

Consumer perception, knowledge, and uses of cannabidiol

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Abstract

Introduction: The legalization of cannabidiol (CBD) across the United States, in varying degrees, has made CBD easily accessible to consumers for complementary and medical purposes. However, there is a paucity of scientific evidence on the benefits and risks of commercially available CBD. In the literature, 2 studies have gathered consumer perceptions and attitudes on cannabis products, specifically CBD, using survey-based questionnaires. This study aimed to build on the aforementioned studies in obtaining consumer perception and knowledge of CBD products using a national survey-based questionnaire.

Methods: Respondents were recruited through an anonymous, nationwide, online survey administered through Qualtrics in the United States from March 28 to April 30, 2021. The survey consisted of demographics, perceived efficacy and safety of CBD, and resources to obtain CBD information. The survey responses were reported using descriptive statistics along with median and interquartile range for the Likert portion.

Results: A total of 1158 respondents accessed the survey. The median age was 43 and 50% of respondents were female. The uses for CBD included neurological disorders, pulmonary conditions, gastrointestinal disorders, and chronic pain. The most commonly reported safety concern related to taking CBD was anxiety. Participants agreed that CBD is safe when used responsibly for medical use, and social media was the main source used to obtain information about CBD.

Discussion: Respondents who used CBD for a condition thought it was helpful; however, most of the adverse effects were rated as moderate to severe, requiring medical attention from a health care professional, hospital, or emergency room visit.

Keywords: cannabidiol, consumer, perception, drug resources, survey

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Introduction

Cannabidiol (CBD), a cannabinoid derived from hemp (*Cannabis sativa*) is the second most prominent chemical in the cannabis plant behind delta-9-tetrahydrocannabinol (THC).¹ Although CBD has some psychoactive properties, it does not produce the euphoric effects seen with THC. The popularity of CBD for medicinal use has increased with many states legalizing CBD and/or THC products.² In 2018, the Agriculture Improvement Act of 2018, Pub. L. 115-334, 2018 Farm Bill, removed hemp, *cannabis sativa* with < 0.3% THC, from the Controlled Substance Act definition of marijuana.³ Subsequently, hemp-derived CBD products became widely marketed at retail stores for various health



conditions without approval by the US Food and Drug Administration (FDA).⁴ This illegal marketing of CBD products has led to the FDA issuing warning letters to these companies, but no further action has been taken.^{5,6} Additionally, many states have laws restricting the sale of hemp-derived CBD and/or THC products by limiting the THC content or limiting sale only for certain conditions.⁷ There remains great confusion about the legality of CBD and the role of the FDA given that CBD is being sold without a prescription while there is an FDA-approved CBD product.

Despite the wide availability of CBD, there is a paucity of scientific evidence on the benefits of CBD. Strong clinical evidence supports use of CBD as treatment of seizures associated with Lennox-Gastaut syndrome or Dravet syndrome.⁸ In 2018, the FDA approved the first and only prescription formulation of cannabidiol (Epidiolex) for these indications along with tuberous sclerosis complex.

Three studies have gathered consumer perceptions on the uses, safety, and efficacy of CBD using survey-based questionnaires.^{4,9,10} A study in 2018 surveyed 2409 CBD users and found more than 60% were taking CBD for chronic pain and depression, but only 36% thought CBD treated their condition “very well.”¹⁰ The most commonly reported (6% to 11%) adverse effects were dry mouth, euphoria, and hunger, and more than 75% of the respondents used the internet to learn about CBD.¹⁰ The second study assessed these factors in patients diagnosed with autoimmune hepatitis. The patients (N = 371) used CBD for symptoms associated with autoimmune hepatitis, such as poor sleep (66.7%), pain (66.7%), fatigue (44.1%), liver inflammation (29%), and itch (10.8%). Most of the respondents reported significant improvement in sleep (93%), pain (87%), and fatigue (65.8%) with 78% retrieving information about CBD from social media.⁴ A third study administered a survey (N = 597) of CBD with users and nonusers in the United Kingdom and Ireland, and of those who used CBD (10.9%), pain and anxiety were the most common reasons for use.⁹

The current study aimed to build on previous studies using a national survey-based questionnaire. To our knowledge, no previous studies have obtained information on consumer perceptions of drug-drug interactions and safety with prescriptions, nonprescription, and other substances (eg, alcohol). Additionally, our study surveyed the source of information for uses, safety, and drug interactions of CBD. The objectives of this study were to obtain consumer perception, knowledge, and uses of CBD and define resources consumers use to seek information about CBD.

Methods

An anonymous, nationwide, online survey administered through Qualtrics (Provo, UT) was used to assess consumers’ perceptions, knowledge, and use of CBD. Consumers register their basic demographic information with Qualtrics and are invited to participate in a survey if they meet qualifying factors. Qualtrics sent the survey to more than 1000 respondents to obtain at least 1000 complete unique responses. Consumers were eligible if they were at least 18 years old, could read and understand English, and could access the survey using an electronic device. The survey consisted of 4 sections: (1) demographic and personal factors, (2) efficacy and safety of CBD use, (3) resources to find CBD information, and (4) perception of CBD (5-point Likert scale questions). The other questions consisted of multiple-choice and yes or no questions.

Demographic information included age, race, sex, education, occupation, and annual household income. Personal factors asked current or previous recreational or medical use of cannabis, CBD, and THC. In the next section, consumers were asked about frequency of CBD use, reasons for use, adverse effects experienced, efficacy, and drug interactions. For each condition selected, participants were asked about the efficacy of CBD for that use (eg, extremely helpful to worsening of symptoms), adverse effects experienced, and severity of adverse effects. Consumers were also surveyed on methods of using CBD (eg, smoking, vaping, topical, sublingual, etc) and where they purchase CBD products. Additional questions in this section included formulations, concerns regarding drug interactions, replacement of prescription medications with CBD, and confidence in the purity of CBD product. The third section asked where consumers obtain information on CBD and how CBD products were selected. The last section gathered consumers’ perceptions of CBD using 15 Likert scale questions (1 = *strongly disagree*, 5 = *strongly agree*). Participants may have answered different numbers of questions as CBD users received additional questions on helpfulness and adverse effects.

The survey responses were reported using descriptive statistics (means, percentages) along with median and interquartile range (IQR) for the Likert portion using SPSS v. 26. Funding for this study was provided by the University of Kansas General Research Fund and Belmont University. Qualtrics provided respondents with incentives based on a point system, and points can be redeemed in the form of gift cards, airline credit, online game credit, etc.

The University of Kansas Human Research Protection Program and Belmont University Institutional Review Board provided institutional review board approval.

TABLE 1: Demographics of survey respondents

Demographic	All Respondents	Never Used THC or CBD	THC	CBD
Age, median (IQR), N = 1158	43 (32–62)	58 (36–70)	41 (23–60)	40 (31–58)
Sex, n	1147	197	809	783
Female, n (%)	579 (50.5)	136 (69.4)	403 (45.3)	358 (45.7)
Race	1028	183	788	728
White, n (%)	836 (81.3)	139 (76.0)	653 (82.9)	601 (82.6)
Asian, n (%)	55 (5.2)	17 (9.3)	27 (3.4)	63 (8.7)
Black, n (%)	98 (9.5)	23 (12.6)	73 (9.3)	32 (4.4)
Other, n (%)	15 (1.5)	2 (1.1)	14 (1.8)	12 (1.6)
More than one race, n (%)	12 (1.2)	2 (1.1)	10 (1.3)	8 (1.1)
Use of cannabis (THC products), n	1142	NA	885	778
Current recreational user of cannabis, n (%)	358 (31.3)	NA	358 (40.5)	316 (40.6)
Current medical user of cannabis, n (%)	148 (13.0)	NA	148 (16.7)	141 (18.1)
Past regular user of cannabis, n (%)	155 (13.6)	NA	155 (17.5)	116 (14.9)
Tried cannabis in past, n (%)	224 (19.6)	NA	224 (25.3)	144 (18.5)
Never used cannabis, n (%)	257 (22.5)	NA	NA	61 (7.8)
Use of CBD, n	1142	NA	885	783
Current daily user, n (%)	230 (20.1)	NA	226 (25.5)	230 (29.4)
Current weekly user of CBD, n (%)	175 (15.3)	NA	161 (18.2)	175 (22.3)
Current monthly user of CBD, n (%)	88 (7.7)	NA	84 (9.5)	88 (11.2)
Past regular user of CBD, n (%)	72 (6.3)	NA	66 (7.5)	72 (9.2)
Tried CBD but not a regular user, n (%)	218 (19.1)	NA	185 (20.9)	218 (27.8)
Have never used CBD, n (%)	359 (31.0)	NA	163 (18.1)	NA
Use CBD recreationally, n (%)	460 (40.2)	NA	486 (54.6)	460 (58.7)
			890	
Education status (highest degree), n	1021	181	783	725
No high school degree, n (%)	21 (2.1)	6 (3.3)	14 (1.8)	11 (1.5)
High school graduate, n (%)	538 (52.7)	111 (61.3)	404 (51.6)	351 (48.5)
Bachelor's degree, n (%)	232 (22.7)	37 (20.4)	172 (22.0)	172 (23.8)
Graduate degree (eg, masters, doctoral, professional degree)	230 (22.5)	27 (14.9)	193 (24.6)	190 (26.2)
Annual household income, n	1023	181	785	727
<\$25,000, n (%)	195 (19.1)	35 (19.3)	149 (19.0)	130 (17.9)
\$25,000 to \$49,999, n (%)	291 (28.5)	52 (28.8)	226 (28.8)	205 (28.2)
\$50,000 to \$99,999, n (%)	288 (28.2)	66 (36.5)	203 (25.9)	198 (26.1)
>\$99,999, n (%)	249 (24.3)	28 (15.4)	207 (26.4)	202 (27.8)

CBD = cannabidiol; IQR = interquartile range; NA = not available; THC = tetrahydrocannabinol.

Results

A total of 1158 participants accessed the survey, and the demographics are provided in Table 1. Most of the respondents self-reported as white with a median age of 43 years. The regional geographic representation of the respondents in the survey included 20.9% from the Midwest, 17.2% from the Northeast, 38.1% from the South, and 23.8% from the West. These percentages are based on the general population gathered by the census and reflect the percentage of census respondents who live in each region. There were 783 respondents who reported using

CBD, 809 reported using THC, and 197 respondents who have never used THC or CBD. The median age for people who had never tried THC or CBD was 58 years of age and more likely to be female (69.4%). Of the respondents who use CBD (n = 783), 58.7% reported using CBD recreationally, defined as getting high in the survey. Smoking CBD (47.5%) was the most common method of using CBD followed by edibles (39.2%), vaping (21.6%), and topical (13.9%). Most participants obtained CBD from the following places: CBD dispensary (29.6%), online (29.2%), pharmacy (20.7%), or health food store (18.1%).

TABLE 2: Uses of cannabidiol and helpfulness ratings for each condition

Condition	n (%), n = 783	Helpfulness Rating, n (%) ^a				
		Extremely Helpful	Helpful	Minimal Help	No Improvement	Worsen Symptoms
Anxiety-related disorder	227 (29.0)	82 (36.1)	94 (41.4)	33 (14.5)	18 (7.9)	0 (0)
Depression	197 (25.2)	86 (43.9)	67 (34.2)	31 (15.8)	10 (5.1)	2 (1.0)
Chronic pain	171 (21.8)	51 (30.2)	71 (42.0)	32 (18.9)	14 (8.3)	1 (0.6)
Sleep-related disorders	155 (19.8)	62 (40.3)	57 (37.0)	20 (13.0)	15 (9.7)	0 (0)
Attention deficit/hyperactivity disorder	132 (16.9)	78 (59.1)	31 (23.5)	17 (12.9)	6 (4.5)	0 (0)
Headaches	131 (16.7)	49 (38.0)	51 (39.5)	21 (16.3)	7 (5.4)	1 (0.8)
Asthma or other pulmonary disorders	82 (10.5)	53 (65.4)	17 (21.0)	7 (8.6)	4 (4.9)	0 (0)
Other	70 (8.9)	11 (16.7)	18 (27.3)	14 (21.2)	22 (33.3)	1 (1.5)
Muscle spasm	64 (8.2)	25 (39.7)	23 (36.5)	12 (19.0)	3 (4.8)	0 (0)
Bipolar disorder	61 (7.8)	28 (45.9)	21 (34.4)	9 (14.8)	3 (4.9)	0 (0)
Seasonal allergies	55 (7.0)	21 (38.2)	20 (36.4)	7 (12.7)	7 (12.7)	0 (0)
Posttraumatic stress disorder	51 (6.5)	21 (41.2)	20 (39.2)	7 (13.7)	3 (5.9)	0 (0)
Weight gain	50 (6.4)	25 (52.1)	11 (22.9)	5 (10.4)	6 (12.5)	1 (2.1)
Fibromyalgia	46 (5.9)	10 (22.2)	24 (53.3)	8 (17.8)	3 (6.7)	0 (0)
Alzheimer disease	45 (5.7)	25 (55.6)	13 (28.9)	5 (11.1)	2 (4.4)	0 (0)
Amyotrophic lateral sclerosis	37 (4.7)	22 (59.5)	13 (35.1)	2 (5.4)	0 (0)	0 (0)
Nausea or vomiting	37 (4.7)	23 (62.2)	10 (27.0)	3 (8.1)	1 (2.7)	0 (0)
Cancer	32 (4.1)	13 (40.6)	14 (43.8)	3 (9.4)	2 (6.3)	0 (0)
Seizure disorder	20 (2.6)	5 (26.3)	12 (63.2)	2 (10.5)	0 (0)	0 (0)
Glaucoma	19 (2.4)	7 (36.8)	8 (42.1)	3 (15.8)	1 (5.3)	0 (0)
Psychosis related disorders	16 (2)	9 (60.0)	5 (33.3)	1 (6.7)	0 (0)	0 (0)
Crohn disease	15 (1.9)	8 (53.3)	4 (26.7)	1 (6.7)	2 (13.3)	0 (0)
Hepatitis	15 (1.9)	9 (60.0)	5 (33.3)	1 (6.7)	0 (0)	0 (0)
Multiple Sclerosis	13 (1.7)	10 (76.9)	2 (15.4)	0 (0)	1 (7.7)	0 (0)
HIV-AIDS	9 (1.1)	4 (44.4)	4 (44.4)	0 (0)	1 (11.1)	0 (0)
Parkinson disease	9 (1.1)	6 (66.7)	2 (22.2)	1 (11.1)	0 (0)	0 (0)

^aPercentages represent the number of participants who rated the helpfulness for each condition they listed.

The respondents (n = 783) used CBD for varying conditions, such as neurological, gastrointestinal, and pain disorders (Table 2). Anxiety (29%), depression (25.2%), and chronic pain (21.8%) were reported as the most common uses for CBD. Use of CBD for psychosis-related disorders, Crohn’s disease, multiple sclerosis, HIV-AIDS, and Parkinson’s disease were reported in less than 2% of respondents. More than 70% of the participants who used CBD for a specific condition found CBD to be helpful (responded extremely helpful or helpful) for the condition, whereas only a few respondents (less than 2%) thought CBD worsened their condition. A total of 39.1% of participants discontinued a prescription medication in favor of CBD, and 39.1% indicated they bought CBD instead of a prescription medication.

In terms of the safety of CBD use, anxiety was the most commonly reported adverse effect with 23.6% of participants reporting anxiety. Of these people who experienced

anxiety, 70.1% reported having a moderately severe or severe reaction (Table 3), which required management by a health care professional (HCP). Other commonly reported adverse effects included dry mouth (18.5%) and mood changes (16.9%) with 60% and 68%, respectively, having a moderately severe or severe reaction. In a general question to all respondents that used CBD, 12.4% reported they required hospitalization or an emergency room visit, and 27.6% sought care from an HCP secondary to adverse effects due to CBD use. Cannabidiol was also reported to cause a positive urine drug screen test based on 13.8% of the respondents and 1.3% reported CBD caused an automobile accident.

Social media (35%) was used the most to obtain information about CBD followed by the internet (federal websites [21.2%] and blogs or forums [15.4%]) and only 10.4% reached out to an HCP. When asked about drug interactions, 25%, 20.4%, and 16.8% were concerned about

TABLE 3: Adverse effects reported with CBD use

Adverse Effect	All CBD Users, n (%), n = 783	Severity of Adverse Effect, n (%) ^a			
		Severe (Required Hospitalization or ED Visit)	Moderately Severe (Visited a Healthcare Professional)	Moderate (Bothersome but Self-Managed)	Mild (Symptoms Easily Managed)
Anxiety	185 (23.6)	70 (38.0)	59 (32.1)	31 (16.8)	24 (13.0)
Dry mouth	145 (18.5)	19 (13.3)	27 (18.9)	40 (28.0)	57 (39.9)
Mood changes	132 (16.9)	34 (25.8)	39 (29.5)	17 (12.9)	42 (31.8)
Appetite changes	124 (15.8)	28 (22.8)	25 (20.3)	26 (21.1)	44 (35.8)
Drowsiness	87 (11.1)	20 (23.3)	10 (11.6)	24 (27.9)	32 (37.2)
Dizziness or lightheadedness	72 (9.2)	14 (19.4)	21 (29.2)	19 (26.4)	18 (25.0)
Diarrhea	61 (7.8)	20 (32.8)	25 (41.0)	15 (24.6)	1 (1.6)
Other	50 (6.4)	1 (2.5)	1 (2.5)	5 (12.5)	33 (82.5)
Nausea/vomiting	37 (4.7)	13 (35.1)	11 (29.7)	7 (18.9)	6 (16.5)
Liver problems	28 (3.6)	13 (48.1)	11 (40.7)	3 (11.1)	0 (0)
Rash/hives	24 (3.1)	6 (25.0)	11 (45.8)	2 (8.3)	5 (20.8)
Difficulty breathing	20 (2.6)	5 (25.0)	4 (20.0)	8 (40.0)	3 (15.0)

CBD = cannabidiol.

^aPercentages represent the number of participants who rated the severity for each adverse event they reported.

an interaction between CBD and their prescription drugs, herbal products, and nonprescription products, respectively. Only 55.4% of people who used CBD indicated they informed their HCP they were using CBD. When selecting brands of CBD, most individuals ask a friend or trusted individual (29.5%), online reviews (25.3%), pharmacist (20.8%), employee recommendation (17.4%), and advertisements (14.9%). Only 12.5% asked an HCP who was not a pharmacist.

Perceptions of CBD are reported in Table 4. Respondents who have used CBD agreed that they understand the difference between THC and CBD, whereas the cohort that never used THC or CBD disagreed. Most of the respondents (n = 1026) agreed that CBD is safe to use with prescription and nonprescription medications and CBD has fewer negative health effects than opiate or prescription medications, tobacco, and alcohol. When asked about the addictive, abusive, and detrimental nature of CBD, the respondents in all 3 cohorts were neutral in their perception.

Discussion

This study found consumers perceived CBD to be safe, effective, and adequately studied for medical purposes. Moreover, around 40% of participants reported discontinuing their prescription medications in favor of CBD, and 10% of participants sought information about CBD from HCPs. This positive perception of safety and efficacy may

result in worsening of their medical condition, adverse effects, and drug interactions.

The most commonly reported condition for CBD use in this study was anxiety followed by depression and pain disorder, which is similar to other studies of CBD users.⁹⁻¹¹ The anxiolytic effects of CBD are mainly studied in animals; human studies remain limited and small in size.¹² An open-label study evaluated the safety and efficacy of a full-spectrum, high-CBD solution in 14 patients with moderate to severe anxiety.¹³ The study found statistically significant reductions in anxiety based on the Beck Anxiety Inventory and the Overall Anxiety Severity and Impairment Scale at 4 weeks. Additionally, a systematic review of 6 randomized controlled trials (RCTs) evaluated different doses of CBD to treat generalized anxiety disorder or social anxiety disorder. The studies showed that CBD was consistent in improving clinical outcomes.¹⁴ Whereas studies for the treatment of anxiety are promising, larger placebo-controlled trials are needed. There are limited, low-quality studies on CBD for treatment of depression; therefore, more research is warranted.^{15,16}

Several studies evaluated the use of CBD for pain disorders.^{17,18} A systematic review and meta-analysis of RCTs (N = 24) investigated the use of cannabis-based products for chronic and postoperative pain. A total of 18 studies compared CBD and/or THC products to placebo for cancer pain (n = 4) and nonchronic cancer pain (n = 14), and the meta-analysis of 11 studies showed there was not a significant difference in reduction of pain.¹⁸ Whereas CBD

TABLE 4: Consumer perception and knowledge of CBD^a

	All Respondents, median (IQR), n = 1026 ^b	Never used THC or CBD, median (IQR), n = 193 ^c	CBD, median (IQR), n = 729 ^d
I understand the difference between delta-9 THC and CBD	3 (2-4)	2 (1-3)	4 (3-5)
I consider myself knowledgeable regarding CBD	3 (2-4)	2 (1-3)	3 (3-4)
I feel that CBD is safe when used responsibly for medical use	4 (3-5)	3 (3-4)	4 (3-5)
I feel that CBD can be detrimental to one's health for medical use	3 (2-4)	3 (2-3)	3 (2-4)
I feel that CBD is often abused	3 (2-4)	3 (3-4)	3 (2-4)
I feel users can become addicted to CBD	3 (2-4)	3 (3-4)	3 (2-4)
I feel that CBD is safe to use with prescription medications	4 (3-5)	3 (3-4)	4 (3-5)
I feel that CBD is safe to use with non-prescription medications	4 (3-5)	3 (2-4)	4 (3-4)
I feel CBD has fewer negative health effects than alcohol.	4 (3-5)	3 (3-4)	4 (3-5)
I feel CBD has fewer negative health effects than tobacco.	4 (3-5)	3 (3-4)	4 (3-5)
I feel CBD has fewer negative health effects than prescription opiate medications.	4 (3-5)	3 (3-4)	4 (3-5)
I feel CBD has fewer negative health effects than prescription medications.	4 (3-5)	3 (3-4)	4 (3-5)
I feel CBD should be available for use in children.	3 (2-4)	3 (2-3)	3 (2-4)
I feel CBD is safe to use in pregnancy and lactation.	3 (2-4)	2 (1-3)	3 (2-4)
I feel CBD is safe to use in my pets (eg, dogs, cats)	3 (3-4)	3 (2-3)	3 (3-4)
I feel that CBD has been adequately studied by scientists.	3 (3-4)	3 (2-3)	4 (3-4)

CBD = cannabidiol; IQR = interquartile range; NA = not available; THC = tetrahydrocannabinol.

^aLikert scale of 1 = *strongly disagree*; 2 = *disagree*; 3 = *neutral*; 4 = *agree*; 5 = *strongly agree*.

^bNumbers ranged from 1020 to 1026 for responses.

^cNumbers ranged from 192 to 193 for responses.

^dNumbers ranged from 725 to 729 for responses.

is often promoted for pain, studies generally do not support this claim.

The use of CBD is associated with minimal adverse effects. The respondents in this study thought CBD was helpful for the condition(s) they selected, but also reported at least a mild adverse effect. Dizziness and drowsiness were found to be more bothersome for individuals using cannabis-based medicines compared with placebo in a previous study.¹⁸ Diarrhea and appetite changes were consistent with the commonly reported adverse events of cannabidiol solution (Epidiolex).⁸ A systematic review and meta-analysis of 12 RCTs found there was an increased incidence of diarrhea in individuals using CBD and reduced appetite in the epilepsy studies.¹⁹ The most common adverse effect reported in our study was anxiety (n = 185/783) even though 227 respondents used CBD for anxiety with the majority rating it as helpful. Within this cohort of 227 respondents who used CBD for anxiety, 24.2% reported anxiety as an adverse effect despite only 7.9% reporting no improvement of their anxiety by using CBD. Most of the respondents rated the adverse effect as moderately severe to severe requiring medical attention from an HCP, hospital, or emergency room visit. A possible explanation for the perceived severity

of these adverse effects may be related to the purity of the CBD products and participants' unawareness of the possible presence of THC and other cannabinoids. THC is found to be anxiogenic, and this adverse effect may be dose-dependent.²⁰ A study found that CBD products purchased online in oil, vaporization liquid, and tincture formulations had a wide range of concentrations of cannabinoids and THC (up to 6.43 mg/mL) in 18 of the 84 samples tested.²¹ Other cannabinoids found in these products included cannabidiolic acid and cannabigerol, although, neither substance appears to have psychoactive properties.²¹⁻²³ Another possible reason for the perceived adverse effects may be the formulation and route of administration of the CBD product. Smoking was the most commonly reported way to consume CBD in this study. Despite the rapid delivery to the systemic circulation, smoking is a variable route of administration due to the potential for 30% to 50% of product to be lost to "side-stream" smoke and the risk of respiratory symptoms if used chronically.^{24,25} Edibles were the second most commonly reported way to consume CBD even though there is literature to indicate product labeling may be inaccurate and may be difficult to dose compared with other formulations.²⁵ A study found 44 products had detectable

levels of CBD; however, only 13 products had the correct CBD content labeled on the packaging, and 9 products did not contain labeled dosage information.²⁶ Overall, the adverse effects were self-reported in this study and may be related to the underlying condition CBD is used to treat and not solely based on use of the CBD product itself.

Only a small number of respondents (25%) were concerned about potential drug-drug interactions with prescription medications compared with 20% who were concerned about interactions with nonprescription products (eg, herbals, natural products, and supplements), and only 55.4% of our participants informed their HCPs they use CBD. Cannabidiol may interact with substrates of CYP1A2, CYP2B6, CYP2C8, CYP2C9, UGT2B7, and UGT1A9 and inducers of CYP3A4 and CYP2C19.⁸ Of note, CBD is shown to increase exposure to several narrow therapeutic index drugs, including warfarin, cyclosporine, tacrolimus, and clobazam.²⁷ The interactions with warfarin and clobazam are clinically relevant due to reports of bleeding and increased risk of adverse events, respectively.²⁸ Additional clinically significant interactions include substrates of CYP2C8 and CYP2C9, such as phenytoin, requiring potential dosage adjustments.⁸ Although this study did not collect medical history of concomitant medications, it is possible for consumers who use these medications and CBD simultaneously to have an increased likelihood of adverse events; therefore, HCPs must be vigilant in screening for CBD use in all settings.

The respondents used internet-based websites, including social media, to obtain drug information related to dosing, adverse events, and drug-drug interactions for CBD. This finding is consistent with previous studies about CBD and other medications.^{10,29} A survey of 236 community pharmacists reported 89.1% answered clinical questions about CBD even though some pharmacies did not sell CBD products.³⁰ A survey of CBD users and nonusers (n = 597) in the United Kingdom and Ireland found, among CBD users (10.9%), the majority did not tell their HCPs about use of CBD (70.8%), were unaware of drug interactions (86%), and used social media to learn about CBD (53%).⁹ Another study found more than 90% of Reddit users claimed CBD could treat a medical condition.¹¹ In a general study of cannabis users, 18% sought information from their primary care providers, 39% used the internet, and 35% asked friends and family.³¹ Additionally, websites about medical cannabis were 3 times more likely to mention cannabis for treatment of a medical condition than the adverse effects.³² Our survey is consistent with these surveys, and a major concern is that consumers are not informing HCPs about CBD use and obtaining information from unreliable sources. Despite minimal respondents inquiring about CBD with their HCPs, pharmacists need to be prepared to talk about the risks and potential benefits of CBD with their patients.

There are several limitations in this study. Participants were provided small rewards for completion of the survey, which may have biased results by encouraging disinterested participants to fill out the survey quickly. Qualtrics was responsible for recruitment, so a response rate was not calculated as it is unknown how many individuals were contacted, refused to participate, or only answered a few questions. The sensitive nature of some questions may have caused some participants not to answer questions truthfully or provide incomplete answers. Additionally, the participants were not required to answer all questions on the questionnaire, and follow up questions were only presented to individuals who provided certain responses to initial questions (ie, those who identified as a CBD user received additional questions). Response bias may be present as participants who have a positive experience with CBD may be more likely to respond to the survey. Dosing information along with the purity of the CBD products or differentiation between isolate and full spectrum products used by the respondents were not collected in the survey, and this may affect the perceived efficacy and safety of the products. The survey defined and asked questions regarding CBD, but participants may have confused efficacy and adverse effects related to their experience with THC. This was a cross-sectional study; therefore, the data should be interpreted with caution.

Conclusion

Although CBD has only received FDA approval for Dravet syndrome, Lennox-Gaustaut syndrome, and tuberous sclerosis complex, consumers use CBD for a variety of conditions, and most respondents thought it was safe to use with prescription and nonprescription medications. The respondents who used CBD for a condition thought it was helpful; however, most of the adverse effects were rated as moderate to severe requiring medical attention from an HCP, hospital, or emergency room. With the wide availability of CBD, HCPs should be knowledgeable and prepared to provide patients with evidence-based information about CBD.

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