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CBD and THC: Who Buys It, and Why?

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Abstract

While the market for CBD and THC products is expanding, less is known about who uses the various cannabis-derived products, their reasons for use, and their product preferences. We surveyed 963 U.S. adults and used market segmentation based on self-reported consumption to understand demand. Results suggest that age, subjective knowledge, and regulatory preferences were associated with general cannabis usage, with gender also associated with THC use. We also detected differences in reasons for product use and product preferences amongst CBD and THC users. Thus, while the CBD and THC markets were similar in certain ways, some differences merit further exploration.

Keywords: cannabis, consumer preferences, CBD, THC

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Introduction

Cannabis markets, including hemp and marijuana, have dramatically transformed over the past decade. The 2014 Farm Bill (Public Law 113-79) allowed states and universities to develop pilot hemp programs for research purposes (Agricultural Act of 2014, 2014), while the 2018 Farm Bill legalized the production, distribution, and sale of hemp and its derivatives throughout the United States (Agricultural Improvement Act of 2018, 2018). Thus, hemp is an agricultural commodity grown for industrial and agri-food purposes. Marijuana, however, remains classified by the federal government as a Schedule I drug.[1] Despite this classification, 18 states and the District of Columbia have legalized marijuana for recreational purposes, and 37 states have legalized marijuana for medicinal purposes (National Conference of State Legislators, 2021).[2]

The primary distinction between industrial hemp and marijuana is the concentration of delta-9-tetrahydrocannabinol (THC), the psychoactive component of marijuana known to provide the user with a *high*, in the cannabis plant. Whereas legal marijuana products average 20% THC (Smart et al., 2017), industrial hemp cannot, by law, have more than 0.3% THC; otherwise, it is classified as marijuana (Establishment of a Domestic Hemp Production Program, 2021). Industrial hemp has several end uses, including textiles, paper, feed, and biofuel (Fortenbery and Bennett, 2004; Das et al., 2017; Mark et al., 2020), but one growing market surrounds its cannabidiol (CBD) content.

CBD is a non-psychoactive cannabinoid in cannabis touted for its perceived health benefits (Tran and Kavuluru, 2020; Moltke and Hindocha, 2021). Google searches for *Cannabidiol* or *CBD* increased by more than 500% after the passing of the 2018 Farm Bill (Leas et al., 2019; Hurd, 2020), and its blossoming popularity has led market analytics groups to forecast that the global CBD market will reach $47 billion in sales by 2028 (Vantage Market Research, 2022). CBD is derived from marijuana and hemp alike, but only CBD derived from hemp is currently legal at the federal level. Given the murky and evolving regulatory landscape of cannabis products (Malone and Gomez, 2019; Raszap Skorbiansky, Thornsbury, and Camp, 2021) coinciding with an increase in demand for cannabis-derived products, there is merit in understanding the demand for CBD and THC products alike (Ellison, 2021).

This study examined the characteristics of CBD and THC consumers and their reasons for consumption using survey data collected from an online panel of 963 U.S. households. We determined the demographics, characteristics, and policy preferences of cannabis and non-cannabis users by estimating a multinomial logistic regression model. Then, reasons for

[1] A Schedule I drug means that the product has no accepted medical value and has a high potential for abuse (U.S. Drug Enforcement Agency, n.d.).

[2] This statistic reflects recreational marijuana legalization at the time this manuscript was prepared. Given recent legislative attempts to reform marijuana policy at the federal level, it is likely that this statistic will become outdated. Indeed, on April 1, 2022, the House of Representatives passed legislation that would legalize marijuana at the federal level (Shabad, 2022). While it remains unknown whether the bill has enough support to become law, the legislation is evidence that the marijuana regulatory landscape is evolving drastically. For a complete overview of current state marijuana policies, the reader is directed to the National Cannabis Industry Association (2021) and the National Conference of State Legislators (2021).

cannabinoid use and general product preferences were explored by partitioning the sample based on self-reported CBD and THC use.

Given the current state of the cannabis industry, several recent studies have analyzed the economic potential and market demand for hemp (Kim and Mark, 2018; Mark and Will, 2019; Kolodinsky, Lacasse, and Gallagher, 2020; Mark et al., 2020; Kolodinsky and Lacasse, 2021), but research on consumer preference for marijuana remains limited. This study most closely resembles Kolodinsky and Lacasse (2021), who analyzed consumer knowledge and the use of hemp products in Vermont. Their findings suggest that knowledge of various hemp-derived products has increased over time and that demographics (e.g., age and income) factor into consumer familiarity and use of hemp products. Our work also builds on Bhamra et al. (2021), who explored consumer uses and perceptions of hemp and marijuana products, and Moltke and Hindocha (2021), who examined the socioeconomic identities of only CBD users.

We extend the literature by focusing on the two most prevalent cannabinoids in the marketplace: CBD and THC. Identifying characteristics associated with cannabis consumption and reasons for consumption have important implications for actors across the hemp supply chain. Hemp producers must consider tradeoffs between fiber, flower, and grain in their production system, and thus understanding market demand for CBD is critical (Sterns, 2019). Also, retailers and marketing firms are concerned about identifying target audiences, understanding which factors drive purchasing behavior, and recognizing consumer preferences for specific products. Lastly, while marijuana remains illegal at the federal level, marijuana legalization has been a significant source of tax revenue for states with legalized sales (Carnevale et al., 2017). Stakeholders and policy makers must understand who consumes cannabis-derived products and why, as more states, or potentially the federal government (Shabad, 2022), liberalize marijuana policies.

The remainder of the article is organized as follows. The Methods section describes our survey instrument and estimation procedures. The Results section presents our findings, and the Discussion and Conclusions section considers the implications of our findings and identifies future research opportunities in cannabis markets.

Methods

Survey Instrument

This study used an online survey distributed by Qualtrics to U.S. households to determine who used cannabis products and for what purposes. The survey instrument, available as Supplemental Material accompanying this manuscript, received IRB approval.

Respondents first reported their demographic information. Then, respondents were asked whether there is a difference between hemp and marijuana and whether there is a difference between CBD and THC as a measure of subjective cannabis knowledge. Respondents who indicated a difference were then asked to provide a written response to what they perceived as the primary difference.

Following the qualitative questioning, respondents were asked about their usage of CBD products. Those who reported using CBD products were then asked questions to better understand product demand, including reasons for CBD use, form(s) of CBD used, place of purchase, and whether CBD was used to replace a prescription or over-the-counter (OTC) drug. The same sequence of questioning was then repeated to examine THC usage.

Once respondents reported CBD and THC usage, they were asked about regulatory preferences for hemp and marijuana separately (i.e., Should hemp [marijuana] be legal or illegal?). The survey concluded with additional questions on household characteristics, political leanings, etc.

Multinominal Logit Regression Analysis

We hypothesized heterogeneity in demographics, attitudes, and policy preferences between cannabis and non-cannabis users. Additionally, as CBD from hemp is federally legal and included in many household products available at traditional retail outlets, we hypothesized that CBD consumers would likely be different from THC users.

To explore these hypotheses, respondents were grouped into one of four mutually exclusive categories based on self-reported CBD and THC usage. Respondents were categorized as consumers of: (i) both CBD and THC, (ii) THC-only, (iii) CBD-only, or (iv) neither CBD nor THC. A multinomial logistic regression model was estimated using the consumer categories as the dependent variable to determine the factors influencing CBD and/or THC usage. The probability that individual i is in category $k = \{CBD\ and\ THC, THC\ only, CBD\ only\}$ can be specified by:

$$\mathrm{P}(Y_i = k|\mathbf{x}) = \mathrm{G}(\alpha_k + \boldsymbol{\beta_k}\mathbf{Demographics_i} + \boldsymbol{\gamma_k}\mathbf{IndChar_i} + \boldsymbol{\delta_k}\mathbf{Knowledge_i} + \boldsymbol{\zeta_k}\mathbf{LegalStatus_i}),$$

where Y_i is individual i's self-reported use, $\mathrm{G}(\cdot)$ is the standard logistic function, and *neither CBD nor THC* served as the baseline category for estimation.

The independent variable vectors **Demographics**$_i$, **IndChar**$_i$, **Knowledge**$_i$, and **LegalStatus**$_i$ represent demographics, other individual characteristics, subjective cannabis knowledge, and state-level recreational marijuana policy, respectively. Parameters α_k, $\boldsymbol{\beta}_k$, $\boldsymbol{\gamma}_k$, $\boldsymbol{\delta}_k$, and $\boldsymbol{\zeta}_k$ are coefficients specific to category k.

Demographic characteristics included gender, age, income, education, and community type. Each was modeled using a binary indicator. Gender was a binary indicator taking value 1 if individual i is male; 0 otherwise. Age was represented by including 5 dummy variables (18–24; 25–34; 35–44; 45–54; and 55–64), with 65 or older serving as our baseline. Household income was modeled using four dummies ($0–$24,999; $25,000–$49,999; $50,000–$74,999; and $75,000–$99,999), where $100,000 or more served as our baseline. Education included 5 dummies (less than high school; high school; some college, no degree; and college degree), with advanced degrees serving as our baseline. Community type was divided into rural, suburban, and urban. Two indicators for urban and suburban communities were included, and rural served as our baseline.

Individual characteristics included binary response variables for whether the individual was the primary shopper, political affiliation, and preferences for hemp and marijuana legalization. The variable for primary shopper equaled 1 if individual *i* is the primary shopper in their household; 0 otherwise. Self-reported political affiliation took four levels (Democrat, Republican, Independent, and other), and thus 3 binary response variables are included in the regression analysis; Republican serves as our baseline. Also included are indicators for the individual's preference for hemp and marijuana legalization (=1 if the respondent supported the legalization of hemp/marijuana; 0 otherwise).

Next, individuals' subjective knowledge of cannabis was likely to correlate positively with cannabis consumption. Respondents who indicated that there was a difference between hemp and marijuana and/or CBD and THC were assumed to have a higher level of subjective knowledge than those who indicated there was no difference or that they were unsure. Subjective knowledge was modeled through two indicators. For hemp and marijuana, the variable evaluates at 1 if the respondent stated there was a difference between hemp and marijuana; 0 otherwise. This was also the case for CBD versus THC.

While subjective knowledge is an imperfect proxy for objective knowledge, we evaluated the qualitative responses to gauge respondent accuracy. Some respondents did not provide the correct distinction, but the most common responses did identify the central distinction between hemp and marijuana as well as between CBD and THC. Respondents commonly cited marijuana as a drug, attributed the "high" from the THC to marijuana, and mentioned the different end uses of the two products (e.g., rope and fiber for hemp). For CBD versus THC, respondents commonly referenced THC as the cannabinoid in marijuana, leading the user to experience a high. Thus, subjective knowledge was an imperfect measure but appeared to correlate well with objective knowledge. Nonetheless, we acknowledge and accept this limitation.

We also accounted for state-level recreational marijuana policy at the time of data collection by including the vector $\mathbf{LegalStatus_i}$. Recreational marijuana policy could take one of three mutually exclusive forms: legal, decriminalized, or illegal. At the time of data collection, 11 states and the District of Columbia had legalized recreational marijuana, 16 decriminalized recreational marijuana, and 23 considered it illegal. Thus, two indicator variables were included to control for the state where a respondent resided; 1 dummy for states where recreational marijuana was legal and another 1 dummy for states where marijuana was decriminalized (states with illegal recreational marijuana served as the baseline).

Results

Data were collected from 963 individuals from an online panel maintained by Qualtrics between December 3 and December 16, 2019.[3] The sample was composed of 312 (32%) self-reported

[3] In total, 1,050 individuals completed the survey, but only 963 respondents provided sufficient responses to perform analysis. Data were collected on time to complete the survey. Measured in total seconds, the average time to complete the survey was 1,051 seconds (17.5 minutes), and the standard deviation was 3,026 seconds (50 minutes). We removed responses from individuals who took longer than 1 standard deviation above the mean (i.e., 4,077

cannabis users (i.e., CBD and/or THC) and 651 individuals (68%) who self-reported as non-cannabis users. Cannabis users were further segmented into groups based on CBD and THC consumption. Of the 312 cannabis users, 147 respondents (47% of cannabis users) reported using both CBD and THC, 77 (25%) reported using THC only, and 88 (28%) reported using CBD only. Put differently, 224 (72% of cannabis users) reported using THC, and 235 (75% of cannabis users) reported consuming CBD.

Table 1 compares sample demographics with U.S. Census estimates. Several statistically significant differences were detected between the sample and U.S. Census estimates. Specifically, statistical differences were detected in sample age, education, and income relative to the U.S. population. For instance, the sample overrepresented individuals between the ages of 35–44 and 65 years or older, and the sample underrepresented individuals between 55–64. While there were larger statistically significant differences in education and income, these differences are common in online surveys (Dillman, Smyth, and Christian, 2009). Table 2 also shows the demographics of non-cannabis users and each of the three cannabis market segments: (i) CBD and THC users, (ii) CBD-only, and (iii) THC-only.

seconds, 68 minutes). This procedure removed 18 individuals, with a range of 4,217 seconds (70 minutes) to 84,867 seconds (23.6 hours). Additionally, we removed 69 individuals who did not self-report their CBD and/or THC use. Given the stigmas surrounding cannabis products in the United States (Reid, 2020), when we asked about CBD and THC use, we allowed respondents to state they were unsure, or they preferred not to answer. Here, 69 stated they were unsure or preferred not to answer for at least one of the two cannabinoid consumption questions. These observations were excluded from analysis, leaving us with a sample of 963 respondents.

Table 1. Demographics of Cannabis Consumers and Non-consumers by Proportion of Respondents

	% of Respondents					
			Cannabis Consumers			
Demographics	**U.S. Census**	**Sample [a]**	**Both CBD and THC**	**THC Only**	**CBD Only**	**Non-cannabis Users**
Gender						
Male	48.5	48.9	53.7	53.2	42.0	48.2
Female	51.5	50.8	46.3	44.2	58.0	51.6
Nonbinary or prefer not to say	---	0.3	0.0	2.6	0.0	0.2
Age						
18–24	12.6	11.7	19.7	13.0	14.8	9.4
25–34	17.8	16.9	26.5	28.6	18.2	13.2
35–44	16.4	19.6*	32.0	19.5	21.6	16.6
45–54	17.4	15.4	9.5	16.9	18.2	16.1
55–64	16.5	12.7*	6.1	10.4	8.0	15.2
65 or older	19.3	23.6*	6.1	11.7	19.3	29.5
Education						
Less than high school	12.7	3.4*	4.8	3.9	0.0	3.5
High school or GED	27.3	25.1	23.8	32.5	30.7	23.8
Some college, no degree	20.8	32.4*	32.0	35.1	38.6	31.3
Associate's or bachelor's degree	27.4	27.7	26.5	24.7	20.5	29.3
Graduate or professional degree	11.8	11.3	12.9	3.6	10.2	12.0
Income						
Less than 25,000	21.4	17.3*	15.0	22.1	12.5	18.0
25,000–49,999	22.5	21.0	22.5	23.4	20.5	20.4
50,000–74,999	17.7	22.2*	17.7	20.8	27.3	22.7
75,000–99,999	12.3	12.1	10.2	14.3	10.2	12.4
100,000 or more	26.2	27.4	34.7	19.5	28.6	26.4
Region						
Midwest	20.9	21.2	17.7	20.8	25.0	21.5
Northeast	17.3	18.2	7.5	24.7	20.5	19.5
South	38.0	39.2	43.5	31.2	37.5	39.3
West	23.8	21.5	31.3	23.4	17.0	19.7
N		963	147	77	88	651

Note: * denotes statistically significant differences between the sample and the U.S. Census estimates at the 5% level. In the survey and regression analysis, we have more granular data on age, education, income, and state, but we aggregate here to match Census categories used to set quotas in the survey. Note that several statistically significant differences exist between the Census estimates and our sample (n = 963)Cannabis consumers are individuals who self-report using either CBD products, THC products, or both CBD and THC products. Non-cannabis consumers are individuals who use neither CBD nor THC products.

Regression Analysis

Table 2 shows multinomial logistic regression results estimating THC and/or CBD usage as a function of demographics, individual characteristics, etc. Most strikingly, there was a generational divide between cannabis users and non-users. Users of both CBD and THC were more likely to be younger than non-cannabis users, with statistically significant differences detected at the 1% level for the three lowest age brackets. THC-only users are also more likely to be younger than non-cannabis users, with statistically significant differences at the 5% and 10% levels for the four youngest age brackets. The distinction in age is less apparent in the CBD-only group, suggesting hemp-derived CBD products appeal to a broader range of consumers.

Table 2. Estimated Coefficients from the Multinomial Logistic Regression Analysis

	Coef. (rbst. std. error)[a]					
Variable	**Both CBD and THC**		**THC Only**		**CBD Only**	
Male	0.622***	(0.237)	0.365	(0.283)	-0.045	(0.265)
Age						
18–24	2.573***	(0.501)	0.941*	(0.556)	0.762*	(0.459)
25–34	1.827***	(0.438)	1.161**	(0.465)	0.161	(0.405)
35–44	2.069***	(0.427)	0.862*	(0.490)	0.233	(0.413)
45–54	0.856*	(0.471)	0.879*	(0.508)	0.128	(0.412)
55–64	0.243	(0.531)	0.184	(0.545)	-0.537	(0.491)
65 or older						
Income						
$0–$25,000	-0.110	(0.365)	0.609	(0.448)	-0.389	(0.404)
$25,000–49,999	-0.114	(0.317)	0.499	(0.406)	-0.004	(0.375)
$50,000–74,999	-0.527*	(0.316)	0.118	(0.429)	-0.009	(0.342)
$75,000–100,000	-0.680*	(0.388)	0.434	(0.468)	-0.380	(0.447)
$100,000 or more						
Education						
Less than high school	0.495	(0.620)	1.104	(0.952)	-16.876***	(0.553)
High school	0.045	(0.444)	1.219*	(0.702)	0.490	(0.479)
Some college, no degree	-0.015	(0.421)	0.987	(0.672)	0.219	(0.452)
College degree	0.010	(0.412)	0.857	(0.678)	-0.099	(0.482)
Advanced degree						
Community						
Suburban	-0.242	(0.273)	0.301	(0.361)	-0.238	(0.307)
Urban	0.354	(0.301)	0.608	(0.414)	0.109	(0.366)
Rural						
Primary shopper	1.178***	(0.295)	0.279	(0.317)	0.951***	(0.326)
Political affiliation						
Democrat	0.506*	(0.274)	-0.100	(0.326)	-0.008	(0.315)
Independent	-0.055	(0.322)	-0.182	(0.354)	-0.246	(0.339)
Republican						

Table 2 (cont.)

Variable	Coef. (rbst. std. error)[a] Both CBD and THC		THC Only		CBD Only	
Policy preference						
Hemp should be legal	1.134	(0.806)	15.816***	(0.318)	0.520	(0.544)
Marijuana should be legal	1.837***	(0.697)	16.479***	(0.289)	0.689	(0.453)
Subjective knowledge						
Diff. hemp and marijuana	0.726**	(0.290)	0.406	(0.319)	0.332	(0.312)
Diff. between CBD and THC	1.715***	(0.331)	1.653***	(0.387)	1.857***	(0.354)
State marijuana policy						
Legal marijuana	1.018***	(0.269)	0.550*	(0.330)	-0.032	(0.321)
Decriminalized marijuana	0.195	(0.276)	0.403	(0.319)	0.164	(0.273)
Illegal						
Constant	-8.915***	(1.304)	-38.389***	(1.084)	-5.331***	(0.738)
N			963			
Log pseudolikelihood			-727.6			
AIC			1,621.3			
BIC			2,025.5			

Note: Single, double, and triple asterisks (*, **, ***) indicate statistical significance at the 10%, 5%, and 1% level.
The *Neither CBD nor THC* group serves as the reference group.

Relative to non-cannabis users, users of both CBD and THC were more likely to be males, whereas the result for gender was insignificant for the THC-only and CBD-only groups. The two groups containing CBD users were also more likely to be primary shoppers in the household (significant at the 1% level). Income and educational attainment had weak associations with cannabis use.

The type of community (suburban, urban, or rural) and political affiliation also had weak associations with cannabis use. The only statistically significant difference across these two categories was that self-reported Democrats were more likely to be users of both CBD and THC products. But the difference is only significant at the 10% level. The weak association of community type and self-reported political affiliation on THC usage provides further evidence that marijuana use is not as partisan as it may have been a decade ago. As expected, regulatory preferences and subjective knowledge (significant at the 1% level) were strongly associated with cannabis usage. That is, those in favor of marijuana legalization and those with greater subjective knowledge of cannabis were more likely to be THC users. Policy preferences were not significant with CBD-only consumers, though CBD-only consumers were more likely to know the difference between CBD and THC compared to non-cannabis users.

We also see the intuitive impact of the state's recreational marijuana policy on THC use. THC users were more likely to reside in states with legal recreational marijuana than in states with illegal recreational marijuana; no statistically significant differences were detected for decriminalized marijuana. Thus, having legal recreational marijuana in your state increased the probability of using THC, as is supported in the literature (Kerr et al., 2017; Cerdá et al., 2020). This finding is appealing as the legalization of recreational marijuana often establishes cannabis dispensaries,

which reduces barriers to market entry and lowers transaction costs of market participation. Thus, we should expect more self-reported THC consumers in states with legalized recreational marijuana. The state's recreational marijuana policy, however, was not strongly associated with the use of only CBD, possibly because hemp-derived CBD products are federally legal and widely available in common retail outlets.

Reasons for Cannabis Usage and Product Preferences

While the logistic regression analysis assessed the question, "Who uses CBD and THC?" it was also critical to address the question, "Why do they use CBD and THC?"

Cannabis consumers in the sample were segmented into one of three groups: (i) CBD and THC users, (ii) CBD-only, and (iii) THC-only. Individuals who reported only using CBD were expected to have considerably different preferences and reasons for usage than those who used both CBD and THC (or only THC). In other words, we hypothesized that those who purchased only hemp-derived products might have different reasons for cannabis use than those who use marijuana.

Reasons for CBD Use and CBD Product Preferences

Of the 235 respondents who reported using CBD products, 147 individuals self-reported using both CBD and THC, while the remaining 88 reported only using CBD. Table 3 presents statistics related to CBD consumption, including reasons for use, preferred form(s), etc.

Table 3. Comparing the Proportion of CBD Preferences and Habits by Consumer Category

	% of respondents			
Question	**All CBD Users**	**Both CBD and THC**	**CBD Only**	***p*-value [a]**
Why do you consume CBD? (Select all that apply.)				
Reduce stress or anxiety to help you relax	53.6	54.4	52.3	0.751
Help with joint pain	55.7	53.7	59.1	0.425
For fun or recreation	16.2	23.8	3.4	0.000
Better sleep	40.9	46.3	31.8	0.027
Other	7.2	4.8	11.4	0.087
What forms of CBD do you use? (Please choose all that apply.)				
Edible (CBD-infused food or drink)	42.1	50.3	28.4	0.001
Drop or spray	42.1	44.2	38.6	0.402
Vaping device	23.8	29.9	13.6	0.002
Topical rub or cream	30.6	26.5	37.5	0.086
Cigarette/smokable form	17.5	25.9	3.4	0.000
Pill or capsule	14.9	17.0	11.4	0.222
Other	3.8	2.0	6.8	0.107

Table 3 (cont.)

	% of respondents			
Question	**All CBD Users**	**Both CBD and THC**	**CBD Only**	***p*-value [a]**
Where do you purchase CBD? (Please choose all that apply.)		56.5		0.000
A cannabis dispensary	41.3		15.9	
A retail store	44.3	40.1	51.1	0.104
An online retailer	28.9	26.5	33.0	0.304
Other	8.5	6.8	11.4	0.255
Did you use CBD to replace a prescription or over-the-counter drug?				
Yes	39.1	45.6	28.4	0.008
N	**235**	**147**	**88**	**---**

[a] The p-value denotes the results of a 2-sided *t*-test assuming unequal variances between the "Both CBD and THC" group and the "CBD only" group.

The most common reason for CBD consumption was to *help with joint pain* (56%), followed by to *reduce stress or anxiety to help you relax* (54%), and *for better sleep* (41%). These results mostly align with the CBD marketing initiatives as well as recent literature (Bhamra et al., 2021; Moltke and Hindocha, 2021). CBD was seen as a substitute for prescription or OTC drugs by approximately 39% of CBD consumers.[4] This implies that nearly 10% of the sample had replaced a prescription or OTC drug with CBD.[5] The research on the medical effectiveness of cannabis has progressed rapidly, though it has thus far remained limited, and warnings regarding potential uses have been notable (Hutchison et al., 2019; Lachenmeier and Diel, 2019). Yet consumers across the country have embraced the potential for this cannabinoid (Maa and Figi, 2014). Importantly, consumers who substitute CBD (or THC) for a prescription or OTC drug may do so without their doctor's knowledge (Boehnke et al., 2021), creating additional concerns for disease or general health treatment.

Using a series of *t*-tests, we compare those who only use CBD and those who use both CBD and THC. Several statistically significant differences exist between these two groups. First, a significantly larger segment of both CBD and THC consumers reported using CBD *for fun or recreation* (24%) than CBD-only consumers (3%). This supports the hypothesis that individuals could derive both CBD and THC from marijuana, but it also demonstrates that some cannabis users do not differentiate between the two cannabinoids as CBD is non-intoxicating.

Pronounced differences also exist when examining product preferences. While CBD edibles (i.e., CBD-infused food or drink) were seen as the most common forms of CBD products amongst the entire group of CBD consumers, the share was much larger for those who use both cannabinoids (50%) compared to those only using CBD (28%). A much larger share of CBD and THC

[4] See McFadden and Malone (2021) for perceptions about the medical value of CBD and THC.

[5] Of the 235 individuals who reported using CBD, 92 stated they replaced a prescription or OTC drug with CBD. Thus, 93 of the 963 individuals (10%) in the sample had replaced a prescription or OTC drug with CBD. A similar calculation is used later with THC users.

consumers also used vaping devices (30%) and smokable flower (26%) compared to the CBD-only group. CBD oil drops or sprays (39%) and topical rubs (38%) were most popular among individuals that only use CBD.

Lastly, the two groups purchased CBD from different settings. Over half of the respondents who use both CBD and THC products reported purchasing their CBD from cannabis dispensaries—which are only in operation in states with legalized medicinal and/or recreational marijuana—versus just 16% for those that only used CBD. Those who only used CBD products were more likely to purchase CBD from a retail store (51%) or online retailer (33%).

Reasons for THC Use and THC Product Preferences

The sample consisted of 224 self-reporting THC consumers: 147 reported using both CBD and THC, and 77 reported using only THC. Table 4 presents stated reasons for THC consumption, product preferences, and purchasing habits, while Figure 1 juxtaposes the reasons for THC use with that for CBD use.

Table 4. Comparing the Proportion of THC Preferences and Habits by Consumer Category

	% of Respondents			
Question	**All THC Users**	**Both CBD and THC**	**THC Only**	***p*-value**
Why do you consume THC? (Select all that apply.)				
Reduce stress or anxiety to help you relax	66.5	67.4	64.9	0.720
Help with joint pain	42.9	43.5	41.6	0.777
For fun or recreation	52.2	49.0	58.4	0.179
Better sleep	56.3	58.5	52.0	0.353
Other	5.8	4.8	7.8	0.394
What forms of THC do you use? (Please choose all that apply.)				
Edible (THC-infused food or drink)	46.4	53.7	32.5	0.002
Drop or spray	18.8	23.8	9.1	0.003
Vaping device	43.3	46.9	36.4	0.127
Topical rub or cream	11.6	14.3	6.5	0.056
Cigarette/smokable form	66.5	62.6	74.0	0.077
Pill or capsule	9.4	11.6	5.2	0.084
Other	3.1	2.0	5.2	0.263
Where do you purchase THC? (Please choose all that apply.)				
A cannabis dispensary	58.9	64.6	48.1	0.019
A retail store	18.3	22.4	10.4	0.015
An online retailer	17.9	20.4	13.0	0.147
Other	24.6	15.6	41.6	0.000
Did you use THC to replace a prescription or over-the-counter drug?				
Yes	45.5	49.0	39.0	0.152
N	**224**	**147**	**77**	---

Note: The *p*-value denotes the results of a 2-sided *t*-test assuming unequal variances between the "Both CBD and THC" group and the "THC only" group.

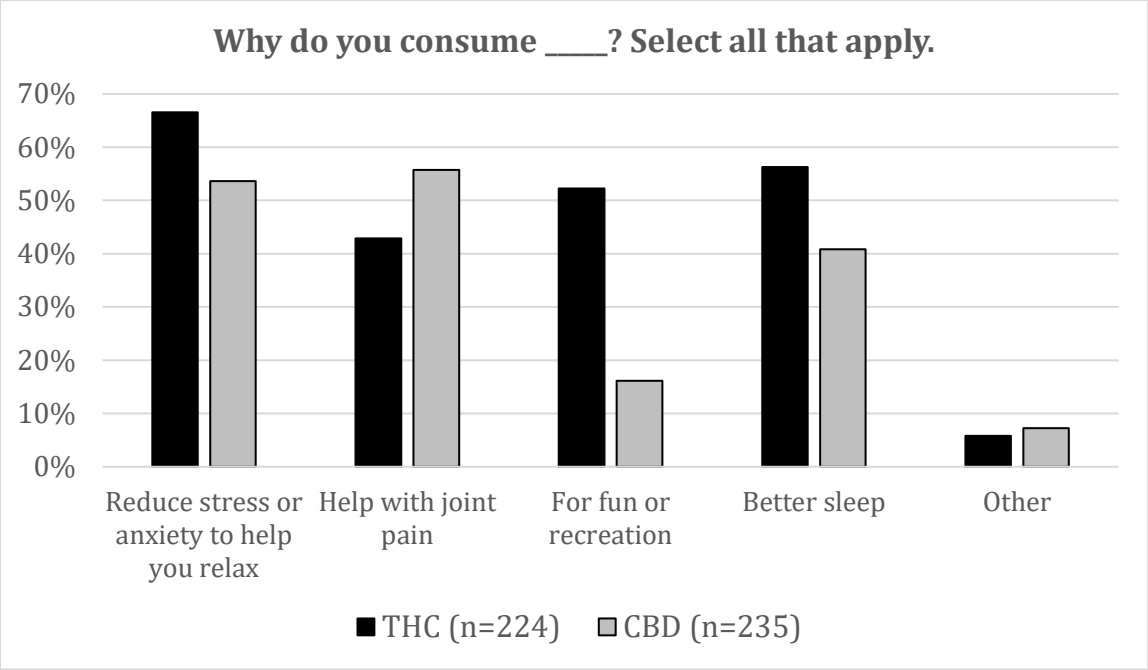

Figure 1. Reasons for CBD Use versus THC Use

The most common responses for why individuals consume THC were to *reduce stress or anxiety* (67%), followed by *better sleep* (56%), and *for fun or recreation* (52%). The majority of THC consumers stated that they purchased THC from a cannabis dispensary, but there was also evidence of shadow market engagement: 24% of respondents stated they purchased THC from outlets not listed in Table 5, with common write-in responses of "from friends" or "from a [shadow market] dealer."[6]

The federal classification of marijuana implies that the drug has no medical value. However, roughly 46% of THC consumers reported replacing a prescription or OTC drug with THC. This suggests that nearly 11% of the sample (n = 963) had replaced prescription or OTC drugs with THC, many of whom were likely self-prescribing (Boehnke et al., 2021).

Amongst the various forms of THC products, marijuana flower (cigarette/smokable form) was the most common form used (67% of consumers), followed by edibles (46%) and vaping devices (43%). Comparing THC consumer preferences with that of CBD consumers, there were clear distinctions between the two product offerings. THC products were most commonly smoked, whereas just 3% of CBD-only consumers reported using smokable CBD. Hemp-derived CBD products were most often consumed through CBD oil drops and topical creams.

[6] As many self-identifying THC users reside in states that do not have legal marijuana, we expected noisy estimates for place of purchase. The purpose of including the statistics here is to show that THC is commonly purchased through dispensaries but also through alternative markets.

Discussion and Conclusions

While cannabis policy has evolved dramatically over the past decade, research on cannabis-derived products has lagged. To provide insights on CBD and THC consumer demands, we surveyed 963 U.S. respondents, partitioned the sample into segments based on their self-reported cannabis usage, and compared consumer characteristics, reasons for consumption, and product preferences across groups.

Results show a clear generational divide between cannabis consumers and non-consumers, where cannabis users were, on average, younger than non-users. When examining the drivers of THC and CBD use, THC consumers were more likely to be younger males (who also use CBD) with higher subjective cannabis knowledge. They were also more likely to reside in states with legalized recreational marijuana. Of note, self-reported community type and political affiliation were not strongly associated with THC usage, providing further suggestive evidence that marijuana use has become increasingly bipartisan.

Gender was not strongly associated with CBD use, however, suggesting more females could be involved in hemp-derived CBD markets than in THC markets. Further, while younger consumers were more likely to self-report being CBD consumers, CBD products also appeal to older age groups (New Frontier Data, 2020). The summary statistics in Table 1 suggest that 19% of CBD-only consumers were over 65 years old. This suggests that while the youngest consumers were most likely to use CBD, older populations used these products; THC use in this age range was much lower. Thus, while there were similarities between CBD and THC consumers, there were also several differences.

These distinctions between the CBD and THC marketplace became more pronounced when exploring the reasons for use and consumers' product preferences. Alleviating joint pain was seen as the most effective use of CBD products, while THC consumers were more likely to report using THC products to reduce stress, improve sleep, and for recreational purposes. Exploring product preferences across groups, CBD consumers were more likely to report using CBD oil drops or sprays as well as topical rubs and creams sold in traditional retail outlets. THC consumers preferred smokable flower, edibles, and vaping devices sold in cannabis dispensaries (in states with legalized recreational marijuana).

Cannabis markets are on track to dramatically increase in volume over the next few decades, creating a need for the academic literature to understand the differences in how consumers approach purchasing decisions. This article emphasizes notable heterogeneity in cannabis consumption, which will likely influence the growth trends in those markets. Indeed, these differences in CBD and THC groups have important implications across the hemp and marijuana supply chains. On the farm, hemp producers make tradeoffs in their production system regarding whether to grow hemp for fiber, flower, and grain. Along with growing region, soil type, and other environmental factors, this decision depends on market expectations. Understanding the market demand for CBD (i.e., flower) is thus an important aspect of the agricultural production system. At the retailer level, from a marketing perspective, it is critical to identify end users and develop

marketing strategies to attract these consumers to new and existing CBD products. This is also true in the THC marketplace, where a murky and constantly evolving regulatory landscape exists. In identifying the primary reasons for CBD and THC use, we also show the similarities and differences between these two marketplaces. This distinction is critical as we work to understand the evolution of these marketplaces and increase consumer knowledge of the differences between the two cannabinoids.

This study is not without limitations. Primarily, respondents self-identified as CBD and/or THC consumers. As stigmas still surround cannabis products, the sample could exhibit social desirability bias (Grimm, 2010; Reid, 2020), and respondents may have had concerns over anonymity or self-incrimination. To mitigate the presence of social desirability bias, respondents could state that they "prefer not to answer" the questions on CBD and THC consumption. Individuals who responded this way were excluded from the analysis. However, it is possible that some cannabis users instead stated that they did not use CBD or THC, in which case they would be placed in our group of non-users.[7]

The second limitation is that respondents were not asked about their frequency of cannabis use, meaning we could not distinguish heavy consumers from infrequent consumers. Future research should consider the frequency of use as frequent cannabis users constitute a significant percentage of annual revenue and thus shape the market. For example, Light et al. (2014) suggest that the top 22% of marijuana consumers in Colorado make up over two-thirds of demand in the state. Attention must be given to the frequency of use and comparing demographic differences between infrequent and heavy users.

The current literature on cannabis demand is thin, leaving several avenues for future research. This includes work on the health benefits and consequences of cannabis consumption, additional marketing research on consumer use and preferences for CBD and THC products over time, and the regulatory landscape surrounding CBD- and THC-infused products and cannabis businesses (Flint and Shelton, 2019; Owens-Ott, 2020). This research is pertinent as hemp and marijuana markets have continued to grow since data collection, which suggests that consumer knowledge and use are also expanding.[8] As cannabis regulations continue to evolve, we can expect this trend to continue.

[7] There are two types of hemp-derived CBD products in the marketplace. Broad-spectrum CBD products, which have 0.0% THC, and full-spectrum CBD products, which may contain up to 0.3% THC. If an individual self-reports as a CBD-only user but uses full-spectrum products, one could argue that they are also a THC consumer. However, given that there are no euphoric effects from trace amounts of THC, we do not expect full-spectrum users to classify themselves as a THC user.

[8] While our data were collected in 2019, we believe results about CBD and THC usage and for usage are relevant for several reasons. First, with respect to CBD usage, our data were collected after the 2018 Farm Bill went into effect, so hemp products were widely available in the marketplace. While product knowledge likely increased over time amongst the general population, we capture early CBD-adopters in our data, which may correlate well with frequency of use. Additionally, legalization of recreational marijuana has occurred in relatively more liberal states; this is particularly true for the earliest adopters (e.g., Washington, Colorado, California). Further, ballot initiatives were the mechanism of deregulation in multiple states, meaning more than half of the voting population approved the measure. Therefore, we can assume a strong correlation between THC usage and the state's recreational

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marijuana policy given that individuals residing in states with recreational marijuana have more access to THC products. We can then expect the earliest adopting states to be the states that have the largest share of self-identifying THC users. If so, then this implies that the states that have not yet legalized recreational marijuana (or legalized recreational marijuana after data collection) have smaller shares of their population using THC products. With this, despite using data from 2019, we feel that our results still have tremendous relevance to the cannabis marketing literature and provide a baseline for future studies at the very least.

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