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Adolescent smoking and volume of exposure to various forms of media

Brian A. Primack[a,b,e,*], **Stephanie R. Land**[c], and **Michael J. Fine**[a,b,d]

[a]Center for Research on Health Care, University of Pittsburgh School of Medicine, 230 McKee Place Suite 600, Pittsburgh, PA 15213, USA

[b]Division of General Internal Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

[c]Department of Behavioral and Community Health Sciences, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA, USA

[d]Center for Health Equity Research and Promotion, VA Pittsburgh Health Care System, Pittsburgh, PA, USA

[e]Division of Adolescent Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

Summary

Objective—To assess the association between adolescent smoking and volume of exposure to various forms of media after controlling for multiple relevant covariates.

Methods—A survey of all adolescents at a large suburban high school assessed: (1) current smoking and susceptibility to future smoking; (2) volume of exposure to various media; and (3) covariates related to smoking. Multivariate logistic regression models assessed relationships between each of the independent variables (media exposures) and the two smoking outcomes after controlling for covariates.

Results—Of the 1138 respondents, 19% (n = 216) reported current smoking. Forty percent (n = 342) of the non-smokers (n = 922) were susceptible to future smoking. Students reported exposure to an average of 8.6 (standard deviation 5.1) h of media daily, including 2.6 h of music. Those with high exposure to films and music were more likely to be smokers (P_{trend} = 0.036 and P_{trend}<0.001, respectively), and those with high exposure to books were less likely to be smokers (P_{trend}<0.001). After controlling for all relevant covariates, those with high exposure to music had greater odds of being smokers than those with low exposure [odds ratio (OR) 1.90, 95% confidence intervals (CI) 1.10–3.30], and those with high exposure to books had lower odds of being current smokers (OR 0.55, 95% CI 0.33–0.94).

Conclusion—Exposure to films and music are associated with smoking, but only the relationship between music exposure and smoking persists after rigorous covariate control. Exposure to books is associated with lower odds of smoking.

*Corresponding author. Center for Research on Health Care, University of Pittsburgh School of Medicine, 230 McKee Place Suite 600, Pittsburgh, PA 15213, USA. Tel.: +1 412 586 9789; fax: +1 412 692 4838. bprimack@pitt.edu (B.A. Primack).

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Keywords

Tobacco; Smoking prevention; Adolescent health; Mass media; Television; Films; Music; School health

Introduction

Smoking is the leading cause of preventable morbidity and mortality in the USA.[1] Of the 442,000 people who die from tobacco-related illnesses each year,[1] the vast majority began smoking as adolescents.[2] An accurate characterization of the factors associated with smoking among adolescents is crucial, as it will help practitioners to provide appropriate educational and policy-related measures aimed at reducing cigarette smoking during adolescence. Adolescent smoking is a complex phenomenon with many potential predisposing factors, including environmental characteristics such as parental smoking, parental style and perceived peer smoking, and intrinsic factors such as sensation seeking, depression and poor self-esteem.[2–4]

It has been shown that exposure to smoking-related media messages is one particularly important environmental factor that increases the risk of smoking. For example, exposure to portrayals of smoking in films, tobacco promotions and smoking advertisements significantly increases the initiation of smoking among adolescents.2,5–8 It is not clear, however, if the volume of general exposure to media messages increases the likelihood of smoking, regardless of whether there is focused smoking-related content. Some researchers have suggested that this is the case. For example, when Gidwani et al. examined data from the National Longitudinal Survey of Youth, they found that young people who watch large amounts of television (>5 h/day) were nearly six times as likely to smoke as young people who watch little television (<2 h/day).9 Similarly, Gutschoven and Van den Bulck reported that high levels of television viewing were related to earlier onset of smoking behavior among adolescents.10 Although Gidwani et al. controlled for demographic and intelligence-related data, and Gutschoven and Van den Bulck controlled for gender, grade level, parental smoking and peer smoking, they were unable to control for many other known risk factors for smoking. These authors suggested two major explanations for their findings: (1) although advertisements for smoking in media such as television are not legal, there may be a substantial number of product placements or other suggestive messages; or (2) perhaps time spent with media such as television, music and films detracts from time that could be spent in activities conferring resistance against smoking.9,10

Although content analyses show that references to tobacco in music are low (about 3%),[11] some have suggested that volume and/or presence of music exposure may be linked to substance use,12 or at least expectancies related to substance use.13 Although video games are primarily thought of as purveyors of violence,14,[15] even teen-rated video games portray substances as often as 15% of the time.[16] Although no one has examined Internet exposure and risk of smoking systematically, content analyses have shown substantial smoking-related information and opportunities to purchase tobacco on the Internet.[17–19] Although newspapers and magazines can contain tobacco advertising, exposure to which is causally related to smoking,[7,20] no one has examined the relationship of general exposure to magazines overall. Little information is available on the relationship between book exposure and smoking.

It is essential to determine if there are significant associations between volume of general media use and smoking-related variables after controlling for a comprehensive set of covariates. If volume of general exposure to one or more particular forms of media is found

to be independently associated with smoking, this will have important implications. First, it would mean that policy and educational interventions aimed at reducing adolescent smoking should focus not only on reduction of specific exposure to smoking-related messages but also on overall volume of exposure to certain media. This is the current understanding with regard to television and obesity; regardless of the specific content, increases in overall television viewing increases the risk of obesity, and this knowledge has aided the ability to combat obesity substantially. [21–24] These findings would also have important implications for further research in this area. If there are indeed associations between volume of general exposure and smoking, it will be important to determine the precise mechanism of this association by testing hypotheses such as those mentioned above.

This study was designed to assess the multivariate associations between two clinically relevant smoking outcomes among adolescents (current smoking and susceptibility to future smoking) and volume of exposure to seven forms of media (television, films, Internet, music, video games, newspapers/magazines and books). In addition, it was designed to control for a wide range of sociodemographic, environmental and intrinsic risk factors for these smoking outcomes. Based on the above studies, it was hypothesized that exposure to television, films and music would have the greatest association with smoking outcomes.

Methods

Procedures, setting and participants

A detailed description of the overall study methodology has been published elsewhere.[25] In brief, in January 2005, all students at a large suburban high school were surveyed regarding their media exposure and substance use. The community served by this school is primarily middle income. Students were eligible to participate if they were aged 14–18 years and available to take the survey on the day on which it was administered. Although the primary objective of the study was to determine the relationship between ‘media literacy’ and substance use, an important secondary objective of the study was to examine relationships between media exposure and substance use. Both the University of Pittsburgh Institutional Review Board and the school superintendent approved the study with opt-out parental informed consent.

Measures

The questionnaire assessed two dependent variables: current smoking, which was defined as having smoked at least once in the past 30 days; and susceptibility to future smoking, which was assessed with Pierce’s reliable and valid three-item scale.[4] According to this scale, which was developed and validated in a population of non-smoking adolescents, a person is considered to be ‘nonsusceptible’ if he or she answers ‘definitely no’ to the following three items: Do you think that you will smoke a cigarette soon? Do you think that you will smoke a cigarette in the next year? If one of your best friends were to offer you a cigarette, would you smoke it? In populations such as these with large numbers of non-smokers, it is useful to examine this construct of susceptibility to future smoking, as it has been shown to strongly predict actual future smoking.[4]

For the independent variables, students were asked to estimate how many hours per day, ranging from 0 to 8 h in 30-min increments, they spend watching television (regular, satellite or cable), using the Internet for fun (not for school work), listening to music (via radio, CDs, MP3 s, iPod™), playing video games, reading newspapers/magazines and reading books for fun. Students were also asked how many complete films they had watched in a cinema or on DVD/VHS during the past 14 days, the ideal amount of time required for accurate recognition according to the pilot studies. When the number of films was converted

to an hourly figure for composite exposure values, it was assumed that each complete film lasted for 2 h.

For hours of watching television, respondents were asked for values for an average weekday, an average Saturday and an average Sunday. Weighted averaging was used to compute the mean daily number of hours of television/cable watched: [(5 × weekday viewing)+(Saturday viewing)+(Sunday viewing)]/7. This was done for television viewing because the pilot studies showed that students were likely to have different responses for television viewing on each of these separate days, but that their exposures to the other media were similar across weekdays and weekends.

In addition to presenting each media type separately, all electronic media and all non-electronic media were combined in composite scales. This combination was supported by both a degree of face validity as well as the results of a principal components analysis on all seven media exposure variables, which yielded two principal factors with eigenvalues of 2.0 and 1.2 explaining 28% and 18% of the data, respectively. The five types of electronic media (television, films, music, Internet and video games) were loaded on Factor 1, and the two types of non-electronic media (books and newspaper/magazines) were loaded on Factor 2.

All media exposure measures were classified as categorical variables, consistent with how media exposures are reported in the literature.[9,10,26] A computer algorithm was used to divide media exposure variables into tertiles, each of which was labelled ‘low exposure’, ‘medium exposure’ or ‘high exposure.’ There are three primary reasons why media exposure measures are often presented in such a way. First, adolescent self-report of media exposure can be imprecise,[27] so reporting in categories is more accurate. Second, presentation in categories provides ease of interpretation for both researchers and practitioners. Third, a statistical benefit is that the approach is robust to high-leverage extreme values.

Several relevant covariates were assessed. Demographic information included age, race, gender and parental education as a surrogate for socio-economic status. Important intrinsic and environmental characteristics of the adolescents were also assessed. Parental, sibling and peer smoking were assessed with standard items.[5,7,26] All covariate items, along with references, are included in Table 1.

Analysis

Descriptive analysis of the valid questionnaires was performed by computing the number and percentage of responses for categorical variables, and calculating the means and standard deviations (SDs) for continuous variables. Chi-squared analyses and *t*-tests (for categorical and continuous variables, respectively) were used to compare the characteristics of current smokers with non-smokers.

Bivariate logistic regression techniques were used to assess the association between each of the dependent variables (current smoking and susceptibility to smoking) and each of the independent variables (exposures to each form of media). A different model was developed for each media type. The authors considered including all media exposures in the same model, but selected this approach because of ease of interpretation. For each of the bivariate models, a non-parametric extension of the Wilcoxon rank sum test developed by Cuzick was performed in order to determine if there was a significant trend.[28]

Finally, multivariate logistic regression was used to assess associations between each of the dependent variables and each of the independent variables while controlling for covariates. A backward stepwise logistic regression was used, with criteria for removal from the model

of $P<0.15$. In order to test the robustness of the results, a sensitivity analysis was performed that included all measured covariates.

When computing values for scales, all available data were used. However, if more than half of the responses to items for a particular scale were missing, the scale value was excluded from the analysis. Levels of missing data were acceptable; the ultimate multivariate models included $n = 944–972$ for the current smoking analyses and $n = 806–819$ for the susceptibility analyses.

Significant interactions to include in the multivariate models were sought, specifically all one-way interactions between the media use variable and other participant characteristics. The tests of interactions were considered significant for $P<0.01$ due to the exploratory nature of these multiple comparisons. The tests for the main effects of media use variables were considered significant for $P<0.05$.

Results

Of the 1525 students who were eligible for the study, 1402 (92%) completed the questionnaire. After 44 surveys that showed a pervasive pattern of improbable responses and 147 surveys in which students admitted to providing dishonest answers were eliminated, 1211 valid surveys remained for analysis (86% of all surveys completed). Of those, 1138 (94.0%) responded to the smoking items. Those eliminated from the analysis were no different from those included in terms of age, race or reported parental education. However, compared with those included, those eliminated were more likely to be male (71% vs 48%; $P<0.001$).

Descriptive analysis showed that the mean age of the respondents was 15.9 years and that 48% were male, 92% were white and 19% were current smokers (Table 1). Of the non-smokers, 40% were susceptible to future smoking. Not accounting for multitasking, the respondents were exposed to an average of 8.6 (SD 5.1) h of electronic media each day, with the greatest exposures being to music, television and the Internet (2.6, 2.3 and 2.3 h/day, respectively). They were exposed to an average of 1.2 h of non-electronic media each day, including 0.6 h of exposure to books.

All measured covariates were significantly associated with current smoking, except for sex, race and self-esteem (Table 1). Smokers were more likely to be older ($P<0.001$), have higher parental education ($P = 0.004$), have parents, peers and siblings who smoked (all $P<0.001$), experience more demanding and more responsive parenting ($P<0.001$ for both), be more sensation seeking and more rebellious ($P<0.001$ for both), have more depression ($P<0.001$), and have lower grades ($P<0.001$).

As illustrated in Table 2, bivariate analyses between current smoking and exposure to media types showed that increased odds of current smoking were associated with increased exposure to films ($P_{trend} = 0.036$), music ($P_{trend}<0.001$) and total electronic media exposure ($P_{trend} = 0.003$). Increased odds of current smoking were also associated with decreased exposure to books ($P_{trend}<0.001$) and total non-electronic media ($P_{trend}<0.001$).

In multivariate analyses that controlled for covariates, the vast majority of bivariate relationships did not retain their significance (Table 2). However, of note, those with high exposure to music had greater odds of being smokers than those with low exposure (OR 1.90, 95% CI 1.10–3.30). Additionally, those with both medium and high exposure to books had lower odds of being current smokers (OR 0.53, 95% CI 0.31–0.93 for medium exposure; OR 0.55, 95% CI 0.33–0.94 for high exposure).

As illustrated in Table 3, bivariate analyses between susceptibility to smoking and exposure to media types showed that the odds of susceptibility to smoking were associated with increased exposure to television ($P_{trend} = 0.001$), films ($P_{trend} = 0.011$), music ($P_{trend} = 0.045$) and total electronic media exposure ($P_{trend} = 0.016$). Odds of susceptibility were decreased with increased exposure to books ($P_{trend}<0.001$) and overall non-electronic media in general ($P_{trend} = 0.002$).

However, in multivariate analyses that controlled for covariates, only one of these associations remained statistically significant. Specifically, those with high exposure to books (≥1 h/day) were less likely to be susceptible to smoking (OR 0.58, 95% CI 0.38–0.86).

Results were similar when analyses using all covariates (instead of using stepwise backward regression) were undertaken. Interactions between participants' characteristics and media use variables were not included in the final models because they did not achieve the significance threshold of $P<0.01$.

Discussion

This survey of adolescents attending a large public high school demonstrated that students were heavily exposed to media (8.6 h/day) and that the greatest exposure was to music (2.6 h/day). These findings regarding the frequency of overall exposure to media are similar to those of earlier studies. For instance, a Kaiser Family Foundation study in 2005 found that young people are exposed to a total of 8 h and 33 min of daily media messages, when not accounting for multitasking.[29]

Although the present bivariate analyses showed that many electronic media exposures were associated with either current smoking or susceptibility to smoking, the multivariate analyses that controlled for covariates found only two independent relationships: (1) high exposure to music was associated with increased odds of current smoking; and (2) high exposure to books was independently associated with reduced odds of smoking and reduced odds of susceptibility to future smoking.

Television

Like Gidwani et al.[9] and Gutschoven and Van den Bulck,[10] who measured television exposure in the same way as in the present study, a significant relationship between smoking and television exposure was found in this study initially; specifically, a significant bivariate association was found between exposure to television and susceptibility to smoking. However, unlike Gidwani et al.[9] and Gutschoven and Van den Bulck,[10] no significant association was found between current smoking and television exposure, and even the bivariate association found between smoking susceptibility and television exposure disappeared after controlling with covariates. The differences in findings may be attributable to the fact that the present study controlled for a large variety of demographic, environmental and intrinsic factors that earlier studies found to be associated with smoking in young people, whereas because of design constraints, Gidwani et al. were only able to control for demographic and intelligence-related variables, and Gutschoven and Van den Bulck were only able to control for gender, grade level, parental smoking and peer smoking. Another explanation for the difference in results relates to the fact that the present data are more recent, and media exposure patterns are changing rapidly. It is possible that smoking used to be more substantially related to television viewing, whereas other media exposures may be of more concern at the present time.

An important implication of these findings would be that whereas merely limiting total television viewing may be useful in combating obesity, anxiety and other public health problems,[21,30,31] it may not be as powerful a strategy alone in reducing adolescent smoking. It may be more useful instead to focus on limiting exposure to specific smoking-related messages, as shown in other studies.[5,6] This may help focus financial and political tobacco control resources on the most essential aspects of research, education and policy in this area.

Films

Initially, there were significant relationships between film exposure and both current smoking and susceptibility to smoking; however, these relationships did not persist with rigorous covariate control. As the specific tobacco-related content of the films these students saw was not assessed, these findings are not inconsistent with those who have shown that exposure to smoking-related content in films relates to smoking uptake.[5,6] Rather, the present findings suggest that overall film exposure, without regard to tobacco-related content, does not appear to be strongly related to smoking.

Music

Interestingly, this study found that music was the electronic media exposure with the strongest relationship to current smoking. There are theoretical reasons to link music exposure and smoking. For instance, there are exposures to smoking-related content in popular music (although these are relatively uncommon).[11,32,33] Also, some have suggested that volume and/or presence of music exposure may be linked to substance use,12 or at least expectancies related to substance use.[13]

The context of this activity is also important to consider. Specifically, listening to music can be a highly social activity that may be associated with concurrent smoking. Film viewing can be social, but cinemas in the study area do not allow smoking. Video game playing and Internet ‘surfing’ can be solitary or social, but they are generally done indoors and require equipment that one might find in a living room, laboratory at school or other similar settings which do not allow smoking. These issues will be important to address in future research.

Books

It is interesting that exposure to books was independently associated with reduced susceptibility to smoking. It is unlikely that there are specific messages in books that are protective against smoking. One possible explanation for this finding is that time spent with books in particular reduces time spent in situations that may lead to smoking; reading books is likely to be a solitary activity. Another possibility is that reading is a marker for a protective covariate not adequately controlled for by the measured covariates. In either case, another implication of these findings is that encouraging reading may be another potentially useful method of protecting against smoking. Further research exploring the relationship between smoking and reading books would be worthwhile.

Overall media exposure

The present results build on those of Gidwani et al. and Gutschoven and Van den Bulck, and help to determine the reason for associations that have been noted between media exposure and smoking. As the present study did not find a clear relationship between the overall number of hours of media exposure and the likelihood of smoking, the results suggest that it is unlikely that overall time spent with media simply removes young people from other activities conferring resistance to smoking. Rather, the findings support the hypothesis that different media exposures carry variable risks for smoking, related to complex combinations

of: (1) smoking-related messages embedded in those media and (2) the social and environmental contexts in which those media are experienced.

Limitations

This study had limitations worth noting. First, the study population was drawn from a single large suburban school, limiting its generalizability. Nevertheless, the participants' rate of smoking34 and exposure to media[29] are similar to those in national studies, supporting the external validity of the results. Second, this study relied on self-report of both media habits and smoking outcomes. Verifying media use (through electronic means or parent reports) or smoking (through biochemical confirmation) would not have been feasible using this design, which allowed students to remain anonymous and which made for a large sample size as parental consent was not required. Although self-report of media habits is subject to recall and other biases, it is currently standard practice in research of this type when it is not feasible to use recognition measures.[35–37] Third, although a cross-sectional study can show concurrent associations, it does not imply causation. For instance, although there was an association between exposure to books and reduced smoking, it is not possible to infer directionality from this. Finally, media exposures are not solitary acts and must be considered alongside other contextual factors. Although it is valuable to examine overall time spent with various media as predictor variables, these results must be interpreted with the realisation that media exposures are complex and associated with various environmental and social contexts.

Conclusion

In conclusion, adolescents spend very little time reading but spend more than half of their waking hours consuming various forms of electronic media. Bivariate analyses show that film, television and music exposure have significant relationships with smoking outcomes. Although most of these relationships did not remain significant after controlling for multiple variables, high exposure to music was independently associated with current smoking. This study also suggests that the total amount of media exposure seems to be less important than the specific medium used and the specific amount of smoking-related content in media exposures. Tobacco control researchers and practitioners should continue to carefully address smoking-related content within each of the media forms to which adolescents will inevitably be exposed.

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References

1. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. J Am Med Assoc 2004;291:1238–1245.
2. Centers for Disease Control and Prevention. Preventing tobacco use among young people, a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services; 1994.
3. Buller DB, Borland R, Woodall WG, Hall JR, Burris-Woodall P, Voeks JH. Understanding factors that influence smoking uptake. Tob Control 2003;12 Suppl 4:IV16–IV25. [PubMed: 14645936]

4. Gilpin EA, Pierce JP, Rosbrook B. Are adolescents receptive to current sales promotion practices of the tobacco industry? Prev Med 1997;26:14–21. [PubMed: 9010893]
5. 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]
6. 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]
7. Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Berry CC. Tobacco industry promotion of cigarettes and adolescent smoking. J Am Med Assoc 1998;279:511–515.
8. Altman DG, Levine DW, Coeytaux R, Slade J, Jaffe R. Tobacco promotion and susceptibility to tobacco use among adolescents aged 12 through 17 years in a nationally representative sample. Am J Public Health 1996;86:1590–1593. [PubMed: 8916525]
9. Gidwani PP, Sobol A, DeJong W, Perrin JM, Gortmaker SL. Television viewing and initiation of smoking among youth. Pediatrics 2002;110:505–508. [PubMed: 12205251]
10. Gutschoven K, Van den Bulck J. Television viewing and age at smoking initiation: does a relationship exist between higher levels of television viewing and earlier onset of smoking? Nicotine Tob Res 2005;7:381–385. [PubMed: 16085505]
11. Roberts, DF.; Henriksen, L.; Christenson, PG. Substance use in popular movies and music. Washington, DC: Office of National Drug Control Policy; 1999.
12. Gueguen N, Le Guellec H, Jacob C. Sound level of background music and alcohol consumption: an empirical evaluation. Percept Motor Skills 2004;99:34–38. [PubMed: 15446627]
13. McKee SA, Wall A-M, Hinson RE, Goldstein A, Bissonnette M. Effects of an implicit mood prime on the accessibility of smoking expectancies in college women. Psychol Addict Behav 2003;17:219–225. [PubMed: 14498816]
14. Gentile DA, Stone W. Violent video game effects on children and adolescents. A review of the literature. Minerva Pediatr 2005;57:337–358. [PubMed: 16402007]
15. Funk JB. Children's exposure to violent video games and desensitization to violence. Child Adolesc Psychiatr Clin N Am 2005;14:387–404. vii–viii. [PubMed: 15936665]
16. Haninger K, Thompson KM. Content and ratings of teen-rated video games. J Am Med Assoc 2004;291:856–865.
17. Ribisl KM, Williams RS, Kim AE. Internet sales of cigarettes to minors. J Am Med Assoc 2003;290:1356–1359.
18. Ribisl KM. The potential of the Internet as a medium to encourage and discourage youth tobacco use. Tob Control 2003;12 Suppl 1:i48–i59. [PubMed: 12773785]
19. Ribisl KM, Lee RE, Henriksen L, Haladjian HH. A content analysis of web sites promoting smoking culture and lifestyle. Health Educ Behav 2003;30:64–78. [PubMed: 12564668]
20. DiFranza JR, Wellman RJ, Sargent JD, Weitzman M, Hipple BJ, Winickoff JP. Tobacco promotion and the initiation of tobacco use: assessing the evidence for causality. Pediatrics 2006;117:1237–1248.
21. Crespo CJ, Smit E, Troiano RP, Bartlett SJ, Macera CA, Andersen RE. Television watching, energy intake, and obesity in US children: results from the third National Health and Nutrition Examination Survey, 1988–1994. Arch Pediatr Adolesc Med 2001;155:360–365. [PubMed: 11231802]
22. Dietz WH Jr, Gortmaker SL. Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. Pediatrics 1985;75:807–812. [PubMed: 3873060]
23. Dietz WH, Gortmaker SL. Preventing obesity in children and adolescents. Annu Rev Public Health 2001;22:337–353. [PubMed: 11274525]
24. Robinson TN. Television viewing and childhood obesity. Pediatr Clin North Am 2001;48:1017–1025. [PubMed: 11494635]
25. Primack BA, Gold MA, Switzer GE, Hobbs R, Land SR, Fine MJ. Development and validation of a smoking media literacy scale. Arch Pediatr Adolesc Med 2006;160:369–374. [PubMed: 16585481]
26. Sargent JD, Beach ML, et al. Effect of seeing tobacco use in films on trying smoking among adolescents: cross sectional study. Br Med J 2001;323:1394–1397. [PubMed: 11744562]

27. Rich M, Bickham D, Koren S, Aneja P, de Moor C, Shrier L. Measuring youth media exposure (MYME): a pilot study. J Adolesc Health 2007;40:S5–S6.

28. Cuzick J. A Wilcoxon-type test for trend. Stat Med 1985;4:87–89. [PubMed: 3992076]

29. Rideout, V.; Roberts, D.; Foehr, U. Generation M: media in the lives of 8–18 year-olds. Menlo Park, CA: Kaiser Family Foundation; 2005.

30. Duggal HS, Berezkin G, John V. PTSD and TV viewing of World Trade Center. J Am Acad Child Adolesc Psychiatry May 2002;41:494–495.

31. Primack B. Counseling patients on mass media and health. Am Fam Phys 2004;69:2545–2554.

32. DuRant RH, Rome ES, Rich M, Allred E, Emans SJ, Woods ER. Tobacco and alcohol use behaviors portrayed in music videos: a content analysis. Am J Public Health 1997;87:1131–1135. [PubMed: 9240102]

33. Gruber EL, Thau HM, Hill DL, Fisher DA, Grube JW. Alcohol, tobacco and illicit substances in music videos: a content analysis of prevalence and genre. J Adolesc Health 2005;37:81–83. [PubMed: 15963915]

34. Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the future national survey results on drug use, 1975–2005. Volume I. Secondary school students. Bethesda, MD: National Institute on Drug Abuse; 2006. NIH Publication No. 06-5883

35. Robinson TN, Chen HL, Killen JD. Television and music video exposure and risk of adolescent alcohol use. Pediatrics 1998;102:E54. [PubMed: 9794984]

36. Carson NJ, Rodriguez D, Audrain-McGovern J. Investigation of mechanisms linking media exposure to smoking in high school students. Prev Med 2005;41:511–520. [PubMed: 15917047]

37. Brown JD, L'Engle KL, Pardun CJ, Guo G, Kenneavy K, Jackson C. Sexy media matter: exposure to sexual content in music, movies, television and magazines predicts black and white adolescents' sexual behavior. Pediatrics 2006;117:1018–1027. [PubMed: 16585295]

Table 1

Characteristics of the sample.[a]

Characteristic	Non-smoker (*n* = 922) %	Current smoker (*n* = 216) %	Total sample (*n* = 1138)	*P*-value[b]
Media exposure				
Electronic media				
Television (h/day)				
Lowest third (0–1.6)	36.6	31.9	35.7	0.30
Middle third (1.7–2.6)	31.9	37.0	32.9	
Highest third (≥2.7)	31.5	31.0	31.4	
Films (no. of films seen in last 2 weeks)				
Lowest third (0–2)	41.6	32.6	39.8	0.055
Middle third (3–4)	28.4	33.0	29.3	
Highest third (≥5)	30.0	34.4	30.9	
Music (h/day)				
Lowest third (0–1)	42.1	21.8	38.2	<0.001
Middle third (1.5–3)	36.7	39.4	37.2	
Highest third (≥4)	21.2	38.9	24.6	
Internet (h/day)				
Lowest third (0–1)	40.8	38.4	40.3	0.36
Middle third (1.5–3)	37.4	35.2	37.0	
Highest third (≥4)	21.9	26.4	22.7	
Video games (h/day)				
Lowest third (0)	45.1	45.8	45.2	0.84
Middle third (0.5–1)	27.5	28.7	27.7	
Highest third (≥1.5)	27.4	25.5	27.0	
Total electronic media (h/day)				
Lowest third (0–5.7)	36.0	27.8	34.4	0.011
Middle third (5.8–9.5)	33.3	31.1	32.8	
Highest third (≥9.6)	30.7	41.0	32.8	
Non-electronic media Books (h/day)				
Lowest third (0)	47.8	68.8	51.8	<0.001
Middle third (0.5)	24.2	14.0	22.3	
Highest third (≥1)	28.0	17.2	25.9	
Newspapers/magazines (h/day)				
Lowest third (0)	31.5	39.6	32.3	0.10
Middle third (0.5)	58.5	51.3	57.1	
Highest third (≥1)	10.1	9.1	10.0	
Total non-electronic media (h/day)				
Lowest third (0–0.5)	46.9	64.7	50.3	<0.001
Middle third (1)	20.0	12.6	18.6	
Highest third (≥1.5)	33.0	22.8	31.1	
Demographics				

Characteristic	Non-smoker (*n* = 922) %	Current smoker (*n* = 216) %	Total sample (*n* = 1138)	*P*-value[b]
Age, mean (SD)	15.8 (1.2)	16.2 (1.1)	15.9 (1.2)	<0.001
Gender				
Male	47.3	46.7	47.2	0.89
Female	52.7	53.3	52.8	
Race				
White	92.1	94.4	92.5	0.27
Black	4.2	1.9	3.7	
Other	3.7	3.7	3.7	
Parental education				
Level 1	35.4	40.6	36.4	0.004
Level 2	29.0	35.8	30.3	
Level 3	35.6	23.7	33.3	
Family and peer smoking				
Parental smoking				
No	66.7	41.2	61.9	<0.001
Yes	33.3	58.8	38.2	
Sibling smoking				
No	82.8	57.4	78.0	<0.001
Yes	17.2	42.7	22.0	
Friend smoking				
No	54.5	3.4	44.4	<0.001
Yes	45.5	96.6	55.6	
Other covariates[c]				
Demanding parenting[d], mean (SD):	3.3 (0.6)	3.1 (0.7)	3.3 (0.6)	<0.001
My parents have rules I have to follow				
My parents always want to know where I am				
Responsive parenting[d], mean (SD):	3.3 (0.6)	3.1 (0.6)	3.3 (0.6)	<0.001
My parents listen to what I have to say				
My parents care about me				
Sensation seeking[e], mean (SD):	2.6 (0.6)	3.1 (0.5)	2.7 (0.7)	<0.001
I like to do dangerous things				
I like to listen to loud music				
Rebelliousness[f], mean (SD):	1.7 (0.5)	2.3 (0.6)	1.8 (0.6)	<0.001
I get in trouble at school				
I do whatever my teacher says to do[g]				
Depression[h], mean (SD):	1.6 (0.7)	1.8 (0.7)	1.7 (0.7)	<0.001
Over the past 2 weeks, how often have you been bothered by these things? [i]				
(a) Little interest or pleasure in doing things				
(b) Feeling down, depressed, or hopeless				

Characteristic	Non-smoker (*n* = 922) %	Current smoker (*n* = 216) %	Total sample (*n* = 1138)	*P*-value[b]
Self-esteem[j], mean (SD):	3.1 (0.6)	3.1 (0.6)	3.1 (0.6)	0.33
I like myself the way I am				
I worry that other kids don't like me[g]				
School achievement, mean (SD):	3.4 (0.6)	3.0 (0.6)	3.3 (0.6)	<0.001
I generally get good grades				

n, sample size; SD, standard deviation.

[a] Values do not always sum to the total *n* because of missing data.

[b] These *P*-values were computed with *t*-tests (for continuous variables) or Chi-squared tests (for discrete variables) and compared non-smokers with smokers.

[c] Unless otherwise noted, these covariates were measured on a four-level Likert scale with response choices of 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree.

[d] Jackson C, Henriksen L, Foshee V. The authoritative parenting index: predicting health risk behaviors among children and adolescents. *Health Educ Behav* 1998;25:319–37.

[e] Zuckerman M, Ball S, Black J. Influences of sensation seeking, gender, risk appraisal, and situational motivation on smoking. *Addict Behav* 1990;15:209–20.

[f] Smith GM, Fogg CP. Psychological antecedents of teenage drug use. In: Simmons R, editor. *Research in community and mental health: an annual compilation of research.*, vol. 1. Greenwich, CT: JAI; 1979. p. 87–102.

[g] These items were reverse coded.

[h] Spitzer RL, Williams JB, Kroenke K, et al. Utility of a new procedure for diagnosing mental disorders in primary care: the PRIME-MD 1000 study. *JAMA* 1994;272:1749–56.

[i] Depression items were measured on a four-level Likert scale with response choices of 1 = not at all, 2 = several days, 3 = more than half the days, 4 = nearly every day.

[j] Blascovich J, Tomaka J. Measures of self-esteem. In: Robinson JP, Shaver PR, Wrightsman LS, editors. *Measures of personality and social psychological attitudes*, 3rd ed. Ann Arbor, MI: Institute for Social Research; 1993. p. 115–60.

Table 2

Associations between current smoking and exposure to various forms of media.

Form of media	OR (95% CI) for current smoking, unadjusted	P_{trend}	OR (95% CI) for current smoking, multivariate[a]
Electronic media			
Television (h/day)			
Lowest third (0–1.6)	1.0	0.51	1.0
Middle third (1.7–2.6)	1.33 (0.93–1.90)		1.32 (0.81–2.14)
Highest third (≥2.7)	1.13 (0.78–1.63)		0.97 (0.58–1.60)
Films (no. of films seen in last 2 weeks)			
Lowest third (0–2)	1.0	0.036	1.0
Middle third (3–4)	1.48 (1.02–2.14)[b]		1.39 (0.84–2.31)
Highest third (≥5)	1.46 (1.02–2.11)[b]		1.19 (0.73–1.94)
Music (h/day)			
Lowest third (0–1)	1.0	<0.001	1.0
Middle third (1.5–3)	2.08 (1.41–3.06)[c]		1.63 (0.97–2.75)
Highest third (≥4)	3.55 (2.39–5.27)[c]		1.90 (1.10–3.30)[b]
Internet (h/day)			
Lowest third (0–1)	1.0	0.24	1.0
Middle third (1.5–3)	1.00 (0.71–1.41)		1.11 (0.69–1.78)
Highest third (≥4)	1.28 (0.88–1.87)		1.40 (0.83–2.37)
Video games (h/day)			
Lowest third (0)	1.0	0.67	1.0
Middle third (0.5–1)	1.03 (0.72–1.46)		1.06 (0.65–1.73)
Highest third (≥1.5)	0.91 (0.63–1.32)		0.66 (0.39–1.10)
Total electronic media (h/day)			
Lowest third (0–5.7)	1.0	0.003	1.0
Middle third (5.8–9.5)	1.21 (0.82–1.78)		1.12 (0.66–1.88)
Highest third (≥9.6)	1.73 (1.19–2.50)[b]		1.12 (0.66–1.89)
Non-electronic media Books (h/day)			
Lowest third (0)	1.0	<0.001	1.0
Middle third (0.5)	0.40 (0.26–0.61)[c]		0.53 (0.31–0.93)[b]
Highest third (≥1)	0.43 (0.29–0.63)[c]		0.55 (0.33–0.94)[b]
Newspapers/magazines (h/day)			
Lowest third (0)	1.0	0.068	1.0
Middle third (0.5)	0.70 (0.50–0.98)[b]		0.87 (0.55–1.38)
Highest third (≥1)	0.72 (0.40–1.29)		0.80 (0.35–1.82)
Total non-electronic media (h/day)			
Lowest third (0–0.5)	1.0	<0.001	1.0
Middle third (1)	0.46 (0.29–0.71)[b]		0.66 (0.37–1.19)

Form of media	OR (95% CI) for current smoking, unadjusted	P_{trend}	OR (95% CI) for current smoking, multivariate[a]
Highest third (≥1.5)	0.50 (0.35–0.72)[c]		0.65 (0.40–1.05)

OR, odds ratio; CI, confidence interval.

[a] Multivariate model controlled for age, gender, race, parental education (as a surrogate for socio-economic status), parent smoking, sibling smoking, friend smoking, demanding parenting, responsive parenting, sensation seeking, rebelliousness, depression and academic achievement. The analytic method was stepwise backward regression, with criteria of $P<0.15$ for removal.

[b] $P<0.05$.

[c] $P<0.001$.

Table 3

Associations between susceptibility to smoking and exposure to various forms of media.

Form of media	OR (95% CI) for smoking susceptibility, unadjusted	P_{trend}	OR (95% CI) for current smoking, multivariate[a]
Electronic media			
Television (h/day)			
Lowest third (0–1.6)	1.0	0.001	1.0
Middle third (1.7–2.6)	1.41 (1.03–1.95)[b]		1.26 (0.85–1.87)
Highest third (≥2.7)	1.72 (1.24–2.37)[b]		1.33 (0.88–2.00)
Films (no. of films seen in last 2 weeks)			
Lowest third (0–2)	1.0	0.011	1.0
Middle third (3–4)	1.40 (1.01–1.93)[b]		1.36 (0.91–2.04)
Highest third (≥5)	1.49 (1.08–2.05)[b]		1.45 (0.97–2.15)
Music (h/day)			
Lowest third (0–1)	1.0	0.045	1.0
Middle third (1.5–3)	1.05 (0.78–1.42)		0.73 (0.49–1.06)
Highest third (≥4)	1.45 (1.03–2.04)[b]		0.94 (0.60–1.47)
Internet (h/day)			
Lowest third (0–1)	1.0	0.13	1.0
Middle third (1.5–3)	1.47 (1.09–1.97)[b]		1.31 (0.90–1.90)
Highest third (≥4)	1.22 (0.86–1.73)		0.90 (0.57–1.40)
Video games (h/day)			
Lowest third (0)	1.0	0.24	1.0
Middle third (0.5–1)	1.45 (1.06–1.98)[b]		1.31 (0.88–1.94)
Highest third (≥1.5)	1.16 (0.84–1.60)		0.82 (0.54–1.25)
Total electronic media (h/day)			
Lowest third (0–5.7)	1.0	0.016	1.0
Middle third (5.8–9.5)	1.49 (1.08–2.07)[b]		1.05 (0.70–1.57)
Highest third (≥9.6)	1.49 (1.07–2.06)[b]		0.81 (0.53–1.23)
Non-electronic media Books (h/day)			
Lowest third (0)	1.0	<0.001	1.0
Middle third (0.5)	0.64 (0.46–0.88)[b]		0.83 (0.56–1.25)
Highest third (≥1)	0.55 (0.40–0.75)[b]		0.58 (0.38–0.86)[b]
Newspapers/magazines (h/day)			
Lowest third (0)	1.0	0.37	1.0
Middle third (0.5)	0.96 (0.71–1.31)		1.01 (0.69–1.49)
Highest third (≥1)	0.75 (0.44–1.27)		0.80 (0.41–1.56)
Total non-electronic media (h/day)			
Lowest third (0–0.5)	1.0	0.002	1.0
Middle third (1)	0.82 (0.58–1.16)		0.91 (0.59–1.39)

Form of media	OR (95% CI) for smoking susceptibility, unadjusted	P_{trend}	OR (95% CI) for current smoking, multivariate[a]
Highest third (≥1.5)	0.63 (0.46–0.85)[b]		0.67 (0.45–0.98)[b]

OR, odds ratio; CI, confidence interval.

[a] Multivariate model controlled for age, gender, race, parental education (as a surrogate for socio-economic status), parent smoking, sibling smoking, friend smoking, demanding parenting, responsive parenting, sensation seeking, rebelliousness, depression and academic achievement. The analytic method was stepwise backward regression, with criteria of $P<0.15$ for removal.

[b] $P<0.05$.