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Initiation and Persistence of Alcohol Use in United States Black, Hispanic, and White Male and Female Youth

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Abstract

Background—The relation between early and frequent alcohol use and later difficulties is quite strong. However, the degree that alcohol use persists, which is often a necessary cause for developing alcohol-related problems or an alcohol use disorder, is not well studied, particularly with attention to race and gender. A novel statistical approach, the Multi-facet Longitudinal Model, enables the concurrent study of age of initiation and persistence.

Methods—The models were applied to longitudinal data on youth alcohol use from ages 12 through 19, collected in the (U.S.) National Longitudinal Survey of Youth 1997 cohort (*N* = 8,984).

Results—Results confirmed that Black adolescents initiate alcohol use at later ages than do White youth. Further, after initiation, White adolescents were substantially more likely than Black adolescents to continue reporting alcohol use in subsequent years. Hispanic teens showed an intermediate pattern. Gender differences were more ambiguous, with a tendency for boys to be less likely to continue drinking after initiation than were girls.

Conclusions—Novel findings from the new analytic models suggest differential implications of early alcohol use by race and gender. Early use of alcohol might be less consequential for males who initiate alcohol use early, Black, and Hispanic youth than for their female and White counterparts.

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Contributors (mandatory): Patrick Malone designed and conducted the analysis and had primary responsibility for drafting the manuscript. Thomas Northrup managed the literature searches and drafted early versions of the Introduction. Katherine Masyn contributed substantially to the statistical methodology. Dorian Lamis and Andrea Lamont participated in the research design and interpretation. All authors contributed to and have approved the final manuscript.

Conflict of Interest (mandatory): All authors declare that they have no conflicts of interest.

Keywords

Alcohol; Adolescence; Race; Gender; Longitudinal modeling

1. Introduction

1.1 Statement of Problem

The relation between early and frequent alcohol use and later difficulties, such as developing an alcohol use disorder (AUD) in young adulthood (e.g., Chassin, Pitts, & Prost, 2002; Grant & Dawson, 1997) is quite strong, even when the influences of other risk factors (e.g., parental alcohol use) are accounted for (Buchmann et al., 2009). Therefore, research has tended to focus on the age of alcohol initiation and associated consequences of such use, with most nationally-representative longitudinal studies in the United States accounting for differences by race and gender. However, the degree that alcohol use persists, which is often a necessary but not sufficient cause for developing alcohol-related problems or an AUD, is not well studied, particularly by race and gender.

1.2 Intent of Current Study

Persistence – continued use after alcohol has first been tried -- is often assumed. This descriptive study provides a critical first step in testing this assumption by assessing how likely adolescents were to continue consuming alcohol once they initiated use. These aspects were further explored by gender and race. This introduction serves as a brief summary of the complex relationship between alcohol and these two variables.

1.3 Background

The literature contains research about differing rates of incidence by age and alcohol usage rates growth across gender and race (e.g., Duncan, Duncan, & Strycker, 2006), or race alone (e.g., LaBrie, Rodrigues, Schiffman, & Tawalbeh, 2007), but questions remain.

1.3.1 Sex Differences—Gender differences in the age of first use by alcohol are far from clear, as some studies have evidenced higher rates of initial use by females (Duncan et al., 2006), whereas others indicate males (Trim, Schuckit, & Smith, 2010; Williams et al., 2007), or no difference (LaBrie et al., 2007; Sartor et al., 2009). The discrepancies in the findings from the above studies may be due to the different characteristics in the samples. For example, although Williams and colleagues and Duncan and colleagues both used longitudinal designs, the eras and age groups were different, which precludes comparisons across studies and highlights the need for national data to be examined. Despite the inconsistent findings of alcohol use initiation by gender, it seems apparent that men tend to experience higher levels of alcohol use (e.g., Jackson, Sher, Cooper, & Wood, 2002), associated problems, and AUDs (e.g., Wagner, Lloyd, & Gil, 2002). Forty-six percent (46%) of men and 32% of women demonstrate lifetime alcohol abuse and 18% of men and 14% of women develop alcohol dependence (Wagner et al., 2002). The picture is more convoluted when race is analyzed.

1.3.2 Ethnic and Racial Differences—A higher percentage of European American adolescents initiate alcohol use at each age compared to African American youth (Williams et al., 2007) and European American youth report a greater history of alcohol use than United States Latinos at 8^{th} and 12^{th} grades (Chavez & Swaim, 1992). However, Vega, Gil, and Zimmerman (1993) found that data comparing Cuban American, African American, and European American children in grade school presented a complex picture of alcohol initiation, such that it was difficult to discern trends across race and ethnicity. Potential

underlying causal mechanisms (e.g., religiosity, family background) of these differences have been investigated with little gained in explanatory knowledge (see Weaver, Cheong, MacKinnon, & Pentz, 2011 for an introductory review). More recent research on Black and White adolescents has sought to understand variation in alcohol use as a function of differing susceptibility to peer influence. Mixed results were found for the hypothesis that Black adolescents were less influenced by perceptions of peer use compared to White adolescents, and Black 7th graders who have higher numbers of friends who drink may be a particularly at-risk group (Weaver et al., 2011). Lower rates of alcohol initiation for African American and Latino youth are associated with a lower risk for an AUD diagnosis, with African Americans generally having the lowest risk of the three groups. Despite well-known differences in alcohol use incidence and AUD rates, very few studies have been undertaken to explore how persistent the use of alcohol is after initial use. Given the mixed state of causal understanding for ethnic/racial differences in adolescent alcohol use, we see this as an important step. Modeling differences between those who initiate and persist, compared to those who initiate and desist, may be important to elucidate distinct race/ethnic drinking trajectories.

1.4 Onset and Persistence of Use

In most cases, studies of alcohol use in adolescence focus on either *age of onset* or *patterns of use*, and each of these foci have limitations with regards to the assumptions made about the outcomes under examination and the relationship of the outcomes to potential risk and protective factors. In studies of *age of onset*, there are often two implicit assumptions made without empirical verification: (1) that once initiated, alcohol use continues or persists; and (2) that regardless of predictive factors related to age of onset, that age of onset itself functions uniformly as a subsequent risk factor related to patterns of use following initiation. In studies of *patterns of use*, observations of non-use are usually all treated the same empirically; that is, there is no distinction made between non-use following onset, reflecting a period of desistence after initiation, and non-use reflecting a state of non-initiation of use. Without such a distinction, it is impossible to evaluate separately the factors related to delayed onset versus the factors related to desistence following initiation of use. It is only by simultaneously examining the age of onset and patterns of use *conditional on initiation*, as is possible with the analytic model utilized in this study, that the roles of risk factors in the initiation *and* persistence of underage alcohol consumption can be effectively and completely investigated.

Without use of a more complete analytic evaluation of onset and persistence, it is likely that there are key differences across race and gender in the persistence or desistence of underage alcohol consumption, conditional on onset, that have been overlooked. Although some studies have examined persistence of use following initiation, we were unable to identify any studies using more than two time points of data collection which have investigated how alcohol use persistence may differ as a function of these demographic variables. Furthermore, none of these studies modeled differences in the timing of initiation. One identified study (Jackson et al., 2002) examining onset of alcohol use at baseline and persistence five years later found that men had greater increases in drinking after initiation than women. Moreover, the researchers found that Whites often mature out of heavy drinking in their early 20's; whereas, heavy drinking among Blacks generally persists longer into adulthood (Jackson et al.). The importance of examining variation in both initiation of use and alcohol use persistence across race and gender cannot be overstated. Indeed, race and gender are routinely studied as covariates that bear influence on alcohol consumption and related problems (e.g., Wagner et al., 2002), and critical differences may have gone undiscovered.

1.5 Current Study

The age of first alcohol use and rate of progression appear to be complicated by several other factors (e.g., religiosity; Wallace, Brown, Bachman, & Laveist, 2003), and these associations with age of first use could exist for alcohol use persistence as well. However, at this nascent stage of research, and for the sake of parsimony, accounting for these associations was beyond the scope of this investigation. Understanding how alcohol consumption persists or desists as a function of gender and race, using a nationally-representative longitudinal dataset, is a critical first step.

2. Material and Methods

The current study is based on secondary data analysis, with calculations using the latent variable modeling software M*plus* (v.6, L. K. Muthén & Muthén, 2010).

2.1 Data Source

The data for this study were drawn from the National Longitudinal Survey of Youth 1997 cohort (NLSY97).The NLSY97 includes data from 8,984 respondents who were 12 to 16 years old as of December 31, 1996, comprising a combination of a nationally representative cross-section and an oversample of Black and Hispanic youth of the same ages. Round 1 of the survey took place in 1997 and the respondents have been followed and reassessed on an annual basis since study initiation. The interviews were conducted at randomly selected households representing the U.S. population born in the years 1980 through 1984 and supplemental samples of the Black and Hispanic population born in those years. Given that the questions on alcohol use represented a sensitive topic, the use of audio computer-assisted self-interview (ACASI) technology, which enabled respondents to enter their answers directly into a computer without the interviewer knowing the responses. A full description of the NLSY97 sample and multistage area probability research design can be found at http://www.bls.gov/nls/nlsy97.htm . The sample used for the current study excluded a small (n = 83, <1%) group of non-Hispanic mixed-race youth, due to that subsample being too small and heterogeneous for reasonable inference. The remaining 8,901 adolescents included, by self- or parent-identification, 1,901 Hispanic youth (21 %), 2,335 non-Hispanic Black youth (26%), and 4,665 non-Hispanic/non-Black (i.e., White or other race, referred to hereinafter as ‘White’) adolescents (52%). The analysis sample was 51 % male (n = 4,559). Four further youth were omitted from analyses due to having given no responses to any of the alcohol-use variables.

Our work was not reviewed by an IRB, as it relied solely on publicly available, de-identified data, and thus does not meet the definition of research with human subjects.

2.2 Variables Used

2.2.1 Demographic Characteristics—The “KEY” variables constructed and edited by the NLSY were used for basic demographics: youth age at the first wave of data collection (mid-1997), youth gender, and youth race/ethnicity.

2.2.2 Alcohol Consumption—Alcohol measures used in the current study include lifetime alcohol use (“Have you ever had a drink of an alcoholic beverage? By drink we mean a can or bottle of beer, a glass of wine, a mixed drink, or a shot of liquor. Do not include childhood sips that you might have had from an older person's drink”) and past year alcohol use (“Have you had a drink of an alcoholic beverage since the last interview on [date of last interview]? (By drink we mean a can or bottle of beer, a glass of wine, a mixed drink, or a shot of liquor”). The lifetime use question was not asked in 2001, 2002, or 2003. For those years, we inferred lifetime use from a combination of the 2000 question and the past-

year question. We used data for each birth cohort up through the age-19 year as to eliminate the possibility of a respondent having consumed alcohol legally by the actual time of the nominal age-20 interview.

We also incorporated in the analyses an assessment of age of first use of alcohol. We derived this value from annual interviews, as the question on the NLSY asking age of first use sometimes yielded inconsistent responding across rounds. The derivation is described in more detail in the next section.

3. Calculation

The calculations for this paper were based on a recently developed class of statistical model, called herein the Multi-facet Longitudinal Model (MFLM). MFLMs assess multiple aspects of longitudinal development of a process in a single model – in this instance, alcohol initiation and persistence, the latter defined as continued use of alcohol year-to-year after initiation. The model used for the current analyses is an extension of an onset-to-growth MFLM described by Witkiewitz and Masyn (2008), who modeled drinking trajectories following an initial lapse after treatment.

The first process in this analysis is initiation of alcohol use in adolescence. This is modeled as a latent class, or mixture, variable, with a separate class for each possible age of onset measured in the data (12 or under, 13, 14 etc.), with a separate class for no measured onset. This variable is measured as latent – i.e., with imperfect indicators -- because of the nature of the accelerated longitudinal design, along with unplanned missing data. For each respondent, possible class membership was constrained based on the pattern of negative, affirmative, and missing responses to the “ever used” question, using facilities in M*plus*. It is important to note that age of initiation is not, for a youth, truly latent. However, this constrained latent variable analytic approach reflected both the known age information and the uncertainty. The second process is persistence of alcohol use after initiation. This was modeled as a general latent growth model (Muthén, 1996), using the “recent use” question at each year as a dichotomous indicator of growth with a logistic link function. The growth parameters were an intercept beginning the year after initiation (use in the year of initiation, other than at the age-12 measure, was 100%, by definition) and an empirically-defined curvature parameter anchored at the year after initiation and age 19, with intermediate loadings freely estimated (as in Meredith & Tisak, 1990). The intermediate loadings, as well as the means, variances, and covariances of the trajectory parameters, were estimated independently for each class, allowing entirely separate trajectories as a function of age of initiation. For later ages of initiation, including the never-used class, the trajectory parameters were constrained to zero as needed for identification.

In sum, this combination resulted in an MFLM with two facets: initiation and persistence. It was an onset-to-growth model analyzed as a growth mixture model. The mixture aspect was a partially observed age of initiation measure, and trajectories of persistence varied by mixture class.

Finally, hypotheses about group differences were tested as a series of nested models from a full model in which all of the above parameters, within and between classes, were allowed to be predicted by race/ethnicity and gender. The M*plus* code for the full model is presented in the supplemental material. It should be noted that the NLSY97-provided sampling weights from recruitment were used in all analyses. However, this presented an extraordinary computational burden of these models in the context of so much missing data due to the accelerated longitudinal design. As a result, we determined it was impractical to also include family-level clustering in the same model; the resulting analysis was beyond readily available computing capacity.

4. Results

4.1 Summary

Latent class models are frequently sensitive to the selection of starting values (McLachlan & Peel, 2000). We utilized the M*plus* facility for searching across a large number of random sets of starting values to find the optimal seed for the maximum likelihood (ML) solution. The full model, which included interactions between age of initiation and each of race/ethnicity and gender, resulted in a stable ML solution across a number of starting value sets; this solution was used as the basis for hypothesis testing. The parameter estimates from this model are presented in Tables 1 (age of initiation), 2 (mean trajectories by age of initiation), and 3 (trajectory effects of race/ethnicity and gender). Due to the sheer number of parameter estimates and the novelty of the modeling approach, however, we find the results easier to interpret from the graphic presentation, with guidance from the hypothesis test results. Race/ethnicity and gender findings are discussed in turn.

4.2 Race/Ethnicity Differences

Considering effects of race/ethnicity on both age of initiation and persistence after initiation, there are 72 regression parameters associated with race/ethnicity. Constraining these parameters to zero as a set – i.e., testing the null hypothesis that there were no overall race/ethnicity effects on alcohol use -- resulted in a significant decrement in fit, Wald $\chi 2$ (72, N = 8,887) > 1,000,000, $p < .001$. Decomposing the possible effects between initiation and persistence components, we found a significant overall effect of race/ethnicity on age of initiation, Wald $\chi 2$ (16, N = 8,887) = 203.0, $p < .001$. These effects are summarized in the form of survival curves in Figure 1 (weighted for the population gender distribution), from which it is clear that Black teens are likely to initiate alcohol use substantially later than Hispanic or White teens.

We next examined race/ethnicity differences in post-initiation trajectories. Model-implied trajectories of persistence in probability scale are depicted in Figures 2 (White), 3 (Black), and 4 (Hispanic). The first such test which we conducted was of the impact of race/ethnicity on the *shapes* of the trajectories after initiation in each onset class – i.e., the race/ethnicity × age of initiation × time interaction. This set of constraints did not significantly harm fit, $\chi 2$ (30, N = 8,887) = 23.4, *ns.* In plain language, the shape of the age-specific post-onset trajectories did not differ by race/ethnicity. For simplicity of interpretation, we constrained those 30 coefficients to zero in subsequent analyses of race/ethnicity effects.

Given that constraint, we tested the impact of the race/ethnicity variable on the post-onset trajectories: the effects on the magnitudes of the intercept and curvature parameters across ages of initiation. Race/ethnicity had a significant overall relation to the trajectory intercepts across initiation classes, $\chi 2$ (14, N = 8,887) = 131.8, $p < .001$. An examination of the coefficient estimates reveals that for all seven classes for which these parameters were estimated (age of initiation of eighteen or less), the effect-coded indicator for Black youth was significant and negative, and the effect-coded indicator for Hispanic youth was not significantly different from zero. Even with appropriate caution in interpreting individual effect variables, this result in combination with Figures 2, 3, and 4 shows a clear difference such that Black youth were less likely than the sample as a whole to use alcohol in the year after initiation. Finally, the effects of race/ethnicity on the curvature parameters across ages of initiation were significant as a set, $\chi 2$ (12, N = 8,887) = 406,186, $p < .001$. However, only four of the twelve individual coefficients in the test were significantly different from zero, and those not in an obvious pattern. The most straightforward summary of these results is that race/ethnicity had a clear impact on age of initiation as depicted and (for Black youth) a broad reduction in post-initation persistence.

4.3 Gender Differences

Following a similar strategy, we first considered effects of gender on the entirety of the patterns of alcohol use. There was a significant overall effect of gender, Wald $\chi 2$ (36, N = 8,887) = 75.6, $p < .001$. In the subtests, we found no significant difference by gender on age of initiation, Wald $\chi 2$ (8) = 5.8, *ns* (survival curves are available from the first author). Further, as for race/ethnicity, the gender effect on the curve *shape* was not significant, Wald $\chi 2$ (14) = 14.8, $p = .394$ (with one parameter fixed due to estimation difficulties). As before, the shape effects were thus constrained to zero in further tests in order to facilitate interpretation.

Gender did show significant prediction of the intercept of the post-initiation trajectories, taken across ages, Wald $\chi 2$ (7) = 8,419.3, $p < .001$, but not of the magnitude of the curvature, Wald $\chi 2$ (5) = 5.7, $p = .336$. Examination of class-specific effects on the intercept revealed that the two (of seven) significant individual coefficients were such that males showed lower post-initiation drinking than females among those with age of initiation of twelve or younger or age seventeen. Model-implied trajectories of persistence in probability scale are depicted in Figures 5 (male) and 6 (female).

5. Discussion

Our application of the novel MFLM approach to the NLSY97 adolescent drinking data has uncovered subtle distinctions in race/ethnicity- and gender-specific patterns of drinking. Because we were unable to model interactions between race/ethnicity and gender, we treat the findings for each variable separately.

5.1 Race/Ethnicity Differences

Our results are consistent with the well-established finding that Black adolescents in the U.S. are likely to initiate alcohol use at later ages than are White youth (Horton, 2007; Strycker, Duncan, & Pickering, 2003). Our results indicate that Black teens were less likely than White teens to show lifetime use of alcohol at any given year. Hispanic youth (predominantly Mexican- American in the NLSY97) showed a survival curve that fell between those for Black and White adolescents. Although we were unable to distinguish first use at age 12 from earlier ages (i.e., 11 or younger), the same patterns held by race and ethnicity for this onset class.

The more dramatic and novel set of findings, however, was the difference in the progression of alcohol use after initiation. Once White adolescents had had a first drink, they were extremely likely (over 85% probability for most point estimates) to continue reporting alcohol use in subsequent years, regardless of age of first use. The likelihood of continued drinking for Black youth was dramatically lower, typically between 60% and 80% probability. Again, Hispanic teens showed an intermediate pattern (approximately 80-90% probability).

The lower likelihood of recent use for Black adolescents compared to White adolescents is well-established. However, this is the first analysis, to our knowledge, revealing that this difference remains significant after adjusting for age of initiation. Research has consistently demonstrated that earlier use of alcohol is associated with greater risk of future alcohol-related problems and alcohol-use disorders (Hingson, Heeren, & Winter, 2006; Warner & White, 1984; though Behrendt et al., 2008, actually found the opposite in a German sample), as well as other adverse adulthood outcomes (McGue, Iacono, Legrand, Malone, & Elkins, 2001; Odgers et al., 2008). However, very few studies have examined this question as a function of demographics. In a rare exception and consistent with our results, LaBrie, Rodrigues, Schiffman, and Tawalbeh (2007) found that Caucasian college students showed

greater differences than other ethnic groups in problematic drinking as a function of retrospectively-reported age of onset.

5.2 Gender Differences

The current results on gender differences in alcohol use progression are more subtle, which is consistent with the mixed findings in the literature. Boys were no more or less likely than girls to have had a drink at a given age but there were gender differences in the likelihood of post-initiation drinking. The differences were scattered, but the direction of the significant individual coefficients was such that boys tended to drink less than girls after first use.

5.3 Interpretation and Future Directions

In total, our results are broadly consistent with previously established literature. The novel findings shown by our MFLM analyses have to do with differential implications of early alcohol use. The simplest summary may be that early “experimentation” with alcohol might be less consequential for Black, and, possibly, male and Hispanic youth than for their female and White counterparts.

This summary must be tempered, of course. The current results do not extend to prediction of adulthood problems or disorders, nor to drinking that is problematic other than in regard to the teens' status as legal minors. There may also be variations in true significance levels due to our inability to incorporate the household-level sampling, but most significant findings we report are likely robust beyond the relatively modest within-household clustering.

Our immediate next step planned is to incorporate a third facet of alcohol use measured in the NLSY97: heavy episodic drinking in the years in which any alcohol use is reported. As in the current report, this will be modeled concurrently with initiation and persistence, enabling concurrent testing of prediction of these different facets. With respect to adulthood problem drinking, the participants in the NLSY97 sample are now in their middle to late 20s, with data available on a wide array of early adulthood outcomes.

A third major direction we anticipate following is moving away from the “black box” model of race/ethnicity and gender. Although some of the differences observed by race and sex are likely to have genetic origins, whatever predictive utility there may be, especially to race, is obscured by the gross classification system used. Further, implications for prevention will require more detailed investigation of early-life variables associated with ethnicity and gender. We plan to study potential third variables measured in the NLSY97 and other datasets to elucidate the more proximal mechanisms linking these demographic variables to our results.

6. Conclusions

This paper presented outcomes of analyses on a large, multi-ethnic dataset using new quantitative methods designed to reveal more nuanced differences in patterns of adolescent initiation and persistence of alcohol use. We reported novel findings of race/ethnicity, and gender differences in continuation of alcohol use through adolescence as a function of age of first use. We plan to continue to develop and apply these methods to learn more about the progression of youth alcohol use, its predictors, and its implications for adolescent and early adulthood outcomes. Results from the current study help elucidate the racial and gender differences in alcohol use initiation and persistence in youth. These findings may also have prevention implications.

Specifically, alcohol prevention programs might be enhanced by identifying at-risk adolescents in the years they are more likely to initiate alcohol use depending on their race and gender. These improved intervention and prevention programs could have important implications for reducing the incidence and prevalence of alcohol use and subsequent abuse and dependence among our youth. Finally, given the enhanced potential to discern such differences, we recommend that versions of the MFLM approach be considered as options by researchers studying problem behaviors as they develop over time.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Research Highlights

- Advanced longitudinal modeling was applied to a large national dataset
- Racial differences were found in both initiation and persistence of alcohol use
- Sex differences were found in persistence of alcohol use

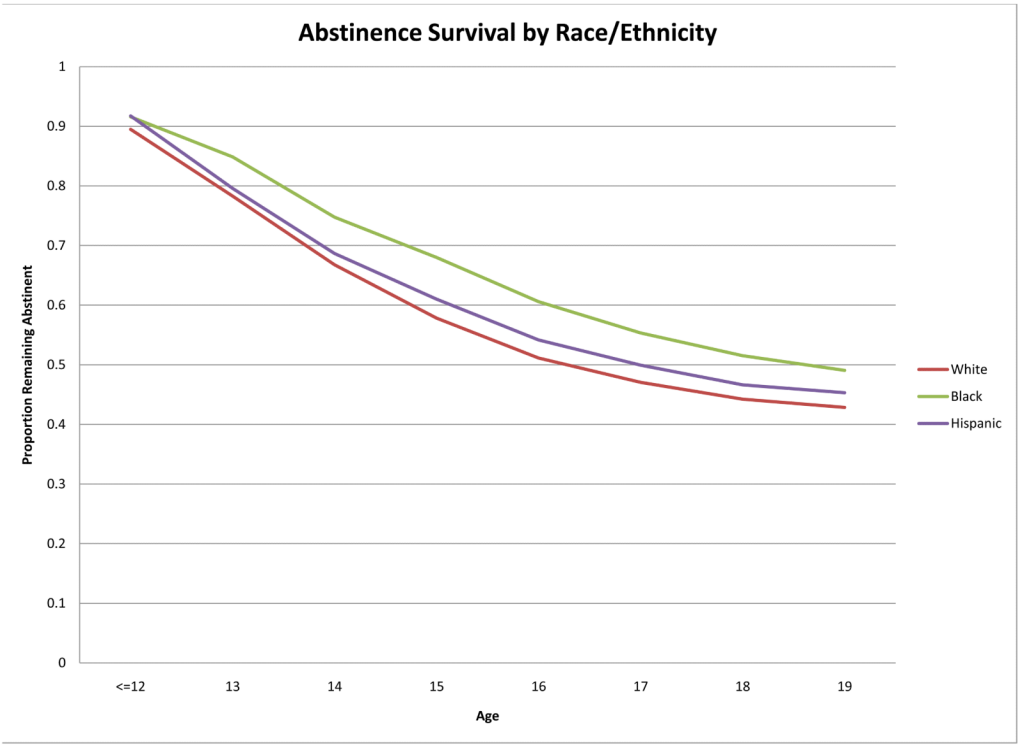

Figure 1.
Abstinence survival by race/ethnicity.

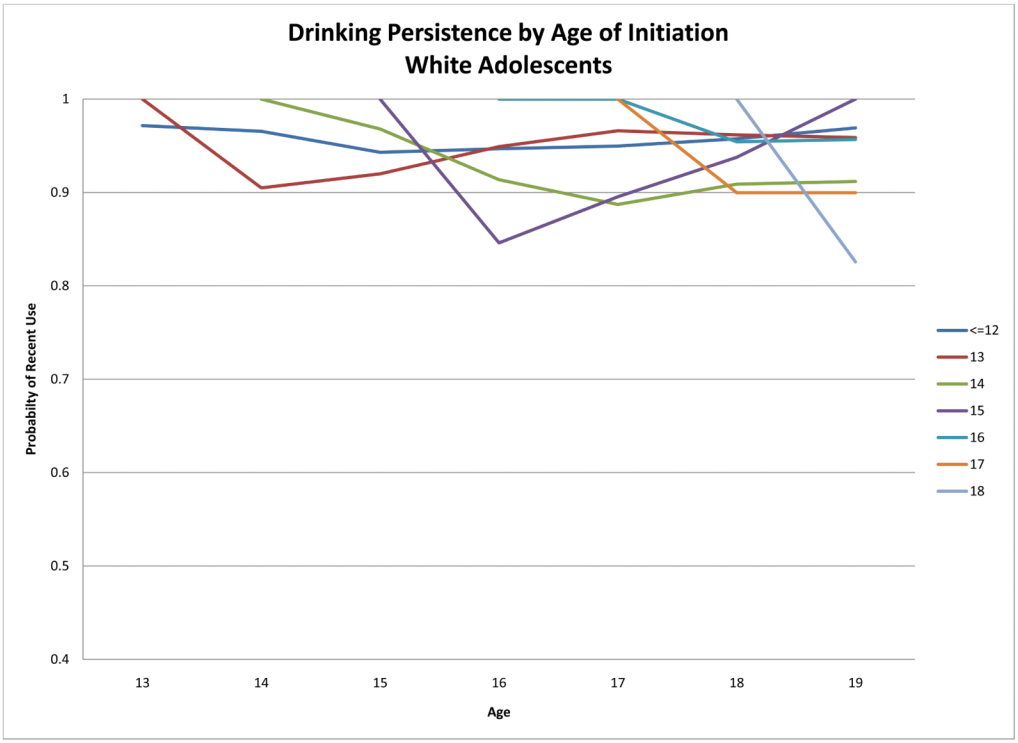

Figure 2.
Drinking persistence by age by age of initiation in White adolescents.

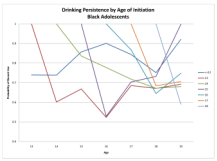

Figure 3.
Drinking persistence by age by age of initiation in Black adolescents.

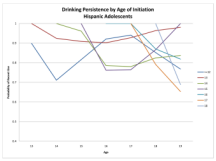

Figure 4.
Drinking persistence by age by age of initiation in Hispanic adolescents.

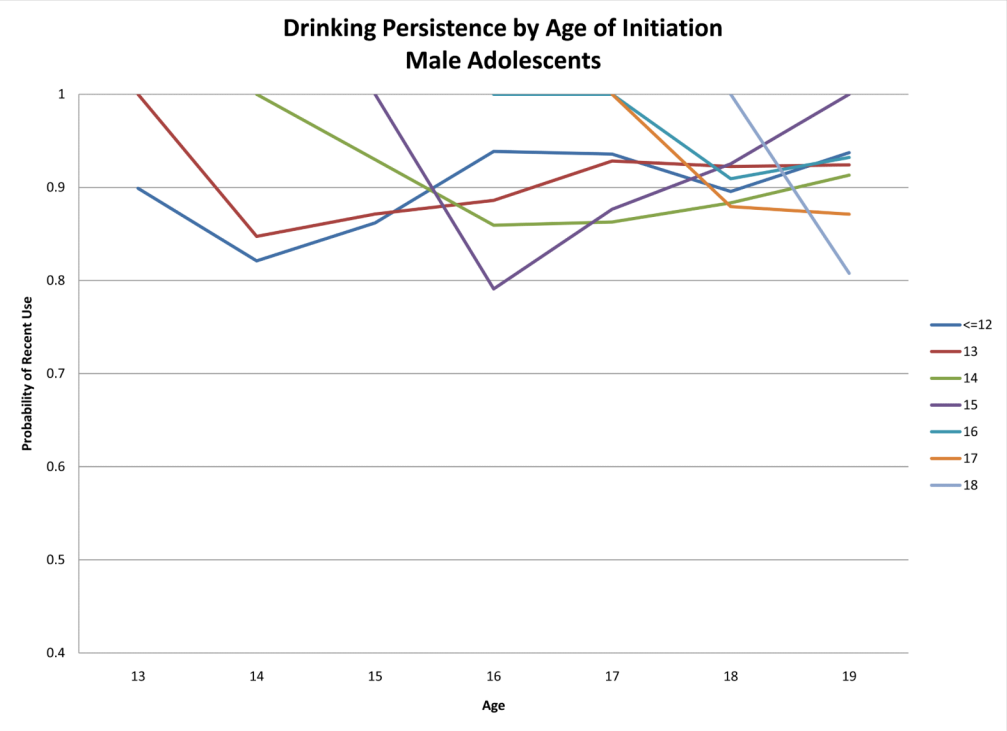

Figure 5.
Drinking persistence by age of initiation in male adolescents.

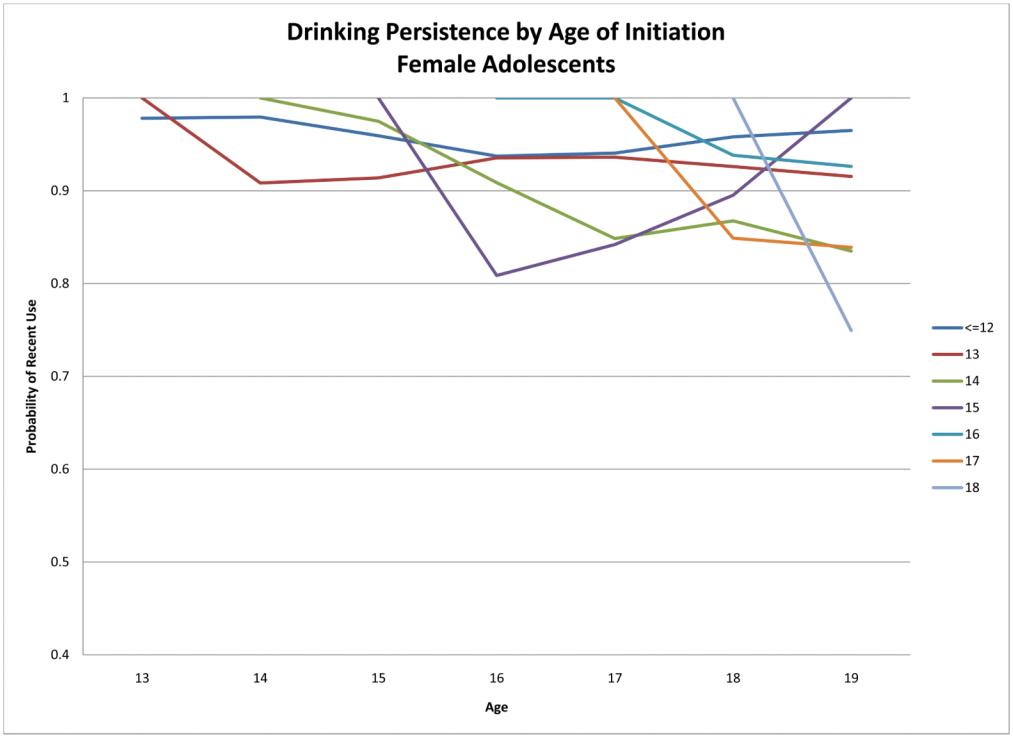

Figure 6.
Drinking persistence by age of initiation in female adolescents.

Table 1
Parameter Estimates from Full Model I: Age of Initiation

Onset Class Age	Logistic Intercept	Prediction by Race (Black)[a]	Prediction by Ethnicity (Hispanic)[a]	Prediction by Gender (Male)[b]
<=12	0.64* (0.04)	-0.72* (0.15)	0.01 (0.18)	0.28 (0.19)
13	-0.58* (0.09)	-0.64* (0.12)	0.04 (0.14)	0.09 (0.16)
14	-0.16* (0.06)	-0.70* (0.08)	0.12 (0.08)	-0.01 (0.10)
15	-0.33* (0.05)	-0.72* (0.08)	0.14 (0.08)	-0.03 (0.10)
16	-0.33* (0.05)	-0.49* (0.07)	0.04 (0.07)	0.20* (0.09)
17	-0.55* (0.05)	-0.47* (0.07)	0.09 (0.08)	0.14 (0.10)
18	-0.72* (0.05)	-0.35* (0.07)	-0.00 (0.09)	-0.01 (0.10)
19	-1.48* (0.07)	-0.09 (0.09)	-0.13 (0.11)	0.06 (0.13)

Note: N = 8,887. Tabled values are logistic regression coefficients and their standard errors; the coefficients can be interpreted as logged hazard ratios in a discrete-time survival analysis. Predictors were centered, so the logistic intercept is the "grand intercept." Reference class is those who did not drink before age 20.

[a] Effect-coded. Interpret individual coefficients with caution.

[b] Dummy-coded, with "male" as high.

* $p < .05$.

Table 2

Parameter Estimates from Full Model II: Mean Trajectories by Age of Initiation

Parameter		**Age of Initiation Class**								
		<=12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**Not by 20**
Intercept Loadings										
	Constant by Age	10.0 (fixed)	10.0 (fixed)	10.0 (fixed)	10.0 (fixed)	10.0 (fixed)	10.0 (fixed)	10.0 (fixed)	10.0 (fixed)	10.0 (fixed)
Intercept Mean		-0.73* (0.04)	-0.79* (0.04)	-0.75* (0.06)	-0.89* (0.01)	-0.84* (0.02)	-0.89* (0.02)	-0.93* (0.01)	0.00 (fixed)	0.00 (fixed)
Intercept Residual Variance		0.02 (0.01)	0.03* (0.01)	0.06 (0.03)	0.02* (0.00)	0.05* (0.01)	0.03* (0.01)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
Curvature Loadings										
	Age 13	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)
	Age 14	23.7 (17.4)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)
	Age 15	80.3* (19.1)	11.1 (14.7)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)
	Age 16	151.9* (47.4)	21.1 (29.3)	42.6 (21.9)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)
	Age 17	129.8* (51.0)	56.3 (50.2)	75.3* (17.9)	0.2 (0.3)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)
	Age 18	147.6* (31.7)	75.0* (32.4)	80.4* (11.1)	1.5* (0.4)	3.4* (2.8)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)
	Age 19	100.0 (fixed)	100.0 (fixed)	100.0 (fixed)	100.0 (fixed)	100.0 (fixed)	100.0 (fixed)	0.0 (fixed)	0.0 (fixed)	0.0 (fixed)
Curvature Mean		-0.002 (0.005)	0.002 (0.010)	-0.013 (0.007)	0.411* (0.013)	0.078* (0.014)	0.000 (0.002)	0.000 (fixed)	0.000 (fixed)	0.000 (fixed)
Curvature Residual Variance		0.000 (0.000)	0.001 (0.001)	0.001* (0.000)	0.356* (0.000)	0.027* (0.010)	0.000 (fixed)	0.000 (fixed)	0.000 (fixed)	0.000 (fixed)
Intercept/Curvature Residual Covariance		-0.001 (0.001)	-0.001 (0.002)	-0.004 (0.003)	0.052* (0.006)	0.019 (0.014)	0.000 (fixed)	0.000 (fixed)	0.000 (fixed)	0.000 (fixed)

Note: N = 8,887. Tabled values are logistic regression parameters and their standard errors. The Curvature Loadings reflect the estimated shape of the trajectory of log-odds of drinking in a given year, anchored at 0 (first year of the trajectory) and 100 (age 19). Values greater than 100 indicate a peak above the age-19 level. Software rounding limits precision in some cases.

* $p < .05$.

Table 3

Parameter Estimates from Full Model III: Effects of Race/Ethnicity and Gender on Trajectories

		Age of Initiation Class								
		<=12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**Not by 20**
Prediction by Race (Black) [a]										
	Intercept	-0.08* (0.04)	-0.08* (0.03)	-0.08* (0.03)	-0.06* (0.02)	-0.08* (0.02)	-0.05* (0.02)	-0.05* (0.01)	0.00 (fixed)	0.00 (fixed)
	Curvature	-0.001 (0.007)	-0.004 (0.008)	-0.003 (0.004)	-0.175* (0.020)	-0.053* (0.011)	0.001 (0.002)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 13	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 14	-0.29 (0.41)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 15	0.08 (0.52)	0.14 (0.34)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 16	-0.43 (1.03)	-0.24 (0.41)	0.22 (0.26)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 17	0.44 (1.08)	0.02 (0.72)	0.09 (0.25)	-0.15 (0.23)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 18	0.04 (0.83)	-0.08 (0.47)	-0.20 (0.24)	-0.16 (0.27)	-0.17 (0.24)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 19	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
Prediction by Ethnicity (Hispanic)[a]										
	Intercept	-0.04 (0.04)	0.05 (0.04)	0.02 (0.03)	0.00 (0.02)	0.01 (0.02)	-0.01 (0.02)	-.01 (0.02)	0.00 (fixed)	0.00 (fixed)
	Curvature	0.001 (0.011)	-0.003 (0.007)	-0.002 (0.003)	0.023 (0.017)	-0.022 (0.015)	-0.003 (0.002)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 13	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 14	0.30 (0.44)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 15	0.16 (0.49)	-0.45 (0.36)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 16	0.60 (1.66)	-0.49 (0.59)	-0.02 (0.24)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 17	0.09 (1.89)	-0.53 (1.02)	0.21 (0.25)	-0.05 (0.02)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 18	0.30 (1.37)	-0.24 (0.70)	0.31 (0.25)	0.12 (0.25)	-0.04 (0.24)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 19	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
Prediction by Gender (Male) [b]										
	Intercept	-0.12* (0.04)	-0.02 (0.04)	-0.06 (0.04)	-0.01 (0.02)	-0.03 (0.03)	0.04 (0.03)	0.03 (0.02)	0.00 (fixed)	0.00 (fixed)

		Age of Initiation Class								
		<=12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**Not by 20**
	Curvature	0.008 (0.009)	-0.002 (0.007)	0.012* (0.005)	0.040* (0.000)	0.018 (0.019)	-0.001 (0.003)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 13	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 14	-0.65 (0.38)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 15	-0.60 (0.59)	-0.43 (0.33)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 16	-0.60 (1.33)	-0.14 (0.52)	-0.31 (0.25)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 17	-0.17 (1.35)	0.16 (0.99)	-0.32 (0.25)	0.32 (0.22)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 18	-0.24 (1.16)	-0.35 (0.73)	-0.22 (0.25)	0.01 (0.26)	0.18 (0.24)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)
	Age 19	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)	0.00 (fixed)

Note: N = 8,887. Tabled values are logistic regression coefficients and their standard errors. The significant demographic effects on curvature reflect differences in the estimated shape of the trajectory of log-odds of drinking in a given year. Positive values indicate greater expected probabilities of alcohol use.

[a] Effect-coded. Interpret individual coefficients with caution.

[b] Dummy-coded, with “male” as high.

* $p < .05$.