enjoyable their experience watching the movie montage was, and how much attention they paid to the task, all rated on a 10-point scale ranging from (1) not at all to (10) very. A dichotomous variable assessed whether they noticed smoking in any of the scenes.

Smoking Assessment—A Bedfont Smokerlyzer was used to measure expired CO (range 1–80 ppm) to provide an unbiased indicator of recent smoking.[50, 51] The primary dependent variable of the study was whether or not participants smoked during the break based on the change in CO levels from baseline to the after the break. A CO change score greater than zero indicated smoking during the break. Participants also self-reported whether they smoked during the break and whether they had cigarettes with them. The agreement between self-reported smoking and smoking behavior based on change in CO level was $\kappa = .98$, $p < .001$. The one discrepant case who reported not smoking but had an increased CO reading was categorized as a smoker. Participants were debriefed and thanked for their participation, then provided with a referral list for smoking cessation programs and study flyers to give others who wished to participate. To reduce potential priming of smoking behavior, following each participant's departure from the clinic, the experimenter cleaned any discarded cigarette butts from outside the clinic vicinity. Participants were also contacted the next day and asked when they had their first cigarette after departing the study.

Statistical Analyses

Descriptive statistics were calculated for participants' demographic and smoking characteristics and their movie exposure. As a manipulation check, t-tests or chi-square tests were conducted to explore differences between the experimental and control groups on demographics, attitudes, conditions on perceptions of the movie montage, and other variables (Table 1). Logistic regression was used to test the main hypotheses, first considering variables one at a time, then in a multivariate model containing the variables discussed above: experimental condition (i.e., whether or not they viewed the montage with smoking scenes), previous exposure to smoking in movies,[26] smoking dependence (measured by the FTND scale), smoking stage of change, impulsivity, gender, ethnicity, and marital status (which differed significantly between the experimental and control groups; Table 1).

Data were collected and analyzed in 2008 and 2009.

RESULTS

Sample Characteristics

There were no significant differences in the demographic or tobacco use characteristics by group randomization except marital status (Table 1).

On average, participants reported previously viewing about a third of the movies in the assessed list ($M = 22.8$ of 60 possible, $SD = 9.7$), consistent with reports of movie viewing in similar studies.[6] Participants saw an average of 218.8 ($SD = 88.6$) total occurrences of smoking (defined as actual smoking, suggested smoking, or tobacco-related items such as cigarette

advertisements or ashtrays) in the 60 films. The number of smoking occurrences viewed by the young adults in this sample is over double that found in previous samples of young adults[25] and adolescents.[8] Men saw significantly more occurrences than women (234.7 vs 199.5, $p = .047$) and married individuals saw more occurrences than singles (257.4 vs 211.0, $p = .049$).

There was no difference between smokers in the two conditions on the total scores on the Minnesota Nicotine Withdrawal Scale (MNSW) completed prior to the study break or the Questionnaire of Smoking Urges completed after the break (Table 1). Nicotine withdrawal and smoking urges differed by gender only, with men reporting higher levels of the urge to smoke after the break (52.6 vs 45.0, $p = .023$).

Movie Manipulation Check

Participants who watched the montage with smoking scenes were more likely to notice smoking in the montage than those watching the smoke free montage, indicating a conscious awareness of their exposure to smoking. Other than in the amount of smoking noticed in the montage, there was no significant difference between those in the experimental versus the control conditions in their experience viewing the films (Table 1).

Smoking Behavior

The odds of smoking during the break in smokers who watched the montage with smoking scenes was triple that of those who watched the smokefree montage (multivariate OR 3.06; 95% CI=1.01, 9.29) (Table 2). There was also an independent dose-dependent effect of having watched movies with more smoking in the past with smoking during the break (OR 6.73, CI 1.00–45.25 for the most exposed).

Level of nicotine dependency also predicted smoking during the break; every one unit increase in participants' FTND score increased the odds that participants smoked by a factor of 1.71 (1.27–2.32) (Table 2). Similarly, smokers in the "contemplation" (OR 9.07; CI 1.71–47.99) and "precontemplation" (OR 7.30; CI 1.39–38.36) stages of change were more likely to smoke during the break, as were smokers who scored higher on measures of impulsivity (OR 1.21; CI 1.03–1.43).

The results of the univariate and multivariate logistic regressions were similar, indicating that the detected effects were acting independently of each other. There was no significant interaction effect of exposure to previous smoking occurrences in movies on the relationship between experimental condition and smoking behavior during the break (P>0.7) (detailed results not shown).

Follow Up Smoking Assessment

Participants were contacted the day following their participation in the study and asked when they had their first cigarette after leaving the study. Eighty-four of the 100 participants were reached for the follow up assessment with an average of 24 hours (SD=5.2 hours) after their participation. Participants in the experimental condition were more likely (multivariate OR 3.64; 95% CI=1.17, 11.30) to have had their first cigarette within 30 minutes of leaving the laboratory (Table 3). Level of nicotine dependency also predicted smoking within 30 minutes of leaving the laboratory; every one unit increase in participants' FTND score increased the odds that participants smoked by a factor of 1.36 (1.02–1.81). (Table 3).

DISCUSSION

This randomized controlled laboratory study demonstrates that exposure to smoking scenes in films increases immediate smoking in young adult smokers. In addition, there is an independent effect of the amount of smoking seen in films prior to participating in the experiment. The results demonstrate a direct causal link between viewing smoking scenes and subsequent smoking behavior. These results are consistent with epidemiologic studies showing a long-term relationship between exposure to smoking in movies and smoking attitudes and behaviors. The current results extend previous research by investigating the effect of smoking in the movies on current smokers rather than consequences of smoking initiation among nonsmokers.

Additional study strengths include the generalizability of the results. Young adults were recruited through locations and channels to ensure a sample beyond college students. The sample was diverse in ethnic origin, SES, and educational status, with less than half of the sample (46%) reporting being currently in college. This study also built on previous literature to examine several potential moderating variables.[5, 6, 41–43] In the current study, these smoking variables influenced both smoking during the break in the study, and smoking following the experimental session. Specifically, participants who were exposed to more smoking in previous movies, had a higher level of nicotine dependence, and were in the contemplation or precontemplation stages of change, were more likely to smoke during the break. Similarly, those with greater previous exposure and level of nicotine dependence were more likely to smoke within 30 minutes after the study. The findings were invariant to the demographic variables of gender, ethnicity, and marital status.

Several previous studies found that visual cues such as movies triggered urges to smoke[24, 52, 53] but in the current study, no differences were detected in self-report of withdrawal symptoms or urge to smoke associated with viewing movie scenes. However, awareness of the purpose of these earlier studies may explain the different results as they were clearly about smoking and the “smoking urge” question was the primary dependent variable, often given several times, and potentially leading to experimental demands. In the current study, participants thought they were coming to a study about memory, and the smoking urge questions were couched among many other items (e.g., urge for salty foods) to ensure that participants would not guess that smoking urge was the important question. Future studies would benefit from including implicit measures of craving that would be invulnerable to some of these issues. The findings also contribute to the cue exposure literature by examining an externally valid set of smoking cues (i.e., montage clips) in a controlled experimental setting and demonstrating an effect on subsequent smoking behavior.

The smoking cues in the movie montage did not influence smoking craving, consistent with recent research that involved much longer film segments.[54] Despite the lack of a difference in urge to smoke in the current experiment, those who watched the movie clips with smoking were much more likely to actually smoke during the break in the study. This finding may stem from a fundamental difference in processes underlying urges and actual behavioral responses, as suggested by the cognitive model of drug urges and drug-use behavior.[55].

Limitations

Our sample consisted of relatively light smokers. Participants had an average smoking dependence (FTND) score of only 2.66 and about half reported smoking less than 10 cig/day, representative of young adult smokers, a demographic with higher levels of social and nondaily smoking patterns associated with low-level consumption.[31, 32] Despite these low levels, an effect for smoking dependence was found, indicating that higher levels of smoking dependence increased the likelihood of smoking during the break in the study.

Thirty-one individuals were excluded (in the process of recruiting 100 eligible participants) because they did not bring cigarettes, but did not differ on any variable other than cig/day smoked and smoking dependence scores.

Participants were generally aware of seeing smoking when exposed to it. It is possible that smoking scenes or paraphernalia embedded within a full length movie would not be recalled, and it is possible that this awareness of smoking influences subsequent smoking behavior. This study used a between-subjects design. A crossover of within-subjects design would have been difficult to implement due to the nature of the dependent variable: smoking assessment. Research participants were unaware that their decision to smoke during the break was a critical variable in the study or that it would be assessed, until they returned to the lab and were asked to provide a second CO reading. Had they been given an additional break, after a second montage viewing, they would no longer be naive to the study's goal, thus introducing the possibility of experimental demands, and corresponding behavior change.

Because of the restrictive environmental setting of the study, the acute effects of seeing smoking in movies may have been underestimated here. Although the laboratory was located on the ground floor with easy access to the sidewalk outside there were several "no smoking" signs in the outdoor area, including one at the entrance to the building where the study was conducted.

Conclusion

Our findings that exposure to smoking on screen is a cue that triggers greater likelihood of immediate subsequent smoking provides valuable insight regarding potential interventions for smoking cessation. For example, interventions based on knowledge of the environmental cues patients experience in their daily lives (e.g., smoking paraphernalia in their home or work, exposure to media and advertisements) might increase patients' successful smoking cessation. A few websites do provide information on whether or not films contain smoking (www.SceneSmoking.org <http://www.SceneSmoking.org>, www.ScreenIt.com <http://www.ScreenIt.com>, and www.SmokeFreeMovies.ucsf.edu <http://www.SmokeFreeMovies.ucsf.edu>), but these sites are not widely known. More important, as of June 2009, the motion picture industry has refused to integrate smoking into the rating system in a reliable way.56 Until smoking has been integrated into movie ratings, the current results suggest that young adults who are attempting to reduce or quit smoking should refrain from or reduce their exposure to movies.

Acknowledgments

The authors thank Dr. James Sargent for access to his database of smoking occurrences in movies, and Steffany Farros and Max Orozco for assistance with recruitment and data collection and entry.

This research was supported by the State of California Tobacco-Related Disease Research Program (16FT-0050 and 17RT-0077) and the National Institute on Drug Abuse (T32 DA007250, K23 DA018691 and P50 DA09253). Dr. Glantz is American Legacy Foundation Distinguished Professor in Tobacco Control and utilized departmental discretionary funds from the UCSF Division of Cardiology to support some of the expenses associated with this study. None of the funding agencies played any role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript.

Dikla Shmueli designed and conducted the experiments, collected the data, did the preliminary analysis and drafted the manuscript. Judith Prochaska provided detailed guidance on the design and conduct of the experiments, assisted in the data analysis and revised the manuscript. Stanton Glantz had the idea for the study, supervised the statistical analysis, revised the manuscript and arranged funding. Glantz has had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

References

1. National Cancer Institute. Tobacco Control Monograph 19: The Role of the Media in Promoting and Reducing Tobacco Use. Bethesda MD: U.S. National Cancer Institute; 2008.
2. WHO. Smokefree movies: from evidence to action. Geneva: WHO; 2009. http://www.who.int/tobacco/smoke_free_movies/en/
3. Keilah, A.; Worth, KA.; Duke, J.; Green, M.; Sargent, JD. Character smoking in top box office movies. 2007.
4. Polansky, JR.; Glantz, SA. First-run smoking presentations in U.S. Movies 1999–2006. Center for Tobacco Control Research and Education Tobacco Control Policy Making; U.S.: 2007.
5. Pechmann C, Shih C. Smoking scenes in movies and antismoking advertisements before movies: effects on youth. Journal of Marketing July;1999 63:1–13.
6. Sargent JD, Dalton MA, Beach ML, Mott LA, Tickle JJ, Ahrens MB, Heatherton TF. Viewing tobacco use in movies: does it shape attitudes that mediate adolescent smoking? Am J Prev Med 2002 Apr;22 (3):137–45. [PubMed: 11897456]
7. Charlesworth A, Glantz SA. Smoking in the movies increases adolescent smoking: a review. Pediatrics 2005 Dec;116(6):1516–28. [PubMed: 16322180]
8. Dalton MA, Sargent JD, Beach ML, Titus-Ernstoff L, Gibson JJ, Ahrens MB, Tickle JJ, Heatherton TF. Effect of viewing smoking in movies on adolescent smoking initiation: a cohort study. Lancet 2003 Jul 26;362(9380):281–5. [PubMed: 12892958]
9. Dalton MA, Beach ML, Adachi-Mejia AM, et al. Early exposure to movie smoking predicts established smoking by older teens and young adults. Pediatrics 2009 Apr;123(4):e551–8. [PubMed: 19336346]
10. Heatherton T, Sargent J. Does watching smoking in movies promote teenage smoking? Curr Dir Psych Sci 2009;18:63–7.
11. Sargent JD, Beach ML, Dalton MA, Mott LA, Tickle JJ, Ahrens MB, Heatherton TF. Effect of seeing tobacco use in films on trying smoking among adolescents: cross-sectional study. BMJ 2001 Dec 15;323(7326):1394–7. [PubMed: 11744562]
12. Sargent JD, Stoolmiller M, Worth KA, Dal Cin S, Wills TA, Gibbons FX, Gerrard M, Tanski S. Exposure to smoking depictions in movies: its association with established adolescent smoking. Arch Pediatr Adolesc Med 2007 Sep;161(9):849–56. [PubMed: 17768284]
13. Titus-Ernstoff L, Dalton MA, Adachi-Mejia AM, Longacre MR, Beach ML. Longitudinal study of viewing smoking in movies and initiation of smoking by children. Pediatrics 2008 Jan;121(1):15–21. [PubMed: 18166552]
14. Sargent JD, Beach ML, Adaclli-Meiia AM, et al. Exposure to movie smoking: Its relation to smoking initiation among U.S. adolescents. Pediatrics 2005;116:1183–91. [PubMed: 16264007]
15. Hanewinkel R, Sargent JD. Exposure to smoking in popular contemporary movies and youth smoking in Germany. Am J Prev Med 2007 Jun;32(6):466–73. [PubMed: 17533061]
16. Hanewinkel R, Sargent JD. Exposure to smoking in internationally distributed American movies and youth smoking in Germany: a cross-cultural cohort study. Pediatrics 2008 Jan;121(1):e108–17. [PubMed: 18166530]
17. Laugesen M, Scragg R, Wellman RJ, DiFranza JR. R-rated film viewing and adolescent smoking. Prev Med 2007 Dec;45(6):454–9. [PubMed: 17707897]
18. Thrasher JF, Jackson C, Arillo-Santillan E, Sargent JD. Exposure to smoking imagery in popular films and adolescent smoking in Mexico. Am J Prev Med 2008 Aug;35(2):95–102. [PubMed: 18617078]
19. Islam SMS, Johnson CA. Western media's influence on Egyptian adolescents' smoking behavior: the mediating role of positive beliefs about smoking. Nicotine Tob Res 2007;9:57–64. [PubMed: 17365737]
20. Gibson B, Maurer J. Cigarette smoking in the movies: the influence of product placement on attitudes toward smoking and smokers. Journal of Applied Social Psychology 2000;30(7):1457–73.
21. Dixon HG, Hill DJ, Borland R, Paxton SJ. Public reaction to the portrayal of the tobacco industry in the film the Insider. Tob Control 2001;10:285–91. [PubMed: 11544395]

22. Dal Cin, M.; Fong, G.; Gibson, B.; Zanna, M. Smoking characters in movies increases automatic identification with smoking: An experimental study using implicit measures (abstract). University of Waterloo; 2003. Abstract
23. Hines D, Saris RN, Throckmorton-Belzer L. Cigarette smoking in popular films: does it increase viewers' likelihood to smoke? J Appl Soc Psychol 2000;30(11):2246–69.
24. Sargent JD, Morgenstern M, Isensee B, Hanewinkel R. Movie smoking and urge to smoke among adult smokers. Nic Tob Research 2009;11(9):1042–6.
25. Song AV, Ling PM, Neilands TB, Glantz SA. Smoking in movies and increased smoking among young adults. Am J Prev Med 2007 Nov;33(5):396–403. [PubMed: 17950405]
26. Sargent JD, Hanewinkel R. Comparing the effects of enterntainment media and tobacco marketing on youth smoking in Germany. Addiction 2009;104:824–5. [PubMed: 19413794]
27. dortch S. Going to the movies. American Demographics 1996;18:4–5. [PubMed: 10182444]
28. America NAo. NAA 2001 movie market study: a special in-theatre audience survey. Newspaper Association of America; 2001.
29. Lantz PM. Smoking on the rise among young adults: Implications for research and policy. Tobacco Control 2003;12:60–70. [PubMed: 12612364]
30. CDC. Cigarette use among high school students—U.S., 1991–2005. MMWR 2006;55(26):724–6. [PubMed: 16826159]
31. Harris JB, Schwartz SM, Thompson B. Characteristics associated with self-identification as a regular smoker and desire to quit among college students who smoke cigarettes. Nicotine Tob Res 2008;10:69–76. [PubMed: 18188747]
32. Levinson AH, Campo S, Gascoigne J, Jolly O, Zakharyan A, Tran ZV. Smoking, but not smokers: Identity among college students who smoke cigarettes. Nicotine Tobacco Research 2007;9:845–52. [PubMed: 17654297]
33. Wortley PM, Husten CG, Trosclair A, Chrismon J, Pederson LL. Nondaily smokers: a descriptive analysis. Nicotine Tob Res 2003;5:755–9. [PubMed: 14577992]
34. Moran S, Wechsler H, Rigotti NA. Social smoking among U.S. college students. Pediatrics 2004;114:1028–34. [PubMed: 15466101]
35. Shmueli D, Prochaska JJ. Resisting tempting foods and smoking behavior: Implications from a self-control theory perspective. Health Psychology 2009;28:300–6. [PubMed: 19450035]
36. Shmueli, D.; Prochaska, JJ. Positive Affect Counteracts Self-Control Depletion among Cigarette Smokers. submitted
37. Hughes JR, Hatsukami D. Signs and symptoms of tobacco withdrawal. Archives of General Psychiatry 1986 Mar;43(3):289–94. [PubMed: 3954551]
38. Zuckerman MKD. Personality and risk-taking: Common biosocial factors. Journal of Personality 2000;68:999–1029. [PubMed: 11130742]
39. DiClemente CC, Prochaska JO, Fairhurst SK, Velicer WF, Velasquez MM, Rossi JS. The process of smoking cessation: An analysis of precontemplation, contemplation, and preparation stages of change. Journal of Consulting and Clinical Psychology 1991 Apr;59(2):295–304. [PubMed: 2030191]
40. Heatherton TF, Kozlowski LT, Frecker RC, Fagerström KO. The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. British Journal of Addiction 1991;86:1119–27. [PubMed: 1932883]
41. Pomerleau O, Pomerleau CS, Mehringer A, SMS, RN, AS. Nicotine dependence, depression, and gender: characterizing phenotypes based on withdrawal discomfort, response to smoking, and ability to abstain. Nicotine Tob Res 2005;2:91–102. [PubMed: 15804681]
42. Pomerleau CS, JLM, Pomerleau O. Who gets what symptom? Effects of psychiatric cofactors and nicotine dependence on patterns of smoking withdrawal symptomatology. Nicotine Tobacco Research 2000;2:275–80. [PubMed: 11082828]
43. Abrams DB, Hertzog TA, Emmons KM, LL. Stages of change versus addiction: a replication and extension. Nicotine Tobacco Research 2000;3:233–9.
44. Mitchell SH. Measuring impulsivity and modeling its association with cigarette smoking. Behavior and Cognitive Neuroscience Review 2004;3:261–75.

45. Worth, K.; Tanski, SE.; Sargent, JD. First Look Report Number 16. Washington, DC: American Legacy Foundation; 2006. Trends in top box office movie tobacco use 1996–2004.

46. Sargent JD, Worth KA, Beach M, Gerrard M, Heatherton TF. Population-based assessment of exposure to risk behaviors in motion pictures. Commun Methods Meas 2008 Jan;2(1–2):134–51. [PubMed: 19122801]

47. Sargent JD. Smoking in movies: impact on adolescent smoking. Adolescent Medicine Clinics 2005;16:345–70. [PubMed: 16111622]

48. Cox LS, Tiffany ST, Christen AG. Evaluation of the brief questionnaire of smoking urges (QSU-brief) in laboratory and clinical settings. Nicotine Tob Res 2001 Feb;3(1):7–16. [PubMed: 11260806]

49. Toll BA, Katulak NA, McKee SA. Investigating the factor structure of the Questionnaire on Smoking Urges-Brief (QSU-Brief). Addict Behav 2006 Jul;31(7):1231–9. [PubMed: 16226843]

50. Irving JM, Clark EC, Crombie IK, Smith WC. Evaluation of a portable measure of expired-air carbon monoxide. Preventative Medicine 1988;17:109–15.

51. Jarvis MJ, Belcher M, Vesey C, Hutchinson DCS. Low-cost carbon monoxide monitors in smoking assessment. Thorax 1986;41:886–7. [PubMed: 3824275]

52. Tong C, Bovbjerg DH, Erblich J. Smoking-related videos for use in cue-induced craving paradigms. Addict Behav 2007;32:3034–44. [PubMed: 17725931]

53. Baumann SB, Sayette MA. Smoking cues in a virtual world provoke craving in cigarette smokers. Psychology of Addictive Behaviors 2006;20:484–9. [PubMed: 17176184]

54. Lochbuehler K, Engels RC, Scholte RH. Influence of smoking cues in movies on craving among smokers. Addiction 2009 Dec;104(12):2102–9. [PubMed: 19804459]

55. Tiffany ST. A cognitive model of drug urges and drug-use behavior: role of automatic and nonautomatic processes. Psychol Rev 1990 Apr;97(2):147–68. [PubMed: 2186423]

56. Polansky, JR.; Titus, K.; Glantz, SA. Two years later: Are MPAA's tobacco labels protecting movie audiences?. UCSF Center for Tobacco Control Research and Education; 2009.

Table 1

Sample characteristics and responses by experimental condition

Variable	Experiment Smoking Clips *n*=50	Control No Smoking Clips *n*=50	p
Demographic Characteristics			
Gender			.159
Male	31 (62%)	24 (48%)	
Female[a]	19 (38%)	26 (52%)	
Age	*20.80 (2.38)*	*21.44 (2.25)*	.170
Ethnicity[b]			.071
Caucasian	20 (40%)	26 (52%)	
African-American	4 (8%)	7 (14%)	
Asian	6 (12%)	8 (16%)	
Other	20 (40%)	8 (16%)	
Hispanic (vs not Hispanic)	11 (22%)	6 (12%)	.198
Marital Status			.017
Married/cohabitating	4 (8%)	13 (26%)	
Single, divorced, separated	46 (92%)	37 (74%)	
Education			.195
< High school degree	6 (12%)	1 (2%)	
High school or GED	27 (54%)	31 (62%)	
Associate or vocational degree	10 (20%)	13 (26%)	
College degree	7 (14%)	4 (8%)	
Graduate studies	0 (0%)	1 (2%)	
Employment Status			.990
Employed	16 (32%)	17 (34.0)	
Unemployed	10 (20%)	10 (20%)	
Student, homemaker, or retired	23 (46%)	23 (46%)	
No response	1 (2%)	0 (0%)	
Impulsivity	*12.42(3.34)*	*11.42 (3.49)*	.147
Smoking Variables			
Minutes since last cigarette	*287.7(877.85)*	*177.2(352.54)*	.419
Smoking Stage of Change			.681
Precontemplation	25 (50%)	21 (42%)	
Contemplation	17 (34%)	21 (42%)	
Preparation	8 (16%)	8 (16%)	
Number of cigarettes smoked on the day prior to testing	*11.4 (7.33)*	*10.4(6.91)*	.504
FTND score	*2.62(2.09)*	*2.69(2.42)*	.871
Total movies seen (of 60)	*21.7 (8.85)*	*23.9 (10.37)*	.261
Total smoking episodes/incidents	*207.42(87.84)*	*230.26(88.72)*	.199

Variable	Experiment Smoking Clips *n*=50	Control No Smoking Clips *n*=50	p
Movie Manipulation Check			
How interesting was montage	*6.44 (2.51)*	*6.30 (2.73)*	.790
How enjoyable	*6.62 (2.29)*	*6.74 (2.64)*	.809
How much attention paid	*8.08 (1.83)*	*7.76 (1.99)*	.404
Seen movies previously	*1.66 (1.27)*	*1.90 (1.14)*	.321
Noticed smoking	48 (96%)	6 (12%)	.001
Outcome Variables			
Smoked during the break	32 (64%)	22 (44%)	.045
Nicotine Withdrawal	*2.72 (1.035)*	*2.54 (1.038)*	.972
Urge to Smoke	*49.26(16.379)*	*49.14 (17.427)*	.386
Smoked within 30 minutes after study	25(62.5%)	15 (37.5%)	.029

Note. Frequency (percentage), M (SD)

[a] One transgendered individual (a transwoman, or male-to-female transgender person) was counted as female.

[b] One participant in the control condition did not state ethnicity and was classified as “Other”

Table 2

Predictors of smoking during the study break

	Univariate OR (95% CI)	Multivariate OR (95% CI)
Experimental Condition (smoking in film clips)	**2.26 (1.01, 5.05)**	**3.06 (1.01, 9.29)**
Prior Movie Exposure (percentile)	**6.93 (1.69, 28.48)**	**6.73 (1.00, 45.25)**
FTND	**1.39 (1.13, 1.71)**	**1.71 (1.27, 2.32)**
Stage of Change		
Preparation	**1.0**	**1.0**
Contemplation	**7.39 (1.84, 29.70)**	**9.07 (1.71, 47.99)**
Precontemplation	**5.96 (1.45, 24.43)**	**7.30 (1.39, 38.36)**
Male gender	**2.40 (1.07, 5.37)**	2.03 (.69, 5.95)
Ethnicity		
Caucasian	1.0	1.0
African American	1.20 (.32, 4.49)	.68 (.11, 4.24)
Asian	1.80 (.52, 6.20)	3.24 (.61, 17.21)
Other	1.33 (.52, 3.43)	.87 (.22, 3.40)
Married/cohabitating	1.27 (.44, 3.65)	.96(.26, 3.50)
Impulsivity	1 .07 (.94, 1.21)	**1.21 (1.03, 1.43)**

Note. Significant ($p \leq 0.05$) ORs are in bold.

Table 3

Predictors of smoking within 30 minutes after the study

	Univariate OR (95% CI)	Multivariate OR (95% CI)
Experimental Condition (smoking in film clips)	**2.65 (1.10, 6.40)**	**3.64 (1.17, 11.30)**
Prior Movie Exposure (percentile)	1.81 (.44, 7.43)	3.46 (.58, 20.44)
FTND	**1.28 (1.03, 1.58)**	**1.36 (1.02, 1.81)**
Stage of Change		
Preparation	1.0	1.0
Contemplation	1.18 (.33, 4.26)	.99 (.21, 4.65)
Precontemplation	2.22 (.59, 8.34)	3.78 (.78, 18.37)
Male gender	1.03 (.43, 2.44)	.70 (.23, 2.15)
Ethnicity		
Caucasian	1.0	1.0
African American	1.11(.28, 4.48)	.53 (.10, 2.75)
Asian	.49 (.13, 1.88)	.27 (.05, 1.43)
Other	1.44 (.51, 4.09)	.98 (.27, 3.47)
Married/cohabitating	1.13 (.38, 3.35)	1.13 (.29, 2.57)
Impulsivity	.99 (.87, 1.12)	.99 (.84, 1.17)
Smoked during the break	1.50 (.63, 3.57)	.74 (.21, 2.57)

Note. Significant ($p<0.05$) ORs are in bold.