# Predicting Persistent, Limited, and Delayed Problematic Cannabis Use in Early Adulthood: Findings From a Longitudinal Study

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**Objective:** To identify risk profiles associated with patterns of problematic cannabis use in early adulthood.

**Method:** Data came from 1,229 participants in the Great Smoky Mountains Study, a prospective 20-year cohort study from 1993 to 2015 that is representative of western North Carolina with yearly assessments conducted from ages 9 and 16 years, and assessments at ages 19, 21, 26, and 30 years. Patterns of problematic cannabis use (i.e., DSM-5 cannabis use disorder or daily use) in early adulthood included the following: nonproblematic use in late adolescence (ages 19–21) and early adulthood (ages 26–30); limited problematic use in late adolescence only; persistent problematic use in late adolescence and early adulthood; and delayed problematic use in early adulthood only. Multinominal logistic regression models examined pairwise associations between these patterns and risk factors in childhood/early adolescence (ages 9–16) and late adolescence (ages 19–21). Risk factors included psychiatric disorders (e.g., anxiety, depressive), other substance use (smoking, alcohol, illicit drugs), and challenging social factors (e.g., low socioeconomic status, family functioning, peers). Sex and race/ethnicity (white, African American, American Indian) interactions were tested.

**Results:** The persistent pattern (6.7% of sample) was characterized by more anxiety disorders across development and more DSM-5 CUD symptoms during late adolescence compared to the limited pattern (13.3%), which, in turn, had more childhood family instability and dysfunction. The delayed pattern (3.7%) was characterized by more externalizing disorders, maltreatment, and peer bullying in childhood compared to those in nonproblematic users. There were no significant interactions of sex or race/ethnicity.

**Conclusion:** Problematic cannabis use patterns during early adulthood have distinctive risk profiles, which may be useful in tailoring targeted interventions.

**Key words:** cannabis use disorder, risk factors, adolescence, early adulthood, epidemiology

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The prevalence of cannabis use in the United States is high, with approximately 70% of the population reporting use by age 30 years.[1,2] Among active users, 18% to 30% report problematic cannabis use, characterized by cannabis use disorder (CUD) or daily use.[3] Such problematic use peaks at ages 19 to 21 years and subsequently decreases or plateaus,[4] and is associated with long-term health and social consequences, including higher risk for altered brain development,[5] psychosis and exacerbated symptoms of schizophrenia,[6] escalation to harsher drug use,[7] and lower educational attainment and employment.[8] Substantial progress has been made in identifying risk factors for substance use in the early life course. For problematic cannabis use specifically, the literature points to psychiatric disorders,[9] other substance use,[10,11] and challenging economic and social circumstances.[12-14] Yet our current understanding of antecedents and correlates of problematic cannabis use in early adulthood is far from complete, due, in part, to the heterogeneous developmental patterns of problematic use.

Comparing the existing evidence across studies is difficult because developmental patterns of problematic use can be defined based on the onset, offset, or intensity of cannabis use.[15,16] The most commonly identified developmental patterns include the following: (1) nonproblematic use across adolescence and adulthood; (2) problematic use that is limited to adolescence; and (3) problematic use that persists throughout adolescence and adulthood. Finally, there is also growing evidence of a delayed problematic use group that begins in adulthood after the typical peak of cannabis use in the late teens/early 20s.[14,15,17] Although the number of delayed users is likely to increase in the coming years following cannabis legalization,[18] very little is known about this group. To optimize preventions and interventions, it is important to pinpoint the risk profiles that precede and accompany these heterogeneous patterns of problematic cannabis use patterns in early adulthood.

Additional gaps in the literature on problematic cannabis use during early adulthood remain. First, the majority of studies examine cannabis use patterns across adolescence or the college years only, omitting early adulthood, which extends into the 30s. Second, research typically compares

problematic cannabis use patterns to patterns of no/low use, but seldom to variations of problematic use; yet these latter comparisons would be most informative for tailored preventions/interventions. Third, much of the evidence to date does not incorporate the cannabis use disorder (CUD) criteria of the *DSM-5*.[19] Finally, interactions of race/ethnicity and sex with risk factors across different developmental patterns of problematic cannabis use are poorly understood.[20]

The current study addresses these gaps using a large, diverse, 20-year cohort that was most recently assessed in 2015. The main objective is to identify how childhood/early-adolescent (ages 9−16) and late-adolescent (ages 19−21) risk profiles differ across problematic cannabis use patterns that occur from late adolescence (ages 19−21) until early adulthood (ages 26−30). A secondary objective is to test potential race/ethnicity and sex differences in risk factors for developmental patterns of problematic cannabis use in early adulthood, given the known racial/ethnic and sex differences in terms of age of onset of cannabis use, frequency of use, CUD, and desistance.[21,22] In doing so, we are able to contribute to the growing literature on the development of cannabis use among American Indians.[23,24] Altogether, this work builds on our previous study that examined differences by race/ethnicity and sex for point prevalence of cannabis use, frequencies, and *DSM-5* CUD from 9 to 30 years of age.[3]

## METHOD

### Participants
The Great Smoky Mountains Study is a prospective, longitudinal study of the development of psychiatric disorders and need for mental health services among rural and urban youth. A community-representative sample of 1,420 participants was recruited from 11 counties in western North Carolina in 1993, using a household equal probability, accelerated cohort design for 3 cohorts of children aged 9, 11, and 13 years at intake. The study oversampled American Indians, who represented 3% of the community population, but make up nearly one-fourth of the study sample (n = 350). To ensure that the results were not biased by the oversampling procedure, all enrolled participants were assigned a sampling weight inversely proportional to their probability of selection. More details on recruitment and data collection are published elsewhere.[25] Briefly, 80% of those recruited chose to participate at intake. Thereafter, 82.1% of all possible interviews were completed up to age 30 (74%–94% at any particular wave). The maximum possible number of interviews per participant is 11 (youngest cohort of 9 years old at intake), 10 (middle cohort), and 8 (oldest cohort). The mean number of interviews to date is 7.7 (SD = 2.3).

The final analytical sample for the present study consists of 1,229 participants who had relevant data on patterns of cannabis use at ages 19 to 21 and 26 to 30. Among these individuals, 134 had missing observations on late-adolescent risk factors (ages 19 to 21), resulting in 1,095 respondents with complete data. Participants with missing data on late adolescent risk factors were more likely to be male ($p < .001$) and less likely to have ever used cannabis by age 16 ($p < .05$), compared to the full analytical sample. There were no differences by race/ethnicity.

### Procedures
Before the study began, both the child participant and a parent (83% biological mother) signed informed consent forms. Each respondent received an honorarium for participation. Interviews were conducted separately for both respondents on an annual basis until the participant was 16 years old. Going forward, only the participant was interviewed at ages 19, 21, 26, and 30 years. The study was approved by the Duke University Medical Center Institutional Review Board.

### Assessment
All variables, except criminal offenses and the neglect portion of the maltreatment variable, were assessed using the Child and Adolescent Psychiatric Assessment (CAPA) self- and parent-reports until age 16 and the Young Adult Psychiatric Assessment (YAPA) self-reports thereafter at ages 19, 21, 26, and 30.[26,27] The reference period for all variables was within the past 3 months immediately preceding the interview to increase the accuracy of the recall. For symptoms of psychiatric disorders and high-risk behaviors such as substance use,[28] the reliability of a 3-month reference period has been shown to be an improvement over longer (e.g., past 6 months or past year) recall time frames because estimates using this reference period are less likely to be biased by forgetting or to show inconsistencies in details related to the onset, duration, and intensity of the experiences.[29] The structured interviews were coded by trained interviewers; each interview was then checked by a supervisor. Scoring programs, written in SAS by the senior authors, combined information about the date of onset, duration, and intensity of each symptom to contribute to diagnoses according to *DSM* criteria. Two-week test−retest reliability of endorsed diagnoses is comparable to that of other highly-structured psychiatric interviews.[30]

### Cannabis Involvement
The substance use module of the YAPA assesses cannabis use at ages 19, 21, 26, and 30 years according to age of onset, frequency of use, symptoms of *DSM-5* CUD, and maladaptive behaviors such as the use of cannabis to improve mood, disinhibited cannabis use, cannabis use first thing in the morning, blackouts, and cannabis-related criminality. For this study, problematic cannabis was defined as either daily cannabis use or meeting full criteria for *DSM-5* CUD. Although highly correlated, these constructs are not synonymous (see also our previous publication detailing the point prevalence of CUD and daily use from ages 9 to 30 years).[3] Specifically, among the total 415 reports of CUD observed in the weighted sample over the course of the study, 72.1% of the observations coincided with an account of daily use. Conversely, only 57.4% of daily use reports (n = 382) overlapped with CUD endorsement. Endorsement of *DSM-5* CUD diagnostic criteria required presentation of at least 2 of 11 symptoms, all of which were routinely collected since study inception in 1993 in the CAPA and later in YAPA prior to *DSM-5* updates in 2013. These included the following: overconsumption, attempts to cut back, excessive time spent acquiring or using, craving, failure to fulfill major roles or obligations, continued use causing problems for interpersonal relationships, reduction in other activities, use in physically hazardous situations (e.g., driving intoxicated), continued use despite observed physical or psychological consequences, increased tolerance, and withdrawal due to cessation.[19]

### Risk Factors
We measured dichotomized variables (0 = no, 1 = yes) for psychiatric disorders, other substance use, and challenging economic and social circumstances aggregated across ages 9 to 16 years in childhood/early adolescence and across ages 19 and 21 years in late adolescence. Psychiatric disorders consisted of anxiety disorders,