Middle and High School Students' Exposure to Alcohol- and Smoking-Related Media: A Pilot Study Using Ecological Momentary Assessment

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Abstract

The goals of this study were to assess the feasibility of using Ecological Momentary Assessment (EMA) to measure adolescents' exposure to alcohol and smoking-related media. A sample of 20 middle and high school students completed a two-week EMA protocol in which they monitored exposures to alcohol and smoking-related media. Results showed that adolescents were highly compliant with the study protocol. A total of 255 exposures to alcohol (67%) and smoking (33%) were captured, representing an average of 8.50 (5.82) alcohol-related media exposures and 4.25 (SD = 3.67) smoking-related media exposures and an average of per participant during the study period. Exposures tended to occur in the afternoon (52% alcohol; 54% smoking), at point of sale (44% alcohol; 65% smoking) and on days leading up to the weekend (57% alcohol; 57% smoking). Exposures were also likely in the presence of family (69% alcohol; 56% smoking). Overall, results of this small pilot provide preliminary evidence that EMA is a useful tool for tracking and characterizing middle and high school students' real-world exposures to alcohol and smoking-related media. Future studies may suggest mechanisms by which media exposures lead to youth uptake of drinking and smoking behaviors.

Keywords

advertising; middle school; high school; ecological momentary assessment; cigarettes; alcohol

Introduction

Alcohol and smoking among middle and high school students are major public health concerns. More than 70% of teenagers have consumed alcohol by high school graduation, and more than 20% of high school seniors have engaged in heavy drinking in the past two weeks (Johnston, O'Malley, Bachman, & Schulenberg, 2011). Adolescent alcohol use contributes to risk of alcohol dependence or abuse, risk behaviors (e.g., drug use, delinquency, and sexual assault) and several leading causes of death (e.g., unintentional injury, homicide, and suicide) (Hingson, Heeren, & Winter, 2006; Office of Applied Studies, 2008). Similarly, nearly 20% of all high school students and more than 6% of eighth graders currently smoke (U.S. Centers for Disease Control and Prevention, 2009; Johnston, O'Malley, Bachman, & Schulenberg, 2012), and nearly one third of current youth smokers will die prematurely from smoking-induced disease (Substance Abuse and Mental

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Health Services Administration, 2011; U.S. Centers for Disease Control and Prevention, 1996).

Key influences on youth drinking and smoking are paid industry advertising and portrayals of these behaviors in other media (e.g., alcohol use and smoking in movies). Teen drinking behavior is influenced by *alcohol-related media* (industry paid alcohol advertising; portrayals of alcohol use in movies/television). Companies target youth with alcohol advertising (King et al., 2009; Chung et al., 2010), and greater exposure to alcohol advertising is associated with increases in underage drinking. For each additional dollar per capita spent on alcohol advertising (the national average is $6.80 per person) youth alcohol consumption increases by 3% (Snyder, Milici, Slaer, Sun, & Strizhakova, 2006). Similarly, tobacco companies spend billions of dollars each year on advertising (U.S. Federal Trade Commission, 2011) and portrayals of smoking in movies and on television are highly prevalent (Worth, Duke, Green, & Sargent, 2007; Wellman, Sugarman, DiFranza, & Winickoff, 2006). Exposure to this type of *smoking-related media* may be highly consequential, as increasing levels of exposure are associated with increasing rates of teen smoking (Wellman, Sugarman, DiFranza, & Winickoff, 2006).

Despite the well-established association between alcohol- and smoking-related media and teens' use of these substances, the exact nature of these complex and dynamic relationships is still largely unknown. In particular, little is known about the mechanisms linking exposure to substance use or how exposure interacts with within-person (e.g., mood, social context) and between-person (e.g., gender, smoking or alcohol use within social network) factors over time to influence youth uptake and regular use of alcohol and tobacco. Part of the problem lies in how exposure to alcohol- and smoking-related media has been measured. Existing research has typically used inexact measures of media exposure (e.g., awareness of advertising; receptivity to advertising; recall of movies seen; see Wellman, et al., 2006; Unger, Schuster, Zogg, Dent, & Stacy, 2003), often relying on retrospective recall which is subject to participant error and response bias (e.g., Shiffman, Hufford, Hickox, Paty, Gnys, & Kassel, 1997). Broad measures of media exposure also fail to take into account the context of exposure, such as when and where exposure occurred, who was present during exposure, and other psychosocial factors which could influence the impact of individual exposures.

Ecological momentary assessment (EMA; Shiffman, Stone, & Hufford, 2008) allows for precise measurement of the specific characteristics and context of individual alcohol- and smoking-related media exposures. EMA uses handheld devices (e.g., cellphones, smartphones, palm-top computers) to monitor psychological and behavioral phenomena in near real-time and in real-life settings. In a recent study, researchers demonstrated that EMA is a valid method for measuring college students' (ages 18–24) exposure to pro-smoking media (Martino, Scharf, Setodji, & Shadel, 2012; Setodji, Martino, Scharf, & Shadel, in press; Shadel, Martino, Setodji, & Scharf, 2012, in press). In that study, college students carried smartphones for three weeks to record their exposures to pro-tobacco media, respond to random prompts (three per day), and to report on their thoughts and feelings about smoking at each interaction with the device. Random prompts provided a within-subjects, no exposure control condition against which to compare students' reports smoking-related media exposures. The study demonstrated the validity of EMA as a method for capturing detailed data on youth exposure to pro-tobacco marketing and media that are not captured through other existing methods (Martino, et al., 2012). The study also showed that college students' risk for future smoking was greater at times of exposure to pro-smoking media than at randomly-sampled control moments (Shadel, et al., 2012), that exposures occurring while in the company of friends were particularly risky (Setodji, et al., in press), and that

exposures at point-of-sale retail locations were particularly potent predictors of future smoking risk (Shadel et al., in press).

To date, no research has used EMA to track exposure to alcohol- or smoking-related media with middle- or high-school-aged youth. This information is extremely important to collect as high school and middle school-age youth are at particular risk of alcohol and cigarette initiation (U.S. Department of Health and Human Services, 2012; National Institutes of Health, 2012) and may be particularly vulnerable to the effects of media and advertising that promote use of these substances (Pechmann, Levine, Loughlin, & Leslie, 2005). Thus the goals of the current study were to assess the feasibility of having middle and high school students carry smartphones for two weeks to record their exposures to alcohol and smoking-related media, to get a preliminary understanding of the frequency with which middle and high school students are exposed to such media, and to characterize the context of those exposures.

Methods

Participants

Fifteen middle and five high school students (for a total of 20 participants) completed the study. Participants were age 12.8 (SD 1.6) years of age, 50% female, and Caucasian (60%), African American (20%) or other or multiple races (20%). Ten percent (10%) of the sample had experimented with cigarettes however no participants were current or regular smokers.

Smartphone devices and software

Data were collected on Palm® Treo 755p smartphones. Data could be entered either via touch-screen or using a stylus. The Pendragron 5.1 forms application (http://pendragonsoftware.com/index.html) was programmed to collect the alcohol- and smoking-related media exposure events and random event data.

Procedures

The study was approved by the RAND Corporation's Human Subjects Protection Committee. Data collection took place in August 2011. Participants were recruited by print media advertising (e.g., newspaper ads). The recruitment materials contained no information about alcohol or smoking-related media; individuals responded to an advertisement that had the generic stated goal of using "cell phones to study advertising". Individuals who responded to the study ad completed a brief telephone screening to determine eligibility. Eligibility criteria were minimal: prospective participants needed to be between the ages of 11 and 17 and not have any physical or psychological condition that would make it difficult for the participant to attend the sessions, carry a smartphone for two weeks, and/or answer questions about advertising or about him or herself. Individuals meeting these criteria were invited to attend a baseline session with a parent or guardian. At the baseline session, individuals and their parents received information about the study jointly, and after all of their questions were answered parents and teens provided written informed consent and assent, respectively.

Participants were trained to use the smartphone devices (additional training detail provided below). They then used the smartphones to record their exposures to alcohol and smoking-related media (i.e., what kind of media they saw, where they were exposed, and who they were with at the time of exposure; see Martino, et al., 2012; Setodji et al., in press) throughout a 14-day study period. They answered questions about their alcohol use expectancies after each reported exposure to alcohol-related media and questions that indexed their risk future smoking immediately after each reported exposure to smoking-

related media. Participants also responded to two randomly-issued prompts (programmed to occur between the hours of 10am and 10pm) on each of the 14 days of the study, similarly answering questions about alcohol use expectancies and future smoking risk. The small sample size of this pilot study did not support meaningful statistical comparisons of random prompt and exposure assessments. As such, random prompt data are not included in this report. Participants were paid a total of $100 if they completed all aspects of the study and adhered closely to the study protocol.

EMA training

All participants completed a 60-minute smartphone training session. Researchers provided each participant with a smartphone to accompany the training and instruction and for the duration of their participation in the study. They were instructed to: 1) turn the device on when they awoke in the morning; 2) take the device with them everywhere they went; 3) respond to random prompts within two minutes of the prompt 4) enter any exposures to alcohol- or smoking-related media (see below) at the time of the exposure; and 5) turn the device off at night when they went to bed, charging it while they slept.

Training included extensive descriptions and slide shows defining each type of media to be recorded (see Martino, et al., 2012 for additional training details). Alcohol- and smoking-related media were defined as ads in print (e.g., magazines, newspapers), on billboards, on the internet, at point of sale (POS) locations (e.g., supermarkets, convenience stores), on personal items (e.g., clothing, backpacks), via coupons, or at sponsored activities (e.g., concerts, sporting events). Portrayals of alcohol use and smoking in movies and on television were also assessed. Following training, participants were provided with a small printed training manual that fit within the handheld carrying case and a 24-hour help-line phone number for problems and technical support. They returned all of these materials with the smartphone device at the end of the study.

Results

Participants were highly compliant with the study protocol (i.e., routinely carrying the smartphone with them and initiating timely responses to random prompts). Participants responded within two minutes to 82% of the random prompt alarms; a rate of compliance that is consistent with other EMA studies of adolescents (e.g., Gwaltney, Bartolomei, Colby, & Kahler, 2008; Van Zundert, Ferguson, Shiffman, & Engels, 2010).

Across the 14-day EMA period, participants reported an average of 8.50 (SD = 5.82) exposures to alcohol-related media and 4.25 (SD = 3.67) exposures to smoking-related media. Figure 1 shows the number of participants reporting different numbers and types of exposure events. Across all participants, there were 255 EMA-captured exposure events including 170 (67%) alcohol and 85 (33%) smoking events. Few alcohol (4%) and cigarette (6%) exposures featured more than one brand.

Following the procedures of Martino et al (2012), we assessed exposures in 6-hour time blocks. The largest proportion of alcohol-related media exposures occurred between noon and 6 PM (52%), followed by 6 PM to midnight (39%); few alcohol-related media exposures occurred between midnight and 6 AM (1%) or between 6 AM and noon (8%). Most alcohol-related exposures occurred leading up to, or early in the weekend (Thursday 35%; Friday 22%; Saturday 13%) while rates of exposure remained lower and fairly consistent on Sunday and weekdays (6% – 9%). Similar exposure patterns were observed for smoking-related media. The largest proportion of smoking-related media exposures occurred between noon and 6 PM (54%), followed by 6 PM to midnight (35%), and few exposures occurred between midnight and 6 AM (4%) or 6 AM and noon (7%). Most smoking-related

media exposures occurred during the days leading up to the weekend (Thursday 33%; Friday 24%), while exposure rates remained lower and consistent during the weekend (Saturday and Sunday) and early in the work week (8% – 9%).

Table 1 shows the number and proportion of alcohol and smoking-related media exposures that occurred through various promotional channels. Approximately 44% of alcohol-related exposures occurred at POS, 24% occurred on television and in movies (combined), and 15% occurred on billboards. In total, only 17% occurred in magazines, over the internet, through the mail, on the radio and at sponsored events. In contrast to alcohol-related exposures, 65% of smoking-related media exposures occurred at POS, and 14% occurred on television and in movies.

The majority of alcohol-related media exposures occurred in the presence of family (69%). While they occasionally occurred while alone (12%) or with friends (12%), few exposures occurred with romantic partners (7%). Data on social context was missing for 5% of alcohol-related media exposures. Results were similar for smoking-related media exposures: exposures largely occurred in the presence of family (56%), occasionally while alone (16%) or with friends (19%); and few exposures occurred with romantic partners (8%). Data on social context was missing for 2% of smoking-related media exposures.

Within alcohol-related exposures, participants were exposed to more media promoting beer (165 exposures) than wine (3 exposures) or spirits (5 exposures). The brands (manufacturer) of beer that participants were most commonly exposed to were Budweiser (Anheuser Busch) (26%), Coors (Miller Coors) (24%) and Miller (Miller Coors) (21%). Participants were exposed to other brands much less often (5% or less). The three brands (manufacturer) of cigarette to which participants were most commonly exposed were Marlboro (Philip Morris USA) (25%), Camel (RJ Reynolds) (16%) and Newport (Lorillard) (19%); exposures to other manufacturers' products were much less common (5% or less).

Discussion

A large body of empirical research has linked youth drinking and smoking risk to alcohol and smoking-related media exposure, respectively. Nonetheless, much remains to be learned about the exposure characteristics that are most likely to impact behavior. EMA may be a useful method for capturing the kinds of detailed data needed to address these issues. For example, in a recent study with college students, researchers showed that EMA is a practical way to capture detailed data (e.g., location, timing, social context, and others) on exposures and to quantify the relationship between exposure and smoking-related cognitions in the moment that the exposure occurs (Martino, et al., 2012; Setodji, et al., in press; Shadel, et al., 2012, in press). The current study adds to this literature by demonstrating the feasibility of using this method to capture the same information in a younger sample that is uniquely at risk for initiation of the substances that these media seek to promote.

In this study, participants provided quick and consistent responses to device-issued random prompts suggesting good compliance with the protocol. Indeed, rates of protocol compliance in this study are comparable to rates obtained with college students (Martino, et al., 2012) and adult samples (Shiffman et al., 1996; 2006) adding to others' work showing that teens may be able to use EMA methods effectively (e.g., VanZundert et al., 2010; Gwaltney et al., 2008; Weinstein, Mermelstein, Shiffman, & Flay, 2008). While larger studies using non-convenience samples are needed to confirm these findings, EMA seems to be a feasible method for tracking and characterizing middle and high school students' exposure to alcohol and smoking-related media.

More specifically, using this new method, we provide a first look at the amount and type of middle and high school students' exposures to alcohol and smoking-related media. Overall, data showed that youth had multiple alcohol and smoking-related media exposures per week. If these weekly exposure rates were held constant, youth would experience an estimated 221 alcohol and 111 tobacco media per year. While this rate of tobacco exposure is less than what was observed for college students (Martino et al., 2012; comparable EMA alcohol data are unavailable), our data illustrate alcohol and tobacco companies' ability to successfully reach youth audiences. Further research is needed to quantify the impact of these exposures and to determine the extent to which they are likely to affect behavior.

Descriptive data from this study also show that youth have approximately twice as many exposures to alcohol than to smoking-related media, and that they were able to report the brand of both types of advertised products, most of the time. One reason for their successful brand reporting could be that the most frequent exposure channel was POS, in which youth have time to read and process the media details (unlike, for example, billboards that might be viewed quickly from a moving car). High rates of POS exposures are consistent with research on college students (Martino et al., 2012) and also with tobacco companies' advertising expenditures (Campaign for Tobacco-Free Kids, 2012). The majority of alcohol advertising also occurred at POS locations however a notable proportion of exposures also occurred through other advertising channels such as television and movies (which accounted for notably fewer smoking-related exposures) of which youth are more accepting and less skeptical than other media exposures (Dal Cin, Zanna, & Dal Cin, 2004; Slater, 2002). High rates of television and movie exposures are also significant components of alcohol companies' advertising expenditures (U.S. Federal Trade Commission, 2012). Such alcohol and smoking-related differences in media exposures may also reflect policy restrictions on when and where alcohol and smoking-related products can be advertised and featured. If replicated, this finding may suggest that further restrictions on alcohol advertising are needed, and that they may also be possible, given the precedence set by existing limits on smoking-related media.

We also found that the timing and social context of alcohol and smoking-related media exposures were similar. Most exposures to both types of media occurred in the afternoon, on the days leading up to the weekend (Thursdays and Fridays), and in the presence of family members. This information is notable as the social context of exposures may moderate their impact. Among college students, for example, the majority of smoking-related media exposures occurred with peers and compared to exposures that occurred in other social contexts, exposures in the presence of peers were associated with the greatest increases in pro-smoking cognitions (Setodji et al., in press). For the middle and high school youth in this study, the majority of alcohol- and smoking-related media exposures occurred in the presence of family members (with whom they likely spend a considerable about of time) who may act to buffer the effects of exposure (Nathanson, 2001). Similarly, clustering of the timing of youth exposures is important as it can inform the regulation of alcohol- and tobacco-related media (e.g., when alcohol commercials can air on TV).

Broadly, our finding that EMA is a feasible method for assessing alcohol and smoking-related media exposure is consistent with other studies suggesting that EMA can capture a variety of phenomena (e.g., diet; environment; mood; media use) that cannot be similarly captured through other methods with children as young as eight years of age (e.g., Dunton, Intille, Wolch & Pentz, 2012; Hilbert, Rief, Tuschen-Caffier, de Zwaan, & Czaja, 2009; Primack, Silk, DeLozier, Shadel, Dillman Carpentier, Dahl & Switzer, 2011; Tan, Forbes, Dahl, Ryan, Siegle, Ladoucer, & Silk, 2012). Nonetheless, we note some challenges to this research. For one, school policies restricting cell phone use during the school day and at school-sponsored activities (e.g., after-hours sports, music) limited when and where youth

engaged in research self-monitoring. To comply with such school policies, other researchers have suspended random prompts during school hours and/or instructed participants to use their study devices only outside of school (e.g., Axelson, Bertocci, Lewin et al., 2003; Dunton, Liao, Intille, Spurijt-Metz & Pentz, 2011). Such restrictions are unlikely to be problematic for tobacco and alcohol advertising research given policies restricting tobacco and alcohol advertising on or near school property. However, they do restrict the timing and nature of random prompts and therefore the representativeness of control situations recorded. For these reasons, we collected data during summer break, thus allowing us to obtain a more complete picture of participants' day-to-day experiences, albeit during a potentially less-representative timeframe. An additional research challenge may be related to youth development and reading and writing skills. In this study, most questions had fixed-field response options however descriptions of alcohol and cigarette brand names were typed into the device. These entries often included misspellings, and although the target information entered were usually very clear in this study (e.g., "Hinekin" beer), open-field responses may be challenging for some youth and/or problematic for some projects.

Limitations of this particular study include its small sample size and its sample of convenience. This sample may have been more willing and able to use the EMA devices effectively than the general population, despite the fact that the sample reported experiences with cellphones and rates of alcohol and tobacco use that are similar to national norms. Some items were asked specifically for alcohol or tobacco (e.g., alcohol expectancies; intentions to smoke) but not for both substances. Other limitations are that information about exposures to anti-tobacco and anti-alcohol media was also not collected, and an assessment of the long-term impact of these exposures on subsequent behavior was beyond the scope of this pilot work. Finally, the small sample size of this pilot study did not support meaningful statistical comparisons of random prompt and exposure assessments; forthcoming, larger studies are needed to identify unique features of alcohol- and smoking-related media exposures.

In sum, this preliminary study demonstrated the feasibility and utility of using EMA to capture middle school and high school students' exposures to tobacco and alcohol advertising in real time and in real-world situations. Future research should extend this work by conducting similar studies in larger, representative samples. It should also include assessments of anti tobacco and anti-alcohol messaging, and follow-up assessments to determine smoking and alcohol use uptake and desistence prospectively. Such information will be essential for identifying mechanisms by which media exposures impact later behavior and ultimately helping policymakers effectively reduce the frequency and ultimately the impact of alcohol and tobacco advertising on youths' decisions to use tobacco and alcohol.

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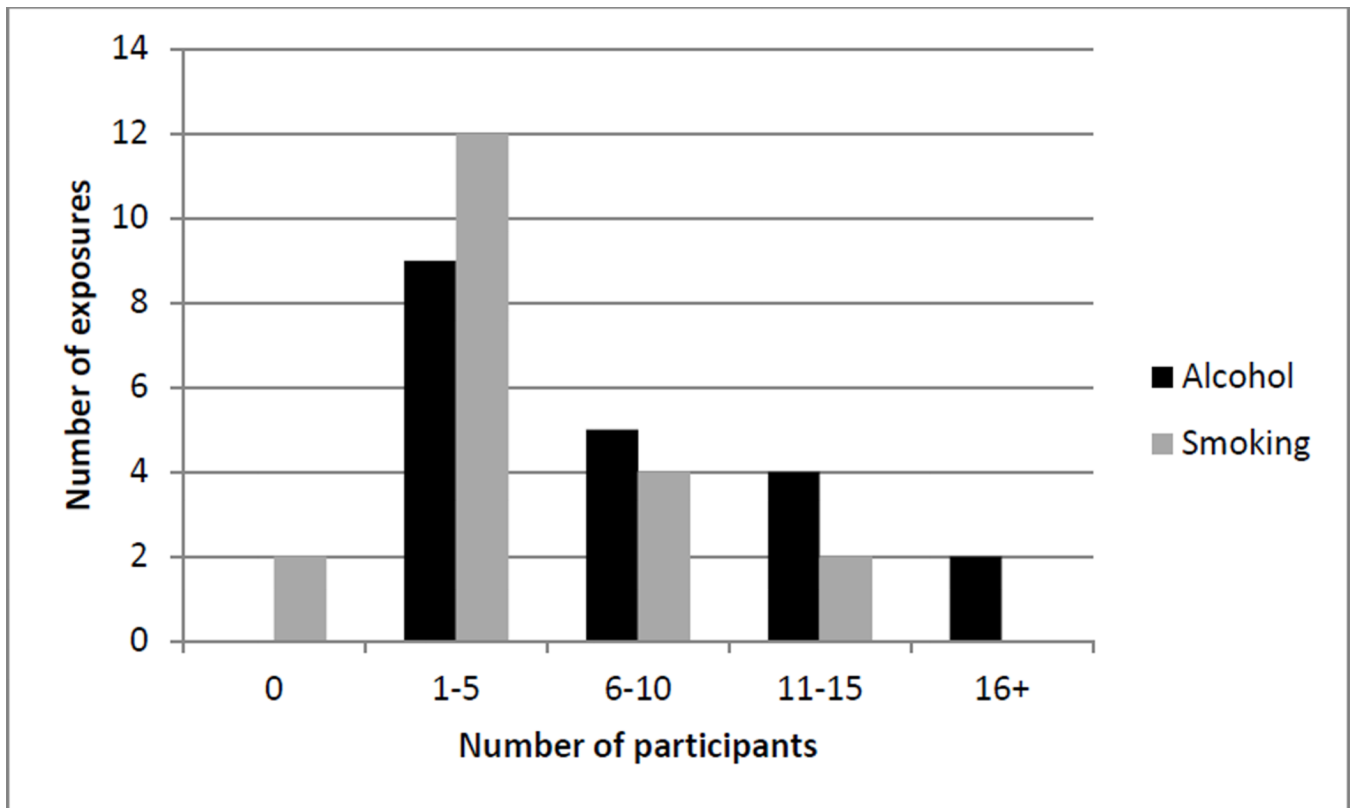
Figure 1.
Participants reporting different numbers of exposure events during the 14-day EMA period

Table 1

Number and proportion of exposures to alcohol and smoking-related media through each promotion type

Type of Exposures	Alcohol		Smoking	
	Number of Exposures	% of Exposures	Number of Exposures	% of Exposures
Point-of Purchase				
In a convenience store	16	9	12	14
Outside: store/gas station	23	14	15	18
Window: store/gas station	27	16	16	19
In a grocery store	9	5	12	14
On television	37	22	6	7
In a movie	3	2	6	7
In a magazine	2	1	3	4
On the Internet	11	6	7	8
On a billboard	26	15	4	5
Direct mail/coupon	1	1	0	0
On the radio	0	0	1	1
Sponsored event	7	4	1	1
Missing	8	5	2	2
TOTAL	170	100%	85	100%