Exposure to Smoking Imagery in the Movies and Experimenting with Cigarettes among Mexican Heritage Youth

Anna V Wilkinson[A], **Margaret R. Spitz**[A], **Alexander V. Prokhorov**[B], **Melissa L. Bondy**[A], **Sanjay Shete**[A], and **James D Sargent**[C]

[A]Department of Epidemiology, Unit 1340, The University of Texas M. D. Anderson Cancer Center, P.O. Box 301439, Houston, TX 77230-1439.

[B]Department of Behavioral Science, Unit 1330, The University of Texas M. D. Anderson Cancer Center, P.O. Box 301439, Houston, TX 77230-1439.

[C]Cancer Control Research Program Norris Cotton Cancer Center, Dartmouth Medical School, Lebanon, NH 03756.

Abstract

There is growing evidence that an adolescent's decision to try cigarettes is influenced by level of exposure to movies in which smoking is portrayed. Less is known about how ethnicity affects this process. We examined whether acculturation and/or country of birth influence the relationship between exposure to smoking imagery in the movies and experimenting with cigarettes among Mexican origin youth. We prospectively followed 1,328 Mexican origin adolescents aged 11–13 at baseline. We assessed which of 50 movies (randomly selected from a pool of 250 popular contemporary movies released from 1999–2004 and content analyzed for smoking) adolescents had seen. Smoking behavior was assessed at baseline and at 6-month intervals over 24 months. 10% of the adolescents had experimented at baseline; 17% tried subsequently. Multivariate analyses revealed, as exposure to smoking imagery in the movies increased, the chances of having ever experimented (AOR=1.27; 95% CI: 1.10–1.48) and of being a new experimenter (AOR=1.19; 95% CI: 1.01–1.40) increased, equivalent to a 4.2% increased risk of ever and a 3.0% increased risk of new experimenting for each additional quartile of movie exposure. This effect was moderated by country of birth. For Mexican-born youth, exposure to smoking imagery in the movies was the strongest independent predictor of new experimentation (AOR=1.52; 95% CI: 1.14–2.05). For US-born youth, we observed a ceiling effect: the percent of experimenters increased with increasing exposure, and then flattened. Among Mexican-born youth exposure to smoking imagery in the movies may be an important part of the acculturation process associated with smoking initiation.

Keywords

Experimenting with cigarettes; exposure to smoking imagery; Mexican origin youth

Introduction

There is evidence that an adolescent's decision to try a cigarette is strongly influenced by his or her level of exposure to watching English-language movies in which smoking is portrayed

(1). The 2008 NCI Monograph entitled "The role of the media in promoting and reducing tobacco use" (1) concluded that "the total weight of evidence from cross-sectional, longitudinal, and experimental studies indicates a causal relationship between exposure to depictions of smoking in movies and youth smoking initiation." Subsequent research has confirmed this causal relationship in a US-based study (2) and in Germany (3), has documented a dose-response relationship between exposure and smoking behavior in young adults (4), demonstrated that smoking in movies predicts risk of becoming an established smoker (5), and demonstrated that the relationship between level of exposure and experimenting with cigarettes also is observed among elementary school-aged children (2). In addition, adolescents whose parents restrict their viewing of R-rated movies, in which on average there are more depictions of smoking compared to G, PG, and PG-13 classified movies, are at decreased risk for smoking initiation (6).

There is evidence that there might be differences in how minorities respond to viewing smoking imagery in movies -- Jackson, Brown, & L'Engle (7), found an effect for white, but not black adolescents, based on their relative exposure to R-rated movies and having a television in the bedroom. However, only one cross-sectional US-based study has addressed the relationship specifically among Hispanics; demonstrating that Hispanics reported higher exposure than non-Hispanic whites (8), while another study suggested that Mexican adolescents also might be influenced by smoking imagery in the movies (9). Among Mexican adolescents, exposure to smoking imagery was related to current and ever smoking, as well as being susceptible to smoking (9).

Finally, in previous research, we found that both country of birth and acculturation impact smoking behavior among the adults in the cohort from where our study participants were drawn (10). Based on our previous findings and those reported by Thrasher et al (9) we hypothesized a) that more acculturated participants and those born in the US would report higher levels of exposure than their less acculturated peers and b) that we would observe a positive relationship between level of exposure to smoking imagery in the movies and experimentation, regardless of level of acculturation and country of birth. Therefore the current analysis was designed to further address the relationship between exposure to smoking imagery in the movies and smoking among Mexican origin adolescents by examining whether acculturation (11) and/or country of birth modify that relationship. We focused on Mexican origin youth since most research to date has examined Hispanic youth as a group, and thereby may have obscured unique risk factors associated with subgroups of Hispanics. In addition, people of Mexican origin represent the largest and most rapidly growing subgroup of Hispanics in the United States. For these reasons, studying smoking behavior in this population is timely and warranted.

Materials and Methods

Participant recruitment

Participants included in this study were drawn from a population-based cohort of Mexican-American households launched in July 2001 by the Department of Epidemiology at The University of Texas M. D. Anderson Cancer Center. Households were initially recruited into the cohort via probability random-digit dialing, door-to-door recruitment, intercepts, and networking approaches. Results from these pooled recruitment methods indicated no significant differences in populations with respect to language preference, nativity, years living in the US and household income (12). Therefore the households in the population-based cohort from which our participants are drawn are representative of the Mexican origin population in Houston. A detailed description of the cohort recruitment methodology has been published (10).

A total of 3,000 households with potential age-eligible (adolescents between the ages of 11 and 13 years) participants were identified from the cohort database. Of the first 1,425 potential participants' parents or legal guardians we contacted to assess interest in the study, just over 90% agreed to enroll their child in the study (N=1,328). The institutional review board at The University of Texas M. D. Anderson Cancer Center approved all aspects of this study.

Data collection

Data were collected via personal interview on five sequential encounters. At baseline and the final interview data were collected in the home, while on the second, third and fourth occasions data were collected over the telephone.

At baseline, after consenting to join the study, each participant completed a 5-minute personal interview during which basic demographic (gender, age, nativity status (US or Mexico)) and acculturation data were collected. To assure confidentiality from the parents overhearing any of the child's responses, the participant was given a personal digital assistant (PDA) to complete the remainder of the survey. Participants answered the survey either in English or Spanish. A detailed description of the baseline data collection procedures has been published (13).

We collected follow-up data at six months, one year, 18 months (by telephone interview to assess changes in smoking status), and 24 months (at the final home visit) after baseline assessment. The final home visit was conducted about two years after the baseline home visit; identical data were collected at each home visit using the same methodology.

Measures

The measures assessed at baseline and the final home visit, are described in detail in TABLE 1. Our study included two primary outcome variables: new experimentation with cigarettes and ever experimentation with cigarettes.

The independent variable of interest in this analysis is the participants' level of exposure to movie smoking. We estimated the participants' exposure to the movie smoking using previously validated methods (14). Briefly, using the Beach method, each participant in our study indicated whether or not s/he had seen a subsample of 50 movie titles selected at random from a pool of 250 movies. The movies included in the pool were the 50 top box office hits for the years 1999–2004. All 250 movies were content analyzed for smoking by the media research laboratory at Dartmouth using previously described methods (15). Based on the movies the adolescent had seen, and the amount of smoking content in each movie, exposure to smoking from the 50 movies was computed. This number was then adjusted to account for the fact that every list of 50 movies had a slightly different aggregate amount of smoking, by scaling the estimate so that it reflected total exposure to smoking in the larger sample of movies. Thus, the Beach method provides a population-based assessment of exposure to a relatively large sample of movies, so that the results generalize to characteristics of the larger sample, rather than the individual survey sample of 50 movies. To be consistent with previous research in this area (5,16), we winsorized the top and the bottom 5% of the exposure to smoking incidents in the movie distribution, such that extreme values at either end of the distribution were recoded to the 5th and 95th percentile. This method is sensitive to the number of outliers in the data, but not their actual values (17).

In addition, we standardized the variable, by subtracting the 5th percentile value on the movie exposure variable and dividing it by the 95th percentile, after winsorization. We analyzed the exposure to smoking incidents in the movies as a continuous variable; the increased risk corresponds to a unit increase in the transformed variable of the movie exposure. However, to facilitate comparisons between our results and previous research we calculate the odds of

experimenting associated with a quartile increase in smoking incidents viewed. This increased risk is obtained using the following formula: $OR = \exp(\text{beta}(x_2-x_1))$, where x_2 and x_1 are the transformed second and first quartiles.

We further controlled for the influence of other established predictors of adolescent smoking. Many studies have shown that smoking behavior is influenced by gender, age (18–20), and socioeconomic status (21), therefore, we included them as control variables in the study. We further examined the role of several established risk factors for experimentation with cigarettes: risk taking tendencies (22–24), anxiety (25), social influence from family and friends (24,26), and school behavior (27).

Statistical analyses

We conducted Student's t-tests and one-way analysis of variance to examine mean differences in exposure to movie smoking by the participant's demographic characteristics and smoking-related covariates and to examine mean differences in exposure to movie smoking by experimenter status for each level of participant demographic characteristics and each level of the smoking-related covariates.

In order to facilitate comparisons between the covariates, each continuous predictor was standardized ($\underline{M}=0$, $\underline{SD}=1$) prior to completing the multivariable analyses. Two multivariable models were developed. The first model assessed associations between ever experimenting and exposure to smoking in the movies, controlling for established risk factors. Participants who reported having experimented at one or more encounters were classified as ever experimenters. All risk factors that demonstrated a significant association (p<0.05) with ever experimenting were entered into this stepwise logistic regression analysis. The second model assessed the relationship between exposure to smoking in the movies movie and new experimenting. Participants who responded negatively ("no") at baseline, but positively ("yes") to questions probing whether they experimented at one of the subsequent interviews were categorized as "new" experimenters. The risk factors identified for ever experimenting were entered into this second stepwise logistic regression analysis. In both models, parental educational attainment was forced into the model to control for variations in household SES.

Finally, participants' level of acculturation and country of birth were forced into the models described above to examine them as direct effects and potential moderating variables. We examined the role of acculturation and country of birth separately as the two are correlated (r=0.36; p<0.001). To determine if either country of birth or level of acculturation moderates the influence of exposure to smoking imagery in the movies on experimentation we followed methodologies outlined by Baron and Kenny (28) and Kraemer et al (29). For these analyses, acculturation and exposure to smoking imagery were examined as continuous variables. Two interaction terms were created (country of birth by exposure to smoking imagery and acculturation by exposure to smoking imagery). Moderation is best detected prospectively, therefore in the model examining new experimentation, each interaction term and the two main effects were simultaneously entered into unconditional logistic regression models, adjusting for the covariates.

Results

A total of 1,328 youth between the ages of 11 and 13 were enrolled into the study. Over the course of follow-up, 11 participants withdrew from the study. Therefore, data from 1,317 participants were available for the current analysis. Data from 31 participants were missing on parental education and data from one child were missing on the anxiety measure. Thus, the final sample size was N=1,286.

Based on 50 movies randomly selected from the pool of 250 popular contemporary movies from 1999–2004, our participants reported viewing an average of 217 (SD=164) depictions of smoking in the movies. The average number varied by demographic characteristics and smoking-related covariates. Boys reported higher exposure than girls (p<0.001), and exposure increased with participants' age (p<0.001; TABLE 2). Youth born in the US, versus Mexico, reported higher exposure (p<0.001), as did more acculturated youth (p<0.001). Higher levels of parental education were associated with increased exposure to smoking in the movies (p<0.001). Overall, 329 (25.6%) of the participants reported ever experimenting; experimenters reported higher levels of exposure to smoking in the movies than non-experimenters (p<0.001). Those who had experimented at baseline reported the highest level of exposure of any subgroup; an average of 305 depictions compared with 271 for new experimenters (p=0.08). Participants who reported risk-taking tendencies and higher levels of anxiety reported higher exposure to smoking in the movies than those who reported low or no risk taking tendencies and lower levels of anxiety (p<0.0001 for both). As the number of smokers in the household increased, so did exposure to smoking imagery in the movies (p<0.001). Having at least one friend who smokes and at least one detention were both associated with higher levels of exposure (p<0.001 for both).

TABLE 2 further explores differences in exposure to smoking in the movies on the demographic characteristics and smoking-related covariates by experimenter status. Experimenters reported higher levels of exposure to smoking in the movies on each level of the demographic characteristics examined; i.e. regardless of gender, age, country of birth, level of acculturation and parental education (p<0.001 for all). Likewise for the smoking-related covariates, experimenters reported higher levels of exposure to smoking in the movies than non-experimenters on the majority of categories we examined, including risk-taking tendencies, anxiety level, number of household members who smoke, and reported detentions, experimenters (p<0.05 for all). Among participants who reported that none of their friends smoke, experimenters reported higher levels of exposure than never experimenters (p<0.01).

We observed a linear relationship between ever experimenting and exposure to smoking imagery in the movies (FIGURE 1). Among those who reported no or very little exposure, just over 10 % reported experimenting, however, as exposure increased to up to 600 depictions of smoking in the movies, experimenting increased to over 45%. Results from the multivariable model examining the relationship between ever smoking and exposure to smoking in the movies are presented in TABLE 3. Neither acculturation nor country of birth maintained significance in the multivariable model. We found that significant predictors of ever experimenting included gender, having at least one friend who smokes, living with one family member or other household member who smokes, being a risk taker and feeling anxious were associated with ever experimenting. Finally, after controlling for the above risk factors, increased exposure to smoking in the movies was associated with ever experimenting (AOR=1.27; 95% CI: 1.10–1.48; p =0.002). Viewed un increments of quartiles of exposure (another way movie exposure has been modeled), a youth in the second quartile on the movie exposure variable is at 4.2% increased risk of experimenting compared to peers in the first quartile on the movie exposure variable. In addition, compared to a youth in the first quartile, one in the 3rd quartile has an increased risk of 10.3% and a 6% increased risk compared to a youth in the 2nd. For ever experimentation, the relationship we observed is additive (i.e. dose-response).

Again we observed a linear relationship between new experimenting and exposure to smoking imagery in the movies (FIGURE 1). Among those who reported no or very little exposure to smoking imagery, just under 10 % reported experimenting, however as exposure increased to up to 600 depictions of smoking in the movies, experimenting increased to almost 30%. TABLE 3 also presents the results from the multivariable model examining the relationship

between exposure to smoking in the movies and new experimentation. Overall, we found that between the two models although the relative standing of the variables changed, the majority of the covariates were associated with ever and new experimentation. Specifically, older age was the most significant predictor of becoming an experimenter, followed by being a boy, a risk taker, and finally having at least one friend who smokes. However, level of anxiety and living with a family or household member who smokes were not associated with new experimentation. Again, after controlling for the above risk factors, we further found that increased exposure to smoking imagery in the movies remained a significant predictor of new experimenting (AOR=1.19; 95% CI: 1.01–1.40; p = 0.04). Viewed in increments of quartiles, a youth in the second quartile on the movie exposure variable is at 3.0% increased risk of new experimenting compared to peers in the first quartile on the movie exposure variable. In addition, compared to a youth in the first quartile, one in the 3rd quartile has an increased risk of 7.3% and a 4.2% increased risk compared to a youth in the 2nd. For new experimentation, the relationship we observed is also additive (i.e. dose-response).

Country of birth, not acculturation per se, moderated the impact of exposure to smoking imagery in the movies on new experimenting (data not shown). Among new experimenters the main effect for country of birth (AOR=1.43; 95% CI: 1.07–1.91; p<0.05) was significant. The odds of being a new experimenter were higher for participants born in the US compared to their peers born in Mexico. In addition, the main effect for exposure to smoking imagery in the movies, (AOR=1.58; 95% CI: 1.20–2.09; p<0.01) was significant. Higher levels of exposure were associated with being a new experimenter. The interaction term (AOR=0.64; 95% CI: 0.45–0.90; p<0.05) also achieved significance. Accordingly the sample for this model was split on country of birth. However, among new experimenters, neither the main effect of (p=0.3) nor the interaction term achieved significance (p=0.1).

In the analysis examining the relationship between exposure to smoking in the movies and new experimentation by country of birth we found distinct risk factors for youth based on the country of birth (TABLE 4). Among Mexican-born youth, we found as age increased so did the odds of experimenting, that risk takers were more likely to have experimented than the risk averse, and participants who had at least one detention were more likely to have experimented than their peers who had not had a detention. In addition, we found that increasing exposure to movies in which the characters smoke was associated with being an experimenter (AOR=1.52; 95% CI: 1.14–2.05). Among the youth born in the US, being a boy, older age and having a friend who smokes were all associated with experimentation, but exposure to imagery of movie stars smoking was not associated. Although exposure to smoking imagery in the movies was not significant for the children born in the US, the interaction analysis is based on linear relationships, and a review of figure 2 suggests a ceiling effect. Among US-born children as exposure increased from 0 to 400 movie smoking depictions, the percent of experimenters increased from 5% to 25%, but beyond 400 there was no longer a relation between higher exposure and higher levels of experimentation (FIGURE 2).

Discussion

Overall, we found that after controlling for several established risk-factors associated with experimenting with cigarettes, as exposure to smoking imagery in the movies increased, the chances of having ever experimented and of being a new experimenter also increased. Our findings are consistent with previous research. Results from a cross-sectional US-based study, based on a on a large representative sample indicate that after adjusting for similar established risk factors, the association between exposure to smoking imagery in the movies and smoking initiation was consistent across ethnic groups (8). Further our findings are consistent with those from longitudinal studies in the US, Germany, and Mexico (2,3,9). In addition, we generated new findings -- among Mexican origin youth residing in the US, country of birth moderates

the relationship between exposure to smoking in the movies and the onset of experimenting with cigarettes. Our results also extend previous findings as we controlled for the participants' self-reported levels of anxiety and still found an effect for exposure to smoking imagery on ever experimenting.

A unique and important contribution of this investigation is that we examined the potential moderating influence of acculturation and the child's country of birth. The results from these analyses indicated that level of acculturation had no main effect on smoking onset, nor did it moderate the exposure-experimenting relationship. However, country of birth had both a main effect and moderated the movie effect for new onset smoking. The acculturation measure we used is a broadly accepted language-based assessment scale (11). Tentatively, we hypothesize that this scale does not fully capture the culture-related determinants of behavior change related to experimentation with tobacco and exposure to smoking in movies. It is possible that other unmeasured aspects or sequelae of acculturation, such as increased levels of depression associated with increased generational status in the US among Mexican origin immigrant youth (30) that drive the relationship between acculturation level and experimenting with cigarettes.

For Mexican-born youth, exposure to smoking imagery in the movies was the strongest independent predictor of new experimentation, suggesting that an important part of the acculturating influence of Hollywood movies is to promote smoking initiation among immigrant Mexican American (MA) adolescents. However, for US-born youth, exposure to smoking imagery in the movies did not predict new experimentation; instead, gender, age and peer smoking were more important predictors. Moreover, in a previous study, Sargent et al (8) noted that Hispanics reported higher exposure than non-Hispanic whites, which may underscore the possibility that the impact of exposure may be higher for Hispanics (8). In contrast our result, examining the moderating impact of country of birth, suggests that among US-born MAs there may be a ceiling effect for exposure, such that higher levels of exposure do not translate into higher levels of smoking in the population. However, this conclusion is tentative since the current result is based on the difference in how 36 high exposure youth born in Mexico responded to their exposure to movies compared to 102 high exposure youth born in the US. Further research is warranted.

The effect size of exposure to smoking imagery on experimentation that we observed was smaller than previously reported in most US-based studies. Song et al (4), report a smaller dose-response relationship among US young adults than has been previously reported among U.S. Caucasian adolescents (8). Unlike the older adolescents in these two studies, our participants were young; therefore very few were established smokers and it seems unlikely that our participants were old enough to be impervious to the impact of the media. It is possible that our participants, who are all of Mexican heritage, are less responsive to the predominantly white role models they see in movies than youth of other ethnicities. Only 3% of movie characters are Hispanic and about 11% are Black (31).The low prevalence of racially and ethnically similar character smokers in movies could explain lower responsiveness among Blacks (7) and Hispanics.

Of note, the majority of covariates that we controlled for in this analysis were related to ever and new experimenting with cigarettes in the expected direction. Our findings were consistent with previous research on smoking experimentation in general, and on the influence of smoking imagery in the movies on smoking in particular. Specifically, and consistent with previous studies, the multivariable model indicated that having at least one friend who smokes (3,8), being older (3,8), and a male (20), living with somebody who smokes (3,32), feeling anxious (33,34), being a risk taker (3,8) and having at least one detention (35), were all associated with smoking.

Numerous studies have noted that peer affiliation is one of the strongest predictors of youth ever experimenting (36,37). It is possible that peer smoking and exposure to movie smoking are confounded. However, it is also theoretically plausible that peer smoking is a mediator of the movie smoking effect on behavior. Youth often view movies with their friends, so peer smoking is, in part, a marker for shared movie exposure. That shared exposure represents a potential cause of smoking onset for the peer; mediation would occur if that peer served as the immediate prompt for the target adolescent to begin smoking. While there is no way to distinguish mediation from confounding statistically, studies have found empirical support for the notion that peer smoking mediates the exposure-experimentation relationship (4,38,39). Similarly, numerous studies have noted that parental smoking is a strong and consistent predictor of youth ever smoking (36,37,40). Previous studies have demonstrated that children whose parents do not smoke tend to be more receptive and influenced by exposure to smoking imagery in the movies than their peers whose parents smoke (3,41). This suggests that parental smoking could be an effect modifier, which we examined (data not shown) but did not observe. Finally, although unlikely, it is possible that parental smoking and exposure to smoking imagery in the movies are confounded.

Our results pertaining to anxiety extend previous findings. Although others have demonstrated a relationship between feeling anxious and experimenting with cigarettes (33,34), previous studies have not examined whether the inclusion of anxiety in multivariable models attenuates the exposure-experimenting relationship. We controlled for trait anxiety, which we found to be an important predictor of ever experimentation in the multivariate model, yet we found the inclusion of trait anxiety did not attenuate the effect of exposure to smoking imagery in the movies.

The current study has both strengths and limitations. The prospective study design allowed us to examine experimentation at follow-up among participants who had not experimented at baseline and to test for moderation effects. Further, participants were from a population-based cohort and included roughly equal numbers of girls and boys. In addition, we assessed exposure to smoking imagery in the movies using a validated methodology, all covariates were assessed using validated measures, and the data were collected in the participants' homes using PDAs, which enabled the participants to read the questions themselves and answer without their parents hearing or viewing their responses, thereby ensuring their privacy. Also the participants represent a large ethnically homogenous and predominantly low-income sample of Mexican origin youth, an understudied population, and the household demographics of the population-based cohort from which our participants are drawn is representative of the Mexican origin population in Houston. A final strength of the study is the high retention rate: 87% of the youth provided data in this study on all five contacts. This is important because it suggests that the low experimentation and smoking rates previously reported based on minority cohorts is not a function of the historically high loss to follow-up observed in these cohorts (43–45).

Conversely, a limitation of this study stems from the fact the participants were all of Mexican origin, and therefore the results may not generalize to youth from other ethnic backgrounds. In addition, we did not have biochemical validation of the participants' smoking status (e.g., cotinine levels in saliva). However, we informed participants during the consent process that they might be selected to provide a saliva sample to check their smoking status; this "bogus pipeline" procedure has been shown to increase the validity of self-reported smoking status (45).

In summary, we found that among Mexican origin youth, the higher their level of exposure to smoking imagery in the movies, the more likely they were to have ever experimented with cigarettes. Similarly we found exposure to smoking imagery in the movies predicted new experimentation. This effect was moderated by country of birth. For Mexican-born youth,

exposure to smoking imagery in the movies was the strongest independent predictor of new experimentation. For the US-born youth we observed a potential ceiling effect: the percent of experimenters increased with increasing exposure up to a point, and then flattened. Overall our results provide further evidence for the global implementation of the World Health Organization's Framework Convention on Tobacco Control guidelines that underscore the continued need to eliminate youths' exposure to any form of social media that promotes smoking, including restricting their viewing of smoking imagery in the movies (46,47).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

References

1. National Cancer Institute. Tobacco control monograph 19, NIH publication no. 07-6242). Bethesda, MD: National Cancer Institute; 2007. The role of the media in promoting and reducing tobacco use.

2. 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;21:15–21. [PubMed: 18166552]

3. Hanewinkel R, Sargent JD. Exposure to Smoking in Internationally Distributed American Movies and Youth Smoking in Germany: A Cross-cultural Cohort Study. Pediatrics 2008;121:e108–e117. [PubMed: 18166530]

4. Song AV, Ling PM, Neilands TB, Glantz SA. Smoking in movies and increased smoking among young adults. Am J Prev Med 2007;33:396–403. [PubMed: 17950405]Erratum in: Am J Prev Med. 2008 Jan; 34(1):86. PubMed PMID: 17950405

5. Sargent JD, Stoolmiller M, Worth KA, et al. Exposure to smoking depictions in movies: its association with established adolescent smoking. Arch Pediatr Adolesc Med 2007;161:849–856. [PubMed: 17768284]

6. Sargent JD, Beach ML, Dalton MA, et al. Effect of parental R-Rated movie restriction on adolescent smoking initiation: a prospective study. Pediatrics 2004;114:149–156. [PubMed: 15231921]

7. Jackson C, Brown JD, L'Engle KL. R-rated movies, bedroom televisions, and initiation of smoking by white and black adolescents. Arch Pediatr Adolesc Med 2007;161:260–268. [PubMed: 17339507]

8. Sargent JD, Beach ML, Adachi-Mejia AM, et al. Exposure to Movie Smoking: Its Relation to Smoking Initiation Among US Adolescents. Pediatrics 2005;116:1183–1191. [PubMed: 16264007]

9. 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;35:95–102. [PubMed: 18617078]

10. Wilkinson AV, Spitz MR, Strom SS, et al. Effects of nativity, age at migration, and acculturation on smoking among adult Houston residents of Mexican descent. Am J Public Health 2005;95:1043–1049. [PubMed: 15914831]

11. Norris AE, Ford K, Bova CA. Psychometrics of a brief acculturation scale for Hispanics in a probability sample of urban Hispanic adolescents and young adults. Hisp J Beh Sci 1996;18:29–38.

12. Saunders, KM. Unpublished Master's Thesis. 2005. Evaluation of recruitment strategies for obtaining a representative cohort of urban Mexican Americans.

13. Wilkinson AV, Waters AJ, Vasudevan V, et al. Correlates of smoking susceptibility among Mexican origin youth. BMC Public Health 2008;8:337. [PubMed: 18822130]

14. Sargent JD, Worth KA, Beach M, Gerrard M, Heatherton TF. Population-based assessment of expsosure to risk beahviors in motion pictures. Communication Methods and Measures 2008;2:134–151. [PubMed: 19122801]

15. Worth, K.; Tanski, S.; Sargent, JD. Trends in top box office movie tobacco use 1996–2004 First Look Report. Washington, DC: American Legacy Foundation; 2006. p. 15

16. Sargent JD, Gibson J, Heatherton TF. Comparing the effects of entertainment media and tobacco marketing on youth smoking. Tob Control 2009;18:47–53. [PubMed: 18948391]

17. Shete S, Beasley TM, Etzel CJ, et al. Effect of winsorization on power and type 1 error of variance components and related methods of QTL detection. Behav Genet 2004;34:153–159. [PubMed: 14755180]

18. Mucha L, Stephenson J, Morandi N, et al. Meta-analysis of disease risk associated with smoking, by gender and intensity of smoking. Gend Med 2006;3:279–291. [PubMed: 17582369]

19. Silva MA, Rivera IR, Carvalho AC, et al. The prevalence of and variables associated with smoking in children and adolescents. J Pediatr 2006;82:365–370.

20. Elder JP, Campbell NR, Litrownik AJ, et al. Predictors of cigarette and alcohol susceptibility and use among Hispanic migrant adolescents. Prev Med 2000;31:115–123. [PubMed: 10938211]

21. Harwood GA, Salsberry P, Ferketich AK, et al. Cigarette smoking, socioeconomic status, and psychosocial factors: examining a conceptual framework. Public Health Nurs 2007;24:361–371. [PubMed: 17553026]

22. Thrasher JF, Niederdeppe J, Jackson C, Farrelly MC. Using anti-tobacco industry messages to prevent smoking among high-risk youth. Health Education Research 2006;21(3):325–337. [PubMed: 16492681]

23. Arillo-Santillán E, Thrasher JF, Rodríguez-Bolaños R, Chávez-Ayala R, Silvia R-V, Lazcano-Ponce E. Susceptibilidad al consumo de tabaco en estudiantes no fumadores de 10 ciudades mexicanas: Una necesidad de cultura contra permisividad social del tabaquismo. Salud Pública de México 2007;49

24. Thrasher JF, Jackson C, Arillo-Santillan E, Sargent JD. Exposure to smoking imagery in popular films and adolescent smoking in Mexico. American Journal of Preventive Medicine 2008;35(2):95–102. [PubMed: 18617078]

25. Spielberger CD. Assessment of state and trait anxiety: Conceptual and methodological issues. South Psycholog 1985;2:6–16.

26. Unger JB, Rohrback LA, Cruz TB, Baezconde-Garbanati L, Howard KA, Palmer PH, et al. Ethnic variation in peer influences on adolescent smoking. Nicotine & Tobacco Research 2001;3:167–176. [PubMed: 11403731]

27. Gritz ER, Prokhorov AV, Hudmon KS, et al. Predictors of susceptibility to smoking and ever smoking: a longitudinal study in a triethnic sample of adolescents. Nicotine Tob Res 2003;5:493–506. [PubMed: 12959787]

28. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. J Pers Soc Psychol 1986;51:1173–1182. [PubMed: 3806354]

29. Kraemer CH, Stice E, Kazdin A, et al. How do risk factors work together? Mediators, Moderators, and Independent, Overlapping, and Proxy Risk Factors. Am J Psychiatry 2001;158:848–856. [PubMed: 11384888]

30. Peña JB, Wyman PA, Brown CH, et al. Immigration generation status and its association with suicide attempts, substance use, and depressive symptoms among Latino adolescents in the USA. Prevention Science 2008 Dec;9(4):299–310. [PubMed: 18855139]

31. Tanski SE, Stoolmiller M, Dal Cin S, Worth K, Gibson J, Sargent JD. Movie character smoking and adolescent smoking: who matters more, good guys or bad guys? Pediatrics 2009;124:135–143. [PubMed: 19564293]

32. Forrester K, Biglan A, Severson HH, Smolkowski K. Predictors of smoking onset over two years. Nicotine Tob Res 2007;9:1259–1267. [PubMed: 18058344]

33. Comeau N, Stewart SH, Loba P. The relations of trait anxiety, anxiety sensitivity and sensation seeking to adolescents' motivations for alcohol, cigarette and marijuana use. Addict Behav 2001;26:803–825. [PubMed: 11768546]

34. Dudas RB, Hans K, Barabas K. Anxiety, depression and smoking in schoolchildren--implications for smoking prevention. J R Soc Health 2005;125:87–92.

35. Gritz ER, Prokhorov AV, Hudmon KS, et al. Cigarette smoking in a multiethnic population of youth: methods and baseline findings. Preventive Medicine 1998;27:365–384. [PubMed: 9612827]

36. Engels RC, Vitaro F, Blokland ED, et al. Influence and selection processes in friendships and adolescent smoking behavior: the role of parental smoking. J Adolesc 2004;27:531–544. [PubMed: 15475045]

37. Wen M, Van Duker H, Olson LM. Social contexts of regular smoking in adolescence: Towards a multidimensional ecological model. J Adolescence. 2008[Epub ahead of print]

38. Wills T, Sargent JD, Stoolmiller M, Gibbons F, Gerrard M. Movie smoking exposure and smoking onset: A longitudinal study of mediation processes in a representative sample of U.S. adolescents. Psychol Addict Behav 2008;22:269–277. [PubMed: 18540724]

39. Wills TA, Sargent JD, Stoolmiller M, et al. Movie exposure to smoking cues and adolescent smoking onset: a test for mediation through peer affiliations. Health Psychol 2007;26:769–776. [PubMed: 18020850]

40. Wilkinson AV, Shete S, Prokhorov AV. The moderating role of parental smoking on their children's attitudes toward smoking among a predominantly minority sample: a cross-sectional analysis. Substance Abuse Treatment. Prevention, and Policy 2008;3:18.

41. Dalton MA, Sargent JD, Beach ML, et al. Effect of viewing smoking in movies on adolescent smoking initiation: a cohort study. Lancet 2003;362:281–285. [PubMed: 12892958]

42. Psaty BM, Cheadle A, Koepsell TD, et al. Race- and ethnicity-specific characteristics of participants lost to follow-up in a telephone cohort. Am J Epidemiol 1994;140:161–171. [PubMed: 8023804]

43. Frack SA, Woodruff SI, Candelaria J, et al. Correlates of compliance with measurement protocols in a Latino nutrition-intervention study. Am J Prev Med 1997;13:131–136. [PubMed: 9088450]

44. Stimpson JP, Ray LA. Attrition of Older Mexican American Survey Respondents. J Immigr Minor Health. 2008 May 16;[Epub ahead of print]

45. Murray DM, O'Connell CM, Schmid LA, et al. The validity of smoking self-reports by adolescents: A reexamination of the bogus pipeline procedure. Addict Behav 1987;12:7–15. [PubMed: 3565116]

46. World Health Organization Report. Guidelines for implementation of Article 13 of the WHO Framework Convention on Tobacco Control. [February 21, 2009]. Available from http://www.who.int/fctc/guidelines/article_13/en/index.html

47. World Health Organization Report. Smoke-free movies: From evidence to action. [August 25, 2009]. Available from http://www.who.int/tobacco/smoke_free_movies/en/index.html

48. Diane, M.; Novy, DM.; Nelson, DV.; Smith, KG.; Rogers, PA.; Rowzee, RD. Psychometric Comparability of the English-and Spanish-Language Versions of the State-Trait Anxiety Inventory Hispanic; Journal of Behavioral Sciences. 1995. p. 209-224.

49. Ginsburg GS, Silverman WK. Phobic and anxiety disorders in Hispanic and Caucasian youth. Journal of Anxiety Disorders 1996;10:517–528.
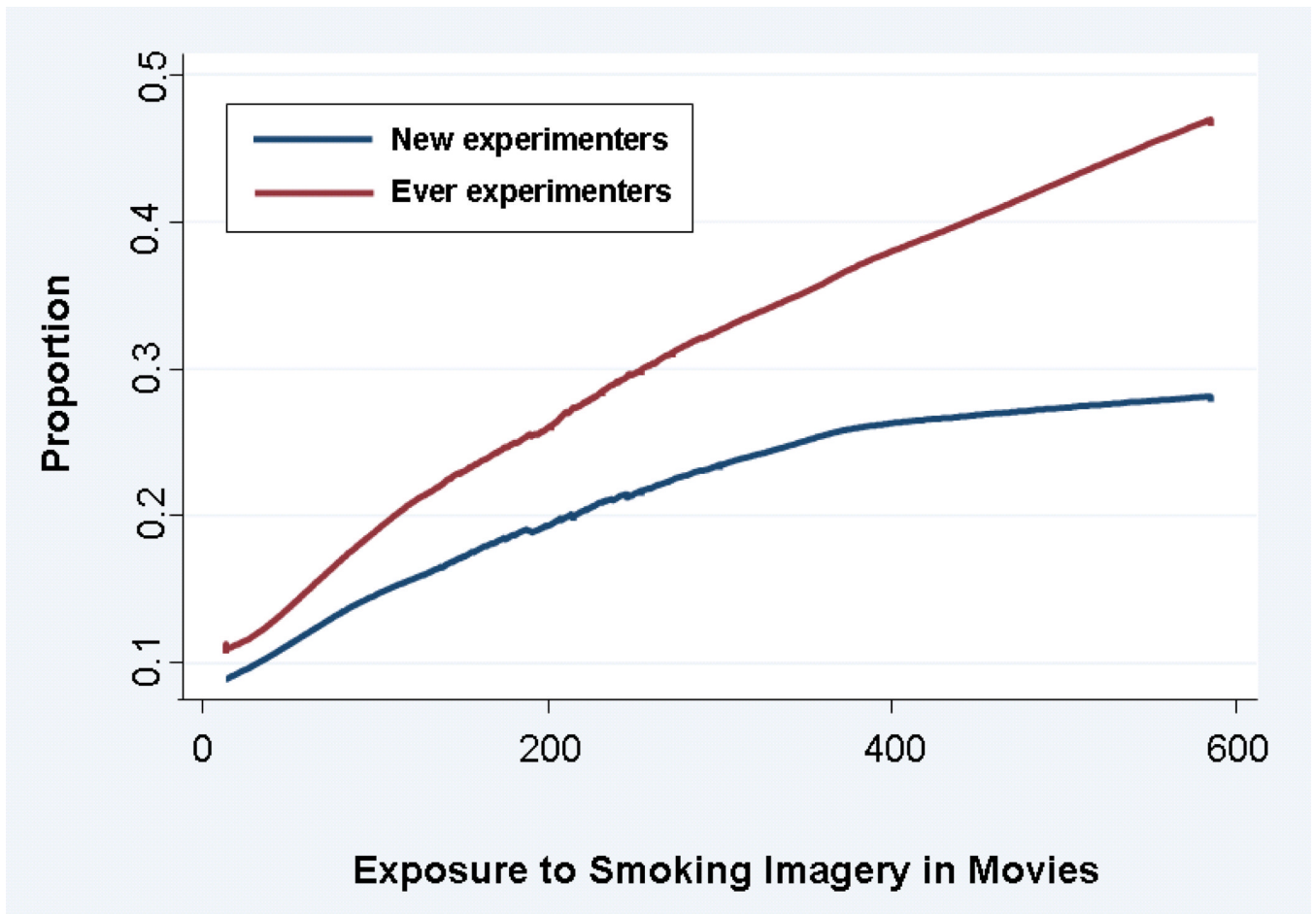
Figure 1.
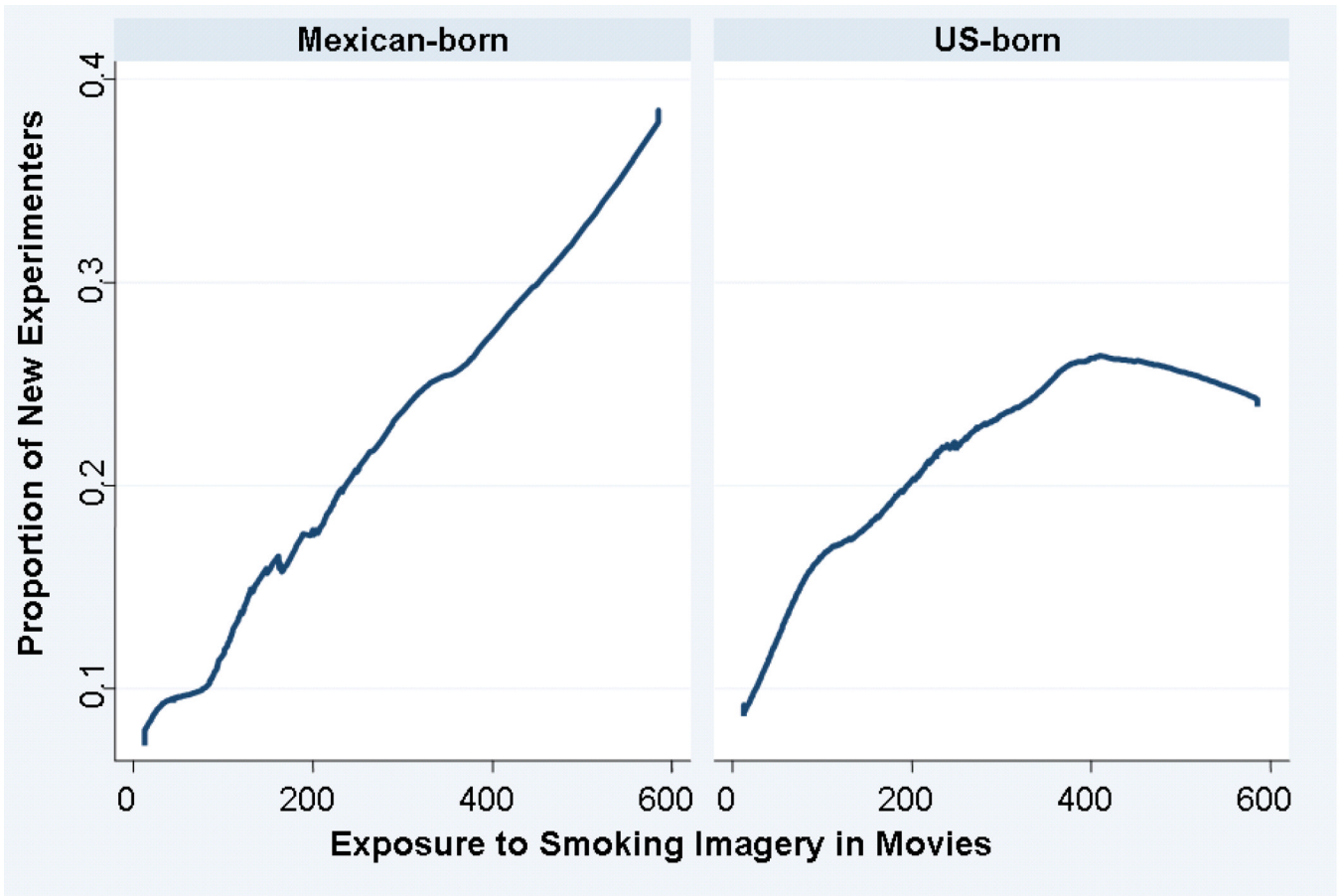Exposure to Smoking Imagery in Movies by Experimenter Status

Figure 2.
Exposure to Smoking Imagery in Movies by Country of Birth

Table 1

Description of Measures

Construct	Description
Experimenter status	Assessed using two questions, "Have you ever smoked a whole cigarette?" and "Have you ever tried a cigarette, even a puff?" Participants who answered positively ("yes") to either question were defined as experimenters. All the other participants defined as never experimenters.
New experimenter	Participants who responded negatively ("no") at baseline, but positively ("yes") to either question at first, second, third or final follow-up.
Ever experimenter	Participants who reported experimenting at one or more encounters, including baseline.
Age	Ranged between 11 and 13 years at baseline, entered in its continuous format.
Socio-economic Status (SES)	Parental educational attainment (available for 93.5% of the study participants), was divided into three categories: less than high school, high school/General Educational Development equivalency, and more than high school. Roughly 80% of these data are provided by the mother. Included educational attainment rather than household income because more than 50% of the data on household income were missing whereas 97.6% of the data on parental educational attainment were available.
Acculturation	Assessed using 4 items from the Language Use subscale of the Brief Acculturation Scale for Hispanics.[11] Questions ascertain language used when reading, speaking at home, speaking with friends, and thinking. The scale has excellent internal reliability among our study participants (alpha=0.92). Responses are made on a 5-point scale ranging from "only speak/read/think in Spanish = 1" to "only speak/read/think in English = 5." Participants whose average score on the four items was above the median were categorized as highly acculturated and those below as less acculturated.
Country of birth	Child's country of birth – either US or Mexico.
Social influence from friends	Assessed by "How many of your three closest friends smoke?" Responses included 0, 1, 2, or 3. Coded as "none", or "at least one" with none serving as the reference category in the multivariable analyses.
Social influence from family	For each potential household member (i.e. father, mother, sister(s), brother(s), and other(s)) asked "Does your father smoke?" and "Do you live with your father?" Summed the number of household members residing with participant, to ensure the variable reflected social influence from all household members with whom the participant currently lived. Coded as "none," "one," "two or more" for descriptive table. Coded as "none" or "at least one," with none serving as the reference category in the multivariable analyses.
Detentions	Assessed by asking "During this school year how many detentions and suspensions have you had?" Coded as "none" or "at least one," with none serving as the reference category in the multivariable analyses.
Risk taking	Assessed using two items "I look for dangerous things to do, just for excitement" and "If I got a chance to skydive from an airplane, I'd do it." Responses made on a four-point scale ranging from "just like me" to "not at all like me" and were averaged. For descriptive purposes the variable was categorized into "high" and "low" based on the median split, however, in the multivariable analysis it was entered as continuous.
Anxiety	Assessed using Spielberger's Trait (26) anxiety measure. The scale is composed of 20 items that assess trait anxiety and has been validated with Spanish-speaking populations in the US (48,49). Responses are made on a 4-point scale ranging from "not at all" to "very much so." The scale has a good reliability based data from our participants (Cronbach's alpha = 0.86). For descriptive purposes those above the 85% percentile were categorized as "high" and those at or below the 85% percentile were categorized as "low" based on clinical diagnostic cut-off points. In the multivariable analysis it was entered as continuous.

Table 2

Distribution of demographic characteristics, experimenter status, and smoking-related covariates at baseline and mean exposure to smoking in the movies by baseline demographic characteristics, experimenter status, and smoking-related covariates (N = 1,286) Mean differences in exposure to smoking in the movies on the demographic characteristics and smoking-related covariates by ever experimenter status (N = 1,286)

| | N (%) | Mean exposure to smoking in movies (SD) | p-value | Experimenter Status | | p-value |
				Ever Experimenter Mean exposure to smoking in movies (SD)	Never Experimenter Mean exposure to smoking in movies (SD)	
Overall	1,286 (100.0)	217.3 (164.09)		283.4 (169.60)	194.6 (155.89)	< 0.001
Gender						
Females	655 (50.9)	186.2 (154.20)		297.4 (165.19)	226.4 (164.44)	< 0.001
Males	631 (49.1)	249.6 (167.90)	< 0.001	260.0 (174.92)	169.2 (143.89)	< 0.001
Age (years)						
Eleven	512 (39.8)	172.3 (145.57)		227.8 (178.61)	163.5 (137.83)	< 0.001
Twelve	411 (32.0)	224.5 (165.41)		284.9 (167.16)	205.4 (160.43)	< 0.001
Thirteen	363 (28.2)	272.7 (169.34)	< 0.001	306.9 (162.34)	245.7 (170.26)	< 0.001
Country of birth						
US	846 (65.8)	231.9 (166.24)		294.3 (169.16)	208.1 (158.93)	< 0.001
Mexico	440 (34.2)	189.3 (156.30)	< 0.001	257.0 (168.61)	170.4 (147.49)	< 0.001
Acculturation						
Low	403 (23.2)	159.3 (152.1)		208.1 (159.5)	145.2 (140.2)	< 0.001
High	883 (76.8)	243.8 (163.8)	< 0.001	312.1 (165.1)	218.6 (157.7)	< 0.001
Parental education						
< HS	837 (65.1)	202.2 (158.56)		262.5 (165.93)	181.3 (150.54)	< 0.001
HS grad	226 (17.6)	236.4 (164.71)		311.3 (167.49)	212.9 (157.08)	< 0.001
> HS	223 (17.3)	254.8 (176.16)	< 0.001	333.4 (173.22)	225.9 (168.73)	< 0.001
Experimenter status						
Never	957 (74.4)	194.6 (155.89)		--	--	--
Ever	329 (25.6)	283.4 (169.60)	< 0.001	--	--	--
Baseline	120 (36.5)	304.9 (172.51)		--	--	--
New	209 (63.5)	271.1 (167.08)	0.08	--	--	--
Risk taking						
Low	567 (44.1)	175.9 (152.03)		220.9 (162.88)	167.3 (148.50)	0.002
High	719 (55.9)	250.0 (165.98)	< 0.001	307.3 (166.30)	221.6 (158.47)	< 0.001
Anxiety						
Low	1139 (88.6)	211.3 (161.11)		279.5 (166.47)	190.4 (153.58)	< 0.001
High	147 (11.4)	264.1 (179.37)	< 0.001	300.4 (182.95)	237.6 (173.02)	0.04
No. household members who smoke						
None	801 (62.3)	201.0 (158.64)		220.9 (162.88)	167.3 (148.50)	0.002
One	383 (29.8)	230.5 (166.17)		307.3 (166.30)	221.6 (158.47)	< 0.001
≥ Two	102 (7.9)	296.2 (172.42)	< 0.001			
A friend smokes						
None	1088 (84.6)	203.5 (159.77)		269.5 (172.81)	188.8 (152.96)	0.001
≥ One	198 (15.4)	293.0 (167.22)	< 0.001	304.7 (162.91)	270.7 (174.19)	0.17
Had detention						
None	919 (71.5)	200.2 (159.95)		276.9 (172.77)	182.7 (151.70)	< 0.001
≥ One	367 (28.5)	260.3 (166.64)	< 0.001	290.4 (166.40)	237.3 (163.51)	0.002

- Risk Taking: Low = 1 (risk averse); High > 1

- Anxiety: Low = below 85th percentile; High >= 85th percentile

Table 3

Logistic Regression for Ever Experimentation (N=1,286) and New Experimentation* (N=1,129)

	Ever (N = 1286)			New (N = 1129)		
	OR	95% CI	p-value	OR	95% CI	p-value
At least one friend smokes	1.74	1.52 – 1.99	< 0.001	1.16	1.01 – 1.34	0.041
Age (years)	1.48	1.26 – 1.72	< 0.001	1.34	1.13 – 1.58	< 0.001
At least one detentions	1.34	1.16 – 1.54	< 0.001	1.23	1.06 – 1.44	0.006
Male	1.33	1.14 – 1.55	< 0.001	1.24	1.02 – 1.46	0.011
At least one household member smokes	1.30	1.13 – 1.50	< 0.001	--	--	--
Anxiety Score	1.28	1.10 – 1.49	0.002	--	--	--
Exposure to Smoking in movies	1.27	1.10 – 1.48	0.002	1.19	1.01 – 1.40	0.037
Risk taking tendencies	1.20	1.04 – 1.39	0.015	1.18	1.02 – 1.38	0.031

- Ever experimenting includes participants who reported having experimented on any of the five contacts from baseline to the final follow-up.

- Adjusted for parental educational attainment (OR=0.93; 95% CI: 0.80 – 1.08)

- New experimentation includes participants who reported that they had not experimented at baseline and reported that they had experimented on one of the four subsequent contacts.

- Adjusted for parental educational attainment (OR=0.92; 95% CI: 0.78 – 1.07)

Table 4

Logistic Regression for New Experimentation Stratified by Country of Birth

	Mexican-born (N = 380)			US-born (N = 749)		
	OR	95% CI	p-value	OR	95% CI	p-value
Age (years)	1.43	1.03 – 1.97	0.03	1.31	1.08–1.60	< 0.01
Male	0.86	0.64 – 1.17	0.34	1.29	1.06–1.58	0.01
At least one detention	1.42	1.07 – 1.87	0.02	1.17	0.98–1.40	0.09
Exposure to smoking in movies	1.52	1.14 – 2.05	< 0.01	1.04	0.86–1.27	0.68
Risk taking tendencies	1.36	1.04 – 1.78	0.02	1.09	0.90–1.32	0.38
At least one friend smokes	1.11	0.83 – 1.48	0.49	1.19	1.01–1.40	0.04

- New experimentation includes participants who reported that they had not experimented at baseline and reported that they had experimented on one of the four subsequent contacts.