Published in final edited form as:

Alcohol Clin Exp Res. 2018 January ; 42(1): 184–194. doi:10.1111/acer.13536.

Exposure to Alcohol Content in Movies and Initiation of Early Drinking Milestones

Kristina M. Jackson^{*},

Center for Alcohol and Addiction Studies, Brown University

Tim Janssen,

Center for Alcohol and Addiction Studies, Brown University

Nancy P. Barnett,

Center for Alcohol and Addiction Studies, Brown University

Michelle L. Rogers,

Hassenfeld Child Health Innovation Institute, Brown University

Kerri L. Hayes, and

Center for Alcohol and Addiction Studies, Brown University

James Sargent

C. Everett Koop Institute, Geisel School of Medicine at Dartmouth

Abstract

Background—Exposure to alcohol content in movies has been shown to be associated with adolescent use of alcohol, including earlier onset. The present study examined the influence of movie alcohol exposure on subsequent alcohol onset, considering the social context (whether the movie was viewed with a friend or parent). We examined whether media's influence holds across a spectrum of early drinking milestones: sipping (but not consuming a full drink of) alcohol, consuming a full drink of alcohol, and engaging in heavy episodic drinking (HED).

Methods—Data were taken from a sample of 882 middle school youth (52% female; 24% non-White) enrolled in an ongoing study on alcohol initiation and progression. Exposure to alcohol content in films was measured using a method that combines content analysis and random assignment of movie titles to youth surveys. The hazard of initiating alcohol use (sip, full drink, HED) as a function of exposure was estimated using survival analysis. Associations were adjusted for demographic, personality, and social influence factors known to be associated with both movie exposure and alcohol use.

Results—Exposure to alcohol content was common. Hours of exposure prospectively predicted earlier onset of alcohol involvement across all outcomes. Viewing movies with friends appeared to augment the media exposure effect, in contrast to viewing movies with parents, which was not a significant predictor of initiation.

^{*}Corresponding Author: Kristina M. Jackson, PhD Professor (Research), Center for Alcohol and Addiction Studies, Brown University, Box G-S121-4, Providence, RI 02912, Telephone: (401) 863-6617, Fax: (401) 863-6647, kristina_jackson@brown.edu.

The authors have no Conflicts of Interest to declare.

Conclusions—Exposure to alcohol in films is involved in the entry into early stages of alcohol involvement. Findings support further investigation into the role of the media in underage drinking, especially in the context of consuming media with friends and peers. Limiting media exposure and/or stronger FTC oversight of movie ratings should be a priority for preventing underage drinking.

Keywords

movie; exposure; drinking; alcohol; initiation

Underage alcohol consumption is consistently shown to be associated with a myriad of adverse outcomes (Marshall, 2014; World Health Organization, 2016), with early adolescence being the peak period of risk for initiation of alcohol use (Miech et al., 2015; Kann et al., 2013). Yet, although early-initiating youth have direct experience with alcohol, indirect experiences such as modeling by parents and media representations constitute a primary source of learning about alcohol (Bandura, 1977). Data from the 2015 Common Sense Census (Rideout, 2016), a nationally representative U.S. survey (N=2,658), indicates that youth age 8- to 12-years old (“tweens”) use an average of six hours of entertainment media daily, with teenagers (13- to 18-year-olds) averaging about nine hours; this includes watching TV, movies, and online videos; playing video, computer, and mobile games; using social media; using the Internet; and listening to music. Further, 62% of tweens and 58% of teenagers watch movies, television, and online videos “every day.”

An emerging line of research demonstrates that exposure to alcohol in popular films during adolescence is associated with higher rates of alcohol use (Waylen et al., 2015; also see Koordeman et al., 2012 and Anderson et al., 2009 for reviews). The majority of movies include alcohol imagery, most of which portray favorable images of drinking with few depicting the hazards of drinking or discouragement of drinking (Stern 2005; Stern & Morr, 2013), and a good portion (including those rated G/PG) contain alcohol brand appearances (Dal Cin et al., 2008). Alcohol content is communicated via media figures who are powerful role models due to their high visibility and their larger-than-life status, and may serve as a “superpeer” (Brown et al., 2005; Strasburger et al., 2009) in terms of their social influence. In their quest to develop identity, adolescents may be particularly susceptible to such media influence, especially given that they have greater control over media choices than other sources of socialization (Arnett, 1995). Peer socialization also predominates at this age, and adolescents frequently watch movies in peer groups, further influencing the interrelationships with teen drinking and movie exposure (Sargent et al., 2006). Shared exposure among friends may signal implicit approval of the media content. In the smoking field, Setodji et al. (2013) found that co-viewing movies with friends augmented the effects of pro-smoking media on college students’ intention to smoke (there was no effect of viewing with family or romantic partner), and Hunt et al. (2011) found an association between smoking and viewing TV and films primarily with friends. Conversely, viewing films with parents may buffer the negative effects of alcohol portrayals. Yet, the literature on these relationships is inconsistent, with studies showing that substance use and intentions are equal to or even greater for youth who co-viewed films with parents than those who did not (De Leeuw et al., 2014; Setodji et al., 2013), perhaps because co-viewing is interpreted by

the child as implicit parental endorsement (Fujioka & Austin, 2003). Thus, the context surrounding the exposure may be as important as the extent of exposure. The present study considers the role of social context in the influence of alcohol exposure to subsequent drinking initiation.

For the most part, research examining exposure to alcohol content in films has focused on indices of consumption, heavy drinking, and alcohol-related problems among drinkers. A few studies have specifically examined initiation of drinking, by prospectively modeling whether drinking onset had or had not occurred by a single time point among non-drinkers (Dal Cin et al., 2009; Hanewinkel et al., 2007; Sargent et al. 2006). However, modeling the timing of onset (i.e., age at which initiation occurred), as was done in Stoolmiller et al. (2012), provides much greater resolution in effects. For example, Primack et al. (2009), found that movie exposure was more strongly associated with alcohol use for adolescents younger than age 17 compared to adolescents older than age 17, supporting timing of onset as an important factor to consider. Replicating and extending the findings in this area with more precise investigation into timing of onset may help to elucidate preliminary findings regarding whether exposure to alcohol might have greater influence for younger versus older youth, and to do so by modeling age of onset, rather than examining whether or not this onset occurred by a specific time point.

In prior work, the drinking outcome measures have varied (Koordeman et al., 2012), and have failed to distinguish between consumption of a full drink versus less than a full drink. Work in our own lab (Jackson et al., 2015) and by others (Donovan & Molina, 2011) shows that youth who take even just sips/tastes of alcohol are at significantly greater risk of continued drinking as well as experiencing subsequent adverse outcomes including getting drunk and engaging in heavy episodic drinking and other substance use. Having a more precise and well defined drinking outcome is important, since one might expect media exposure to be particularly salient for very early stages of use (e.g., taking sips/tastes) among highly alcohol naïve youth who have the least amount of direct knowledge about the effects of alcohol. By using multiple drinking outcome definitions, the current study seeks to inform alcohol exposure effects on very early stages versus later stages of use.

Overview

Using previously validated measures of exposure to movie smoking and drinking (Sargent et al., 2003; Sargent et al., 2006), we test the hypothesis that exposure to alcohol in movies is associated with subsequent earlier onset of alcohol use using prospective data from a study on adolescent alcohol use. We also investigate whether there are differential associations as a function of social context, that is, whether the movie was viewed with a friend or parent. We examine whether media's influence holds across a spectrum of early drinking outcomes, modeling age of initiation and differentiating across stages of alcohol use by focusing on three successive early drinking milestones: sipping (but not consuming a full drink of) alcohol, consuming a full drink of alcohol, and engaging in heavy episodic drinking (HED). We also tested for age-related effects (whether media's influence is stronger at younger ages). We describe both unadjusted associations and associations adjusted for various demographic, personality, and social influence factors known to be associated with both

movie exposure and alcohol use, so that the impact of movie exposure cannot be interpreted as simply reflecting the tendency of some youth to view movies that portray alcohol use.

Materials and Methods

Participants

Participants were drawn from a larger study of 1,023 middle school youth enrolled in an ongoing prospective study on drinking initiation and progression (see Jackson et al., 2014; 2015). The full sample in this parent study was 52% female, 24% non-White (5% Black, 3% Asian, 2% American Indian, 8% mixed race, 6% other), 12% Hispanic, and was comprised of roughly equal numbers of 6th, 7th, and 8th graders (33%; 32%; 35%, respectively). Mean age at baseline was 12.2 years (range: 10–15, SD=0.98).

The present study is based on participants who contributed data for the movie assessment ($n=882$); see below. This subsample was 54% female, 22% non-White (4% Black, 3% Asian, 2% American Indian, 7% mixed race, 6% other), 12% Hispanic. Individuals who completed the movie assessment did not differ from those who did not on age or grade, but there were differences by race, with non-Whites being more likely to be missing than Whites, $\chi^2(2, N=1,023)=8.42, <.01$) and gender, with boys being more likely to be missing than girls, $\chi^2(2, N=1,023)=8.02, p<.01$). Movie assessments were completed at mean age 13.7 years old.

Procedure

Participants were recruited from six local middle schools which were enrolled in five school cohorts on a semi-annual basis. Packets with study information and consent forms were mailed to parents and were also distributed in schools by faculty. Across the six schools, an average of 38% of students returned a consent form, 65% of forms returned were consents allowing for participation, and 88% of these individuals were enrolled into the study. Thus, the overall response rate was 22% (1,023 of the 4,582 students enrolled across the six schools). Based on school-level data (Information Works, 2009), the sample was largely representative of the schools from which they were drawn with respect to sex and grade; in terms of race and socio-economic status, the sample was more diverse than the school populations but also less disadvantaged (see Jackson et al. 2015).

Participants attended a two-hour in-person group orientation where they completed a 45-minute computerized baseline survey. This was followed by a series of web-survey assessments that could be completed from any location with Internet access. Multiple alerts and reminders (via mail, email, text, and phone) indicated when a survey was available. Participants completed a total of five semi-annual surveys across two years and a follow-up survey one year later; subsequent to this (at the point of research re-funding), ongoing surveys were administered on a quarterly basis through the end of high school. The present study pulls on data collected for all participants up to the four-year follow-up point, and all movie exposure assessments occurred within two years of baseline data collection. Because the movie assessment occurred in the fall and cohorts were enrolled on a rolling basis, exposure to alcohol in films was assessed at different follow-up points after the baseline

survey; the movie exposure assessment was administered in Fall 2011 for four of the five school cohorts (n=796), and for the fifth school in Fall 2012 (n=227). Participants were compensated with a \$25 gift card for completion of the baseline assessment and \$20 for each completed follow-up survey.

In addition, one self-selected parent or guardian completed a 30-minute paper-and-pencil survey at baseline and one year later; parents/guardians received a \$30 store gift card for survey completion. Parent report was obtained from 90% (794/882) of the study sample at baseline (86% were the biological mother) and from 88% (774/882) of the study sample one year later.

Procedures were approved by the Brown university institutional review board, and a Certificate of Confidentiality was obtained from NIAAA to preserve participant confidentiality.

Measures

Exposure to alcohol in films—Our assessment was based on a method used by other studies on alcohol exposure in underage youth (Sargent et al., 2003; Sargent et al. 2006; Sargent et al., 2008). This method combines content analysis and random assignment of movie titles to youth surveys. The top 100 box office hits (based on *Motion Picture Association of America* ratings) from each of the prior 5 years (2006–2010) were coded as to alcohol exposure prior to survey programming; see coding methods below. We also included the top MPAA-rated movies from early 2011 that had been coded to date. Thus the movie sample included 530 movies. Fifty films were randomly sampled for each participant stratified by year and exposure rating. To minimize fatigue, the films were presented in 5 blocks of 10 movies spread out throughout the full assessment battery. The DVD cover or poster image was displayed alongside the questions to facilitate recall. For each movie, participants were asked if they had seen the movie and if so, how many times they saw it; response options included: 0 times, 1 times, 2 times, 2–5 times, and 6 or more times. Participants were then asked “Have you seen it with any of your friends?” and “Have you seen it with your parents/guardians?” Response options included: Never, Once, and More than once.

For each movie, real or implied use of an alcoholic beverage by a character was coded by a team of two trained content coders. Ten percent of the movies were examined by both coders to monitor reliability. Average Krippendorff alphas for 5-second blocks within each movie were 0.76 for alcohol time. Coding resulted in the amount of time alcohol use was shown as well as a count of all visual alcohol depictions and alcohol brand appearances (the latter two of which are not of interest in the present study). From these variables, a measure of scaled alcohol exposure was computed by calculating the number of minutes from movies reported as having been seen by the participant divided by the number of minutes possible in the participant’s group of 50 movies, multiplied by the number of minutes across the total set of movies. That is, we derived an estimate of alcohol exposure if all 530 films had been assessed. Because many participants reported viewing a movie more than once, we computed this variable both unweighted by number of times seen (used in primary analyses) and weighted by number of times seen (examined in ancillary models in order to probe a

dose-response effect, as suggested by Koordeman et al., 2012). In addition, we computed a measure of scaled alcohol exposure that was weighted by the number of times the participant viewed that movie with parents and a measure weighted by the number of times the participant viewed the movie with friends. We also calculated the number of discrete occurrences of alcohol use and the character prevalence of drinking (number of major characters that were drinkers).

Age at first alcohol use—Participants indicated at each survey whether they had ever (1) had a sip of alcohol (not including consumption as part of a religious service), (2) consumed a full drink of alcohol, and (3) consumed three or more drinks on a single occasion (as recommended by Donovan, 2009 as an index of HED for this age group); this was converted to half-age based on the participant age at the given survey.

Covariates—We included several classes of variables in our adjusted models. Each was taken from the time point corresponding to the movie exposure measurement unless otherwise noted.

Demographic factors—Participants reported their date of birth (used to calculate age), gender, racial group, and ethnicity at baseline. Parents indicated whether the child received lunch subsidy (reduced- or free lunch) at the time of the movie alcohol exposure assessment.

Availability—Perceived availability of alcohol was measured with a binary item from Arthur et al. (2000): “If you wanted to get some beer, wine, or hard liquor (for example: vodka, whiskey, or gin) could you get some?”

Sensation seeking was measured using the UPPS+P Impulsive Behavior Scale (Lynam et al., 2006) ($\alpha=.81$). Response options ranged from 1=Agree strongly to 4=Disagree strongly. Scores were averaged across items.

Friend norms—We assessed best friend drinking using an item adapted from cigarette smoking items from the University of Missouri-St. Louis (2013): “Of your three best friends, how many drink alcohol at least once a month?” Response options ranged from 0=None to 3=Three Friends.

Parental drinking was computed based on a parent report of the 10-item Alcohol Use Disorders Identification Test (AUDIT, Saunders et al., 1993). This measure screens for excessive alcohol consumption, dependence, and alcohol related problems, and was administered to the parent at baseline and one year later. All responses were summed within parent at both time points ($\alpha=.80$ and $\alpha=.74$) and averaged across the two time points. Parents were also asked to respond to the same set of items asking about their partner (when available; $\alpha=.74$ and $\alpha=.76$). Our final measure was then averaged across parent/partner.

Parents also indicated whether the child’s biological mother and/or biological father (first-degree relative) “have/had had a *drinking problem*.” Responses were coded into No (neither) versus Yes (either or both biological parents had a drinking problem).

Child externalizing—The externalizing scale from the Child Behavior Checklist (CBCL; Achenbach, 1979) was completed by parents; this included 35 items corresponding to rule-breaking behavior and aggressive behavior.

Analytic Strategy

The hazard of initiating alcohol use was estimated using survival analysis (Discrete-time survival models; Singer & Willett, 2003), using Mplus Version 7.3 (Muthén & Muthén, 1998–2015). Survival analyses handle right censoring due to failure to reach a milestone because of attrition or study end. We predicted age at first alcohol use from our measure of standardized exposure to alcohol in films (in hours) after controlling for covariates (gender, ethnicity, race, lunch subsidy use; alcohol availability, best friend drinking, and biological parent drinking problem items; sensation seeking, AUDIT, and externalizing scales). For the sip model, we excluded the 449 (of 882) cases (51%) who had endorsed sipping at any time prior to the movie assessment (Wave 1); for the full drink and HED models, we excluded the 119 (of 878) cases (14%) who had endorsed consuming a full drink at Wave 1. Thus our final sample sizes for the survival models were $n=433$ for sipping and $n=759$ for full drink and HED. To account for missing data, we conducted models using full information maximum likelihood (FIML), which employs all available data for parameter estimation under the assumption that data are missing at random. Our models were parameterized such that baseline variables (time-invariant predictors of age, gender, and race) were exogenous to the other covariates that were measured during the movie exposure assessment, which in turn predicted our alcohol outcomes. In this way, cases with missing values on covariates became endogenous and hence were not deleted from models, allowing us to account for selective attrition based on race and gender.

In addition, we tested the proportional hazards assumption that risk remains constant over time, which tests whether the predictor variables have the same effects at all points in time (i.e., an interaction with time). In Mplus, this test is conducted by directly regressing the alcohol onset indicators on the movie exposure predictor, while predicting the latent variable representing age at alcohol onset by all other covariates¹. Our approach was to estimate the relation between early onset (first half of alcohol indicators, up to and including age 15.5 years) versus later onset (second half, after age 15.5 years) and movie exposure, and evaluate whether this significantly improved model fit based on loglikelihood indices. This test permitted us to explore whether the contribution of alcohol exposure to initiation of alcohol use is greater at certain developmental stages than others, that is, whether its effects are specific to earlier versus later age of initiation.

Results

Descriptive Analyses

Overall, 84.9% of the 530 movies depicted some alcohol use (47.8% of G, 65.7% of PG, 94.4% of PG-13, and 88.2% of R-rated movies). Extrapolating from a sample of 50 films, participants had seen on average 12.31 (SD=6.33) different films and viewed on average

¹These calculations were based on Example 6.19 in the Mplus User's Guide (Mplus User's Guide v7, p147–148).

5.72 hours (343 minutes; $SD=4.34$) of alcohol content. Accounting for films seen more than once, youth viewed on average 8.73 hours (524 minutes; $SD=7.26$) of alcohol content. For films viewed with friends, total average exposure was 3.19 hours ($SD=3.42$), and for films viewed with parents, total average exposure was 3.83 hours ($SD=3.32$). To deal with the skew observed in exposure, we censored the exposure variables at the 95% value². In addition, participants saw on average 43.64 ($SD=29.43$) instances of a character drinking³. Figure 1 shows the distribution of scaled alcohol exposure in hours.

Descriptive statistics and correlations among the movie exposure variables, alcohol outcomes, and covariates are presented in Table 1. Correlations between movie alcohol exposure and subsequent (Wave 2) drinking outcomes ranged from $r=.20$ to $r=.25$; Wave 2 drinking correlations were on the same order of size as for sensation seeking and were twice as high as for best friend or parent drinking.

Predictors of Time to Onset

Unadjusted hazard models revealed that the estimated odds of onset increased with each additional hour of alcohol content the adolescents have viewed for sip ($HR=1.07$; 95% CI: 1.03–1.11), full drink ($HR=1.06$; 95% CI: 1.03–1.09), and HED ($HR=1.08$; 95% CI: 1.04–1.12). Thus, the risk of sipping alcohol at any given time point increased by 7% for an additional hour of alcohol content, and the risk of consuming a full drink and engaging in HED at any given time point were 6% and 8%, respectively. When these models were re-estimated using the weighted exposure variable, effects remained significant although were somewhat reduced in magnitude ($HR=1.04$; 95% CI: 1.02–1.06), full drink ($HR=1.03$; 95% CI: 1.01–1.05), and HED ($HR=1.04$; 95% CI: 1.02–1.07).

Results of the survival models for sipping, full drink, and HED adjusting for all covariates are presented in Tables 2–4. Hours of exposure to alcohol content was a significant predictor of all three outcomes: for sip, $adjHR=1.05$; 95% CI: 1.01–1.09, for full drink, $adjHR=1.05$; 95% CI: 1.02–1.08, and for HED, $adjHR=1.07$; 95% CI: 1.03–1.12. Note that the unit for these hazard ratios is one hour of movie exposure, but participants viewed 5.72 hours of exposure on average ($SD=4.34$). To better contextualize our effect size⁴, we re-calculated the hazard ratio for a one-standard-deviation unit of 4.34 hours rather than one hour and found that for sipping, $adjHR=1.24$ ($e^{4.34\beta}$ where $\beta=.050$); for full drink, $adjHR=1.25$ ($e^{4.34\beta}$ where $\beta=.051$); for HED, $adjHR=1.35$ ($e^{4.34\beta}$ where $\beta=.069$). To illustrate the effect of exposure for the three outcomes, Figures 2a–2c portray the survival curves for high exposure (90th percentile, corresponding to 10.7 hours of exposure) versus low exposure (10th percentile, corresponding to 1.1 hours of exposure) for sipping, full drink, and HED, respectively.

²The final results were largely unchanged by this censoring.

³As exposure was correlated with character drinking at $r=.90$, we did not further consider this variable.

⁴We can roughly compare the movie exposure effect to that of other predictors of initiation by estimating hazard ratios for “high” versus “low” based on values corresponding to 75% and 25%. As a comparison, in the full drink model, the (crude) HR for high versus low sensation seeking is 1.43, the HR for parent drinking is 1.16, and the HR for externalizing is 1.23; the crude HR for alcohol exposure is 1.42.

In addition, we estimated parallel models examining alcohol exposure weighted by the number of times the participant had seen a given movie (to get a dosage effect). Again, hours of exposure was a significant predictor of all three drinking outcomes, although with slightly lower magnitude than models using the unweighted exposure variable: for sip, adjHR=1.03; 95% CI: 1.003–1.05, for full drink, adjHR=1.03; 95% CI: 1.01–1.04, and for HED, adjHR=1.04; 95% CI: 1.01–1.06.

Finally, we re-ran models using (1) friend-shared exposure and (2) parent-shared exposure. Findings indicated that for full drink and HED, friend-shared exposure was a significant predictor (adjHR=1.04; 95% CI: 1.02–1.07; adjHR=1.06; 95% CI: 1.03–1.10, respectively) but parent-shared was not (adjHR=1.02; 95% CI: 0.99–1.05; adjHR=1.02; 95% CI: 0.98–1.06, respectively). For sip, neither friend- or parent-shared exposure reached significance (adjHR=1.03; 95% CI: 0.995–1.06; adjHR=1.03; 95% CI: 0.996–1.06, respectively). Survival curves for full drink are portrayed for friend-shared exposure (Figure 3a) and parent-shared exposure (Figure 3b) for high exposure (90th percentile, corresponding to 10.1 hours and 11.6 hours of exposure, respectively) versus low exposure (10th percentile, corresponding to 0.04 hours and 0.6 hours of exposure, respectively). Parallel figures for HED are found in the Supplemental materials.

For all models, there were no interactions with time. That is, none of the models with effect of alcohol exposure estimated independently for earlier vs. later onset had significantly improved loglikelihood, indicating that the proportional hazards assumption was not violated. From a substantive standpoint, this means that there were no apparent differences in the association between movie alcohol exposure and initiation as a function of the timing of first drink.

Discussion

The present study indicated that exposure to alcohol content in the movies was pervasive, whereby typical adolescents are exposed to hours of screen drinking, and that this exposure prospectively predicted earlier onset of alcohol involvement, including consumption of a full drink and heavy drinking as well as the earliest milestone of sipping alcohol, a robustness shared by few other covariates. Viewing movies with friends appeared to augment the media exposure effect, in contrast to viewing movies with parents, which was not a significant predictor of initiation. In their study on adolescent film-smoking exposure, Hunt et al. (2011) found that youth who reported watched TV/films primarily with friends had a higher risk for smoking, independent of their film-smoking exposure, and suggest that these adolescents may be the ones who are more likely to spend time in social contexts that include opportunities to smoke. Youth drinking is heavily influenced by peers, and prior research in the alcohol and smoking fields has supported social influence and affiliation with substance-using peers as mediators of the association between movie exposure and substance use (Gibbons et al., 2010; Song et al., 2007; Wills et al., 2008; 2009) and this seems particularly true for the alcohol use of friends (vs. “kids your age”) (Titus-Ernstoff et al., 2008).

There was no evidence that exposure to alcohol content was associated with increased risk of initiation when films were viewed with parents. Contradictory results have been observed regarding whether parental co-viewing of media influences substance use (Collier et al., 2016), perhaps because co-viewing may be intentional, as an opportunity to discuss movie content with the intent to promote critical thinking, or it may be passive, where media is consumed together by the adolescent and the parent, which could convey an implicit message of approval (Collier et al., 2016). Our study unfortunately is not able to address parental motives or intentions during co-viewing. In general, given that the context in which films are viewed seems to influence adolescent response to alcohol-related content, a natural next step for research is to determine how the context of media exposure interacts with the context (both environmental and social) surrounding the drinking occasion in predicting likelihood of risky alcohol use and related problems. Furthermore, future studies may benefit from explicitly asking whether media exposure occurred alone, with friends, parents, or a combination thereof.

Our test of the association between movie alcohol exposure and alcohol consumption was rigorous in that it controlled for a wide array of temperamental, behavioral, and environmental factors shown to contribute to adolescent drinking, which minimizes the confound that youth at risk for alcohol consumption may self-select to watch films that contain more alcohol portrayals. Furthermore, our finding that the effect of movie exposure was robust when controlling for parental drinking and perceived alcohol availability suggests that the media effect is more than simply a function of living in a home environment that favors alcohol use; likewise, our findings do not support the idea that the media effect is simply a marker for an underlying disposition for problem behavior.

Our study also extends prior work by indicating that even the most minimal experience with alcohol, having a few sips/tastes (but less than a full drink), is prospectively predicted by having viewed films with alcohol content earlier in adolescence. Youth obtain information related to alcohol use both vicariously and through personal experience with alcohol (Dawson, 2000), and media exposure assures that some knowledge of alcoholic beverages is present prior to a drinking opportunity (Zucker, 2006). Beliefs about the acceptability of alcohol use begin to emerge in mid-adolescence (Prins et al., 2011), and these are influenced by media figures who serve as powerful models due to their high visibility and their larger-than-life status (Distefan et al., 1999), consistent with Social Learning Theory (Bandura, 1977).

Although prior work with smoking has shown a dose effect to media exposure (Hunt et al., 2011), we did not find that repeated viewing strengthened the association with drinking, even though youth reported frequently viewing a movie on more than one occasion. We also did not find support for a differential association as a function of timing of onset – that is, there were no apparent differences in the association between media exposure and initiation as a function of the age at which the drinking milestone was reached. This may in part be because due to the age of our sample, we captured relatively early initiation for our latter two milestones.

Implications for Intervention

Our study adds to a growing body of research suggesting that media exposure to alcohol remains a robust prospective predictor of early onset after controlling for many sociodemographic and social predictors. This body of research suggests that early adolescents are routinely exposed to alcohol in media, which reliably impacts their alcohol use. Our findings are directly relevant to efforts to delay drinking initiation, given the robust evidence that early onset is associated with myriad adverse outcomes. Our finding that alcohol use was associated with exposure to alcohol content in films viewed with peers but not with parents suggests that there may be value in designing intervention strategies that incorporate a peer component into media literacy programs (Gordon et al., 2015). Social contexts influence the way media content is perceived (Weber, 2013), and this might be true at both the distal level (one's broader peer group) and the proximal level (e.g., a small group of friends viewing a movie together). The notion of jointly targeting the media and peers is supported by a study showing that adolescents considered pro-smoking messages in the mass media to be highly persuasive to their peers (Gunther et al., 2006). Programs might also offer alternate reinforcing activities (Goldstein et al., 2013) as a means to foster alternate means of strengthening peer relationships, interpersonal communication, and group identity.

In addition, given that adolescent alcohol consumption itself tends to occur in a social context, often with friends (Anderson & Brown, 2011; Goncy & Mrug, 2013), programs that counter positive media messages specifically about the social benefits of drinking may be effective in reducing youth drinking. At the same time, our findings suggest that interventions to promote parent-child co-viewing of media aren't likely to succeed in delaying alcohol initiation. Our null findings may reflect a combination of purposeful co-viewing (protective) and passive co-viewing (risk-inducing). We suspect that unless it is accompanied by active mediation such as discussion to promote critical thinking about the media content, co-viewing may send the implicit message of approval of any media content consumed together (Padilla-Walker et al., 2012). Future work needs to investigate the circumstances under which youth are viewing adult content in movies, especially when viewing with peers; this might include number, age, and gender of peers, their specific relationship to the adolescent, and whether there is parental supervision. This information can provide valuable information for programs that target the context of the exposure to ultimately reduce rates of underage drinking.

Study findings confirm that limiting media exposure and/or adjusting federal media policy should be a priority for national alcohol prevention policy. It is worth noting the impact that limits on paid cigarette product placement in movies and television had on movie smoking depictions. After the implementation of the Master Settlement Agreement (MSA) in 1998, in which the US Attorneys General enforced strict limits on cigarette product placement in movies and television, cigarette brand appearances decreased exponentially. Moreover, the limits were associated with an immediate and sustained drop in the average smoking scene from over a minute to less than 30 seconds, suggesting that longer smoking scenes were in part due to brand placement activity. In light of the current evidence implicating screen alcohol use as an important youth drinking risk factor, the Federal Trade Commission should

provide better oversight of alcohol product placement and seek to limit such placements in any movie considered appropriate for adolescents (this includes all PG-13, PG, and G rated movies). As noted in the results section, alcohol products appear as often in PG-13 movies as they do in movies rated R for adults.

Strengths, Limitations, and Future Directions

Our large, diverse sample of youth with limited direct experience with alcohol is ideal for studying the influence of media on subsequent alcohol involvement. We used a rigorous survey method for assessing exposure to alcohol in movies that combined content analysis of contemporary movies and random assignment of movie titles to each participant. Additionally, this is one of the first studies to examine social context of exposure which we hope will stimulate a promising line of research, given the powerful influence of parent and peer norms and modeling of drinking behavior.

Our work extends previous work that predicted whether or not onset had occurred by a specific time point. By modeling age at which a given alcohol milestone was attained among youth who had not yet initiated, we advance literature assuming media's influence based on cross sectional or single time-point based prospective associations. Although our effect size for movie alcohol exposure is on the low side, it was similar to that of sensation seeking and larger than that for parent drinking and externalizing when we compare estimates for "high" (75%) versus "low" (25%). Moreover, compared to the broader literature, our effect size generally falls in between effect sizes found in prior work predicting drinking (e.g., studies by Hanewinkel & Sargent, 2009; Sargent et al. 2006; Stoolmiller et al., 2012), but it is lower than corresponding effect sizes for HED, although this may be in part because our measure of HED was 3+ drinks compared to the other studies using 5+ drinks.

At the same time, some study limitations must be noted. Consent form return rates were relatively low, and as a result, our sample is likely comprised of relatively low-risk youth whose parents provided consent for participation in an intense study on alcohol use. Our sample was drawn from a subset of middle schools in a single geographic region and hence is not representative of the full U.S. population. Although on average the participants were more diverse than the student populations from which they were sampled, they were still primarily White, non-Hispanic, and on average they were less disadvantaged than the larger school populations. Alcohol exposure in films has been shown to be less predictive of alcohol use for Black adolescents as compared to White adolescents (Wills et al., 2010), and in the smoking literature, studies have demonstrated that the smoking behavior of Black, and to a lesser extent, Hispanic youth is resistant to the influence of movie smoking as compared to Whites (Jackson et al., 2007; Tanski et al., 2012; Wilkinson et al. 2009). It may be that minority youth are less responsive to White actors, which predominate in popular movies (Tanski et al., 2012). Thus, given our primarily White sample, our effect may be slightly stronger than what would be observed in a more nationally representative sample. We did not examine racial/ethnic group differences in the present study, in part due to the low prevalence of non-White youth; future attention needs to be given to whether these powerful movie exposure effects hold across racial/ethnic group and across gender (which to date has only been treated as a covariate).

Self-report of alcohol use can be prone to recall bias, comprehension problems, and social desirability, although our assessments asked youth to recollect over relatively short periods of time, and our study espoused factors associated with valid reporting including good rapport, privacy, and assurances of confidentiality (Stone & Latimer, 2005; Winters et al., 2008). Also, movies released between the years 2006 and 2011 were content coded for alcohol portrayals, which allowed for an estimate of exposure during this period of time only, and precluded a measure of youth total lifetime exposure. In addition, we cannot rule out the possibility that some of our effects reflect exposure to other forms of media that have alcohol portrayals and brand appearances (e.g., television, YouTube, music/radio, internet or print marketing) or an overall media effect on general deviance (as in the video game literature, Hull et al., 2014), especially given the similarity in findings for models accounting for films seen more than once. However, the effect of movie exposure on smoking is shown to be independent of a wide variety of general media exposures (Hunt et al., 2011; Sargent et al., 2005), and experimental studies show an effect of exposure to film clips positively portraying alcohol on positive attitudes towards drinking (Koordeman et al., 2014), willingness to drink (Gibbons et al., 2016), and alcohol consumption (Koordeman et al., 2015), suggesting that effects of alcohol content in films on drinking are not a function of general media exposure alone. Both a challenge and an opportunity for future research is how to assess and model media influence as adolescents increasingly access content on Smartphones, tablets, and other portable devices at will, and often with little oversight. With television shows and online videos, the universe from which to sample is much larger, although there has been some preliminary work on alcohol content in YouTube videos (Cranwell et al., 2015; Primack et al., 2015). The present study confirms the profound effect of exposure to media alcohol content on early alcohol onset and clearly warrants this future direction.

Conclusion

In conclusion, this research rigorously demonstrated that exposure to alcohol in films is involved in the entry into early stages of alcohol involvement and support further investigation into the role of the media in underage drinking. Further, viewing films with peers appears to connote further risk, suggesting that future research on media's influence on substance use ought to consider the context of exposure. Research is warranted both in terms of understanding the mechanisms underlying this association and in developing tools with which to intervene to slow the progression of underage drinking and its adverse consequences.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was supported by grants R01 AA016838 (PI: Jackson), K02 AA13938 (PI: Jackson), and T32 AA007459 (PI: Monti).

References

- Achenbach TM. The Child Behavior Profile: An empirically based system for assessing children's behavioral problems and competencies. *International Journal of Mental Health*. 1979; 7:24–42.
- Anderson KG, Brown SA. Middle school drinking: Who, where, and when. *Journal of Child and Adolescent Substance Abuse*. 2010; 20:48–62. [PubMed: 26300621]
- Anderson P, De Bruijn A, Angus K, Gordon R, Hastings G. Impact of alcohol advertising and media exposure on adolescent alcohol use: a systematic review of longitudinal studies. *Alcohol and alcoholism*. 2009; 44:229–243. [PubMed: 19144976]
- Arnett JJ. Adolescents' uses of media for self socialization. *Journal of Youth and Adolescence*. 1995; 24:519–532.
- Arthur, MW., Hawkins, JD., Catalano, RF., Pollard, JA. Student Survey of Risk and Protective Factors and Prevalence of Alcohol, Tobacco & Other Drug Use. Seattle: University of Washington, Social Development Research Group; 2000. p. 5
- Bergamini E, Demidenko E, Sargent JD. Trends in tobacco and alcohol brand placements in popular US movies, 1996 through 2009. *JAMA Pediatrics*. 2013; 167:634–639. [PubMed: 23712747]
- Brown JD, Halpern CT, L'Engle KL. Mass media as a sexual super peer for early maturing girls. *Journal of Adolescent Health*. 2005; 36:420–427. [PubMed: 15837346]
- Bandura, A. Social learning theory. Oxford, England: Prentice-Hall; 1977.
- Collier KM, Coyne SM, Rasmussen EE, Hawkins AJ, Padilla-Walker LM, Erickson SE, Memmott-Elison MK. Does parental mediation of media influence child outcomes? A meta-analysis on media time, aggression, substance use, and sexual behavior. 2016
- Cox DR. Regression models and life tables. *Journal of the Royal Statistical Society*. 1972; 34:187–202.
- Cranwell J, Murray R, Lewis S, Leonardi-Bee J, Dockrell M, Britton J. Adolescents' exposure to tobacco and alcohol content in YouTube music videos. *Addiction*. 2015; 110:703–711. [PubMed: 25516167]
- Dal Cin S, Worth KA, Dalton MA, Sargent JD. Youth exposure to alcohol use and brand appearances in popular contemporary movies. *Addiction*. 2008; 103:1925–32. [PubMed: 18705684]
- Dal Cin S, Worth KA, Gerrard M, Gibbons FX, Stoolmiller M, Wills TA, Sargent JD. Watching and drinking: Expectancies, prototypes, and friends' alcohol use mediate the effect of exposure to alcohol use in movies on adolescent drinking. *Health Psychology*. 2009; 28:473–483. [PubMed: 19594272]
- Dawson DA. U.S. low-risk drinking guidelines: An examination of four alternatives. *Alcoholism: Clinical and Experimental Research*. 2000; 24(12):1820–1829.
- de Leeuw RN, Blom H, Engels RC. Parental co-viewing and susceptibility for smoking and drinking in adolescents: An experimental pilot study. *The American Journal on Addictions*. 2014; 23:349–356. [PubMed: 24629048]
- Distefan J, Gilpin E, Sargent J, Pierce J. Do movie stars encourage adolescents to start smoking? Evidence from California. *Preventive Medicine*. 1999; 28:1–11. [PubMed: 9973581]
- Donovan JE. Estimated blood alcohol concentrations for child and adolescent drinking and their implications for screening instruments. *Pediatrics*. 2009; 123:e975–e981. [PubMed: 19482748]
- Donovan JE, Molina BSG. Childhood risk factors for early onset drinking. *Journal of Studies on Alcohol and Drugs*. 2011; 72:741–751. [PubMed: 21906502]
- Fujioka Y, Weintraub Austin E. The implications of vantage point in parental mediation of television and child's attitudes toward drinking alcohol. *Journal of Broadcasting & Electronic Media*. 2003; 47:418–434.
- Gibbons FX, Kingsbury JH, Wills TA, Finneran SD, Dal Cin S, Gerrard M. Impulsivity moderates the effects of movie alcohol portrayals on adolescents' willingness to drink. *Psychology of Addictive Behaviors*. 2016; 30:325. [PubMed: 27099959]
- Gibbons FX, Pomery EA, Gerrard M, Sargent JD, Weng CY, Wills TA, ... Tanski SE. Media as social influence: racial differences in the effects of peers and media on adolescent alcohol cognitions and consumption. *Psychology of Addictive Behaviors*. 2010; 24:649–659. [PubMed: 21198226]

- Goldstein AL, Wall AM, Wekerle C, Krank M. The impact of perceived reinforcement from alcohol and involvement in leisure activities on adolescent alcohol use. *Journal of Child & Adolescent Substance Abuse*. 2013; 22:340–363.
- Goncy EA, Mrug S. Where and when adolescents use tobacco, alcohol, and marijuana: comparisons by age, gender, and race. *Journal of Studies on Alcohol and Drugs*. 2013; 74:288–300. [PubMed: 23384377]
- Gordon CS, Jones SC, Kervin L. Effectiveness of alcohol media literacy programmes: A systematic literature review. *Health Education Research*. 2015; 30:449–465. [PubMed: 25840435]
- Gunther AC, Bolt D, Borzekowski DL, Liebhart JL, Dillard JP. Presumed influence on peer norms: How mass media indirectly affect adolescent smoking. *Journal of Communication*. 2006; 56:52–68.
- Hanewinkel R, Sargent JD. Longitudinal study of exposure to entertainment media and alcohol use among German adolescents. *Pediatrics*. 2009; 123:989–995. [PubMed: 19255030]
- Hull JG, Brunelle TJ, Prescott AT, Sargent JD. A longitudinal study of risk-glorifying video games and behavioral deviance. *Journal of Personality and Social Psychology*. 2014; 107:300–325. [PubMed: 25090130]
- Hunt K, Henderson M, Wight D, Sargent JD. Exposure to smoking in films and own smoking among Scottish adolescents: a cross-sectional study. *Thorax*. 2011; 66:866–874. [PubMed: 21764893]
- Information Works. Measuring Rhode Island Schools for Change: State Report Card 2009. Rhode Island Department of Education, and National Center on Public Education and Social Policy; Providence, RI: 2009.
- Jackson C, Brown JD, L'Engle KL. R-rated movies, bedroom televisions, and initiation of smoking by white and black adolescents. *Archives of Pediatrics & Adolescent Medicine*. 2007; 161:260–268. [PubMed: 17339507]
- Jackson KM, Barnett NP, Colby SM, Rogers ML. The prospective association between sipping alcohol by the 6th grade and later substance use. *Journal of Studies on Alcohol and Drugs*. 2015; 76:212–221. [PubMed: 25785796]
- Jackson KM, Roberts ME, Colby SM, Barnett NP, Abar CC, Merrill JE. Willingness to drink as a function of friend and peer norms. *Journal of Studies on Alcohol and Drugs*. 2014; 75:404–414. [PubMed: 24766752]
- Kann L, Kinchen S, Shanklin SL, Flint KH, Kawkins J, Harris WA, et al. Centers for Disease Control and Prevention Youth Risk Behavior Surveillance-United States. *Morbidity and Mortality Weekly Report (MMWR)* 2014. 2013; 63:1–168.
- Koordeman R, Anschutz DJ, Engels RC. Alcohol portrayals in movies, music videos and soap operas and alcohol use of young people: Current status and future challenges. *Alcohol and Alcoholism*. 2012; 47:612–623. [PubMed: 22759413]
- Koordeman R, Anschutz DJ, Engels RC. The effect of positive and negative movie alcohol portrayals on transportation and attitude toward the movie. *Alcoholism: Clinical and Experimental Research*. 2014; 38:2073–2079.
- Koordeman R, Anschutz DJ, Engels RCME. Self-control and the effects of movie alcohol portrayals on immediate alcohol consumption in male college students. *Frontiers in Psychiatry*. 2015; 5doi: 10.3389/fpsy.2014.00187
- Lynam, DR., Smith, GT., Whiteside, SP., Cyders, MA. Technical Report. West Lafayette: Purdue University; 2006 Jun. The UPPS-P: Assessing five personality pathways to impulsive behavior. Downloaded from <http://www1.psych.purdue.edu/~dlynam/uppspage.htm>2009
- Marshall EJ. Adolescent alcohol use: Risks and consequences. *Alcohol and Alcoholism*. 2014; 49:160–164. DOI: 10.1093/alcac/agt180 [PubMed: 24402246]
- Miech, RA., Johnston, LD., O'Malley, PM., Bachman, JG., Schulenberg, JE. Monitoring the Future national survey results on drug use, 1975–2014: Volume I, Secondary school students. Ann Arbor: Institute for Social Research, The University of Michigan; 2015. Available at <http://monitoringthefuture.org/pubs.html#monographs>
- Morgenstern M, Stoolmiller M, Bergamini E, Sargent JD. Did limits on payments for tobacco placements in US movies affect how movies are made? *Tobacco Control*. 2017; 26:105–108. [PubMed: 26822189]

- Muthén, LK., Muthén, BO. Mplus User's Guide. 7. Los Angeles, CA: Muthén & Muthén; 1998–2015.
- Padilla-Walker LM, Coyne SM, Fraser AM, Dyer WJ, Yorgason JB. Parents and adolescents growing up in the digital age: Latent growth curve analysis of proactive media monitoring. *Journal of Adolescence*. 2012; 35:1153–1165. [PubMed: 22507383]
- Primack BA, Kraemer KL, Fine MJ, Dalton MA. Media exposure and marijuana and alcohol use among adolescents. *Substance Use & Misuse*. 2009; 44:722–739. [PubMed: 19306219]
- Prins JC, Donovan JE, Molina BG. Parent–child divergence in the development of alcohol use norms from middle childhood into middle adolescence. *Journal of Studies On Alcohol And Drugs*. 2011; 72:438–443. [PubMed: 21513680]
- Rideout. The common sense census: Media use by tweens and teens. Common Sense Media; 2016. https://www.commonsensemedia.org/sites/default/files/uploads/research/census_researchreport.pdf
- Sargent JD, Beach ML, Adachi-Mejia AM, Gibson JJ, Titus-Ernstoff LT, Carusi CP, Swain SD, Heatherton TF, Dalton MA. Exposure to movie smoking: its relation to smoking initiation among US adolescents. *Pediatrics*. 2005; 116:1183–1191. [PubMed: 16264007]
- Sargent JD, Dalton MA, Heatherton T, Beach M. Modifying exposure to smoking depicted in movies: a novel approach to preventing adolescent smoking. *Archives of Pediatrics & Adolescent Medicine*. 2003; 157:643–648. [PubMed: 12860784]
- Sargent JD, Wills TA, Stoolmiller M, Gibson J, Gibbons FX. Alcohol use in motion pictures and its relation with early-onset teen drinking. *Journal of Studies on Alcohol*. 2006; 67:54–65. [PubMed: 16536129]
- Sargent JD, Worth KA, Beach M, Gerrard M, Heatherton TF. Population-based assessment of exposure to risk behaviors in motion pictures. *Communication Methods and Measures*. 2008; 2:134–151. [PubMed: 19122801]
- Saunders JB, Aasland OG, Babor TF, De La Fuente JR, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction*. 1993; 88:791–804. [PubMed: 8329970]
- Setodji CM, Martino SC, Scharf DM, Shadel WG. Friends moderate the effects of pro-smoking media on college students' intentions to smoke. *Psychology of Addictive Behaviors*. 2013; 27:256. [PubMed: 22686961]
- Singer, JD., Willett, JB. *Applied longitudinal data analysis: Modeling change and event occurrence*. New York, NY, US: Oxford University Press; 2003.
- Song AV, Ling PM, Neilands TB, Glantz SA. Smoking in movies and increased smoking among young adults. *American Journal of Preventive Medicine*. 2007; 33:396–403. [PubMed: 17950405]
- Stern SR. Messages from teens on the big screen: Smoking, drinking, and drug use in teen-centered films. *Journal of Health Communication*. 2005; 10:331–346. [PubMed: 16036740]
- Stern S, Morr L. Portrayals of teen smoking, drinking, and drug use in recent popular movies. *Journal of Health Communication*. 2013; 18:179–191. [PubMed: 23121156]
- Stone AL, Latimer WW. Adolescent substance use assessment: concordance between tools using self-administered and interview formats. *Substance Use & Misuse*. 2005; 40:1865–1874. [PubMed: 16419561]
- Stoolmiller M, Wills TA, McClure AC, Tanski SE, Worth KA, Gerrard M, Sargent JD. Comparing media and family predictors of alcohol use: a cohort study of US adolescents. *BMJ Open*. 2012; 2:e000543.
- Strasburger VC, Jordan AB, Donnerstein E. Health effects of media on children and adolescents. *Pediatrics*. 2010; 125:756–767. [PubMed: 20194281]
- Tanski SE, Stoolmiller M, Gerrard M, Sargent JD. Moderation of the association between media exposure and youth smoking onset: Race/ethnicity, and parent smoking. *Prevention Science*. 2012; 13:55–63. [PubMed: 21901429]
- Thompson KM, Yokota F. Depiction of alcohol, tobacco, and other substances in G-rated animated feature films. *Pediatrics*. 2001; 107:1369–1374. [PubMed: 11389259]
- Titus-Ernstoff L, Dalton MA, Adachi-Mejia AM, Longacre MR, Beach ML. Longitudinal study of viewing smoking in movies and initiation of smoking by children. *Pediatrics*. 2008; 121:15–21. [PubMed: 18166552]

- University of Missouri - St. Louis. Middle School ANR Adapted Questionnaire, Youth Empowerment in Action. Center for Character & Citizenship; 2013. Downloaded from <http://www.healthymissouri.net/cdrom/MiddleSchool%20ANR%20Adapted%20Questionnaire.pdf>. (latest download 21 January 2012)
- Waylen A, Leary S, Ness A, Sargent J. Alcohol use in films and adolescent alcohol use. *Pediatrics*. 2015 peds-2014.
- Weber M. Psychosocial functions of shared media use among German adolescents. *Journal of Children and Media*. 2013; 7:366–382.
- Gibbons FX, Pomery EA, Gerrard M, Sargent JD, Weng CY, Wills TA, Kingsbury J, Dal Cin S, Worth KA, Stoolmiller M, Tanski SE, Yeh HC. Media as social influence: racial differences in the effects of peers and media on adolescent alcohol cognitions and consumption. *Psychology of Addictive Behaviors*. 2011; 24:649–659.
- Wills TA, Sargent JD, Gibbons FX, Gerrard M, Stoolmiller M. Movie exposure to alcohol cues and adolescent alcohol problems: A longitudinal analysis in a national sample. *Psychology of Addictive Behaviors*. 2009; 23:23–35. [PubMed: 19290687]
- Wills TA, Sargent JD, Stoolmiller M, Gibbons FX, Gerrard M. Movie smoking exposure and smoking onset: A longitudinal study of mediation processes in a representative sample of U.S. adolescents. *Psychology of Addictive Behaviors*. 2008; 22:269–277. [PubMed: 18540724]
- Winters, KC., Stinchfield, R., Bukstein, OG. Assessing adolescent substance use and abuse. In: Kaminer, Y., Bukstein, OG., editors. *Adolescent substance abuse: Psychiatric comorbidity and high-risk behaviors*. New York, NY: Routledge/Taylor & Francis Group; 2008. p. 53-85.
- World Health Organization. Youth violence and alcohol fact sheet. 2016. Retrieved May 13, 2016, from http://www.who.int/violence_injury_prevention/violence/world_report/factsheets/ft_youth.pdf
- Zucker, RA. Alcohol use and the alcohol use disorders: A developmental-biopsychosocial systems formulation covering the life course. In: Cicchetti, D., Cohen, DJ., editors. *Developmental psychopathology*, Vol 3: Risk, disorder, and adaptation. 2. Hoboken, NJ US: John Wiley & Sons Inc; 2006. p. 620-656.

Figure 1.
Estimated exposure (in hours) to alcohol use from 530 popular contemporary movies

Sipping

Full drink

HED

Figure 2.

Figure 2a–2c. Estimated age of onset of **sipping**, **full drink**, and **HED** based on movie alcohol exposure.

Note. Survival estimates are based on One Minus Hazard estimates (see Singer & Willett, 2003, table 11.5, p. 392), among those who were naïve at baseline ($n=433$ for sipping, $n=759$ for full drink and HED), which models the probability of not experiencing onset by multiplying the probability at the previous time point by one minus the estimated conditional hazard probability, conditioned on the values of the predictors. Exposure for *sipping* was $M=5.05$ (10th pctl: 0.89, 90th pctl: 10.53); adjHR: 1.05, $p < .05$. Exposure for both *full drink* and *HED* was $M=5.33$ (10th pctl: 1.06, 90th pctl: 10.70); *full drink* adjHR: 1.05, $p < .001$; *HED* adjHR: 1.07, $p < .001$. Models are adjusted for the following covariates (all centered): gender, race, ethnicity, perceived alcohol availability, sensation seeking, willingness to drink, parent drinking, externalizing behavior, family history of alcoholism, and lunch subsidy.

Friend-shared movie exposure

Parent-shared movie exposure

Figure 3.

Figure 3a–3b. Estimated age of onset for **full drink** based on friend and parent-shared movie alcohol exposure.

Note. Survival estimates are based on One Minus Hazard estimates (see Singer & Willett, 2003, table 11.5, p. 392), among *full drink* naïve at baseline ($n=759$), which models the probability of not experiencing onset by multiplying the probability at the previous time point by one minus the estimated conditional hazard probability, conditioned on the values of the predictors. Friendshared exposure $M=4.00$ (10th pctl: 0.03, 90th pctl: 10.10), adjHR: 1.04, $p<.001$. Parent-shared exposure $M=4.92$ (10th pctl: 0.58, 90th pctl: 11.55), adjHR: 1.02, $p=.11$. Models are adjusted for the following covariates (all centered): gender, race,

ethnicity, perceived alcohol availability, sensation seeking, willingness to drink, parent drinking, externalizing behavior, family history of alcoholism, and lunch subsidy.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

Descriptive data and correlations for movie exposure, covariates, and outcomes.

Predictor	Mean(SD)/%	Alcohol Exposure	Wave 1 Sip	Wave 1 full drink	Wave 1 HED	Wave 2 sip	Wave 2 full drink	Wave 2 HED
Movie alcohol exposure	5.61 (4.28)	-	.13**	.15**	.17**	.20**	.25**	.24**
Alcohol availability	28.6%	.13**	.31**	.29**	.23**	.30**	.28**	.26**
Gender (Male)	47.8%	-.11**	-.01	-.04	-.05	-.10**	-.15**	-.12**
Race (White)	83.0%	-.02	.06	-.01	-.02	.02	.02	-.03
Ethnicity (Hispanic)	12.1%	-.04	-.06	-.02	.01	.02	-.04	-.01
Sensation Seeking	2.23 (0.85)	.11**	.17**	.09**	.02	.19**	.21**	.21**
Best friend drinking	0.35 (0.85)	.01	.16**	.16**	.18**	.09*	.13**	.18**
Parent drinking	2.67 (2.52)	-.05	.12**	.06	.06	.11**	.07*	.10*
Externalizing problems	4.86 (6.44)	-.01	.08*	.09**	.12**	.10**	.10**	.13**
Family history of alcohol	0.32 (0.60)	.03	-.03	.07	.06	-.03	.02	.01
Lunch Subsidy use	36.0%	.06	.08*	.08*	.06	.04	.09*	.07
Wave 1 sip	51.0%	.13**	-	.38**	.25**	.59**	.39**	.31**
Wave 1 full drink	13.6%	.15**	.38**	-	.64**	.23**	.42**	.47**
Wave 1 HED	5.9%	.18**	.25**	.64**	-	.15**	.26**	.38**
Wave 2 sip	72.5%	.20**	.59**	.23**	.15**	-	.56**	.39**
Wave 2 full drink	45.7%	.25**	.39**	.42**	.26**	.56**	-	.70**
Wave 2 HED	29.7%	.24**	.31**	.47**	.38**	.39**	.70**	-

Note. HED=Heavy Episodic Drinking. Based on subsample that completed questionnaires on alcohol exposure in films ($n=882$); Wave 2 $n=758$

Table 2Adjusted estimates for the discrete-time survival model for onset of **sip**.

	HR (adj)	95% lower bound	95% upper bound	p-value
Alcohol Exposure in Films	1.05	1.01	1.09	.01
Gender (Male)	0.62	0.44	0.85	.003
Ethnicity (Hispanic)	1.12	0.67	1.89	.66
Race (White)	1.00	0.61	1.64	.996
Alcohol Availability	1.36	0.90	2.04	.13
Sensation Seeking	1.19	0.97	1.45	.08
Best Friend Drinking	1.00	0.80	1.26	.98
Parent Drinking	1.07	0.99	1.15	.07
Externalizing Problems	1.03	1.00	1.05	.03
Biological Parent Drinking Problem	0.98	0.73	1.32	.92
Lunch Subsidy use	1.17	0.79	1.72	.42

Note. Analyses were conducted on the sipping-naïve participants, $n=433$

Table 3Adjusted estimates for the discrete-time survival model for onset of **full drink**.

	HR (adj)	95% lower bound	95% upper bound	p-value
Alcohol Exposure in Films	1.05	1.02	1.08	.001
Gender (Male)	0.53	0.40	0.70	.000
Ethnicity (Hispanic)	1.24	0.78	1.98	.35
Race (White)	1.14	0.73	1.79	.55
Alcohol Availability	1.20	0.89	1.62	.23
Sensation Seeking	1.32	1.11	1.56	.001
Best Friend Drinking	1.10	0.94	1.28	.23
Parent Drinking	1.08	1.02	1.14	.004
Externalizing Problems	1.03	1.01	1.06	.002
Biological Parent Drinking Problem	1.16	0.91	1.48	.23
Lunch Subsidy use	1.00	0.72	1.39	.99

Note. Analyses were conducted on the full drink-naïve participants, $n=749$

Table 4

Adjusted estimates for the discrete-time survival model for onset of **heavy episodic drinking**.

	HR (adj)	95% lower bound	95% upper bound	p
Alcohol Exposure in Films	1.07	1.03	1.12	.001
Gender (Male)	0.59	0.41	0.86	.01
Ethnicity (Hispanic)	2.00	1.13	3.55	.02
Race (White)	1.19	0.67	2.14	.54
Alcohol Availability	1.22	0.76	1.66	.55
Sensation Seeking	1.39	1.12	1.74	.003
Best Friend Drinking	1.21	0.997	1.46	.05
Parent Drinking	1.07	0.997	1.15	.06
Externalizing Problems	1.05	1.02	1.08	.001
Biological Parent Drinking Problem	1.19	0.87	1.64	.26
Lunch Subsidy use	0.76	0.48	1.18	.21

Note. Analyses were conducted on the HED-naïve participants, $n=749$