
Differences in Onset and Persistence of Substance Abuse and Dependence Among Whites, Blacks, and Hispanics

SEAN F. REARDON, EdD
STEPHEN L. BUKA, ScD

SYNOPSIS

Objective: This article describes patterns of onset, persistence, and cessation of substance abuse among whites, blacks, and Hispanics that are masked in cross-sectional prevalence data.

Methods: The authors analyzed longitudinal data from a sample of 1,004 white, black, and Hispanic respondents from Chicago to investigate processes of onset, persistence, and cessation of substance abuse and dependence for two age cohorts, 15 and 18 at baseline and 17 and 20 at follow-up.

Results: The data show few racial or ethnic differences in the prevalence of alcohol and marijuana abuse and dependence at age 15. Rates of onset of alcohol abuse and dependence among whites between ages 15 and 17 were significantly higher than for blacks and Hispanics, and the rates of onset of marijuana abuse and dependence among blacks between ages 18 and 20 were significantly higher than for whites and Hispanics of the same age group. There were few significant differences among the three groups in the persistence rates of abuse and dependence.

Conclusion: By age 20 the rates of marijuana abuse and dependence are significantly higher among blacks than among whites and Hispanics.

Dr. Reardon is an assistant professor of education and sociology at Pennsylvania State University, and Dr. Buka is an associate professor at Harvard University School of Public Health.

Address correspondence to:

Sean F. Reardon, EdD, Assistant Professor of Education and Sociology, Pennsylvania State University, 310F Rackley Building, University Park, PA 16802, tel 814-865-2584, fax 814-865-1480, e-mail <sean@pop.psu.edu>.

INTRODUCTION

National surveys—such as Monitoring the Future and the National Household Survey on Drug Abuse—show a higher prevalence of frequent substance use for white adolescents than for black adolescents. By early adulthood, however, frequent substance use and adverse health consequences associated with frequent substance use are more common among blacks than whites.¹⁻⁶ This reversal could be accounted for by either or both of two processes: blacks may tend to begin heavy substance use and abuse in early adulthood or whites may tend to stop abusing substances before early adulthood.

The analysis presented in this article is primarily descriptive, intended to disentangle different patterns of onset, persistence, and cessation of substance abuse that are masked in cross-sectional prevalence data. This kind of analysis is an important first step in developing appropriate public health policy responses to disparities in substance abuse and dependence among whites, blacks, and Hispanics.

METHODS

Data. The data are drawn from the Project on Human Development in Chicago Neighborhoods (PHDCN), a multi-level, prospective, longitudinal study designed to investigate the effects of neighborhood demographic and social contexts on a wide array of developmental and behavioral outcomes. PHDCN uses a three-stage sampling design. At the first stage, 343 neighborhoods, comprising all residents of Chicago, were cross-classified by two census-derived stratification variables: racial-ethnic mix (seven categories) and socioeconomic status (three levels). A stratified probability sample of 80 neighborhoods was selected. At the second stage, block groups were selected at random within each of the sample neighborhoods, and a complete listing of dwelling units was collected for sampled block groups. At the third stage, residents were contacted and the household composition was enumerated. Seven cohorts of children—birth to 6 months and within 6 months of ages 3, 6, 9, 12, 15, and 18 years—were selected for the longitudinal study. Baseline assessments were in-person interviews with participants and their primary caregiver, conducted between 1995 and 1997. The first follow-up surveys were administered in 1998 and 1999. Because the PHDCN neighborhood boundaries were drawn to

correspond to census tract boundaries, the data set also includes 1990 census data for each of the neighborhoods in which the respondents lived at the time of interview.⁷

The analyses reported here rely on data from only the 15- and 18-year-old cohorts, as substance abuse and dependence symptoms are rare in younger cohorts.* The data on the 15- and 18-year-old cohorts included substance use survey responses from 1,314 adolescents from 79 of the 80 study neighborhoods. First follow-up data included responses from 1,050 of these respondents, a retention rate of 80%. Retention rates did not vary significantly by cohort, gender, parental education, or neighborhood; retention rates were slightly lower among black respondents (76%, compared with 82% for Hispanic and 84% for white respondents). Data were dropped from these analyses if subjects were not white, black, or Hispanic (44 respondents) or if race, socioeconomic status, or age data were missing (2 respondents), leaving a final analytic sample of 1,004 respondents, all of whom had valid substance use data from both the baseline and first follow-up surveys. Of these, 530 were in the 15-year-old cohort and 474 in the 18-year-old cohort.

Sample respondents had the following characteristics: 48% were male; 45% were Hispanic; 37% were black, non-Hispanic; 18% were white, non-Hispanic; 34% had parents with less than a high school diploma; 17% had parents with a high school diploma; 34% had parents with some college education, but less than a bachelor's degree; and 15% had parents with a bachelor's degree. Socioeconomic status (SES) was measured as the first principal component of parental education, parental occupation, and household income, with missing values imputed on the basis of regression models using the full study sample. The SES measure is standardized with a mean of 0 and a standard deviation of 1. Age is the exact age of the subject at the date of interview.

Measures of Substance Abuse and Dependence. During both waves of data collection, respondents were asked a series of questions about their substance use behavior to assess abuse of and dependence on alcohol, marijuana, cocaine, crack, inhalants, and other drugs. For each substance, respondents were classified as abusing a substance if they answered affirmatively to at least one of the following two questions:

* Comparable data were collected from the 12-year-old cohort. These data could be used to investigate patterns of early onset of abuse and dependence.

1. During the past 12 months, have you often been under the effects or after-effects of [specific substance] in situations where your physical safety was threatened (such as riding a bike or driving a car, using heavy machinery, or swimming)?
2. During the past 12 months, did your use of [specific substance] cause you to have emotional problems or to have problems with your family or friends, work, school, or police?*

For each substance, the respondents were classified as dependent on a substance if they answered at least two of the following five questions affirmatively:

1. During the past 12 months, have you had a period of a month or more when you spent a great deal of time getting [specific substance], using it, or getting over its effects?
2. During the past 12 months, have you used [specific substance] much more often or in larger amounts than you intended to?
3. During the past 12 months, have you experienced tolerance for [specific substance], so that using the same amount of it had less effect than before?
4. During the past 12 months, have you wanted to cut down or stop using [specific substance]?
5. During the past 12 months, were you able to stop your use of [specific substance] every time you wanted to?

Respondents who met either abuse or dependence criteria were categorized as having a substance use disorder (SUD). This dichotomous variable (1 = SUD; 0 = no SUD) is the outcome variable used in all analyses presented in this article. These criteria are proxy measures of DSM-IV substance abuse and dependence criteria, and are similar to those used in other published research.⁸⁻¹⁰

Statistical Models. We estimate the model

$$\eta_i \equiv \log \left[\frac{P(Y_{i1} = 1)}{1 - P(Y_{i1} = 1)} \right] = \alpha + X_i \beta$$

Model 1

where Y_{i1} indicates whether individual i meets SUD criteria at baseline and X_i is a vector of covariates for person i .^{**} X_i includes variables for age at baseline, gender (male = 1), SES, and race/ethnicity (white omitted). From the estimated parameters from model 1, we get $p0_{ij}$, the estimated probability of SUD at time 0 (baseline) for individual i .

Given the estimates of SUD prevalence from model 1, we next estimated the transition probabilities between baseline and follow-up. In particular, we estimated the probability that an individual who does not meet SUD criteria at baseline does meet the criteria at follow-up. We call this conditional probability of SUD onset the onset hazard rate, which we denote as $p01_{ij}$.

We also estimated the probability that a person who does meet SUD criteria at baseline meets them at follow-up—this conditional probability of SUD persistence, given the state of SUD presence at baseline, we call the persistence hazard rate and denote as $p11_{ij}$.

We model these two rates by estimating the model

$$\eta_i \equiv \log \left[\frac{P(Y_{i2} = 1)}{1 - P(Y_{i2} = 1)} \right] = D_{0i}(\alpha_0 + X_i \beta_0) + D_{1i}(\alpha_1 + X_i \beta_1)$$

Model 2

where Y_{i2} is a dummy variable indicating whether individual i meets SUD criteria at follow-up. D_{0i} is a dummy variable taking on the value 1 if $Y_{i1} = 0$ at baseline (if individual i did not meet SUD criteria at baseline); D_{1i} is a dummy variable taking on the value 1 if $Y_{i1} = 1$ at baseline (if individual i met SUD criteria at baseline). Note that $D_{1i} = 1 - D_{0i}$. As above, X_i is a vector of covariates for person i . X_i includes variables for age at time 0 (baseline); time elapsed between baseline and follow-up (this is the exposure variable; we control for it because subjects with longer elapsed times likely have a greater probability of transition); gender (male = 1); SES; and race/ethnicity (white omitted).

From model 2, we obtain the probability of meeting SUD criteria at follow-up, conditional on SUD status at baseline. If $Y_{i1} = 0$ at baseline, we get the onset hazard probability ($p01_{ij}$); if $Y_{i1} = 1$ at baseline, we get the persistence hazard probability ($p11_{ij}$). We can obtain $p1_{ij}$, the estimated marginal probability of SUD at follow-up for individual i , from equation 1:

* For alcohol abuse only, respondents were also asked separately if they had ever been in trouble with the police for any driving offense involving alcohol in the past year. Respondents were classified as meeting alcohol abuse criteria if they answered yes to at least one of these three questions.

** This and all models are estimated with robust standard errors to account for the neighborhood clustering of the sample.

Table 1. Observed prevalence of substance use disorders, by cohort, wave, and substance (percent)

Substance	Type of disorder	15-year-old cohort (n=530)		18-year-old cohort (n=474)	
		Baseline (age~15)	Follow-up (age~17)	Baseline (age~18)	Follow-up (age~20)
Alcohol	Abuse	4.5	8.1	11.8	12.0
	Dependence	7.4	12.3	17.7	14.8
	Abuse or dependence	9.3	15.9	21.7	19.8
Marijuana	Abuse	4.5	7.4	7.8	8.2
	Dependence	6.6	10.0	12.7	12.0
	Abuse or dependence	7.6	13.4	15.6	13.9
Marijuana or other illicit substance (cocaine, crack, inhalants, and other drugs)	Abuse	5.7	7.7	8.2	8.7
	Dependence	7.4	10.4	13.1	12.2
	Abuse or dependence	9.1	13.8	16.2	14.4
Alcohol, marijuana, or other illicit substance (cocaine, crack, inhalants, and other drugs)	Abuse	7.4	11.3	14.8	15.8
	Dependence	10.8	17.7	23.4	20.3
	Abuse or dependence	12.6	22.1	27.6	25.1

Note: Figures represent percentage of cohort meeting substance-specific abuse and/or dependence criteria at specified wave.

$$p1_i = p0_i \cdot p11_i + (1-p0_i) \cdot p01_i$$

Equation 1

RESULTS

PHDCN respondents report higher rates of abuse and dependence on alcohol than on marijuana (table 1). Among other substances (not shown), no other substance category has an abuse or dependence prevalence higher than 3% for any age group; most have prevalences of less than 1%. Almost all respondents reporting some type of illicit substance abuse or dependence report marijuana abuse or dependence. Because of the small number of respondents reporting SUD symptoms for any substance other than marijuana, we restrict the remainder of the analysis to alcohol and marijuana use disorders.

The prevalence of substance use disorder rises between ages 15 and 18 but then declines slightly by age 20 for alcohol and marijuana. For other substances (not shown), it appears that the prevalences of abuse

and dependence increase between ages 18 and 20, although the number of cases is small, even at age 20.

In examining race-specific rates of substance abuse and dependence, we focus on alcohol and marijuana abuse and dependence, since these substance use disorders have the greatest prevalences. For both whites and Hispanics, alcohol abuse and dependence prevalences increase from age 15 to 17 or 18 and then decline by age 20 (table 2). For blacks, however, alcohol abuse and dependence rates increase slightly from age 18 to 20, so that by age 20, the difference in prevalence between blacks and whites is considerably narrowed (figure 1).

The patterns of marijuana abuse and dependence prevalences are similar (figure 2). Prevalences for marijuana abuse and dependence decline sharply for whites and Hispanics between ages 18 and 20, while prevalence rates for blacks increase slightly over the same period. By age 20, blacks have significantly higher rates of marijuana abuse and dependence than either whites or Hispanics. (Note that figures 1 and 2 use age-adjusted prevalence in order to estimate prevalence at specific ages, whereas tables 1 and 2 use observed prevalence.)

Table 2. Observed prevalence of alcohol and marijuana use disorders, by cohort, wave, and race/ethnicity (percent)

Substance	Type of disorder	Race/ethnicity	15-year-old cohort (n = 530)		18-year-old cohort (n = 474)	
			Baseline (age~15)	Follow-up (age~17)	Baseline (age~18)	Follow-up (age~20)
Alcohol	Abuse	White	5.6	16.9	22.1	20.0
		Black	2.1	5.8	8.2	10.9
		Hispanic	6.0	6.8	10.2	9.2
	Dependence	White	11.2	18.0	27.4	22.1
		Black	4.8	9.5	16.9	16.4
		Hispanic	7.9	12.3	13.8	9.7
	Abuse or dependence	White	12.4	25.8	34.7	29.5
		Black	5.3	11.1	19.7	21.3
		Hispanic	11.1	15.9	17.4	13.8
Marijuana	Abuse	White	3.4	13.5	17.9	9.5
		Black	4.2	6.4	6.0	10.9
		Hispanic	5.2	6.0	4.6	5.1
	Dependence	White	7.9	12.4	13.7	11.6
		Black	4.8	11.6	16.9	18.0
		Hispanic	7.5	7.9	8.2	6.6
	Abuse or dependence	White	7.9	16.9	23.2	15.8
		Black	5.8	15.3	18.6	20.2
		Hispanic	8.7	10.7	9.2	7.1

The second set of analyses examines whether the racial or ethnic differences in alcohol and marijuana use disorders are due to racial or ethnic differences in onset and persistence probabilities. Tables 3 and 4 show the estimated prevalence and transition probabilities for alcohol and marijuana use disorders by race and ethnicity. The regression models include controls for age, sex, and SES. All probabilities reported in tables 3 and 4 are estimated for respondents ages 15 and 18 at baseline and ages 17 and 20 at follow-up, with an SES score of 0 (the mean). (Full regression results are available from the authors on request.)

The first column of each table shows the estimated probability of reporting an SUD at age 15. The second and third columns show the estimated probabilities specific to race and ethnicity for onset and persistence of SUD between ages 15-17. The onset probability for alcohol use disorder among whites 15-17 is 26.5%, meaning that roughly a quarter of whites not reporting use disorder symptoms at age 15 will report symptoms at age 17. The alcohol use disorder persistence probability of 49.5% for whites indicates that roughly one-half of those who reported alcohol use disorder

symptoms at age 15 will continue to report them at age 17. The fourth column is computed from the first three columns, using equation 1. Columns 5-8 show the results for the 18-year-old cohort. The rows below the estimated probabilities indicate whether racial or ethnic differences in the estimated probabilities are statistically significant.

Racial and ethnic differences in the patterns of alcohol use disorder are not explained by differences in SES. White adolescents report levels of alcohol abuse/dependence at age 15 roughly similar to those for blacks and Hispanics, but they experience a much higher onset rate between 15 and 17. Persistence rates for whites, blacks, and Hispanics are similar between 15 and 17. These patterns result in higher prevalences of alcohol abuse and dependence at ages 17 and 18 among whites than blacks and Hispanics. From age 18 to 20, however, there are no substantial racial or ethnic differences in onset and persistence. Hispanics appear to have lower onset rates than blacks and lower persistence rates than whites, however, so that by age 20, Hispanic alcohol abuse and dependence prevalences are much lower than those of whites.

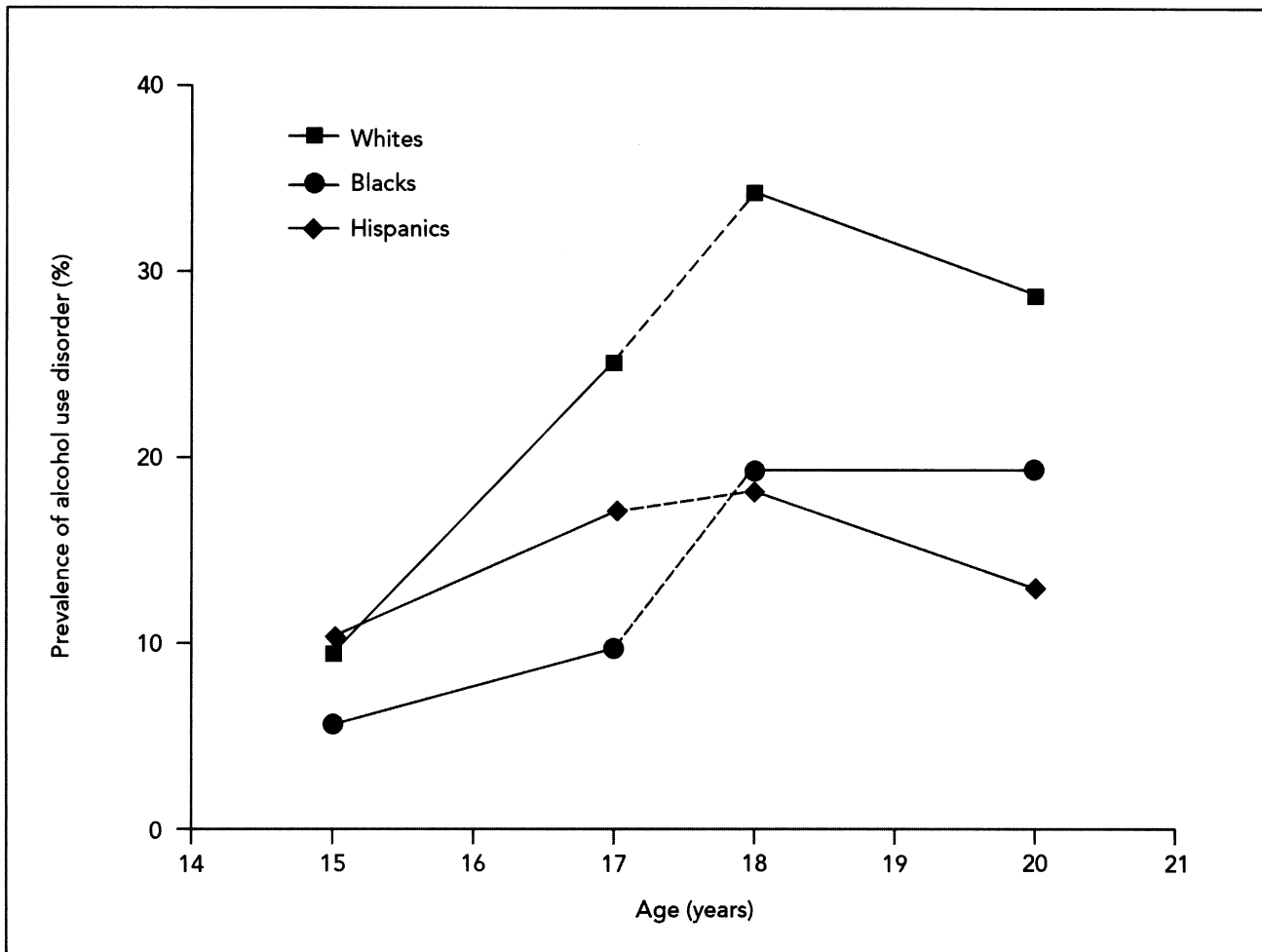


Figure 1. Age-adjusted observed prevalence of alcohol use disorder, ages 15-20, by racial or ethnic group

Marijuana abuse and dependence follow a pattern very different from that of alcohol (table 4). All three groups have similar (and relatively low) prevalences of marijuana use at age 15. Between 15 and 17, whites have a more rapid onset rate for marijuana use disorder than Hispanics, with rates for blacks falling in between. Among those who reported marijuana abuse or dependence at age 15, however, blacks have much higher persistence rates than Hispanics and whites (these estimates are based on a small number of subjects reporting marijuana use disorder symptoms at age 15). These countervailing patterns lead to roughly similar rates of marijuana SUD at ages 17 and 18 for blacks and whites, with lower rates for Hispanics. Between 18 and 20, however, blacks have a much higher incidence of marijuana use disorder symptoms than whites and Hispanics, so that by age 20 marijuana abuse/dependence prevalence is higher for blacks than for whites and Hispanics.

CONCLUSION

Between adolescence and young adulthood, racial and ethnic patterns of prevalence of substance use disorders change, particularly between blacks and whites. Our analyses suggest that different processes are at work in shaping abuse and dependence patterns for white, black, and Hispanic adolescents. For whites early onset of alcohol abuse or dependence appears to be the main component of high rates of alcohol abuse or dependence. For blacks late onset of marijuana abuse and dependence is the primary component of high rates of marijuana abuse and dependence in early adulthood. These differences remain after controlling for socioeconomic background.

There are a number of possible explanations for these different patterns of abuse and dependence. One possibility is that white, black, and Hispanic adolescents and young adults differ in their access to alcohol and marijuana at different ages, because

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Table 3. Estimated prevalence of alcohol use disorder and transition probabilities by age cohort for whites, blacks, and Hispanics (percent)

	15-year-old cohort			18-year-old cohort				
	Estimated prev. at age 15	Estimated onset rate ages 15-17	Estimated persis. rate ages 15-17	Estimated prev. at age 17	Estimated prev. at age 18	Estimated onset rate ages 18-20	Estimated persis. rate ages 18-20	Estimated prev. at age 20
White	8.4	26.5	49.5	28.4	29.3	10.8	58.0	24.6
Black	4.0	9.8	44.5	11.2	18.5	13.4	37.3	17.8
Hispanic	10.4	13.7	38.8	16.3	18.7	8.3	36.4	13.6
Significance of racial comparisons								
White/black		**		**	*			
White/Hispanic		**		*				*
Black/Hispanic	*							
White/black/Hispanic	*	**		*				

* $p < .05$, ** $p < .01$.

Note: Some black/white and Hispanic/white differences that appear large are not statistically significant because statistical power is limited by the fact that the sample of whites is the smallest of the three groups (18% of the sample).

Table 4. Estimated prevalence of marijuana use disorder and transition probabilities by age cohort for whites, blacks, and Hispanics (percent)

	15-year-old cohort			18-year-old cohort				
	Estimated prev. at age 15	Estimated onset rate ages 15-17	Estimated persis. rate ages 15-17	Estimated prev. at age 17	Estimated prev. at age 18	Estimated onset rate ages 18-20	Estimated persis. rate ages 18-20	Estimated prev. at age 20
White	5.0	16.2	21.0	16.4	20.5	6.1	32.0	11.4
Black	4.4	12.6	70.1	15.1	18.8	14.5	32.7	17.9
Hispanic	8.1	9.5	22.0	10.5	10.3	3.6	38.5	7.2
Significance of racial comparisons								
White/black						*		
White/Hispanic		*			*			
Black/Hispanic			*			**		**
White/black/Hispanic			*		*	**		**

* $p < .05$, ** $p < .01$.

Note: Some black/white and Hispanic/white differences that appear large are not statistically significant because statistical power is limited by the fact that the sample of whites is the smallest of the three groups (18% of the sample).

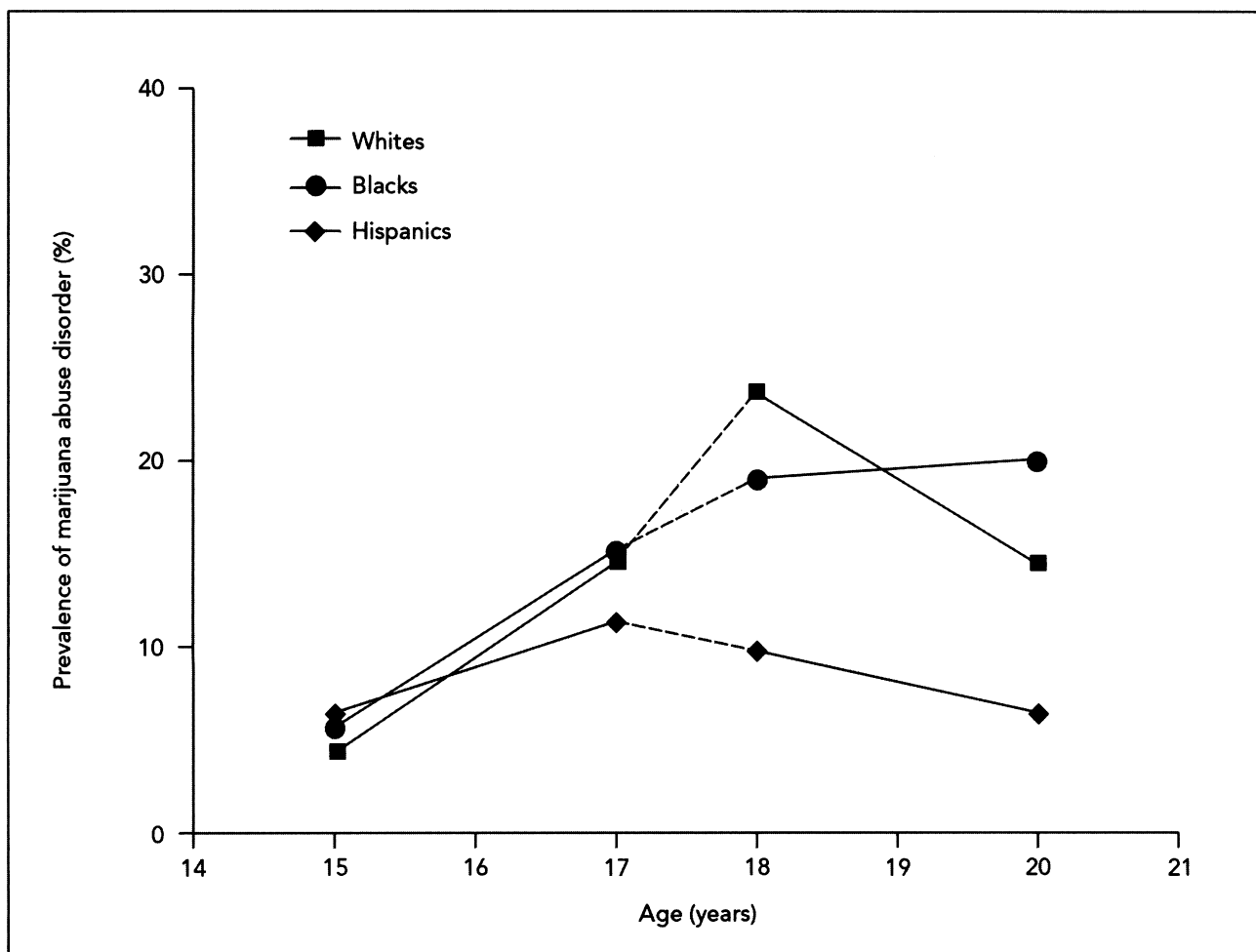


Figure 2. Age-adjusted observed prevalence of marijuana use disorder, ages 15-20, by racial or ethnic group

of household differences in the availability of alcohol at home, neighborhood differences in the availability of alcohol outlets, or neighborhood or peer group differences in access to marijuana sales. A second possibility is that white, black, and Hispanic adolescents and young adults are exposed to different age-specific norms, expectations, and monitoring regarding alcohol and marijuana use, in both their homes and their neighborhoods. The higher rates of early alcohol abuse and dependence among whites, for example, may be due to greater tolerance of adolescent alcohol use or lower levels of parental and community monitoring in white neighborhoods than in black neighborhoods. A third possibility is that white, black, and Hispanic adolescents and young adults experience or perceive different opportunity structures available to them, which in turn influences their likelihood of substance abuse or dependence. For example, the higher rates

of marijuana abuse and dependence onset in late adolescence among blacks may be due to a weak opportunity structure for young black men. Fewer labor market and post-secondary educational opportunities for blacks may lead to higher rates of abuse and dependence in the post-high school years.

While our analyses do not explain the social processes behind these patterns, they do suggest avenues for future research. The clear evidence of racial and ethnic disparities in patterns of onset and prevalence of substance abuse and dependence indicates the need for more longitudinal research on patterns of substance use and abuse from adolescence through young adulthood.

This study has several potential limitations. The sample may have been biased, particularly because of sample attrition between baseline and follow-up interviews. There were no significant differences in attrition rates relative to baseline alcohol use—those reporting alcohol

abuse or dependence at baseline were no more likely to drop out of the study before the follow-up than non-abusers. Likewise there was no statistically significant attrition bias relative to baseline marijuana use among the 18-year-old cohort. Among the 15-year-old cohort, however, those reporting marijuana abuse or dependence at baseline were more likely to be lost to the study at follow-up than those not reporting abuse or dependence at baseline (odds ratio = 1.89; $p = .033$). These findings suggest that our results are largely free of bias resulting from sample attrition, although we should be cautious in interpreting the estimated persistence rates for marijuana use disorders between 15 and 17.

A second limitation of the study stems from our operationalization of “onset” and “persistence.” The PHDCN interview protocol measures substance abuse and dependence symptoms only in the past year. Thus our definitions of “onset” and “persistence” do not account for respondents’ abuse or dependence status more than a year before the baseline interview or after the baseline interview but a year or more before follow-up. It is possible that some respondents moved between states in ways that are not fully captured by our data and models. Nonetheless, our data and models do capture broad patterns of substance abuse and dependence transitions in more detail than is possible with cross-sectional data and simple prevalence tabulations alone.

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