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Changes in gender and racial/ethnic disparities in rates of cigarette use, regular heavy episodic drinking, and marijuana use: ages 14 to 32

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Abstract

Background—The purpose of this study is to investigate disparities in substance use behaviors across gender and race/ethnicity as a flexible function of age from mid-adolescence through young adulthood.

Methods—Using data from the National Longitudinal Study of Adolescent Health, the time-varying effect model (TVEM) was used to examine gender and racial/ethnic differences in the prevalences of cigarette use, regular heavy episodic drinking (HED), and marijuana use as a smooth function of developmental age.

Results—Prevalences of cigarette use, regular HED, and marijuana use were higher for males than females overall, although gender differences varied with age. With regard to race, prevalence of each substance was higher for White than Hispanic or Black individuals; these differences increased considerably from age 16 to 20, particularly for cigarette use. Differences in cigarette use by race/ethnicity were found across age, but were largest at age 18, when cigarette use peaks for White individuals, but continues to climb throughout the 20s among Hispanic and Black individuals.

Conclusions—These results suggest that substance use, particularly for certain population subgroups, increases past early adolescence. Disparities in substance use behaviors fluctuate considerably throughout adolescence and young adulthood, suggesting that targeted intervention programs are more critical at particular ages. These findings also demonstrate that TVEM can advance our understanding of health risk behaviors and their correlates across developmental time.

Keywords

cigarette smoking; heavy episodic drinking; marijuana; adolescence; young adulthood; health disparities

1. INTRODUCTION

The use of cigarettes, alcohol, and other illegal substances is highest in adolescence and young adulthood (Chen & Kandel, 1995; Chen & Jacobson, 2012; Jackson, Sher, Cooper, & Wood, 2002). However, there are racial and ethnic differences in rates of use in the United States. Generally, white adolescents have higher prevalence of substance use than Black or Hispanic adolescents (Johnston, O'Malley, Bachman, & Schulenberg, 2012; McCabe et al., 2007). Rates of substance use also differ by gender, such that male adolescents and young adults report more use than their female counterparts (Cranford, McCabe, & Boyd, 2006; Everett, Oeltmann, Wilson, Brener, & Hill, 2010; Johnston et al., 2012) with the exception of early adolescence, when female adolescents have slightly higher rates of all substance use than male adolescents (Chen & Jacobson, 2012; Duncan, Duncan, & Strycker, 2006).

Despite documented racial/ethnic differences in substance use, it remains unclear to what extent these disparities change across adolescence and young adulthood. Research suggests that rates of cigarette use, HED, and marijuana use rise through the early 20s and subsequently decline for all subgroups similarly (Chen & Kandel, 1995; Brobeck, Bachmann, Croudace, & Brown, 2013; Lee, Mun, White, & Rutgers, 2010), suggesting gender and racial/ethnic disparities in use are relatively stable throughout adolescence and young adulthood. Other research suggests existence of a crossover effect, such that Hispanic and Black adolescents have lower rates in adolescence but higher rates later in adulthood (French, Finkbiner, & Duhamel, 2002; Geronimus, Neidert, & Bound, 1993). However, to date studies on group differences in substance use behaviors have been limited by the range of ages spanned in a study, as well as in their ability to flexibly model disparities as a function of age. Additionally, there has been insufficient focus on substance use disparities past the early twenties in national samples. Instead research has focused on adolescents, despite the fact that some research suggests that emerging adulthood is a particularly risky period for some individuals (Cooper et al., 2008; Lanza & Collins, 2006; White, Nagin, Replogle, Strouthamer-Loeber, 2004).

Thus, to better understand how racial/ethnic and gender disparities change over the course of adolescence and young adulthood we use the time-varying effect model (TVEM; Tan, Shiyko, Li, Li, & Dierker, 2012) to estimate regression coefficients as a highly flexible function of age. TVEM has previously been used with Add Health data to examine developmental trends related to sexual risk behavior (Vasilenko & Lanza, in press). This innovative approach enables a more accurate identification of the age periods of highest risk, a more nuanced examination of age trends with the possibility of multimodal peaks, and the identification of specific age windows during which disparities are present. We use TVEM to examine gender and racial/ethnic disparities in the prevalence of cigarette use, regular HED, and marijuana use from age 14 to 32.

2. METHODS

2.1. Study population and design

This study used four waves of data from the National Longitudinal Study of Adolescent Health (Add Health; Harris, Halpern, & Witsel, 2013), a school-based survey of adolescents

surveyed in 1994-95, 1996, 2001, and 2008. The original sample was drawn using a stratified, random sampling frame to obtain a representative sample of U.S. adolescents in grades 7-12. The Public Institutional Review Board (IRB) at the University of North Carolina approved the data collection, and the Penn State IRB approved our data analysis.

Our study was limited to the core sample of adolescents, which is self-weighted to the general population (Harris, 2011). We included any measurement occasion on which an individual completed data on the relevant variables and were between 14 to 32 years of age, resulting in a sample of 10,132 individuals (12.3% Hispanic, 19.3% Black, Non-Hispanic, 61.2% White, Non-Hispanic, and 48.4% male). Analyses incorporating race/ethnicity were limited to participants who self-reported as White, Black, or Hispanic as the number of individuals in other racial and ethnic groups was insufficient for drawing comparisons. All four waves of data were analyzed simultaneously, resulting in 37,219 person-times for gender analyses and 34,528 person-times for race/ethnicity analyses. A single individual only contributed data for up to four different ages, but by combining all four waves of data and coding age to the nearest month¹, we leveraged all available data in order to cover the entire age range of 14 to 32 in nearly continuous time.

2.2. Measures

Gender and *race/ethnicity* were measured by self-report at Wave 1. Three mutually exclusive racial/ethnic groups were created: Hispanic, White Non-Hispanic, and Black Non-Hispanic. *Cigarette use* was assessed by any use reported in the past 30 days (reported on 33.4% measurement occasions). *Regular HED* was assessed by drinking 5 or more drinks in a row more often than monthly within the past 12 months (reported on 17.5% measurement occasions). *Marijuana use* was assessed by any past 30 day use (reported on 17.4% measurement occasions).

2.3. Analysis

Intercept-only logistic TVEMs were used to examine the prevalence of cigarette use, regular HED, and marijuana use across ages 14 to 32 years by gender and race/ethnicity. For

example, the age-varying rate of regular HED is expressed as $E(HED_{ij}) = \frac{\exp(\eta_{ij})}{1 + \exp(\eta_{ij})}$ with $\eta_{ij} = \beta_0(t)$ where $B_0(t)$ is an age-varying logistic regression coefficient that expresses the odds of regular HED as a smooth, nonparametric function of age. These coefficients are converted to prevalence estimates to facilitate interpretation. We ran a separate model for each gender and racial/ethnic group which allowed each intercept function to be fully moderated by the grouping variable. All models were run in SAS 9.3 using the %TVEM_logistic macro (TVEM SAS Macro Suite, 2012; Yang, Tan, Li, & Wagner, 2012). P-spline smoothing was used for all models; this approach automatically selects the optimal form of each coefficient function. Note that TVEM results are presented primarily as figures because the coefficients are estimated as a function of continuous time, creating a number of coefficients across age too large to present in tables.

¹Age was calculated by subtracting a participant's birthday from the interview date.

3. RESULTS

3.1. Gender Disparities

Figure 1 depicts disparities in rates of use for males and females. Figure 1a depicts the prevalence of cigarette use across developmental age by gender. Through age 15.8, use was slightly higher for females than males. However, it increased more steeply for males and by age 17.6, cigarette use was higher for males than females. A bimodal peak in cigarette use was evident only among males. The first peak, (18.7 years, 38.2% reporting cigarette use), was followed by a modest decline in use and then a second peak (28.5 years, 43.1% reporting use). For females, cigarette use peaked at 18.0 years, with 34.3% reporting use; it remained fairly steady thereafter.

Figure 1b shows regular HED as a function of age for males and females. There was no significant difference between males and females in the prevalence at age 14. However, the rate for males increased until peak use at age 22.2, when nearly 34% reported regular HED. Prevalence of regular HED remained much lower for females throughout late adolescence and emerging adulthood. Females experienced a small and gradual increase in use until age 27.1 when regular HED prevalence peaked at 15.1% and then declined sharply by age 32.

Results for marijuana use (Figure 1c) were similar to those for regular HED. The prevalence of marijuana use was not significantly different across gender in early adolescence. However, the prevalence among males rose more sharply and for a longer age period than for females. Use among males and females peaked at 21.5 years (27.5% reporting use) and 19.8 years (18.5% reporting use), respectively. Rates of use among both genders showed a steady decline after their peak, falling to 17.6% for males and 10.1% for females by age 32.

3.2. Racial/ethnic disparities

Figure 2 shows race/ethnic disparities in the prevalence of cigarette use, regular HED, and marijuana use. For cigarette use (Figure 2a), although White individuals had higher rates than Black or Hispanic individuals throughout the entire age range, the disparity was stronger earlier in adolescence and lessened over time. At 18.5 years old, when White adolescent use of cigarettes peaked, their prevalence was approximately 1.6 to 2.4 times higher than Hispanic or Black adolescents (43.5%, 27.4%, and 18.4% for White, Hispanic, and Black adolescents, respectively). However, when cigarette use among Black and Hispanic individuals peaked at age 29.1, use among White adolescents was only 1.3 to 1.4 times higher (40.3%, 29.6%, and 30.7% for White, Hispanic, and Black individuals, respectively).

The prevalence of regular HED (Figure 2b) was similar across the three groups in early adolescence, but significant differences emerged by age 16. The rate rose fastest among White adolescents, more slowly among Hispanic adolescents, and most slowly among Black adolescents. Disparities were greatest around age 21, when regular HED peaked among White individuals. The prevalence was 1.5 to 2.6 times higher among White adolescents compared to Hispanic or Black adolescents (28.6%, 19.5%, and 10.8% for White, Hispanic, and Black adolescents, respectively). In contrast, at age 28, when regular HED peaked among Black individuals, the prevalence among White individuals was only 1.3 to 1.8 times

higher than Hispanic or Black individuals (23.7%, 18.9%, and 13.1% for White, Hispanic, and Black individuals, respectively).

The prevalence of marijuana use was similar among White and Black adolescents until age 16 and among White and Hispanic adolescents until age 18.5 (Figure 2c). However, the prevalence of use among White adolescents continued to rise through age 20.7 (24.7% reporting use). Use among White adolescents began to decline after this age; after age 24 all three groups followed a similar pattern of declining rates, to 10-15% by young adulthood.

4. DISCUSSION

This study highlighted ages at which disparities in substance use by gender and race/ethnicity were most prominent. We found similar patterns of gender disparities across the three substances, with males and females having similar rates until age 16, after which males had higher rates of use. For marijuana use, this gender disparity remained fairly constant after age 16, however, disparities in cigarette use and regular HED varied after age 16; differences in cigarette were greatest in the late twenties when prevalence among males was more than twice that of females. Regular HED among females peaked much later and at a much lower level than among males (age 27), and then dropped sharply. This gender disparity may be due to changes in females' social roles (e.g., parenthood) during this period.

This study also found age-varying racial/ethnic disparities in substance use. For example, although Black and Hispanic adolescents exhibited lower prevalence of cigarette use compared to White adolescents, this disparity narrowed through their 20s. This is consistent with evidence that Black individuals' cigarette use surpasses that of White individuals later in adulthood (Kandel, Schaffran, Hu, & Thomas, 2011). Similarly, racial/ethnic differences became smaller for HED and tobacco use after about age 21. Taken together, these results suggest that Black individuals may stand to benefit from additional intervention efforts in young adulthood.

Two limitations of this study are worth noting. First, because individuals of different ages from roughly ages 12-18 were included in the first wave of the study, there may be modest cohort effects. Second, the data from earlier ages were collected in 1994-1995; all findings may not be generalizable to later cohorts of adolescents. Despite these limitations, this study provided insight into age-varying trends in substance, suggesting that age, gender, and race/ethnicity should be considered when targeting age-specific substance use prevention interventions. Further, this study demonstrated the potential of TVEM for understanding age-related changes in health behaviors.

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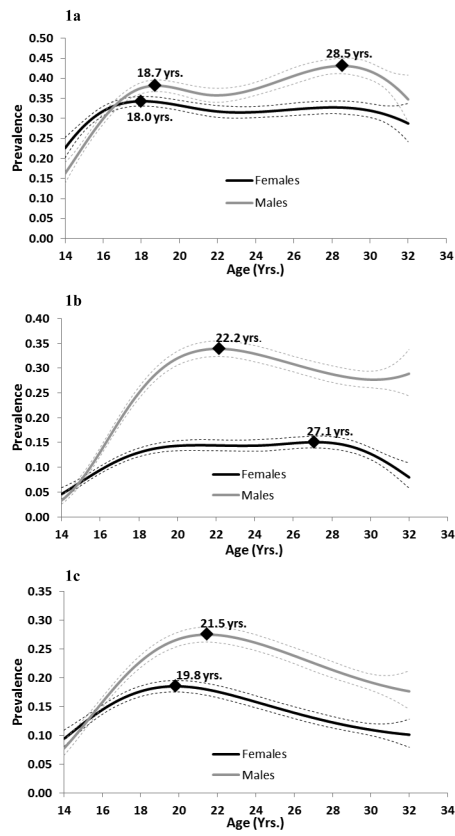


Figure 1. Gender disparities in (a) cigarette use, (b) regular HED, and (c) marijuana use from age 14

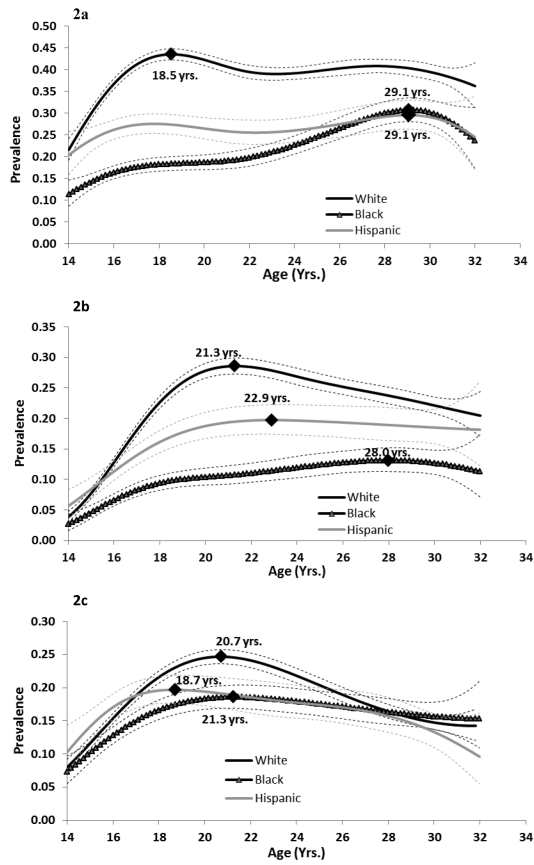


Figure 2. Racial/ethnic disparities in (a) cigarette use, (b) regular HED, and (c) marijuana use from age 14 to 32.