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# Prevalence of Cannabidiol Use in Patients With Spine Complaints: Results of an Anonymous Survey

FRANCIS LOVECCHIO, MD, MARK T. LANGHANS, MD, PHD, TIANNA BENNETT, BS, MICHAEL STEINHAUS, MD, AJAY PREMKUMAR, MD, MPH, MATTHEW CUNNINGHAM, MD, PHD, JAMES FARMER, MD, TODD ALBERT, MD, RUSSEL HUANG, MD, YOSHIHIRO KATSUURA, MD, SHEERAZ QURESHI, MD, FRANK SCHWAB, MD, HARVINDER SANDHU, MD, HAN JO KIM, MD, VIRGINIE LAFAGE, PHD, SRAVISHT IYER, MD

Hospital for Special Surgery, Spine Service, New York, New York

## ABSTRACT

**Background:** Cannabidiol (CBD) is a cannabis derivative that has been popularized as a medicinal product with analgesic and anti-inflammatory effects. Given the anecdotal observations that several patients have reported use of CBD for spine-related pain, this study was designed to characterize CBD consumption patterns and perceived effects in patients with spine-related complaints.

**Methods:** The study design was a cross-sectional survey. Over a 4-week period, an anonymous paper survey was administered to all patients presenting for evaluation by 1 of 9 spine surgeons at a single institution. Surveys were given upon registration for the office visit and collected by the office manager or nurse before evaluation by the surgeon. Patients were included regardless of surgical status (ie, preoperative, postoperative, or nonoperative) or region of pathology (lumbar, thoracic, or cervical). The survey consisted of multiple-choice questions on patient patterns of CBD use.

**Results:** Out of 300 surveys, 214 (71%) were completed. CBD use for spine-related pain was reported by 54 (25.2%) patients. CBD was initially used for potential relief of back pain (66.7%), neck pain (37.0%), leg pain (35.2%), and/or arm pain (9.3%). Users also sought improvements in insomnia (25.9%) and mood (18.5%). Oil was the most popular formulation (64.8%). CBD was most often consumed 2–5 times (40.7%) or 6–10 times (31.5%) per week. The most common source of initial recommendation for CBD was friends or family (75.9%). Reported benefits were pain relief (46.3%), improved sleep (33.3%), and reduced anxiety (20.4%); however, 24.1% of patients reported no benefit from CBD use. The most reported side effect was fatigue (7.4%). Most users (63.0%) would recommend CBD to a friend for pain relief.

**Conclusion:** CBD is already used by many patients, and further high-quality research on this supplement is essential.

**Level of Evidence:** 4.

**Clinical Relevance:** CBD is a commonly used by spine patients as an off label treatment.

Cervical Spine

Keywords: cannabidiol, analgesia, back pain, neck pain

## INTRODUCTION

The endocannabinoid system is a recently characterized endogenous neurotransmitter network in humans.<sup>1</sup> The most powerful exogenous mediators include delta-9-tetrahydrocannabinol (THC) and its partner cannabidiol (CBD), both derivatives of the *Cannabis sativa* or marijuana plant. While the exact mechanisms of the endocannabinoid system are still under investigation, THC is considered an agonist at the CB1 and CB2 receptors, while CBD is an antagonist. Therefore, CBD is not believed to produce the psychoactive effects associated with the

use of marijuana as a recreational drug.<sup>2</sup> This distinction led to recent changes in regulation of hemp products, placing CBD in an uncertain position with the law.<sup>3</sup>

Except for a single Food and Drug Administration (FDA)-approved drug used to treat rare forms of childhood epilepsy,<sup>4</sup> the marketing and sale of CBD has outpaced the science behind its efficacy. Given that the endocannabinoid system is involved in a variety of pathologies ranging from neurodegenerative disorders to diabetes,<sup>1,5,6</sup> CBD has been marketed as a cure for almost every imaginable ailment. As a result, the availability of CBD has

skyrocketed, transforming it from a Schedule I controlled substance into a ubiquitous supplement, available at a wide variety of physical and online stores. Many spine surgeons face questions about the potential of the drug to reduce spine-related complaints, such as mechanical or neuropathic pain.<sup>7</sup>

While some of this popularity may be related to marketing, there is certainly evidence behind CBD as a potential mitigator of inflammatory and neurogenic pain. Multiple rat models have shown decreases in early phase inflammatory markers, neuropathic pain signaling, and pain behaviors after the oral or transdermal administration of CBD.<sup>8–11</sup> The purpose of our study was to characterize CBD consumption patterns and beliefs of patients with spine-related complaints through an anonymous cross-sectional survey.

## MATERIALS AND METHODS

### Study Population

This study was approved by the Institutional Review Board. A cross-sectional paper survey was administered to all patients presenting for evaluation by 1 of 9 spine surgeons at a single center in New York, New York during the month of October 2019. The survey was given to all adult patients (age  $\geq 18$  years) upon check-in for their office visit, regardless of surgical status (ie, preoperative, postoperative, or nonoperative) or region of pathology (lumbar, thoracic, or cervical). Given the continued stigma regarding the use of marijuana-related products for therapeutic purposes, the survey was administered anonymously. Exclusion criteria included non-English speakers or inability to understand or answer survey questions secondary to a medical condition (eg, dementia, history of traumatic brain injury). Surveys were completed in the waiting area or in the examination room and collected upon completion by the office staff or the nurse rooming the patient always before evaluation by the surgeon.

The survey was prefaced by an information sheet that explained the background and purpose of the study, assured that no protected health information would be collected, and that patients' choice to participate would not impact their care in any manner. The survey was designed by the investigators, consisting of 22 multiple-choice questions, with

options for free-text answers for 10 items. When applicable, patients were permitted to select more than 1 response (Appendix 1).

### Demographics

Patients were asked to self-report age, height, weight, gender, state of residence, and identify an ethnicity (American Indian or Alaska Native, Black or African America, Asian, Native Hawaiian or Other Pacific Islander, White, or Other [free text]). The site of previous surgery, if applicable, was also queried (cervical, lumbar/thoracic, or not applicable).

### Reasons for CBD Consumption

Participants were asked if CBD was used for pain control for one of several spine-related areas (back, neck, leg, arm, or none). Patients who responded affirmatively were asked to identify the initial reason for trying CBD and the form in which CBD was consumed. The survey also questioned participants regarding how they first heard about CBD and how they purchased CBD. CBD consumers were asked if they would "recommend CBD for pain control to a friend" (yes or no).

### Timing and Effects of CBD Consumption

Questions on the timing, frequency, and effects of CBD consumption were asked. Specifically, CBD users were asked about the timing (before surgery, after surgery, before and after surgery, or not applicable) and the frequency of CBD use (0–1, 2–5, 6–10, 11–20, 21–30, or  $>30$  times/week). Subjects that reported CBD use were asked about the beneficial and adverse side effects they experienced after CBD consumption.

### Statistical Analysis

Descriptive analytics, including means, standard deviations, and proportions were used to report the data. Demographics and surgical history were compared between CBD users and non-CBD users. Categorical variables were analyzed using  $\chi^2$  tests (Fischer's exact when appropriate); continuous variables were analyzed for normality using Shapiro Wilk's tests and then compared using student's *t* test or Mann-Whitney *U* tests as appropriate. All analyses were conducted using SPSS version 25.0 (IBM, Armonk, NY).

**Table 1.** Comparison of cannabidiol users to nonusers.

	CBD+ (N = 54)	CBD- (N = 160)	P
Age, mean ± SD, y	56.2 ± 14.7	58.6 ± 14.4	0.308
BMI, mean ± SD, kg/m <sup>2</sup>	26.5 ± 4.2	28 ± 5.8	0.102
Gender, n (%) <sup>a</sup>			0.073
Male	25 (46.3)	98 (61.3)	
Female	26 (48.1)	57 (35.6)	
Ethnicity, n (%) <sup>a</sup>			0.35
White	48 (88.9)	137 (85.6)	
Black	0 (0.0)	5 (3.1)	
Asian	1 (1.9)	7 (4.4)	
American Indian	0 (0.0)	2 (1.3)	
Other	0 (0.0)	4 (2.5)	
State of residence, n (%) <sup>a</sup>			0.621
New York	35 (64.8)	101 (63.1)	
New Jersey	9 (16.7)	36 (22.5)	
Connecticut	2 (3.7)	9 (5.6)	
Other	5 (9.3)	10 (6.3)	
Surgical history, n (%) <sup>a</sup>			0.117
Lumbar or thoracic	27 (50.0)	73 (45.6)	
Cervical	14 (25.9)	33 (20.6)	
Both	0 (0.0)	11 (6.9)	
Never had spine surgery	13 (24.1)	33 (20.6)	

Abbreviations: BMI, body mass index; CBD, cannabidiol; SD, standard deviation.

<sup>a</sup>Eight, 10, 7, and 10 patients declined to answer these questions, respectively.

## RESULTS

Out of 300 distributed surveys, 214 (71%) were completed. Average age of the patient sample was 58.0 ± 14.5 years, with an average body mass index (BMI) of 27.6 ± 5.5 kg/m<sup>2</sup>, and most participants identified as white (86%, 185/214) and male (58%, 123/214). Approximately a quarter of the sample (26%, 46/214) had never had surgery, 47% (100/214) had a history of lumbar or thoracic surgery, 22% (47/214) cervical surgery, and 5% (11/214) had both cervical and lumbar or thoracic surgery. CBD was used by 25% of patients (54/214). Age, BMI, gender, ethnicity, and surgical history were similar between CBD and non-CBD users (*P* > 0.05; Table 1).

Among participants who reported CBD use, consumption patterns were analyzed (Table 2). Most (67%, 36/54) patients reported using CBD for back pain, with 37% (20/54) using for neck pain. Approximately a quarter of patients also used CBD for potential improvements in sleep (26%, 14/54). Out of the CBD users with a history of spine surgery, 29% (11/38) used CBD before their surgery, 18% (7/38) before and after, and 53% (20/38) after surgery. Oil or tincture was the most common formulation (65%, 35/54), with topical creams (37%, 20/54) and edible methods (33%, 18/54) being the next most common. Approximately a third of patients (35%, 19/54) used more than 1 form. Most patients used CBD either 2–5 (41%, 22/54) or 6–10 (32%, 17/54) times per week.

**Table 2.** Patterns of cannabidiol use.

Usage	n (%), N = 54
Reason for using CBD	
Back pain	36 (66.7)
Neck pain	20 (37.0)
Arm pain	5 (9.3)
Leg pain	19 (35.2)
Insomnia	14 (25.9)
Mood	10 (18.5)
Timing of CBD use	
After surgery	20 (37.0)
Before surgery	11 (20.4)
Before and after	7 (13.0)
Never had surgery	16 (29.6)
Method of consumption	
Oil	35 (64.8)
Topical cream	20 (37.0)
Vaporized	2 (3.7)
Edible (eg, pills, candy)	18 (33.3)
Average number of times used per week	
0–1	4 (7.4)
2–5	22 (40.7)
6–10	17 (31.5)
11–20	6 (11.1)
21+	2 (3.7)
Not specified	3 (5.6)
Initial recommendation for CBD	
Friend	41 (75.9)
Doctor	12 (22.2)
Advertisement	5 (9.3)
Other	2 (3.7)
Method of obtaining CBD	
Friend	5 (9.3)
Online	14 (25.9)
Physical store	15 (27.8)
Prescription	11 (20.4)
Other	6 (11.1)
Not specified	3 (5.6)
Benefits experienced from CBD	
Pain relief	25 (46.3)
Anxiety relief	11 (20.4)
Improved sleep	18 (33.3)
None	13 (24.1)
Adverse side effects	0 (0.0)
Agitation	1 (1.9)
Diarrhea	2 (3.7)
Fatigue	4 (7.4)
Nausea	2 (3.7)
None	46 (85.2)

Abbreviation: CBD, cannabidiol.

Nearly half of patients who used CBD experienced pain relief (46%, 25/54), a third noted improvements in sleep (33%, 18/54), a fifth reported reduced anxiety (20%, 11/54), and approximately a quarter noted no beneficial effects (24%, 13/54). Adverse effects were reported by 15% (9/54) of CBD users, consisting of agitation (n = 1 patient), diarrhea (n = 2), fatigue (n = 4), and nausea (n = 2). Most patients received the initial recommendation for CBD from a friend (76%, 41/54). Only 22% (12/54) of patients reported the initial recommendation for CBD came from a physician. Out of all CBD users, 63% (34/54) answered that they would “recommend CBD for pain control to a friend.”

## DISCUSSION

In this cross-sectional, anonymous survey of 214 patients presenting for evaluation by a spine surgeon, it was found that a quarter of patients had used CBD at some point for relief of spine-related pain. This study took place in a state where recreational marijuana is illegal, and the survey participants were majority white (86%) and middle aged. Out of the patients who took CBD, three-quarters first heard about CBD from a friend, consistent with the spread of the product in popular culture. Many survey participants also heard about CBD from a physician, showing that the perceived effects of CBD are espoused by members of the medical community. While the anonymous methodology limited the ability to capture many patient-level factors, there were no demographic variables associated with CBD use. These findings provide quantitative support behind the perceived adoption of CBD by many patients with spine-related complaints.

The incidence of CBD use in this study appears consistent with similar trends in orthopaedic patient populations, as patients' willingness to try cannabis-based medicines has followed changes in public perceptions about the substance.<sup>12,13</sup> This study shows that patients hear about CBD from trusted sources (friends, family, and their physician). The prevalence of CBD use can only be expected to increase, especially considering that most of the CBD users (63%) in our study would recommend it to a friend. These trends have wide-reaching implications for spine surgeons. While the compound is generally well tolerated with relatively benign side effects, CBD has been associated with elevated liver enzymes and interactions with the cytochrome P450 family (responsible for metabolism of the drug), potential concerns for unaware patients.<sup>2</sup> Furthermore, the unregulated status of CBD has led to concerns about the actual ingredients in the supplements, with several reports revealing widespread mislabeling.<sup>2,4</sup> Though self-reported marijuana use has not been shown to affect short-term outcomes after surgeries such as lumbar fusion or knee replacement, this may not apply to CBD given its unregulated status.<sup>14,15</sup> Surgeons must be aware of the prevalence of CBD use, potential side effects, medication interactions, and in many cases, uncertain ingredients.

This study found that the predominant reasons for initially using CBD were for potential relief of

back and neck pain. Given that axial back and neck pain are 2 symptoms often refractory to various forms of conservative and surgical treatments,<sup>16,17</sup> it would be expected that patients with these symptoms would be eager to try a novel therapy for relief. The etiology of chronic back and neck pain is multifactorial, consisting of inflammatory, neuro-pathic, and psychogenic components.<sup>16,17</sup> The CB1 receptor is found in regions of the peripheral and central nervous system where pain signaling is intricately controlled, including the peripheral and central terminal of primary afferent neurons, and the CB2 receptor has been shown to modulate inflammatory signaling.<sup>18</sup> From a pathophysiologic standpoint, there are several animal studies providing evidence for the ability of CBD to mitigate both the inflammatory and neuropathic components of musculoskeletal pain. Several studies have shown promising initial results in orthopaedic applications. One study showed decreased afferent nerve-fiber firing from a rat knee joint after topical CBD administration.<sup>8</sup> Similarly, another study compared pain behaviors and knee joint inflammation after topical application of CBD in a rat osteoarthritis model, finding a dose-dependent response to topical CBD.<sup>9</sup> In addition to topical application, oral CBD use has also been found to be efficacious in animal studies.<sup>10</sup> While data in spine patients are scarce, a noncontrolled observational study of 11 patients with failed back surgery syndrome found that an oral CBD/THC combination drug provided improvements in several pain-related patient-reported outcomes, even after the failure of multiple other pharmacologic modalities.<sup>19</sup>

Regarding the benefits of CBD use, slightly fewer than half of survey participants reported pain relief. Other benefits included improved sleep and anxiety relief, effects that may be particularly useful in the acute postoperative period, an association corroborated by past studies.<sup>20–22</sup> Regarding the effect of CBD on pain, there are no published investigational trials on the effects of CBD alone on musculoskeletal pain, but there is low-quality evidence supporting the efficacy of THC-predominant compounds in reducing pain.<sup>14,23–27</sup> A recent systematic review on this subject found many low-quality observational or noncontrolled studies but only 5 randomized controlled trials, only 1 of which showed a low risk of bias.<sup>25</sup> The trials consisted of heterogeneous patient populations, orally administered, THC-based compounds, and follow-up periods ranging

from 300 minutes to 14 weeks. Two of these studies demonstrated improved pain responses versus placebo, 1 showed an equivalent response to placebo, and 2 trials with active comparators (ketoprofen and dihydrocodeine crossover) showed decreased pain improvement with medical cannabis. The authors concluded that the current body of literature on medical cannabis provides preliminary evidence that cannabinoids are effective for musculoskeletal pain and that larger studies are needed to make definitive conclusions.<sup>25</sup> Whether these beneficial effects of THC-predominant compounds translate to CBD products remains unknown.

There are numerous limitations of the current study. Most significantly, reported effects of CBD are not objective and subject to confirmation bias and the placebo effect. Given that the study is purposefully not designed to determine whether CBD is an effective treatment for spine-related complaints, conclusions about the effectiveness of CBD cannot be drawn from this investigation. Rather, this study should provide impetus for researchers to design randomized trials on the potential benefits of CBD in spinal pathologies. Second, the survey is subject to selection bias in that patients could decline participation in the survey, which could impact both the estimate of CBD use and its reported effects. Third, the survey used in the study was designed specifically for this investigation and has not been validated in other populations. Fourth, while we believe the anonymous design of the survey was useful given the stigma attached to the use of cannabis-derived compounds, this did impact our ability to make associations between patient or surgery-related factors with CBD use. Fifth, given that CBD continues to be unregulated by the FDA, the method of consumption (tinctures, edibles, or topical) and actual content of the supplements was certainly variable, making it difficult to draw generalizable conclusions about their effects. Unless the content of the CBD product is verified by a regulatory agency (eg, by the FDA or in a controlled experimental setting), this will continue to present a problem when studying the effects of CBD. Future trials will need to consider the contents and route of administration of CBD compounds, as clinical outcomes may differ based on dosage and route.<sup>9,10,25</sup> Lastly, the findings reported in this study may be unique to this specific geographic and demographic sample, as use pat-

terns are likely different in states or countries in which recreational marijuana is legal.<sup>12,13</sup>

## CONCLUSIONS

This is the first study, to our knowledge, to examine the consumption patterns and perceived effects of CBD in patients with spinal pathology. This investigation demonstrates that CBD is a prevalent alternative therapy used by many patients with spine-related symptoms. As the popularity of the supplement is only expected to increase over time, spine surgeons must educate themselves on the evidence behind the use of CBD, understand its legal status, and be aware of the potential for mislabeling of ingredients. Surgical candidates should be specifically questioned on the use of CBD. While CBD use may be generally safe, the potential risks inherent to perioperative use of this unregulated compound (eg, possible medication interactions or unknown ingredients) must be explicitly discussed with the patient. While its risk profile remains unknown, the findings in this study provide preliminary evidence for CBD as a perceived therapeutic modality in spinal pathologies, a strong impetus to create well-designed, randomized trials to test the effectiveness of CBD.

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**Corresponding Author:** Mark T. Langhans, MD, PhD, Hospital for Special Surgery, Spine Service, 535 East 71st Street, New York, NY 10021. Phone: (212) 606-1000; Email: langhansm@hss.edu.

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