

# Assessing Health Care Providers' Knowledge of Medical Cannabis

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## Abstract

**Introduction:** Many health care providers would benefit from greater knowledge and awareness of medical cannabis, even if they choose not to integrate it into their medical practice. Unfortunately, health care providers generally report low knowledge of medical cannabis and cite this lack of knowledge as a barrier to making patient recommendations. It is important to understand health care providers' medical cannabis knowledge and its correlates. However, few studies have rigorously assessed clinically relevant cannabis-related knowledge, instead typically focusing on attitudes toward cannabis and perceived knowledge.

**Methods:** Physicians in a university-affiliated health system completed an anonymous online survey. The survey assessed participants' basic demographics and medical experience, experiences with cannabis education, beliefs about their knowledge of and competency regarding medical cannabis, and knowledge of medical cannabis in relation to the current scientific evidence.

**Results:** The average level of medical cannabis knowledge was 58% correct, with scores ranging from 39% to 78% correct. Perceived cannabis knowledge predicted actual knowledge, and those who pursued self-initiated study or attended a lecture on medical cannabis had higher knowledge levels.

**Conclusion:** Levels of factual knowledge about medical cannabis among physicians were moderate. Our results highlight the mismatch between physician knowledge and cannabis policy. We offer our brief, 10-min assessment as a baseline for characterizing cannabis knowledge, acknowledging that the content and interpretation may change as knowledge advances.

**Keywords:** assessment; cannabis; knowledge; medical marijuana

## Introduction

People have used cannabis medicinally for over 5000 years.<sup>1</sup> Although cannabis remains on Schedule I under the Federal Controlled Substances Act, a designation for drugs with no accepted medical use and a high potential for abuse and/or dependence, policies in the United States have shifted from cannabis prohibition to legalization, especially for medical use.<sup>2,3</sup> As of July 2021, the use of cannabis for medical purposes was legal in 36 of 50 states, 4 out of 5 U.S. territories, and the District of Columbia.<sup>4</sup>

Given these trends, health care providers would benefit from competence in medical cannabis, especially

those in fields most affected by medical cannabis use, such as primary care. Unfortunately, physicians receive little training on medical cannabis, giving evidence-based recommendations,<sup>5,6</sup> or even the endocannabinoid system, in medical school and may not have sufficient knowledge for informed decisions.<sup>7</sup> Health care providers generally report low levels of knowledge across topics related to medical cannabis<sup>8</sup> and cite this lack of knowledge as a barrier to making patient recommendations.<sup>7,9-12</sup> Most physicians surveyed report needing additional cannabis-related education.<sup>13</sup> Many people use cannabis medicinally without the knowledge of or input from their primary health care

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providers<sup>14,15</sup> and may utilize cannabis as a substitute for prescription drugs,<sup>2,16,17</sup> often without the awareness of their primary health care providers.<sup>18</sup> In Colorado about a decade ago, only 15 physicians registered half of medical cannabis patient in the state registry, raising concerns of conflict of interests and lack of responsibility for the welfare of patients.<sup>6</sup> Due to the lack of health care providers' expertise, many cannabis dispensary workers end up operating as proxy clinicians, interviewing customers about their health conditions and recommending products for medical use.<sup>5,19</sup>

These factors indicate the importance of systematically assessing health care providers' medical cannabis knowledge and its correlates. Such information would inform efforts to develop and utilize appropriate educational materials. However, there are no currently available assessment instruments, as few attempts have been made to measure health care professionals' knowledge of medical cannabis. Most studies addressing medical cannabis knowledge are actually based on self-reported perceptions of knowledge<sup>20–27</sup> or focus on details of regulations in state-level programs.<sup>10,12,28–30</sup> There are few examples of nonregulatory factual knowledge assessments, with existing efforts targeting one or two areas (e.g., medical uses, adverse effects,<sup>31</sup> and open-ended items on administration or dose<sup>32</sup>) rather than a comprehensive assessment.

Previous researchers have highlighted specific accurate and inaccurate beliefs, noting that most health care providers did not believe that medical cannabis improved patient quality of life,<sup>12</sup> despite evidence from patients with chronic neuropathic pain for example.<sup>33</sup> However, no previous study has rigorously assessed general medical cannabis knowledge across physicians or other health care providers. Thus, the goal of the current project was to assess medical cannabis-related knowledge among physicians based on the empirical evidence currently available. The content included knowledge of the cannabinoids  $\Delta 9$ -tetrahydrocannabinol (THC) and cannabidiol (CBD), medical effectiveness for various conditions or symptoms, increased risks for adverse events, and harm reduction techniques. Although knowledge of state cannabis laws and regulations is important for practitioners, we chose not to include state-specific knowledge of medical cannabis regulations to ensure the general utility of the tool. Analyses examined the relationships between overall medical cannabis knowledge and beliefs about knowledge, cannabis education experiences, and basic demographics and professional characteristics.

## Methods

### Participants

This study was approved by the Institutional Review Board for Health Sciences and Behavioral Sciences at the University of Michigan prior to data collection. Researchers obtained e-mail addresses for physicians in a university-affiliated health system and emailed an invitation to participate in an online survey. There are no educational or training requirements for physicians to authorize medical cannabis use in the state.

Participants were prevented from taking the survey more than once using the "Prevent Ballot Stuffing" feature in Qualtrics. Of the 290 surveys that were started, 244 (84%) were completed. After the survey was completed, participants had the option of receiving a \$5 incentive or donating it to charity. Incentive contact information was entered in a separate on-line survey. Response rates and population sizes by specialty were 45/85 (52.9%) for OBGYN, 5/13 (38.5%) for Anesthesia-Pain, 31/120 (25.8%) for Family Practice, 119/1008 (11.8%) for Internal Medicine, and 31/276 (11.2%) for Psychiatry, for an overall response rate of 16.2%. Data were collected between May 28 and July 19, 2020. At the time of the study, medical cannabis had been legal at the state level for 11 years and unregistered adult use ("recreational") cannabis had been legally available for 6 months.

### Measures

An 18-item questionnaire (Supplemental Data) collected information on participants' basic demographics and medical experience, experiences with cannabis education, beliefs about their knowledge of and competency regarding medical cannabis, and knowledge of medical cannabis in relation to the current scientific evidence. The education item read: "What education on cannabis or cannabinoids (if any) have you ever received? (select all that apply)." Knowledge of and competency items included: "How knowledgeable would you say you are on cannabis and cannabinoids?"; "How competent do you believe you are in identifying harmful and irresponsible use of cannabis medicinally?"; and "How comfortable or uncomfortable do you feel integrating cannabis into your patient's treatment regimen?" (Table 1).

Cannabinoid knowledge items were designed to incorporate a range of difficulty, and included: True or False: similar to the endogenous opioid system, there is an endogenous cannabinoid system in our bodies? (*True, False*); Is THC, CBD, or both responsible for the "high" of cannabis? (*THC, CBD, Both, Unsure*);

**Table 1. Participant (N = 244) Demographics and Descriptives**

Descriptive	
Sex <i>n</i> (%)	
Female	60%
Male	39%
Other	1, 1%
Age ( <i>M</i> , <i>SD</i> , <i>range</i> )	47, 12, 29–79
Years in practice ( <i>M</i> , <i>SD</i> , <i>range</i> )	19, 11, 1–54
Setting, <i>n</i> (%)	
Primary care	52%
Specialty	48%
Educational experiences, <i>n</i> (%)	
Lecture	44%
Own research	30%
Continuing Medical Education	29%
Grand rounds	19%
Workshop	5%
Formal course	4%
None	30%
Cannabis and cannabinoid knowledge, <i>n</i> (%)	
Not knowledgeable at all	15%
Slightly knowledgeable	46%
Moderately knowledgeable	31%
Very knowledgeable	6%
Extremely knowledgeable	2%
Identifying harmful and irresponsible use of cannabis medicinally, <i>n</i> (%)	
Not competent at all	16%
Slightly competent	33%
Moderately competent	38%
Very competent	10%
Extremely competent	3%
Integrating cannabis into patients' treatment regimens, <i>n</i> (%)	
Very uncomfortable	33%
Somewhat uncomfortable	31%
Neither comfortable nor uncomfortable	18%
Somewhat comfortable	12%
Very comfortable	6%

*M*, mean; *SD*, standard deviation.

What do you think is an effective dose of THC (in milligrams), if unsure please write in “unsure”; What do you think is an effective dose of CBD (in milligrams), if unsure please write in “unsure”; What do you think the percentage of THC is in “high-THC” flower strains or cultivars; What do you think the percentage of THC is in “low-THC” flower strains or cultivars; What do you think the percentage of CBD is in “high-CBD” flower strains or cultivars; What do you think the percentage of CBD is in “low-CBD” flower strains or cultivars. Participants responded to percentage items on a 0% to 100% continuous scale. Selected values were displayed to participants and each response could be modified until participants advanced to the next page. Other than the first two items, the items in this set were from a knowledge assessment of medical cannabis users.<sup>34</sup>

Knowledge of therapeutic effectiveness was assessed with an inventory developed for medical cannabis

users<sup>14</sup> based on conclusions from The National Academies of Sciences, Engineering, and Medicine (NASEM).<sup>35</sup> Health conditions, where there was conclusive, substantial, or moderate empirical support for treatment, were selected for correct “effective” responses and conditions with insufficient or no empirical support for treatment effectiveness were selected for correct “ineffective” responses. Knowledge of health risks increased by cannabis use was also assessed with an adaptation of an inventory<sup>14</sup> based on conclusions from NASEM.<sup>35</sup> Risk items included conditions with substantial evidence (correct) or no or insufficient evidence to support or refute a statistical association (incorrect). Health conditions and risks with limited evidence were not included. Item stems were “Which of the following conditions do you think cannabis is effective at treating?” and “Which of the following conditions/events do you think cannabis use increases the risk for? (check all that apply),” followed by lists of conditions. Knowledge of harm reduction strategies was assessed with an inventory<sup>36</sup> based on a literature review.<sup>37</sup> The item stem read, “Which of the following do you believe lowers risk of cannabis use?” and was followed by a list potential harm reduction behaviors. Participants were able to provide feedback with an open-ended text item at the end of the survey, “Do you have any comments on these topics?”

### Analyses

Data were recoded to facilitate analyses. One point was awarded for each correct response on the knowledge items, based on evidence in the current scientific literature. Total scores for cannabis knowledge were computed for each participant. Independent samples *t*-tests assessed differences in overall knowledge by form of education received. Pearson correlations assessed relationships between beliefs about cannabis knowledge of and competency and actual cannabis knowledge. Nonparametric independent samples *t*-tests and Pearson correlations assessed patterns of cannabis knowledge by participant characteristics.

### Results

#### Participant characteristics

Analyses included only the 244 completed surveys; participant demographics and descriptives are shown in Table 1. Most (70%) participants had some type of cannabis education, although 61% rated themselves as slightly knowledgeable or not knowledgeable at all on cannabis and cannabinoids, and somewhat

uncomfortable or very uncomfortable (64%) in integrating cannabis into their patients' treatment regimens. Only 13% rated themselves as very competent or extremely competent in identifying harmful and irresponsible medical cannabis use.

#### Cannabis knowledge

Responses between 2 and 10 mg were accepted as correct for effective doses of THC and CBD. The Canadian Pharmacists' Association recommends that individuals titrate THC and CBD dosages starting at 2 mg with gradually increasing dosages.<sup>38</sup> The recommended adult starting dosage of Marinol (Dronabinol) is 2.5 mg orally twice daily, 5 mg has been proposed as a standard THC unit,<sup>39</sup> and states in the United States either consider 5 or 10 mg of THC to be one serving.<sup>40</sup>

The average THC concentration in illicit cannabis confiscated in the United States in 2017 was 17.1%.<sup>41</sup> High THC strains have been defined as 13% THC<sup>42</sup> and 12–18% THC<sup>43</sup> and low THC strains have been defined as 3% THC<sup>43</sup> and 4% THC.<sup>42</sup> Low CBD strains have been defined as <1.5% CBD.<sup>43</sup> The most potent strains currently available range from 27% to 34% THC.<sup>44</sup> Some low-THC strains have around 0.3% THC, which is the limit for THC concentration authorized for hemp cultivation in the Agricultural Improvement Act of 2018.<sup>45</sup> The THC:CBD ratios of commercial cannabis strains form three broad chemotypes: High THC/Low CBD (I), roughly balanced ratios of THC and CBD (II), and Low THC/High CBD (III).<sup>46</sup> In a large sample of commercial cannabis strains in Washington State (where cannabis is legally available for medical and unregistered adult use), chemotype I ranged from 17.7% to 23.2% THC and 0–2% CBD (with a mode near 0.1% CBD. Chemotype II samples tend to have <10% THC and <15% CBD. Chemotype III samples tend to have between 10% and 14% CBD and <3% THC.<sup>46</sup> Thus, responses between 10% and 35% THC were considered to be in the correct range of high-THC cultivars and responses between 0% and 4% in the correct range of low-THC cultivars. Responses between 3% and 25% CBD were considered to be in the correct range of high-CBD cultivars and responses between 0% and 2% in the correct range of low-CBD cultivars.

Most participants correctly recognized the existence of the endogenous cannabinoid system (73%) and that THC is responsible for the "high" of cannabis (84%). Accuracy on other cannabinoid knowledge items was lower, ranging from 4% to 26% (Table 2). Two participants were completely accurate on medicinal effective-

**Table 2. Participant Accuracy on Cannabinoid Items**

Item(s)	"Unsure" responses	Participants accurate	Accurate values	M	SD	Range
THC dose	88%	4%	2–10 mg	14 mg	27	1–100 mg
CBD dose	89%	2%	2–10 mg	46 mg	43	5–100 mg
High-THC		26%	10–35%	41%	26	0–92%
Low-THC		7%	0–4%	16%	12	0–66%
High-CBD		16%	3–25%	47%	24	2–100%
Low-CBD		4%	0–2%	20%	15	0–87%

CBD, cannabidiol; THC,  $\Delta^9$ -tetrahydrocannabinol.

ness items, one participant was completely accurate on risk reduction items, no participants were completely accurate on risk items (Tables 3 and Supplementary Tables S1–S3). Total scores for cannabis knowledge ranged from 15 to 30 out of 36 possible points (i.e., 39–78% correct;  $M = 21$ ,  $SD = 3$ ). There were no differences in overall cannabis knowledge by physician age,  $r(238) = -0.086$ ,  $p = 0.186$ , years in practice,  $r(239) = -0.085$ ,  $p = 0.188$ , gender,  $t(238) = 0.56$ ,  $p = 0.578$ ,  $d = 0.07$ , or whether the participant was a primary care provider or specialist,  $t(237) = 0.41$ ,  $p = 0.681$ ,  $d = 0.05$ . Overall cannabis knowledge was related to perceived knowledge,  $r(244) = 0.253$ ,  $p < 0.001$ , and perceived competence in identifying harmful and irresponsible use of cannabis medically,  $r(244) = 0.178$ ,  $p = 0.005$ , but not comfort in integrating cannabis into patients' treatment regimens,  $r(243) = 0.102$ ,  $p = 0.113$ . *Post hoc* analyses indicated that greater comfort in integrating cannabis into patients' treatment regimens was uniquely predicted by higher perceived cannabis knowledge, belief in treatment effectiveness for a greater number of conditions, and fewer beliefs in risks, rather than accuracy in these beliefs (Supplementary Table S4).

Participants' open-ended comments indicated that their comfort in integrating cannabis into patients' treatment regimens was also influenced by their attitudes toward cannabis, for example: "Risks are unknown and there is an erroneous belief that it is not addictive and has no risk. In my view, calling it 'medicinal cannabis' is like calling alcohol use for purposes of pain or insomnia, 'medicinal alcohol.' There is a

**Table 3. Participant Accuracy on Scale Items**

Scale	Total items	M accuracy	SD accuracy	Accuracy range
Medicinal effectiveness	12	8	1	4–12
Risks	6	4	1	2–5
Risk reduction	12	8	2	5–12

massive double standard and, in my opinion, the vast majority of patients are saying it's medicinal but it's really for recreational or addictive purposes. Labeling it medicinal provides a cover for harmful and risky use.”; “You have been brain washed by the cannabis industry.”; “I think it's fine for people to use cannabis recreationally, but pretending it's medicine is harmful.”

Those who reported having no education on medical cannabis scored lower on overall knowledge,  $t(242)=5.10$ ,  $p<0.001$ ,  $d=0.71$ . Participants who attended a lecture,  $t(242)=4.23$ ,  $p<0.001$ ,  $d=0.55$ , and initiated their own studies,  $t(242)=4.64$ ,  $p<0.001$ ,  $d=0.65$ , on medical cannabis had higher overall knowledge scores. There was a trend approaching significance for those who completed Continuing Medical Education,  $t(242)=1.82$ ,  $p=0.070$ ,  $d=0.26$ . There was no difference in overall knowledge scores for those attended workshops,  $t(242)=0.55$ ,  $p=0.584$ ,  $d=0.17$ , a formal course,  $t(242)=0.47$ ,  $p=0.417$ ,  $d=0.26$ , or grand rounds on medical cannabis,  $t(242)=0.82$ ,  $p=0.415$ ,  $d=0.13$ .

## Discussion

In this study, we assessed medical cannabis knowledge among health care providers, drawing from a review of previous literature, including knowledge of cannabinoids, therapeutic effectiveness, health risks, and harm reduction strategies. We show that physicians from a university-affiliated health system in a state with legal recreational and medical cannabis have generally low levels of factual knowledge about medical cannabis. The average level of medical cannabis knowledge was moderate (58% correct), with scores ranging from 39% to 78% correct. Nearly all physicians had little or no knowledge of effective CBD/THC doses or of the percentage of THC or CBD found in cannabis varieties. This result echoes the low knowledge of dosages found in previous studies, in which very low numbers of respondents were able to estimate a starting dose or dosing regimen.<sup>32,33,34,47</sup> The mean score was 66% accurate for all other areas (harm reduction, risk accuracy, and medical effectiveness). These results on medical effectiveness are similar to those found in a study of primary care health care providers in Minnesota.<sup>12</sup> The previous study assessed how helpful participants thought cannabinoids were for the treatment of qualifying medical conditions in the state, and a range of symptoms noted by previous patients. There were significant discrepancies between qualifying medical conditions and conclusions regarding effectiveness by the NASEM.<sup>12</sup>

In our study, cannabis knowledge was significantly associated with perceived knowledge, and those who had received cannabis-related education had higher knowledge levels than those who had not. However, this knowledge did not always lead to comfort in integrating cannabis into patient care. These findings align with other studies of health care professionals, many of which point to concerns about abuse/misuse, drug/drug interactions, side effects (especially in the context of mental health), and the lack of consistent clinical guidelines as barriers to effective integration of cannabis into health care.<sup>1-4</sup> Cannabis' status as a Schedule I drug may also deter physicians from engaging with their patients as some institutions have cautioned physicians about writing certifications for patients or even prohibited them from doing so.<sup>1</sup>

## Limitations

Our study was conducted in a single health system in a state with legal medical and recreational cannabis, so the results may not reflect knowledge in other states or nationwide. Our questions on dosing and CBD/THC percentage are drawn from literature synthesis rather than consensus professional guidelines, which did not exist at the time of the study. Our operational definitions for effective dosing will likely be refined and elaborated as medical cannabis research progresses. For example, several of the U.S. National Institutes of Health recently established 5 mg of THC as the Standard Unit for Research (NOT-DA-21-049, May 7, 2021), whereas other countries consider 10 mg of THC as an effective dose. Some participants noted that dosing guidelines may differ depending on the conditions treated. As with other medical areas, the instrument content and evaluation of responses may change as knowledge advances—especially with both dosing and medical conditions (e.g., Dravet Syndrome and CBD,<sup>6</sup> which was not incorporated in the 2017 NASEM report<sup>35</sup>). Recommended dosages of Epidiolex (CBD) for seizures due to Lennox–Gastaut syndrome or Dravet syndrome are based on body weight, starting at 2.5 mg/kg taken by mouth twice daily with a maximum dosage of 10 mg/kg taken by mouth twice daily. Indeed, dosing specific to conditions as well as routes of administration will need to be continually informed by new studies. At this point, the most informative finding may be that ~90% of participants were unsure of effective dosages for THC and CBD and did not provide any

estimates. Although the instrument content is based on the available empirical evidence, it has not been assessed for predictive criterion validity or test–retest reliability.

### Implications

Our results highlight the mismatch between physician knowledge and medical cannabis policy. Despite numerous long-standing medical cannabis laws (11 years in the state of the current study), physician training and education has insufficiently prepared physicians on cannabis-related knowledge. This is especially true for dosing, as most respondents were unsure about effective doses (in mg) of THC or CBD. Overconsumption of THC can lead to diarrhea, disorientation, anxiety, confusion, dyspnea, seizures, psychosis, hallucination, and paranoia,<sup>48</sup> and THC content in edibles can exceed guidelines.<sup>40</sup> High levels of THC have also been associated with catatonia.<sup>43</sup> As demonstrated by our survey and several similar studies, this lack of knowledge has contributed to general discomfort with integrating cannabis into medical practice. This discomfort likely pushes patients to turn to other sources to obtain cannabis-related knowledge, including the popular press, personal research,<sup>49</sup> or from dispensary staff who receive little or no medical training.<sup>19,50</sup> As such, more comprehensive training is necessary for physicians to bridge the gap between cannabis policy and clinical care. This training could include a focused module on cannabis and the endocannabinoid system during medical school, Continuing Medical Education courses for practicing physicians, and training courses for physicians who provide medical cannabis certifications.

Although detailed prescribing information similar to that available for FDA-approved medications is currently lacking for medical cannabis products, there is sufficient evidence to adequately guide patients toward strategies to optimize their medical cannabis use. These include harm reduction (e.g., avoiding smoking), developing a shared plan that defines treatment success and failure with regards to specific symptoms, carefully monitoring said symptoms when using cannabis products, and sharing the empirical evidence base about situations for which cannabis may be therapeutically valuable or harmful.<sup>4</sup>

### Conclusion

We show that medical cannabis knowledge is low among physicians, highlighting the mismatch between physician knowledge and medical cannabis policy. The instrument described herein can quickly and effectively

assess medical cannabis knowledge in domains relevant to health care providers. We offer our brief, 10-minute assessment as a baseline for characterizing cannabis knowledge, acknowledging that the content may change as knowledge advances.

### Author Disclosure Statement

Dr. Clauw has consulted for Pfizer, Inc., Eli Lilly and Company, Tonix Pharmaceuticals, Aptinyx, Regeneron, IMC, and Intec. Dr. Boehnke sits on a Data Safety and Monitoring Committee for Vireo Health (unpaid).

### Funding Information

This work was supported by a Capstone for Impact Grant from the University of Michigan Medical School.

### Supplementary Material

Supplementary Data  
Supplementary Table S1  
Supplementary Table S2  
Supplementary Table S3  
Supplementary Table S4

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**Cite this article as:** Kruger DJ, Mokbel MA, Clauw DJ, Boehnke KF (2021) Assessing health care providers' knowledge of medical cannabis. *Cannabis and Cannabinoid Research* X:X, 1–7, DOI: 10.1089/can.2021.0032.

#### Abbreviations Used

CBD = cannabidiol  
 NASEM = National Academies of Sciences, Engineering, and Medicine  
 THC =  $\Delta$ 9-tetrahydrocannabinol