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Friends moderate the effects of pro-smoking media on college students' intentions to smoke

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Abstract

Exposure to pro-smoking media (e.g., smoking in movies, advertising in magazines) contributes to smoking in young people. However, the extent to which the impact of exposure depends on the social context in which those exposures occur has not been investigated. This study used ecological momentary assessment to examine the moderating role of social context in the relationship between college students' exposure to pro-smoking media and their smoking refusal self-efficacy and intention to smoke. College students ($N = 134$) carried handheld computers for 21 days, recording their exposure to all forms of pro-smoking media during the assessment period. They also responded to three investigator-initiated control prompts (programmed to occur randomly) each day of the assessment. After each exposure to pro-smoking media and after each control prompt, participants answered questions about smoking refusal self-efficacy and their intentions to smoke; they also indicated whether they were with friends, with family, with a romantic partner, or alone (i.e., their social context). When participants were with friends, pro-smoking media exposures were associated with stronger smoking intentions and lower smoking refusal self-efficacy; these associations were not present when participants were alone. Being with family members or with a romantic partner did not moderate the impact of pro-smoking media exposure on either dependent variable. These results suggest a new role for peers in the development of youth smoking.

Keywords

Cigarette advertising; movies; smoking; peers

Exposure to pro-smoking media, such as tobacco industry sponsored cigarette advertising in magazines and exposure to smoking in movies, contributes to smoking initiation in adolescents (Wellman, Sugarman, DiFranza, & Winickoff, 2006) and young adults (Rigotti, Moran, & Wechsler, 2005). However, the extent to which the social context of those exposures (i.e., the social circumstances in which youth see or hear pro-smoking media) moderates the impact of pro-smoking media has not been investigated (Pechmann & Knight, 2002). Understanding how social context moderates pro-smoking media exposure effects has important implications for intervening to help young people resist its persuasive intent and for policy designed to limit exposure. This study examined the moderating role of specific social contexts on college students' exposure to pro-smoking media.

Family can influence whether or not an individual smokes. Indeed, both parent (Engels, Knibbe, DeVries, Drop, & Van Breukelen, 1999) and sibling (Rende, Slomkowski, Lloyd-Richardson, & Niaura, 2005) smoking can have an impact on youth smoking. However, the

extent to which these parent and/or sibling effects directly moderate the impact of pro-smoking media on smoking is not known. The presence of a parent or sibling may also activate certain cognitions or beliefs that challenge or enhance media messages, making those messages less (or more) powerful than they would otherwise have been (McCool, Cameron & Robinson, 2011), and indeed research in other domains (e.g., nutrition) has shown that the presence of a parent can blunt the effect of media on young people (Dorey & McCool, 2009; Nathanson, 1999, 2001) while the presence of a sibling may have the opposite effect (Wilson & Weiss, 1993). During media exposure, for example, parents may make rules about what media can be viewed, model behaviors that confirm or disconfirm media messages, communicate norms that influence what information is sought from media, and actively discuss media content (Austin, 1993). Parents tend to discourage their children from engaging in risky behaviors, thus exposures to pro-smoking media in the presence of parents may reduce smoking intentions and improve smoking refusal self-efficacy. College students interact frequently and communicate often with their parents, particularly about health-related behaviors like smoking and drinking alcohol (Small, Morgan, Abar, & Maggs, 2011). As such, the presence of family members could influence the impact of exposure to pro-smoking media in college students.

Similarly, the presence of peers or a romantic partner may moderate the effects of pro-smoking media exposure on youth smoking. Young adults spend the majority of their leisure time with peers (Larson & Verma, 1999) and romantic relationships gain prominence in young adulthood (Furman, 2002). The presence of smoking peers and romantic partners contributes to smoking (Kobus, 2003) and could moderate the effects of pro-smoking media on behavior. For example, peers or romantic partners might influence the absolute number of exposures to pro-smoking media and their impact by influencing the nature and location of shared leisure time activities. Peers might also make many common pro-smoking media messages more salient. For example, adolescents believe that smoking cigarettes can help them fit in socially (Lewis-Esquerre, Rodrigue & Kahler, 2005) and help with weight control (Baker, Brandon & Chassin, 2004; Myers, McCarthy, MacPherson & Brown, 2003), and the presence of peers or romantic partners during pro-smoking media exposures that evoke these themes could make smoking seem especially appealing. Finally, shared exposure to pro-smoking media could also signal implicit approval of the messages contained in pro-smoking media (Leventhal & Cupchick, 1975).

In the present study, we assessed the impact of pro-smoking media exposures on college students across three key social contexts: family, romantic partners, and friends (versus being alone). College students participated in a 3-week Ecological Momentary Assessment (EMA) study (Martino, Scharf, Setodji & Shadel, 2012; Shadel, Martino, Setodji & Scharf, 2012), in which they carried handheld data collection devices (i.e., smart phones) that allowed them log their exposures to pro-smoking media and report the social context of those exposures (i.e., whether exposure happened when they were with family, with friends, with a romantic partner, or alone) as they occurred in the real world. After entering this information, they responded to questions about their smoking intentions and smoking refusal self-efficacy, each of which has been shown to predict smoking behavior (Choi, Gilpin, Farkas & Pierce, 2001; Wakefield et al., 2004). In addition, they responded to three random prompts per day during which they reported their current social context and responded to the same questions about smoking intentions and smoking refusal self-efficacy. We expected that pro-smoking media exposures would have a differential impact on smoking intentions and smoking refusal self-efficacy depending on whether those exposures occurred in the presence of others (whether friends, romantic partners, or family members) or while students were alone. Specifically, we expected that the presence of peers and romantic partners would be related to increases in intentions to smoke and decreases in smoking refusal self-efficacy. In contrast, we were uncertain about how the presence of family during pro-

smoking media exposures would affect these outcomes, as the effects of parents (protective) were hypothesized to be opposite of the effects of siblings (risk-enhancing).

Methods

Participants

Individuals were eligible to participate in this study if they were 18–24 years old and an undergraduate currently enrolled in college. Participants ($N = 134$) were recruited through advertisements in university and other local newspapers. The sample was 37% male and 66% Caucasian. Participants' smoking status was collected and participants were grouped as follows: never smokers, experimental smokers and current smokers (see Choi et al., 2001 for definitions). Never smokers ($n = 52$) were defined as those participants who reported never smoking a cigarette, even a puff. Experimental smokers ($n = 69$) were defined as those participants who reported any level of smoking in the past, but who had not smoked in the past month. Current smokers ($n = 13$) were defined as those participants who reported any level of smoking in the past and who also reported smoking in the past month. Because of the small number of current smokers, both experimental and current smokers will be combined in the group of ever smokers for all analyses. Additional sample details may be found in Authors (in press).

Procedure

The study was approved by the authors' institution Human Subjects Protection Committee. Data collection took place June 2010 – January 2011. At a baseline session, participants 1) received an explanation of the study and provided written informed consent for their involvement; 2) completed a survey about their demographic characteristics and smoking history; and 3) were trained to use a handheld data collection device (smartphone) to record information about their exposure to pro-tobacco media. Training consisted of a detailed, 60-minute oral presentation accompanied by electronic slides. A Palm® Treo 755p device running the Palm OS Garnet v5.4.9 and using a 312 MHz Intel PXA270 processor was provided to each participant at the start of the training so they could practice data entry prior to completing the study EMA in the field. Participants were instructed to turn the device on when they woke up in the morning and off at night when they went to sleep, carry the device with them at all times, initiate data entry each time they encountered pro-tobacco media, and respond to random prompts (see below).

Participants carried the Palm devices with them for 21 consecutive days to record their exposures to pro-smoking media. Participants provided descriptive information about each encounter with pro-smoking marketing and media, including the medium of exposure using a forced-choice response format: in a magazine, on a billboard, outside of a convenience store or gas station, inside a grocery store, inside or on the window of a convenience store or gas station, in a tobacco store, in a bar or restaurant (including being approached by a salesperson in these venues), via direct mailing or coupon, at a sponsored event, in a movie, on television, on the radio, and on the internet (see Authors, in press, for descriptive information on these exposures). Participants also indicated their social context at the moment of each exposure to pro-smoking media that occurred during the 21 days of data collection (alone, with one or more family members, with one or more friends, with a romantic partner). Immediately after each exposure to pro-smoking media, they answered questions about their smoking intentions and smoking refusal self-efficacy (see details below). Participants similarly reported their social context and their smoking intentions and refusal self-efficacy in response to random control prompts that occurred three times per day during the 21-day measurement period.

Participants attended weekly in-person sessions during which EMA data from the previous week were downloaded into a central database. Participants were paid \$8 for each day of EMA assessment (or \$168 total), and \$10 each for the baseline and end-of-study visit. They were paid an additional \$2/day if they responded to all of the random control prompts on that day within two minutes of the prompt. Thus, participants could be paid up to \$230 if they completed all aspects of the study and adhered closely to the study protocol.

Measures

Smoking intentions—After each pro-smoking media exposure and random prompt, participants indicated their intention to smoke by completing a 3-item scale adapted from Choi et al. (2001) and shown to predict smoking: “Do you think you will try a cigarette anytime soon?”, “Do you think you will smoke a cigarette anytime in the next year?”; and “If one of your best friends offered you a cigarette, would you smoke it?” Responses were made on a 1 (Definitely Not) to 10 (Definitely Yes) scale and averaged ($\alpha = 0.94$) to produce a smoking intention scale score (range: 1 – 10), where higher scores indicate stronger intentions to smoke.

Smoking refusal self-efficacy—We adapted a four-item measure (Ellickson & Hays, 1992; Tucker, Ellickson & Klein, 2002) to measure smoking refusal self-efficacy. After each exposure to pro-smoking media and at random prompts, participants rated their confidence to refuse smoking in the following situations: (a) your best friend is smoking, (b) your date is smoking, (c) you are bored at a party, and (d) all your friends at a party are smoking. Ratings were made on a four-point scale, with these endpoints: “I would definitely smoke (1)” and “I would definitely not smoke (4).” Responses to these four items were averaged to form a measure of refusal self-efficacy ($\alpha = 0.93$), where higher scores indicate stronger refusal self-efficacy.

Results

Descriptive Information

Across the 21-day EMA monitoring period, participants reported an average of 8.24 ($SD=7.85$) exposures to pro-smoking media. Compliance with the random prompts was good and consistent with compliance rates with other EMA studies of college students (Piasecki, Richardson, & Smith, 2007) and with EMA studies of other populations (see Shiffman, 2009): participants responded to 83% of all random prompts. Given that participants responded to random prompts on the same days as they recorded their exposures to pro-smoking media (and presumably under similar circumstances), this study can be used to approximate a within-subject design in which participants' own equivalent, non-exposure (random) reports serve as control for pro-smoking media exposure situations. This control assumption is supported by the fact that participants' social contexts during times of exposure to pro-smoking media were not different from their social contexts during random prompts ($\chi^2 = 0.044$, $p = 0.52$). Of the 1,112 exposures to pro-smoking media reported by participants, 168 (15%) of them were reported during random prompt assessment and these observations were discarded. Additionally, nine exposures (and 68 out of 6779 random prompts) were deleted because of missing data on social context. Of the remaining 935 exposures, 46% (vs. 48% of random prompts) occurred when participants were alone, 11% (vs. 10% of random prompts) when they were with family, 8% (vs. 8% of random prompts) with a romantic partner and 35% (vs. 35% of random prompts) with friends. Number of exposures to pro-smoking media over the 21-day monitoring period did not differ between never smokers ($M = 7.90$, $SD = 5.89$) and ever smokers ($M = 7.75$, $SD = 6.20$). Thirty-five percent of exposures occurred on weekends (Friday and Saturday); exposures on the other

five days of the week were relatively evenly distributed (12–14% of the total number of exposures occurred on each of the five days).

Moderator analyses

We used a hierarchical linear mixed model (Schwartz & Stone, 2007; Moghaddam & Ferguson 2007; Raudenbush & Bryk 2002) to compare participants' smoking intention and self-efficacy (separately) between random prompts and pro-smoking media exposures. These models (one for each outcome) tested for a link between exposure to pro-smoking media and the outcome variable while accounting for the within-participant correlation of responses to the outcome measures. Each model included three dummy indicators representing participants' social context at the time of exposure to pro-smoking media or during a random prompt: with a friend or friends, with a family member or members, and with a romantic partner (being alone was the comparison category). To test whether social context moderated the effect of exposure to pro-smoking media on participants' cognitions, we included interactions between exposure and each of the three indicators of social context. Because of the possibility of participant's self-selection into circumstances where they are likely to be exposed to pro-smoking media, we fit two models to each outcome one with and one without covariates. Covariates included the day of the week (weekend vs. weekdays) on which the exposure or random prompt occurred, participant demographics (gender and race), and participants' smoking status. Each of these variables has been shown to be associated with responses to smoking-related media (DiRocco & Shadel, 2007; Hafez & Ling, 2006; Scharf, Chandra, & Shiffman, 2007; Wellman et al., 2006). To more fully model the effect of exposure to pro-smoking media on participants' intentions and self-efficacy, as described in Begg and Parides (2003), we also included the proportion of occasions (*i.e.*, both random prompts and exposure events) that were exposure events for a participant. The model assumes a random participant-level average outcome (intercept) and a random exposure impact (slope), thus allowing for the estimation of exposure-related and person-related fixed effect as well as the variance explained by participants and pro-smoking media exposure. In this study, the use of causal language to describe the relationship between smoking outcomes and exposure is for heuristic purposes. Thus, terminology such as "effect," "influence," "impact," or "contribution" is used to convey predictive or associative relationships, not necessarily causal relationships. Table 1 presents the results of the analysis of pro-smoking media exposure on smoking intention and refusal self-efficacy with and without covariates. With covariate adjustment, inferences made remain the same, but some of the estimated impacts are stronger. As hypothesized, social context moderated the impact of exposure to pro-smoking media exposure on participants' smoking intentions and refusal self-efficacy. In particular, the exposure to pro-smoking media was positively associated with smoking intention when participants were with friends but unassociated with smoking intention when they were alone (interaction $\beta=0.23$, $p < 0.001$) after controlling for participants' smoking status and the cumulative volume of exposure. Similarly, exposure to pro-smoking media was negatively associated with participants' smoking refusal self-efficacy when they were with friends but not associated with smoking refusal self-efficacy when they were alone (interaction $\beta=-0.15$, $p < 0.05$). Non-significant interactions between social context, smoking status, and exposure (not shown) suggest that the moderating effects of social context are evident among non-smokers as well as smokers. There was specificity to this social context effect: neither being with family members nor being with a romantic partner moderated the impact of smoking media exposure on either smoking intentions or smoking refusal self-efficacy. In each of the models, the coefficient for the effect of exposure to pro-smoking media represents the within-participant effect of exposure when participants are alone after controlling for the overall number of exposures. The estimate of the proportion of exposure events represents the between-participants effects, comparing fewer to greater exposures. The within-participant effect was not significant in either model.

This indicates that, controlling for the total number of exposures, when participants are alone, each specific exposure does not lead to a change in smoking intentions ($\beta = -0.03$, $p = 0.71$) or a change in self-efficacy ($\beta = -0.02$, $p = 0.75$). However, between participants, a higher volume of exposures was associated with greater smoking intentions and weaker smoking refusal self-efficacy.

Eighty-one percent of the variance ($0.81 = 3.96 / [3.96 + 0.3 + 0.65]$) in smoking intentions observed in this study was explained by variation in participants, whereas 6% of the variance ($0.06 = 0.3 / [3.96 + 0.3 + 0.65]$) was explained by exposure to pro-smoking media (the remainder is error variance). Likewise, 85% of the variance in self-efficacy observed in this study was explained by variation in participants, whereas 2% of the variance was explained by exposure to pro-smoking media. Nevertheless, exposure to pro-smoking media did explain a statistically significant proportion of the total variance in each outcome.

Discussion

We examined the joint impact of smoking media exposure and social context at the time of exposure on young adults' smoking intentions and smoking refusal self-efficacy. We found that the impact of exposure was moderated by the presence of one or more friends at the time of exposure after controlling for frequency of exposure; additional exposures were not associated with smoking intentions or self-efficacy unless they occurred in the presence of friends. This finding represents a new contribution to the literature on how smoking-related media contributes to smoking among young people. Indeed, while many studies suggest that smoking media exposure contributes to smoking initiation (Dalton et al., 2003; Kobus, 2003) and progression to established smoking (Sargent et al., 2007), no previous studies have examined the role of social context in these exposure effects. Clearly, peers play an important role in the development of smoking more broadly (Kobus, 2003; Simons-Morton & Farhat, 2010); the current study provides evidence that this relationship might be attributable, at least in part, to a greater acceptance of pro-smoking media messages. The use of EMA rather than retrospective report of exposure to pro-smoking media increases confidence in the external validity of these results. Few studies collect "in vivo" information on participants' pro-smoking media exposure as well as the circumstances of the exposure. The most common approach has been to use retrospective self-reports of exposure, which are subject to a host of cognitive biases (see Brown, 1978; Ross, 1989). EMA as used in this study assures that the moderating relationship observed can be linked to peer influence, not recall bias.

There may be several mechanisms for these observed effects. The presence of peers might make many common pro-smoking media messages (e.g., that smoking is a social lubricant; see Lewis-Esquerre et al., 2005) especially appealing. It may also be that shared exposure to pro-smoking media among friends signals implicit approval of the content of pro-smoking media (Leventhal & Cupchick, 1975) thereby increasing smoking risk compared to exposures occurring when young adults are alone. On the other hand, it is possible that the circumstances under which young people both see pro-smoking media and are with friends may be different from other circumstances, and it may be these circumstances rather than the joint influence of the media and peers that is responsible for the effect observed. Future research needs to examine these explanations in more detail.

Being with family members or romantic partners did not moderate the impact of pro-smoking media exposures, however. Although there initially were conceptual reasons to believe that family would also moderate the effects of pro-smoking media exposure (Dorey & McCool, 2009; Nathanson, 1999, 2001; Wilson & Weiss, 1993), friends are likely much more salient at this stage of life and much more time is spent with friends than in either of

these other social contexts (Larson & Verma, 1999). In this context, then, it may not be surprising that friends had a significant moderating effect, whereas family members and romantic partners did not. Still, the non-significant moderating effects of family members and romantic partners can also be the result of low statistical power as only a relatively small proportion of the exposure events occurred in those social contexts.

There are limitations to this study that need to be acknowledged. The EMA method relies on participants being able to carry and operate palmtop computers, making the study sample only a representative subsample of the population of interest that is technologically sophisticated enough to operate the devices used. In addition, this study only covered a three week “snapshot” of college students’ exposure to pro-smoking media and peer interaction; it is not known how knowledge of past exposures and peer influences would have changed the moderating effect observed. Similarly, the absolute change in smoking intentions and self-efficacy following pro-smoking media exposures was small. Although the notion of cumulative media effects is consistent with communication theory and models of persuasion (Neuman & Guggenheim, 2011), it has not yet been demonstrated in the area of pro-smoking media. Future studies are needed to determine if the effect of exposure has a cumulative, long-term impact on youths’ decisions to smoke.

The results of this study might also be subject to demand effects related to the repeated-measures design of the protocol. The act of repeatedly recording one’s reactions to pro-smoking media could affect how such exposures are evaluated. Similarly, due to the high demand on participants from the repeated daily assessments (three random prompts and additional pro-smoking media exposures), participants may have only reported particular kinds of exposures (e.g., exposures occurring when participants were particularly likely to remember to record the event); the characteristics of these exposures may be related to the outcomes of interest, and possibly lead to study bias. Finally this study provided information on a college-aged sample; it is not known whether similar relationships would be found with younger adolescents.

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References

- Austin EW. Exploring the effects of active parental mediation of television content. *Journal of Broadcasting & Electronic Media*. 1993; 37:147–158.
- Baker TB, Brandon TH, Chassin L. Motivational influences on cigarette smoking. *Annual Review of Psychology*. 2004; 55:463–491.
- Begg MB, Parides MK. Separation of individual-level and cluster-level covariate effects in regression analysis of correlated data. *Statistics in Medicine*. 2003; 22:2591–2602. [PubMed: 12898546]
- Brown, L. Nonanalytic concept formation and memory for instances. In: Rosch, E.; Lloyd, B., editors. *Cognition and categorization*. Hillsdale, NJ: Erlbaum; 1978. p. 169-211.
- Choi WS, Gilpin E, Farkas A, Pierce J. Determining the probability of future smoking among adolescents. *Addiction*. 2001; 96:313–323. [PubMed: 11182877]
- 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; 362:281–285. [PubMed: 12892958]

- DiRocco D, Shadel WG. Gender differences in adolescents' responses to themes of relaxation in cigarette advertising: Relationship to intentions to smoke. *Addictive Behaviors*. 2007; 32:205–213. [PubMed: 16650623]
- Dorey E, McCool J. The role of the media in influencing children's nutritional perceptions. *Qualitative Health Research*. 2009; 19:645–654. [PubMed: 19380500]
- Ellickson P, Hays R. On becoming involved with drugs: Modeling adolescent drug use over time. *Health Psychology*. 1992; 11(6):377–385. [PubMed: 1286657]
- Engels R, Knibbe R, DeVries H, Drop M, Van Breukelen G. Influences of parental and best friends' smoking and drinking on adolescent use: A longitudinal study. *Journal of Applied Social Psychology*. 1999; 29:337–361.
- Furman W. The emerging field of adolescent romantic relationships. *Current Directions in Psychological Science*. 2002; 11:177–180.
- Hafez N, Ling PM. Finding the Kool Mixx: how Brown & Williamson used music marketing to sell cigarettes. *Tobacco Control*. 2006; 15:359–366. [PubMed: 16998169]
- Kobus K. Peers and adolescent smoking. *Addiction*. 2003; 98(Supplement 1):37–55. [PubMed: 12752361]
- Larson R, Verma S. How children and adolescents spend time across the world: work, play and developmental opportunities. *Psychological Bulletin*. 1999; 125(6):701–736. [PubMed: 10589300]
- Leventhal H, Cupchik GC. The informational and facilitative effects of an audience upon expression and evaluation of humorous stimuli. *Journal of Experimental Social Psychology*. 1975; 11:363–380.
- Lewis-Esquerre JM, Rodrigue JR, Kahler CW. Development and validation of an adolescent smoking consequences questionnaire. *Nicotine and Tobacco Research*. 2005; 7:81–90. [PubMed: 15804680]
- Martino SC, Scharf D, Setodji C, Shadel WG. Measuring exposure to protobacco marketing and media: a field study using ecological momentary assessment. *Nicotine & Tobacco Research*. 2012; 14:398–406. [PubMed: 22039076]
- McCool D, Cameron LD, Robinson E. Do parents have any influence over how young people appraise tobacco images in the media? *Journal of Adolescent Health*. 2011; 48:170–175. [PubMed: 21257116]
- Moghaddam NG, Ferguson E. Smoking, mood regulation, and personality: an event-sampling exploration of potential models and moderation. *Journal of Personality*. 2007; 75:451–478. [PubMed: 17489888]
- Myers MG, McCarthy DM, MacPherson L, Brown SA. Constructing a short form of the Smoking Consequences Questionnaire. *Psychological Assessment*. 2003; 15:163–172. [PubMed: 12847776]
- Nathanson AI. Identifying and explaining the relationship between parental mediation and children's aggression. *Communication Research*. 1999; 26:124–143.
- Nathanson AI. Parents versus peers: Exploring the significance of peer mediation of antisocial television. *Communication Research*. 2001; 28:251–274.
- Neuman WR, Guggenheim L. The evolution of media effects theory: A six-stage model of cumulative research. *Communication Theory*. 2011; 21:169–196.
- Pechmann C, Knight SJ. An experimental investigation of the joint effects of advertising and peers on adolescents' beliefs and intentions about cigarette consumption. *Journal of Consumer Research*. 2002; 29:5–19.
- Piasecki TM, Richardson AE, Smith SM. Self-monitored motives for smoking among college students. *Psychology of Addictive Behaviors*. 2007; 21:328–337. [PubMed: 17874883]
- Raudenbush, S.; Bryk, AS. *Hierarchical linear models: Applications and data analysis methods*. CA: Sage; 2002.
- Rende R, Slomkowski C, Lloyd-Richardson E, Niaura R. Sibling effects on substance use in adolescence: social contagion and genetic relatedness. *Journal of Family Psychology*. 2005; 19:611–618. [PubMed: 16402876]
- Riggotti NA, Moran SE, Wechsler H. US College students' exposure to tobacco promotions: Prevalence and association with tobacco use. *American Journal of Public Health*. 2005; 95:138–144. [PubMed: 15623874]

- Ross M. Relation of implicit theories to the construction of personal histories. *Psychological Review*. 1989; 96:341–357.
- 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. *Archives of Pediatric and Adolescent Medicine*. 2007; 161:849–856.
- Shadel WG, Martino SC, Setodji C, Scharf D. Momentary effects of exposure to prosmoking media on college students' future smoking risk. *Health Psychology*. 2012 (In press).
- Scharf, D.; Chandra, S.; Shiffman, S. Temporal patterns of craving and smoking: differences between weekdays and weekends?. Poster presented at the Society for Research on Nicotine and Tobacco; Austin, TX. 2007.
- Schwartz, JE.; Stone, A. The analysis of real-time momentary data: a practical guide. In: Stone, AA.; Shiffman, SS.; Atienza, A.; Nebeling, L., editors. *The Science of Real-Time Data Capture: Self-Report in Health Research*. Oxford, England: Oxford University Press; 2007. p. 76-113.
- Shiffman S. Ecological Momentary Assessment (EMA) in studies of substance use. *Psychological Assessment*. 2009; 21:486–497. [PubMed: 19947783]
- Simons-Morton BG, Farhat T. Recent findings on peer group influences on adolescent smoking. *Journal of Primary Prevention*. 2010; 31(4):191–208. [PubMed: 20614184]
- Small M, Morgan N, Abar C, Maggs JL. Protective effects of parent-college student communication during the first semester of college. *Journal of American College Health*. 2011; 59:547–554. [PubMed: 21660810]
- Tucker JS, Ellickson PL, Klein DJ. Five-year prospective study of risk factors for daily smoking in adolescence among early nonsmokers and experimenters. *Journal of Applied Social Psychology*. 2002; 32:1588–1603.
- Wakefield M, Kloska DD, O'Malley PM, Johnston LD, Chaloupka F, Pierce J, et al. The role of smoking intentions in predicting future smoking among youth: Findings from monitoring the future data. *Addiction*. 2004; 99:914–922. [PubMed: 15200587]
- Wellman RJ, Sugarman DB, DiFranza JR, Winickoff JP. The extent to which tobacco marketing and tobacco use in films contribute to children's use of tobacco. *Archives of Pediatric and Adolescent Medicine*. 2006; 160:1285–1296.
- Wilson BJ, Weiss AJ. The effects of sibling coviewing on preschoolers' reactions to suspenseful movie scenes. *Communication Research*. 1993; 20:214–224.

Table 1

Hierarchical linear mixed models predicting smoking intention and smoking refusal self-efficacy from exposure to pro-smoking media, social context, and their interaction

Fixed effects	Smoking intention			Smoking refusal self-efficacy		
	Without covariates	With covariates		Without covariates	With covariates	
	<i>b</i> (SE)	<i>p</i>	<i>b</i> (SE)	<i>b</i> (SE)	<i>p</i>	<i>p</i>
Intercept	2.28 (0.27)	<0.001	2.99 (0.33)	8.99 (0.25)	<0.001	8.43 (0.32) <0.001
Pro-smoking media Exposure ^a	-0.02 (0.07)	0.74	-0.03 (0.07)	-0.02 (0.05)	0.73	-0.02 (0.05) 0.75
Proportion of exposure events	3.31 (1.45)	0.02	4.32 (1.28)	-3.19 (1.33)	0.02	-4.04 (1.23) <0.001
Social context ^b						
Romantic partner	-0.02 (0.04)	0.58	-0.03 (0.04)	0.06 (0.04)	0.10	0.07 (0.04) 0.08
One or more family member	-0.07 (0.04)	0.09	-0.08 (0.04)	0.04 (0.04)	0.26	0.05 (0.04) 0.20
One or more friends	0.04 (0.02)	0.13	0.03 (0.02)	0.00 (0.02)	0.99	0.00 (0.02) 0.96
Social context by exposure interactions						
Exposure × romantic partner	0.22 (0.12)	0.08	0.21 (0.12)	-0.11 (0.11)	0.30	-0.11 (0.11) 0.29
Exposure × family member(s)	0.01 (0.11)	0.95	0.00 (0.11)	0.03 (0.10)	0.72	0.03 (0.10) 0.72
Exposure × friend(s)	0.23 (0.07)	<0.001	0.23 (0.07)	-0.15 (0.06)	0.01	-0.15 (0.06) 0.01
Gender: Male			0.17 (0.37)		0.65	0.09 (0.36) 0.80
Racial/ethnic minority status ^c			-0.05 (0.37)		0.90	-0.22 (0.36) 0.55
Weekend ^d			0.05 (0.02)		0.01	-0.02 (0.02) 0.24
Never smoker ^e			-2.33 (0.36)		<0.001	1.84 (0.35) <0.001
Variance components						
Participant-level intercept	5.20 (0.64)	<0.001	3.96 (0.50)	4.27 (0.53)	<0.001	3.58 (0.45) <0.001
Smoking media exposure	0.30 (0.06)	<0.001	0.30 (0.06)	0.09 (0.02)	<0.001	0.09 (0.02) <0.001
Error	0.65 (0.01)	<0.001	0.65 (0.01)	0.54 (0.01)	<0.001	0.54 (0.01) <0.001

Note. Number of observations = 7,647

^aVersus random prompt

^bBeing alone is the reference category

^cCompared with non-Hispanic White

^dWeekend (Friday, Saturday, Sunday) vs. weekday (the reference category)

^eEver smoker is the reference category