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Event-Level Marijuana Use, Alcohol Use, and Condom Use Among Adolescent Women

Devon J. Hensel, PhD, Nathan W. Stupiansky, PhD, Donald P. Orr, MD, and J. Dennis Fortenberry, MD, MS

Section of Adolescent Medicine, Indiana University School of Medicine, Indianapolis, IN

Abstract

Background—It is widely believed that marijuana use and alcohol use directly intercede on successful condom use. However, measurement differences and inconsistent findings in past research remain unclear whether marijuana and alcohol work directly to influence condom behavior, or spuriously function through other factors that actually reflect an increased likelihood of vaginal sex. The current study prospectively disentangles the association of marijuana and alcohol use on condom behavior among adolescent women.

Methods—Young women (N = 387; 14–17 years) provided daily sexual diaries as part of a longitudinal cohort study (1999–2009) of sexual behavior and sexual relationships. To separate the effects of marijuana and alcohol use on vaginal sex from condom use (when vaginal sex occurs), we estimated a 3-category outcome variable (no vaginal sex, vaginal sex with a condom, vaginal sex without a condom), alternating no sex (Model 1) and sex without a condom (Model 2) as the referent categories. Generalized estimating equation multinomial logistic regression adjusted odds ratios for multiple sexual events from the same young woman over time.

Results—Subjects contributed 14,538 coital events; 30% of these events were condom-protected. Neither marijuana nor alcohol use was directly associated with lower condom use; the strongest effect of condom use (adjusted odds ratio) and nonuse was performance of these behaviors in the past week.

Conclusions—This study finds no evidence of a relationship between marijuana or alcohol use and condom nonuse. Both condom use and nonuse were identified as consistent behavioral patterns, regardless of the effect of marijuana and alcohol use.

Consumption of marijuana or alcohol is believed to augment adolescent sexual risk-taking, either by increasing sexual disinhibition or by impairing the cognitive skills required for successful risk-reduction behaviors.^{1–3} However, the precise relationship between marijuana or alcohol use and condom use remains unclear,^{4–6} with some studies suggesting that alcohol or drug use is associated with decreased likelihood of condom use,^{7,8} and other studies finding no association^{9–11} or increased likelihood of condom use.^{12,13}

Some of these inconsistencies can be attributed to differences in behavior measurement. Retrospective and cross-sectional studies may only demonstrate correlation between 2 variables, making it impossible to assess whether alcohol and marijuana's effect is directly associated with condom decision-making, or if these effects are spuriously associated through an increased likelihood of vaginal sex. Although an event-level association between marijuana or alcohol use and vaginal sex is reasonably well established, it is less clear

whether marijuana or alcohol use is associated with a direct decreased likelihood of event-level condom use,⁴ or whether the long-term development of a sexual relationship is dually associated with less condom use¹⁴ and increased marijuana or alcohol consumption.¹⁵ For example, among first year college students, alcohol use is associated with unsafe sex,^{16,17} although research among young adults¹⁸ and adolescent women^{19–21} suggests no relationship between drinking and condom nonuse. Studies on marijuana use show similarly mixed patterns, with consumption associated with decreased likelihood of condom use at most recent sex among detained adolescents,^{22,23} but not among young adults,^{24,25} teenagers,²⁶ or adolescent women at an sexually transmitted infection (STI) clinic.²⁷

Disentangling these effects is important, as interventions targeted toward reducing alcohol and marijuana use before vaginal sex are likely different from those aimed at increasing condom use when substance use occurs. To date, however, most research has compared alcohol and marijuana use across events when condoms are and are not used, rather than extending the comparison to include use when vaginal sex does not occur. This additional comparison allows us to disentangle a direct effect of alcohol and marijuana from a spurious effect.

In the current study, we use prospective daily diary data to examine the association of alcohol use and marijuana use with condom behavior among adolescent women. Prospective collection methods, such as diaries, permit the capture of a sufficient number of observations required to examine variability in infrequent events, as well as to compare those events against different situations, such as vaginal sex and condom use. These data extend findings from previous research to the following: (1) distinguish the separate effects of event-level alcohol from event-level-marijuana on when condoms are and are not used; (2) control for the influences of recent patterns of behavior, including recent alcohol, marijuana, vaginal sex, and condom use; and (3) compare marijuana and alcohol use when no vaginal sex occurs, to marijuana and alcohol use when condoms are and are not used during vaginal sex.

MATERIALS AND METHODS

Study Design and Data

Data were collected as part of a larger longitudinal cohort study (initiated in 1999; ongoing at the time of analyses) of sexual relationships, sexual behaviors, and STIs among young women in middle- to late-adolescence. As part of this study, subjects kept daily diaries assessing sexual behaviors, marijuana or alcohol use, contraception, mood, and partner interactions. Diaries, collected weekly by trained field staff, were completed in alternating 84-day diary collection time frames over a period of up to 8 years. All collection periods were bracketed by a resting time frame in which no diaries were kept, and each collection period was bracketed with a clinic visit for collection of interview and physical examination information related to the larger project. At enrollment and at each bracketed interview, young women identified up to 5 partners, including friends, dating partners, boyfriends, and sexual partners. This was done to analyze various types and stages of relationships, rather than limiting partners to those with whom sexual contact had occurred.²⁸ Research was approved by the institutional review board of Indiana University/ Purdue University at Indianapolis-Clarian. Assent was obtained from each participant and permission obtained from a parent or legal guardian.

Compared with other methods, diaries provide the detailed data requisite to disentangle the event level relationships among sexual and contraceptive behavior,^{29,30} and are characterized by high levels of completion, and low levels of dropout or item missingness.^{18,31} Although behavior changes are possible in response to diary completion,³²

most published research finds little or only very short-lived diary reactivity effects,^{31,32} and we find little evidence of this in our data.^{33,34}

Participants

The subjects were 386 adolescent women in the patient population in 1 of 3 primary care adolescent health clinics in Indianapolis, IN, serving primarily lower- and middle-income families, residing in areas with high rates of pregnancy and STI ($N = 46/386$; 11.88% at baseline). The average maternal education was 12th grade. The majority (90%) of participants were black and were eligible for the study if they were 14 to 17 years of age (mean = 15.33; SD = 1.06), spoke English, and were not pregnant at study enrollment. However, young women who became pregnant during the course of the study were permitted to continue. Sexual experience was not a criterion for entry.

Measures

Outcome Variables—Using 2 diary items (“Did you have vaginal sex today?” [no/yes] and “Did you use a condom?” [no/yes]), we created a 3-category outcome variable: no vaginal sex, vaginal sex without a condom, and vaginal sex with a condom.

Predictor Variables—We used 2 classes of predictor variables: within-day and recent behavior effects. Within-day effects evaluated the influence of behaviors temporally associated with a given day/sexual event. These included the following: marijuana use (no/yes) and alcohol use (no/yes). Because of space limitations in the diary, timing of marijuana or alcohol use relative to vaginal sex was not assessed. Additionally, because event level alcohol and/or marijuana use, as well as sexual behavior and condom use, are likely related to use or similar behavior in the recent past, we created time lagged variables to evaluate the potential carry-over of the past week’s behavior on the current day: recent marijuana use (past 7 days: no/yes), recent alcohol use (past 7 days: no/yes), recent vaginal sex (past 7 days: no/yes), and recent condom use (past 7 days: no/yes).

Covariates—All models additionally controlled for the within-day influence of other variables known through our research to effect vaginal sex and condom use,^{27,35} including vaginal bleeding, age, and hormonal contraceptive use. We also included other intrapersonal, situational, and relational effects: positive mood (3-items; $\alpha = 0.86$; e.g., “I felt happy,” “I felt friendly,” and “I felt cheerful”), negative mood (3-items; $\alpha = 0.83$; e.g., “I felt unhappy,” “I felt angry,” and “I felt irritable”), feeling in love (1 item), sexual interest (1 item), partner support (4-items; $\alpha = 0.95$; e.g., “He let me know he cared about me,” “He made me feel special,” “He made me feel loved,” and “I felt happy about your relationship”), and partner negativity (5-items; $\alpha = 0.83$; e.g., “He made me feel bad about myself,” “He made me feel disrespected,” “He made me feel stupid,” and “He made me feel mad”).

Analysis

Bivariate associations are used to summarize marijuana and alcohol use across vaginal sex and condom use. Multinomial logistic regression was used to assess associations between predictor variables and the outcome variable’s categories likelihood relative to the reference category. Using 2 models, we alternated the referent category (Model 1: no vaginal sex; Model 2: vaginal sex without a condom). In Model 1, we compared marijuana use on days without vaginal sex to marijuana use on days when condoms were and were not used. In Model 2, we isolated the comparison of marijuana and alcohol effects on vaginal sex events with and without condom use. We expected that if marijuana and alcohol were independently associated with the decision to use or not to use a condom (Model 2), their

effects should be different from the decision to engage or not to engage in vaginal sex (Model 1). A generalized estimating equation approach adjusted estimates for multiple within-subject observations.³⁶ All analyses were performed using SUDAAN, Version 9.01.³⁷

RESULTS

Event Level Behaviors

Subjects contributed 213,592 partner-diary days; alcohol use was reported on 2.1% of all diary days (4572/213,592), marijuana use was reported on 6.7% of all days (14,434/213,592), and vaginal sex was reported on about 7% (14,538/213,592) of all days. Approximately one-third (4211/14,538) of all coital events was condom protected.

Bivariate Association of Alcohol and Marijuana

As shown in Table 1, substance use was higher on days when vaginal sex was reported (alcohol: 6.2%; marijuana: 15.7%) as compared to days when vaginal sex was not reported (alcohol: 1.8%; marijuana: 6.0%). However, alcohol and marijuana use were generally similar regardless of when condoms were used during vaginal sex (alcohol: 6.8%; marijuana: 14.2%) and were not used during vaginal sex (alcohol: 5.9%; marijuana: 16.2%).

Table 2 shows the adjusted odds ratios (AORs) and 95% confidence intervals (95% CI) for vaginal sex with a condom compared to no vaginal sex (Model 1), for vaginal sex without a condom compared to no vaginal sex (Model 1), and for vaginal sex with a condom compared to vaginal sex without a condom (Model 2). Controlling for other influences, vaginal sex with a condom was more likely than no vaginal sex on days with alcohol use (AOR = 1.83; 95% CI = 1.49, 2.24), marijuana use (AOR = 1.47; 95% CI = 1.23, 1.75), recent marijuana use (AOR = 1.58; 95% CI = 1.36, 1.82), no recent vaginal sex (AOR = 0.86; 95% CI = 0.75, 0.99), and recent condom use (AOR = 10.00; 95% CI = 8.72, 11.47). Similarly, vaginal sex without a condom was more likely than no vaginal sex with alcohol use (AOR = 1.19; 95% CI = 1.01, 1.40), marijuana use (AOR = 1.35; 95% CI = 1.20, 1.53), recent alcohol use (AOR = 1.44; 95% CI = 1.31, 1.59), recent marijuana use (AOR = 1.39; 95% CI = 1.26, 1.53), recent vaginal sex (AOR = 9.95; 95% CI = 9.24, 10.71), and no recent condom use (AOR = 0.21; 95% CI = 0.19, 0.24).

Controlling for other influences, vaginal sex with a condom was more likely than vaginal sex without a condom with alcohol use (OR = 1.54; 95% CI = 1.21, 1.95), no recent alcohol use (AOR = 0.78; 95% CI = 0.66, 0.92), no recent vaginal sex (AOR = 0.09; 95% CI = 0.07, 0.10), and recent condom use (AOR = 46.81; 95% CI = 39.74, 55.14). Not having vaginal sex was more likely than vaginal sex without a condom with no alcohol (AOR = 0.84; 95% CI = 0.81, 0.92), no marijuana (AOR = 0.74; 95% CI = 0.66, 0.84), no recent alcohol (AOR = 0.68; 95% CI = 0.76, 0.83), no recent marijuana (AOR = 0.72; 95% CI = 0.65, 0.80), no recent vaginal sex (AOR = 0.10; 95% CI = 0.09, 0.11), and recent condom use (AOR = 4.48; 95% CI = 4.21, 5.20).

DISCUSSION

This study investigated the relationships between alcohol use, marijuana use, and condom behavior among adolescent women. Human immunodeficiency virus and STI prevention programs often implicitly assume a causal event-level relationship between marijuana or alcohol use and risky sex, inferring that alcohol and marijuana cause people to use condoms less frequently than when not under the influence.¹⁹ Our findings do support the suggestion that marijuana and alcohol use are independently associated with an increased likelihood of vaginal sex (with or without condom use)³⁸; however, we have found no evidence that either

alcohol or marijuana use is associated with decreased likelihood of condom use, if vaginal sex occurs. In the current study, alcohol use was associated with an increased likelihood of condom use. Recent alcohol use, however, was associated with decreased likelihood of condom use. This may suggest that alcohol use is a marker for a larger lifestyle associated with sexual risk (at least in terms of condom nonuse) rather than a direct influence on condom decision-making. The findings that recent vaginal sex is associated with decreased likelihood of condom use, and that recent condom use is associated with increased likelihood of condom use are consistent with other research showing that coital frequency and habitual condom use are both important determinants of condom use at an event level.^{18–21}

Event-level marijuana, event-level alcohol, and recent marijuana use were associated with decreased likelihood of not having vaginal sex over not using a condom. These variables also increased the odds of using a condom over both no vaginal sex and not using a condom. Marijuana is often used as part of a larger shared lifestyle in long-term relationships,³⁹ and these relationships are also longitudinally characterized by increasing vaginal sex and decreasing condom use.³⁰ Alcohol use, on the other hand, may be more common with casual partners,⁴⁰ with whom condoms are used more frequently.⁴¹ We did not directly assess partnership type in the present analysis, but we did control for subject perceived relational effects (such as partner support and feeling in love) in the models. It is also important to note that the strongest predictors of event-level condom use were recent vaginal sex and recent condom use. That is, young women tend to follow general patterns of sexual behavior, regardless of whether alcohol or marijuana is used.

These findings underscore the importance of a clinician's asking specific questions about marijuana or alcohol use and condom use both in the context of, and independent of, a young woman's romantic relationships, as such information is likely to point to where opportunities for intervention are possible and most effective. For example, even in cases where a practitioner is able to persuade an adolescent to make individual marijuana or alcohol use changes, existing long-term partnership-based condom use may be unlikely to change. Such slight differences may also be important in new or nonexclusive relationships, where individual habits exert a greater influence on event-level condom use. Moreover, these findings may inform public health efforts to increase condom use among young women by emphasizing consistent use during all instances of vaginal sex, including those that occur outside of substance use. Young women's condom behaviors are patterned and stable, even on days when substances were used. These data suggest a need for partner-specific or attitudinal interventions as opposed to situation-specific messages.

Limitations

Several limitations of the current study should be noted. First, the sample is primarily selected from urban, low- to middle-income areas marked by high rates of STIs, which are therefore not representative of all adolescent women. Second, our measures did not assess the exact timing or amount of marijuana or alcohol use before vaginal sex, subjective intoxication, concurrent use by a sex partner, or coercion by a sex partner. Marijuana or alcohol use could be associated with risky sexual behavior for a subset of people who are more impaired. An intoxicated male partner may coerce intercourse or refuse condoms, even if the female partner is normally committed to their use. Furthermore, we did not assess the effect of condom use in instances where vaginal sex occurred more than once on a specific day; however, less than 0.5% of all days are associated with multiple sexual events. Finally, although the data were collected at a partner-specific level, the models presented here do not incorporate information about the couples' histories, pregnancy intentions, or relationship status before a given event; however, we did control for partner-specific emotional attributes at the event level that are known from our prior work to be associated with the occurrence of

sex and with condom use. Future research may seek to implement a more complex set of models that address in more detail the trajectory of relationships.

CONCLUSIONS

These findings have important public health implications, as they challenge widely held assumptions about substance-associated disinhibition as a sexual risk behavior. Prevention programs that solely address “sex under the influence” and assume a direct relationship between any marijuana or alcohol use and condom nonuse may be ineffective if dual consideration is not given to both the type of substance used, as well as the type and context of recent behavior in an adolescent’s life. Clinically, health care providers of adolescent women should consider that condom use behavior is regimented and independent of substance use. Practitioners may benefit from devoting some portion of clinical visits with women in sexual relationships in detailing the habitual or recent condom habits and the quality of their relationships. This information may offer additional points of individualized intervention not available through questions about current condom use and/or current substance use.

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TABLE 1

Bivariate Event Level Association of Alcohol Use, Marijuana Use, Vaginal Sex, and Condom Use Among Adolescent Women

	Vaginal Sex			Condom Use		
	Yes, N (%)	No, N (%)	χ^2 (df)	Yes, N (%)	No, N (%)	χ^2 (df)
Alcohol use	908 (6.2)	615 (5.9)	972.5 (1) [*]	290 (6.8)	615 (5.9)	5.9 (1) [†]
Marijuana use	2283 (15.7)	12,102 (6.0)	144.4 (1) [*]	597 (14.2)	1676 (16.2)	7.2 (1) [‡]
Total	14,538	199,054		4211	10,327	

Only the yes categories from both alcohol and marijuana use are given, therefore the columns and rows do not sum to 100%.

^{*} $P < 0.001$;

[†] $P < 0.001$;

[‡] $P < 0.001$.

TABLE 2

Adjusted Odds Ratios (AORs) of Vaginal Sex With and Without a Condom Compared to No Vaginal Sex (Model 1) and Vaginal Sex With a Condom Compared to Vaginal Sex Without a Condom (Model 2)

	Vaginal Sex With a Condom vs. No Vaginal Sex (Model 1) AOR* (95% CI)	Vaginal Sex Without a Condom vs. No Vaginal Sex (Model 1) AOR* (95% CI)	Vaginal Sex With Condom vs. Vaginal Sex Without a Condom (Model 2) AOR* (95% CI)
Alcohol use	1.83 (1.49,2.24) [†]	1.19 (1.01,1.40) [†]	1.54 (1.21–1.95) [†]
Marijuana use	1.46 (1.23,1.75) [†]	1.35 (1.20,1.53) [†]	1.09 (0.89–1.33)
Recent alcohol (yes)	1.13 (0.98,1.31)	1.44 (1.31,1.59) [†]	0.78 (0.66–0.92) [†]
Recent marijuana (yes)	1.58 (1.36,1.82) [†]	1.39 (1.26,1.53) [†]	1.14 (0.96–1.34)
Recent vaginal sex (yes)	0.86 (0.75,0.99) [†]	9.95 (9.24,10.71) [†]	0.09 (0.07–0.10) [†]
Recent condom use (yes)	10.00 (8.72,11.47) [†]	0.21 (0.19,0.24) [†]	46.81 (39.74–55.14) [†]

* Adjusted for event-level age, vaginal bleeding, hormonal contraceptive use, as well as interpersonal, relational, and situational influences.

[†] $P < 0.05$.

CI indicates confidence interval.