

PAA 2011

Manuscript Draft: Race and Gender Differences in Adolescent Alcohol Use

March 10, 2011

**Assessment of Race and Gender Differences in Patterns of Adolescent Alcohol Use and Associations
with Adolescent and Adult Illicit Drug Use in the United States: A Latent Class Analysis**

Maria R. Khan, *Department of Epidemiology, University of Maryland, College Park, MD*

Charles M. Cleland, *NYU College of Nursing, New York, NY*

Amanda T. Berger, *Department of Family Science, University of Maryland, College Park, MD*

ABSTRACT

Using the National Longitudinal Study of Adolescent Health, we conducted latent class analyses of adolescent alcohol use by race and estimated associations between latent class membership and adolescent (Wave I) and adulthood (Wave III) illicit drug use. Alcohol use was higher among whites than blacks. Analyses yielded a four class solution among whites [abstainers (male: 49%, female: 49%); experimenters (male: 16%, female: 19%); moderate drinkers (male: 18%, female: 22%); problem drinkers, who reported high alcohol use and alcohol-related consequences (male: 16%, female: 10%)] *versus* a three class solution among blacks [abstainers (male: 64%, female: 63%); experimenters (male: 20%, female: 24%); problem drinkers (male: 17%, female: 12%)]. Within race, no gender differences in alcohol use typologies were observed. In analyses adjusting for socio-demographic factors and past drug use, white and black experimenters and, to a greater extent, moderate/problem drinkers reported more adolescent and adult drug use. Race-specific typologies must be considered when addressing adolescent alcohol use and when planning drug prevention programs.

INTRODUCTION

Alcohol is the most commonly used substance among adolescents in the United States (US);¹ 72.5% of high school students have tried alcohol, 41.8% currently use alcohol, and 24.2% report heavy or binge drinking behavior.² Adolescent alcohol use has deleterious short-term and long-term consequences. Adolescent use of alcohol is thought to negatively influence cognitive, neurological, and psychosocial development,³⁻⁸ which may lead to inhibited judgment and increased impulsivity,⁹⁻¹¹ as well as involvement in high-risk behaviors and environments^{12,13} Adolescent alcohol use is associated with negative physical and psychosocial outcomes such as an increased risk for exhibiting violence and aggression,^{14,15} poor school performance,¹⁶ risky sexual behavior,⁸ and illicit substance use,⁹ unintended injuries, homicide, and suicide.¹⁷ Adolescent alcohol use also is strongly associated with use of other illicit substance uses both during adolescence^{26,31} and in adulthood.¹⁸⁻²⁰

Research indicates that a one-dimensional measure of alcohol use may not accurately identify problem groups; a more appropriate measurement approach may include identifying multi-dimensional risk groups.²¹ Latent class analysis (LCA) is a model-based analogue to cluster analysis that captures the heterogeneity in a population by identifying groups of individuals that are homogenous with respect to a set of observed variables.²² LCA is a technique that has been employed to identify groups of adolescent alcohol users.²³⁻²⁵ A number of prior LCA studies have identified the latent class structure of adolescent alcohol use in US sub-populations, including current drinkers, college students, and clinical samples, such as those in addiction treatment centers.²⁵⁻²⁸ Though adolescent alcohol use is a clear public health concern in the US general population, there is limited research on typologies of adolescent alcohol use using data that are nationally-representative.²⁹ In addition, there is limited research assessing whether adolescent alcohol use typologies differ by race and gender in general-population US samples, though current evidence points to differences in adolescent alcohol use typologies by race.^{29,30}

Dauber et al. (2009) used Wave I of the public use dataset of the National Longitudinal Study of Adolescent Health (Add Health), a data source which contains half the observations of the full Add Health dataset but that yields nationally-representative estimates by race, to examine alcohol use typologies among

white and African American adolescent girls.²⁹ The study, importantly, indicated that latent class structure differed for African American and white girls in the US general population, highlighting the need to conduct population-specific LCAs of adolescent alcohol use to best understand the phenomenon of adolescent alcohol use in the US and to most effectively plan alcohol and substance use prevention programs for each sub-population. The study, conducted only among girls and in half the Add Health sample, points to the need to conduct an alcohol use LCA in the full Add Health dataset to assess whether latent class structure of adolescent alcohol use differs not only by race but by gender in the US general population.

An important strength of Add Health is the ability to assess, not only correlates of adolescent health using Wave I data, but also the longitudinal relationship between adolescent risk factors and long-term adulthood health outcomes. Since adolescent alcohol use is strongly associated with use of illicit drugs both during adolescence^{26,31} and adulthood,¹⁸⁻²⁰ measurement of the association between adolescent alcohol latent class membership and both adolescent and adulthood substance use in a nationally-representative sample is warranted. By identifying groups of adolescent alcohol users by race and by examining associations between latent class membership and use of other drugs, it may be possible to identify the degree to which alcohol users—and which types of users—constitute priority populations for substance use prevention and treatment.

The purpose of this study was to expand on the work by Dauber et al. (2009) to use Waves I (1994-95; adolescence) and III (2001-2002; adulthood) of the complete sample of the National Longitudinal Study of Adolescent Health (Add Health) to conduct latent class analyses to identify adolescent alcohol use groups based on indicators of frequency, severity, and consequences of alcohol use, by race (African American and white) and gender, and to measure associations between latent class membership and both adolescent and young adult illicit drug use.

METHODS

Data

Using longitudinal data from Waves I (1994-95; adolescence) and III (2001-02; young adulthood) of the National Longitudinal Study of Adolescent Health (Add Health) survey (N=13,123), we conducted latent class analyses to identify adolescent alcohol use groups by gender and by race (African American, N= 4,005; white N = 9,548). The Add Health study includes a nationally representative sample of adolescents who were in grades 7-12 in the United States during the 1994-1995 school year and follows them into young adulthood. The data are, thus, appropriate for use in the current study because they allow for analyses of adolescent risk behaviors, for comparisons between sub-populations, and for identification of risk trajectories into adulthood.

Measures

Adolescent Alcohol Use Indicators Used in LCA

An initial group of adolescents who abstained from alcohol were identified by asking two questions at Wave I: "Have you had a drink of beer, wine, or liquor—not just a sip or a taste of someone else's drink—more than 2 or 3 times in your life?" and "During the past 12 months, on how many days did you drink alcohol?" If the response to the first question was no, the subsequent alcohol questions were skipped for that participant. If the answer to the second question was never, the adolescents were classified as being in the Abstainer group. To identify classes of adolescent alcohol users, the following indicators of adolescent alcohol use were used:

Alcohol Use Four adolescent alcohol use indicators were used; the first was *Frequency of Drinking* ("During the past 12 months, on how many days did you drink alcohol?"). This variable was rescaled so that 0 = never; 1 = once a month; 2 = 2-3 times a month; 3 = once a week or more. The next variables were *Frequency of Being Drunk* ("Over the past 12 months, on how many days have you gotten drunk or 'very, very high' on alcohol?"); and *Frequency of Binge Drinking* ("Over the past 12 months, on how many days did you drink five or more drinks in a row?"). These were rescaled so that 0 = never bingeing/getting drunk, 1 = bingeing/getting drunk less than monthly, and 2 = bingeing/getting drunk once a month or more. The fourth variable was

Quantity of Drinking (“Think of all the times you have had a drink during the past 12 months. How many drinks did you usually have each time?”); this variable was rescaled so that 0 = no drinks, 1 = one drink, 2 = 2-3 drinks, and 3 = four or more drinks per occasion.

Physiological Consequences of Alcohol Use Two indicators of physiological consequences of alcohol were used: *Hangovers* (“Over the past 12 months, how many times were you hung over?”); and *Getting Sick to Stomach/Throwing Up* (“Over the past 12 months, how many times were you sick to your stomach or threw up after drinking”). Each was rescaled: 0 = never drank; 1 = drank but the problem was not reported; and 2 = drank and the problem was reported.

Social Consequences of Alcohol Use These indicators measured whether adolescents had social problems due to alcohol and included: *Problems with Parents* (“You got into trouble with your parents because you had been drinking”); *Problems with School* (“You’ve had problems at school or with school work because you had been drinking”); *Problems with Friends* (“You had problems with your friends because you had been drinking”); or *Problems with Dating* (“You had problems with someone you were dating because you had been drinking”). Additional indicators included: *Getting into Regrettable Situations* (“You did something you later regretted because you had been drinking”); *Getting into Regrettable Sexual Situations* (“Over the past 12 months, did you get into a sexual situation that you later regretted because you had been drinking”); and *Getting into Physical Fights* (“Over the past 12 months, did you get into a physical fight because you had been drinking”). Each variable was rescaled so that 0 = never drank; 1 = drank but the problem was not reported; and 2 = drank and the problem was reported.

Peer Alcohol Associations This indicator was based on how many of the adolescent’s friends used alcohol: *Friends who Drink* (“Of your 3 best friends, how many drink alcohol at least once a month?”). This variable was rescaled to indicate that 0 = never drank; 1 = drank but no best friends drank; and 2 = drank and one or more best friends drank at least monthly.

Adolescent and Young Adult Correlates of Latent Class Membership

Socio-demographic Characteristics We examined associations between latent class membership and the following: age; maternal education measured by Wave I self-report if the mother was interviewed, otherwise by adolescent's report; and Wave III low functional income status in the past year (mother or father on public assistance or a household inability to pay for housing or pay ones bills).

Adolescent Illicit Drug Use We examined associations between class membership and use of the following substances in adolescence: *Marijuana*; *Cocaine* (including powder, freebase, crack cocaine); *Inhalants* (including glue, solvents); or *Injection Drugs* (including heroin, cocaine). Respondents were asked whether they had ever used each substance and were coded as: 0 = never used and 1 = used.

Analyses

Using Mplus software, LCAs were conducted to identify classes of adolescent alcohol use based on indicators of frequency, severity, and consequences of adolescent alcohol use. Given their expected association with patterns of alcohol use and alcohol use consequences, age and lifetime marijuana use at Wave I were included as covariates in latent class analyses. The distinction between indicators and covariates in these models is that the latent class variable is thought to be a cause of responses to indicator variables (i.e., indicators are regressed on latent class) while the covariates predict latent class membership (i.e., latent class is regressed on covariates). Four racial and gender subgroups were defined (African American males, African American females, white males, and white females), and the optimal number of classes for each group was identified using the Lo-Mendell-Rubin adjusted likelihood ratio test. The Lo-Mendell-Rubin test compares the fit of a $k - 1$ class model with the fit of a k class model, with the p-value indicating whether the improvement in fit due to adding an additional class is statistically significant. When the test is not statistically significant, the $k - 1$ class model is preferred over the k class model (see Lo, Mendell, & Rubin, 2001 for a more detailed review of methods).ⁱ We used logistic regression to measure associations (odds ratios and 95% confidence intervals) between latent class membership and respondent socio-demographic characteristics and use of illicit

drugs in adolescence. Survey commands in Stata (version 11.1) were used to account for stratification, clustering, and unequal selection probabilities, yielding nationally representative estimates.

RESULTS

Race Differences in Adolescent Alcohol Use Indicators

Whites were more likely than African Americans to have used alcohol in the previous year (whites: 53%, African Americans: 35%); to drink more frequently, indicated by drinking more two to three times a month (whites: 10%, African Americans: 5%) and weekly (whites: 11%, African Americans: 8%); to drink a greater number of drinks per occasion; to binge drink (whites: 32%, African Americans: 14%); and to get drunk (whites: 35%, African Americans: 17%) (Table 1). Whites also were more likely to experience physiological and social consequences (including regretting an action taken) due to drinking (whites: 17%, African Americans: 9%) and to have drinking-related problems with a parent (whites: 11%, African Americans: 5%), friend (whites: 8%, African Americans: 3%), or dating partner (whites: 10%, African Americans: 5%). In addition, having a best friend peer who drank at least once per month was more common among whites (44%) than African Americans (28%).

Patterns of Adolescent Alcohol Use

Figure 1 presents profiles of each latent class on the indicator variables. The abstainer latent classes, which are at the lowest category of every ordinal indicator variable, are not shown. The LCAs indicated that numbers of classes and patterns of use differed by race but were comparable among males and females within each race. Among male and female white adolescents three alcohol use groups were identified (experimenters, moderate users, and problem users) while among male and female African American adolescents two alcohol use groups were identified (experimenters and problem users). White problem users reported greater a frequency and quantity of drinking and greater levels of drinking-related problems than African American problem users.

White Adolescents

Among white adolescents, gender-specific LCAs indicated that a four class solution best fit the data. Among whites, 49% of males and females were abstainers; 16% of males and 19% of females were experimenters; 18% of males and 22% of females were moderate drinkers; and 16% of males and 10% of females were problem drinkers.

Among white males and females in the problem drinking class, frequency, quantity, binge, and drunk were near the maximum, suggesting that those in this group drank approximately weekly, on a typical drinking occasion had approximately four or more drinks, and binged and got drunk once per month or more commonly. Among these problem users, 42% had problems with parents; 17% had problems with school; 29% had problems with friends; 35% had problems with dating; 58% had regretted actions; 72% had been hungover; 69% had been sick; 40% had regretted sex; 34% had problems fighting; and nearly all (97%) had peers who drank at least monthly.

White male and female moderate drinkers drank less frequently than problem drinkers (less than weekly but generally more than once a month), but on a typical drinking occasion they had a comparable number of drinks as problem drinkers (approximately four or more drinks). Binging and getting drunk occurred less than once per month. White moderate drinkers reported social consequences of alcohol use including problems with parents and dating, but at lower levels than observed among problem drinkers. Most moderate drinkers (87%) had a best friend peer who drank at least once per month.

Finally, white experimenters reported moderate frequency and quantity of drinking and 68% had peer who drank at least once per month, yet they were unlikely to report physiological or social consequences.

African American Adolescents

Among African American adolescents, the gender-specific LCAs indicated that a three class solution best fit the data. In this group, 64% of males and 63% females were abstainers; 20% of males and 24% of females were experimenters; 19% of males and 12% of females were problem drinkers.

African American problem drinkers reported drinking less frequently and drinking few drinks than white problem drinkers. Specifically, while white problem drinkers drank approximately weekly, many African

American problem drinkers (55%) drank less than weekly. On a typical drinking occasion, 90% of white problem drinkers consumed 4 or more drinks while only 66% African American problem drinkers consumed 4 or more drinks. Further, bingeing and getting drunk occurred at least once a month among white problem drinkers and less than once a month among most African American problem drinkers. However, physiological and social consequences of drinking occurred about as commonly among African American problem users as their white counterparts.

African American experimenters exhibited a drinking pattern similar to that observed among white experimenters; African American experimenters reported moderate frequency and quantity of drinking and high levels of peer drinking yet were unlikely to report physiological or social consequences.

Associations between Participant Characteristics and Alcohol Use Latent Class

Table 2 represents the socio-demographic profiles of the abstainer and experimenter groups *versus* the moderate and problems drinking groups. Comparing groups, adolescents who were older at Wave I were significantly more likely to be in the moderate/problem drinking groups than in the abstainer/experimenter groups. Females were less likely to be in the moderate/drinking groups than males (odds ratio (OR): 0.87; 95% confidence interval (CI): 0.78-0.97), and African Americans were significantly less likely to be in one of the drinking groups than whites (OR: 0.34; 95% CI: 0.26-0.43). Adolescents who lived in households that had problems paying bills or paying for housing were significantly more likely to be in the moderate/problems drinking groups than those that did not have such problems (OR: 1.51; 95% CI: 1.30-1.76).

Associations between Adolescent Alcohol Use Latent Class and Adolescent Drug Use

Whites

For white males, being in any of the drinking groups was associated with marijuana use (*experimenter* OR: 3.10; 95% CI: 2.30-4.17; *moderate* OR: 11.30; 95% CI: 8.51-15.01; *problem* OR: 29.37; 95% CI: 20.37-42.34). Being in the moderate or problems drinking groups was associated with cocaine use (*moderate* OR: 4.53; 95% CI: 2.44-8.41; *problem* OR: 13.28; 95% CI: 7.50-23.54), inhalant use (*moderate* OR: 4.81; 95% CI: 3.09-7.47; *problem* OR: 7.22; 95% CI: 4.47-11.64), and injection drug use (*moderate* OR: 15.21; 95% CI: 3.42-

67.60; *problem* OR: 49.22; 95% CI: 11.76-205.97). However, being in the experimenter group was associated with a decreased likelihood of injection drug use (*experimenter* OR: 0.10; 95% CI: 0.02-0.60).

For white females, being in any of the drinking groups (experimenter, moderate, or problem) was associated with marijuana use (*experimenter* OR: 2.89; 95% CI: 2.12-3.94; *moderate* OR: 17.31; 95% CI: 13.39-22.37; *problem* OR: 59.60; 95% CI: 42.02-84.50). Being in either the moderate or problem drinking groups was associated with cocaine use (*moderate* OR: 5.95; 95% CI: 3.28-10.78; *problem* OR: 16.79; 95% CI: 9.44-29.85) and inhalant use (*moderate* OR: 3.04; 95% CI: 2.05-4.53; *problem* OR: 7.11; 95% CI: 4.60-10.99). Also, problem drinking was associated with injection drug use (*problem* OR: 14.99; 95% CI: 4.51-49.87).

Controlling for confounders, analyses among white adolescents revealed that being in any of the drinking groups was associated with a 3 to 35 times greater likelihood of adolescent marijuana use (*experimenter* OR: 2.95, 95% CI: 2.35-3.71; *moderate* OR: 12.83, 95% CI: 10.50-15.68; *problem* OR: 35.97, 95% CI: 26.91-48.08). Being in any of the drinking groups also was associated with an increased likelihood of inhalant use (*experimenter* OR: 1.76, 95% CI: 1.20—2.57); *moderate* OR: 4.36, 95% CI: 3.23-5.90; *problem* OR: 8.15, 95% CI: 5.73-11.57). Being in the moderate or problems drinking groups was associated both with cocaine use (*moderate* OR: 4.98; 95% CI: 2.99-8.31; *problem* OR: 14.17; 95% CI: 8.94-22.48) and injection drug use (*moderate* OR: 6.19; 95% CI: 2.06-18.62; *problem* OR: 25.40; 95% CI: 8.18-78.90). However, being in the experimenter group was associated with a significantly decreased likelihood of injection drug use (*experimenter* OR: 0.04, 95% CI: 0.01-0.20).

African Americans

For African American males, being in either of the drinking groups was significantly associated with marijuana use (*experimenter* OR: 4.38; 95% CI: 2.99-6.41; *problem* OR: 16.69; 95% CI: 10.81-25.76). Being in the problem drinking group was also associated with use of cocaine (*problem* OR: 3.39; 95% CI: 1.33-8.62), inhalants (*problem* OR: 2.82; 95% CI: 1.29-6.16), and injection drugs (*problem* OR: 14.07; 95% CI: 1.54-128.75).

For African American females, being in either of the two drinking classes (moderate drinkers or problems users) was significantly associated with marijuana use (*experimenter* OR: 3.72; 95% CI: 2.57-5.38; *problem* OR: 24.92; 95% CI: 16.03-38.75) (Table 3). However, being in the experimenter group was also associated with a decreased likelihood of cocaine use (*experimenter* OR: 0.06; 95% CI: 0.01-0.48).

Among African American adolescents, adjusted analyses revealed that being in either of the drinking groups was associated with a 4 to 20 times greater likelihood of adolescent marijuana use (*experimenter* OR: 3.99, 95% CI: 2.78-5.72; *problem* OR: 20.26, 95% CI: 14.31-28.68). Being in the problem drinking group was associated with an increased likelihood of cocaine use (*problem* OR: 3.49, 95% CI: 1.48-8.23), inhalant use (*problem* OR: 2.39, 95% CI: 1.22—2.57); and injection drug use (*problem* OR: 7.15, 95% CI: 1.50-34.00). However, being in the experimenter group was associated with a significantly decreased likelihood of cocaine use (*experimenter* OR: 0.19, 95% CI: 0.04-0.92).

Associations between Adolescent Alcohol Use Latent Class and Young Adult Drug Use

Whites

Controlling for confounders and adolescent drug use, adjusted analyses revealed that among whites, being in any of the drinking groups in adolescence was associated with an increased likelihood of young adulthood marijuana use (*experimenter* OR: 1.58, 95% CI: 1.34-1.87; *moderate* OR: 2.18, 95% CI: 1.83-2.59; *problem* OR: 2.33, 95% CI: 1.83-2.96). Being in the moderate or problems drinking groups was associated both with cocaine use (*moderate* OR: 1.88; 95% CI: 1.30-2.71; *problem* OR: 2.13; 95% CI: 1.47-3.07) and other illicit drug use (*moderate* OR: 1.81; 95% CI: 1.31-2.49; *problem* OR: 1.65; 95% CI: 1.20-2.27). Additionally, being in the moderate drinking group was associated with an increased likelihood of crystal methamphetamine use (*moderate* OR: 1.90 (1.12-3.22)). However, being in the moderate group was associated with a decreased likelihood of injection drug use (*experimenter* OR: 0.19, 95% CI: 0.42-3.27).

African Americans

Among African Americans, adjusted analyses revealed that being in either of the drinking groups in adolescence was associated with an increased likelihood of young adult marijuana use (experimenter OR: 1.72, 95% CI: 1.21-2.45; problem OR: 2.59, 95% CI: 1.80-3.73) and a 3 to 6 times greater likelihood of other illicit drug use (experimenter OR: 3.05, 95% CI: 1.39-6.71; problem OR: 6.01, 95% CI: 2.89-12.51). Adolescent alcohol use was not significantly associated with young adult crystal methamphetamine use or injection drug use.

DISCUSSION

This study, conducted in a nationally-representative sample of white and African American male and female adolescents, indicated that adolescent alcohol latent class typologies were similar for males and females within each racial group and that, while there were some similarities in types of alcohol users observed in white and African American adolescents in the US, there also were important race differences. The study also indicated that among both whites and African Americans, in adjusted analyses, alcohol experimenters and, to an ever greater extent, moderate and problem users also were much more likely than non-users to use additional drugs in adolescence and adulthood. The study was the first to assess both race and gender differences in typologies of adolescent alcohol use and to use latent class membership to predict adolescent and subsequent adulthood substance use in the US general population. The findings indicate that race differences in typologies of alcohol use should be considered when designing population-specific programs to address adolescent alcohol use, and that working with adolescent users may reduce risk of a trajectory that leads to substance use in adulthood.

The results corroborated the well-established trend of substantially higher levels of adolescent alcohol use among white *versus* African American adolescents³² and indicated that among male and female adolescents, alcohol use typologies differed by race. Among both white male and female adolescents, four latent classes emerged: abstainers, experimenters, moderate drinkers, and problem drinkers. Among both African American males and female adolescents, three classes were identified: abstainers, experimenters, and

problem drinkers. Among both race groups, experimenters reported use of alcohol yet did not experience negative consequences of drinking and problem drinkers reported frequent and heavy drinking and alcohol-related physiological and social problems. While African American problem drinkers drank less frequently and reported a lower quantity of alcohol consumed than white problem users, report of negative consequences of use appeared to be comparable to that of white problem users. There was an additional class of moderate users that was observed among whites, but not among African Americans. These results corroborated the findings of Dauber et al. (2009), who conducted an adolescent alcohol use LCA among adolescent girls using the Add Health public use dataset (half the number of observations), and provided further evidence that race differences in typologies of alcohol use should be considered when designing population-specific programs to address adolescent alcohol use.

To our knowledge, this study was among the first to assess whether adolescent alcohol use typology differed by gender in a nationally-representative sample. The study found that strikingly similar alcohol use typologies defined both girls and boys within each race; among both white girls and boys, four classes defined by the same pattern of use were observed, while among African American girls and boys, three classes defined by the same pattern of use were observed. While typologies of use were comparable by gender, as has been observed in numerous prior studies, levels of problematic alcohol use were more common among males than females.

Across race and gender groups, those who were members of an alcohol user class were more likely to use illicit drugs in adolescence. This has important drug prevention implications, as research suggests that experimentation with substances has become a normative rite of passage among adolescents in the U.S.³³ Levels of drug use tended to increase with increasing severity of alcohol use class. This suggested that while all alcohol users should be targeted for prevention of adolescent illicit drug use, moderate and problem drinkers—those who drink more frequently, drink a greater quantity, and who experience consequences of use—are a particularly vulnerable to drug use and should be considered a priority population for implementation of programs. While the results of an association between alcohol use and adolescent illicit

drugs may provide evidence that alcohol may serve as a gateway to other drugs during adolescence, it also is possible that the risk for substance use of any kind might be driven by a common set of underlying risk factors that were not measured and controlled for in this analysis.^{19,20,34-36}

Results of this study also indicate that adolescent alcohol use class may, in fact, be predictive of adulthood substance use. We observed that adolescents who were members of any alcohol user class were more likely use illicit drugs in adulthood and that the risk of drug use in young adulthood is greater among moderate and problem alcohol users than among less frequent, less problematic “experimenters.” These results support previous findings indicating that adolescent substance use – and, in particular, early initiation of substance use – is linked with adulthood and lifetime drug use.¹⁸⁻²⁰ It is possible that this relationship is partially accounted for by the fact that adolescent alcohol use leads to continued alcohol use in young adulthood,^{19,37} which may, in turn, be associated with adulthood drug use. It also is possible that this association is indicative of a set of common, underlying risk factors that drive all forms of alcohol use over the life course.^{19,20} Regardless of the underlying mechanism linking adolescent alcohol use and adulthood drug use, the results highlight the tremendous importance of targeting adolescent alcohol users in drug prevention programs.

While our findings have important implications for group-specific drug prevention and intervention programs, limitations must be noted. Most important, we captured alcohol latent classes at one point in time during adolescence, while transitions between alcohol classes are expected to change rapidly, even within even a one-year time period.²⁴ Another important limitation is that when attempting to understand the degree to which adolescent alcohol use is an independent risk factor of adolescent and adult drug use, residual confounding, particularly by unmeasured personality or environmental factors, may have biased the observed associations.^{19,20,34-36} Finally, LCA analyses were based on self-reported measures of adolescent alcohol use, which are known to be affected by social desirability bias.

Despite these limitations, this study, for the first time, assessed both race and gender differences in typologies of adolescent alcohol use and used latent class membership to predict not only adolescent but

subsequent adulthood substance use. The findings indicated that race differences in typologies of alcohol use should be considered when designing population-specific programs to address adolescent alcohol use, and that working with adolescent users may reduce risk of a following a trajectory that leads to substance use in adulthood.

REFERENCES

1. U.S. Department of Health and Human Services. The Surgeon General's Call to Action to Prevent and Reduce Underage Drinking: U.S. Department of Health and Human Services, Office of the Surgeon General, 2007.
2. CDC. Youth Risk Behavior Surveillance United States, 2009. *MMWR* 2010;59(SS-5):1-142<<http://www.cdc.gov/mmwr/pdf/ss/ss5905.pdf>>. 2010.
3. Field M ST, Wiers RW. Cognitive processes in alcohol binges: a review an... [Curr Drug Abuse Rev. 2008] - PubMed result. *Curr Drug Abuse Rev.* 2008;1(3):263-79.
4. Corte CM, Sommers MS. Alcohol and risky behaviors. *Annu Rev Nurs Res.* 2005;23:327-60.
5. Hartley DE, Elsabagh S, File SE. Binge drinking and sex: effects on mood and cognitive function in healthy young volunteers. *Pharmacol Biochem Behav.* Volume 78. United States, 2004:611-9.
6. Squeglia LM, Jacobus J, Tapert SF. The influence of substance use on adolescent brain development. *Clin EEG Neurosci.* 2009 Jan;40(1):31-8.
7. Townshend JM, Duka T. Binge drinking, cognitive performance and mood in a population of young social drinkers. *Alcohol Clin Exp Res.* Volume 29. United States, 2005:317-25.
8. Brown SA, Tapert SF, Granholm E, Delis DC. Neurocognitive functioning of adolescents: effects of protracted alcohol use. *Alcohol Clin Exp Res.* 2000 Feb;24(2):164-71.
9. de Wit H. Impulsivity as a determinant and consequence of drug use: a review of underlying processes. *Addict Biol.* Volume 14. England, 2009:22-31.
10. Norris J, Stoner SA, Hessler DM, et al. Cognitive mediation of alcohol's effects on women's in-the-moment sexual decision making. *Health Psychol.* Volume 28. United States: 2009 APA, all rights reserved., 2009:20-8.
11. Fromme K, D'Amico EJ, Katz EC. Intoxicated sexual risk taking: an expectancy or cognitive impairment explanation? *J Stud Alcohol.* 1999 Jan;60(1):54-63.
12. Miller JW, Naimi TS, Brewer RD, Jones SE. Binge drinking and associated health risk behaviors among high school students. *Pediatrics.* Volume 119. United States, 2007:76-85.
13. Maney DW H-GD, Mahoney BS. The alcohol-related psychosocial and behavioral ri... [J Sch Health. 2002] - PubMed result. *J Sch Health.* 2002;72(4):157-63.
14. Swahn MH, Simon TR, Hammig BJ, Guerrero JL. Alcohol-consumption behaviors and risk for physical fighting and injuries among adolescent drinkers. *Addict Behav.* 2004 Jul;29(5):959-63.
15. Baskin-Sommers A, Sommers I. The co-occurrence of substance use and high-risk behaviors. *J Adolesc Health.* 2006 May;38(5):609-11.
16. Miller JW, Naimi TS, Brewer RD, Jones SE. Binge drinking and associated health risk behaviors among high school students. *Pediatrics.* 2007 Jan;119(1):76-85.
17. CDC. Surveillance Summaries. *MMWR* 2004;53.
18. Grant BF, Dawson DA. Age of onset of drug use and its association with DSM-IV drug abuse and dependence: results from the National Longitudinal Alcohol Epidemiologic Survey. *J Subst Abuse.* Volume 10. United States, 1998:163-73.
19. Grant JD, Scherrer JF, Lynskey MT, et al. Adolescent alcohol use is a risk factor for adult alcohol and drug dependence: evidence from a twin design. *Psychol Med.* Volume 36. England, 2006:109-18.
20. Palmer R, Young S, Hopfer C, et al. Developmental epidemiology of drug use and abuse in adolescence and young adulthood: Evidence of generalized risk. *Drug Alcohol Depend.* 2009 Jun 1;102(1-3):78-87.
21. Townshend JM, Duka T. Patterns of alcohol drinking in a population of young social drinkers: a comparison of questionnaire and diary measures. *Alcohol Alcohol.* 2002 Mar-Apr;37(2):187-92.
22. Goodman LA. Exploratory latent structure analysis using both identifiable and unidentifiable models. *Biometrika.* 1974;61(215-231).

23. Hesselbrock VM, Hesselbrock MN. Are there empirically supported and clinically useful subtypes of alcohol dependence? *Addiction*. 2006 Sep;101 Suppl 1:97-103.
24. Bucholz KK, Heath AC, Madden PA. Transitions in drinking in adolescent females: evidence from the Missouri adolescent female twin study. *Alcohol Clin Exp Res*. 2000 Jun;24(6):914-23.
25. Chung T, Martin CS, Clark DB. Concurrent change in alcohol and drug problems among treated adolescents over three years. *J Stud Alcohol Drugs*. 2008 May;69(3):420-9.
26. Chassin L, Flora DB, King KM. Trajectories of alcohol and drug use and dependence from adolescence to adulthood: The effects of familial alcoholism and personality. *Journal of Abnormal Psychology*. 2004;113(4):483-98.
27. Reboussin BA, Song EY, Shrestha A, Lohman KK, Wolfson M. A latent class analysis of underage problem drinking: evidence from a community sample of 16-20 year olds. *Drug Alcohol Depend*. 2006 Jul 27;83(3):199-209.
28. Fergusson DM, Horwood LJ, Lynskey MT. The prevalence and risk factors associated with abusive or hazardous alcohol consumption in 16-year-olds. *Addiction*. 1995;90:935-46.
29. Dauber S, Hogue A, Paulson JF, Leiferman JA. Typologies of alcohol use in White and African American adolescent girls. *Subst Use Misuse*. 2009;44(8):1121-41.
30. Flory K, Brown TL, Lynam DR, Miller JD, Leukefeld C, Clayton RR. Developmental patterns of African American and Caucasian adolescents' alcohol use. *Cultur Divers Ethnic Minor Psychol*. 2006 Oct;12(4):740-6.
31. Dierker LC, Vesel F, Sledjeski EM, Costello D, Perrine N. Testing the dual pathway hypothesis to substance use in adolescence and young adulthood. *Drug Alcohol Depend*. 2007 Feb 23;87(1):83-93.
32. SAMHSA. Results from the 2009 National Survey on Drug Use and Health: national findings. Rockville, MD: Office of Applied Studies, Substance Abuse and Mental Health Services Administration, 2010.
33. Vega WA GA. *Drug Use and Ethnicity in Early Adolescence*. New York: Plenum, 1998.
34. Kendler KS, Myers J, Prescott CA. Specificity of genetic and environmental risk factors for symptoms of cannabis, cocaine, alcohol, caffeine, and nicotine dependence. *Arch Gen Psychiatry*. Volume 64. United States, 2007:1313-20.
35. Rhee SH, Hewitt JK, Young SE, et al. Comorbidity between alcohol dependence and illicit drug dependence in adolescents with antisocial behavior and matched controls. *Drug Alcohol Depend*. Volume 84. Ireland, 2006:85-92.
36. Young SE, Rhee SH, Stallings MC, Corley RP, Hewitt JK. Genetic and environmental vulnerabilities underlying adolescent substance use and problem use: general or specific? *Behav Genet*. 2006 Jul;36(4):603-15.
37. Englund MM, Egeland B, Oliva EM, Collins WA. Childhood and adolescent predictors of heavy drinking and alcohol use disorders in early adulthood: a longitudinal developmental analysis. *Addiction*. 2008 May;103(Suppl 1):23.

PAA 2011

Manuscript Draft: Race and Gender Differences in Adolescent Alcohol Use

March 10, 2011

Figure 1. Profiles of Alcohol Latent Classes by Gender and Race

Abstainer — Experimenters — Moderate — Problem

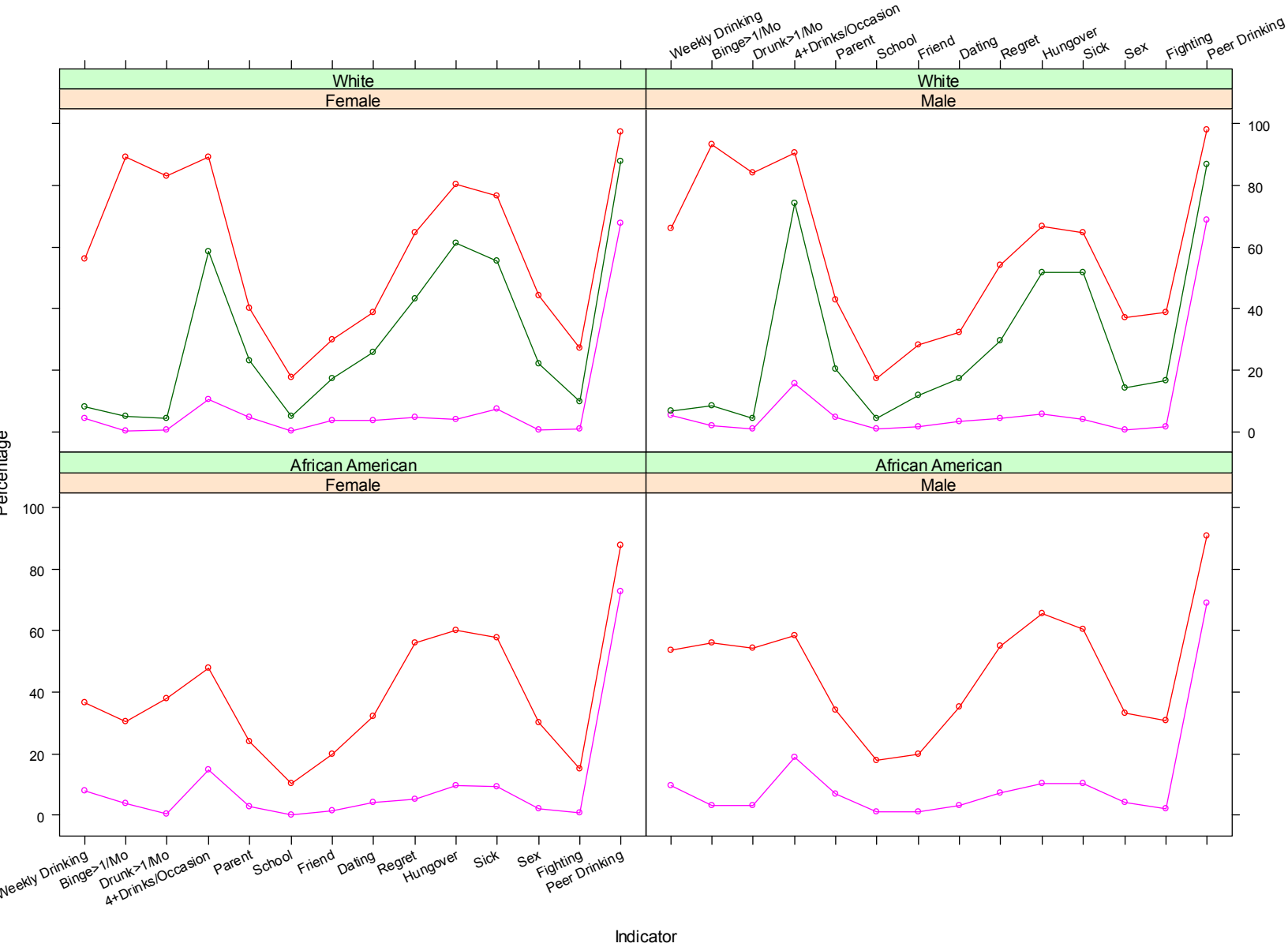


Table 1. Comparison of White (N=9,548) and African American (4,005) Adolescents in the U.S.*

	White %	Black %	Total %
Past Year Drinking			
Never	47.4	65.5	52.4
Once a month	32.1	22.9	29.4
Two to three times a month	9.8	4.7	8.3
Once a week or more	10.8	7.9	9.9
Number of Drinks/Occasion			
Never drank	47.7	65.1	52.9
One drink	9.9	11.7	10.4
Two or three	14.4	12.7	13.9
Four or more	28.0	10.5	22.9
Past Year Binge Drinking			
Never	68.0	86.5	73.5
Once a month	18.2	7.1	14.9
More than once a month	13.8	6.4	11.7
Past Year Getting Drunk			
Never	65.4	83.2	70.6
Once a month	22.4	10.4	18.8
More than once a month	12.3	6.4	10.5
Past Year Physical/Social Problems from Drinking			
Problems with parent(s)	11.1	4.9	9.2
Problems with school	3.5	2.0	3.0
Problems with friend(s)	7.5	2.9	6.2
Problems with dating	10.0	5.3	8.6
Regret actions	16.5	8.7	14.2
Hung over	22.6	10.5	19.0
Sick	21.7	9.9	18.2
Regret sex	9.4	4.9	8.0
Fights	7.6	3.4	6.3
Peer Drinkers			
Never drank	47.4	64.6	52.5
No best friends drink monthly	8.7	7.9	8.5
One or more best friends drink monthly	43.9	27.5	39.1

* Differences between whites and African-Americans were tested using the chi-square statistic with adjustment for Add Health's weighted sampling design. All differences were significant at $p < .001$.

Table 2. Associations Between Participant Characteristics and Alcohol Use Latent Class.

	Abstainer/Experimenter %	Moderate/Problem Drinking %	Odds Ratio & 95% CI Moderate/Problem Drinking vs. Abstainer/Experimenter
Age at Wave I			
13-14	88.6	11.4	Referent
15	75.2	24.8	2.77 (2.24-3.43)
16	67.0	33.0	4.24 (3.51-5.13)
17	59.2	40.8	5.76 (4.74-6.99)
18-21	56.4	43.6	6.95 (5.54-8.70)
Gender			
Male	70.0	30.0	Referent
Female	73.4	26.6	0.87 (0.78-0.97)
Race			
White	65.4	34.6	Referent
Black	86.8	13.2	0.34 (0.26-0.43)
Maternal Education			
< High School	72.1	27.9	Referent
High School	71.1	28.9	1.06 (0.87-1.30)
≥ College	72.7	27.3	1.10 (0.88-1.38)
Mother or Father Public Assistance			
No	71.5	28.5	Referent
Yes	74.1	25.9	0.85 (0.70-1.02)
Problem Paying Housing/Utilities (Past Year, Wave III)			
No	74.0	26.0	Referent
Yes	67.0	33.0	1.51 (1.30-1.76)

Table 3. Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) of Associations* between Adolescent Alcohol Use Latent Class and Adolescent Substance Use among Whites (N=10,455) and Blacks (4,669) in the U.S.

	Marijuana			Cocaine			Inhalants			Injection		
	%	Odds Ratio	%	Odds Ratio	%	Odds Ratio	%	Odds Ratio	%	Odds Ratio	%	Odds Ratio
Whites												
Abstainer	7.9	Referent	1.2	Referent	3.2	Referent	0.2	Referent	0.2	Referent	0.04	(0.01-0.20)
Experimenter	20.5	2.95 (2.35-3.71)	0.9	0.62 (0.31-1.24)	6.3	1.76 (1.20-2.57)	0.1	0.04 (0.01-0.20)	0.1	0.04 (0.01-0.20)	0.1	0.04 (0.01-0.20)
Moderate	54.0	12.83 (10.50-15.68)	5.6	4.98 (2.99-8.31)	10.7	4.36 (3.23-5.90)	0.9	6.19 (2.06-18.62)	0.9	6.19 (2.06-18.62)	0.9	6.19 (2.06-18.62)
Problem	77.3	35.97 (26.91-48.08)	14.1	14.17 (8.94-22.48)	18.4	8.15 (5.73-11.57)	3.2	25.40 (8.18-78.90)	3.2	25.40 (8.18-78.90)	3.2	25.40 (8.18-78.90)
Blacks												
Abstainer	11.8	Referent	0.9	Referent	2.4	Referent	0.1	Referent	0.1	Referent	0.10	(0.01-1.11)
Experimenter	34.7	3.99 (2.78-5.72)	0.3	0.19 (0.04-0.92)	2.7	1.12 (0.68-1.83)	0.1	0.10 (0.01-1.11)	0.1	0.10 (0.01-1.11)	0.1	0.10 (0.01-1.11)
Problem	73.8	20.26 (14.31-28.68)	3.5	3.49 (1.48-8.23)	4.8	2.39 (1.22-4.71)	1.2	7.15 (1.50-34.00)	1.2	7.15 (1.50-34.00)	1.2	7.15 (1.50-34.00)

*Controlling for gender, poverty, and maternal education

Table 4. Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) of Associations* between Adolescent Alcohol Use Latent Class and Young Adulthood Substance Use among Whites (N=10,455) and Blacks (4,669) in the U.S.

	Marijuana		Cocaine		Crystal Methamphetamine		Other Illicit Drugs		Injection	
	%	Odds Ratio	%	Odds Ratio	%	Odds Ratio	%	Odds Ratio	%	Odds Ratio
Whites										
Abstainer	26.8	Referent	5.5	Referent	1.9	Referent	8.4	Referent	0.5	Referent
Experimenter	38.1	1.58 (1.34-1.87)	7.0	1.17 (0.83-1.65)	2.7	0.92 (0.51-1.66)	12.4	1.31 (0.97-1.76)	0.3	0.22 (0.05-1.05)
Moderate	43.3	2.18 (1.83-2.59)	11.4	1.88 (1.30-2.71)	5.0	1.90 (1.12-3.22)	16.0	1.81 (1.31-2.49)	0.2	0.19 (0.04-0.93)
Problem	49.8	2.33 (1.83-2.96)	16.6	2.13 (1.47-3.07)	6.2	1.43 (0.74-2.76)	17.8	1.65 (1.20-2.27)	1.4	1.17 (0.42-3.27)
Blacks										
Abstainer	19.0	Referent	1.1	Referent	0.3	Referent	2.0	Referent	0.3	Referent
Experimenter	32.5	1.72 (1.21-2.45)	1.9	1.86 (0.74-4.68)	1.3	2.01 (0.36-11.30)	4.7	3.05 (1.39-6.71)	0.3	0.47 (0.06-3.63)
Problem	42.6	2.59 (1.80-3.73)	4.2	2.44 (0.76-7.79)	1.7	1.47 (0.17-12.69)	6.4	6.01 (2.89-12.51)	0.3	1.36 (0.16-11.68)

*Controlling for gender, poverty, maternal education and adolescent substance use (marijuana, cocaine, inhalants, and injection drugs)

PAA 2011

Manuscript Draft: Race and Gender Differences in Adolescent Alcohol Use

March 10, 2011
