



# Trajectories of risk behaviors across adolescence and young adulthood: The role of race and ethnicity



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## HIGHLIGHTS

- Controlling for gender and family SES, substance abuse behavior development is associated with race and ethnicity.
- African Americans and Hispanics are less likely than non-Hispanic Whites to use cigarettes and smokeless tobacco early.
- There were no significant differences regarding any marijuana use between race/ethnicity groups after controlling for SES.
- Findings help identify time points for morbidity- and early mortality-reduction interventions for substance use behaviors.

## ARTICLE INFO

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## ABSTRACT

**Introduction:** Despite important advances of longitudinal research in substance use behaviors, most studies stratify analyses by gender or race, which limits the ability to directly compare the likelihood of a particular developmental pathway across demographic groups. Thus, there is critical need for well-designed research to examine the associations of race/ethnicity with developmental trajectories of substance use behaviors across adolescence through adulthood.

**Methods:** Using an accelerated longitudinal design, we examined behaviors across ages 12–31 from Waves I–IV of the National Longitudinal Study of Adolescent to Adult Health. We performed growth mixture modeling, resulting in estimated trajectories over time. Next, we assessed the association between race/ethnicity and trajectory membership using multinomial logistic regression.

**Results:** Five trajectories resulted for marijuana use, four for cigarette smoking, three for smokeless tobacco use and number of days drunk, and two trajectories for heavy episodic drinking. Controlling for gender and family socioeconomic status, African Americans and Hispanics were less likely than non-Hispanic Whites to use cigarettes or smokeless tobacco early or to use alcohol heavily.

**Conclusions:** Substance use behavior development follows different pathways for US adolescents and young adults, with some individuals experimenting earlier in adolescence and others beginning to use later in adolescence or in early adulthood. We extend developmental knowledge about these behaviors by demonstrating that the patterns of behavior vary by race/ethnicity; members of lower-risk trajectories (those involving later or no initiation of substance use) are more likely to be African American or Hispanic than to be non-Hispanic White.

## 1. Introduction

Adolescence is a vulnerable time for the development of risk behaviors associated with disease and premature death (CDC, 2013).

Substance use behaviors are initiated and established from adolescence to adulthood (Mahalik et al., 2013). In a recent study, about 31.4% of high school students use tobacco products; 63.2% have drunk alcohol; and 38.6% have used marijuana (CDC, 2013). Since these behaviors can

**Abbreviations:** ADD Health, The National Longitudinal Study of Adolescent to Adult Health; US, United States; GMM, growth mixture modeling; ALD, accelerated longitudinal study design; AIC, Akaike information criteria; SSA-BIC, Bayesian information criteria; LMR-LRT, Vuong-Lo-Mendell Rubin unadjusted test; LMR-A-LRT, Vuong-Lo-Mendell Rubin adjusted test; HED, heavy episodic drinking; SES, socio-economic status

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lead to disease and death and often start in adolescence, it is important to understand their patterns of development. There is not one common trajectory of development; rather, subgroups of adolescents initiate and maintain risk behaviors at different times and to varying degrees (Frech, 2012). It is important to analyze these trajectory patterns to design more effective prevention policies and programs, tailored to specific subgroup needs and characteristics.

According to Life Course Theory, trajectories of health behaviors change across life stages and vary depending on social factors and cultural context (Elder, 1998). Further, risk or protective factors and experiences tend to accumulate over time, across an individual's life course. Cumulative advantage and disadvantage is defined as a "systemic tendency for interindividual divergence in a given characteristic with the passage of time" (Dannefer, 2003, p. S327). In other words, over time individuals with certain risk or protective characteristics tend to become more like others who share those characteristics, and distinct from others who do not share those characteristics. This is important for behavioral outcomes because it allows identifying persons more likely to embark on a riskier developmental trajectory.

Recent advanced longitudinal research provides an important understanding of the patterns of trajectories for tobacco, alcohol, and marijuana use. Prior research suggests there are 4–6 different trajectory classes of smoking behavior: early stable smokers, late stable smokers, experimenters, and quitters (Audrain-McGovern et al., 2004; Chassin et al., 2000; Costello, Dierker, Jones, & Rose, 2008; Fergus, Zimmerman, & Caldwell, 2005). For alcohol and marijuana use, most studies identify four categories of trajectories, typically categorized as early high users, light/moderate stable users, steady increasers, and occasional light users (Maggs & Schulenberg, 2004; Passarotti et al., 2015; Tucker, Ellickson, Orlando, Martino, & Klein, 2005). However, there are some gaps and inconsistencies in the identified patterns among these studies (Nelson et al., 2015), potentially as a result of sampling differences, measurement issues, and/or modeling differences. Thus, the current study aims to improve on prior research by using a nationally-representative longitudinal data set covering a wide developmental period, and by using an up-to-date modeling methodology.

One important modeling choice is the treatment of racial/ethnic groups. Most prior studies stratify analyses by race/ethnicity, thereby limiting the ability to directly compare the likelihood of a particular developmental pathway across groups (Chen & Jacobson, 2012; Finlay, White, Mun, Cronley, & Lee, 2012). Such an approach may lead readers to assume that race/ethnicity can serve as a proxy for exposure to determinants of risk behavior development. Moreover, there is indication that different racial and ethnic groups have unique patterns of development of substance use behaviors (Chen & Jacobson, 2012; Pampel, 2008). Most studies show African American or Hispanic youth engage in lower levels of tobacco, drug, and alcohol use, and tend to begin these behaviors at older ages than White youth (Evans-Polce, Vasilenko, & Lanza, 2015; White, Nagin, Replogle, & Stouthamer-Loeber, 2004). However, relatively few studies have quantified the associations of race/ethnicity with developmental trajectories of substance use behaviors across adolescence and into adulthood.

### 1.1. Goals of the study

A better understanding of similarities and differences between trajectory classes of behavioral development can help health care professionals develop more tailored intervention approaches. To achieve this, we use a latent modeling approach to explore whether there are unique subgroups distinguishable within the developmental trajectories of different risk behaviors by examining deviations from each trajectory. To provide more nuanced insight into the relationship between race/ethnicity and substance use outcomes, we examine whether and how race/ethnicity is a significant predictor of subgroup membership for each substance use behavior. The goals of this study are to (1) identify

subgroups of adolescents and young adults in the transition to adulthood with distinct trajectories of change over time for each of type of behavior: tobacco, alcohol, and marijuana use; and (2) examine how race/ethnicity is associated with subgroup membership. This approach advances the field of risk behavior research focused on the transition to adulthood by allowing for unobserved, latent classes of substance use behavior trajectories to emerge.

## 2. Methods

### 2.1. Sample

This study analyzes data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative sample of U.S. adolescents and young adults (Add Health, 2016; Harris, 2009). We employed growth mixture modeling (GMM) that allows us to distinguish subpopulations defined by their patterns of change over time and characterize subgroups of individuals based on their substance use patterns (Ram & Grimm, 2009). The 9421 participants interviewed at all four waves of data collection were included in data analysis while others were handled with subpopulation analyses and weighting accounting for longitudinal attrition. Trajectory classes were modeled in adolescents and young adults from ages 12 to 31. Participants without sample weights were removed. The subpopulation of participants who did not have missing race/ethnicity or were not Native American and had valid, non-missing data on each dependent variable of interest, calculated age, as well as dates of interviews and birth were analyzed in each model with subpopulation analysis (Chantala & Tabor, 2010). The university institutional review board approved this study.

### 2.2. Measures

Age was calculated by subtracting the respondent's date of birth (reported at Wave I or IV, respectively) assuming the 15th day of month and year from the date of interview.

Race/ethnicity was categorized from Wave I self-report as Hispanic, non-Hispanic Black or African American, non-Hispanic Asian, non-Hispanic White, or non-Hispanic other (not including non-Hispanic Native American in subpopulation analysis).

We examined three domains of substance use behavior available at each wave: cigarette use, alcohol use, and marijuana use. Days of cigarette smoking or chewing tobacco in the past 30 days ranged from zero to 30. Number of cigarettes smoked in the past 30 days ranged from 0 to 100. Number of days in the past year of drinking 5 or more drinks in a row if male and 4 or more drinks in a row if female (heavy episodic drinking) and getting drunk were conservatively considered as 0 days for responding never, 1 day for once or twice, 3 days for once a month or less (3–12 times in the past 12 months), 24 days for 2 or 3 days a month, 52 days for 1 or 2 days a week, 156 days for 3 to 5 days a week, and 365 days for every day or almost every day (cf. Table SM1 in Supplemental material is an example of frequencies of responses by wave for heavy episodic drinking). Dichotomous outcomes were any marijuana use in the past 30 days (dichotomized to any times vs. none due to low prevalence).

### 2.3. Statistical analysis

Analyses were performed under an accelerated longitudinal study design (ALD) framework (Galbraith, Bowden, & Mander, 2017). All analyses took into account the complex survey design of Add Health according to Chantala and Tabor (2010). GMM was performed to estimate trajectories (latent classes) of health risk behaviors over time and to compare groups while accounting for classification uncertainty (Wang and Bodner, 2007). Counts were modeled using negative binomial regression GMMs while binary outcomes were similarly modeled using logistic GMM. Non-planned missing data were handled through

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