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Participation in Team Sports and Alcohol and Marijuana Use Initiation Trajectories

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Abstract

A parallel-process latent growth curve model was used to model alcohol and marijuana use (vs. nonuse). Participation in team sports and gender were considered to be time-invariant covariates. The sample consisted of 8,179 youth from the National Survey of Parents and Youth. Data were collected over four yearly rounds. Analysis revealed that being part of a competitive sports team was related to a lower probability of marijuana initiation, but to increased rates of alcohol use over time. Males had significantly higher levels of marijuana initiation and decreases in rates of alcohol use over time; females had significantly greater rate of increase in alcohol use over time. Analysis suggests that youth involved in sports are less likely to use marijuana over time. This information may help to uncover other predictors of use over time and to inform policy making as well design as effective prevention.

Keywords

physical activity; alcohol use; alcohol abuse; alcohol dependence; health promotion; population-based survey; NSPY

Participation in organized sports teams is a core aspect of life for many youths and adolescents. The benefits of sports participation can be enormous, ranging from physical benefits such as longevity and heart-health (Blair & Morris, 2009) and increased long-term physical activity participation (Graham, Sirard, & Neumark-Sztainer, 2011). However, the relationship between participation in sport and substance use is equivocal. Several reviews indicate that participation in sports is related to higher alcohol use (Martens, Dams-O'Connor, & Beck, 2006), but lower levels of marijuana use (Diehl et al., 2012; Lisha & Sussman, 2010), and most studies have focused on college students (Lisha & Sussman, 2010).

A number of studies demonstrate a positive relationship between participation in team sports, increased alcohol use (Ford, 2007; Martens et al., 2006; Vuchinich & Heather, 2003),

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and decreased marijuana use (Lisha, Martens, & Leventhal, 2011; Martens et al., 2006). While the possible mechanisms linking alcohol and sports have not been tested directly, several theoretical possibilities have been proposed. One of the leading theories applies to the contextual factors that surround sports and alcohol use. It is possible that youth are motivated to consume excessive alcohol in certain circumstances (Mays, DePadilla, Thompson, Kushner, & Windle, 2010). Drinking with other team members also might be a way to increase team unity. In addition, organized sport often is associated with socializing outside of the practice or game environment and often involves the use of alcohol (Martens et al., 2006). Youth are highly influenced by peer norms and it might be because of this that we see the opposite pattern for marijuana use. Athletes tend to socialize with other athletes, and drinking is normatively accepted, whereas marijuana is not (Lisha & Sussman, 2010).

Findings regarding the relationship between sports, substance use, and gender are more mixed. Mays et al. (2010) found no differences in the relationship between sports participation and rate of change of problem alcohol use by gender (Ford, 2007). Ford (2007) found that for alcohol, cross-country and track athletes reported the lowest levels of alcohol use, while male hockey and female soccer players reported the highest levels of use. A gender difference was also found such that sports were correlated with recent drunkenness in males only, but repeated alcohol use was correlated with females only (Crano, Siegel, Alvaro, Lac, & Hemovich, 2008). For marijuana, Peretti-Watel, Beck, and Legleye (2002) found a u-curve (highest levels of use at moderate levels of sports) for males only.

A potential problem clouding interpretation of past research is that most past studies have been cross-sectional, or have used multiple regression analyses across two time points. To comprehend the complicated relationship between substance use, sports, and gender requires more complex longitudinal designs and analyses.

We sought to study the relationship between sports team participation and both marijuana and alcohol use trajectories by extending previous research using new modeling techniques that clarify initiation and growth patterns based on participation in sports and gender. One study (Mays et al., 2010) utilized latent growth curve modeling (LGM) to model whether participation in school-based sports was associated with initial levels and change in problem alcohol use over three waves of data collection. The researchers found that sports participation was associated with quicker acceleration in problem-alcohol-use. The present study extends these findings by investigating initiation into alcohol use rather than problematic-alcohol-use, and examines another substance, marijuana. It is hypothesized that participating in sports will be related to the initial level of use and rate of change for initiation into alcohol and marijuana use. Overall linear trends were predicted for both substances. On the basis of earlier research, it is predicted that being part of a team will be related to a higher initial status and slope factor for alcohol use, but a lower initial status and slope factor for marijuana use. For exploratory purposes, we also will examine the relationship of gender. However, no specific hypotheses are advanced regarding gender, as previous gender-relevant findings are inconsistent.

Method

Sample and Procedure

Participants consisted of a nationally representative sample of youth in the United States. Data were drawn from the restricted data archive of the National Survey of Parents and Youth (NSPY). The present sample consisted of 8,179 youths aged from 9 to 18 years in the first year of the study, and measured every year for 4 years (participants aged out at age 18). Data were collected in four rounds from November 1999 to June 2004 (see Crano et al., 2008, for a more complete description of the sampling procedures). Overall, the cross-sectional response rate for all youth (ages 9-18) at each round was defined as the product of (a) the percentage of sampled eligible households, (b) households that completed the screening roster, (c) eligible households who were selected for follow-up, and (d) completion rate for youth in that round, was 64.8% in Round 1. Follow-up (conditional) eligible participant response rates were 86.3%, 92.3%, and 93% in Rounds 2 to 4, respectively.

Measures

Extracurricular activities (team status)—Participants were asked a number of questions about their extracurricular activities, including, “In the last 12 months, have you ever participated in the following types of organized activities or groups: *Athletic teams or organized sports*, in or outside of school?” Responses were dichotomous (1 = yes, 2 = no).

Adolescent alcohol and marijuana use—Adolescents’ alcohol and marijuana use was measured at all four waves using self-report items. A dichotomous measure was used for each substance indicating whether participants had used in their lifetime (0 = never, 1 = have used).

Demographic indicators—Age and gender was asked of all participants. Gender was considered a categorical predictor (1 = male, 0 = female). Age was continuous.

Statistical Analyses

The analysis made use of multivariate LGM to model adolescents’ use of alcohol and marijuana across four yearly time points (T1-T4). Activity status and gender were considered indicators on initial status of adolescents’ alcohol and marijuana use.

Several procedures were used to model the data; these techniques have been used in previous studies to model substance use or problem behaviors (for details see technical appendix; Auerbach & Collins, 2006; Wu, Witkiewitz, McMahon, & Dodge, 2010). In the analysis, each growth model was fit using the marijuana and alcohol use variables separately. In the second step, both processes were examined together and the intercepts and slopes were allowed to correlate (see Figure 1). Goodness-of-fit indices were evaluated by considering the overall model fit (absolute, parsimony, and comparative fit). Absolute fit was evaluated using the model chi-square (χ^2), where a nonsignificant *p* value indicated good model fit. Parsimony was indicated by the root mean square error of the approximation (RMSEA) where values below .06 indicated good fit (Brown, 1989). Comparative fit was

assessed using the Tucker–Lewis index (TLI) and the Comparative Fit Index (CFI) where values above 0.95 indicated adequate fit (Bentler, 1990). Because of the large sample size, it is advisable not to rely on the chi-square alone as the probability of Type 1 error might be increased (Cheung & Rensvold, 2000).

The structural equation modeling analyses used in this article use the full information maximum likelihood (FIML) method in Mplus to account for missing data (Little & Rubin, 1987; Rubin, 1976). The FIML method has been shown to produce greater accuracy in model estimations by adjusting for the uncertainty caused by missing data (Collins, Schafer, & Kam, 2001; McArdle & Hamagami, 1992). Analyses were performed using Mplus 5.1 software (Muthen & Muthen, 2007).

Results

Item and Sample Information

Table 1 displays means, standard deviations, and zero-order correlations for alcohol and marijuana use at all four time points, age, gender, and team status. Table 2 presents the percentage of using alcohol and marijuana at all four times, overall, and as a function of age and gender. The observed percentages of users appear to be increasing over time. In addition, use of alcohol and marijuana at each time is highly correlated within and across rounds of measurement. Age was positively correlated with the use variables indicating that older participants reported higher percentages of users of alcohol and marijuana. However, team status appears to be negatively correlated with use at all time points except at T3 and T4 for alcohol.

Cases missing team status were eliminated from the analysis by Mplus. We compared the sample that was used in the analysis with the deleted cases and found no significant differences by gender, ethnicity, and household income. The samples differed in terms of age such that the sample used in the analysis was older (M = 16.39, SD = 1.51) than the sample that was not used (M = 12.96, SD = 1.48). The sample used in the analysis was 51.3% male, the ethnic breakdown was 66.6% White, 14.6% African American, 14.4% Latino, and 4.4% Asian; in terms of household income, 22.7% earned less than US$24,999, 29.6% earned between US$25,000 and US$49,999, 33.8% earned between US$50,000 and US$99,999, and 13.9% earned more than US$100,000, and 63.9% played on a team.

Parallel-Process Latent Growth Model

Because linear growth models were found to be a good fit for alcohol and marijuana use over time, their relationship was further explored using a parallel-process LGM (results not presented for individual models; McArdle & Hamagami, 1989). Variation around the group growth curves was investigated by simultaneously estimating the linear growth curves for marijuana and alcohol use over time and regressing them on age, gender, and team status. The a priori hypothesized model was tested such that age, gender, and team status predicted the intercept and slope factors for alcohol and marijuana use. In addition, correlations were estimated between the adolescent marijuana and alcohol use intercept factors and between adolescent alcohol and marijuana use slope factors. Structural parameters were also

estimated such that the intercept factor of alcohol use was correlated with the slope factor of marijuana use, and the intercept factor of marijuana use was correlated with the slope factor for alcohol use. Standardized estimates are reported.

Overall, the linear parallel-process model fit the data well, $\chi^2(21) = 98.40$, $p < .001$, TLI = .997, CFI = .997, and RMSEA = .03. The means for the slope factors for alcohol ($\hat{\mu} = -.79$, $p = .76$) and marijuana ($\hat{\mu} = -.413$, $p = .88$) were not statistically significant; this indicates that when both substances were estimated simultaneously, adolescents as a group did not show increases in growth of usage for either alcohol or marijuana. The residual variances of the marijuana intercept ($\psi = 5.53$, $p < .001$) and slope factor ($\psi = 17.69$, $p < .05$), and the alcohol intercept factor ($\psi = 8.58$, $p < .001$) and slope factor ($\psi = 41.53$, $p < .01$) were statistically significant, indicative of individual differences. More simply, variance in the fitted slopes indicates observed interindividual differences in the rates at which the substance use changes over time. Correlations between estimated intercepts and slopes were also calculated to examine the associations between fitted initial status and fitted rate of change, to determine whether observed baseline status was related to the rate of change. The alcohol slope factor was significantly correlated with the marijuana intercept factor ($r = .33$, $p < .001$) and the marijuana slope factor ($r = -.10$, $p < .001$). These results indicate that having a steeper slope factor for alcohol was positively correlated with a higher initial status and slope on marijuana. The alcohol intercept factor was also significantly positively correlated with alcohol slope ($r = .38$, $p < .001$), marijuana intercept factor ($r = .88$, $p < .001$), and marijuana slope factor ($r = .27$, $p = .07$). Thus, initial alcohol status was associated with steeper slopes of marijuana and alcohol use, as well as a higher initial status on marijuana use.

The marijuana intercept and slope factors were significantly correlated ($r = .63$, $p < .001$) indicating that individuals with higher initial marijuana status grew faster than those who were nonusers at baseline. The slope factor for alcohol was significantly related to gender ($\beta = -.11$, $p < .001$) and team ($\beta = .10$, $p < .001$), but only marginally related to age ($\beta = .11$, $p = .07$). These results indicate that females were more likely to be users of alcohol over time, and that being part of a team was not a protective factor for alcohol use over time. The intercept factor for alcohol was significantly related to age ($\beta = .49$, $p < .001$), but not to team ($\beta = -.01$, $p = .62$), or gender ($\beta = .02$ $p = .39$). This indicates that older individuals were more likely to use alcohol, but that initial alcohol use was not related to being on a team or to gender. The marijuana slope was not related to team, gender, or age (all $p > .05$) indicating that the change in marijuana status was not related to team, gender, or age. The marijuana intercept factor was significantly related to age ($\beta = .52$, $p < .001$), gender ($\beta = .06$, $p < .01$), and team ($\beta = -.09$, $p < .001$). Thus, it appears that males were more likely than females to be marijuana users at Time 1, and that being on a team was protective to marijuana use initial status.

Discussion

Determining whether youth who participate in sports are more likely than others to use alcohol and marijuana has direct implications for selective interventions. As millions of U.S. adolescents participate in organized sports (Eaton et al., 2008), the team sports setting may

be an ideal venue for administering drug and alcohol programming. The present study examined whether playing on a sports team was related to the change in initiation of use of alcohol and marijuana over time. Gender also was explored as a possible correlate to changes over time.

When modeled together, the analysis indicated that marijuana and alcohol use did not show systematic increases or decreases in use over time (slope) when age, gender, and team were entered as covariates. While the linear trends (slope factors) were not statistically significant, the model fit was good, most likely due to the relationships with the covariates. Sports participation exhibited a number of relationships with substance use. Being part of a sports team was related to lower chances of early initiation of marijuana use (intercept) and a higher rate of increase in alcohol use over time (slope). These results are consistent with earlier cross-sectional research, which suggested that being part of a team was related to increased alcohol use and decreased levels of marijuana use (Diehl et al., 2012; Lisha & Sussman, 2010). Thus, while participating in team sports may be protective against marijuana use, it may enhance risk for alcohol use when examining the effect over time.

As studies examining the underlying mechanisms responsible for the relationship between substance use and physical activity have begun only recently (Buscemi, Martens, Yurasek, & Smith, 2011; Lisha et al., 2011), the proffered mechanisms remain speculative. It is possible that individuals who are more physically active are by nature more competitive, and thus might be more inclined to play sports, and also to drink the most. This pattern of increased alcohol use may be tied to stable personality traits (e.g., sensation seeking) or more malleable socioenvironmental influences (e.g., drinking as a team after a win).

Perhaps athletes are less inclined to use drugs such as marijuana because they are drug tested. In addition, athletes depend on their lungs to perform in their sport at the highest level. Alcohol can impair performance, but its cumulative effects evolve over time, and generally are less immediately obvious. Moreover, due to high levels of conditioning, athletes may build up a resistance to the harmful effects of alcohol (Andersen, 2005). However, marijuana use will show more immediate breathing problems and physical damage (Dunn & Wang, 2003). In addition, alcohol dissipates more quickly from the system and therefore is less detectable and thus is likely more commonly consumed by underage athletes.

Gender also was found to be a promising variable associated with substance use. Being male was associated with higher initial levels of marijuana use (intercept). Interestingly, being female was related to greater increases in alcohol use over time. Males are disproportionately users of marijuana (Pope & Yurgelun-Todd, 1996); thus, it is not surprising that males would be more likely than females to initiate use. Most evidence indicates that male and female athletes are more at risk of initiation in alcohol use (Aaron et al., 1995), so it is surprising that being female was related to increases in alcohol use over time. It should be noted, however, that one study has found similar results (Martinsen & Sundgot-Borgen, 2012).

Age was entered as a covariate, but understandably exhibited some relationships with the intercepts for marijuana and alcohol such that older individuals showed higher starting values for both substances. Substance use typically begins during adolescence and increases over time until it peaks during emerging adulthood (Chen & Kandel, 1995).

The present findings should be interpreted within the context of the study's strengths and limitations. It is preferable to examine growth trajectories using continuous variables, but because of low base rates of alcohol and marijuana use at young ages, and the variables available in the dataset, use trajectories were based on a dichotomous predictor. However, the fact that the growth of the prevalence of these substances (use vs. nonuse) was modeled successfully can be thought of as strength (Duncan, Duncan, & Strycker, 2006). Dichotomous measures of substance abuse outcomes are data restriction, but did not specifically change the modeling. The most important is to keep in mind that while we use the common label “growth,” in reality when dichotomous indicators are used we are really discussing moving from nonuse to use or “change.”

Ideally the data would have been analyzed by age, rather than by wave (covarying by age); however, when the analysis was done in this fashion, the number of missing data patterns was too large to achieve convergence. Another possible solution was to examine different patterns by age range by dividing the data into age-group clusters. However, this also was impossible with the given data. Another limitation is that only three covariates were examined. It is important to note that in a secondary data analysis, the available data are not always ideal, but we believe they were sufficient for the purposes of the present study. Last, the present model treats team status as time invariant and does not take into account team status over time. This could be important as youth often engage and disengage at multiple times, and the data do not indicate reasons for not playing (e.g., did not make team or did not want to play). While this limits our analysis in some ways, it was not possible to analyze the data in this way with the current data and with the complex modeling that was used. This might be a future direction for work in this arena.

In addition to its limitations, the study has a number of strengths. The data were collected from a nationally representative respondent sample in a 4-year panel design. The data allowed youth even at a young age to be included in the analysis, which is not typical of most substance use studies. It has been shown that for alcohol use, a large proportion of use has its onset before adolescence (Fournet, Estes, Martin, & Robertson, 1990); thus, it is critical to measure youth starting at an early age.

Conclusion

The current study used a parallel-process LGM to examine the rates of marijuana and alcohol use initiation over time in a nationally representative sample. While the relationship between involvement in sport and substance use does not appear clear-cut, there are some important implications that may be drawn from the analyses. Participation in sport appears to be a protective factor against marijuana initiation, but it might increase early initiation of alcohol use in youth. The sophisticated analysis method allows a unique contribution to the existing body of literature by furthering initial cross-sectional results and examining the

long-term impact of sports in the initiation of substance use in youth. For this reason, it is important to direct prevention efforts targeted at alcohol use in these groups. Future research should continue to measure substance use starting at an early age, and to continue this research longitudinally, to obtain a clearer picture of usage trajectories. In addition, future analyses should use other measures of substance use. This study and others like it are important for laying the foundation for policy making and designing future prevention programming, but they represent only the beginning of a larger stream of research.

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Appendix

Mplus Program Codes

The following program specifications were used to test the hypothesized models. All models were run using Mplus (Muthen & Muthen, 2007).

Parallel-Process Latent Growth Curve Model: Alcohol and Marijuana

```
TITLE: Parallel process LGCM for alc and mar;

DATA:

File = C:\Documents and Settings\Administrator\Desktop\nspymplus_cat.dat;

Variable:

Names = team ID1 ID2 round age gender

c_m_1 c_m_2 c_m_3 c_m_4 c_a_1 c_a_2 c_a_3 c_a_4;

USEVAR = team age gender c_m_1-c_m_4 c_a_1-c_a_4;

MISSING=.;

CATEGORICAL = c_m_1-c_m_4 c_a_1-c_a_4;

Analysis: ITERATIONS = 400000;

parameterization = theta;Model:

im on team;
```

sm on team;

im on age;

sm on age;

im on gender;

sm on gender;

im by c_m_1-c_m_4 @1;

sm by c_m_1@0 c_m_2@.25 c_m_3@.75 c_m_4@1;

[c_m_1$1*1 c_m_2$1*1 c_m_3$1*1 c_m_4$1*1] (1);

im*5.687 sm*1.626;

im with sm*2.562;

[im@0 sm*.11];

c_m_1@1 c_m_2-c_m_4;

ia on team;

sa on team;

ia on gender;

sa on gender;

ia on age;

sa on age;

ia by c_a_1-c_a_4 @1;

sa by c_a_1@0 c_a_2@.25 c_a_3@.75 c_a_4@1;

[c_a_1$1*1.004 c_a_2$1*1.019 c_a_3$1*1.044 c_a_4$1*0.773] (1);

ia*3.939 sa*12.335;

ia with sa*3.11;

[ia@0 sa*1.184];

c_a_1@1 c_a_2-c_a_4;

OUTPUT: sampstat tech1;

PLOT: TYPE = Plot3;

series = c_m_1 (1) c_m_2 (2) c_m_3 (3) c_m_4 (4) |

c_a_1 (1) c_a_2 (2) c_a_3 (3) c_a_4 (4)

Biography

Nadra Erin Lisha is a postdoctoral fellow in the Postdoctoral Training Program in Drug Abuse Treatment/Services Research at the University of California, San Francisco (UCSF). She is particularly interested in elucidating the theoretical mechanisms that underlie the positive relationship between physical activity and alcohol use, as well as substance use and misuses in emerging adulthood. She is also interested in statistical techniques and how they can be best applied in longitudinal research.

William D. Crano is Oskamp professor and chair of psychology, Claremont Graduate University. His empirical work, involving primary and secondary analyses, is focused on the use of media in prevention of adolescent drug misuse.

Kevin L. Delucchi is professor of biostatistics in psychiatry at UCSF. He works primarily in studies of treatments of drug abuse.

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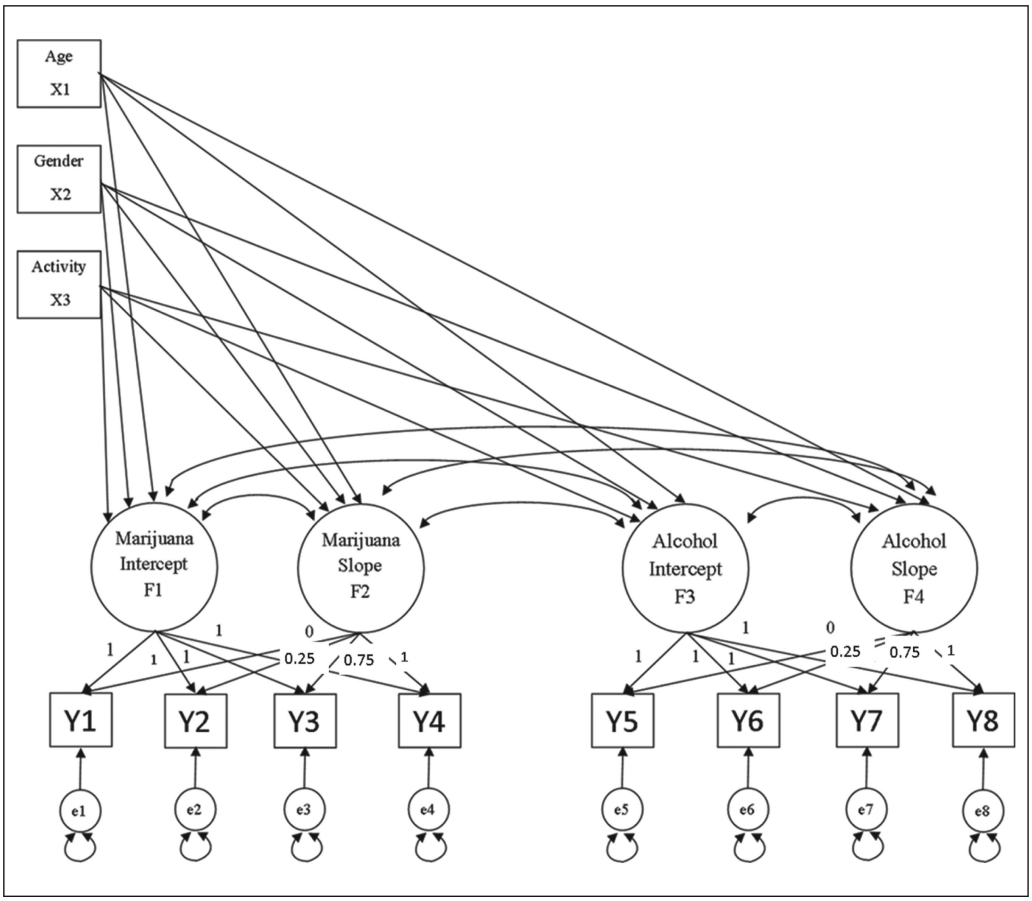

Figure 1.
Graphical representation of the associative growth mixture model.

Table 1

Means, Standard Deviations, and Zero-Order Correlations for All Predictor and Criterion Variables.

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Time 1 marijuana	—										
2. Time 2 marijuana	.60	—									
3. Time 3 marijuana	.44	.68	—								
4. Time 4 marijuana	.31	.52	.68	—							
5. Time 1 alcohol	.51	.46	.41	.34	—						
6. Time 2 alcohol	.36	.52	.49	.46	.57	—					
7. Time 3 alcohol	.24	.38	.50	.51	.46	.63	—				
8. Time 4 alcohol	.17	.29	.37	.49	.33	.49	.63	—			
9. Age	.38	.37	.34	.28	.47	.46	.41	.34	—		
10. Gender	.02	.01	−.01	−.01	.01	.01	−.03	−.04	−.02	—	
11. Team	−.10	−.05	−.05	−.01	−.05	−.02	.03	.07	−.13	.15	—
M	.11	.15	.19	.22	.27	.33	.39	.46	13.1	.52	.63
SD	.32	.36	.39	.42	.44	.47	.49	.49	2.6	.49	.48

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Table 2

Percentage of Users for Substance Use by Round as a Function of Age and Gender.

	Total (*N* = 25,613)	Male	Female	Ages 9-12	Ages 13-15	Ages 16-18
Time 1 marijuana	11.5	12.1	10.8	1.2	11.2	38.8
Time 2 marijuana	15.1	15.5	14.6	1.7	13.2	39.1
Time 3 marijuana	18.6	18.3	18.9	1.9	14.5	38.5
Time 4 marijuana	22.2	22.0	22.4	2.1	14.4	36.2
Time 1 alcohol	27.0	27.2	26.7	9.0	34.5	31.8
Time 2 alcohol	33.5	34.0	33.0	8.3	36.5	30.8
Time 3 alcohol	39.2	37.5	40.9	9.7	36.7	32.6
Time 4 alcohol	46.4	44.5	48.4	12.0	36.7	34.2

Note. Baseline gender and age indicators are used. Round 1 = Nov 1999-June 2001, Round 2 = July 2001-June 2002, Round 3 = July 2002-June 2003, Round 4 = July 2003-June 2004.