



Published in final edited form as:

Soc Sci Med. 2015 January ; 124: 132–141. doi:10.1016/j.socscimed.2014.11.035.

Racial/ethnic differences in use of alcohol, tobacco, and marijuana: Is there a cross-over from adolescence to adulthood?

Katherine M. Keyes^{1,2}, Thomas Vo¹, Melanie Wall^{2,3}, Raul Caetano^{4,5}, Shakira F Suglia¹, Silvia S. Martins¹, Sandro Galea¹, and Deborah Hasin^{1,2,6}

¹ Department of Epidemiology, Columbia University Mailman School of Public Health, New York, NY

² Department of Psychiatry, Columbia University College of Physicians and Surgeons, New York, NY

³ Department of Biostatistics, Columbia University Mailman School of Public Health, New York, NY

⁴ University of Texas Southwestern School of Health Professions, Dallas, TX

⁵ University of Texas School of Public Health, Dallas TX

⁶ New York State Psychiatric Institute

Abstract

Black adolescents in the US are less likely to use alcohol, marijuana, and tobacco compared with non-Hispanic Whites, but little is known about the consistency of these racial/ethnic differences in substance use across the lifecourse. Understanding lifecourse patterning of substance use is critical to inform prevention and intervention efforts. Data were drawn from four waves of the National Longitudinal Study of Adolescent Health (Add Health; Wave 1 (mean age=16): N=14,101; Wave 4 (mean age=29): N=11,365). Outcomes included alcohol (including at-risk drinking, defined as 5+/4+ drinks per drinking occasion or 14+/7+ drinks per week on average for men and women, respectively), cigarette, and marijuana use in 30-day/past-year. Random effects models stratified by gender tested differences-in-differences for wave by race interactions, controlling for age, parents' highest education/income, public assistance, and urbanicity. Results indicate that for alcohol, Whites were more likely to use alcohol and engage in at-risk alcohol use at all waves. By mean age 29.9, for example, White men were 2.1 times as likely to engage in at-risk alcohol use (95% C.I. 1.48-2.94). For cigarettes, Whites were more likely to use cigarettes and smoked more at Waves 1 through 3; there were no differences by Wave 4 for men and a diminished difference

© 2014 Elsevier Ltd. All rights reserved.

Corresponding author: Katherine M. Keyes, Assistant Professor of Epidemiology, Columbia University Department of Epidemiology, Mailman School of Public Health, 722 West 168th Street, Suite 503, New York, NY 10032, Tel: (212) 304-5652, kmk2104@columbia.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Financial disclosure/conflict of interest: The authors report no conflicts of interest

for women, and difference-in-difference models indicated evidence of convergence. For marijuana, there were no racial/ethnic differences in use for men at any wave. For women, by Wave 4 there was convergence in marijuana use and a cross-over in frequency of use among users, with Black women using more than White women. In summary, no convergence or cross-over for racial/ethnic differences through early adulthood in alcohol use; convergence for cigarette as well as marijuana use. Lifecourse patterns of health disparities secondary to heavy substance use by race and ethnicity may be, at least in part, due to age-related variation in cigarette and marijuana use.

Keywords

race; ethnicity; African American; substance use; tobacco; alcohol; marijuana; Add Health

Introduction

In adolescence and young adulthood, Blacks are less likely to use alcohol and tobacco (Baker et al., 2003; Breslau et al., 2006; Hasin et al., 2007; Pacek et al., 2012; Swendsen et al., 2012; Wu et al., 2011; Zapolski et al., 2014), and equally or less likely to use marijuana depending on the time frame assessed (Pacek et al., 2012; Wu et al., 2011), compared with non-Hispanic Whites (henceforth referred to as “Whites”). However, among users of the substances, Blacks progress from use to dependence faster than Whites (Alvanzo et al., 2011), have longer duration of use (Caetano & Kaskutas, 1995), and experience more substance-related consequences than other racial/ethnic groups.. Specifically, in early adulthood, Blacks are more likely to experience legal and social/interpersonal problems related to use (Witbrodt et al., 2014), arrest/incarceration for marijuana-related offences (Ramchand et al., 2006), and injury (Keyes et al., 2012a; Witbrodt et al., 2014). At later stages of adulthood, Blacks have higher rates of lung cancer mortality (Gadgeel & Kalemkerian, 2003), and cardiovascular outcomes (Volkow et al., 2014). The reasons for the contrast in race/ethnic differences in substance use patterns, and in consequences of use, both in young adulthood and as individuals progress through the lifecourse, among users are unknown. Many of these consequences occur later in the lifecourse than adolescence or early adulthood, suggesting potential explanations of the contrast.

Explanations underlying these observations are emerging. While overall rates of alcohol, marijuana, and tobacco use among Blacks are generally lower than among Whites, several large-scale epidemiologic studies show a convergence in use by age, with rates becoming more similar, or ‘crossing-over’ by age (Caetano, 1984; Feigelman & Lee, 1995; Finlay et al., 2012; Kandel et al., 2011; Pampel, 2008; Robins, 1985; Watt, 2008). While studies vary in the age at which this cross-over occurs, generally the late 20s and early to mid 30s are found to be the critical developmental period for cross-over in substance use (Pampel, 2008; Watt, 2008). Therefore, while lower overall prevalence of use among Black compared with White adolescents is driven by patterns in these early life stages, higher use among Blacks compared with Whites in later stages of adulthood may drive the greater burden of substance use consequences among Blacks. Our understanding of the epidemiological patterns of

substance use across race/ethnicity over the lifecourse, however, remains inadequate for several reasons.

First, studies of racial/ethnic differences across the lifecourse are predominately comprised of large cross-sectional samples of adolescents (Bachman et al., 1991; Feigelman & Lee, 1995; Kandel, 1995; Kandel et al., 1976; Swendsen et al., 2012; Wallace & Bachman, 1991) or adults (Alvanzo et al., 2014; Dunlop et al., 2003; D. Herd, 1990; Wallace, 1999; Watt, 2008; Witbrodt et al., 2014). Longitudinal studies are largely community and convenience samples with limited variation in age ranges (Brown et al., 2005; Caetano & Kaskutas, 1995, 1996; Cooper et al., 2008; Finlay et al., 2012; Myers et al., 1995; Weaver et al., 2011), with notable exceptions (Chen & Jacobson, 2012; K. M. Harris et al., 2006; Pampel, 2008). These longitudinal samples suggest convergence in tobacco (White et al., 2004) and marijuana use (Finlay et al., 2012), but not for alcohol (Caetano & Kaskutas, 1995, 1996). Data from the National Longitudinal Study of Youth indicated convergence in rates of cigarette smoking over time between White and Black Americans followed into their mid-thirties (Pampel, 2008). Confirmation of these findings and expansion to examine possible gender differences is necessary to fully elucidate lifecourse patterns of substance use.

Second, the effects of socio-economic status on racial/ethnic differences in substance use remain inadequately understood, and some data suggest that racial/ethnic differences in age-related variation could be fully accounted for by socio-economic indicators (Watt, 2008). The extent to which racial/ethnic differences persist despite mean differences in socio-economic status, versus other cultural or social group differences (Zapolski et al., 2014), is important for inferring conclusions from the data on racial and ethnic differences across the lifecourse. For alcohol, available evidence indicates that while income is positively associated with use in general (Keyes & Hasin, 2008), among those in poverty, Black men have higher rates of heavy drinking compared with Whites. (Ford et al., 2007; Gilman et al., 2008; Jones-Webb, 1998; Jones-Webb et al., 1997). Examining these relations across other substances with rigorous control for socio-economic factors is critical.

Third, the role of gender in substance use is critically important to understanding its etiology and consequences. While social norms regarding substance use are changing for women (Goodwin et al., 2009; Keyes et al., 2008a; Keyes et al., 2010b), drinking and other substance use remains less acceptable for women than for men (Ahern et al., 2008; Greenfield & Room, 1997; Jones-Webb, 1998; Keyes et al., 2011). Recent evidence indicates that Whites are more susceptible to influence from social norms regarding substance use compared with Blacks (Keyes et al., 2012b) and report more positive attitudes toward drinking (Caetano & Clark, 1999; D. Herd, 1997), suggesting that the intersection of race and gender in trajectories of substance use may shed light on potential emerging disparities. Recent evidence from cross-sectional data indicate, for example, that Black women have higher rates of alcohol-related problems relative to White women at equal levels of alcohol consumption (Witbrodt et al., 2014). In addition, Black men have higher rates of alcohol-related problems among those with low levels of heavy drinking (Witbrodt et al., 2014); higher rates of incident alcohol disorders among Black compared with White women, although not among Black compared with White men over the age of 29 (Grant et al., 2012). Thus, examining the intersection of race and gender when examining patterns of

substance use over time may yield important insights about the processes that underlie racial/ethnic differences in substance use across the lifecourse.

Using data from the first three waves of a nationally representative US sample followed from adolescence through the early twenties (National Longitudinal Study of Adolescent Health [Add Health]), Harris et al. (2006) documented increases in alcohol, marijuana, and tobacco use during the transition to adulthood for both White and Black participants, but no evidence of convergence or cross over, though this was not specifically tested (K. M. Harris et al., 2006). More recently, in the same sample followed to early to mid-30s, Chen and Jacobson (2012) documented age-related differences by race and ethnicity in patterns of any substance use. Consistent with prior evidence, Whites had higher prevalence of alcohol, tobacco, and marijuana use in early adulthood. Differences between Black and White young adults either diminished (alcohol) or crossed over (tobacco and marijuana) by the early to mid-30s. However, trajectories of quantity and frequency of use among users may differ in important ways from trajectories of any use. For example, previous research has demonstrated that Black young adults have different drinking patterns compared with Whites, including different beverage preferences and premise utilization patterns (Zapolski et al., 2014). Examination of such variation in quantity and frequency is critical, as adverse physical health outcomes secondary to substance use, both in young adulthood and through the lifecourse, are only exhibited at high and chronic levels of consumption (Connor, 2006). Further, existing studies in these data have not controlled for important socio-economic differences across groups; a full accounting is critical in inferring the extent to which racial/ethnic differences persist over and above socio-economic circumstances.

Informed by previous studies in these data, we tested differences in trajectories of alcohol, marijuana, and tobacco use among Black and White participants in the Add Health sample. We examine differences in quantity and frequency of alcohol, tobacco, and marijuana use between Black and White respondents from adolescence (mean age 16) through adulthood (mean age 29), stratified by gender, robustly testing modification of association with race/ethnicity by survey wave, and fully adjusting for multiple measures of socio-economic position to comprehensively investigate the evidence for convergence and/or cross-over of risk among Black and White participants during the transition to adulthood.

Method

Sample

Data were drawn from Add Health (K.M. Harris et al., 2009), an ongoing national-representative longitudinal study to address health, behaviors, and relationships from adolescence through adulthood. The study began with approximately 90,000 adolescents sampled in school in 1994-1995; 20,745 of these underwent in-depth home interviews (1995, age 12-21). Waves 2 through 4 attempted re-interview of respondents who underwent the in-depth interviews at Wave 1. However, children who graduated high school were not included in the Wave 2 sample unless they were part of a sibling sub-study; therefore the mean age of the Wave 2 sample is slightly lower than the mean age of the Wave 1 sample (Wave 1: 16.03; Wave 2: 15.99). Respondents that were no longer in high school at the Wave 2 interview, however, remained eligible for the Wave 3 and 4 interviews and were

recontacted. We analyzed data on non-Hispanic Whites and Blacks with a sample weight at Wave 1 (N=14,101). Sample sizes in remaining interview waves were as follows: 1996 (Wave 2, N=10,203), 2001-2002 (Wave 3, N=10,786), and 2007-2008 (Wave 4, N=11,365). Further details on the study design can be found elsewhere (K.M. Harris et al., 2009).

Measures

We utilized substance use measures that were queried consistently across the four waves of sampling. All measures are based on the self-report of the respondent. Measures of self-reported substance use have well-documented reliability and validity (Buchan et al., 2002; Midanik, 1988; Patrick et al., 1994), especially when asked over short, recent time frames. We utilized measures of substance use in the past 30 days and past year.

Tobacco use

Respondents were asked consistently across waves: 1) how many days they smoked cigarettes in the past 30 days; and 2) how many cigarettes they smoked on average on days they smoked in the past 30 days. Based on preliminary analyses of distributions of the data, we examined three primary smoking-related outcomes: past 30-day use (yes/no), use more than 25 days in the past month (yes/no), and average number of cigarettes smoked on days smoked.

Alcohol use

Respondent were consistently asked across waves: 1) ever had more than a taste or sip of alcohol (since last interview for Waves 2 through 4); 2) average frequency of drinking in the past year; 3) average number of drinks per drinking occasion; 4) number of occasions had 5+ drinks in a row in the past year; and 5) number of occasions gotten drunk or very high on alcohol, past 12 months. For questions on frequency of drinking, graded response options were allowed ranging from once a year to every day. At-risk drinking was defined as any instance of 5+ drinks per drinking occasion or 14+ drinks per week on average for men, and any instance of 4+ drinks per drinking occasion or 7+ drinks per week on average for women (National Institute on Alcohol Abuse and Alcoholism, 2005, 2013).

Using these questions, we examined three primary alcohol-related outcomes to include a range of indicators of quantity, frequency, and potential problem drinking in the past 12 months: any drinking in the past year (yes/no), at-risk drinking in the past year (yes/no), average number of drinks consumed when drinking alcohol, among consumers, and frequency of drunkenness among drinkers.

Marijuana use

Respondents were consistently asked across waves the number of days that they used marijuana in the last 30 days. Measures of quantity were not available.

Using these questions we examined two marijuana-related outcomes covering use and frequency of use: any marijuana use in the past 30 days, frequency of marijuana use in the past 30 days among users, and at least weekly marijuana use in the past 30 days.

Covariates

All analyses were done stratified by gender, given the substantial differences in base rates of substance use by gender (Keyes et al., 2008a), and evidence that racial/ethnic differences in trajectories of substance use differ by gender (e.g., (Caetano, 1984)). Age within measurement wave was included as a covariate in adjusted models, as was highest level of parental education, urban versus rural location (Gibbons et al., 2007), family use of public assistance, and household income in adolescence given evidence that racial/ethnic differences in substance use are partially accounted for by socio-economic status (Watt, 2008). All socio-economic indicators were significantly correlated. The strongest correlations were between parental education and family income ($r=0.35$) and use of public assistance and family income ($r=0.47$). By race, there were no average differences in baseline age ($\chi^2=2.1$, $df=2$, $p=0.34$); Black respondents on average had lower levels of parental education ($\chi^2=21.9$, $df=2$, $p<0.01$), lived in urban areas ($\chi^2=44.8$, $df=2$, $p<0.01$) were more likely to be in families that used public assistance ($\chi^2=1099.6$, $df=1$, $p<0.01$), and had lower household income in adolescence ($\chi^2=598.8$, $df=1$, $p<0.01$).

Statistical analysis

The analysis proceeded in three stages. First, we estimated prevalence for binary outcomes and means/standard deviations for continuous outcomes among Blacks and Whites for each wave of the study. Second, we estimated multivariate random effects models, modeling log odds and/or mean differences in each substance use outcome between Blacks and Whites at each wave of the study, accounting for the correlation within person in substance use across time while estimating between group variance. Third, we estimated difference-in-difference random effects models to test whether the association between race/ethnicity and substance use changed across the four waves of the study. For example, we tested whether the difference in any past 30-day smoking between Blacks and Whites became larger, smaller, or did not change from Wave 1 to Wave 2, Wave 2 to Wave 3, Wave 3 to Wave 4, Wave 1 to Wave 4. We implemented this difference-in-difference approach by creating model constraint parameters in MPLUS that estimated the difference in estimates of effect across waves, and tested whether these parameters were significantly different from 0 (0 would indicate no difference in the estimates of effect across wave) (Muthen & Muthen, (1998-2012)). Models were estimated first unadjusted and then adjusted for age within wave, highest level of parental education, urban versus rural location, family use of public assistance, and household income. Complex sampling weights were included in all stages of analysis. SAS version 9.4 was used for data management, and MPLUS version 7 was used for all analysis.

Treatment of missing data

Some attrition of Add Health respondents occurred over time. Among Black and White respondents, 48.7% completed all four waves, 29.6% completed three waves, 29.31% completed two waves, and 7.5% completed the baseline survey only. Whites were less likely to complete all four waves than Blacks (45.5% versus 55.0%, $X^2=43.2$, $df=3$, $p<0.01$). We treated missing data, both attrition and variable missing data, with two approaches. First, we used full-information maximum likelihood imputation in MPLUS software based on the set

of covariates described above. Second, we conducted a sensitivity analysis using complete cases (results below), those respondents who completed all four interviews and had complete data on all covariates, only. In these sensitivity analyses, we also incorporated a different set of longitudinal sampling weights that are available on those followed to Wave 4, which adjust the sample to be representative of sample characteristics at baseline.

Results

Descriptive statistics on substance use

Figures 1 through 3 show the trajectory of tobacco, alcohol, and marijuana among Black and White respondents at each wave of the study, by gender.

Alcohol use—Any alcohol use ranged from 35.8% (Black males) to 50.8% (White females) at Wave 1, and 55% (Black females) to 80% (White males) at Wave 4. Among both male and female white drinkers, risky drinking peaked at Wave 2 (approximately age 16) and decreased thereafter. Among Blacks, at-risk drinking was relatively stable or decreasing throughout the study period, approximately 20-30%. Similar trajectories were documented for average number of drinks per drinking occasion, among drinkers.

Tobacco use—At Wave 1, past 30-day smoking ranged from 17.4% (Black) to 30.4% (White) among men and 12.5% (Black) to 32.8% (White) among females. Smoking in the past 30 days increased across the four waves of the study for all groups except White females, in which it peaked at Wave 2 and thereafter decreased. Among smokers, number of cigarettes smoked on days smoked peaked in Wave 3 for all groups except Black males.

Marijuana use—Use and frequency of use was generally lower among women than men, but few racial/ethnic differences emerged by gender. Among users, frequency of use generally increased across the study. For both males and females, Whites had a higher frequency of use at Waves 1 through 3, whereas Blacks had a higher frequency of use at Wave 4. This is most pronounced among females.

Online Figures 1 through 3 show the results when substance use was estimated by age rather than Wave. While there is more variability in the estimates, the trends over time by race remain similar to those demonstrated by wave.

Associations between race/ethnicity and substance use across waves

Tables 1 and 2 examine the association between race and substance use at each wave, all adjusted for age, highest level of parental education, urban versus rural location, family use of public assistance, and household income in adolescence to determine the extent to which differences persist once accounting for socio-economic status.

Alcohol use—Whites were significantly more likely than Blacks to use alcohol, engage in at-risk drinking, and had more average drinks per drinking session, at all waves for both males (Table 1) and females (Table 2). For frequency of drunkenness among drinkers, among females, Whites had higher frequency at all waves; among males, there were no

significant differences at Waves 1 and 2; Whites had higher frequency of drunkenness at Waves 3 and 4.

Tobacco use—Whites were more likely than Blacks to engage in any smoking, in males (Table 1) and females (Table 2), at Waves 1 through 3; by Wave 4, there was no significant difference in any smoking among men (OR=1.17, 95% C.I. 0.95-1.44) though there remained a substantial difference among women (OR=2.93, 95% C.I. 2.14-4.03). Among smokers, Whites also smoked more cigarettes on average at all waves. The magnitude of the relationship between race/ethnicity and tobacco use generally decreased across time. For example, among males, Whites had 2.6 times the odds of smoking in the past month at Wave 1 (95% C.I. 2.0-3.4), but 1.17 times the odds of smoking in the past month at Wave 4 (95% C.I. 1.0-1.4).

Marijuana use—Among males, there were no significant race/ethnic differences in any marijuana use or at least weekly use at any wave, save for an increase in frequency of use among Whites compared with Blacks at Wave 2 (B=0.45, 95% C.I. 0.06-0.84). Among females, Whites were more likely to use than Blacks at Waves 1-3; no significant difference was observed at Wave 4 (OR=1.27, 95% C.I. 0.93-1.73). There were no significant differences in frequency at any wave, save for an increase in frequency of use among Whites compared with Blacks at Wave 2 (B=0.64, 95% C.I. 0.22-1.07)

Difference-in-differences models

Table 3 shows the difference in the magnitude of the association between race/ethnicity and substance use, comparing Wave 4 to Wave 1. Other pairwise comparisons are provided in Online Table 1. A negative coefficient indicates a reduction in the magnitude of association between race/ethnicity and substance use across the study period (convergence); a positive coefficient indicates an increase in the magnitude of association between race/ethnicity and substance use across the study period.

Alcohol use—For males, there were no significant differences in alcohol outcomes comparing Wave 4 to Wave 1. However, as shown in Online Table 1, estimates significantly converged between Wave 4 and Wave 3 for at-risk drinking (B=-0.56, SE=0.21, p=0.01) and average number of drinks consumed, suggesting a possible trend towards convergence as this cohort ages. Among females, the difference in the magnitude of association between race/ethnicity and average number of drinks consumed on days used diminished over time (B=-0.64, SE=0.28, p<0.01) (see Table 3), and any use as well as frequency of drunkenness exhibited non-significant negative coefficients.

Tobacco use—Among males, there was evidence of convergence in any use (B=-1.27, SE=0.22, p<0.01), use >25 days (B=-2.09, SE=0.46, p<0.01), and average days of use among users (B=-5.11, SE=1.32 p<0.01) (see Table 3). Similar results were found for females.

Marijuana use—There was no evidence for differences in magnitude of associations between race/ethnicity and marijuana across time for males. Among females, the difference

in the magnitude of association between race/ethnicity and any marijuana use ($B=-0.63$, $SE=0.25$, $p=0.01$) and at least weekly use ($B=-0.97$, $SE=0.30$, $p<0.01$) diminished over time (see Table 3), and frequency of use among users ($B=-0.69$, $SE=0.32$, $p=0.03$) crossed-over, whereby Black females had significantly higher frequency of use by Wave 4. Convergence was also documented for at least weekly use ($B=-0.97$, $SE=0.30$, $p<0.01$, see Online Table 3).

Sensitivity analyses

Due to attrition in the sample over time, we conducted a complete case analysis of only those respondents who completed all four waves of the study with complete data. Results are provided in Online Tables 2 and 3. Results remain largely unchanged among those who completed all four waves. One notable difference is that the difference-in-difference estimates for the association between race and marijuana use among women are no longer significant; however, the results are in the same direction, both suggesting cross-over in use across development.

Discussion

We examined the evidence for convergence and cross-over in the prevalence of alcohol, cigarette, and marijuana use between White and Black men and women sampled in adolescence from schools in the US as they age from adolescence to adulthood. Importantly, the present study attends rigorously to socio-economic differences, controlling for a range of economic indicators including material deprivation, geographic location, and supplementation with use of public assistance. We summarize the results for each substance. First, for alcohol use, we found little evidence of convergence or cross-over in prevalence of any outcome, though there is some evidence that heavy drinking is beginning to converge among adult males; further follow-up is necessary to determine whether these trends continue. Overall, however, among both men and women, Whites were more likely than Blacks to use any alcohol and engage in at-risk or heavy alcohol use, higher drinking quantity and frequency across time. The exception is that there is convergence (but not cross-over) over time in average drinks per drinking setting between White and Black female drinkers. Second, for cigarette use, there is robust evidence of convergence in past-30 day cigarette use, as well as using >25 days in the past month and in the number of days of use among users, among both men and women. There was no evidence, however, of a crossover of prevalence between Whites and Blacks. Third, marijuana use was the only outcome for which there was some evidence of cross-over, among women only. Among males, there were few differences in marijuana use or frequency at any time frame; among females, however, there was evidence of convergence and for marijuana users, Whites had higher frequency of use at Wave 1, though by Wave 4, Blacks had higher frequency of use. The study benefitted from one the largest samples examined to date, wide geographic variation, and follow-up into adulthood to examine trajectories of substance use by race/ethnicity in the US.

Overall, our results provide limited evidence for a *cross-over* in racial-ethnic differences in substance use in the general population through early adulthood. However, there is

convergence in almost all cigarette and marijuana use measures at this developmental period. Results for cigarettes and marijuana use suggest that race/ethnic disparities in substance-related consequences that often occur later than young adulthood may arise in part due to race/ethnicity differences in use of these substance that vary across lifecourse stages. These results were apparent in unadjusted models and persisted after rigorous control for socio-economic differences.

Our results are consistent with other literature that has examined trajectories of substance use in longitudinal samples through adulthood. For example, Pampel (2008) observed convergence in race/ethnic rates of smoking from early to mid adulthood in a national longitudinal sample, and a longitudinal sample of high-risk boys in Pittsburgh also demonstrated a later onset and greater persistence among African Americans relative to Whites followed into young adulthood (Finlay et al., 2012; White et al., 2004). These results are also consistent with, and extend, the findings of Chen and Jacobsen in the Add Health sample, who reported that racial/ethnic differences in smoking converge, and cross-over for marijuana use, in young adulthood (Chen & Jacobson, 2012). We note differences between the two analyses, however. We document in the present study that rates of cigarette use and alcohol use, in particular, remain robustly higher in Whites compared with Blacks into young adulthood, controlling rigorously for socio-economic differences through the lifecourse, and document these effects for a wide range of quantity and frequency indicators of use, which are critical in order to understand disparities that emerge in health consequences of use. We suggest that the results of the present study, combined with those of Chen and Jacobsen (2012), indicate that lifecourse trajectories of substance use in general indicate limited evidence for a cross-over in early adulthood, but robust evidence for convergence for smoking.

Several mechanisms may underlie convergence in racial/ethnic differences in smoking and, for women, marijuana use across the lifecourse. First, our results as well as results of others suggest that two simultaneous mechanisms may underlie smoking convergence: White young adults are more likely to cease smoking in young adulthood (Barbeau et al., 2004; King et al., 2004), and the average age of onset of smoking is later for Blacks than for Whites (Geronimus et al., 1993; Kandel et al., 2011; Moon-Howard, 2003). This pattern also holds for marijuana (Finlay et al., 2012). This combined later onset of smoking and lower cessation at least partially underlies the convergence in young adulthood. Second, substantial evidence has supported a ‘weathering’ hypothesis for Blacks in the US (Geronimus, 1992). That is, the cumulative stress of disadvantage and chronic exposure to discrimination through the lifecourse portends greater adverse health consequences at relatively earlier points in the lifecourse compared with Whites, and adoption of problematic health behaviors such as smoking at later points in the lifecourse to mitigate the experiences chronic stress. Combined, this literature indicates that disparities in long-term health consequences of cigarette and marijuana use may reflect differences in lifecourse patterns of use across time, potentially suggesting that a public health approach that recognizes the structural and institutional contribution of stress and discrimination to onset of problem health behaviors may be an effective strategy to reducing long-term health consequences from use. In the short term, prevention and intervention strategies that are culturally

appropriate, targeted, and resourced should be adopted to specifically reduce the onset and persistence of smoking among Blacks in the US.

In contrast, we document little evidence for convergence or cross-over in alcohol use or other alcohol-related outcomes including quantity and frequency by early adulthood. The dynamics of alcohol use across race and ethnicity may be different than those related to other substance use, which may underlie the differences in results. Substantial evidence has documented that alcohol is less part of social life for Blacks compared with Whites, and used less frequently at mealtimes and as part of cultural events (Zapolski et al., 2014). Blacks in the US, on average, are more likely to affiliate with a religious organization and report that religion is a more important part of life compared with Whites (Chatters et al., 2008; Taylor et al., 1999), which robustly predicts alcohol abstinence and less frequent use (Haber et al., 2011). Further, evidence indicates that Whites are more susceptible to influence from perceived (D. A. Herd, 1994; Weaver et al., 2011) and objectively-measured (Keyes et al., 2012b) social norms around alcohol use compared with Blacks, whereas the same effects are not found for other substances (Keyes et al., 2011). Thus, Black youth may be less likely to engage in alcohol use as young adults and less culturally normalized to alcohol use as part of social life, predicting lower rates of use and heavy use through the lifecourse. However, we note that the Add Health sample has currently been followed through early adulthood, but further research on potential cross-over as this cohort ages is critical to follow these potential trends forward.

Nonetheless, some evidence indicates higher likelihood of alcohol abuse and dependence (Caetano, 1997; Caetano et al., 1998; Galvan & Caetano, 2003; Mulia et al., 2008) and alcohol-attributable injury (Keyes et al., 2012a) among Blacks compared with Whites. The reasons for such disparities remain inadequately understood, particularly as the present study suggests that age-related differences in drinking through the mid-30s may not be potentially underlying these epidemiologic patterns. Available data indicate few racial/ethnic differences in treatment utilization for substance problems (Alvanzo et al., 2014; Keyes et al., 2008b), suggesting that differential rates of service use are also unlikely to explain these results. Further research that attends to lifecourse patterns of substance use and its consequences into adulthood are needed.

Study limitations are noted. First, all responses are based on self-report, which is known to have error. However, we used current time frames for all analyses, limiting the effect of recall bias. However, differences in norms around drinking could lead to differential under-reporting, especially as Blacks in the US attach higher stigma to individuals perceived to have alcohol problems compared with Whites (Keyes et al., 2010a). Second, there was substantial attrition over the four waves of the study, and more attrition among Whites than among Blacks. If substance users were more likely to be lost to follow-up, which we would expect, then the sample is missing more White substance users. Thus, again, we would expect the results to be underestimated. Third, there are sizeable gaps between data collection periods, thus nuance in lifecourse associations from a year-to-year basis may be missed when relying on four data-points across two decades of development. Nonetheless, the Add Health study is a landmark study about population-based longitudinal study of development, with national representativeness and a large, diverse sample. Thus, the

limitations of misclassification and informative losses-to-follow-up do not outweigh the substantial strengths of the study.

In conclusion, the present results inform ongoing inconsistencies in the epidemiological patterns of substance use and consequences of use by race and ethnicity in the US. We find convergence in rates over the lifecourse for cigarette use and, for women, marijuana use frequency from adolescence to adulthood, suggesting that problematic patterns of use may, in part, underlie disparities in health outcomes that emerge later in life. However, similar effects are not documented for alcohol use, quantity or frequency at least through early adulthood, suggesting that further research into race/ethnicity disparities in alcohol-related health conditions that do not correspond to the consumption patterns is needed. Greater attention to exploring and understanding the intersection of race, substance use, and consequences is imperative for improving public health. Smoking and heavy drinking remain among the most prevalent and preventable causes of morbidity and mortality in the US, and mortality disparities are well documented (Gadgil & Kalemkerian, 2003). Marijuana remains the most commonly used illicit substance in the US (Compton et al., 2007), and changing policy towards decriminalization and legalization of use portends greater access and higher rates of use. A commitment to improving public health requires research resources and attention to patterns and predictors of substance use over the lifecourse.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

This research was supported by the National Institute of Alcohol Abuse and Alcoholism (K01AA021511, Keyes), National Institute of Child and Human Development (R01HD060072, Martins), National Heart Lung and Blood Institute (K01HL103199, Suglia). The funding organizations had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript. This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (<http://www.cpc.unc.edu/addhealth>). No direct support was received from grant P01-HD31921 for this analysis.

References

- Ahern J, Galea S, Hubbard A, Midanik L, Syme SL. "Culture of drinking" and individual problems with alcohol use. *Am J Epidemiol.* 2008; 167:1041–1049. [PubMed: 18310621]
- Alvanzo AA, Storr CL, La Flair L, Green KM, Wagner FA, Crum RM. Race/ethnicity and sex differences in progression from drinking initiation to the development of alcohol dependence. *Drug Alcohol Depend.* 2011; 118:375–382. [PubMed: 21652154]
- Alvanzo AA, Storr CL, Mojtabai R, Green KM, Pacek LR, La Flair LN, et al. Gender and race/ethnicity differences for initiation of alcohol-related service use among persons with alcohol dependence. *Drug Alcohol Depend.* 2014
- Bachman JG, Wallace JM Jr, O'Malley PM, Johnston LD, Kurth CL, Neighbors HW. Racial/Ethnic differences in smoking, drinking, and illicit drug use among American high school seniors, 1976-89. *Am J Public Health.* 1991; 81:372–377. [PubMed: 1994746]

- Baker L, Wagner TH, Singer S, Bundorf MK. Use of the Internet and e-mail for health care information: results from a national survey. *JAMA*. 2003; 289:2400–2406. [PubMed: 12746364]
- Barbeau EM, Krieger N, Soobader MJ. Working class matters: socioeconomic disadvantage, race/ethnicity, gender, and smoking in NHIS 2000. *Am J Public Health*. 2004; 94:269–278. [PubMed: 14759942]
- Breslau J, Aguilar-Gaxiola S, Kendler KS, Su M, Williams D, Kessler RC. Specifying race-ethnic differences in risk for psychiatric disorder in a USA national sample. *Psychol Med*. 2006; 36:57–68. [PubMed: 16202191]
- Brown EC, Catalano RF, Fleming CB, Haggerty KP, Abbott RD. Adolescent substance use outcomes in the Raising Healthy Children project: a two-part latent growth curve analysis. *J Consult Clin Psychol*. 2005; 73:699–710. [PubMed: 16173857]
- Buchan BJ, M, L.D. Tims FM, Diamond GS. Cannabis use: consistency and validity of self-report, on-site urine testing and laboratory testing. *Addiction*. 2002; 97(Suppl 1):98–108. [PubMed: 12460132]
- Caetano R. Ethnicity and drinking in northern California: a comparison among whites, blacks and Hispanics. *Alcohol Alcohol*. 1984; 19:31–44. [PubMed: 6497950]
- Caetano R. Prevalence, incidence and stability of drinking problems among whites, blacks and Hispanics: 1984-1992. *J Stud Alcohol*. 1997; 58:565–572. [PubMed: 9391915]
- Caetano R, Clark CL. Trends in situational norms and attitudes toward drinking among whites, blacks, and hispanics: 1984-1995. *Drug Alcohol Depend*. 1999; 54:45–56. [PubMed: 10101616]
- Caetano R, Clark CL, Tam T. Alcohol consumption among racial/ethnic minorities: theory and research. *Alcohol Health Res World*. 1998; 22:233–241. [PubMed: 15706749]
- Caetano R, Kaskutas LA. Changes in drinking patterns among whites, blacks and Hispanics, 1984-1992. *J Stud Alcohol*. 1995; 56:558–565. [PubMed: 7475037]
- Caetano R, Kaskutas LA. Changes in drinking problems among whites, blacks, and Hispanics: 1984-1992. *Subst Use Misuse*. 1996; 31:1547–1571. [PubMed: 8908707]
- Chatters LM, Taylor RJ, Bullard KM, Jackson JS. Spirituality and Subjective Religiosity among African Americans, Caribbean Blacks and Non-Hispanic Whites. *J Sci Study Relig*. 2008; 47:725–737. [PubMed: 21052481]
- Chen P, Jacobson KC. Developmental trajectories of substance use from early adolescence to young adulthood: gender and racial/ethnic differences. *J Adolesc Health*. 2012; 50:154–163. [PubMed: 22265111]
- Compton WM, Thomas YF, Stinson FS, Grant BF. Prevalence, correlates, disability, and comorbidity of DSM-IV drug abuse and dependence in the United States: results from the national epidemiologic survey on alcohol and related conditions. *Arch Gen Psychiatry*. 2007; 64:566–576. [PubMed: 17485608]
- Connor J. The life and times of the J-shaped curve. *Alcohol Alcohol*. 2006; 41:583–584. [PubMed: 17028307]
- Cooper ML, Krull JL, Agocha VB, Flanagan ME, Orcutt HK, Grabe S, et al. Motivational pathways to alcohol use and abuse among Black and White adolescents. *J Abnorm Psychol*. 2008; 117:485–501. [PubMed: 18729604]
- Dunlop DD, Song J, Lyons JS, Manheim LM, Chang RW. Racial/ethnic differences in rates of depression among preretirement adults. *Am J Public Health*. 2003; 93:1945–1952. [PubMed: 14600071]
- Feigelman W, Lee J. Probing the paradoxical pattern of cigarette smoking among African-Americans: low teenage consumption and high adult use. *J Drug Educ*. 1995; 25:307–320. [PubMed: 8907402]
- Finlay AK, White HR, Mun EY, Cronley CC, Lee C. Racial differences in trajectories of heavy drinking and regular marijuana use from ages 13 to 24 among African-American and White males. *Drug Alcohol Depend*. 2012; 121:118–123. [PubMed: 21908109]
- Ford BC, Bullard KM, Taylor RJ, Toler AK, Neighbors HW, Jackson JS. Lifetime and 12-month prevalence of Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition disorders among older African Americans: findings from the National Survey of American Life. *Am J Geriatr Psychiatry*. 2007; 15:652–659. [PubMed: 17504908]
- Gadgeel SM, Kalemkerian GP. Racial differences in lung cancer. *Cancer Metastasis Rev*. 2003; 22:39–46. [PubMed: 12716035]

- Galvan FH, Caetano R. Alcohol Use and Related Problems Among Ethnic Minorities in the United States. *Alcohol Research and Health*. 2003; 27:87–94. [PubMed: 15301403]
- Geronimus AT. The weathering hypothesis and the health of African-American women and infants: evidence and speculations. *Ethn Dis*. 1992; 2:207–221. [PubMed: 1467758]
- Geronimus AT, Neidert LJ, Bound J. Age patterns of smoking in US black and white women of childbearing age. *Am J Public Health*. 1993; 83:1258–1264. [PubMed: 8363001]
- Gibbons FX, Reimer RA, Gerrard M, Yeh HC, Houlihan AE, Cutrona C, et al. Rural-urban differences in substance use among African-American adolescents. *J Rural Health*. 2007; 23(Suppl):22–28. [PubMed: 18237321]
- Gilman SE, Breslau J, Conron KJ, Koenen KC, Subramanian SV, Zaslavsky AM. Education and race-ethnicity differences in the lifetime risk of alcohol dependence. *J Epidemiol Community Health*. 2008; 62:224–230. [PubMed: 18272737]
- Goodwin RD, Keyes KM, Hasin DS. Changes in cigarette use and nicotine dependence in the United States: evidence from the 2001-2002 wave of the national epidemiologic survey of alcoholism and related conditions. *Am J Public Health*. 2009; 99:1471–1477. [PubMed: 19008515]
- Grant JD, Verges A, Jackson KM, Trull TJ, Sher KJ, Bucholz KK. Age and ethnic differences in the onset, persistence and recurrence of alcohol use disorder. *Addiction*. 2012; 107:756–765. [PubMed: 22085024]
- Greenfield TK, Room R. Situational norms for drinking and drunkenness: trends in the US adult population, 1979-1990. *Addiction*. 1997; 92:33–47. [PubMed: 9060196]
- Haber JR, Koenig LB, Jacob T. Alcoholism, personality, and religion/spirituality: an integrative review. *Curr Drug Abuse Rev*. 2011; 4:250–260. [PubMed: 22150624]
- Harris KM, Gordon-Larsen P, Chantala K, Udry JR. Longitudinal trends in race/ethnic disparities in leading health indicators from adolescence to young adulthood. *Arch Pediatr Adolesc Med*. 2006; 160:74–81. [PubMed: 16389215]
- Harris, KM.; Halpern, CT.; Whitsel, E.; Hussey, J.; Tabor, J.; Entzel, P., et al. The National Longitudinal Study of Adolescent to Adult Health: Research Design [WWW document]. 2009. URL: <http://www.cpc.unc.edu/projects/addhealth/design>
- Hasin DS, Stinson FS, Ogburn E, Grant BF. Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch Gen Psychiatry*. 2007; 64:830–842. [PubMed: 17606817]
- Herd D. Subgroup differences in drinking patterns among black and white men: results from a national survey. *J Stud Alcohol*. 1990; 51:221–232. [PubMed: 2342362]
- Herd D. Racial differences in women's drinking norms and drinking patterns: a national study. *J Subst Abuse*. 1997; 9:137–149. [PubMed: 9494945]
- Herd DA. The effects of parental influences and respondents' norms and attitudes on black and white adult drinking patterns. *J Subst Abuse*. 1994; 6:137–154. [PubMed: 7804014]
- Jones-Webb R. Drinking patterns and problems among African-Americans: recent findings. *Alcohol Health Res World*. 1998; 22:260–264. [PubMed: 15706752]
- Jones-Webb R, Snowden L, Herd D, Short B, Hannan P. Alcohol-related problems among black, Hispanic and white men: the contribution of neighborhood poverty. *J Stud Alcohol*. 1997; 58:539–545. [PubMed: 9273921]
- Kandel, D. Ethnic differences in drug use.. In: Botvin, GJ.; Schinke, S.; Orlandi, MA., editors. *Drug Abuse Prevention with Multiethnic Youth*. Sage; Thousand Oaks, CA: 1995. p. 81-105.
- Kandel D, Schaffran C, Hu MC, Thomas Y. Age-related differences in cigarette smoking among whites and African-Americans: evidence for the crossover hypothesis. *Drug Alcohol Depend*. 2011; 118:280–287. [PubMed: 21561724]
- Kandel D, Single E, Kessler RC. The epidemiology of drug use among New York State high school students: Distribution, trends, and change in rates of use. *Am J Public Health*. 1976; 66:43–53. [PubMed: 1247136]
- Keyes KM, Grant BF, Hasin DS. Evidence for a closing gender gap in alcohol use, abuse, and dependence in the United States population. *Drug Alcohol Depend*. 2008a; 93:21–29. [PubMed: 17980512]

- Keyes KM, Hasin DS. Socio-economic status and problem alcohol use: the positive relationship between income and the DSM-IV alcohol abuse diagnosis. *Addiction*. 2008; 103:1120–1130. [PubMed: 18494841]
- Keyes KM, Hatzenbuehler ML, Alberti P, Narrow WE, Grant BF, Hasin DS. Service utilization differences for Axis I psychiatric and substance use disorders between white and black adults. *Psychiatr Serv*. 2008b; 59:893–901. [PubMed: 18678687]
- Keyes KM, Hatzenbuehler ML, McLaughlin KA, Link B, Olfson M, Grant BF, et al. Stigma and treatment for alcohol disorders in the United States. *Am J Epidemiol*. 2010a; 172:1364–1372. [PubMed: 21044992]
- Keyes KM, Liu XC, Cerda M. The role of race/ethnicity in alcohol-attributable injury in the United States. *Epidemiol Rev*. 2012a; 34:89–102. [PubMed: 21930592]
- Keyes KM, Martins SS, Blanco C, Hasin DS. Telescoping and gender differences in alcohol dependence: new evidence from two national surveys. *Am J Psychiatry*. 2010b; 167:969–976. [PubMed: 20439391]
- Keyes KM, Schulenberg JE, O'Malley PM, Johnston LD, Bachman JG, Li G, et al. The social norms of birth cohorts and adolescent marijuana use in the United States, 1976–2007. *Addiction*. 2011
- Keyes KM, Schulenberg JE, O'Malley PM, Johnston LD, Bachman JG, Li G, et al. Birth cohort effects on adolescent alcohol use: the influence of social norms from 1976 to 2007. *Arch Gen Psychiatry*. 2012b; 69:1304–1313. [PubMed: 22868751]
- King G, Polednak A, Bendel RB, Vilsaint MC, Nahata SB. Disparities in smoking cessation between African Americans and Whites: 1990–2000. *Am J Public Health*. 2004; 94:1965–1971. [PubMed: 15514238]
- Midanik LT. Validity of self-reported alcohol use: a literature review and assessment. *Br J Addict*. 1988; 83:1019–1030. [PubMed: 3066418]
- Moon-Howard J. African American women and smoking: starting later. *Am J Public Health*. 2003; 93:418–420. [PubMed: 12604485]
- Mulia N, Ye Y, Zemore SE, Greenfield TK. Social disadvantage, stress, and alcohol use among black, Hispanic, and white Americans: findings from the 2005 U.S. National Alcohol Survey. *J Stud Alcohol Drugs*. 2008; 69:824–833.
- Muthen, L.; Muthen, B. Chapter 6: Growth modeling and survival analysis. *Mplus User's Guide*. Seventh Edition. Muthén & Muthén, Los Angeles, CA: 1998–2012). Available at: <http://www.statmodel.com/ug excerpts.shtml>
- Myers HF, Kagawa-Singer M, Kumanyika SK, Lex BW, Markides KS. Behavioral risk factors related to chronic diseases in ethnic minorities. *Health Psychol*. 1995; 14:613–621. [PubMed: 8654339]
- National Institute on Alcohol Abuse and Alcoholism. Helping patients who drink too much: A clinician's guide. Rockville, MD: 2005.
- National Institute on Alcohol Abuse and Alcoholism. National Institute on Alcohol Abuse and Alcoholism. [April 1, 2014] Overview of Alcohol Consumption. 2013. Available at: <http://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption>.
- Pacek LR, Malcolm RJ, Martins SS. Race/ethnicity differences between alcohol, marijuana, and co-occurring alcohol and marijuana use disorders and their association with public health and social problems using a national sample. *Am J Addict*. 2012; 21:435–444. [PubMed: 22882394]
- Pampel FC. Racial convergence in cigarette use from adolescence to the mid-thirties. *J Health Soc Behav*. 2008; 49:484–498. [PubMed: 19181051]
- Patrick DL, Cheadle A, Thompson DC, Diehr P, Koepsell T, Kinne S. The validity of self-reported smoking: a review and meta-analysis. *Am J Public Health*. 1994; 84:1086–1093. [PubMed: 8017530]
- Ramchand R, Pacula RL, Iguchi MY. Racial differences in marijuana-users' risk of arrest in the United States. *Drug Alcohol Depend*. 2006; 84:264–272. [PubMed: 16600529]
- Robins, L. Alcohol Abuse in Blacks and Whites as Indicated in the Epidemiological Catchment Area Program.. In: Spiegler, D., editor. *Alcohol Use Among U.S. Ethnic Minorities*. U.S. Department of Health and Human Services.; Bethesda, MD: 1985.

- Swendsen J, Burstein M, Case B, Conway KP, Dierker L, He J, et al. Use and abuse of alcohol and illicit drugs in US adolescents: results of the National Comorbidity Survey- Adolescent Supplement. *Arch Gen Psychiatry*. 2012; 69:390–398. [PubMed: 22474107]
- Taylor RJ, Mattis J, Chatters LM. Subjective religiosity among African Americans: A synthesis of findings from five national studies. *Journal of Black Psychology*. 1999; 25:524–543.
- Volkow ND, Baler RD, Compton WM, Weiss SR. Adverse health effects of marijuana use. *N Engl J Med*. 2014; 370:2219–2227. [PubMed: 24897085]
- Wallace JM Jr. The social ecology of addiction: race, risk, and resilience. *Pediatrics*. 1999; 103:1122–1127. [PubMed: 10224199]
- Wallace JM Jr, Bachman JG. Explaining racial/ethnic differences in adolescent drug use: the impact of background and lifestyle. *Social Problems*. 1991; 38:333–357.
- Watt TT. The race/ethnic age crossover effect in drug use and heavy drinking. *J Ethn Subst Abuse*. 2008; 7:93–114. [PubMed: 19842303]
- Weaver SR, Cheong J, Mackinnon DP, Pentz MA. Investigating Ethnic Differences in Adolescent Alcohol Use and Peer Norms using Semi-Continuous Latent Growth Models. *Alcohol Alcohol*. 2011
- White HR, Nagin D, Replogle E, Stouthamer-Loeber M. Racial differences in trajectories of cigarette use. *Drug Alcohol Depend*. 2004; 76:219–227. [PubMed: 15561473]
- Witbrodt J, Mulia N, Zemore SE, Kerr WC. Racial/Ethnic disparities in alcohol- related problems: differences by gender and level of heavy drinking. *Alcohol Clin Exp Res*. 2014; 38:1662–1670. [PubMed: 24730475]
- Wu LT, Woody GE, Yang C, Pan JJ, Blazer DG. Racial/ethnic variations in substance-related disorders among adolescents in the United States. *Arch Gen Psychiatry*. 2011; 68:1176–1185. [PubMed: 22065533]
- Zapolski TC, Pedersen SL, McCarthy DM, Smith GT. Less drinking, yet more problems: Understanding African American drinking and related problems. *Psychol Bull*. 2014; 140:188–223. [PubMed: 23477449]

- Alcohol use and at-risk drinking are robustly higher in Whites compared with Blacks
- The prevalence of cigarette use and heavy smoking converge between Whites and Blacks in adulthood
- By adulthood, among marijuana users, Black women use marijuana more frequently than White women

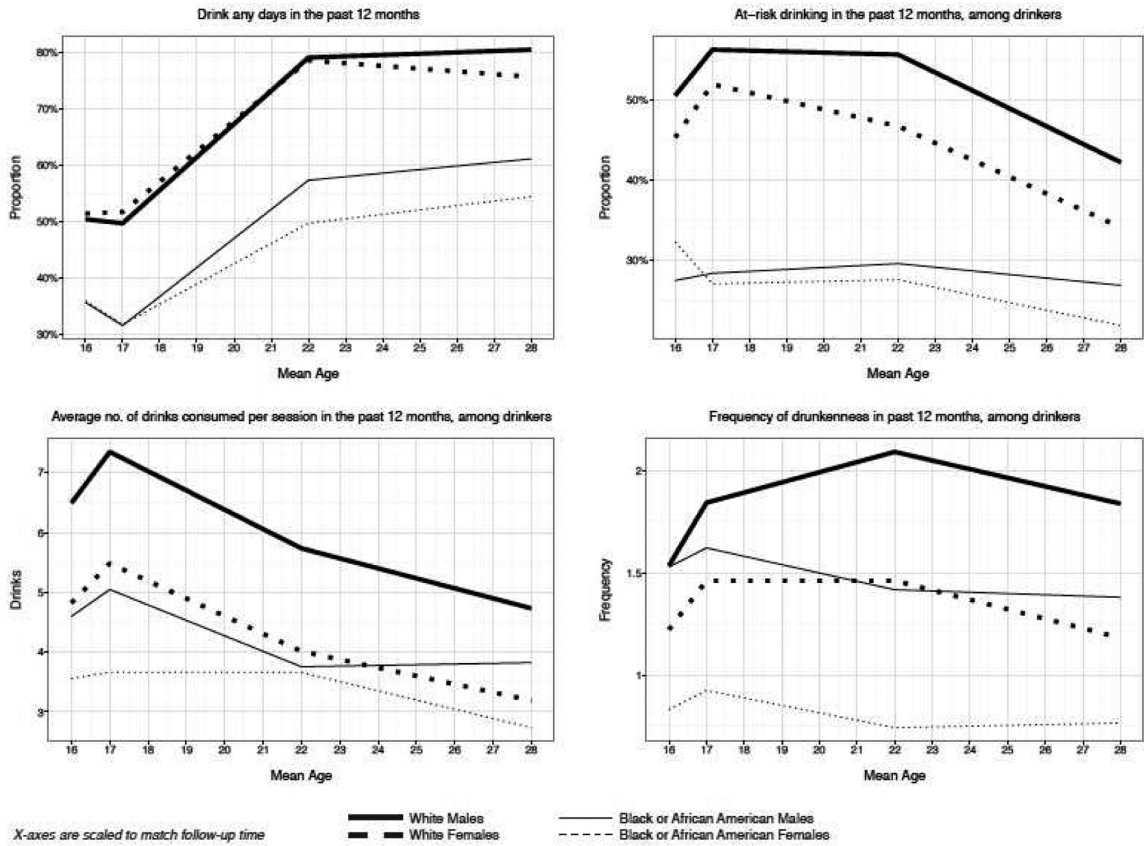


Figure 1.

Descriptive proportions and means for alcohol use outcomes by race and gender in the National Longitudinal Study of Adolescent Health

*Mean ages based on four waves of data collection. Wave 1 (mean age: 16.03); Wave 2 (mean age: 15.99); Wave 3 (mean age: 21.85); Wave 4 (mean age: 29.00). Wave 1 and Wave 2 were separated by one year, however the mean age of the Wave 2 sample is slightly lower than the mean age of the Wave 1 sample (Wave 1: 16.03; Wave 2: 15.99).

Respondents that were no longer in high school at the Wave 2 interview, however, remained eligible for the Wave 3 and 4 interviews and were re-contacted. We display them on the graph as one year apart given the time difference in data collection.

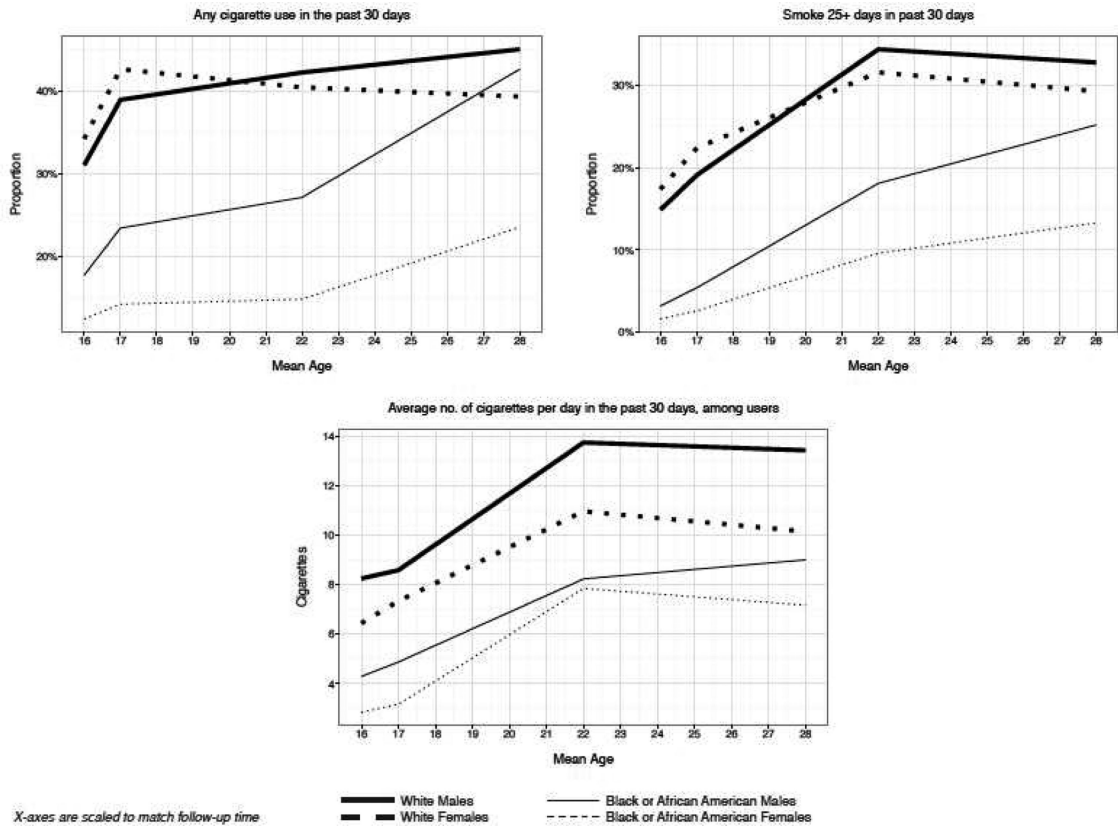


Figure 2.

Descriptive proportions and means for cigarette use outcomes by race and gender in the National Longitudinal Study of Adolescent Health

*Mean ages based on four waves of data collection. Wave 1 (mean age: 16.03); Wave 2 (mean age: 15.99); Wave 3 (mean age: 21.85); Wave 4 (mean age: 29.00). Wave 1 and Wave 2 were separated by one year, however the mean age of the Wave 2 sample is slightly lower than the mean age of the Wave 1 sample (Wave 1: 16.03; Wave 2: 15.99).

Respondents that were no longer in high school at the Wave 2 interview, however, remained eligible for the Wave 3 and 4 interviews and were re-contacted. We display them on the graph as one year apart given the time difference in data collection.

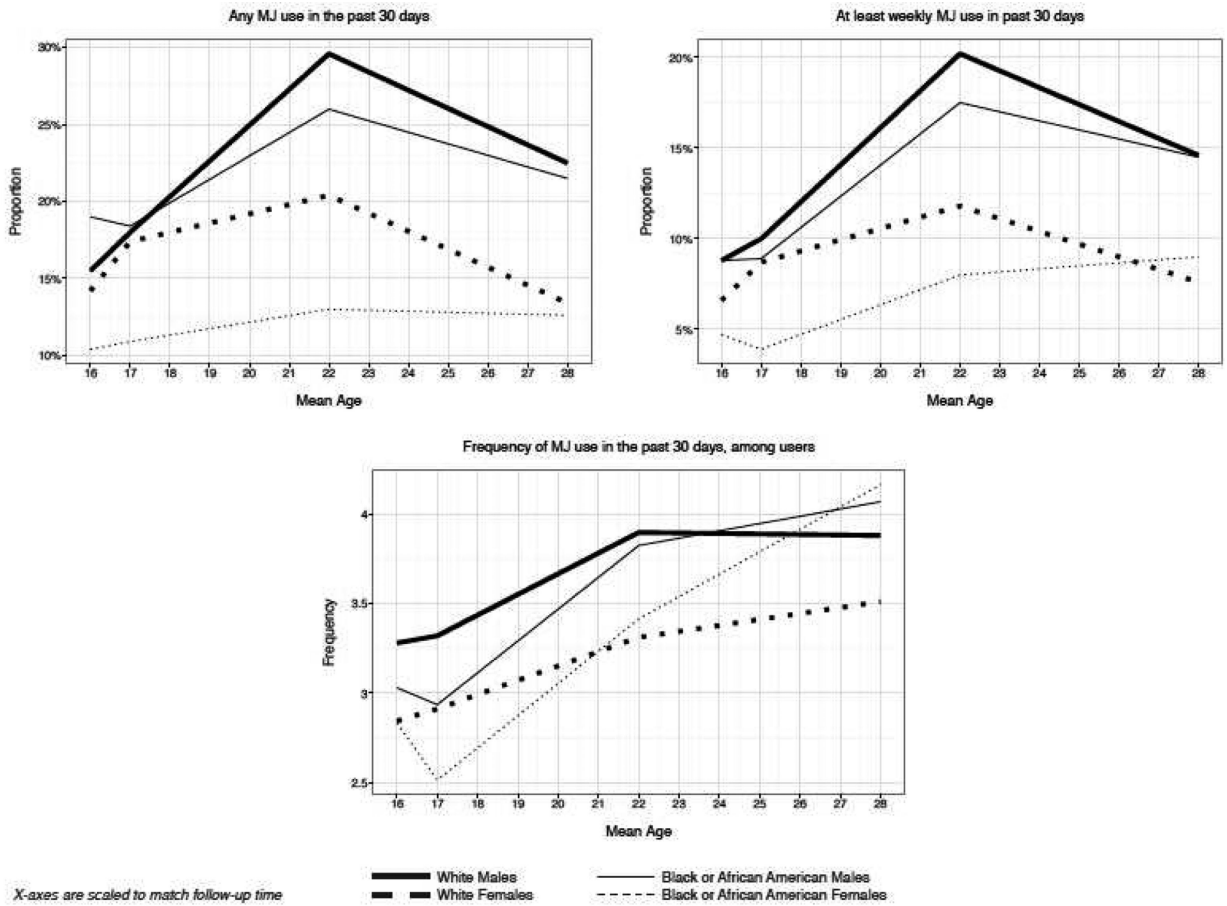


Figure 3. Descriptive proportions and means for marijuana use outcomes by race and gender in the National Longitudinal Study of Adolescent Health
 *Mean ages based on four waves of data collection. Wave 1 (mean age: 16.03); Wave 2 (mean age: 15.99); Wave 3 (mean age: 21.85); Wave 4 (mean age: 29.00). Wave 1 and Wave 2 were separated by one year, however the mean age of the Wave 2 sample is slightly lower than the mean age of the Wave 1 sample (Wave 1: 16.03; Wave 2: 15.99). Respondents that were no longer in high school at the Wave 2 interview, however, remained eligible for the Wave 3 and 4 interviews and were re-contacted. We display them on the graph as one year apart given the time difference in data collection.

Table 1
Adjusted association between race/ethnicity (non-Hispanic White versus Black) and substance use from adolescence to adulthood among men (N=6,836) in the National Longitudinal Study of Adolescent Health

		Men (N=6836)			
		Wave 1 (Mean age: 16.03)	Wave 2 (Mean age: 15.99)	Wave 3 (Mean age: 21.85)	Wave 4 (Mean age: 29.00)
Alcohol use (past year)					
	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)
Any use	1.86 (1.47, 2.36)	1.78 (1.39, 2.28)	2.59 (1.95, 3.42)	2.14 (1.67, 2.75)	
At-risk drinking, among drinkers	2.92 (2.03, 4.20)	3.21 (2.31, 4.47)	3.42 (2.54, 4.61)	2.09 (1.48, 2.94)	
	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)
Average # of drinks consumed, among drinkers	1.84 (0.52, 3.17)	2.47 (0.77, 4.17)	2.22 (1.71, 2.73)	1.16 (0.71, 1.60)	
Frequency of drunkenness, among drinkers	0.09 (-0.22, 0.40)	0.29 (-0.05, 0.62)	0.53 (0.30, 0.76)	0.41 (0.20, 0.62)	
Cigarette use (past 30 days)					
	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)
Any use	2.56 (1.95, 3.37)	2.24 (1.71, 2.95)	1.97 (1.55, 2.52)	1.17 (0.95, 1.44)	
Use >25 days	6.81 (4.13, 11.24)	5.18 (3.28, 8.18)	2.46 (1.87, 3.24)	1.65 (1.26, 2.17)	
	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)
Average # of cigarettes, among users	5.98 (4.65, 7.31)	5.49 (3.92, 7.06)	6.30 (4.54, 8.06)	5.60 (4.08, 7.11)	
Marijuana use (past 30 days)					
	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)
Any use	0.83 (0.61, 1.11)	1.03 (0.77, 1.37)	1.11 (0.84, 1.46)	1.08 (0.79, 1.46)	
At least weekly use	1.11 (0.74, 1.67)	1.20 (0.84, 1.71)	1.15 (0.81, 1.63)	1.14 (0.77, 1.68)	
	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)
Frequency of use, among users	0.39 (-0.08, 0.86)	0.45 (0.06, 0.84)	-0.01 (-0.42, 0.41)	-0.02 (-0.45, 0.41)	

Adjusted for: baseline age, highest level of parental education, urban versus rural location, family use of public assistance, and household income.

Table 2

Adjusted association between race/ethnicity (non-Hispanic White versus Black) and substance use from adolescence to adulthood among women (N=7,265) in the National Longitudinal Study of Adolescent Health

		Women (N=7265)			
		Wave 1 (Mean age: 16.18)	Wave 2 (Mean age: 16.18)	Wave 3 (Mean age: 21.96)	Wave 4 (Mean age: 29.14)
Alcohol use (past year)					
	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)
Any use	2.34 (1.85, 2.95)	2.28 (1.77, 2.93)	2.71 (2.17, 3.40)	2.10 (1.70, 2.61)	
At-risk drinking, among drinkers	2.12 (1.55, 2.91)	3.42 (2.37, 4.94)		2.54 (1.96, 3.28)	2.60 (1.89, 3.57)
	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)
Average # of drinks consumed, among drinkers	1.50 (0.98, 2.02)	2.55 (1.61, 3.48)	0.60 (0.18, 1.02)	0.85 (0.56, 1.15)	
Frequency of drunkenness, among drinkers	0.49 (0.31, 0.68)	0.56 (0.28, 0.83)	0.64 (0.50, 0.78)	0.45 (0.32, 0.58)	
Cigarette use (past 30 days)					
	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)
Any use	5.17 (3.88, 6.89)	5.76 (4.17, 7.97)	4.71 (3.21, 6.92)	2.93 (2.14, 4.03)	
Use >25 days	27.76 (14.25, 54.07)	18.52 (9.49, 36.14)	5.80 (3.79, 8.88)	4.17 (2.85, 6.12)	
	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)
Average # of cigarettes, among users	4.93 (3.96, 5.90)	5.14 (3.95, 6.33)	4.14 (2.04, 6.23)	3.16 (0.75, 5.58)	
Marijuana use (past 30 days)					
	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)	AOR (95% C.I.)
Any use	2.06 (1.46, 2.89)	2.16 (1.52, 3.08)	1.73 (1.30, 2.31)	1.27 (0.93, 1.73)	
At least weekly use	2.36 (1.55, 3.59)	3.86 (2.09, 7.14)	1.69 (1.15, 2.50)	1.11 (0.76, 1.62)	
	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)	Beta estimate (95% C.I.)
Frequency of use, among users	0.116 (-0.33, 0.65)	0.64 (0.22, 1.07)	0.29 (-0.18, 0.75)	-0.44 (-0.95, 0.08)	

Adjusted for: baseline age, highest level of parental education, urban versus rural location, family use of public assistance, and household income.

Table 3

Adjusted difference-in-difference estimates for the association between race/ethnicity (non-Hispanic White versus Black) and substance use from adolescence to adulthood among men, comparing the magnitude of Wave 4 associations to Wave 1 associations, N=11,365

	Men			Women		
	Est.	S.E.	P-value	Est.	S.E.	P-value
Alcohol use (past year)						
Any use	0.19	0.23	0.41	-0.15	0.22	0.51
At-risk drinking, among drinkers	-0.41	0.27	0.13	0.22	0.27	0.41
Average # of drinks consumed, among drinkers	-0.81	0.59	0.17	-0.64	0.28	0.02
Frequency of drunkenness, among drinkers	0.29	0.18	0.11	-0.03	0.10	0.76
Cigarette use (past 30 days)						
Any use	-1.27	0.22	0.00	-0.84	0.23	0.00
Use >25 days	-2.09	0.46	0.00	-2.74	0.53	0.00
Average # of cigarettes, among users	-0.60	0.87	0.49	-1.69	1.23	0.17
Marijuana use (past 30 days)						
Any use	0.35	0.32	0.28	-0.63	0.25	0.01
At least weekly use	-0.08	0.40	0.84	-0.97	0.30	0.00
Frequency of use, among users	-0.54	0.32	0.09	-0.69	0.32	0.03

Bold=p<0.05

Adjusted for: baseline age, highest level of parental education, urban versus rural location, family use of public assistance, and household income.