

# Cannabis for medical purposes: A cross-sectional analysis of health care professionals' knowledge

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## ABSTRACT

**Background:** Legalization of cannabis use and the evidence base supporting both risks and benefits of cannabinoids are expanding, but our understanding of health care professionals' (HCPs) knowledge about cannabis for medical purposes is limited. Understanding of the knowledge base and knowledge gaps about medical cannabis use is critical to advanced practice registered nurses (APRNs) because they are increasingly called on to manage patients taking multiple drugs, including prescribed and unprescribed cannabis and prescription cannabinoids.

**Purpose:** The purpose of this study was to examine HCPs' knowledge of clinical cannabis, including laws and regulations; risks and harms; pharmacology; and effects on pain, multiple sclerosis spasticity, and seizures as assessed with written tests before an in-person, continuing medical education program.

**Methods:** Total scores and differences among professions and topics were compared.

**Results:** A total of 178 of the 226 program attendees completed the test (79%) (107 [47%] physicians, 30 [13%] APRNs, and 18 [8%] registered nurses). The mean test score was 63.2% (SD = 12.7%) without significant differences among professions ( $F_{(3, 174)} = 1.53; p = .21$ ) but with significant differences among topics ( $\chi^2_{(7, 1068)} = 201.13; p < .001$ ). The score was lowest for effects on seizures (43.8%) and with scores below 70% for all other areas except laws and regulations (85.7%).

**Implications for practice:** There are substantial gaps in HCPs' knowledge about the clinical effects of cannabis, especially about risks and harms, pharmacology, and the effects on pain, multiple sclerosis spasticity, and seizures. Further education may help HCPs to understand the risks and benefits of cannabis and cannabinoids across conditions.

**Keywords:** Cannabis; chronic pain; multiple sclerosis; pharmacology; seizures.

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## Background

In the United States, cannabis remains federally prohibited (schedule 1), but in the past decade, an increasing number of states have legalized the medical and/or recreational use of cannabis. As of November 2020, the use of cannabis for medical purposes is approved by 35 states and the District of Columbia. Fifteen states and the District of Columbia have also legalized the recreational use of cannabis. Fourteen additional states have legalized cannabidiol (CBD) only products (NCSL, 2020). Advanced practice registered nurses (APRNs) are authorized

by at least five states to endorse qualifying conditions for use of cannabis for medical purposes in their patients to support them obtaining “medical marijuana” cards. The growing legalization of cannabis has resulted in increased use of cannabis by the general public and by our patients (Hasin, 2018; Park & Wu, 2017) resulting in APRNs managing more and more patients using, or asking about using, cannabis and cannabinoids. Advanced practice registered nurses must educate patients about relative risks and benefits and monitor for side effects and drug interactions in patients “armed” with cannabis claims from a wide array of sources.

Pain, spasticity, and seizures are common medical conditions for which people use cannabis or cannabinoid preparations. Pain is the leading condition for which patients use clinical cannabis (Bonn-Miller et al., 2014), with moderate evidence for efficacy (Whiting et al., 2015). Spasticity resulting from multiple sclerosis (MS) is the only condition identified as having level one evidence

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for a cannabis preparation being effective (Koppel et al., 2014). Based on mounting clinical trials data, 30 countries, although not the United States, have legalized nabiximols (Sativex), a pharmaceutical produced cannabis-derived oral mucosal spray with a 1:1 tetrahydrocannabinol (THC) to CBD ratio, for the treatment of MS-related spasticity. The Food and Drug Administration (FDA) also recently approved a specific formulation of cannabis plant-derived CBD (Epidiolex) for the treatment of seizures associated with tuberous sclerosis and Lennox–Gastaut and Dravet syndromes (Devinsky et al., 2016, 2017).

Amid this backdrop of increasing legalization and use of cannabis, as well as growing evidence base regarding the potential risks and benefits of cannabis (Friedman et al., 2019; Nugent et al., 2017; Ware et al., 2015; Honarmand et al., 2011; Semple et al., 2005; Cooper & Abrams, 2019), nursing and medical boards across the United States are starting to expect health care professionals (HCPs) to receive education on this topic (FSMB, n.d.). The National Council of States Board of Nursing provide best practice data for APRNs certifying qualifying conditions in patients seeking cannabis for medical purposes (NCSBN Medical Marijuana Guidelines Committee, 2018). Additionally, in Oregon, where medical use of cannabis was legalized in 1998 and recreational use was legalized in 2014, the Oregon Medical Board issued recommendations for continuing medical education (CME) on clinical cannabis in 2016 (Oregon Health Authority, 2016). These recommendations state that a physician who recommends the medical use of cannabis should complete a minimum of three hours of category 1 CME on the topic. This education should ideally occur before making recommendations for the medical use of cannabis to patients and should “explain the proper use of marijuana, including the endo-cannabinoid system, pharmacology and effects of marijuana (e.g., distinction between cannabidiol [CBD] and tetrahydrocannabinol [THC]; methods of administration; and potential side effects or risks)” (Oregon Health Authority, 2016).

## Purpose

To meet the growing need for evidence-based education on cannabis for medical purposes, we launched a half-day CME program on clinical cannabis in Portland, Oregon, for HCPs. This program covered cannabis laws and regulations; risks, harms, and pharmacology of cannabis; and potential benefits for pain, spasticity resulting from multiple sclerosis, and seizures. At the beginning of the program, before the presentations, we evaluated attendees’ knowledge about clinical cannabis with a written test. Here, we present our analysis of overall knowledge about cannabis based on attendees’ test scores, comparisons of knowledge among types of professionals, and comparisons of knowledge among topics. Despite physicians being the only professionals allowed

to certify to qualifying medical conditions for medical marijuana in Oregon, we hypothesized that different HCPs would have similar levels of knowledge about cannabis because all medical professionals receive very little education about cannabis (Morris, 2019). We also hypothesized that there would be specific knowledge gaps concerning the effects of cannabis. We conclude with seven key steps to guide APRN providers when counseling patients who have access to cannabis products.

## Methodology

### Institutional review board approval

This study analyzing knowledge test scores was granted exempt status by the institutional review board of our institution because only deidentified data were used.

### Study participants

Study participants were attendees of an in-person half-day CME program on clinical cannabis. The program was open to all types of HCPs but was primarily promoted to physicians, nurses, and APRNs. Promotion was by e-mail using an academic medical center’s marketing team’s lists of HCPs’ e-mails, identified by state, profession, and specialty.

### Data collection

A paper knowledge test was administered to attendees at the beginning of the CME program. The data are from two offerings of this program, one in March 2018 and the other in October 2019. The test evaluated knowledge about cannabis clinical pharmacology and pharmacodynamics, drug–drug interactions, medical uses of cannabis and cannabinoids for the treatment of pain, multiple sclerosis spasticity and seizures, and adverse effects of cannabis (**Table 1**). The test was developed by the program presenters, edited by people with survey design expertise, and included multiple-choice and true-or-false questions regarding content areas from each of the topics covered. The test was completed anonymously and collected before any of the educational content was presented.

### Statistical approach

Test results from the two programs were combined into a single data set with 31 unique questions. Total and topic scores for each respondent were calculated. Professions were categorized as physician (MD/DO), APRN, registered nurse, and other (e.g., psychologist, physician assistant, dietitian, naturopath). Differences in scores among professions were analyzed by one-way analysis of variance. Differences in scores among topics were analyzed by mixed effects linear regression. Topic scores were also compared with a cutoff of 70% (C grade). Statistical analyses were performed using R version 4.0.0. Data visualizations were performed using the R package ggplot2 version 3.3.0.

**Table 1. Examples of key concepts evaluated in the paper knowledge test given to attendees of the half-day continuing medical education symposium**

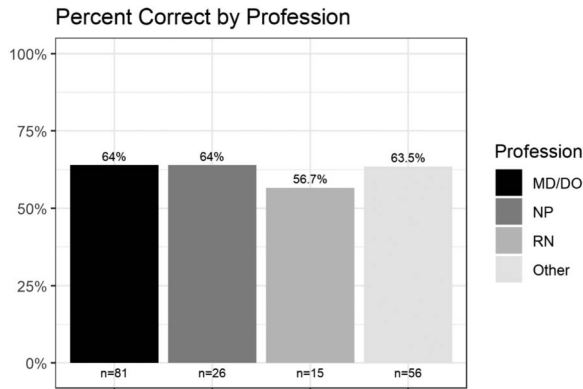
Laws and regulations	<ul style="list-style-type: none"> <li>• The federal government considers there to be no currently accepted medical use and a high potential for abuse of cannabis</li> <li>• There are more states with legal medical marijuana than with legal recreational marijuana</li> <li>• In states where medical marijuana has been legalized, employers may penalize workers for urine tests that are positive for THC</li> </ul>
Pharmacology	<ul style="list-style-type: none"> <li>• There are more than 140 identified cannabinoid compounds in nature, including terpenes, flavonoids, and phytocannabinoids</li> <li>• THC is the major psychoactive component in cannabis. CBD has no intoxicating effects and modulates the action of THC</li> <li>• Oral THC has a slower onset of action than inhaled THC but lasts longer. There are many active metabolites</li> <li>• Scientists have identified two types of cannabinoid receptors (CB1, CB2) and our bodies make cannabinoids that act on them. THC activates these receptors</li> </ul>
Risk/harms	<ul style="list-style-type: none"> <li>• Cannabis use disorder exists, and there are a variety of screening tools available</li> <li>• There are little data on the effects of heavy cannabis use on pulmonary function</li> <li>• Early cannabinoid use is linked to affective, behavioral, cognitive, and neurochemical consequences lasting into adulthood</li> <li>• There is moderate strength evidence that active, long-term cannabis use is associated with small negative effects on all domains of cognitive function</li> <li>• Inhaling cannabis has been demonstrated to increase heart rate and blood pressure, but it is less clear if inhaling cannabis can trigger the onset of a myocardial infarction</li> <li>• The most common reason for cannabis use in pregnancy is nausea and/or vomiting</li> <li>• Half of women who use cannabis prior to pregnancy continue to use while pregnant</li> </ul>
Pain	<ul style="list-style-type: none"> <li>• Pain is the most common reason for medical cannabis use in the United States</li> <li>• Cannabis/cannabinoids demonstrate modest analgesic effect and are generally safe in the management of adults with chronic pain</li> <li>• No specific cannabinoid preparation has been shown in controlled clinical trials to be superior to other cannabinoid preparations for managing pain</li> <li>• At this time, there is insufficient clinical trial data to promote CBD only products for the treatment of chronic pain</li> </ul>
Spasticity in MS	<ul style="list-style-type: none"> <li>• There is level I (high-quality) evidence that cannabinoids can reduce self-reported spasticity in people with MS.</li> <li>• Pharmacologic cannabinoid preparations examined in clinical trials for spasticity in MS generally contain a fixed ratio of THC and CBD</li> <li>• Clinical trials of cannabinoids for spasticity in MS have demonstrated an improvement in patient-rated spasticity but not clinician-rated spasticity</li> </ul>
Seizures	<ul style="list-style-type: none"> <li>• A pharmaceutical grade oral preparation of CBD (Epidiolex) has been proven to reduce seizure frequency in Dravet syndrome and Lennox–Gastaut syndrome</li> <li>• Diarrhea is a common side effect of high-dose Epidiolex in children</li> <li>• Elevated liver enzymes can occur when Epidiolex is used in combination with valproate (Depakote)</li> </ul>
<p><i>Note: CBD = cannabidiol; MS = multiple sclerosis; THC = tetrahydrocannabinol.</i></p>	

**Results**

A total of 226 individuals attended the two iterations of the CME program. Almost half of these were physicians (47.3%, *n* = 107), followed by nurses or APRNs (21.2%, *n* = 48) with 95% residing in Oregon, Washington, or California (*n* = 216).

A total of 178 of the 226 attendees (79%) completed the knowledge test and were included in the analyses. There were no significant differences in proportions of respondents compared with nonrespondents among

professions ( $\chi^2_{(4, 226)} = 5.49; p = .241$ ). The mean total score for all respondents was 63.2% (SD = 12.7%). Total scores did not differ significantly among professions ( $F_{(3, 174)} = 1.53; p = .21$ ) (Figure 1). There was a significant difference in correct response rate between topic areas ( $\chi^2_{(5, 1068)} = 201.13; p < .001$ ). Participants only scored above 70% on questions about laws and regulations and scored below 70% on questions on all other topics, including risks and harms, pharmacology, pain, multiple sclerosis spasticity, and seizures. The highest correct response rate was for



**Figure 1.** Percentage of correct responses by profession. Note: MD/DO = doctor of medicine; NP = nurse practitioner; RN = registered nurse.

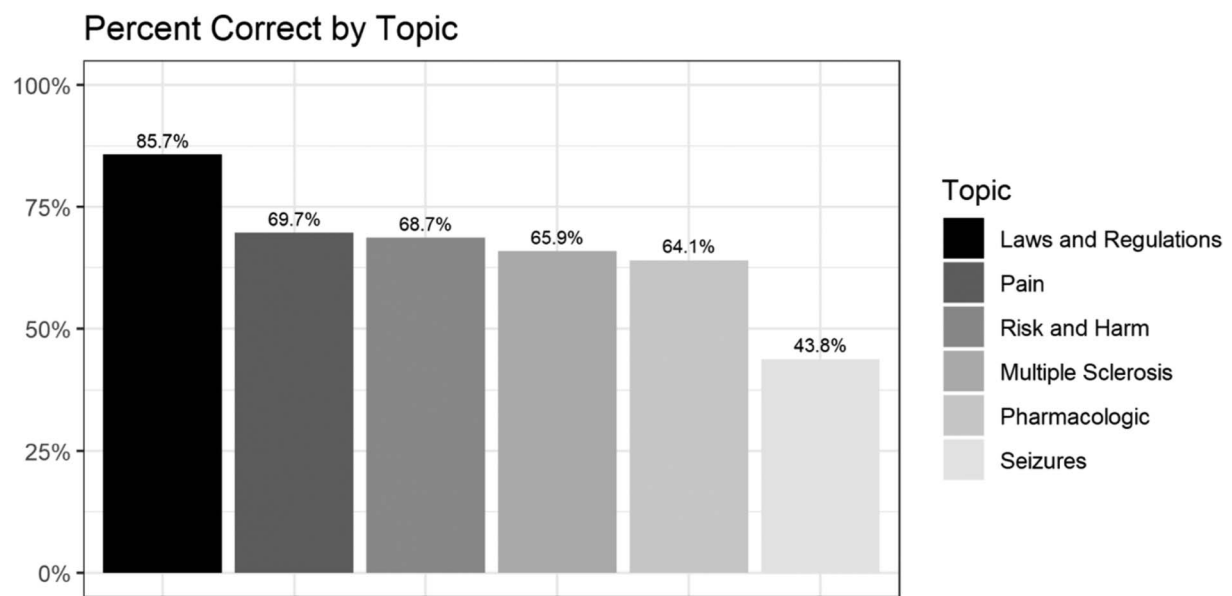
questions about laws and regulations (85.7%). The lowest correct response rate was for questions about seizures (43.8%) (Figure 2).

**Conclusions**

This study found that HCPs’ knowledge about the medical risks and benefits of clinical cannabis, although similar among professions, is generally poor and has specific important gaps. Health care professionals scored an average of only 63.2% on direct knowledge tests about clinical cannabis, with no significant differences among professions. Attendees scored highest on questions about laws and regulations (85.7%). Mean scores for questions related to all other topics, including risks and harms, pharmacology, pain, multiple sclerosis spasticity, and seizures, were all below 70%, equivalent to a C grade. Scores were lowest for questions about the effects of cannabinoids on seizures (43.8%). This is particularly

concerning given that the one FDA-approved cannabis-derived medication is for the treatment of seizures. Furthermore, despite more than 95% of respondents practicing in states (Oregon, Washington, or California) where clinical cannabis had been legal for more than 20 years and recreational cannabis had been legal for at least two years, their knowledge about clinical cannabis was poor. This supports that wide and prolonged availability of cannabis is not sufficient to accomplish provider knowledge and that more education is needed.

Although other studies have measured HCPs’ beliefs or confidence as an indirect measure of their knowledge about cannabis (Ananth et al., 2018; Carlini et al., 2017; Gardiner et al., 2019; Kansagara et al., 2020; Kondrad & Reid, 2013; Mendoza & McPherson, 2018; Morris, 2019; Philpot et al., 2019; Szyliowicz & Hilsenrath, 2019), our study is one of very few directly measuring HCPs’ knowledge about clinical cannabis on a breadth of topics. Although the HCPs and clinical cannabis knowledge measured in other studies differed from those in our study, all consistently found substantial deficits (Ananth et al., 2018; Kansagara et al., 2020; Mendoza & McPherson, 2018). One of these studies, published in 2018, asked 288 pediatric oncology HCPs practicing in Illinois, Washington, or Massachusetts about laws and regulations related to clinical cannabis at the state and national levels. They found that most respondents were familiar with federal regulations regarding cannabis and knew whether their state had legalized medical cannabis (Ananth et al., 2018). This study found that physicians and advanced practice providers in Washington state, who are all eligible to certify for medical marijuana, were more likely to know that cannabis was federally prohibited compared with HCPs who were not eligible to certify. This is in contrast to



**Figure 2.** Percentage of correct responses in each topic category.

our study, which found no difference in knowledge test score between different HCP types. Despite only physicians being eligible to certify for medical marijuana in Oregon, we did not find physicians to be more knowledgeable than other HCPs.

Another study, also published in 2018, assessed 94 hospice-based HCPs' knowledge, skills, and attitudes regarding clinical cannabis before and after an online CME program (Mendoza & McPherson, 2018). Most (58.3%) of their respondents were nurses, with the remainder being social workers (11.4%) or "other" (22.4%). These respondents practiced in 19 different states, and the authors assessed knowledge about cannabis pharmacology, indications for cannabis use, and adverse effects/safety. Before the CME program, scores were poor (41% correct), corroborating our finding that HCPs knowledge about cannabis has substantial gaps. After the program, mean scores improved significantly (78% correct).

A recently published study of HCPs' knowledge about clinical cannabis included 249 Veterans Affairs primary care physicians working in 39 different states (Kansagara et al., 2020). There were four true/false questions about clinical cannabis formulations and the effects of CBD and THC. These respondents also had substantial knowledge gaps, with mean correct response rates for the knowledge-based questions ranging from 34% to 80%.

Our study has several strengths that uniquely contribute to our current understanding of HCP's knowledge about the neurological effects of cannabis. We examined and compared the knowledge of physicians, APRNs, and registered nurses, and we measured HCPs' direct knowledge, rather than knowledge confidence, about clinical cannabis. In addition, all of the test developers had research experience and direct clinical experience working with patients using cannabis for medical purposes.

Our study also has certain limitations. Participants had enrolled in a CME program about clinical cannabis. Therefore, they may have been particularly interested in this topic or aware that they could benefit from further education. In addition, this was a small sample of each profession. This sample may not represent the general HCP community or those currently recommending cannabis to their patients. Although the knowledge test used in this study was developed by experts in the field and edited by people with survey design expertise, this test has not been validated.

## Implications

Our findings are particularly important for APRNs. Advanced practice registered nurses often independently manage a large panel of primary care patients, including many with chronic pain and other highly symptomatic chronic illnesses that may have evidence of benefit for cannabis. Advanced practice registered nurses should not expect that their patients will receive adequate

medical information about cannabis use for medical purposes where they obtain their cannabis. Although some dispensary workers are quite knowledgeable about cannabis, requirements of dispensary workers vary widely among states and are generally limited to a background check and knowledge of cannabis laws. Do not presume that all dispensary workers provide accurate medical information, obtain a medical history, counsel about drug-drug interactions, or are educated about the medical effects of cannabis or the conditions for which medical marijuana is recommended. Purchasing cannabis products online can be even more fraught with challenges. Many cannabis products marketed online have inaccurate medical claims and inaccurate information about cannabinoid potency and the presence of contaminants, such as molds, pesticides, and solvents (Bonn-Miller et al., 2017; Vandrey et al., 2015).

Whether the provider's jurisdiction allows APRNs to certify (attest/authorize) qualifying conditions for the use of cannabis for medical purposes, the provider is increasingly expected to counsel patients who have access to, and often use, cannabis products. As such the National Council of State Boards of Nursing recommends that the APRN shall 1) perform an in-person, clinical assessment for a comprehensive and systematic assessment of the patient; 2) review current and past treatments and response to treatments; 3) complete a thorough medication reconciliation and prescription drug monitoring program review; 4) evaluate mental health, alcohol, and substance use history-seeking consultation or referral if necessary; 5) gather data regarding patient's values, preferences, needs, and knowledge related to cannabis use; 6) consider the available scientific evidence regarding the qualifying condition; and 7) determine an ongoing monitoring and evaluation plan for the patient (NCSBN Medical Marijuana Guidelines Committee, 2018). In light of these challenges, expectations, and responsibilities, it is imperative that APRNs are knowledgeable about the clinical effects of cannabis and cannabinoids and also that gaps in knowledge are addressed.

In conclusion, the findings of this study support that, despite a growing evidence base, and even after many years of legalization, HCPs including APRNs have substantial gaps in their knowledge of the potential risks and benefits associated with the use of cannabis for medical purposes. Test scores suggest high levels of knowledge about laws and regulations (85.7%), lower levels of knowledge about cannabis risks/harms (68.7%), pharmacology (64.1%), effects on pain (69.7%) and multiple sclerosis spasticity (65.9%), and the lowest level of knowledge about effects on seizures (43.8%) despite seizures being the only currently FDA-approved use of a cannabinoid formulation. These knowledge gaps may negatively affect the quality of patient care. As cannabis and cannabinoid products become more widely

available, approved HCPs, including APRNs, should seek out education to improve their knowledge base and be ready to accurately and effectively counsel their patients about the clinical effects of cannabis using an evidence-based approach.

**Authors' contributions:** All authors are responsible for the conception and design of the work, interpretation of the data, drafting and revising the manuscript, and final approval. All have agreed to be accountable for all aspects of the work.

**Competing interests:** J. Rice has payment and consulting from Greenwich Biosciences. M. H. Cameron has payment and consulting from Greenwich Biosciences, Adamas Pharmaceuticals and Heliuss Medical. The remaining authors report no conflicts of interest.

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