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# Cannabidiol Knowledge, Perceptions, and Use Among Young Adults in 6 U.S. Metropolitan Areas

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**Abstract**

**Background:** Cannabidiol (CBD) has gained popularity in the United States, particularly among certain populations, including young adults. Thus, we examined (1) CBD product knowledge, perceptions, use, and use intentions among young adults and (2) correlates of use and use intentions.

**Methods:** We analyzed data from a Fall 2020 survey regarding tobacco and other substance use among 2464 young adults in 6 U.S. cities ($M_{age} = 24.67$; 57.4% female; 28.7% racial/ethnic minority). We used multinomial regression to identify correlates of use status (i.e., former [ever but no past 6 months] use vs. current [past 6 months] and never use, respectively), and linear regression to examine use intentions among never users.

**Results:** Around 51.4% reported ever use, and 32.0% reported current use. On average, participants perceived CBD as safe and effective for addressing pain, anxiety, and sleep (also prominent use motives: ~40% to 60%, respectively). Use intentions were relatively high, particularly for edibles and topicals (also the most common use modes). Roughly one-fourth mistakenly believed that CBD products were required to be approved by U.S. Food and Drug Administration (24.9%), tested/proven safe (28.8%), and proven effective to be marketed for pain, anxiety, sleep, and so on. (27.2%). Compared to former users, never users perceived greater CBD-related risk ($p < 0.001$), less social acceptability ($p < 0.001$), and greater difficulty accessing CBD ($p = 0.004$); current users perceived more health benefits ($p < 0.001$). Among never users, greater use intentions were associated with greater perceived social acceptability ($p < 0.001$), health benefits ($p < 0.001$), and difficulty accessing CBD ($p = 0.005$).

**Conclusions:** Given misperceptions about CBD, surveillance of young adults' knowledge, perceptions, and use of CBD is critical as its market expands.

**Keywords:** cannabinoids; cannabidiol; prevention; risk perceptions; public health policy; young adults

## Introduction

Products containing cannabidiol (CBD), one of the main active cannabinoids of the cannabis plant, have become popular in the United States.[1] In 2019 reports, over 25% of U.S. adults reported ever trying CBD products at least once in the past 2 years,[2] and ~14% reported "personally using" CBD products.[3] CBD use is particularly prominent among those 18–29 years of age, with 2019 reports indicating 39.7% ever used in their lifetime,[2,4] 40% used at least once in the past 2 years,[2] and 20% "personally use" CBD products.[3]

CBD's popularization largely followed the 2018 Farm Bill, which allowed cannabis derivatives (i.e., CBD) containing ≤0.3% tetrahydrocannabinol (THC) to be excluded from the category of federally controlled substances.[5–7] Unlike THC, CBD does not have intoxicating effects.[8] In a 2019 systematic review covering 13 medical contexts, 23 of 35 studies reported that CBD

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use was associated with significant improvements in primary outcomes (e.g., psychotic symptoms, anxiety, seizures, pain, Crohn's disease),[9] particularly for epilepsy—the most frequently studied medical condition.[9] Accordingly, the U.S. Food and Drug Administration (FDA) approved Epidiolex, a CBD-based medication for seizures,[10,11] but the agency has not yet approved CBD-based treatments for other conditions.

CBD is advertised as a food and health supplement.[12] Many types of retailers sell CBD products, including pharmacies, gas stations, convenience stores, health/vitamin shops, and coffee shops,[8,11,13–15] and sales have increased rapidly.[16] CBD is typically consumed as pills, edibles, or beverages,[17] but can also be vaped, applied topically (e.g., oils, lotions), and used other ways.[13,18,19] Among young adult CBD users, edibles, tinctures, and vape products were most commonly used for stress relief, relaxation, and sleep.[4]

People hold positive perceptions of CBD, despite having limited knowledge of its evidence base or regulation.[4,20] In one study of US adult CBD users, 75.9% of respondents reported learning about CBD from internet research, family members, or friends.[21] A social media analysis of Pinterest indicated that pins portrayed an overall positive view of CBD use for health promotion, but failed to provide reliable sources and contained limited information regarding FDA regulation, dosage, or side effects.[22] The same study found that 42% of pins endorsed CBD use for treating problems with mental or physical health, which is concerning given that social media communications are outside of the purview of FDA regulation.[22]

Given CBD's growing popularity and marketing, regulatory oversight is needed.[23] In 2021, the U.S. Congress introduced 3 bills to regulate CBD product packaging and labeling.[24–26] Similarly, some state governments are establishing/enforcing regulations. For example, California passed CBD-related guidance that appears to contradict the FDA's ban on the use of CBD in food and dietary supplements.[23]

In short, CBD product diversity, marketing, sales, and use have outpaced the evidence base, and regulations are currently evolving to address CBD. Moreover, there is limited research on CBD use prevalence, general knowledge and perceptions, and correlates of use and intentions to use. This is particularly relevant among young adults who represent a group especially likely to use CBD.[2–4] Finally, there is very little theory-driven research regarding CBD use.

Thus, this study is informed by the Health Belief Model, which suggests that whether a person engages in a behavior largely results from one's perceptions of the behavior, including the perceived health benefits as well as the perceived risks and barriers to engaging in a behavior.[27] More specifically, we examined the following: (1) CBD product knowledge, perceptions, use, and use intentions among young adults; (2) differences among those reporting never use, former (ever but no past 6 months) use, and current (past 6 months) use; and (3) correlates of CBD use intentions among never users.

## Materials and Methods

### Data source

This study analyzed survey data among young adults (18–34 years of age) in a 2-year longitudinal study, the Vape shop Advertising, Place characteristics, and Effects Surveillance (VAPES) study. VAPES examines the vape retail environment and its impacts on young adult e-cigarette and other substance use. This study draws participants from 6 metropolitan statistical areas (MSAs; i.e., Atlanta, Boston, Minneapolis, Oklahoma City, San Diego, Seattle) representing different tobacco control policies[28] and different policies with respect to legal CBD product sales (as of 2020 when survey data were collected).[29] This study (detailed elsewhere[30]) was approved by the Emory University Institutional Review Board.

Potential participants were recruited through ads on social media (Facebook, Reddit) in Fall 2018. Eligibility criteria at baseline were as follows: (1) 18–34 years of age; (2) residing in the 6 aforementioned MSAs; and (3) English speaking. After clicking an ad, individuals were directed to a webpage with a consent form, completed an online eligibility screener, and then completed the online Wave 1 survey. Participants were then notified that 7 days later, they would receive an email to confirm their participation.

Upon confirming, they were officially enrolled and emailed their first incentive ($10 e-gift card). Purposive, quota-based sampling was used to ensure sufficient proportions of e-cigarette and cigarette users and to obtain roughly equal numbers of men and women and 40% racial/ethnic minority; subgroup enrollment was capped by MSA. Of 10,433 who clicked on ads, 9847 consented, of which 2751 (27.9%) were not allowed to advance due to a) ineligibility ($n = 1472$) and/or b) their subgroup target being met ($n = 1279$). Of those allowed to advance, 48.8% (3460/7096) provided complete data; 3006 (86.9%) confirmed participation at the 7-day follow-up.

Current analyses used baseline sociodemographic and Wave 5 (W5; Fall 2020) data ($n = 2476$, 82.4% retention). Analyses were restricted to those who completed the assessment of CBD ever/never use ($n = 2464$, excluding 12 who reported "prefer not to answer").

## Measures

### Sociodemographics.

Baseline measures assessed the following: age, sex, sexual orientation, race, ethnicity, and education. We also included MSA of residence at W5; Atlanta was used as the referent group in regression analyses because it represented the greatest proportion of never users.

### CBD awareness and information sources.

Participants reported agreement with, "I am familiar with CBD" (1 = not at all to 7 = extremely/very much). Participants were also asked, "Where did you first learn about CBD? friends/family; products/ads at convenience store, grocery store, and/or gas station; CBD-related content/ads online (e.g., online advertisements or ads shared through social media); social media postings; CBD stores; healthcare provider; fliers, ads, and promotions, in print media (newspapers, magazines); TV; radio; other; and have not heard of CBD."

### CBD use.

We asked, "Have you ever used CBD products?" Ever users were asked, "In the past 6 months, on how many days have you used CBD products?" These items were used to categorize participants as never versus ever users; ever users were further subcategorized as former (ever but not past 6 months) vs. current (past 6 months) users. Current users also reported the number of days used in the past 30 days.

### CBD use intentions.

We asked, "How likely are you to try or continue to use CBD products in the next year?" and "How likely are you to try or use the following products containing CBD in the next year: capsules or pills? edible products (such as gummies, candies, etc.)? beverages? lotions, creams, or balms? CBD in a vaporizer or vape pen; oil extracts?" (1 = not at all likely to 7 = extremely likely).

### Knowledge of CBD products and regulation.

Participants were asked to indicate "true," "false," or "don't know" to the following: "CBD, hemp, and marijuana are all the same"; "CBD can get you 'high'"; "CBD is illegal"; and "CBD is available for anyone to use." Regarding marketing/retail regulations, we asked participants to respond similarly to the following: "CBD products are required to be: a) tested and proven safe to be sold to consumers; b) approved by the Food and Drug Administration (FDA) to be sold to consumers; and c) proven to be effective to be marketed for pain relief, anxiety reduction, sleep."

We created an index score regarding knowledge of product regulation by coding responses to these last 3 items as 0 = true or do not know and 1 = false and then creating a count variable for number of accurate responses (range = 0–3; Cronbach's $\alpha = 0.84$). (We excluded the first 4 items from our knowledge measure given nuances regarding interpretation of the items.)

### CBD perceptions.

Perceptions were assessed on a 7-point scale (1 = not at all to 7 = extremely). To assess *perceived risk*, we asked, "How addictive do you think using CBD is?" and "How harmful to your health do you think using CBD is?" Responses from these 2 items were averaged to create a risk perception index score (range = 1–7; item correlation = 0.64). *Perceived social acceptability* was assessed by asking, "How socially acceptable among your peers do you think using CBD is?"

To assess *perceived benefits*, we asked participants to indicate their agreement with "CBD is effective in: a) relieving pain; b) reducing anxiety; c) helping people sleep; and d) therapy for epilepsy/seizures." These 4 items were operationalized as a health-related CBD perception index score by calculating the average rating across items (range = 1–7; Cronbach's $\alpha = 0.93$). To assess *perceived barriers* to CBD, we asked, "In the town where you live, how difficult or easy would it be to buy CBD products at a store?" (1 = very easy to 5 = very difficult).

### CBD use characteristics in ever users.

Ever users were asked, "Have you ever used the following products that contain CBD? capsules or pills; edible products (e.g., gummies, candies); beverages; lotions/creams/balms; CBD in a vaporizer or vape pen; oil extracts; or other CBD products"; "Where did you get the first CBD product you tried? friends/family; CBD store; convenience store, grocery store and/or gas station; online; or other"; and "For what reasons did you first try CBD products? pain relief, reduce anxiety, help with sleep, therapy for epilepsy/seizures, and other." Current users were also asked which product they used most often, where they most commonly get CBD products, and reasons for current use.

### Data analysis

We conducted descriptive analyses to characterize participants. Then, we conducted bivariate analyses to examine differences between CBD use status groups - never users, ever users (ever, but not past 6 months), and current users (past 6 months) - with regard to sociodemographics, CBD knowledge/perceptions, and other related variables. We then used: (1) multinomial logistic regression to assess correlates of use (former vs. never and current); and (2) a multivariable linear regression to examine correlates of CBD use intentions among never users. Models included MSA, sociodemographics, CBD knowledge and perceptions, and perceived difficulty accessing CBD. Analyses were conducted in Stata SE v16; alpha was set at 0.05.

## Results

### Participant characteristics

Participants were an average age of 24.67 years old, 57.4% female, 68.9% heterosexual, 71.3% White, and 89.0% non-Hispanic (Table 1). Overall, 51.4% reported ever using CBD, and 32.0% were current users. Bivariate analyses indicated differences across never, ever (but not current), and current users with respect to age, sex, sexual orientation, race, and education (see Table 1 for details).

Current CBD users reported the greatest familiarity with CBD; never users reported the least ($p < 0.001$). The greatest proportion of participants had learned about CBD from friends/family members (58.9%), followed by products/ads at retail stores (36.4%), online content/ads (34.8%), exposure to CBD stores (27.5%), and social media (26.7%; Table 1).

### Knowledge of CBD products and regulation

Few participants believed that CBD, hemp, and marijuana were the same (6.3%), that CBD could get one "high" (9.8%), or that CBD was illegal (5.2%; Fig. 1). In addition, roughly a quarter of participants indicated "true" to CBD products are required to be "approved by FDA to be sold to consumers" (24.9%), "tested/proven safe to be sold to consumers" (28.8%), and to "proven effective to be marketed for pain relief, anxiety reduction, and sleep." (27.2%). Overall, 48.6% reported inaccurate (i.e., "true") responses or "don't know" to all 3 items. Those most misinformed (i.e., those providing inaccurate or "do not know" responses) were never users and current users ($p$'s $< 0.01$). Notably, knowledge was negatively correlated with perceived risks ($r = -0.12$), health benefits ($-0.06$), and difficulty accessing CBD ($-0.20$) and positively with perceived social acceptability ($r = 0.12$, $p$'s $< 0.01$).

### CBD use intentions and perceptions

Never users reported the lowest use intentions in general and for specific product types, while current users reported the highest ($p$'s $< 0.001$; Table 1). Current users perceive CBD most favorably (i.e., least risks, and greatest social acceptability and health benefits), while never users perceived CBD least favorably ($p$'s $< 0.001$). Never users reported the greatest perceived difficulty obtaining CBD products, and current users reported the least ($p < 0.001$).

### CBD use among ever users

Among all ever users (both former and current), the most common product used was edibles (59.7%), followed by lotions, creams, or balms (48.3%) and vaporizer or vape pen (39.3%; Table 2). The largest proportion first obtained CBD products from friends/family (38.6%), followed by a CBD store (27.7%). The most common reason reported for first trying CBD was to reduce anxiety (60.5%), followed by pain relief (45.8%). Current users were more likely to report ever using each product type ($p$'s $< 0.001$), except vaping CBD; were less likely to obtain it from friends/family, but more likely to obtain it online ($p$'s $< 0.001$); and were more likely to use for pain relief, anxiety, and sleep ($p$'s $< 0.001$).

### Predictors of CBD use and use intentions

In multinomial logistic regression (Table 3), never (vs. former) users perceived CBD use to have more risks ($p < 0.001$) and to be less socially acceptable ($p < 0.001$), and reported greater perceived difficulty accessing CBD ($p = 0.004$); they were also more likely to be Hispanic ($p = 0.020$). Current (vs. former) users perceived more health benefits of CBD ($p < 0.001$) and were also older ($p = 0.001$).

In linear regression (Table 3), greater intention to use CBD among never users was associated with greater perceived social acceptability ($p < 0.001$), CBD health benefits ($p < 0.001$), and difficulty accessing CBD ($p = 0.005$), as well as living in Seattle ($p = 0.004$) or other MSA (moved since baseline relative to Atlanta; $p = 0.038$) and being Hispanic ($p < 0.001$).

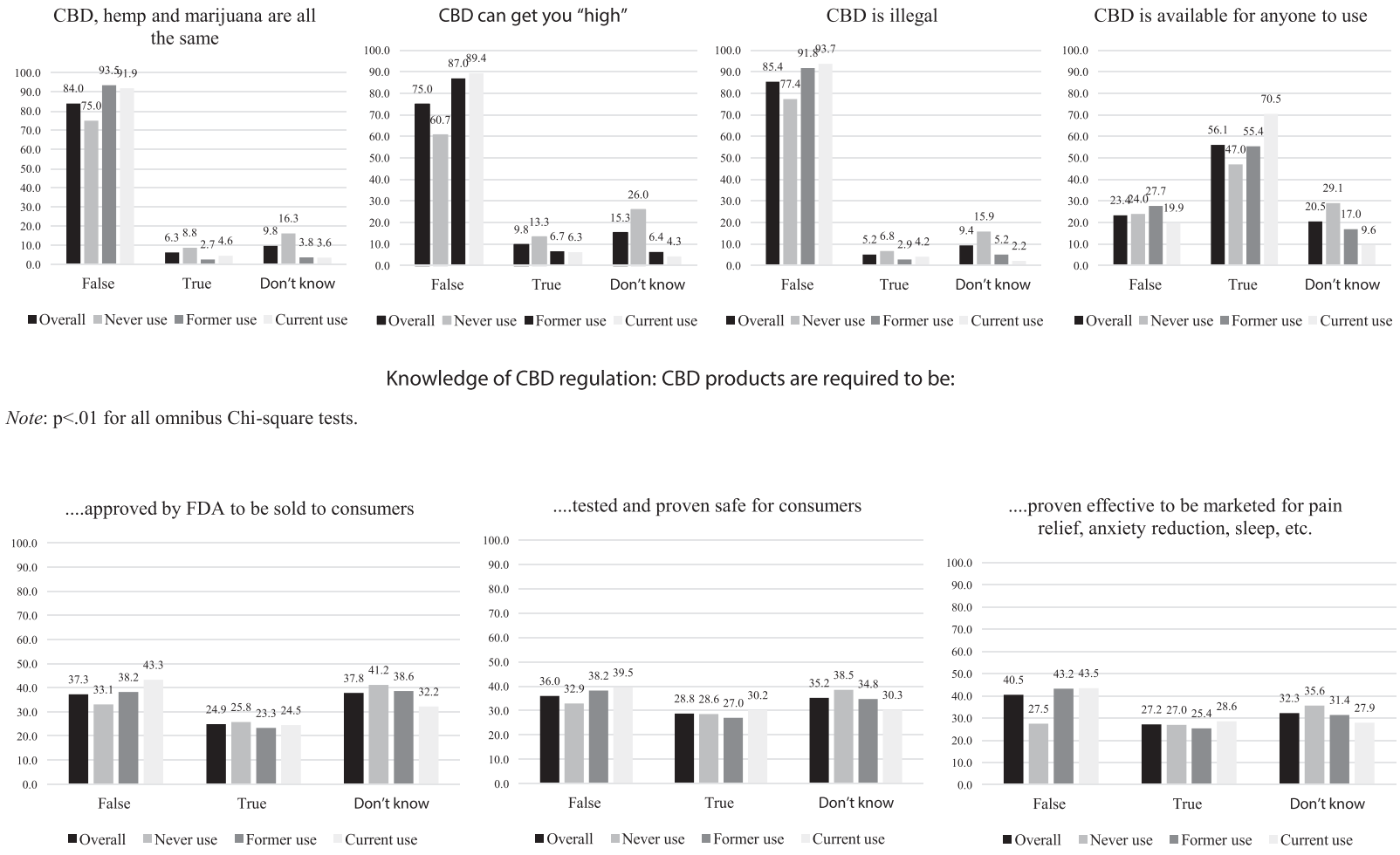
## Discussion

This theory-driven study examined CBD-related knowledge, perceptions, use, and use intentions among young

**Table 1. Participant Characteristics Overall and Across Never Users, Former (Ever But Not Past 6 Months) Users, and Current (Past 6 Months) Cannabidiol Users**

| | Overall, $N = 2464$ (100.0%) | Never use,[a] $N = 1198$ (48.6%) | Former use, $N = 477$ (19.4%) | Current use, $N = 789$ (32.0%) | |
|---|---|---|---|---|---|
| **Variables** | ***n*** **(%)** | ***n*** **(%)** | ***n*** **(%)** | ***n*** **(%)** | ***p*** |
| Sociodemographics | | | | | |
| MSA | | | | | < 0.001 |
| Atlanta metro area | 382 (15.5) | 207 (17.3) | 67 (14.1) | 108 (13.7) | |
| Boston metro area | 326 (13.2) | 175 (14.5) | 63 (13.2) | 89 (11.3) | |
| Minneapolis metro area | 343 (13.9) | 154 (15.5) | 74 (15.5) | 114 (14.6) | |
| Oklahoma City metro area | 153 (6.2) | 83 (6.9) | 25 (5.2) | 45 (5.7) | |
| San Diego metro area | 365 (14.8) | 170 (14.2) | 66 (13.8) | 129 (16.4) | |
| Seattle metro area | 312 (12.7) | 125 (10.4) | 53 (11.1) | 134 (17.0) | |
| Other[b] | 583 (23.7) | 285 (23.8) | 129 (27.0) | 169 (21.4) | |
| Age (mean, SD) | 24.67 (4.69) | 24.28 (4.67) | 24.51 (4.57) | 25.35 (4.71) | < 0.001 |
| Female[c] | 1374 (57.4) | 618 (52.8) | 281 (61.0) | 475 (62.3) | < 0.001 |
| Sexual minority | 766 (31.1) | 312 (26.0) | 174 (36.5) | 280 (35.5) | < 0.001 |
| Race | | | | | < 0.001 |
| White | 1756 (71.3) | 809 (67.5) | 363 (76.1) | 584 (74.0) | |
| Black | 133 (5.4) | 77 (6.4) | 17 (3.6) | 39 (4.9) | |
| Asian | 315 (12.8) | 206 (17.2) | 44 (9.2) | 65 (8.2) | |
| Other | 260 (10.6) | 106 (8.9) | 53 (11.1) | 101 (12.8) | |
| Hispanic | 272 (11.0) | 145 (12.1) | 39 (8.2) | 88 (11.2) | 0.068 |
| Education ≥ Bachelor's degree | 1860 (75.5) | 936 (78.1) | 356 (74.6) | 568 (72.0) | 0.007 |
| CBD-related characteristics | | | | | |
| I am familiar with CBD, mean (SD)[d] | 4.74 (1.76) | 3.87 (1.68) | 5.18 (1.50) | 5.79 (1.31) | < 0.001 |
| How first learned about CBD[e] | | | | | |
| From friends/family members | 1451 (58.9) | 637 (53.2) | 318 (66.7) | 496 (62.9) | < 0.001 |
| Products/ads at retail stores | 897 (36.4) | 486 (40.6) | 171 (35.9) | 240 (30.4) | < 0.001 |
| Content/ads online | 858 (34.8) | 451 (37.6) | 150 (31.5) | 257 (32.6) | 0.015 |
| Exposure to CBD stores | 678 (27.5) | 347 (29.0) | 122 (25.6) | 209 (26.5) | 0.276 |
| Social media postings | 659 (26.7) | 329 (27.5) | 118 (24.7) | 212 (26.9) | 0.522 |
| TV | 261 (10.6) | 143 (11.9) | 47 (9.9) | 71 (9.0) | 0.096 |
| Fliers, ads, and promotions in print media | 235 (9.5) | 117 (9.8) | 49 (10.3) | 69 (8.8) | 0.623 |
| Radio | 160 (6.5) | 95 (7.9) | 24 (5.0) | 41 (5.2) | 0.019 |
| Health care provider | 152 (6.2) | 52 (4.3) | 22 (4.6) | 78 (9.9) | < 0.001 |
| Other | 191 (7.8) | 65 (5.4) | 41 (8.6) | 85 (10.8) | < 0.001 |
| Never heard of CBD | 52 (2.1) | 52 (4.3) | 0 (0.0) | 0 (0.0) | n/a |
| CBD use intentions (next year), mean (SD)[d] | | | | | |
| Any CBD product | 3.17 (2.18) | 1.99 (1.46) | 2.83 (1.78) | 5.17 (1.88) | < 0.001 |
| Edible product (e.g., gummies, candies) | 3.09 (2.14) | 2.13 (1.63) | 2.94 (1.95) | 4.64 (2.06) | < 0.001 |
| Lotions, creams, or balms | 3.08 (2.15) | 2.18 (1.71) | 2.99 (1.98) | 4.51 (2.10) | < 0.001 |
| Oil extracts | 2.52 (1.94) | 1.75 (1.35) | 2.26 (3.86) | 3.86 (2.15) | < 0.001 |
| Capsules or pills | 2.43 (1.94) | 1.75 (1.38) | 2.20 (1.70) | 3.59 (2.24) | < 0.001 |
| Beverages | 2.33 (1.86) | 1.64 (1.28) | 1.63 (1.63) | 3.47 (2.19) | < 0.001 |
| CBD in a vaporizer or vape pen | 2.23 (1.85) | 1.55 (1.22) | 2.13 (1.70) | 3.31 (2.19) | < 0.001 |
| Knowledge of CBD regulation, mean (SD) | 1.14 (1.26) | 1.03 (1.25) | 1.19 (1.27) | 1.26 (1.27) | < 0.001 |
| Perceptions of CBD, mean (SD)[d] | | | | | |
| Perceived risk | 2.32 (1.48) | 2.79 (1.63) | 1.99 (1.19) | 1.82 (1.13) | < 0.001 |
| Perceived addictiveness | 2.34 (1.64) | 2.77 (1.79) | 2.02 (1.41) | 1.90 (1.35) | < 0.001 |
| Perceived harmfulness to health | 2.30 (1.62) | 2.82 (1.79) | 1.95 (1.29) | 1.73 (1.23) | < 0.001 |
| Perceived social acceptability | 5.87 (1.62) | 5.32 (1.87) | 6.27 (1.24) | 6.47 (1.03) | < 0.001 |
| CBD is effective in: | | | | | |
| Relieving pain | 4.60 (1.68) | 4.19 (1.67) | 4.59 (1.67) | 5.23 (1.50) | 0.002 |
| Reducing anxiety | 4.53 (1.68) | 4.13 (1.63) | 4.48 (1.71) | 5.16 (1.50) | 0.005 |
| Helping people sleep | 4.56 (1.69) | 4.11 (1.65) | 4.54 (1.68) | 5.25 (1.52) | 0.017 |
| Therapy for epilepsy/seizures | 4.59 (1.78) | 4.15 (1.76) | 4.66 (1.78) | 5.21 (1.61) | 0.008 |
| Overall index score (average of above 4 items) | 4.57 (1.54) | 4.15 (1.55) | 4.57 (1.53) | 5.21 (1.29) | < 0.001 |
| Perceived difficulty accessing CBD, mean (SD)[f] | 1.62 (0.97) | 1.85 (1.07) | 1.47 (0.89) | 1.35 (0.74) | < 0.001 |

*Notes*: *p*-values reflect omnibus tests of differences across three subgroups (i.e., never, former, current users).
[a] $n = 73$ "do not know" to "Have you ever used CBD?" were recoded as "never users."
[b] Moved since baseline.
[c] $n = 69$ chose "other."
[d] Scale of 1 = not at all to 7 = extremely.
[e] Check all that apply.
[f] 1 = very easy to 5 = very difficult; $n = 13$ "prefer not to answer" (excluded).
CBD, cannabidiol; MSA, metropolitan statistical area; SD, standard deviation.




*Note*: p<.01 for all omnibus Chi-square tests.

**FIG. 1.** Knowledge of CBD products and regulation. CBD, cannabidiol; FDA, U.S. Food and Drug Administration.

**Table 2. Cannabidiol Products Used, Product Source, and Reasons for Use Among Those Who Ever Used Cannabidiol, *N* = 1266**

| Variables | Ever use, *N* = 1266 (51.4%) *n* (%) | Former use, *N* = 477 (19.4%) *n* (%) | Current use, *N* = 789 (32.0%) *n* (%) | *p* |
|---|---|---|---|---|
| Products ever used[a] | | | | |
| Capsules or pills | 220 (17.4) | 51 (10.7) | 169 (21.4) | < 0.001 |
| Edible products (e.g., gummies, candies) | 756 (59.7) | 235 (49.3) | 521 (66.0) | < 0.001 |
| Beverages | 276 (21.8) | 73 (15.3) | 203 (25.7) | < 0.001 |
| Lotions, creams, or balms | 611 (48.3) | 176 (36.9) | 435 (55.1) | < 0.001 |
| Vaporizer or vape pen | 497 (39.3) | 176 (36.9) | 321 (40.7) | 0.181 |
| Oil extracts | 483 (38.2) | 138 (28.9) | 345 (43.7) | < 0.001 |
| Other | 70 (5.5) | 20 (4.2) | 50 (6.3) | 0.106 |
| How first obtained CBD | | | | < 0.001 |
| Friend/family members | 489 (38.6) | 212 (44.4) | 277 (35.1) | |
| CBD store | 351 (27.7) | 132 (27.7) | 219 (27.8) | |
| Convenience/grocery store, gas station | 127 (10.0) | 52 (10.9) | 75 (9.5) | |
| Online | 139 (11.0) | 30 (6.3) | 109 (13.8) | |
| Other | 160 (12.6) | 51 (10.7) | 109 (13.8) | |
| Reasons for first trying CBD[a] | | | | |
| Pain relief | 580 (45.8) | 174 (36.5) | 406 (51.5) | < 0.001 |
| Reduce anxiety | 766 (60.5) | 259 (54.3) | 507 (64.3) | < 0.001 |
| Help with sleep | 485 (38.3) | 141 (29.6) | 344 (43.6) | < 0.001 |
| Therapy for epilepsy/seizures | 17 (1.3) | 5 (1.0) | 12 (1.5) | 0.479 |
| Other | 176 (13.9) | 97 (20.3) | 79 (10.0) | < 0.001 |

[a]Check all that apply.

adults in the United States. Participants were generally familiar with CBD, and the majority (58.9%) reported first learning about CBD from friends/family, with roughly a third learning about it at retailers or online (respectively), consistent with prior literature.[8,11,13–15] Overall, 51.4% had ever used CBD products, and 32.0% used CBD products in the past 6 months, which is greater than 2019 reports indicating 39.2% of young adults reported lifetime use[4] and 20% "personal use."[3]

These differences might suggest growing popularity of CBD use in young adults—or may be a result of methodological differences (e.g., different assessments and/or sample characteristics). Use intentions were relatively high, particularly for edibles and topicals, which were also among the most common modes of use among CBD users (e.g., 59.7% and 48.3% among ever users). Previous research on CBD users also found noncombustible extract products were most commonly used, specifically orally ingested oils.[8,21]

On average, participants perceived relatively little risk (i.e., harm, addictiveness) and little difficulty accessing CBD. Moreover, they held positive perceptions of CBD, perceiving CBD use to be socially acceptable and to have health benefits particularly in terms of addressing headaches, anxiety, pain, and sleep; these were also among the most common reasons for CBD use. These findings are concerning, given that there is limited evidence for CBD's effectiveness for these purposes, as noted in prior research.[8,9]

Notably, roughly a quarter of survey participants falsely believed that CBD products are required to be approved by FDA to be sold to consumers, tested/proven safe to be sold to consumers, and proven effective to be marketed for pain relief, anxiety reduction, and sleep. Such concerns are similar to those associated with "herbal" and "alternative medicines," labels that reflect how CBD marketers have positioned CBD.[31] In general, these findings add to the literature that suggests confusion about the legality and regulation of CBD, likely due to limited and evolving regulation and manufacturing guidelines.[4,32]

Regression results largely aligned with health behavior theories, such as the Health Belief Model,[27] which suggest that behavior is predicted by perceived risks and benefits.[33–35] More specifically, relative to never users, ever users held more favorable perceptions of CBD (i.e., less perceived risk and greater social acceptability) and perceived accessing CBD to be easier, and compared to former users, current users perceived greater health benefits of CBD. In addition, greater intentions to use CBD among never users were not only associated with greater perceived social acceptability and CBD health benefits but also greater perceived barriers (i.e., difficulty accessing CBD).

**Table 3. Regressions Identifying Correlates of Never or Current Cannabidiol Use Relative to Former Use and Intentions to Use Among Never Users**

| | Multinomial logistic regression: never or current use relative to former use, $n = 2375$[a] | | | | | | Linear regression: intention to use among never users, $n = 1158$ | | |
|---|---|---|---|---|---|---|---|---|---|
| | Never use | | | Current use | | | | | |
| Variables | OR | CI | p | OR | CI | p | B | CI | p |
| MSA (Ref: Atlanta) | | | | | | | | | |
| Boston | 1.20 | 0.78 to 1.85 | 0.397 | 0.84 | 0.53 to 1.34 | 0.473 | 0.11 | −0.17 to 0.40 | 0.425 |
| Minneapolis | 0.82 | 0.53 to 1.26 | 0.368 | 1.05 | 0.67 to 1.65 | 0.832 | 0.26 | −0.04 to 0.56 | 0.087 |
| Oklahoma City | 1.56 | 0.89 to 2.76 | 0.122 | 1.02 | 0.56 to 1.88 | 0.938 | 0.16 | −0.20 to 0.51 | 0.398 |
| San Diego | 0.89 | 0.58 to 1.37 | 0.603 | 1.07 | 0.68 to 1.67 | 0.777 | 0.23 | −0.06 to 0.51 | 0.118 |
| Seattle | 1.00 | 0.63 to 1.59 | 0.998 | 1.53 | 0.96 to 2.45 | 0.075 | 0.47 | 0.15 to 0.79 | 0.004 |
| Other | 0.82 | 0.56 to 1.19 | 0.294 | 0.88 | 0.59 to 1.32 | 0.551 | 0.27 | 0.01 to 0.52 | 0.038 |
| Sociodemographics | | | | | | | | | |
| Age | 0.98 | 0.95 to 1.00 | 0.074 | 1.04 | 1.02 to 1.07 | 0.001 | 0.01 | −0.01 to 0.03 | 0.201 |
| Female (Ref: male) | 0.83 | 0.66 to 1.05 | 0.129 | 1.00 | 0.78 to 1.28 | 0.992 | 0.10 | −0.06 to 0.26 | 0.211 |
| Sexual minority (Ref: heterosexual) | 0.81 | 0.63 to 1.05 | 0.109 | 0.87 | 0.67 to 1.12 | 0.272 | 0.15 | −0.04 to 0.34 | 0.121 |
| Race (Ref: White) | | | | | | | | | |
| Black | 1.72 | 0.95 to 3.10 | 0.072 | 1.37 | 0.73 to 2.59 | 0.330 | 0.18 | −0.16 to 0.51 | 0.295 |
| Asian | 1.33 | 0.91 to 1.96 | 0.143 | 1.11 | 0.72 to 1.72 | 0.624 | −0.05 | −0.27 to 0.18 | 0.679 |
| Other | 0.76 | 0.52 to 1.13 | 0.177 | 1.06 | 0.72 to 1.56 | 0.751 | 0.20 | −0.09 to 0.49 | 0.167 |
| Hispanic (Ref: non-Hispanic) | 1.63 | 1.08 to 2.45 | 0.020 | 1.33 | 0.86 to 2.05 | 0.196 | 0.58 | 0.33 to 0.83 | <0.001 |
| Knowledge of CBD regulation | 1.00 | 0.91 to 1.10 | 0.968 | 1.07 | 0.97 to 1.18 | 0.158 | 0.05 | −0.02 to 0.11 | 0.154 |
| Perceptions of CBD | | | | | | | | | |
| Perceived risk | 1.27 | 1.16 to 1.40 | <0.001 | 0.94 | 0.84 to 1.05 | 0.246 | −0.05 | −0.10 to 0.00 | 0.066 |
| Perceived social acceptability | 0.77 | 0.70 to 0.84 | <0.001 | 1.07 | 0.96 to 1.20 | 0.204 | 0.10 | 0.05 to 0.14 | <0.001 |
| Health-related CBD perception index score | 0.95 | 0.88 to 1.03 | 0.238 | 1.39 | 1.27 to 1.52 | <0.001 | 0.23 | 0.18 to 0.29 | <0.001 |
| Perceived difficulty accessing CBD products[a] | 1.21 | 1.06 to 1.39 | 0.004 | 0.90 | 0.78 to 1.05 | 0.196 | 0.12 | 0.03 to 0.20 | 0.005 |
| R-squared[b] | 0.266 | | | | | | 0.147 | | |

[a] $n = 13$ "prefer not to answer" (excluded).
[b] Cragg and Uhler's R-square for multinomial regression, Adjusted R-square for linear regression.
CI, confidence interval; OR, odds ratio.

These findings suggest that a main driver of continued CBD use is whether one gleans or perceives its use to have personal health benefits, but initially trying CBD is driven more so by a more diffuse set of perceptions. Of note, however, is that knowledge about CBD regulation did not predict use status or intentions to use, underscoring the importance of perceptions and perhaps the need to increase knowledge to impact perceptions regarding CBD risks and benefits.

Interestingly, few sociodemographic variables were significantly related to CBD use and use intentions. Among this sample of young adults (18–34 years of age), current CBD users were older than former users, which may be due to accumulating issues with pain or sleep that individuals may treat with CBD.[21,36] Other findings are notable, but difficult to explain. For instance, Hispanics were less likely to have used CBD, but had greater intentions to use it. Such findings warrant further investigation.

### Limitations

Study limitations include limited generalizability to other U.S. young adults, given that this sample was drawn from 6 MSAs using purposive sampling to obtain target sample sizes of e-cigarette and cigarette users. In addition, assessments were self-reported (thus subject to recall bias[37]) and were not comprehensive of all potential sources of CBD information and products, reasons for use, or other factors related to CBD use. These data were also cross-sectional, limiting our ability to determine causal associations.

## Conclusions

Young adults' CBD use and use intentions correlated with positive perceptions of CBD, and young adults perceived CBD favorably on average, with a large proportion holding misperceptions about CBD regulatory oversight. Prominent information and product sources included participants' social networks, retailers, and

online. Collectively, these findings underscore the need for surveillance of CBD retail and marketing and their impact on consumer perceptions and behavior, particularly as the market expands and policies evolve to further regulate CBD.[23] Moreover, future research is needed to better understand the efficacy of CBD for intended uses cited by participants (e.g., anxiety, pain), as well as dosage and potential side effects of CBD products.

## Authors' Contributions

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the article. Furthermore, each author certifies that this material or similar material has not been and will not be submitted to or published in any other publication before its appearance in Cannabis and Cannabinoid Research.

## Data Availability Statement

Data not publicly available (available upon request).

## Author Disclosure Statement

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**Abbreviations Used**

CBD = cannabidiol
CI = confidence interval
FDA = U.S. Food and Drug Administration
OR = odds ratio
SD = standard deviation
THC = tetrahydrocannabinol
VAPES = Vape shop Advertising, Place characteristics, and Effects Surveillance