



Published in final edited form as:

Am J Prev Med. 2010 May ; 38(5): 491–498. doi:10.1016/j.amepre.2010.01.023.

Sports Participation and Problem Alcohol Use:

A Multi-Wave National Sample of Adolescents

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Abstract

Background—Sports participation, though offering numerous developmental benefits for youths, has been associated with adolescent alcohol use. Differences also exist between men/boys and women/girls in both sports participation and patterns of alcohol-related behaviors, but there are few longitudinal investigations of this relationship.

Purpose—This study investigated the relationship between school-based sports participation and alcohol-related behaviors using data from a multiwave national study of adolescent men/boys and women/girls.

Methods—Nationally representative data from the National Longitudinal Study of Adolescent Health, collected between 1994 and 2001, were analyzed in 2009 ($n = 8271$). Latent growth modeling, accommodating the complex sampling design, was applied to examine whether participation in school-based sports was associated with initial levels and change in problem alcohol use over three waves of data collection.

Results—After taking into account time-invariant covariates including demographics and other predictors of alcohol use, greater involvement in sports during adolescence was associated with faster average acceleration in problem alcohol use over time among youths who took part in only sports. The findings suggest, however, that the relationship between sports participation and problem alcohol use depends on participation in sports in combination with other activities, but it does not differ between men/boys and women/girls.

Conclusions—Sports may represent an important and efficient context for selective interventions to prevent problem alcohol use and negative consequences of alcohol use among adolescents.

Introduction

Sports participation is an important aspect of many adolescents' lives, offering benefits for cognitive, physical, and social development.^{1–3} Evidence suggests,^{4–8} however, that sports

participation may be associated with alcohol use among U.S. adolescents. Unfortunately, a review of research investigating this relationship reveals several limitations in previous studies. Many studies^{5,7,9,10} used measures of sports that do not distinguish between school-based and non-school-based contexts, which may have an impact on associations with drinking behaviors. There has also been limited research examining behaviors beyond alcohol consumption and heavy drinking, such as the negative consequences of alcohol use.⁷ Finally, prior longitudinal studies^{6,11–13} have been limited in similar ways.

Several studies^{6,7,11,12} have demonstrated differences between men/boys and women/girls in the relationship between sports participation and alcohol use, consistent with similar population-level data in both patterns of alcohol consumption¹⁴ and school-based sports participation.^{15,16} Longitudinal studies of these issues^{3,6,12} are limited to data collected at only two time points⁶ and among youths from two states.^{3,12} Prior research also suggests that developmental outcomes among youths are associated with participation in sports in combination with other activities (e.g., academic or music activities).^{17,18} However, no studies have examined the longitudinal relationships between participation in sports in combination with other activities and alcohol use and alcohol-related problems.

Whether sports participation is a risk factor for adolescent alcohol use is controversial^{11,19–21} and likely depends on other factors influencing alcohol use and sports participation, not on sports alone.^{21,22} Determining whether adolescents who participate in sports are more likely to use alcohol and experience alcohol-related problems over time has implications for the development of selective interventions targeting sports participants. Millions of U.S. adolescents take part in school-based sports each year,^{23,24} suggesting that sports may represent an important context for efficiently administering selective alcohol interventions to a large number of youths who can be easily identified by their participation in sports.

To advance research on this topic, the present study investigated the longitudinal relationship between school-based sports participation during adolescence and problem alcohol use by analyzing data from the National Longitudinal Study of Adolescent Health. The current study also examined differences between men/boys and women/girls in this relationship.

Methods

Procedures

Data were analyzed from the National Longitudinal Study of Adolescent Health (Add Health).²⁵ Add Health used a multistage, stratified-sampling design to create a representative sample of U.S. schools. The sampling frame included 26,666 high schools, from which a systematic random sample of 80 high schools was selected. For each high school selected, the largest feeder school was also recruited to participate. In total, 132 schools (79% of those selected) agreed to take part in the study.²⁵

The Add Health sample included youths in Grades 7 through 12 during the 1994–1995 school year.²⁵ An in-school questionnaire was administered to more than 90,000 students in

the 1994–1995 school year.²⁵ A randomly selected subsample of students completed in-home questionnaires during the same year (Wave 1, 1994–1995; $n = 20,745$) and approximately 1 (Wave 2, 1996; $n = 14,738$) and 6 years later (Wave 3, 2001–2002; $n = 15,170$).²⁵ The sample for the present study included adolescents who responded to the in-school assessment and all waves of the survey, and had weights designed for longitudinal analysis ($n = 8271$). Table 1 displays the characteristics of the sample by respondent gender.

Measures

Problem alcohol use—Several alcohol-related behaviors were assessed at each wave. Alcohol use behaviors in the past 12 months included drinking alcohol, getting drunk, and having five or more drinks on one occasion. Numerous alcohol-related problems in the past 12 months were also examined, such as having problems with parents, friends, or at school/work as a result of drinking; doing something regrettable while drinking; and drinking and driving. Similar to previous analyses of Add Health data,^{26–28} a continuous problem alcohol use variable was created for each wave by summing dichotomous variables for alcohol use and alcohol-related problems. Problem alcohol use (PAU) ranged from 0 to 12 for Wave 1 (PAU1; 12 items, Kuder–Richardson [KR]-20 = 0.87); 0 to 13 for Wave 2 (PAU2; 13 items, KR-20 = 0.88); and 0 to 12 for Wave 3 (PAU3; 12 items, KR-20 = 0.86). Table 2 illustrates descriptive statistics on alcohol-related behaviors by respondent gender.

Sports and other activity participation—Participation in school-based activities was measured at Wave 1 and variables were treated time-invariant. Participation in sports, academic, and music activities was operationalized in a manner similar to prior research.^{4,17} Sports participation was assessed during the in-school survey by stating, *Here is a list of clubs, organizations, and teams found at many schools. Darken the oval next to any of them you are participating in this year, or that you plan to participate in later in the school year.* The list of sports included cheerleading/dance team, baseball/softball, basketball, field hockey, football, ice hockey, soccer, swimming, tennis, track, volleyball, wrestling, and other sports. The number of sports was summed into a continuous variable for analyses. Response options for academic (e.g., foreign-language clubs, debate team) and music (e.g., band, choir) activities were included in the same index. Dichotomous variables were used to indicate whether respondents took part in any academic or music activities. Interaction terms were created to examine the effects of participation in sports in combination with academic or music activities. To create interaction terms, the number of sports reported was standardized and multiplied by the dichotomous music and academic activity variables, in order to avoid collinearity in analyses.

Covariates—All covariates were measured at Wave 1 and treated as time-invariant. Demographics included gender, age, and race/ethnicity. Other covariates included variables that prior research has shown to be strong predictors of problem alcohol use among adolescents (parental alcoholism, parental monitoring, friends' drinking).²⁹ Friends' drinking was measured by asking, *Of your 3 best friends, how many drink alcohol at least once a month?* with responses ranging from 0 to 3. Parental monitoring was measured by summing seven dichotomous items examining whether respondents' parents were involved in decisions related to curfew, bed time, friends, clothing, and TV watching (KR-20 = 0.94).

Parental alcoholism was assessed by asking parents interviewed at Wave 1 to indicate whether the respondent's biological mother or father currently had alcoholism. A dichotomous variable was created to indicate whether either biological parent had alcoholism based on self-report.

Data Analysis

Data were analyzed in 2009. Latent growth modeling (LGM)³⁰ was used to examine the longitudinal relationship between participation in school-based sports and other activities at Wave 1 and problem alcohol use over time. Latent growth modeling was applied because it has several advantages over alternative approaches to analysis of change, including relaxing assumptions underlying traditional approaches.³¹ Similar analyses have been conducted²⁸ in prior research using Add Health data.

Latent growth models were created using Mplus 5.2,³² accounting for the sampling design using the suggested cluster, stratification, and weight variables.³³ The LGMs included two latent variables representing the intercept and slope factors for problem alcohol use. The intercept and slope each have two parameters, representing the mean and variance of the collection of initial levels of alcohol use and rate of change in drinking behaviors. The intercept factor represents the average intercept at Wave 1 derived from estimated individual intercepts of each participant; the factor loading for each of the measured variables was fixed at 1 to constrain the height of the reference curve. For the growth factor, the time points for the manifest alcohol variables were fixed at 1, 2, and 6, corresponding to the time at which data collection occurred at each of the three waves. The parameter estimates for covariates and predictors from the LGM can be interpreted in a manner similar to standard regression models. The parameters indicate whether covariates and predictors are significantly associated with initial status (i.e., intercept) and rate of change in problem alcohol use over time (i.e., slope). Model fit was assessed using the following criteria: comparative fit index (CFI)>0.96; root mean square error of approximation (RMSEA)<0.05.³⁴

An unconditional growth model, without predictors or covariates, was first created to confirm that the data were consistent with the specified LGM ($\chi^2[1] = 10.3, p = 0.001, CFI = 1.00, RMSEA = 0.03$) and that there was significant variation in the latent intercept ($t = 18.62, p < 0.001$) and slope ($t = 8.89, p < 0.001$) factors to be explained by adding predictors. Although the chi-square statistic for the model was significant, the significance of chi-square statistics is highly sensitive to large sample sizes.³⁰ Given the large sample in the present study, even slight distributional differences could lead to a significant model chi-square statistic.³⁰ After establishing the unconditional LGM, time-invariant predictors, covariates, and interaction terms were added to the model. This conditional model evaluated how well time-invariant predictors, covariates, and interaction terms predicted average initial levels and growth in problem alcohol use.

To test whether the relationship between participation in sports and other school-based activities and drinking behaviors differed by respondent gender, a multiple-group LGM was evaluated. First, a complete invariance model was created, which included 20 equality constraints holding the intercept and slope parameters for each predictor and covariate equal

across men/boys and women/girls. Modification indices were then examined and the equality constraints for the covariates and the activity variables were released systematically based on the modification indices. The rescaled Satorra–Bentler chi-square test³⁵ was used to evaluate whether freeing equality constraints improved model fit.

Results

Conditional Latent Growth Modeling for the Sample

The conditional LGM ($n = 8271$) was a good fit for the observed data ($\chi^2[12] = 30.9$, $p = 0.002$, CFI = 1.00, RMSEA = 0.01), explaining 35% and 24% of the variance in the latent intercept and slope factors, respectively (Figure 1). The means of the measured alcohol variables increased over time (Wave 1, 1.67; Wave 2, 1.90; Wave 3, 3.44). Participation in sports without other activities at Wave 1 was a significant predictor of growth in alcohol-related behaviors, indicating that, without taking part in other activity types, greater sports involvement at Wave 1 was associated with more rapid average growth in problem alcohol use. However, among those who took part in sports *and* academic activities at Wave 1, greater sports involvement was associated with slower average acceleration in alcohol use over time. Participation in music activities without sports at Wave 1 was associated with significantly lower initial levels of problem alcohol use and with more accelerated growth in alcohol-related behaviors. Of the activity combinations examined, participation in music activities without sports was most strongly associated with initial status and growth in problem alcohol use. Neither participation in academic activities without sports nor participation in sports with music activities was significantly associated with the intercept or slope factors.

Multiple-Group Latent Growth Modeling

The complete invariance model was a good fit for the data ($\chi^2[42] = 84.9$, $p = 0.002$, CFI = 0.99, RMSEA = 0.02). Modification indices indicated that the intercept parameters for the covariates age, white race, and friends' drinking differed significantly between men/boys and women/girls. Freeing the equality constraints for these three parameters significantly improved model fit (Satorra–Bentler $\chi^2[3] = 7.91$, $p = 0.02$) and the resulting partial invariance model fit the data well ($\chi^2[39] = 64.8$, $p = 0.006$, CFI = 0.99, RMSEA = 0.01). One additional modification index indicated that the slope parameter for participation in both sports and academic activities differed significantly between men/boys and women/girls. Freeing this equality constraint, however, did not significantly improve model fit (Satorra–Bentler $\chi^2[1] = 1.05$, $p = 0.15$). Consequently, the final model held all parameters equal between men/boys and women/girls except the intercept parameters for the covariates age, white race, and friends' drinking.

The results of the final model are displayed in Table 3. Substantively, there were no significant differences between men/boys and women/girls in the relationships between participation in sports and other activities and problem alcohol use.

Discussion

Among adolescents who participated only in sports, greater sports involvement was associated with faster average acceleration in problem alcohol use. The longitudinal relationship between sports participation and alcohol-related behaviors varied based on respondents' participation in nonsports activities, in both men/boys and women/girls.

Among adolescents who participated only in sports at Wave 1, greater sports involvement was associated, on average, with significantly more rapid growth in problem alcohol use. This finding supports prior research,^{3,13,36} which suggests that sports participation is associated with more rapid increases in drinking during adolescence. It also suggests that, among those who participate only in sports, greater involvement in sports may be associated with a more comprehensive alcohol use construct, which includes a number of negative consequences of drinking alcohol.

Consistent with prior research,¹⁴ men/boys and women/girls evinced increasing levels of drinking behaviors over time, and men/boys had slightly higher levels compared to women/girls, especially at Wave 3. The negative correlation between the intercept and slope factors in the LGMs shows that adolescents with lower initial levels of problem alcohol use at Wave 1 exhibited faster acceleration in alcohol-related behaviors over time, a finding consistent with previous analyses of Add Health data.²⁸ This is due to the fact that respondents with higher initial levels of problem alcohol use were more likely to maintain those levels over time, whereas those with lower initial levels of alcohol use demonstrated more rapid growth over time.²⁸

The findings of the multiple-group analysis indicate that there were no differences between men/boys and women/girls in the relationships between participation in sports and other activities and problem alcohol use. In the final model, the relationship between initial status in alcohol-related behaviors and three covariates (age, white race, and friends' drinking) differed between men/boys and women/girls; however, there was no significant improvement in model fit when equality constraints for participation in sports and other activities were released. Recent studies examining similar relationships are useful to contextualize several specific findings. For instance, the findings of the present study indicate that among adolescents who participated in one or more academic activity and sports, greater sports involvement was associated with slower average acceleration in drinking behaviors over time. In another recent study,¹⁸ it was demonstrated that participation in sports plus other nonsports activities was associated with more positive developmental outcomes, when compared to sports participation alone. When alcohol use was specifically examined, however, participation in sports plus other activities was positively associated with drinking behaviors over time.¹⁸ In contrast, the results from the present study suggest that one pattern of activity participation that may benefit adolescents with respect to drinking behaviors is participation in sports plus academic activities. Prior research¹³ also indicates that, compared to sports participants, youths who engage in academic activities are more academically inclined, less likely to drink alcohol, and have fewer friends who drink. Taken together, this evidence suggests that the developmental

benefits associated with participation in academic activities may outweigh any risks resulting from participation in sports with respect to alcohol-related behaviors.

Research also indicates that youths who participate in performing arts, such as music activities, exhibit significantly lower levels of alcohol use during adolescence³ and more rapid increases in drinking over time,¹³ and that this relationship is moderated by respondents' gender.³ The findings from the present study reflect a similar pattern with respect to music activities; however, the differences between men/boys and women/girls reported previously³ were not evident. Participation in music activities without sports was significantly associated with lower initial levels and more rapid average growth in alcohol-related behaviors over time, and this pattern of activity participation was most strongly linked to initial status and change in problem alcohol use over time. In addition, this relationship was not present among adolescents who participated in *both* sports and music activities.

These findings highlight the potential importance of school-based sports and other activities as contexts for interventions to reduce problem alcohol use. Millions of U.S. adolescents take part in school-based sports each year,²³ and these youths can be easily targeted by selective prevention efforts.³⁷ In addition, indicated interventions may be tailored to sports participants who are at a greater risk for alcohol-related problems over time. Recent research suggests, for example, that adolescents who participate in sports and engage in other problem behaviors may be more likely to engage in heavy drinking and experience alcohol-related problems over time.¹¹ A few preliminary educational and skills-based interventions integrated into sports contexts^{38,39} have shown promising results in reducing alcohol use and improving alcohol expectancies, behavioral control, and normative beliefs. Recent research also suggests that sports-based intervention programs may result in sustained reductions of drinking into young adulthood, particularly among women/girls.⁴⁰ Interventions implementing drug-testing programs, however, have failed to demonstrate reductions in alcohol use among sports participants.⁴¹ Nevertheless, the impact of educational and skills-based alcohol interventions targeting adolescent sports participants has been limited.^{38,40} Research is needed to better understand the optimal targets of selective interventions seeking to reduce alcohol use among adolescent sports participants.

The present study has several strengths, including the large sample, longitudinal design, and expanded measures of sports participation and drinking behaviors, compared to previous longitudinal research. Nevertheless, because of study limitations, caution should be exercised when interpreting the findings. First, all assessments were based on self-report and may have been affected by respondent biases. Second, only adolescents who were enrolled at participating schools could take part in the Add Health study, which excluded youths who were not in school from the sample. Third, only participants with weights at all waves of data collection were included in analyses because a substantial proportion of the initial sample was lost to follow-up. Finally, the use of only three data points for the LGMs limited the shape of growth curves that could be tested.

Despite these limitations, the findings of the present study suggest that selective interventions targeting adolescents who take part in school-based sports may help reduce problem alcohol use among youths.

Acknowledgments

The preparation of this manuscript was supported in part through professional development funding by the Laney Graduate School of Arts&Sciences, Emory University. This research uses data from Add Health, a program project designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 17 other agencies. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. People interested in obtaining data files from Add Health should contact Add Health, Carolina Population Center, 123 W. Franklin Street, Chapel Hill NC 27516-2524 (addhealth@unc.edu). No direct support was received from grant P01-HD31921 for this analysis.

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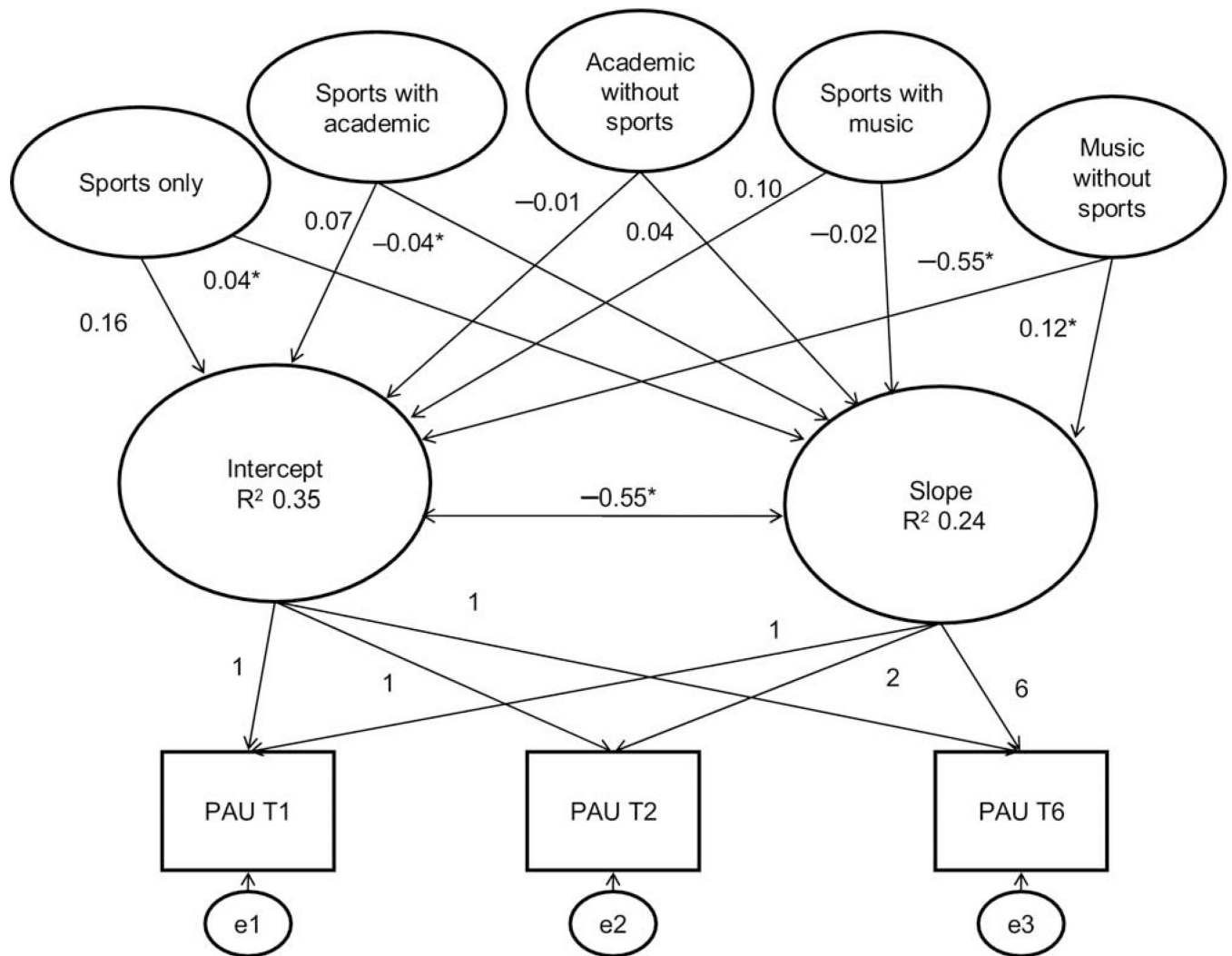


Figure 1.

Latent growth model for the sample

Note: Latent growth model among the entire sample ($n = 8721$). Model fit: $\chi^2(12) = 30.9$, $p = 0.002$, CFI = 1.00, RMSEA = 0.01. Time-invariant (Wave-1) covariates not shown in the figure included gender, white race, age, parental alcoholism, friends' drinking, and parental monitoring. Significant paths at $p < 0.05$ are denoted by an asterisk. Error terms e1–e3 represent variability in measured problem alcohol use not explained by the model. Unstandardized coefficients are displayed. CFI, comparative fit index; PAU, problem alcohol use; RMSEA, root mean square error of approximation

Table 1

Sample characteristics by respondent gender—weighted percentages unless otherwise indicated

	Sample (n=8721)	Men/boys (n=3814)	Women/girls (n=4457)
Wave-1 age (years; M [SE])	14.4 (0.12)	14.5 (0.12)	14.3 (0.12)
12	14.1	13.3	14.9
13–15	58.8	57.8	59.8
16–17	25.2	26.3	24.0
18	1.9	2.6	1.3
Race/ethnicity			
Black (non-Hispanic)	15.6	14.5	16.6
Hispanic	10.1	10.2	10.0
White (non-Hispanic)	69.6	70.2	69.1
Other	4.7	5.1	4.3
Sports involvement (M [SE])	1.25 (0.05)	1.38 (0.05)	1.12 (0.04)
Any academic activity	33.6	26.9	40.1
Any music activity	25.8	18.3	33.0
Parental monitoring (M [SE])	5.37 (0.10)	5.38 (0.10)	5.37 (0.10)
Friends drinking (M [SE])	1.10 (0.05)	1.15 (0.05)	1.05 (0.04)
Parental alcoholism	15.9	14.7	17.0

Table 2
 Past 12 months' alcohol use and related consequences by gender—weighted percentages unless otherwise indicated

	Wave 1		Wave 2		Wave 3	
	Men/boys	Women/girls	Men/boys	Women/girls	Men/boys	Women/girls
Alcohol-related problems						
Any drinking	42.6	43.5	43.4	45.4	76.1	72.7
Binge drinking	24.4	20.3	29.8	25.6	60.9	44.1
Gotten drunk	25.0	23.8	29.6	27.8	59.9	48.5
Parent problems	8.7	7.8	9.3	7.0	—	—
School/work problems	2.4	2.2	2.6	2.5	8.8	4.9
Friend problems	4.6	6.2	5.3	6.8	11.3	6.4
Dating problems	6.1	7.2	6.5	8.0	12.6	9.8
Regret act	11.2	13.4	11.2	12.1	—	—
Regret sex	5.8	6.0	7.5	7.3	19.4	12.8
Hung over	15.7	16.7	18.7	18.6	47.6	39.5
Sick/threw up	14.9	14.8	17.3	17.3	39.5	35.4
Physical fight	6.4	3.8	7.2	3.9	13.9	3.6
Drive drunk	—	—	6.3	3.5	32.9	18.3
Drunk at school/work	—	—	—	—	9.2	3.1
Problem alcohol use (M [SE])	1.68 (0.11)	1.66 (0.08)	1.94 (0.12)	1.85 (0.09)	3.89 ^a (0.12)	2.99 ^b (0.09)

Note: Means with different superscript letters are significantly different at $p < 0.01$. Tests for mean differences for weighted means derived using contrast statements SAS PROC SURVEYREG.

Table 3

Final multiple group latent-growth model examining differences between men/boys and women/girls

	Men/boys (n =3814)	Women/girls (n=4457)
PROBLEM ALCOHOL USE INTERCEPT PARAMETERS		
Time-invariant activities		
Sports only	0.02	0.02
Sports with academic	0.06	0.06
Academic without sports (1=yes)	0.00	0.00
Sports with music	0.11	0.11
Music without sports (1=yes)	0.55***	0.55***
Time-invariant covariates		
Wave-1 age ^a	0.46***	0.34***
White race (1=yes) ^a	0.36**	0.56***
Friends' drinking ^a	0.71***	0.85***
Parental monitoring	-0.01	-0.01
Parental alcoholism (1=yes)	0.37	0.37
PROBLEM ALCOHOL USE SLOPE PARAMETERS		
Time-invariant activities		
Sports only	0.04***	0.04***
Sports with academic	-0.04*	-0.04*
Academic without sports (1=yes)	0.04	0.04
Sports with music	-0.02	-0.02
Music without sports (1=yes)	0.12***	0.12***
Time-invariant covariates		
Wave-1 age	-0.07***	-0.07***
White race (1=yes)	0.15***	0.15***
Friends' drinking	-0.10***	-0.10***
Parental monitoring	0.00	0.00
Parental alcoholism (1=yes)	-0.07	-0.07
Correlation between intercept and slope	-0.50***	-0.58***

Note: Model fit: $\chi^2(39)=64.8$, $p=0.006$, comparative fit index=0.99, root mean square error=0.01. Unstandardized coefficients are displayed. Boldface indicates significance.

^aEquality constraints across men/boys and women/girls released based on modification indices

* $p<0.06$;

** $p<0.01$;

*** $p<0.001$