Characteristics Associated With Cannabis Use Initiation by Late Childhood and Early Adolescence in the Adolescent Brain Cognitive Development (ABCD) Study

Early-onset cannabis use is common (eg, 12% of 14- to 15-year-olds in the US report lifetime use) and is associated with increased risk for cannabis use disorder, other psychiatric disorders, and other problems (eg, early school dropout) during childhood and adulthood.[1,2] Prospective risk factors of early-onset cannabis use remain poorly understood. Here, using data from the Adolescent Brain Cognitive Development (ABCD) Study,[3] we identified characteristics associated with cannabis use initiation by early adolescence (mean [SD] age, 13.43 [0.62] years).

Supplemental content

Methods | Participants provided assent and caregivers provided written informed consent to protocols approved by institutional review boards at each data collection site. We followed the (STROBE) reporting guideline for cohort studies. Associations between early-onset cannabis use (n = 170 [1.56 %]), defined as endorsement of cannabis use beyond a puff in any form (ie, smoking cannabis, consuming edibles, and using concentrates, oils, or tinctures) reported at any assessment (baseline [June 1, 2016, to October 15, 2018] to 3.5-year follow-up sessions) and psychopathology, personality, and cognition as well as cannabis-related familial, environmental, and peer variables (n = 46; eMethods in Supplement 1) were estimated using mixed-effect logistic regression models, nesting data by collection site (lme4 package in R version 4.2.1 [R Foundation]). The no cannabis use group was defined as those who had heard of cannabis by 2-year follow-up (mean [SD] age, 12.00 [0.66] years), but not used by 3.5-year follow-up (n = 10 711). Fixed-effect covariates included family and twin status as well as sociodemographic and parental variables significantly associated with cannabis use (**Table** and **Figure** caption).

Table. Baseline Sociodemographic and Parental Variable Comparisons for Cannabis Use Initiation Groups

Variable	No./total No. (%)		Nonparametric comparison, *P* value
	Used cannabis (n = 170)	Heard of but have not used cannabis (n = 10 711)	
Sex			
Female	61/170 (35.9)	5048/10 711 (47.1)	.004
Male	109/170 (64.1)	5663/10 711 (52.9)	
Race and ethnicity[a,b]			
Asian	2/169 (1.2)	232/10 684 (2.2)	<.001
Black/African American	31/169 (18.3)	1715/10 684 (16.1)	
Hispanic/Latino	25/169 (14.8)	531/10 684 (5.0)	
Native American/Alaska Native	NA	36/10 684 (0.3)	
Pacific Islander	NA	12/10 684 (0.1)	
White	109/169 (64.5)	8073/10 684 (75.6)	
Other[c]	2/169 (1.2)	85/10 684 (0.8)	
Religious affiliation[a,d]	117/161 (72.7)	7447/10 235 (72.8)	>.99
Parent marital status[a]			
Married/cohabiting	104/169 (61.5)	7909/10 628 (74.4)	.002
Widowed	2/169 (1.2)	86/10 628 (0.8)	
Divorced/separated	32/169 (18.9)	1403/10 628 (13.2)	
Never married	31/169 (18.3)	1230/10 628 (11.6)	
Parent education[a]			
Less than high school	16/170 (9.4)	654/10 694 (6.1)	<.001
High school/GED/some college	64/170 (37.6)	2814/10 694 (26.3)	
Undergraduate degree	67/170 (39.4)	4446/10 694 (41.6)	
Graduate degree	23/170 (13.5)	2780/10 694 (26.0)	
Household income, $[a,e]			
<25 000	31/153 (20.3)	1379/9823 (14.0)	<.001
25 000-49 999	39/153 (25.5)	1419/9823 (14.4)	
50 000-74 999	23/153 (15.0)	1354/9823 (13.8)	
75 000-99 999	19/153 (12.4)	1431/9823 (14.6)	
100 000-199 999	30/153 (19.6)	3070/9823 (31.3)	
≥200 000	11/153 (7.2)	1170/9823 (11.9)	

(continued)

Table. Baseline Sociodemographic and Parental Variable Comparisons for Cannabis Use Initiation Groups (continued)

Variable	No./total No. (%)		Nonparametric comparison, *P* value
	Used cannabis (n = 170)	Heard of but have not used cannabis (n = 10 711)	
Participant age at baseline, mean (SD), y	10.2 (0.6)	9.9 (0.6)	NA[g]
Parent age at baseline, mean (SD), y[f]	39.6 (7.9)	40.2 (6.8)	.045

Abbreviations: GED, general educational development test; NA, not applicable.

[a] Group comparison conducted using Fisher exact test.

[b] Child race and ethnicity were reported by parents at baseline. See eMethods in Supplement 1 for the reason race and ethnicity were reported as variables in this study.

[c] Other race and ethnicity includes other single or multiple races reported, or declined to respond, no response, or unknown.

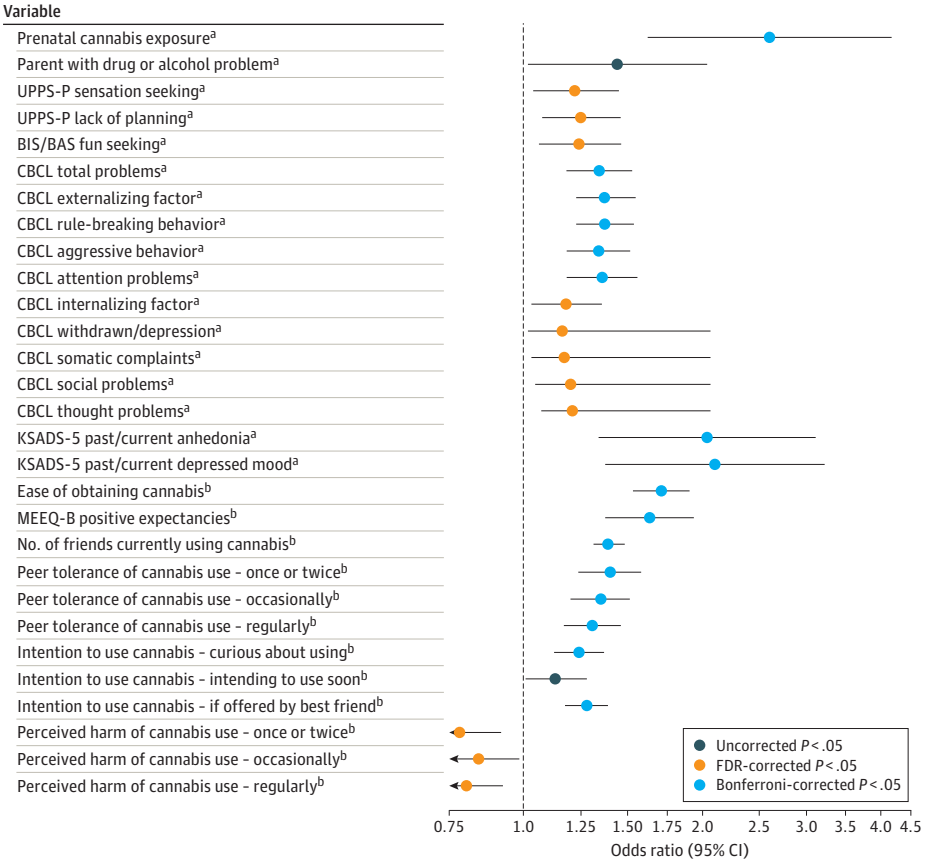
[d] Religious affiliation was defined as endorsing any religious preference vs agnostic, atheist, or none.

[e] Median household income level: used cannabis ($50 000 to $74 999), heard of but have not used cannabis ($75 000 to $99 999).

[f] Group comparison conducted using Wilcoxon rank sum test.

[g] Descriptive only, not assessed as a covariate in models.

Figure. Variables Associated With Cannabis Initiation as Children Enter Early Adolescence



Odds ratios and 95% CIs, presented on a log scale, are from mixed-effects logistic models with binary cannabis use initiation outcome variable (0 = have not used, 1 = have used). Random intercepts were specified based on data collection site. Fixed-effect covariates included baseline (1) child sex (0 = female, 1 = male), (2-5) self-reported child race and ethnicity (Asian, Black or African American, Hispanic or Latino, White), (6-8) parent marital status (married or cohabiting, widowed, divorced), (9-11) parent education level (less than high school, high school diploma or equivalent, undergraduate degree), (12-15) household income (<$25 000; $25 000 to $49 999; $50 000 to $74 999; $75 000 to $99 999), (16) parent age at baseline, (17) family membership (0 = not related to any other child in sample, 1 = shared family membership), and (18) twin status (0 = not a member of twin pair, 1 = member of twin pair). All variables plotted are significant at uncorrected *P* < .05 with additional significance thresholds presented for 5% false discovery rate (FDR) and Bonferroni multiple testing corrections. Nonsignificant variables are not shown. Supplement 1 has additional details regarding variables and analytic approach. BIS/BAS indicates Child Behavioral Inhibition & Behavioral Activation Scales; CBCL, Child Behavior Checklist; KSADS-5, Kiddie Schedule for Affective Disorders and Schizophrenia; MEEQ-B, Marijuana Effect Expectancy Questionnaire–Brief; UPPS-P, modified UPPS-P Impulsive Behavior Scale for Children.

[a] Assessed at baseline.

[b] Assessed at 1-year follow-up.

Results | Following false discovery rate correction, 29 of 46 variables were significantly associated with cannabis use initiation (Figure), 18 of which survived Bonferroni correction. As expected, initiation of alcohol and tobacco use by 3.5-year follow-up exhibited the greatest effect sizes (odds ratio [OR], 17.46; 95% CI, 11.10-27.47 and OR, 35.85; 95% CI, 23.21-55.37, respectively). Outside of these associations, prenatal cannabis exposure was associated with the largest risk for cannabis use initiation (OR, 2.60; 95% CI, 1.62-4.17); this association remained when additionally con- trolling for alcohol and tobacco use initiation, family or par- ent alcohol or drug problems, and prenatal alcohol and tobacco exposure (OR, 2.16; 95% CI, 1.17-3.97). Several cannabis-specific factors at 1-year follow-up (mean [SD] age, 10.92 [0.64] years), including ease of obtaining, positive expectancies, number of friends using, and greater peer tol- erance, were associated with greater odds of early initiation of cannabis use. Greater externalizing symptomatology, depressed mood, and anhedonia at baseline were also sig- nificantly prospectively associated with cannabis use initia- tion (Figure).

Discussion | Prevalence of cannabis use initiation by early adolescence in the ABCD study (1.56%) closely parallels rates of cannabis initiation observed in nationally representative samples (eg, 1.87%[1]). Prenatal cannabis exposure was associated with a more than 2-fold increase in early onset of cannabis use, independent of prenatal exposure to or use of other substances or family history of drug or alcohol problems. Similar associations have been noted in later adolescence or adulthood,[4] but our study suggests an association with early-onset use. In addition to replicating associations between externalizing behavior and early cannabis use,[5] anhedonia and depressed mood at age 9 to 11 years were associated with future early-onset cannabis use, highlighting internalizing symptomatology as a risk factor for early initiation. Moreover, cannabis-related individual (eg, positive expectancies), social (eg, peer use/attitudes), and environmental (eg, ease of access) factors were associated with early onset use. Permissive social milieu in childhood and adolescence may represent a tractable target for prevention and intervention efforts.[6] Notwithstanding limitations of the small sample of participants having used cannabis, our findings suggest greater caution in cannabis-related attitudes, access, and use during periods of vulnerability (eg, pregnancy), particularly for youth with other mental health liabilities.

Alex P. Miller, PhD
David A. A. Baranger, PhD
Sarah E. Paul, MA
Alexander S. Hatoum, PhD
Cynthia Rogers, MD
Ryan Bogdan, PhD
Arpana Agrawal, PhD

Author Affiliations: Department of Psychiatry, Washington University School of Medicine, St Louis, Missouri (Miller, Rogers, Agrawal); Department of Psychological and Brain Sciences, Washington University in St Louis, St Louis, Missouri (Baranger, Paul, Hatoum, Bogdan).

Accepted for Publication: March 31, 2023.

Published Online: June 26, 2023. doi:10.1001/jamapediatrics.2023.1801

Corresponding Author: Alex P. Miller, PhD, Department of Psychiatry, Washington University School of Medicine, 660 S Euclid, CB 8134, St Louis, MO 63110 (m.alex@wustl.edu).

Author Contributions: Dr Miller had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Drs Bogdan and Agrawal contributed equally.
Concept and design: Miller, Hatoum, Bogdan, Agrawal.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Miller, Bogdan, Agrawal.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Miller, Baranger, Hatoum, Bogdan, Agrawal.
Obtained funding: Bogdan, Agrawal.
Administrative, technical, or material support: Paul, Bogdan, Agrawal.
Supervision: Bogdan, Agrawal.

Conflict of Interest Disclosures: None reported.

Funding/Support: Data for this study were provided by the Adolescent Brain Cognitive Development (ABCD) study, which was funded by the National Institutes of Health grants U01DA041022, U01DA041025, U01DA041028, U01DA041048, U01DA041089, U01DA041093, U01DA041106, U01DA041117, U01DA041120, U01DA041134, U01DA041148, U01DA041156, U01DA041174, U24DA041123, and U24DA041147 and additional federal partners (https://abcdstudy.org/federal-partners.html). Support for this study was also derived from National Institutes of Health grants T32DA015035 (A.P.M.), F31AA029934 (S.E.P.), K01AA030083 (A.S.H.), R01DA054750 (R.B., A.A.), U01DA055367, R01DA046224 (C.R., R.B., A.A.).

Role of the Funder/Sponsor: Beyond listed authors, no other ABCD Study investigator contributed to this manuscript. The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Disclaimer: This article reflects the views of the authors and may not reflect the opinions or views of the National Institutes of Health or the Adolescent Brain Cognitive Development (ABCD) consortium investigators.

Data Sharing Statement: See Supplement 2.

Additional Contributions: We thank Deanna Barch, PhD (Department of Psychological and Brain Sciences, Washington University in St Louis), for providing information regarding 2020 recreational cannabis legalization status of data collection sites, for which compensation was not received.

Additional Information: The ABCD data repository grows and changes over time. The ABCD data used in this report came from https://dx.doi.org/10.15154/1523041.

1. Substance Abuse and Mental Health Services Administration. Key substance use and mental health indicators in the United States: results from the 2018 National Survey on Drug Use and Health. HHS Publ No PEP19-5068 NSDUH Ser H-54. Published May 2019:51-58. https://www.samhsa.gov/data/sites/default/files/cbhsq-reports/NSDUHNationalFindingsReport2018/NSDUHNationalFindingsReport2018.pdf

2. Connor JP, Stjepanović D, Le Foll B, Hoch E, Budney AJ, Hall WD. Cannabis use and cannabis use disorder. *Nat Rev Dis Primers*. 2021;7(1):16. doi:10.1038/s41572-021-00247-4

3. Lisdahl KM, Sher KJ, Conway KP, et al. Adolescent brain cognitive development (ABCD) study: overview of substance use assessment methods. *Dev Cogn Neurosci*. 2018;32:80-96. doi:10.1016/j.dcn.2018.02.007

4. Sonon KE, Richardson GA, Cornelius JR, Kim KH, Day NL. Prenatal marijuana exposure predicts marijuana use in young adulthood. *Neurotoxicol Teratol*. 2015;47:10-15. doi:10.1016/j.ntt.2014.11.003

5. King SM, Iacono WG, McGue M. Childhood externalizing and internalizing psychopathology in the prediction of early substance use. *Addiction*. 2004;99(12):1548-1559. doi:10.1111/j.1360-0443.2004.00893.x

6. Turel O. Perceived ease of access and age attenuate the association between marijuana ad exposure and marijuana use in adolescents. *Health Educ Behav*. 2020;47(2):311-320. doi:10.1177/1090198119894707