

Online patient-provider cannabis consultations.

Article Metadata

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Journal: Prev Med

Year: 2020

Volume/Issue: 132/None

PMID: 31954143

DOI: 10.1016/j.ypmed.2020.105987

PubMed URL: <https://ncbi.nlm.nih.gov/pubmed/31954143>

Full Text (from PubMed Central)

<https://pmc.ncbi.nlm.nih.gov/api/oai/v1/mh/>

oai:pubmedcentral.nih.gov:7035882

pmc-is-collection-domain

NIHPA Author Manuscripts

10.1016/j.ypmed.2020.105987

Online Patient-Provider Cannabis Consultations

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Cannabis has been legalized, decriminalized, or medicalized in over half the U.S. states. With restrictions on cannabis research, accepted standards to guide clinical practice are lacking. Analyzing online communications through a digital health platform, we characterized patient questions about cannabis use and provider responses. Coded for content were 4,579 questions posted anonymously online between March 2011 through January 2017, and the responses from 1,439 U.S. licensed clinicians. Provider responses to medical cannabis use questions were coded for sentiment: "negative", "positive", and "mixed." Responses could be "thanked" by patients and receive "agrees" from providers. The most frequent themes were detection of cannabis use (25.3%), health harms (19.9%), co-use with other substances (9.1%), and medical use (8.2%). The 425 medical cannabis use questions most frequently related to treatment of mental illness (20.3%), pain (20.0%), and cancer care (6.7%). The 762 provider responses regarding medical cannabis use were coded for sentiment as 59.5% negative, 28.6% mixed, and 11.8% positive. Provider sentiment was most positive regarding cannabis use for palliative care and most negative for treating respiratory conditions, poor appetite, and mental illness. The proportion of positive sentiment responses increased from 17.6% to 32.4%. Provider responses coded as negative sentiment received more provider "Agrees" (mean rank=280) than those coded as positive (mean rank=215), beta coefficient=0.33; 95% CI: 0.05, 0.62;

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Since 2002, adult use of cannabis has been increasing.

Currently, 34 states, the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands have legalized cannabis for the treatment of medical conditions.

At the federal level, cannabis remains illegal. The U.S. Federal Drug Enforcement Agency (DEA) classifies cannabis as a Schedule I substance, which is reserved for drugs with a high potential of abuse and no accepted medical value. Schedule I requires the highest level of DEA permission and background checks to study cannabis and its constituents.

To consolidate research findings toward a consensus, in 2017, the National Academies of Sciences, Engineering, and Medicine (NAS) published a comprehensive in-depth review of 10,000 studies investigating what could conclusively be said about the health effects of cannabis.

States that have legalized cannabis for medical purposes list qualifying conditions, which do not necessarily map to the evidence-base. California, the first state to legalize medical cannabis in 1996, references medical cannabis for the treatment of "cancer, anorexia, AIDS, chronic pain, spasticity, glaucoma, arthritis, migraine, or any other illness for which marijuana provides relief."

The NAS 2017 report also summarized evidence of the adverse health effects of cannabis use, identifying **substantial evidence of worsened respiratory symptoms with long-term cannabis smoking**; lower birth weight of offspring following prenatal exposure; and the development of schizophrenia or other psychoses, with the highest risk among the most frequent users.

Patients are more likely to initiate a discussion about medical cannabis for treatments than their provider.

With the expanding legalization of cannabis use, **more** patients are likely to seek direction from clinicians. Online platforms provide an opportunity for patients to seek medical advice, in some cases with anonymity. Digital health communication platforms increase accessibility, and when catalogued and analyzed for research, can provide novel insights.

Analyzing patient-provider online communications through an anonymous digital health platform, we aimed to characterize patients' questions about cannabis use and analyze provider sentiment in their responses to patients' questions concerning medical cannabis use. The digital health platform allows for patients visiting the site to indicate satisfaction or "Thanks" for a provider response and for other providers to indicate their endorsement of a provider's response through an "Agrees" function.

Study Design and Setting:

This research is an exploratory analysis of patient questions concerning cannabis use and the corresponding responses from U.S. licensed clinicians. Patient questions and provider responses were posted online between March 2011 through January 2017 on the HealthTap digital health service. HealthTap has a repository of anonymous patient questions on all types of health-related topics with responses from 140,000 U.S.-licensed clinicians. Providers find out about HealthTap through a variety of sources (e.g., press coverage, word-of-mouth, email outreach), can sign-up for free, choose how actively they participate, and can search and respond to questions on topics where they have experience and expertise. Questions are also directed to providers based on their specialty. This study had no direct contact or engagement with participants, as the HealthTap data existed and are publicly available. Hence, the study qualified for an exemption from Stanford University's Institutional Review Board.

Data Identification and Coding:

To identify patient questions of interest, the study team created a list of cannabis-related keywords (e.g., marijuana, cannabis, THC, CBD, weed), which was utilized by a HealthTap collaborator to identify and extract patient questions concerning cannabis and the corresponding provider responses. Cleaning, coding, and analyses were conducted from February through December 2018. Initial data cleaning was performed to remove irrelevant questions. For coding of themes, a grounded theory approach was utilized.

One team member coded all patient questions. A random sample of 5% of the questions and provider answers were independently double coded by a research associate, and percentage of agreement was determined to be 85.2% for coding of patient questions ($\kappa=.82$); 89.7% for medical

cannabis treatment categories ($\kappa=.88$); and 85.0% for provider sentiment ($\kappa=.74$). Coding for themes (questions and provider responses to treatment codes) was conducted in ATLAS.ti Qualitative Data Analysis version 7.

For patient questions concerning medical cannabis use, a second level of coding for the health condition of interest (e.g., cancer, pain;

Simple counts summarized patient cannabis-related questions over time. Frequencies were calculated to summarize the cannabis-related word tag identifiers in patients' questions and the themes of the patient questions. Mean ranks and medians were calculated to summarize patient "Thanks" and provider "Agrees" for the provider responses to questions regarding medical use of cannabis. A multinomial generalized linear mixed model (GLMM) with a logit link

A search of 23 unique keywords pertaining to cannabis identified a total of 18,447 questions. Removing duplicated questions due to multiple keywords or more than one provider responding, the dataset was reduced to a unique set of 5,160 questions. Removing questions unrelated to cannabis, the final sample was 4,579 questions. As indicated in

The final response set was 6,891 responses from 1,439 clinicians licensed in 50 states and the District of Columbia. Most frequently represented provider specialties were psychiatry (12.7%), family medicine (11.3%), internal medicine (8.5%), pediatrics (4.9%), clinical psychology (3.5%), obstetrics and gynecology (3.0%), dentistry (2.9%), ophthalmology (2.4%), pain management (2.3%), neurology (2.2%), addiction (1.9%), general practice (1.7%), and general surgery (1.6%). Provider responses to patient questions were posted from March 15, 2011 through the dataset extraction period of January 16, 2017. During this time, the response frequency rose to a peak in early 2013 (

Patient question themes:

The 4,579 patient questions received 5,211 content codes. Most frequently asked were questions regarding detection and elimination of cannabis or cannabis chemicals (e.g., THC, cannabis oil, CBD; 25.3%); followed by negative health effects, including neurocognitive adverse effects (19.9%); co-use with illicit drugs, alcohol, tobacco, or prescribed medications (9.1%); medical cannabis use (8.2%); use with existing health conditions or medical procedures (8.1%); effects on conception, pregnancy, and breastfeeding (7.0%); addiction (5.1%); secondhand exposure, including around youth (3.8%); use by minors (2.3%); use as a harm reduction alternative (2.3%); legality of use (1.5%); and dosing (0.4%) (

A total of 425 patient questions concerned medical cannabis use. One question could focus on multiple medical uses, which led to a total of 464 treatment codes, in order of frequency: mental illness (20.3%); pain (20.0%); cancer, including lung cancer (6.7%); sleep issues (6.7%); eye conditions (6.5%); conditions of the central nervous system (6.0%); conditions of the bone, joints, skin and other tissues (5.0%); respiratory conditions (e.g., COPD, asthma) (3.7%); stomach and digestive conditions (3.2%); nausea (3.0%); endocrine disorders (2.6%); poor appetite concerns (1.5%); and palliative care (0.9%). Another 8.6% of questions concerned the general medical helpfulness of cannabis, 3.0% medical cannabis cards and state laws, and the remaining 2.4% a myriad of low frequency (< 2 questions) on specific health conditions coded collectively as "Other" (

Provider response sentiment regarding medical cannabis use:

A total of 762 provider responses to patient questions regarding medical use of cannabis were posted online by 358 clinicians licensed in 46 states and the District of Columbia. Responses per provider ranged from 1 to 58, with a mode and median of 1. Coding indicated provider response sentiment toward medical cannabis use was 59.6% negative, 28.6% mixed, and 11.8% positive (

Of the 358 clinicians responding to patient questions on medical cannabis use, 58.5% were licensed in states where cannabis use was legalized, 40.7% in states where cannabis use was not legalized, and 0.8% did not have their state listed. Providers' response sentiment did not differ significantly by state legalization status, for negative ($\beta=0.41$; 95% CI: -0.14 , 0.95 ;

"Agrees" and "Thanks":

The 762 provider responses concerning medical cannabis use received 852 patient "Thanks" and 1,288 provider "Agrees." The number of "Thanks" per response ranged from 0 to 31, with a mode and median of 1; 48.0% of provider responses received at least one patient "Thanks". "Thanks" did not differ significantly by provider response sentiment (negative [$\beta=0.07$; 95% CI: -0.40 , 0.53 ;

In a database of online patient-provider consultations from a publicly available digital health service, keyword searches identified nearly 5,000 unique patient questions related to cannabis use, confirming public interest. Keywords of marijuana, weed, THC, and cannabis, were most commonly used by patients in reference to the product, and future health care research will benefit from focusing on these terms. The number of patient questions rose to a peak in early 2013 with rising interest likely reflecting public discussion and increased state legalization in our study period from 2011 through 2016, and then declining numbers likely due to the database becoming saturated over time or as public information and understanding grew. The questions and responses are maintained on the site for others to search, reducing the need to ask the same questions overtime. Our patient-response data were posted up until January 2017, and it is likely that we captured the leading contemporary question themes concerning cannabis use in the U.S.

The detection and elimination of cannabis was the topic of most frequent interest, accounting for 1 in 4 questions, asked often in relation to employers. Cannabis is federally scheduled as a Class I substance, continues to be illegal for medical use in 16 states,

Responses yield insight into providers' opinions of the medical uses of cannabis. Provider sentiment toward medical cannabis use tended to be negative overall though varied by medical concern of interest. Most negative was sentiment regarding cannabis use for the treatment of respiratory disorders, mental illness, and poor appetite. Sustained use of inhaled combusted products will cause respiratory harm, and use of cannabis in other forms (e.g., oils, wax, edibles) is not supported as a treatment for respiratory conditions. For mental illness, rather than a treatment, the evidence implicates cannabis use in the development of psychosis, particularly with longer duration of use and use of high-potency cannabis.

In contrast, there was greater clinician support for cannabis use in palliative care. Similarly, in a national survey of hospice professionals, 91% reported support for cannabis use in hospice patients.

Overall, variability was observed in provider sentiment, suggesting the need for consensus building in the field, the development of clinical practice guidelines, and dissemination through medical education (i.e., instruction on medical cannabis and cannabinoid research). Of 101 medical school deans surveyed nationally, 66.7% reported that their graduates were not at all prepared to recommend cannabis.

The proportion of positive sentiment increased from 2011 to 2016, though the numbers were too small to test statistically by treatment code. A possible catalyst for the shift may be the U.S. Department of Justice's decision in late 2013 to no longer challenge state cannabis law; publicized legalization of medical cannabis use in New York and Minnesota; and/or the passing of a senate spending bill in 2014 that blocked the Justice Department from funding enforcement of federal cannabis law in states where cannabis had been legalized.

A novel summary of online patient-provider communications regarding cannabis, the current study has limitations. Patients' questions were posted anonymously, which limits understanding of the data origins. People could have posted multiple cannabis-related questions, within or across themes. Given the anonymous platform provided to patients, we were unable to control for dependency in the dataset of question. The providers were identified and their responses were posted publicly, which may have constrained their advice. Purely observational, this study did not assess patient experience, potential use of cannabis, or past medical history, information sources guiding provider opinions, or the overall patient-provider experience. The features for "Thanks" and "Agrees" could be influenced by factors other than content, such as patient gratitude that they received a response or how long an answer was on the site, the latter was controlled for in analyses. The political and controversial nature of discussions regarding cannabis, its health effects, and its legalization may create self-selection by providers who are adamant proponents or opponents of cannabis. Although this study's exploratory findings generally cannot provide strong inferential evidence, they do illustrate a well-reasoned set of themes and inferences to inform future hypotheses. Lastly, though not an in-person clinical interaction, virtual medical contacts are increasingly common, and patients may be more open in their communications on cannabis in a virtual context.

In the U.S., cannabis use is on the rise and practicing clinicians are likely to encounter a growing number of questions from their patients. While most provider comments online tended to view medical cannabis use negatively, the proportion of positive sentiment increased over time. Variability in provider responses suggest the need for more research, consensus building, and provider education to inform best practices and evidence-based guidelines for clinical care.

We would like to thank Eric J. Daza, DrPH, MPS (Clarify Health Solutions) and Michael Baiocchi, PhD (Stanford University, Department of Medicine, Stanford Prevention Research Center) for their statistical guidance.

This work was supported by the National Institutes of Health NIH 5 T32 HL007034-43 [KG]

The specific role of the funding organization or sponsor in design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication: None

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Conflict of Interest statement

The authors declare that there are no conflicts of interest

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Citation

Gali K, Narode R, Young-Wolff KC, Rubinstein ML, Rutledge G, Prochaska JJ. Online patient-provider cannabis consultations.. Prev Med. 2020. DOI: 10.1016/j.ypmed.2020.105987

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