# Media Exposure and Marijuana and Alcohol Use Among Adolescents

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## Abstract

We aimed to determine which media exposures are most strongly associated with marijuana and alcohol use among adolescents. In 2004, we surveyed 1,211 students at a large high school in suburban Pittsburgh regarding substance use, exposure to entertainment media, and covariates. Of the respondents, 52% were female, 8% were non-White, 27% reported smoking marijuana, and 60% reported using alcohol. They reported average exposure to 8.6 hr of media daily. In adjusted models, exposure to music was independently associated with marijuana use, but exposure to movies was independently associated with alcohol use. Implications, limitations, and suggestions for further research are discussed.

### Keywords

alcohol; marijuana; mass media; entertainment media; adolescence; music; movies; television; video games; books

## Introduction

Adolescents in the United States are currently exposed to media for over 8.5 hr/day when accounting for multitasking (Rideout, Roberts, and Foehr, 2005). This includes substantial engagement with various types of media such as television, films, music, internet, video games, and magazines (Rideout et al., 2005). Recently, certain media exposures were shown

to have significant associations with substance abuse[1] behaviors. In particular, it is now established that viewing smoking-related mass media messages is associated with adolescent smoking initiation (Centers for Disease Control and Prevention, 2005; Dalton et al., 2003; DiFranza et al., 2006; Pierce, Choi, Gilpin, Farkas, and Berry, 1998; Sargent et al., 2005; Wakefield, Flay, Nichter, and Giovino, 2003). Some researchers have even concluded that, based upon established criteria (Hill, 1965), the relationship between smoking-related media messages and adolescent smoking is causal (DiFranza et al., 2006).

Fewer studies, however, have examined the relationship between marijuana use and media exposure. Marijuana is the most common illicit drug used by children and adolescents in the United States (Heyman et al., 1999). More than half of U.S. adolescents will experiment with marijuana, and of those who try it more than once, approximately one third will subsequently use marijuana regularly (Gruber and Pope, 2002). Despite adolescents' lack of concern regarding potential dangers of marijuana (Heyman et al., 1999), researchers have determined that it is a drug of dependence, the risk of which increases with decreasing age of initiation (Hall, 2006). Additionally, its use is associated with use of other illicit drugs (Raphael, Wooding, Stevens, and Connor, 2005), poor school performance (Lynskey and Hall, 2000), depression (Degenhardt, Hall, and Lynskey, 2003), and psychosis (Arseneault, Cannon, Witton, and Murray, 2004; Green, Young, and Kavanagh, 2005; Raphael et al., 2005). Although many factors are associated with risk of marijuana use—including genetic predisposition, demographic characteristics, temperament and parenting style (Gruber and Pope, 2002; Hall, 2006; Heyman et al., 1999; Lynskey and Hall, 2000)—it is not currently known to what extent media exposure among adolescents is associated with marijuana use.

Similarly, more studies are necessary to elucidate the relationship between alcohol use and media exposure. Alcohol use is responsible for 75,000 deaths in the United States each year (Stahre, Brewer, Naimi, and Miller, 2004), making it the third leading preventable cause of death (Mokdad, Marks, Stroup, and Gerberding, 2004). It is considered the leading cause of death in the adolescent years, since it is responsible for a substantial proportion of three major causes of death in this age group: motor vehicle accidents, other accidents, and violence (Columbia University Center on Addiction and Substance Abuse, 2002; Smith, Branas, and Miller, 1999; Stahre et al., 2004). A relationship between alcohol use and media exposure is highly plausible (Austin, Chen, and Grube, 2006), and initial evidence suggests that early use of alcohol may be linked to movie exposure (Dalton et al., 2002, 2006; Sargent, Wills, Stoolmiller, Gibson, and Gibbons, 2006). Studies have also shown a relationship between viewing alcohol in advertising and promotions and actual alcohol use in adolescence (Austin et al., 2006; Robinson, Chen, and Killen, 1998; Snyder, Milici, Slater, Sun, and Strizhakova, 2006).

Several years ago, a series of three content analyses published by the Office of National Drug Control Policy documented that alcohol and marijuana use are portrayed in multiple media, including television, films, music lyrics, and music videos (Christenson, Henriksen, and Roberts, 2000; Roberts, Christenson, Henriksen, and Brandy, 2002; Roberts, Henriksen, and Christenson, 1999). Of the 200 popular films from 1996 to 1997 they studied, 22% referenced illicit drugs and 93% portrayed consumption of alcohol (Roberts et al., 1999). Of the top 1,000 popular songs they studied in this time period, 18% referenced illicit drugs and 17% referenced alcohol (Roberts et al., 1999). In a second report, these authors found that 20% of the 168 television episodes studied contained references to illicit drugs and that 77% contained references to alcohol (Christenson et al., 2000). Their third report, from 2002, found that of the 258 popular music videos studied, 20% verbally referenced illicit drugs and

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[1]The journal's style utilizes the category *substance abuse* as a diagnostic category. Substances are used or misused; living organisms are and can be *abused.* Editor's note.

37% displayed alcohol (Roberts et al., 2002). In every case, marijuana was the illicit drug most commonly represented (Christenson et al., 2000; Roberts et al., 1999, 2002). In contrast, video games seem to contain fewer substance use related messages. The most recent content analysis of 147 M (mature) rated video games revealed references to illicit drugs in five (3.8%) but no references to either alcohol or tobacco (Thompson, Tepichin, and Haninger, 2006). The most recent content analysis of 396 T-rated (teen rated) games revealed that none contained references to illegal drugs and that only six (1.5%) contained references to alcohol or tobacco (Haninger and Thompson, 2004). There have been important concerns raised regarding the presence of substance use related messages on the internet (Ribisl, 2003; Ribisl, Lee, Henriksen, and Haladjian, 2003). For instance, content analyses have revealed that smoking-related Web sites are easily accessible to youth who search for them (Ribisl et al., 2003). Finally, youth are well known to be disproportionately exposed to alcohol advertising in magazines, to the extent that youth view 45% more beer advertisements and 27% more liquor advertisements in magazines than do adults (Georgetown University Center on Alcohol Marketing to Youth, 2002).

Although we know that these different types of media contain various levels of exposure to marijuana and alcohol-related messages, we do not know whether these media exposures are associated with marijuana and/or alcohol use. Knowing more about which media exposures are more strongly associated with actual substance use will enable us to focus our research, educational, and policy efforts on the most relevant and important media exposures related to both marijuana and alcohol use.

The purpose of this study is to determine the associations between various media exposure types and marijuana and alcohol use in adolescents, after controlling for multiple demographic, intrinsic, and environmental risk factors for substance use. Our a priori hypothesis was that media exposures more likely to contain references to marijuana and alcohol—such as television, films, and music—would be associated with marijuana and alcohol use, whereas exposure to media such as video games, internet, and books with less established substance-related content would not be associated with marijuana and alcohol use.

## Methods

### Design and Setting

A detailed description of the overall study methodology has been published elsewhere (Primack, Gold, Land, and Fine, 2006a; Primack et al., 2006b; Primack, Switzer, and Dalton, in press). In brief, in January 2005 we surveyed all students at a large suburban high school outside Pittsburgh. We selected this school because it draws from a large region of middle-income families. The 30-min survey assessed media exposure, substance use, and sociodemographic characteristics. The survey was distributed by all social studies teachers on the same day. Prior to the study, we conducted a session with all social studies teachers instructing them how to minimize bias in administration of the survey. Students did not place their names or any other unique identifiers on their surveys. Students were not required to complete the survey for a grade, extra credit, or any other school-based incentive. However, those who completed the survey received a bag of trail mix as thanks for their time. Although there were not enough research personnel to be present in each classroom, two research personnel were continuously available for questions that arose.

Since the survey was anonymous, both the University of Pittsburgh IRB and the school superintendent approved the study with opt-out parental informed consent. Although the primary objective of this study was to develop and validate a battery of items measuring the

media literacy of individuals, an important secondary goal of the study was to examine the interrelationships between media exposure and adolescent substance use.

### Sample

The high school selected for this study is located in a blue-collar neighborhood about 20 min from the city center of Pittsburgh. The school is predominantly Caucasian (>90%) and roughly half of the population is female. Although students at this school are drawn from a relatively wide region, they represent primarily a middle-income population with few families at socioeconomic extremes.

### Survey Measures

The survey consisted of approximately 100 items. It was designed to require no more than 30 min to complete. It was extensively reviewed by experts in public health, adolescent medicine, and psychometrics, and it was pilot tested in a convenient sample of adolescents. It contained empirically based items assessing substance use, media exposures, and covariates.

**Substance Use**—In the questionnaire, we assessed marijuana use by asking "Have you ever smoked marijuana?" and listing checkboxes for "yes" or "no." For alcohol use we asked "Have you ever drunk beer, wine, or liquor with friends in secret?" and listed checkboxes for "yes" and "no." We chose to frame our alcohol use measure in this way in order to avoid identifying as alcohol users those who had only consumed alcohol for religious reasons or in the context of a family gathering.

**Media Use**—For the independent variables, we first asked students to estimate how many hours per day, ranging from 0 to 8 hr in half-hour increments, they spend watching television (regular, satellite, or cable), using the internet for fun (not for school work), listening to music (via radio, CD's, MP3's, iPod™), playing video games, reading newspapers/magazines, and reading books for fun. We also asked students how many hours of movies they watched in a theater or on DVD/VHS during the past 14 days, the ideal amount of time required for accurate recognition according to our pilot studies.

For hours of watching television, we asked respondents for values for an average weekday, an average Saturday, and an average Sunday. We then used weighted averaging to compute the mean daily number of hours of television/cable watched: $[(5 \times \text{weekday viewing}) + (\text{Saturday viewing}) + (\text{Sunday viewing})]/7$. We did this for television watching because our pilot studies showed that students were likely to have different responses for television watching on each of these separate days, but that their exposures to the other media were similar across weekdays and weekends.

We classified all media exposure measures as categorical variables, consistent with how media exposures are reported in the literature (Gidwani, Sobol, DeJong, Perrin, and Gortmaker, 2002; Gutschoven and Van den Bulck, 2005; Sargent et al., 2001). We selected cut-off points roughly approximating quartiles or quintiles that were appropriate for each media exposure. For example, we divided television exposure into five categories: 0–1 hr/day, >1–2 hr/day, >2–3 hr/day, >3–4 hr/day, and >4 hr/day.

**Covariates**—We assessed several relevant covariates. Demographic information included age, race/ethnicity, gender, and socioeconomic status as approximated by parental education. We also assessed important intrinsic and environmental characteristics of the adolescents including authoritative parenting, stress level, depression, self-esteem, rebellious behavior, and sensation seeking. Although we based our measures on established scales

when they were available (Blascovich and Tomaka, 1993; Jackson, Henriksen, and Foshee, 1998; Kroenke, Spitzer, and Williams, 2003; Smith and Fogg, 1979; Zuckerman, Ball, and Black, 1990), we were not able to include all items from each scale because of unacceptable respondent burden. All covariate items are included in the tables.

### Analysis

We first performed a descriptive analysis of the valid questionnaires by computing the number of responses to each survey item and calculating the means and standard deviations for continuous variables. We computed these figures in the total sample, among ever users of marijuana, and of ever users of alcohol. We then used chi-squared tests (for categorical variables) and *t*-tests (for continuous variables) to determine which covariates were significantly different in ever users of marijuana (versus never users) and ever users of alcohol (versus never users). Finally, we used bivariate and multivariate logistic regression techniques to assess the association between the dependent variables (ever smoking marijuana and ever drinking alcohol) and each of the independent variables (exposures to each form of media). Our primary multivariate models were trimmed to include only covariates that had bivariate relationships with the outcomes at a level of $p < .10$ or stronger. However, we also ran analyses with all measured covariates in order to test the robustness of our results. We developed a different multivariable model for each of the independent media exposure variables.

We searched for significant interactions between media exposure variables and age, sex, and race. The tests for the main effects of media use variables were considered significant for $p < .05$. The tests for interactions were considered significant for $p < .01$ due to the exploratory nature of these multiple comparisons.

## Results

### Participants

Official records show that, of the 1,690 students enrolled in the school, 1,525 (90.2%) were present on the day of the survey and eligible for the study. Of those eligible, 1,402 (91.9%) completed the questionnaire. Using specific criteria established before administering the survey, we eliminated any questionnaire if three or more responses were deemed to be impossible or extremely improbable ($N = 44$) or if the students admitted to providing dishonest answers ($N = 147$). The final sample size was therefore 1,211 (86% of the surveys completed). The mean age of the 1,211 respondents was 15.9 years, about half (48%; $N = 572$) were male and 92% ($N = 1,092$) were white. Since so few subjects were Hispanic/Latino (1%), we did not include this variable in the subsequent analyses.

### Media Exposure, Marijuana Use, and Alcohol Use

Twenty-seven percent of the participants ($N = 321$) had smoked marijuana and 60.0% had used alcohol ($N = 713$). The respondents were exposed to an average of 8.6 hr ($SD = 5.1$) of electronic media each day, with the greatest exposures being to music, television, and internet (2.6 [$SD = 2.2$], 2.3 [$SD = 1.5$], and 2.3 hr [$SD = 2.1$] each day, respectively). They were exposed to an average of 1.2 hr ($SD = 1.5$) of non-electronic media each day, including 0.6 hr ($SD = 1.1$) of exposure to books and 0.6 hr ($SD = 0.7$) to that of magazines/newspapers (Table 1). Older students were progressively exposed to less electronic media ($p < .001$). Male and female exposures were similar with the exception of video games: males were exposed to 1.9 hr of video games per day whereas females were exposed to 0.4 hr per day ($p < .001$). Non-white participants were exposed to significantly more electronic media than white participants with regard to television ($p < .001$), movies ($p < .001$), music ($p = .$

009), video games (*p* = .002), and overall electronic media (*p* = .002) but not the internet (*p* = .36).

### Demographic, Intrinsic, and Environmental Associations with Marijuana and Alcohol Use

Nearly all of the measured covariates were significantly related to use of both marijuana and alcohol. Marijuana smoking was associated with older age (*p* < .001), African–American race (*p* = .003), low socioeconomic status (*p* < .001), less demanding parenting (*p* < .001), less responsive parenting (*p* < .001), increased tress (*p* < .001), increased sensation seeking (*p* < .001), increased rebelliousness (*p* < .001), increased depression (*p* < .001), and lower school achievement (*p* < .001) (Tables 1 and 2). Only gender, self-esteem, and "other" race were not significantly associated with marijuana smoking. Alcohol use was associated with older age (*p* < .001), lower socioeconomic status (*p* = .035), less demanding parenting (*p* < .001), less responsive parenting (*p* < .001), increased stress (*p* = .01), increased sensation seeking (*p* < .001), increased rebelliousness (*p* < .001), increased depression (*p* < .001), lower self-esteem (*p* = .045), and lower school achievement (*p* < .001) (Tables 1 and 2). Of the covariates, only race was not statistically significantly associated with alcohol use.

### Multivariate Analyses

In the fully adjusted and trimmed models, ever using marijuana retained a significant dose–response relationship with music exposure (Table 3). Compared with adolescents with less than an hour of music use per day, those with 3–4 hr of daily music use (OR = 1.90, 95% CI: 1.01, 3.56) and over 4 hr of daily music use (OR = 2.70, 95% CI: 1.57, 4.63) were significantly more likely to have ever used marijuana. All levels of video game exposure above the reference group were associated with lower odds of having ever smoked marijuana. For instance, those with exposure of >1.5 hr/day were less likely to have used marijuana (OR = 0.56, 95% CI: 0.38, 0.83). Compared with their reference group, only those with the highest level of exposure to books (>1.5 hr/day) were less likely to have smoked marijuana (OR = 0.53, 95% CI: 0.31, 0.89). Television, movie, internet, and newspaper/magazine exposures were not independently associated with ever use of marijuana (Table 3).

Multivariate results involving alcohol showed that all levels of movie exposure above the reference group were associated with increased odds of ever using alcohol (Table 3). Those exposed to two to four movies during the previous 2 weeks (versus those with exposure to less than two movies during the previous 2 weeks) had odds of 1.65 of having used alcohol (95% CI: 1.13, 2.42). Compared with their reference group, only those with the highest level of television exposure had lower odds of having used alcohol (OR = 0.56, 95% CI: 0.33, 0.97). Those with exposure to more than 1 hr of video game use were less likely than those with the lowest exposure to have used alcohol (OR = 0.58, 95% CI: 0.35, 0.95) and (OR = 0.55, 95% CI: 0.36, 0.84) for those who were exposed to 1–1.5 hr and >1.5 hr of daily video games, respectively. Those exposed to the two highest levels of books had decreased odds of having used alcohol: OR = 0.46 (95% CI: 0.30, 0.71) for 1–1.5 daily hours of books and OR = 0.37 (95% CI: 0.24, 0.57) for >1.5 daily hours of books.

We also ran all analyses with untrimmed models including all measured covariates. These results were no different in terms of levels of significance. Only one multivariate model contained a significant one-way interaction: the term representing the interaction between movie viewing and age in the alcohol model was significant (*p* < .006). Specifically, the association between movie exposure and alcohol use was stronger for participants who were 16 years old or younger compared to those who were older than 16 years. The adjusted odds ratio for having tried alcohol for those with the highest level of movie exposure was 3.2 (95% CI: 1.8, 5.6) for those who were ≤ 16 years but was 0.80 (95% CI: 0.4, 1.7) for those who were ≥ 17.

## Discussion

We find that, after controlling for multiple demographic, intrinsic, and environmental risk factors, marijuana use is independently associated with increased music exposure. In contrast, alcohol was independently associated with increased movie exposure but not music exposure. Finally, we find that exposure to video games and books were associated with reduced odds of having used either substance.

Total hours of adolescent media exposure found in this study were also similar to those reported in recent national surveys. In particular, the Kaiser Family Foundation found in 2005 that youth are exposed to 8 hr and 33 min of electronic mass media when accounting for multitasking (Rideout et al., 2005), very similar to the figure of 8.6 hr that we found. Our results were also very similar to the Kaiser Family Foundation's study in which we found that non-White students and those from disadvantaged socioeconomic backgrounds were more heavily exposed to electronic mass media, with the exception of the internet (Rideout et al., 2005).

We found a strong multivariate association between alcohol use and movie exposure but no association between marijuana use and movie exposure. One potential explanation is that alcohol is portrayed more commonly in films than is marijuana (93% vs. <22%) (Roberts et al., 1999). However, it is also possible that there are qualitative differences between the portrayals of the substances. For example, messages involving alcohol in films may be more likely to be associated with attractiveness, humor, and/or positive consequences than portrayals of marijuana use. Alternatively, the visual portrayal of alcohol may be more compelling in some way than the visual portrayal of marijuana.

It is noteworthy that marijuana use (but not alcohol use) was independently associated with music exposure in a dose–response fashion, despite the fact that marijuana and alcohol are thought to be equally represented in popular music (Roberts et al., 1999). There are several potential explanations for the link we found between music exposure and marijuana use. First, it could be that lyrics related to marijuana are currently either more prevalent—or that marijuana is portrayed in more of a positive light in music—than has been previously thought. It will be important to perform new content analyses to answer this question. It is also possible that music induces mood states that predispose to marijuana use, regardless of the presence of references to marijuana. The presence, volume, and type of music played have been shown to affect accessibility of subjects to the use of alcohol and tobacco (Gueguen, Guellec, and Jacob, 2004; Lazev, Herzog, and Brandon, 1999; McKee, Wall, Hinson, Goldstein, and Bissonnette, 2003; Willner, Field, Pitts, and Reeve, 1998), but perhaps these elements even more profoundly predispose to marijuana use. Finally, it may be that those who smoke marijuana like to listen to music to enhance their experience, but this is also likely to be true with regard to alcohol. Clearly more investigation into the complex relationship between music exposure and marijuana use is warranted.

Interestingly, video game exposure was associated with *reduced* odds of having used either substance. As previously mentioned, video games contain few if any references to these substances. However, this does not fully explain the lower odds of substance use we observed in video game players. One possibility is that video games tend to be played during times (after school and on weekends) that might otherwise be spent engaging in risk-taking behavior such as substance use. It is also possible that the time spent playing video games reduces exposure to other forms of media that have more frequent portrayals of alcohol and marijuana use. Thus, while video games may still represent a public health concern in terms of their potential association with aggressive behavior (Gentile and Stone, 2005), desensitization to violence (Funk, 2005), and attention deficit disorder (Chan and

Rabinowitz, 2006), they potentially also may represent an activity that removes them from situations leading to substance use.

Our finding that exposure to books is associated with less use of either substance will also be important to investigate in more detail. It is unlikely that books contain specific antisubstance use messages. As with video games, it is possible that these activities simply remove students from (1) situations that may lead to substance use; or (2) time spent with other media that portray substance use. However, it is also possible that exposure to books is a marker for an underlying variable or variables for which we did not adequately control. Although we controlled for a number of demographic, intrinsic, and environmental variables, it is certainly possible that other unmeasured covariates exist. Future research should attempt to better characterize this relationship so we can appropriately tap the power of these potentially protective activities.

We found one interesting interaction worth considering. Specifically, we found that movie viewing was more significantly associated with alcohol use among younger students (16 or less) than among older students. This may suggest that younger adolescents are more susceptible to alcohol-related messages in movies. The differential associations between movie exposure and alcohol in those of different ages should continue to be explored and considered.

## Limitations

External generalizability of our findings is limited since our study population was drawn from a single large high school. However, our sample's rate of previous marijuana use (27.0%), previous alcohol use (60.0%), and media exposure were similar to those previously reported in national samples (Eaton et al., 2006; Rideout et al., 2005). Another limitation is that we focused on the outcomes of having ever smoked marijuana and having ever used alcohol, so we do not know how these exposures may relate to the frequency of use of these substances. However, we do know that adolescent triers of alcohol and marijuana are at greatest risk for continued use of these substances, and thus having ever tried a substance is a standard outcome for populations in this age range (Best et al., 2005; Strang and McCambridge, 2005; Sutherland and Shepherd, 2002).

Importantly, the cross-sectional design of this study precludes our ability to determine the temporal relationship of the observed associations. Although it is theoretically plausible that media exposure precedes substance use behavior, longitudinal research is needed to definitively determine this. Also, our measure of media use was self-reported did not allow us to specifically quantify exposure to episodes of substance use in the various media studied. Although self-reported frequency of media use is often used in observational studies with large sample sizes (Brown et al., 2006; Carson, Rodriguez, and Audrain-McGovern, 2005; Robinson et al., 1998), this method of measurement is subject to bias. Finally, we acknowledge that using statistical models such as these offer only a limited view of what is clearly a much more complex system. It is our hope that future researchers will be able to build upon these results using more complex and nuanced methodologies.

## Conclusion

To our knowledge, this is the first study comparing adolescents' marijuana and alcohol use across a variety of media exposures. We found that marijuana use was linearly and independently related to music exposure but not movie exposure. In contrast, alcohol use was independently associated with movie exposure but not music exposure. This suggests that different forms of media may have varying influences on health risk behaviors. Further research is needed to determine the direction of the relationships and to explore the

mechanistic reasons for the diverse associations between various types of media exposure and use of different substances in adolescents.

## Acknowledgments

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## Biographies



**Brian A. Primack**, M.D., Ed.M, M.S., is an Assistant Professor of Medicine and Pediatrics at the University of Pittsburgh School of Medicine. After graduating Yale University magna cum laude in 1991 with degrees in English literature and mathematics, Dr. Primack spent 4 years teaching adolescents and studying human development for his master's degree, which he received from Harvard University. He subsequently graduated first in his class from Emory Medical School and trained in Family Medicine from UPMC Saint Margaret Hospital in Pitts-burgh. Now, on the faculty of the University of Pittsburgh School of Medicine, Dr. Primack combines his expertise in education, technology, human development, and medicine by researching the effect of the mass media messages on health. Specifically, he focuses on the use of media literacy education in preventing adolescent smoking, underage drinking, and other harmful adolescent health behaviors. He is the recent recipient of the University of Pittsburgh Provost's Innovation in Education Award, the New Investigator of the Year by the National Society of Adolescent Medicine, and the Robert Wood Johnson Faculty Physician Scholar Award.



**Kevin L. Kraemer,** M.D., M.Sc., is an Associate Professor of Medicine at the University of Pittsburgh and has a secondary appointment in the Department of Health Policy and Management. He is a general internist and substance abuse researcher with a special interest in screening and brief intervention and the application of cost-effectiveness and cost-utility analyses to substance abuse prevention and treatment services. He is currently principal investigator of NIH-supported research on improving the quality of care for patients with unhealthy alcohol use and the measurement of utilities for a spectrum of alcohol and drug problems. He serves as co-investigator and site PI for the Veterans Aging Cohort Study, a national observational study of the impact of alcohol and drug abuse on health outcomes in HIV-infected veterans. He is very involved in training fellows and junior faculty through his activities as Director of the General Internal Medicine Fellowship Program, Director of the University of Pittsburgh Postdoctoral Program in Health Services Research, and as course director/instructor in the training programs of the University of Pittsburgh Institute for Clinical Research Education.

**Michael J. Fine,** M.D., M.Sc., Professor of Medicine and Associate Director of the Center for Research on Health Care at the University of Pittsburgh, serves as the Director of the VA Center for Health Equity Research and Promotion (CHERP) at the VA Pittsburgh Healthcare System. Dr. Fine's overarching research theme focuses on ways to improve the quality of medical care for patients with common medical problems. As Director of the VA CHERP, he is particularly interested in conducting research to detect, understand, and eliminate disparities in health and health care among vulnerable patient populations. His past research employed retrospective and prospective cohort designs, with extensive emphasis on assessment of patient-centered outcomes. His current research utilizes randomized clinical trial design to test the effectiveness and safety of medical practice guidelines to improve the quality and efficiency of care for patients with common medical illnesses. Dr. Fine has over 124 peer review publications, is a member of the American Society of Clinical Investigation, serves on several editorial boards, and is a member of the National Advisory Council of the National Institute of Health Center for Minority Health and Health Disparities (NCMHD). Dr. Fine has successfully mentored over 25 medical students, residents, fellows, graduate students, and junior faculty, the majority of whom currently hold academic positions.



**Madeline A. Dalton,** Ph.D., is an Associate Professor in the Department of Pediatrics at Dartmouth Medical School and Director of the Hood Center for Children and Families at Dartmouth–Hitchcock Medical Center. An accomplished scientific researcher in behavioral epidemiology, Dr. Dalton's research focuses on the prevention of health risk behaviors during adolescence and early childhood. She has been Principal Investigator of multiple NIH-funded studies, several of which examine the social and environmental risk factors for tobacco use. Her investigations span from early childhood to adulthood and address a wide range of issues related to smoking prevention, uptake, and progression. For the past 10 years, Dr. Dalton has worked closely with a multi-disciplinary team to understand the mechanisms for media effects on adolescent smoking and to identify areas for intervention to help reduce children's exposure to smoking in movies. She has co-authored several seminal papers on this topic and her research has prompted personal dialogues with Senators, State Attorneys General, and representatives from the motion picture industry about how to reduce children's exposure to smoking in movies.

**Table 1**

Media exposures, marijuana use, and alcohol use by demographic group[a]

| Covariate | N (%) | Electronic media | | | | | | Non-electronic media | | | | Ever used alcohol (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TV viewing | Movies | Music | Internet | Video games | Total | Newspapers[b] | Books | Total | | |
| Age | | | | | | | | | | | | |
| 14 | 186 (15.7) | 2.5 (1.5) | 0.3 (0.2) | 2.3 (2.0) | 2.6 (2.1) | 1.1 (1.8) | 8.7 (4.4) | 0.6 (0.7) | 0.6 (0.9) | 1.2 (1.4) | 12.0 | 42.1 |
| 15 | 277 (23.3) | 2.5 (1.6) | 0.3 (0.3) | 2.8 (2.4) | 2.5 (2.3) | 1.4 (2.0) | 9.5 (5.6) | 0.6 (0.7) | 0.9 (1.7) | 1.5 (1.9) | 21.0 | 52.4 |
| 16 | 328 (27.6) | 2.3 (1.5) | 0.3 (0.2) | 2.6 (2.4) | 2.4 (2.1) | 1.0 (1.6) | 8.6 (5.1) | 0.6 (0.8) | 0.6 (1.1) | 1.2 (1.6) | 31.6 | 67.3 |
| 17 | 301 (25.3) | 2.2 (1.3) | 0.3 (0.2) | 2.6 (2.1) | 2.1 (2.1) | 0.9 (1.5) | 7.9 (4.9) | 0.6 (0.7) | 0.4 (0.6) | 1.0 (1.1) | 34.5 | 67.4 |
| 18 | 95 (8.0) | 2.1 (1.4) | 0.3 (0.3) | 2.4 (2.1) | 1.9 (1.9) | 1.1 (1.6) | 7.7 (5.1) | 0.5 (0.6) | 0.6 (1.0) | 1.1 (1.3) | 33.7 | 67.4 |
| Gender | | | | | | | | | | | | |
| Male | 572 (47.6) | 2.5 (1.5) | 0.3 (0.3) | 2.2 (2.1) | 2.2 (2.0) | 1.9 (2.0) | 9.1 (5.5) | 0.6 (0.8) | 0.4 (0.9) | 1.0 (1.3) | 27.0 | 57.2 |
| Female | 630 (52.4) | 2.2 (1.4) | 0.3 (0.3) | 2.9 (2.3) | 2.5 (2.2) | 0.4 (0.9) | 8.2 (4.7) | 0.6 (0.7) | 0.8 (1.2) | 1.3 (1.7) | 26.9 | 62.4 |
| Race | | | | | | | | | | | | |
| White | 1092 (91.7) | 2.3 (1.4) | 0.3 (0.2) | 2.5 (2.2) | 2.3 (2.1) | 1.0 (1.6) | 8.4 (5.0) | 0.6 (0.7) | 0.6 (1.1) | 1.2 (1.4) | 26.4 | 60.3 |
| Black | 49 (4.1) | 4.1 (2.0) | 0.4 (0.6) | 3.5 (2.6) | 2.1 (2.3) | 1.8 (2.4) | 11.9 (6.1) | 0.8 (1.5) | 0.9 (1.4) | 1.7 (2.4) | 48.9 | 66.7 |
| Other | 50 (4.2) | 2.6 (1.9) | 0.3 (0.3) | 2.8 (2.4) | 2.1 (2.4) | 1.5 (2.2) | 9.3 (6.0) | 0.6 (0.8) | 0.6 (1.3) | 1.2 (1.9) | 19.6 | 47.9 |
| SES[c] | | | | | | | | | | | | |
| Level 1 | 64 (5.4) | 2.8 (1.9) | 0.3 (0.3) | 3.8 (2.5) | 2.2 (2.4) | 1.1 (1.7) | 10.3 (5.1) | 0.6 (0.8) | 0.7 (1.3) | 1.3 (1.9) | 45.0 | 67.2 |
| Level 2 | 369 (31.0) | 2.4 (1.5) | 0.3 (0.3) | 2.5 (2.1) | 2.4 (2.2) | 1.1 (1.8) | 8.8 (5.0) | 0.5 (0.7) | 0.5 (0.9) | 1.0 (1.3) | 28.3 | 62.6 |
| Level 3 | 328 (27.6) | 2.3 (1.4) | 0.3 (0.3) | 2.6 (2.3) | 2.2 (2.2) | 1.0 (1.6) | 8.4 (4.8) | 0.6 (0.6) | 0.6 (1.0) | 1.2 (1.4) | 30.9 | 64.1 |
| Level 4 | 430 (36.1) | 2.2 (1.5) | 0.3 (0.2) | 2.5 (2.3) | 2.4 (2.1) | 1.1 (1.7) | 8.4 (5.3) | 0.6 (0.8) | 0.7 (1.3) | 1.3 (1.7) | 21.2 | 54.5 |
| Total | 1211[d] | 2.3 (1.5) | 0.3 (0.3) | 2.6 (2.2) | 2.3 (2.1) | 1.1 (1.7) | 8.6 (5.1) | 0.6 (0.7) | 0.6 (1.1) | 1.2 (1.5) | 27.0 | 60.0 |

*Note:* N = sample size, SD = standard deviation.

[a]Unless otherwise specified, table values are in hours per day (*SD*).

[b]Also included magazines.

[c]Based upon parental education. Level 1: At least one parent did not graduate high school. Level 2: Both parents graduated high school but neither graduated college. Level 3: One parent graduated college. Level 4: Both parents graduated college.

[d]Values do not always sum to 1,211 due to missing data.

**Table 2**

Covariates and their relationship with outcomes

| Covariate[a] | Total sample mean (SD) | Ever used marijuana mean (SD) | | | Ever used alcohol mean (SD) | | |
|---|---|---|---|---|---|---|---|
| | | Yes | No | P value[b] | Yes | No | P value[c] |
| Demanding parenting (1–4) | 3.3 (0.6) | 3.1 (0.6) | 3.4 (0.6) | <0.001 | 3.2 (0.6) | 3.4 (0.5) | <0.001 |
| My parents have rules I have to follow | | | | | | | |
| My parents always want to know where I am | | | | | | | |
| Responsive parenting (1–4) | 3.3 (0.6) | 3.1 (0.6) | 3.3 (0.6) | <0.001 | 3.2 (0.6) | 3.3 (0.6) | <0.001 |
| My parents listen to what I have to say | | | | | | | |
| My parents care about me | | | | | | | |
| Stress (1–4) | 2.7 (0.9) | 2.6 (0.9) | 2.7 (0.9) | <0.001 | 2.8 (0.8) | 2.6 (0.9) | 0.01 |
| I have a lot of stress in my life | | | | | | | |
| Sensation seeking (1–4) | 2.7 (0.7) | 3.0 (0.5) | 2.6 (0.7) | <0.001 | 2.9 (0.6) | 2.4 (0.7) | <0.001 |
| I like to do dangerous things | | | | | | | |
| I like to listen to loud music | | | | | | | |
| Rebelliousness (1–4) | 1.9 (0.6) | 2.2 (0.6) | 1.7 (0.5) | <0.001 | 2.0 (0.6) | 1.6 (0.5) | <0.001 |
| I get in trouble at school | | | | | | | |
| I do whatever my teacher says to do[d] | | | | | | | |
| Depression (1–4) | 1.7 (0.7) | 1.8 (0.7) | 1.6 (0.7) | <0.001 | 1.7 (0.7) | 1.6 (0.6) | <0.001 |
| Over the past 2 weeks, how often have you been bothered by these things?[e] | | | | | | | |
| (a) Little interest or pleasure in doing things | | | | | | | |
| (b) Feeling down, depressed, or hopeless | | | | | | | |
| Self-esteem (1–4) | 3.1 (0.6) | 3.1 (0.6) | 3.1 (0.6) | 0.64 | 3.1 (0.6) | 3.2 (0.6) | 0.05 |
| I like myself the way I am | | | | | | | |
| I worry that other kids do not like me[d] | | | | | | | |
| School Achievement (1–4) | 3.3 (0.7) | 3.0 (0.6) | 3.4 (0.6) | <0.001 | 3.2 (0.7) | 3.5 (0.6) | <0.001 |
| I generally get good grades | | | | | | | |

*Note: SD* = standard deviation.

[a]Unless otherwise noted, items used to measure these characteristics used a four-level Likert scale with responses ranging from strongly agree to strongly disagree. Higher values correspond to more of each characteristic.

[b]These *p*-values were computed with *t*-tests comparing characteristics in ever users of marijuana with never users of marijuana.

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[c]These p-values were computed with t-tests comparing characteristics in ever users of alcohol with never users of alcohol.

[d]These items were reverse coded.

[e]Depression items were measured on a four-level Likert scale with response choices of "not at all," "several days," "more than half the days," and "nearly every day."

**Table 3**

Relationships between media exposure and outcomes

| Media exposure[a] | Total sample (N = 1,211) | Ever used marijuana (N = 321) | | | Ever used alcohol (N = 713) | | |
|---|---|---|---|---|---|---|---|
| | N (%) | OR unadjusted (95% CI) | N (%) | OR adjusted (95% CI)[b] | N (%) | OR unadjusted (95% CI) | OR adjusted (95% CI)[c] |
| Electronic media exposure Television | | | | | | | |
| 0–1 | 162 (13.8) | 1 | 42 (13.1) | 1 | 92 (13.0) | 1 | 1 |
| >1–2 | 397 (33.8) | 1.03 (0.68, 1.56) | 105 (32.8) | 0.82 (0.49, 1.38) | 247 (34.9) | 1.24 (0.85, 1.79) | 1.04 (0.66, 1.62) |
| >2–3 | 304 (25.9) | 1.22 (0.80, 1.87) | 91 (28.4) | 0.96 (0.57, 1.64) | 190 (26.8) | 1.29 (0.87, 1.90) | 1.05 (0.66, 1.67) |
| >3–4 | 164 (14.0) | 0.95 (0.58, 1.57) | 41 (12.8) | 0.67 (0.36, 1.25) | 96 (13.9) | 1.09 (0.70, 1.69) | 0.89 (0.52, 1.53) |
| >4 | 149 (12.7) | 1.08 (0.66, 1.79) | 41 (12.8) | 0.61 (0.32, 1.16) | 83 (11.7) | 0.94 (0.60, 1.47) | 0.56 (0.33, 0.97)* |
| Movies (# seen in last 2 weeks) | | | | | | | |
| 0–2 | 223 (19.3) | 1 | 53 (16.9) | 1 | 107 (15.4) | 1 | 1 |
| >2–4 | 431 (37.4) | 1.14 (0.78, 1.66) | 113 (36.1) | 1.15 (0.73, 1.82) | 260 (37.5) | 1.67 (1.20, 2.31)* | 2.09 (1.28, 3.42)* |
| >4–6 | 251 (21.8) | 1.12 (0.74, 1.70) | 65 (20.8) | 1.04 (0.63, 1.72) | 160 (23.0) | 1.96 (1.36, 2.83)* | 2.77 (1.60, 4.77)* |
| >6 | 249 (21.9) | 1.57 (1.05, 2.36)* | 82 (26.2) | 1.20 (0.73, 1.97) | 167 (24.0) | 2.30 (1.58, 3.34)* | 3.17 (1.79, 5.61)* |
| Music | | | | | | | |
| 0–1 | 225 (19.1) | 1 | 32 (10.0) | 1 | 107 (15.0) | 1 | 1 |
| >1–2 | 333 (28.2) | 1.58 (1.00, 2.49)* | 69 (21.6) | 1.45 (0.85, 2.49) | 181 (25.5) | 1.32 (0.94, 1.86) | 0.87 (0.58, 1.30) |
| >2–3 | 184 (15.6) | 2.19 (1.33, 3.60)* | 49 (15.3) | 1.70 (0.94, 3.07) | 115 (16.2) | 1.81 (1.22, 2.69)* | 1.14 (0.71, 1.83) |
| >3–4 | 137 (11.6) | 3.15 (1.88, 5.27)* | 47 (14.7) | 1.90 (1.01, 3.56)* | 96 (13.5) | 2.46 (1.58, 3.84)* | 1.42 (0.84, 2.42) |
| >4 | 300 (25.5) | 4.19 (2.70, 6.50)* | 123 (38.4) | 2.70 (1.57, 4.63)* | 211 (29.7) | 2.67 (1.86, 3.84)* | 1.19 (0.76, 1.87) |
| Internet | | | | | | | |
| 0–1 | 290 (24.6) | 1 | 80 (24.9) | 1 | 159 (22.4) | 1 | 1 |
| >1–2 | 296 (25.1) | 1.01 (0.70, 1.44) | 82 (25.6) | 0.84 (0.54, 1.32) | 180 (25.4) | 1.30 (0.94, 1.81) | 1.18 (0.80, 1.74) |
| >2–3 | 193 (16.4) | 0.87 (0.57, 1.32) | 48 (15.0) | 0.67 (0.40, 1.11) | 119 (16.8) | 1.34 (0.92, 1.93) | 1.14 (0.73, 1.78) |
| >3–4 | 135 (11.4) | 0.95 (0.60, 1.51) | 36 (11.2) | 0.79 (0.45, 1.40) | 82 (11.6) | 1.31 (0.86, 1.99) | 0.99 (0.60, 1.63) |
| >4 | 266 (22.5) | 1.03 (0.71, 1.49) | 75 (23.4) | 0.69 (0.44, 1.10) | 169 (23.8) | 1.43 (1.02, 2.01)* | 1.03 (0.68, 1.54) |
| Video games | | | | | | | |
| 0–0.5 | 531 (45.0) | 1 | 152 (47.5) | 1 | 333 (47.0) | 1 | 1 |
| >0.5–1 | 201 (17.0) | 0.89 (0.62, 1.29) | 53 (16.6) | 0.60 (0.38, 0.96)* | 131 (18.5) | 1.12 (0.80, 1.58) | 0.98 (0.64, 1.49) |

| Media exposure[a] | Total sample (N = 1,211) | Ever used marijuana (N = 321) | | | Ever used alcohol (N = 713) | | |
|---|---|---|---|---|---|---|---|
| | N (%) | N (%) | OR unadjusted (95% CI) | OR unadjusted (95% CI)[b] | OR unadjusted N (%) | OR adjusted (95% CI) | (95% CI)[c] |
| >1–1.5 | 131 (11.1) | 30 (9.4) | 0.74 (0.47, 1.16) | 0.49 (0.28, 0.85)* | 72 (10.2) | 0.72 (0.49, 1.06) | 0.58 (0.35, 0.95)* |
| >1.5 | 318 (26.9) | 85 (26.6) | 0.91 (0.67, 1.24) | 0.56 (0.38, 0.83)* | 173 (24.4) | 0.73 (0.55, 0.97)* | 0.55 (0.36, 0.84)* |
| Total electronic media | | | | | | | |
| 0–4 | 181 (16.0) | 29 (9.4) | 1 | 1 | 92 (13.45) | 1 | 1 |
| >4–8 | 445 (39.2) | 129 (41.6) | 2.13 (1.37, 3.35)* | 1.83 (1.06, 3.15)* | 270 (39.5) | 1.50 (1.06, 2.12)* | 1.17 (0.77, 1.77) |
| >8–12 | 268 (23.6) | 69 (22.3) | 1.82 (1.12, 2.94)* | 1.07 (0.59, 1.95) | 170 (24.9) | 1.73 (1.18, 2.54)* | 1.04 (0.65, 1.66) |
| >12–16 | 134 (11.8) | 43 (13.9) | 2.47 (1.45, 4.24)* | 1.27 (0.64, 2.50) | 83 (12.1) | 1.62 (1.03, 2.56)* | 0.82 (0.47, 1.44) |
| >16+ | 107 (9.4) | 40 (12.9) | 3.13 (1.79, 5.47)* | 1.38 (0.68, 2.79) | 69 (10.1) | 1.73 (1.06, 2.82)* | 0.82 (0.45, 1.49) |
| Non-electronic media exposure | | | | | | | |
| Newspapers and magazines | | | | | | | |
| 0–0.5 | 335 (28.4) | 106 (33.1) | 1 | 1 | 210 (29.6) | 1 | 1 |
| >0.5–1 | 579 (49.1) | 145 (45.3) | 0.72 (0.54, 0.97)* | 0.89 (0.62, 1.27) | 345 (48.6) | 0.89 (0.68, 1.17) | 0.99 (0.72, 1.38) |
| >1–1.5 | 165 (14.0) | 45 (14.1) | 0.81 (0.54, 1.22) | 1.17 (0.72, 1.93) | 96 (13.5) | 0.85 (0.58, 1.25) | 0.93 (0.60, 1.46) |
| >1.5 | 101 (8.6) | 24 (7.5) | 0.67 (0.40, 1.12) | 0.56 (0.29, 1.07) | 59 (8.3) | 0.87 (0.55, 1.37) | 0.78 (0.45, 1.34) |
| Books | | | | | | | |
| 0–0.5 | 611 (51.8) | 205 (64.1) | 1 | 1 | 415 (58.5) | 1 | 1 |
| >0.5–1 | 262 (22.2) | 50 (15.6) | 0.47 (0.33, 0.66)* | 0.67 (0.44, 1.02) | 150 (21.2) | 0.64 (0.48, 0.86)* | 0.83 (0.59, 1.18) |
| >1–1.5 | 142 (12.0) | 36 (11.3) | 0.67 (0.44, 1.02) | 0.79 (0.48, 1.30) | 73 (10.3) | 0.50 (0.35, 0.72)* | 0.46 (0.30, 0.71)* |
| >1.5 | 165 (14.0) | 29 (9.1) | 0.42 (0.27, 0.65)* | 0.53 (0.31, 0.89)* | 71 (10.1) | 0.36 (0.25, 0.51)* | 0.37 (0.24, 0.57)* |
| Total non-electronic media | | | | | | | |
| 0–0.5 | 242 (20.7) | 91 (28.6) | 1 | 1 | 168 (23.8) | 1 | 1 |
| >0.5–1 | 346 (29.5) | 96 (30.2) | 0.64 (0.45, 0.90)* | 0.70 (0.47, 1.07) | 224 (31.8) | 0.83 (0.59, 1.18) | 0.90 (0.60, 1.35) |
| >1–1.5 | 221 (18.9) | 50 (15.7) | 0.49 (0.32, 0.73)* | 0.86 (0.52, 1.41) | 132 (18.7) | 0.67 (0.46, 0.98)* | 0.94 (0.60, 1.49) |
| >1.5 | 363 (31.0) | 81 (25.5) | 0.48 (0.33, 0.68)* | 0.62 (0.40, 0.97)* | 181 (25.7) | 0.45 (0.32, 0.64)* | 0.49 (0.33, 0.74)* |

*Note:* N = number; OR = Odds ratio; CI = Confidence interval.

[a] Measured in hours per day unless otherwise specified.

[b]The trimmed multivariate model for marijuana was adjusted for age, gender, race, socioeconomic status, demanding parenting, responsive parenting, stress, sensation seeking, rebelliousness, depression, and school achievement.

[c]The trimmed multivariate model for alcohol was adjusted for age, gender, sex, socioeconomic status, demanding parenting, responsive parenting, stress, sensation seeking, rebelliousness, depression, self-esteem, and school achievement.

[*]$p < .05$.