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Trajectory Classes of Cannabis Use and Heavy Drinking among Rural African American Adolescents: Multilevel Predictors of Class Membership

Allen W. Barton,

Center for Family Research, University of Georgia, 1095 College Station Road, Athens, Georgia 30602-4527

Gene. H. Brody,

Center for Family Research, University of Georgia, 1095 College Station Road, Athens, Georgia 30602-4527

Tamika C. B. Zapolski,

Department of Psychology, Indiana University–Purdue University Indianapolis, 402 N. Blackford Street, Indianapolis, Indiana 46202-3275

Trenette C. Goings,

School of Social Work, University of North Carolina at Chapel Hill, 325 Pittsboro Street, Chapel Hill, North Carolina 27599

Steven M. Kogan,

Department of Human Development and Family Science, University of Georgia, 305 Sanford Drive, Athens, Georgia 30602

Michael Windle, and

Department of Behavioral Sciences and Health Education, Rollins School of Public Health, Emory University, 1518 Clifton Road NE, Atlanta, Georgia 30322

Tianyi Yu

Center for Family Research, University of Georgia, 1095 College Station Road, Athens, Georgia 30602-4527

Abstract

Aims—To inform research on the etiology and prevention of substance use among rural African American youth by (a) identifying developmental trajectory classes of cannabis use and heavy drinking across adolescence and young adulthood, and (b) examining associations between trajectory class membership and multi-level assessments of risk factors.

Design—A prospective study spanning nine years with assessments of cannabis use and heavy drinking, the catecholamines epinephrine and norepinephrine, perceived stress, and psychosocial risk factors.

Setting—Rural communities in the southeastern United States.

Participants—African American youth ($N = 518$).

Measurements—Participants were assessed for cannabis use and heavy drinking at seven assessments beginning at 16 years of age and continuing to 25 years of age. At age 19, participants provided overnight urine voids that were assayed for catecholamines, a biological marker of life stress resulting from sympathetic nervous system activation. At ages 16 and 19, participants provided information on malleable psychosocial risk factors.

Findings—Latent class growth models revealed three distinct trajectory classes for cannabis use and for heavy drinking. Higher levels of circulating stress hormones and perceived stress were associated with classes reporting greater substance use over time (all $ps < .05$). A composite of selected risk factors discriminated class membership (all $ps < .05$). Trajectory classes characterized by rapid usage increases in early adulthood exhibited the greatest increase in deviant peer affiliations between ages 16 and 19.

Conclusions—Rural African American youths' cannabis use and heavy drinking across adolescence and young adulthood demonstrate distinct developmental courses; a small number of risk factors and measures of biological and perceived stress prognostically differentiate class membership. Variability over time in these measures, specifically an increase in deviant peer affiliation, may help to account for steep increases in young adulthood.

Keywords

Cannabis; heavy drinking; latent class growth modeling; African American; risk factors; stress

INTRODUCTION

Alcohol and cannabis are the drugs most commonly used among adolescents and young adults in the United States [1]. The widespread use of these drugs is a significant public health issue because of the negative social and health outcomes associated with their use, such as impairments in critical thinking and memory, drug-related injuries and illnesses, and an elevated risk for violence and delinquent behavior [2]. Understanding and preventing drug use is particularly important for African American youth and adults, who experience more negative consequences per ounce of alcohol or other drugs consumed than do members of other racial groups [3]. In addition, epidemiological research has identified a variety of intriguing findings concerning the uniqueness of African American youth's and adults' substance use patterns [4–9]. The most notable of these findings concerns African American individuals' relatively high use during adulthood, despite a late onset and low rates of use during adolescence [10]; this phenomenon has been termed the “racial crossover effect” [11]. Epidemiological research describing the racial crossover effect, however, has been based primarily on cross-sectional analyses (see Keyes et al. [12] for an exception). Furthermore, most research on substance use among minority populations has focused on between-race comparisons (e.g., Chen et al. [6]); consequently, important within-race differences in substance use trajectories have not been detected, particularly among non-urban minorities. The first aim of this report, therefore, was to characterize cannabis and heavy alcohol use among a representative sample of rural African American adolescents over a 9-year period, beginning when the participants were 16 years of age. Using a person-

centered data analytic approach, latent class growth modeling, we expected to find two or more distinct trajectory classes for cannabis use and for heavy drinking; possible trajectories included: stable low use, stable high use, late-onset rapid increase, and concave parabolic (e.g., increasing use in adolescence, decreasing use in young adulthood).

A second aim of the study was to test the conjecture that biological markers and perceptions of stress, along with a selected set of psychosocial risk factors, would differentiate substance use classes. A growing body of literature has emphasized the importance of exposure to stress in the epidemiology of African American adults' substance use (e.g., Green et al. [13]). Most extant studies on this topic have focused on the contemporaneous association between self-reported stress levels and elevated substance use (e.g., Mulia et al. [14]). However, as outlined in models of allostatic load [15] and the biological embedding of poverty [16], exposure to stress during childhood and adolescence can incubate over time and weather multiple physiological systems in a manner that renders individuals susceptible to drug use [17]. As a result, patterns of substance use among young African American adults may have developmental, biological origins as a result of undetected elevations in stress markers "under the skin" [18]. Prospective research investigating the stress incubation hypothesis for substance use, however, is sparse. The current study provides a preliminary examination of this hypothesis by investigating the ways in which levels of catecholamines (biological markers of stress resulting from sympathetic nervous system activation) forecast differences in substance use trajectory classes; group differences in perceived stress are also explored.

Psychosocial risk factors may also differentiate substance use trajectory patterns. In particular, change in these factors following high school may account for the steep increases in substance use that some individuals exhibit at this time. We propose that African American youth who evince low levels of drug use across adolescence followed by a precipitous increase during young adulthood will report an increase in risk factors that presage increases in drug use. Informed by the literature on the etiology of drug use among African American samples, we investigated group differences in psychosocial risk factors related to negative academic orientation, racial discrimination, affiliations with deviant peers, and parent-youth relationships [19–22]. Given research noting the importance of considering multiple risk factors in developmental research [23], as well as other research emphasizing the importance of examining individuals measures as a means to facilitate specificity and interpretation [24], group differences in risk factors were investigated using composite and individual measures. These risk factors were assessed at ages 16 and 19, allowing us to determine whether change in some or all of them during the transition to adulthood was associated with a pattern of young adult onset/precipitous increase in drug use among a subgroup of African American young adults.

To summarize, in the present study we examined 9-year developmental trajectories of cannabis use and heavy drinking among a sample of rural African American young people during adolescence and into adulthood. This demographic continues to represent an understudied population, even among studies with African American samples, which have predominantly focused on youth living in urban settings (e.g., Pardini et al. [9]). We also investigated biological and psychosocial factors predicting class membership. Particular

attention was given to the ways in which variability in stress and risk factors may account for rapid increases in use. Accordingly, the current study provides one of the first prospective analyses of the nature and correlates of African American individuals' substance use trajectories across adolescence and young adulthood. The results can clarify the etiology of substance use among this understudied demographic group and inform prevention and treatment approaches.

METHOD

Participants

The present sample was drawn from a larger longitudinal study of African American families that began when youth were 11 years of age. The families in that study resided in small towns and communities in rural Georgia in which poverty rates are among the highest in the nation and unemployment rates are above the national average [25]. From lists of 5th-grade students that schools provided, 667 families were selected randomly for an initial assessment (see Brody et al. [26]). Participating families then completed additional periodic assessments during the next 14 years. Because rates and variability in cannabis use and heavy drinking during the first four waves of data collection (spanning ages 11 to 15 years) were minimal (< 2% at each wave), the first data point used in the present analyses corresponded to Wave 5 in the original study, when the youth's mean age was 16 years. For the current study, we selected individuals who provided information for at least one assessment during adolescence (ages 16 to 18) and at least one assessment during young adulthood (ages 19 to 25); the final study sample included 518 participants. Comparisons using independent *t*-tests and χ^2 tests of these 518 youth with the 149 not included revealed no differences based on youth sex, youth age, parent age, parental education, or other demographic variables (i.e., poverty status, family structure, parental employment) at the initial assessment (see Supplemental Table S1). Of the youth in the final sample, 54% were female. At baseline, 42% of families lived below federal poverty standards, with a median family income per month of \$2080 (*SD* = \$1432).

Procedures

Youth provided data at seven assessments at mean ages 16, 17, 18, 19, 20, 21, and 25. Sample sizes at each wave were, respectively, 460, 455, 515, 495, 481, 461, and 408. At each wave, primary caregivers consented to minor youth's participation in the study, and minor youth assented to their own participation. Youth age 18 and older consented to their own participation. All data were collected in participants' homes using a standardized protocol. African American field researchers visited families' homes to administer computer-based interviews at each wave of data collection, allowing responses to sensitive questions to be input privately by respondents. All assessments were conducted with no other family members present. At the age 16 and 19 assessments, youth and their primary caregivers provided information on psychosocial risk processes. Overnight urine voids were collected from youth at age 19, from which the catecholamines epinephrine and norepinephrine were assayed. Participants were compensated \$100 at each data collection wave. The Institutional Review Board of the sponsoring research institution approved the study protocol.

Measures

Cannabis use—To assess levels of past-month cannabis use, youth were asked at each of the seven waves in the study, “During the past month, on how many days did you use marijuana?” Response options were 0 = none, 1 = one to three, 2 = four to seven, 3 = eight to twelve, 4 = thirteen to nineteen, and 5 = twenty or more. This question was based on a widely used instrument from the Monitoring the Future Study [27].

Heavy drinking—To assess levels of past-month heavy drinking, youth were asked at each wave, “During the past month, on how many days have you drunk three or more drinks at one time?” from ages 16 to 18 and “...on how many days have you drunk four or more drinks at one time?” from ages 19 to 25. As with cannabis use, response options ranged from 0 = none to 5 = twenty or more. This question was based on a widely used instrument from the Monitoring the Future Study [27].

Catecholamines—The catecholamine measurement protocol was based on procedures that Evans et al. [28] and Brody et al. [29] developed for field studies involving children and adolescents. Participants received training and supplies on the day of their data collection visit for collecting all urine voided from 8 pm that evening to 8 am the next morning. On that morning, a research assistant visited the home and stored the urine on ice in a container with metabisulfite as a preservative prior to transporting it to a laboratory at the University of Georgia. The total volume was then recorded and four 10-ml samples were randomly extracted and deep frozen at -80°C until subsequent assays were completed. The pH of two of these samples was adjusted to 3 to inhibit catecholamine oxidation. The frozen urine was delivered to the Emory University Hospital medical laboratory in Atlanta, Georgia, for assaying. Epinephrine and norepinephrine were assayed with high-pressure liquid chromatography with electrochemical detection [30]. For epinephrine, mean intra-assay coefficients of variation (CV) for nonsequential duplicates are 27.1% (< 40 pg/ml), 13.5% (40 to 80 pg/ml), and 9.6% (> 80 pg/ml); pooled samples mean inter-assay CV for 60 to 140 pg/ml is 16.3%; and blanks read 7.0 ± 14.5 (SD) pg/ml. For norepinephrine, mean intra-assay CVs for nonsequential duplicates are 6.6% (< 400 pg/ml), 6.5% (400 to 800 pg/ml), and 7.1% (> 800 pg/ml); pooled mean inter-assay CV for 300 to 500 pg/ml is 10.3%; and blanks read 6.0 ± 10.3 (SD) pg/ml. Creatinine assay via Jaffe rate methods controlled for body size differences and incomplete urine voiding [31]. SNS catecholamine scores were calculated by summing standardized scores for overnight epinephrine and norepinephrine ($r = .545$, $p < .001$); higher scores indicated greater amounts of stress hormones circulating in the body.

Perceived stress—Youth perceptions of stress were assessed using 10 items from the Perceived Stress Scale [32], an instrument that has been used in multiple previous studies with African American samples that support its reliability ($\alpha = .82$) and predictive validity [33, 34]. Response options ranged from 1 = never to 5 = very often. Sample items included how often in the past month participants: “felt that you were unable to control the important things in your life” and “found that you could not cope with all the things that you had to do” ($\alpha = 0.81$). Higher scores indicated greater perceived stress.

Risk factors—*Negative academic orientation* was assessed using 20 items that Conger [35] developed. Sample items, rated from 1 = strongly disagree to 5 = strongly agree, involved youth's attitudes (e.g., "School bores me"), motivation (e.g., "I try hard at school" [reverse coded]), efficacy (e.g., "I do most of my school work without help from others" [reverse coded]), and relationships with teachers ("I get along well with my teachers" [reverse coded]). Items were summed, with higher scores indicating more negative academic orientations. Coefficients alpha at ages 16 and 19 exceeded .87, as in previous research [36]. Youth who, at age 19, reported that they were not currently in school ($n = 155$; 31% of age 19 sample) were asked to "think about the last time you went to school or an educational program" when completing the measure.

Perceived racial discrimination was assessed with the Schedule of Racist Events [37]. This measure has demonstrated concurrent and predictive validity and good reliability in previous studies involving rural African American youth [38]. Items assessed the frequency with which respondents had perceived specific discriminatory events during the previous year, on a scale from 0 = never happened to 2 = happened a lot. These events included racially based slurs and insults, disrespectful treatment from community members, physical threats, and false accusations from business employees or law enforcement officials. Items were summed, with higher scores indicating more experiences with racial discrimination. Coefficients alpha for the scale were 0.88 at age 16 and 0.91 at age 19.

Deviant peer affiliation was assessed through youth's reports of the proportions of their close friends who engaged in deviant or risk-taking behaviors, drawn from Elliot's work with delinquent youth [39]. Behaviors included selling drugs, getting in trouble with the police, skipping school, and damaging property. Response options ranged from 0 = none of them to 2 = all of them. Cronbach's alpha was 0.90 at age 16 and 19. Previous studies with this measure support its reliability and predictive validity [40, 41]. At age 16 years, 13 behaviors were assessed, and at age 19 years, 14 behaviors were assessed. Responses to items were averaged, with higher scores indicating more peer deviance or risk-taking behaviors.

Parent-child arguments were assessed using a 7-item adaptation of the Ineffective Arguing Inventory [42]. Originally designed for adult spouses and domestic partners, we adapted the IAI for use with parents and children. The adapted version has been used in prior research with rural African American families that support its reliability ($\alpha = 0.57 - 0.71$) and predictive validity [43, 44]. In this 7-item measure, youth reported their perceptions of the frequency, from 1 = strongly disagree to 5 = strongly agree, of unsettled arguments, lingering anger, and conflicted communications with their parents. Sample items include: "You and this person go for days being mad at each other" and "You and this person's arguments are left hanging and unsettled". Cronbach's alphas were 0.70 at age 16 and 0.84 at age 19.

All risk factors were assessed using these measures at age 16 and age 19. Measures were standardized prior to averaging for the composite measure for each age. Measures comprising the composite were all significantly correlated ($.10 < r < .44$; $p < .017$; see Supplemental Table S2) with other measures in the composite at that time point.

Plan of analysis

The data analyses were executed in three stages. First, latent class growth models (LCGMs) with linear and quadratic slopes were used to identify trajectories of (a) cannabis use and (b) heavy drinking from 16 to 25 years of age (see Supplemental Figure S1 for growth curve model diagram). We compared model fits of one-, two-, three-, and four-class LCGMs, assessing their relative fit with conventional indices, including the Bayesian information criterion (BIC), entropy value, and the Lo-Mendell-Rubin adjusted likelihood ratio (adjusted LRT [45]). Lower BIC scores indicated better fit, whereas higher entropy scores reflected greater accuracy in classification. Optimal models were chosen on the basis of goodness of fit and parsimony; BIC scores received primary focus. Second, we conducted orthogonal linear contrasts to determine whether the means of the biological and psychosocial indicators increased or decreased across substance use classes in a linear manner. Third, univariate between-group analyses of covariance (ANCOVAs) and repeated-measures ANCOVAs were used to test specific comparisons in the composite and individual risk factors across substance use trajectory classes.

All growth curve analyses were conducted using Mplus 7.4 software [46]. Given the overdispersion of zeros, substance use was modeled as zero-inflated Poisson count variables in LCGMs. Factor loadings for the rate of change parameters were set equal to mean age at the particular wave of data collection and the intercept representing participants' substance use at age 16. ANCOVAs were conducted in IBM SPSS 24 [47], with post-hoc analyses using least significant difference tests. Missing data for cannabis use and heavy drinking were less than 12% across all seven waves in the study and were handled via full information maximum likelihood in Mplus. Missing data were less than 7% for the risk factor measures and stress markers. Sex was included as a predictor of class membership in the LCGMs, given previous research indicating significant differences in rates of substance use between sexes [6]. Sex and a family socioeconomic status risk index (see Brody et al. [26]) were included as control variables in group-based comparisons; baseline risk factor levels were also included as covariates in between-group ANCOVAs examining group differences in age 19 risk factors.

RESULTS

Modeling of cannabis use and heavy drinking trajectories

The results for the LCGM analyses are summarized in Table 1. For cannabis use, BIC values declined with greater numbers of classes. Entropy values and the LRT ratios, however, indicated that a three-class solution fit better than the four-class solution. For heavy drinking, the three-class solution had the lowest BIC value and highest entropy value. Thus, three-class models were chosen for both substances. The resulting plots of the three-class solutions for cannabis use and heavy drinking are shown in Figure 1, and the corresponding parameter estimates for each class are shown in Table 2.

For cannabis use, the majority of participants (66%, $n = 342$) were assigned to the *No use, stable* class, which had a low intercept at age 16 with continued low use throughout adolescence and young adulthood. The second class, which comprised 20% of the sample (n

= 102), was the *Low start, low increase* class. Youth in this class had a low intercept at age 16, with use increasing gradually during adolescence and young adulthood. The third class, which comprised 14% of the sample ($n = 74$), was the *High start, high increase* class. Youth in this class reported the highest intercept and steep rates of increase during the earlier waves of the study, with the most rapid increase occurring between the ages of 18 and 19.

For heavy drinking, the majority of participants (73%, $n = 380$) were assigned to the *Low start, low increase* class, which had a low intercept at age 16 with use increasing slightly throughout adolescence and young adulthood. The second class, which comprised 21% of the sample ($n = 107$), was the *Low start, high increase* class. Youth in this class had a low intercept at age 16, but increased use precipitously between the ages of 19 and 21. The third class, which comprised 6% of the sample, was the *High start, stable* class. This group reported the highest intercept and continued high use throughout adolescence and young adulthood (results presented in Table 2 indicate no significant change over time for this group).

A review of the trajectory parameters (Table 2) indicated that all classes with significant changes over time had a positive linear term and negative quadratic term. Thus, rates of substance use for these classes demonstrated significant increases over time, but the rate of positive increase diminished over time. That is, in describing the shape of change across time, rates of increase were greater at earlier time points (i.e., in adolescence) than at later time points (i.e., in young adulthood).

Differences among cannabis use and heavy drinking classes

The next set of analyses was executed to determine class differences across (a) biological and subjective measures of stress at age 19, and (b) psychosocial risk factors at ages 16 and 19. Using linear contrasts (see Table 3), significant effects emerged for nearly all constructs; these exceptions were: age 19 parent-child arguments (for cannabis use and heavy drinking classes) as well as age 19 negative academic orientation and catecholamine levels (for heavy drinking classes only). Thus, overall results indicated that individuals in cannabis use and heavy drinking classes characterized by higher levels of use also reported higher levels of perceived stress and catecholamines (for cannabis use only) at age 19 as well as elevated psychosocial risk factors at ages 16 and 19 (with exceptions of age 19 parent-child arguing and negative orientation).

Mirroring findings from linear contrasts, between-group ANCOVAs revealed significant omnibus differences across cannabis use classes and heavy drinking classes for all composite and individual measures, except for differences among heavy-drinking groups in catecholamine levels as well as heavy-drinking groups and cannabis use groups in age 19 parent-child arguing. In addition, repeated measures ANCOVAs to identify potential group differences in change over time on individual risk factors indicated, for cannabis use class, a significant Class $\times$ Time interaction for reported deviant peer affiliation ($F[2,435] = 4.339$, $p = .01$; see Supplemental Table S3 for summary statistics for all risk factors). Thus, in the remainder of the Results section, results are presented with respect to between-group ANCOVAs for all outcomes except for deviant peer affiliation, which are presented with repeated measures ANCOVAs.

Mean levels and post-hoc comparisons of ANCOVA analyses are summarized in Table 4. Group differences among cannabis use classes were as follows. Individuals assigned to the *High start, high increase* class manifested significantly greater catecholamine levels at age 19 than did the *No use, stable* class. *High start, high increase* and *Low start, low increase* classes both perceived higher levels of stress at age 19 than did the *No use, stable* class. With respect to the composite risk factor, significant differences in risk were evident across all three classes at age 16, with the highest levels of risk factors reported by the *High start, high increase* class and the lowest levels reported by the *No use, stable* class. At age 19, the *High start, high increase* class continued to exhibit greater levels of risk factor compared to the other two cannabis use classes.

Differences were also evident across heavy drinking class trajectories. Individuals assigned to the *High start, stable* and *Low start, high increase* classes both perceived higher levels of stress at age 19 than did those in the *Low start, low increase* class. At age 16, significant differences in risk factors were evident across all three classes. However, at age 19, the *Low start, high increase* class (who previously reported lower levels of risk factors than did the *High start, stable* group) now reported similar levels of risk as the *High start, stable* group, both of which were significantly higher than the *Low start, low increase* class.

For both cannabis use and heavy drinking, group comparisons on individual-level risk factors revealed similar findings (see Supplemental Table S4 for tabulated summary). For cannabis use, the *No use, stable* class consistently reported the lowest levels of risk factors at ages 16 and 19 of any class. Risk factors for the *Low Start, Low Increase* class were less than or equivalent to the *High start, High increase* class, depending on the particular risk factor. For heavy drinking, the *Low Start, Low Increase* class consistently reported lower levels of risk factors at ages 16 and 19 than either of the other two heavy drinking class. The *Low Start, High Increase* class, in the majority of comparisons, was similar to the *High Start, Stable* class.

Given the significant Cannabis Use Class $\times$ Time interaction for reported deviant peer affiliation identified in repeated measures ANCOVAs (Supplemental Table S3), we plotted mean levels of deviant peer affiliation for each cannabis use class at age 16 and age 19 to clarify the nature of this interaction. The results, shown in Figure 2, indicated that the greatest increase in deviant peer affiliation over time was associated with the *high start, high increase* class. For heuristic purposes, Figure 2 also presents differences in deviant peer affiliation over time for heavy drinking classes, for which the interaction approached statistical significance ($F[2,435] = 2.526, p = .08$). As with cannabis use, the greatest increase in deviant peer affiliation was evident in the class characterized by the steepest increase in use during the transition to adulthood, which for heavy drinking was the *low start, high increase* class. Thus, individuals in classes with steep mean increases in levels of cannabis use and heavy drinking around the transition to young adulthood were also characterized by greater increases in deviant peer affiliation. Differences between classes in change over time were not evident for any other risk factor.

DISCUSSION

In this study, we sought to identify the developmental course of rural African American adolescents' substance use and its predictors by identifying trajectory classes of cannabis use and heavy drinking and multilevel correlates of class membership. LCGMs demonstrated that cannabis use and heavy drinking each was characterized by three general classes, with rapid growth in young adulthood documented in one class for cannabis use and one class for heavy drinking. For heavy drinking, the steeply increasing class was observed among individuals with little to no use during adolescence, whereas for cannabis use, the steeply increasing class characterized individuals reporting early onset of use. Differences between classes in biological and perceived measures of stress also emerged; results were consistent with the proposition that elevated levels of biological and perceived stress are associated with elevations in substance use over time. The selected risk factors reliably differentiated class membership; comparisons of levels over time indicated that classes manifesting greater accelerations in use between ages 16 and 19 were characterized by a concomitant greater increase in deviant peer affiliation. Results from this study provide new information regarding substance use patterns among African Americans living in rural areas as well as factors that discriminate class membership.

Consistent with prior research with mixed-race samples (see Nelson et al. [48]), the trajectory classes identified for both cannabis use and heavy drinking were characterized by (1) no/low incidence, (2) early onset and high use, or (3) low onset with increasing use. No evidence emerged, however, for a mean decline in any class throughout young adulthood, despite its documentation in other samples of various racial groups [48]. These findings suggest that, for rural African American young adults, substance use may demonstrate a *young adult perpetuation* pattern whereby usage rates do not decline as individuals mature out of young adulthood. This pattern contrasts with the *young adult limited* pattern found in the general population, in which usage rates decline in the middle and late twenties [49]. Additional longitudinal studies on these patterns are clearly needed, as are efforts to elucidate factors that account for African American adults' sustained use, including the potential lack of stable life reinforcers (see Zapolski et al. [3]). As another contribution of the current study, linear and quadratic parameter estimates also revealed greater fluctuation in substance use rates in adolescence (ages 16–19) than in early adulthood (ages 19–25), suggesting the importance of prevention efforts that alter developmental trajectories of substance use prior to young adulthood, when patterns of use begin to stabilize.

Both biological markers and perceptions of stress demonstrated prognostic significance for substance use trajectory class membership, associations to which scientists have alluded in prior research (e.g., Sinha [17]) but less frequently examined empirically. Consistent with the stress incubation hypothesis [17], individuals in the highest cannabis use class throughout adolescence and young adulthood had the highest catecholamine levels at age 19. Catecholamine levels did not vary according to heavy drinking class membership. Previous research has suggested that the effects of biological stress on substance use may occur through depressive symptomatology [50] or through immediate coping behaviors [51]. Catecholamine levels may have differentiated cannabis use, but not heavy drinking, classifications to the extent that elevated biological stress levels engendered coping

behaviors with anxiolytic properties [52]. Significant group differences in perceived stress also emerged; higher stress characterized trajectories in which substance use increased over time. Taken together, the results underscore the relevance of both elevated biological stress markers and contemporaneous perceptions of stress for African American young adults' substance use patterns.

The risk factors examined in the current study appear to be sensitive markers of membership in both cannabis use and heavy drinking classes. These results underscore the risk-inducing properties of low orientation to schooling, racial discrimination, deviant peer affiliation, and conflicted parent-child relationships in forecasting classes of cannabis use and heavy drinking across adolescence and young adulthood. Furthermore, the current results suggest that an increase in deviant peer affiliation, along with moderate to high levels of risk in other areas, may help to account for significant increases in cannabis use and heavy drinking around the transition to adulthood. Extending prior research on the influence of peers on concurrent and future substance use [53], results from this study highlight the unique effects of peer affiliation on classes with rapidly increasing substance use during the transition to adulthood. Because risk processes are dynamic, future research can continue to explore the ways in which levels of risk factors fluctuate over time and interact with protective factors to forecast substance use patterns across adolescence and young adulthood among youth residing in rural, urban, and other geographic locations.

Several limitations of the present study should be noted. First, consistent with other studies, self-reports of substance use are susceptible to inaccurate recall. Second, we assessed only the frequency of use and not the amounts used; therefore, problematic or clinically disordered substance use cannot be documented. Third, causality cannot be determined for the associations of substance use trajectory class membership with risk factors. Fourth, model entropy for selected classes was low, suggesting the potential for more classes better to explain substance use. Fifth, because only 4% of primary caregivers were fathers, we lacked a sufficient sample size to test for any differential impacts that caregiver relationship status to child (e.g., mothers, fathers, grandparent) may have on substance use; future research can address this limitation and the others noted herein. These limitations notwithstanding, the current study is one of the first investigations to document African American individuals' cannabis use and heavy drinking prospectively across adolescence and young adulthood and to identify sensitive, multilevel risk factors that distinguish trajectory class memberships. These findings can be used to inform future research on the etiology and prevention of substance use among African American adolescents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Latent class growth curve trajectories of (a) cannabis use and (b) heavy drinking.

Figure 2.

Group differences at age 16 and 19 in deviant peer affiliation for cannabis use classes and heavy drinking classes. Error bars = ± 1 standard error. Effect size (from between group ANCOVAs): Age 16. $\eta^2 = .10$ (cannabis use) and $= .06$ (heavy drinking), Age 19: $\eta^2 = .20$ (cannabis use) and $= .09$ (heavy drinking).

Table 1

Results for Latent Class Growth Modeling (N = 518)

Substance and model	Model-fit indices				Percentage of sample in class				
	Log likelihood	BIC	Entropy	LMR LRT	p	1	2	3	4
Cannabis use									
One class	−2642	5359	—	—	—	100			
Two class	−1969	4033	.86	578	.00	74	26		
Three class	−1917	3959	.76	101	.03	66	20	14	
Four class	−1896	3947	.76	41	.25	68	12	11	10
Heavy drinking									
One class	−2005	4085	—	—	—	100			
Two class	−1482	3059	.73	288	.00	78	22		
Three class	−1454	3034	.73	62	.06	73	21	6	
Four class	−1443	3042	.64	41	.03	61	27	6	5

Note. BIC = Bayesian Information Criterion. LMR LRT = Lo-Mendell-Rubin likelihood ratio test.

Table 2

Class Parameter Estimates (N = 518)

Substance and class	Trajectory parameter		
	Intercept	Linear term	Quadratic term
Cannabis use			
No use, stable	-4.595 **	0.234	0.002
Low start, low increase	-1.902	0.425	-0.013
High start, high increase	-0.057	0.395 **	-0.027 **
Heavy drinking			
Low start, low increase	-5.465 **	0.752 **	-7.268 *
Low start, high increase	-6.556 **	2.181 **	-0.162 **
High start, stable	-0.484	0.203	-0.016

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

Table 3

Polynomial Contrasts

	Cannabis use			Heavy drinking		
	Estimate	SE	p	Estimate	SE	p
Stress markers (age 19)						
Catecholamines	.423	0.18	.017	.350	0.26	.174
Perceived stress	.236	0.10	.017	.480	0.14	.001
Risk factors (age 16)						
Composite	0.49	0.07	.000	0.62	0.09	.000
Negative academic orientation	5.28	0.97	.000	4.87	1.39	.001
Racial discrimination	1.18	0.34	.001	2.16	0.47	.000
Deviant peer affiliation	0.19	0.03	.000	0.21	0.04	.000
Parent-child arguing	2.23	0.46	.000	3.11	0.65	.000
Risk factors (age 19)						
Composite	0.27	0.05	.000	0.15	0.08	.048
Negative academic orientation	3.95	0.94	.000	1.78	1.36	.192
Racial discrimination	0.81	0.30	.000	0.91	0.43	.034
Deviant peer affiliation	0.21	0.03	.000	0.10	0.04	.000
Parent-child arguing	0.02	0.51	.974	0.45	0.74	.541

Note. Class means and group difference comparisons are shown in Table 4.

Table 4

Class Means and Between Class Comparisons

Variables	Cannabis Use Class				Heavy Drinking Class			
	No use, stable	Low start, low increase	High start, high increase	<i>F</i> <i>p</i> η^2	Low start, low increase	Low start, high increase	High start, stable	<i>F</i> <i>p</i> η^2
Stress markers (age 19)								
Catecholamines	-.14 (.10) ^a	.10 (.19)	.45 (.23) ^b	3.09 .046 .01		-.11 (.10)	.39 (.35)	1.93 .146 .01
Perceived stress	-.09 (.06) ^a	.17 (.11) ^b	.24 (.13) ^c	4.39 .013 .02		-.09 (.05) ^a	.59 (.19) ^b	7.79 .000 .03
Risk factor composite								
Age 16	-0.17 (.04) ^a	0.25 (.07) ^b	0.52 (.08) ^c	35.63 .000 .14		-0.13 (.04) ^a	0.76 (.13) ^c	29.55 .000 .12
Age 19	-0.09 (.03) ^a	0.04 (.06) ^a	0.30 (.07) ^b	12.81 .000 .06		-0.07 (.03) ^a	0.15 (.11) ^b	7.02 .001 .03

Note. Covariates: Target gender and SES risk index [all models]; age 16 risk factor composite (for models comparing age 19 risk factor composite). Variable (sample size): catecholamines ($n = 455$), perceived stress ($n = 466$), risk factor composite, age 16 ($n = 464$), and risk factor composite, age 19 ($n = 495$). Significant group differences indicated by superscripted letters ($p < .05$).