

Marshall University

Marshall Digital Scholar

Theses, Dissertations and Capstones

2023

Benefits of medical THC for neurological disorders in the U.S.

Andrew Lester

andrewlester000@gmail.com

Alexandria Gartin

Follow this and additional works at: <https://mds.marshall.edu/etd>



Part of the [Business Administration, Management, and Operations Commons](#), [Health and Medical Administration Commons](#), and the [Nervous System Diseases Commons](#)

Recommended Citation

Lester, Andrew and Gartin, Alexandria, "Benefits of medical THC for neurological disorders in the U.S." (2023). *Theses, Dissertations and Capstones*. 1772.

<https://mds.marshall.edu/etd/1772>

This Research Paper is brought to you for free and open access by Marshall Digital Scholar. It has been accepted for inclusion in Theses, Dissertations and Capstones by an authorized administrator of Marshall Digital Scholar. For more information, please contact beachgr@marshall.edu.

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

BENEFITS OF MEDICAL THC FOR NEUROLOGICAL DISORDERS IN THE U.S.

ABSTRACT

Introduction: The introduction of THC into the medical field has allowed medical professionals to offer a new treatment option to aid in their patients treatment plan by decreasing their symptoms of side effects of other medications used for their conditions.

Methodology: This study utilized a literature review. Five databases were used to collect 116 total sources. These sources were reviewed and reduced to 33 sources that were used in the written research. Of these, 16 sources were used in the results section.

Purpose of the Study: The purpose of this research was to analyze the prescription use of THC in patients with chronic pain conditions, such as neurological disorders, to determine if THC has a positive impact for patients. Despite the ethical barriers that are present regarding the use of THC, researchers and healthcare professionals are using THC as part of treatment plans for patients with neurological disorders to ease pain and symptoms from the disorder and side effects of medications.

Results: The research showed that with the correct dosage of THC prescribed by medical professionals, patients have reported decreased pain levels and decreased signs and symptoms, despite taking their other medications.

Discussion/Conclusion: Patients with various medical conditions associated with chronic pain, such as neurological disorders, can receive benefits through THC that is prescribed from a doctor. The findings of this research showed that patients with neurological disorders can have decreased side effects from their other medications, as well as decreased pain levels in their day to day life.

Keywords: ‘Tetrahydrocannabinol’ (THC), ‘Cannabis’, ‘Neurological Disorders’, ‘Pain’, ‘Symptoms’, ‘Marijuana’

INTRODUCTION

Some researchers and medical professionals have considered Tetrahydrocannabinol (THC) to help ease symptoms and side effects that have been caused from certain medical conditions, without the intoxicating or mood-altering effects that are associated with recreational use of marijuana (Urits, Charipova, & Gress, 2021). There has been an increased interest in the role of medical THC with treating various medical conditions (Klein & Clark, 2022). THC has allowed many physicians and other healthcare professionals to provide a treatment to benefit patients with certain medical conditions, such as neurological disorders (Gupta, 2022). Patients who have been diagnosed with a neurological disorder, most likely have symptoms such as weakness, tingling, numbness, muscle stiffening, to name a few (Klein & Clark, 2022). Although these symptoms or diseases cannot be cured, their symptoms and pain can be relieved and decreased using prescription THC (Solimini et al., 2017). The U.S Food and Drug Administration (FDA) approved various THC based medications in various forms such as liquid, pill, oil, powder, and dried leaves, which has been only available to patients by a licensed healthcare provider, dependent on the state in which an individual resides (NIDA, 2021).

Some patients have found relief for their neurological disorder through various THC treatments (Kruger & Kruger, 2021). However, due to the current drug classification of marijuana in the US, in addition to its legality in different states, medical research has been limited (McKenna, 2014). The Drug Enforcement Administration (DEA) has classified THC as a schedule 1 drug, which has been defined as drugs with no currently accepted medical use and a high potential for abuse (DEA, 2023).

Some studies have suggested that using THC can have some negative health outcomes and unintended consequences. Adverse side effects from THC can include increased heart rate,

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

dizziness, impaired concentration and memory, decreased reaction times, increased appetite, and increased risk of heart attack and stroke (Berger, 2021). These adverse effects can be the result of short term or long term use and can range from mild to severe (NIDA, 2021). Short term adverse effects reported included: impaired short term memory, impaired motor coordination, and altered judgment. These effects can in turn lead an individual to have difficulty learning and retaining information, driving, or making decisions, among other things, which can then lead to injury or other negative health outcomes (Berger, 2021). Long term adverse effects have included: risk of addiction, altered brain development, symptoms of bronchitis, and increased risk of chronic psychosis disorders, among others (Volkow, et. al., 2014).

For many years, THC has been federally prohibited in the United States (US). However, 33 states and Washington D.C. have all passed laws legalizing THC for medical use to provide benefits to patients with certain medical conditions (McKenna, 2014). This change in legislation has increased the number of patients who use marijuana for medical purposes, as well as increased the number of medical marijuana dispensaries located within the US (Cook et al., 2020). In addition, the number of physicians who have participated in research and prescribed medical THC has also increased (Cook et al., 2020). According to the World Health Organization (WHO), THC has been the most cultivated, trafficked, and abused illicit drug worldwide. Additionally, THC consumption has an annual prevalence rate of around 2.5% of the global population (World Health Organization, 2023). Medical THC use has continued to rise, as shown by the increase in states legalizing use for certain medical conditions and symptoms (Bridgeman, et. al., 2017).

The most common use of THC in the US is for pain control (Russo, 2021). Researchers along with medical professionals, offered patients with certain medical conditions prescriptions

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

for THC to manage their pain, in addition to undergoing other medications and treatments (NIDA, 2021). However, THC benefits have only been shown in some patients, depending on their diagnosis. Neurological disorder symptoms can be decreased through the use of medical marijuana due to the affected pathways in which the consumption of medical marijuana also affects (Borgelt, Franson, & Nussbaum, 2013). According to Peter Grinspoon, MD, THC has not been as effective for a patient with broken bones or a post surgical patient (Grinspoon, 2020). THC has shown to be most effective for patients with chronic pain (Vickery & Finch, 2020). Patients can receive prescriptions in forms of pills, liquid, oil, or powder depending on the patient's medical history, diagnosis, state in which patients reside in, and the medical provider who is providing the prescription (Cook et al., 2020).

The purpose of this research has been to analyze the prescription use of THC in patients with chronic pain conditions, such as neurological disorders, to determine if THC has a positive impact for patients, despite the ethical barriers that are present regarding the use of THC.

Specifically, patients with neurological disorders have been shown to benefit from using THC to alleviate symptoms from their neurological disorder, as well as decrease side effects from medications they are currently using (Vickery & Finch, 2020). As a result, this allows patients with neurological disorders to have an increased quality of life (Borgelt, Franson, & Nussbaum, 2013).

METHODOLOGY

The hypothesis of this study was: patients who have been diagnosed with certain medical conditions, such as neurological disorders, will have decreased symptoms and pain relief with the correct dosage of THC.

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

The intended methodology for this study consisted of a qualitative literature review with an anonymous, open-ended survey with experts in the field of medical THC, as well as their patients who use medical THC. This survey was approved by the Marshall University IRB. Research articles and peer-reviewed literature were located using Marshall University's EbscoHost, CINAHL, ProQuest, and PubMed research databases. When information could not be located within these databases, Google Scholar was utilized. In addition, the google search engine was used to research government and private associates websites. Key words used in the search 'THC' OR 'cannabis' AND 'neurological disorders' AND 'pain' OR 'symptoms' OR 'benefit'. The thirty-three articles were reviewed and were limited to the English language and were all published from the years of 2012 to 2023. The search identified 104 relevant citations and articles were excluded (N=85) if they did not meet inclusion principles. Articles were included (N=33) if they described medical THC benefits or limitations, articles from other sources (N=12) were also included in this search. These 33 references were subject to full-text review, and these 31 citations were included in the data abstraction and analysis. Only 16 references were used in the results section. (PRISMA, Figure 1).

A professional presentation was also utilized as a source of research for vital data that contributed to the literature review. The information gained from these articles, websites, and the presentation were used as the sources of primary and secondary materials. Following the review of relevant abstracts, appropriate articles were used for the reporting of information and conclusions. This research was completed by AG and AL and validated by AC who acted as the second reviewer and determined if the references met inclusion criteria.

RESULTS

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

Medical THC has been known to offer pain management and relief of symptoms for patients with chronic pain, which is reported in more than 50 million adults living in the US (Poli et al., 2018). The use of THC for medical purposes has given patients an option to manage pain in a safer and controlled way through various medical professionals. Medical THC has offered many benefits to patients, regardless of their chronic pain condition or diagnosis, such as reduced pain, decreased muscle spasticity, improved sleep, increases appetite, reduces nausea, and decreases anxiety, depression, and stress levels, which overall has improved the mental health and quality of life (Mücke et al., 2018). Medical professionals reported decreased pain levels in 88% of patients who used medical THC (National Academy of Sciences, 2017).

By increased prescription of opioids to patients, this results in higher chances of opioid abuse, as well as illegal consumption of opioids, which can have an increased impact on the issue of opioids in the United States (Greenwell, 2012). Although this is not the case for all patients who have been prescribed opioids, it has been shown that 30% of patients prescribed opioids become addicted to them, in the United States (Webb & Webb, 2019). Through research, prescribed THC has become increasingly popular due to the effects shown to help many medical diagnoses, including neurological disorders. It was noticed that with the correct dosage of THC, patients can receive pain management benefits for neurological disorders and other medical problems, without having the intoxication of recreational use that THC offers (Aviram et al., 2021). 78% of patients who were diagnosed with a neurological disorder, reported decreased pain levels and improved everyday life, once prescribed THC (Aviram et al., 2021). Many patients who have been diagnosed with a neurological disorder, have the condition for the rest of their life, causing patients to take various medications throughout their life, which can result in various side effects from these medications (Mücke et al., 2018). Side effects from medications

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

can include nausea, muscle weakness, confusion, or cognitive changes, numbness, as well as anxiety and depression. In addition, the correct dosage of THC can provide relief to not only physical symptoms, but to psychological symptoms that can be side effects of various medications, such as depression, anxiety, and insomnia (Poli et al., 2018).

In 2021, in a study published from Medical Cannabis and Cannabinoids, conducted a study in adults living in the United States who were diagnosed with a neurological disorder, or another medical condition, who reported using medical THC for their condition (Schauer et al., 2021). As shown in Figure 2, patients were placed in various age categories and separated into neurological disorders vs non-neurological disorders to compare the findings of how many adults reported using medical THC to help with a neurological disorder compared to individuals who used medical THC and had another medical condition (Schauer et al., 2021). The study reported higher percentages of patients using medical THC who had been diagnosed with a neurological disorder, compared to other medical conditions, across all age categories. Although further research could be completed to verify findings, the findings of this study could be due to the beneficial factors that are higher in patients using medical THC to aid in treatment of their neurological disorder, compared to patients using medical THC for other medical conditions (Vidot et al., 2021).

As of 2022, a study published by The College of Medicine and the Medical Association of Malawi, looked at the percentage of patients who reported improvements after using medical cannabis with various medical conditions in 2020. In this study, participants were divided in categories based on their age and diagnosed medical condition of Crohn's Disease, Post-Traumatic Stress Disorder (PTSD), Alzheimer's Disease, Cancer, or Epilepsy, which is a common neurological disorder (Bandawe, 2022). The study reported that patients diagnosed with

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

epilepsy reported higher benefits of using medical cannabis to aid in their treatment plan of their epilepsy medication (Bandawe, 2022). It is important to note that despite age differences and medical conditions, all patients did receive some benefits to medical cannabis, however higher percentages were reported specifically in patients with epilepsy, a common neurological disorder. Thus, it has shown researchers, as well as other healthcare professionals, that medical cannabis can provide benefits for patients who have been diagnosed with a chronic medical condition (Rosenthal & Pipitone, 2022).

Through the anonymous survey sent to local healthcare clinics in West Virginia, ten participants responded to the survey, however only four participants reported using THC for medical purposes. Ten questions were asked based on the patient's prescription use of THC, how often the patient has used their prescription, the medical condition in which they have been diagnosed with, and if their symptoms and side effects from other medications have improved since using THC. The survey reported that all participants were not using medical THC for a neurological disorder, however it was reported that despite the medical condition, all participants reported improved symptoms and/or side effects.

Through years of research, It has been shown that THC can offer multiple benefits for medical use, however research has also shown side effects, adverse events, and other negative outcomes from THC use. According to an article from the Mayo Clinic, when the question of “Is medical marijuana safe?” is posed, the list of possible side effects include: potential for addiction, hallucinations or mental illness, and increased risk of heart attack or stroke, among other common side effects (mayoclinic.org, 2021). This shows that the use of medical THC, though it has benefits, may not be entirely absent of adverse effects (Greenwell, 2012). However, this is true of many commonly used medications and medical treatments. For example, some side

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

effects of chemotherapy, a commonly used cancer treatment, include: easy bruising and bleeding, infection, anemia, nausea and vomiting, sores, nerve problems, kidney problems, and mood changes, among others (American Cancer Society, 2023). Thus, the question becomes do the benefits outweigh the risks.

One significant concern and debated topic about the use of THC is its addictiveness and effect on the brain. According to the Centers for Disease Control and Prevention, some people who use marijuana (which contains THC and is commonly used for medical purposes stated in this study) will develop marijuana use disorder. This disorder is defined as the inability of an individual to stop using marijuana even though it is causing health and social problems in their lives. According to the CDC, studies have shown that approximately 30% of people who use marijuana have marijuana use disorder, and it is estimated that people who use cannabis have around a 10% likelihood of becoming addicted. The disorder is characterized by a list of warning signs, including, but not limited to: marijuana cravings, experiencing withdrawal symptoms when stopping marijuana use, continuous marijuana use despite physical, psychological, social, or relationship problems, and trying but failing to quit using marijuana (cdc.gov, 2020).

Using THC for medical purposes may also have unintended effects on the brain, especially for adolescents and frequent users. According to studies by the National Institute on Drug Abuse, evidence from animal research, as well as increasing human studies show that marijuana exposure during development can cause long term or permanent adverse changes to the brain. In mice, adolescents who were exposed to THC showed problems with learning and memory tasks later in life, and were shown to have an altered reward system, increasing the chances that an animal will self administer other drugs. Additionally, rats exposed to THC also showed cognitive impairments related to structural and functional changes in the hippocampus.

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

However, studies of marijuana's effects on the human brain have shown more mixed results; some showing normal brain function, and others showing significant changes to both the brain structure and cognitive abilities (U.S. DHHS, 2021).

In addition to negative effects related to cognitive abilities, THC in general can cause adverse effects, and reactions with different medications. Generally, adverse effects include things like anxiety, dry mouth, cough, dizziness, eye irritation, bronchitis, among other relatively mild reactions. However, THC can have more serious interactions with certain drugs. For example, THC can interact with Clobazam, by raising the levels of clobazam in children treated for epilepsy (Geffrey, 2015). Additionally, alcohol increases THC levels in the body. According to the District of Columbia Department of Health, serious adverse effects are rare, but are more common among adolescents. The highest levels of concern involving THC use are its possible drug interactions (Abrams, et. al., 2023).

DISCUSSION

The purpose of this research was to analyze prescription use of THC in patients with chronic pain symptoms, such as neurological disorders, despite the ethical barriers that are present regarding the use of THC. The results of the literature review and the interview with an expert in the field have demonstrated a positive correlation between the correct dosage taken by patients with neurological disorders can see decreased pain levels, as well as decreased side effects from other medications.

The research completed did have limitations. The literature review was limited to the majority of available research found with keywords used focused on THC and neurological disorders. Long term effects associated with prescriptions of THC were not abundant in the databases searched. Other limitations included lack of research available for patients who

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

reported symptoms of addiction after using prescribed THC to help their medical condition or patients who previously used opioids as a pain management and then switched to using THC. In addition, the anonymous survey that was conducted locally, presented limitations as it was only released to a certain number of individuals, in which only 40% of those individuals reported using medical THC. Other limitations of this anonymous survey were small populations and the survey only covered a small portion of research topics that were discussed throughout other research outlets. There was also the possibility of bias within the publishers of the articles utilized. Moreover, researcher and Expert bias could have also played a role.

Additional research is needed in order to report additional findings for the benefits of medical THC, in order for more people to be open to this treatment plan. Additional studies need to be completed to report findings on the number of patients who have reported decreased pain levels and if anything else changed along with their medications. Also, additional information could be provided if any other form of treatment plans changed, as well as if any other improvements can be reported. For patients who have reported decreased pain levels from using their prescription THC, additional research needs to be completed on what other medications patients have used, in addition to what times other medications were taken throughout the day, including what time the THC prescription was taken to see if this has any effect on patients' reports. As for our findings through the anonymous survey, a larger group of patients should be surveyed for future studies to get additional results, as well as exclude certain populations to focus on patients with certain medical conditions.

CONCLUSION

As a result of this research, the correct dosage of THC can provide relief for patients who suffer from a medical condition, such as neurological disorders. Of the research available, there

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

are some ethical barriers within the United States still present on whether or not THC should be used as a treatment plan for patients who suffer from chronic pain, despite their medical condition. Therefore, the hypothesis of this research has been supported by this literature review.

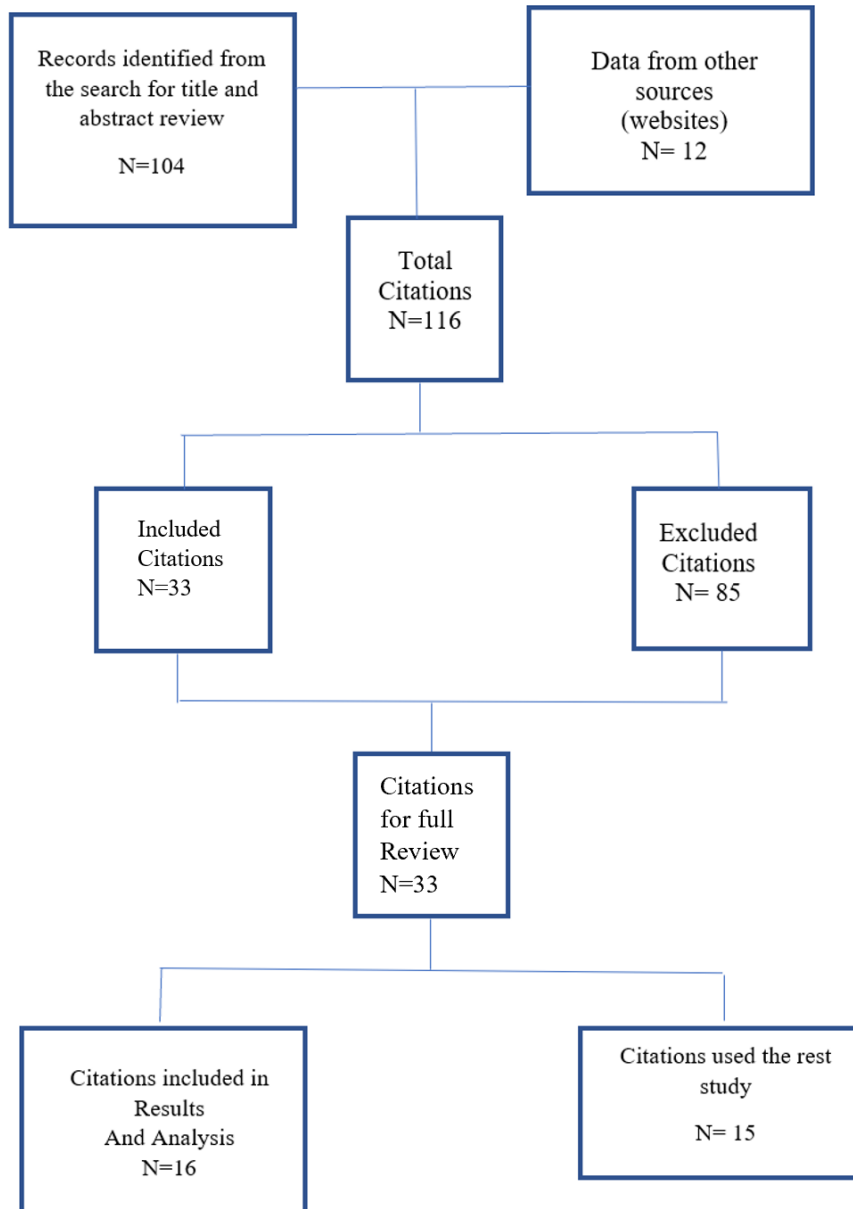


Figure 1: PRISMA diagram used in this study (Adapted from Moher et al, 2009).

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

When conducting this research, critical terms included: 'THC' or 'neurological disorders' or 'dosage' or 'diagnosis' and 'prescription' or 'marijuana'. These keywords were criteria for inclusion in the study. The electronic databases of Marshall University's EbscoHost, CINAHL, ProQuest, and PubMed and Google Scholar were utilized to obtain academic peer-reviewed literature. The search identified 104 relevant citations and articles were excluded (N=85) if they did not meet inclusion principles. Articles were included (N=33) if they described medical THC benefits or limitations, articles from other sources (N=12) were also included in this search. These 33 references were subject to full-text review, and these 33 citations were included in the data abstraction and analysis. Only 16 references were used in the results section. (see Figure 1).

1. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. (2009). *Preferred Reporting Items for Systematic Reviews and Meta-Analysis: The PRISMA Statement*. PLoS Med 6(7): e1000097. doi:10.1371/journal.Pmed1000097

ANONYMOUS SURVEY QUESTIONS

1. How old are you? And how long have you been using THC for medical reasons?
2. How long have you experienced the medical issue(s) in which you use THC for?
3. For what issues do you use THC?
4. Do you feel that your symptoms have improved by THC?
5. What type of doctor prescribes your THC?
6. What is your dosage of THC prescribed by your doctor?
7. How often do you use your prescribed THC?
8. Have you experienced any new symptoms while taking THC?
9. Has your opioid medication decreased since taking THC?
10. Have you tried methods alternative to THC to treat your medical issues?

Link to Survey:

[Benefits of Medical THC for Neurological Disorders vs Legal and Ethical Barriers in the U.S. - Formstack](#)

REFERENCES

- Abrams, D. *Medical Cannabis: Adverse effects & drug interactions* - / DOH. (n.d.). [CHA5] Retrieved March 5, 2023, from https://doh.dc.gov/sites/default/files/dc/sites/doh/publication/attachments/Medical%20Cannabis%20Adverse%20Effects%20and%20Drug%20Interactions_0.
- American Cancer Society. (Last revised May 1, 2020). *Chemotherapy side effects*. Retrieved March 2, 2023, from <https://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy/chemotherapy-side-effects.html>
- Aviram, J., Pud, D., Gershoni, T., Schiff-Keren, B., Ogintz, M., Vulfsons, S., Yashar, T., Eisenberg, E.(2021). *Medical cannabis treatment for chronic pain: Outcomes and prediction of Response*. *European Journal of Pain*. 25(2):359-374. doi: 10.1002/ejp.1675.
- Bandawe, G. (2022). Percentage of Patients Reporting Improvements after using Medical Cannabis Use of multiple Medical Conditions as of 2020, by age. *The College of Medicine and the Medical Association of Malawi*. 34(2):138-142. doi: 10.4314/mmj.v34i2.10.
- Berger, A., Cornett, E., Kassem, H., Kaye, D., & Viswanath, O. (2021). Adverse Effects of Recreational and Medical Cannabis. *Psychopharmacology bulletin*, 51(1), 94–109.
- Borgelt, L.M., Franson, K.L., Nussbaum, A.M. (2013). The pharmacologic and clinical effects of medical cannabis. *Pharmacotherapy*. 33(2):195-209. doi: 10.1002/phar.1187.
- Bridgeman, M. B., & Abazia, D. T. (2017). Medicinal Cannabis: History, Pharmacology, And Implications for the Acute Care Setting. *P & T : a peer-reviewed journal for formulary management*, 42(3), 180–188.
- Centers for Disease Control and Prevention (CDC). (2020, October 19). *Addiction*. Centers for Disease Control and Prevention. Retrieved March 2, 2023, from <https://www.cdc.gov/marijuana/health-effects/addiction.html>

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

- Cook, A. C., Leung, G., & Smith, R. A. (2020). Marijuana Decriminalization, Medical Marijuana Laws, and Fatal Traffic Crashes in US Cities, 2010–2017. *American Journal of Public Health*, 110(3), 363–369. <https://doi-org.marshall.idm.oclc.org/10.2105/AJPH.2019.305484>
- Drug Enforcement Administration [DEA]. *Drug Scheduling*. Retrieved January 20, 2023, from <https://www.dea.gov/drug-information/drug-scheduling>
- Geffrey, A., Pollack, S., Bruno, L., Thiele, A. (2015). Drug-drug interaction between clobazam and cannabidiol in children with refractory epilepsy. *Epilepsia*. 56(8):1246-51.
- Greenwell, G.T. (2012). Medical marijuana use for chronic pain: risks and benefits. *Journal of Pain and Palliative Pharmacotherapy*. 26(1):68-9. doi: 10.3109/15360288.2011.652350.
- Grinspoon, P. (April 10, 2020). Medical Marijuana. *Harvard Health Blog*, (75)3, 50-57. Retrieved January 24, 2023, from [Medical marijuana - Harvard Health](#).
- Gupta, V. (2022). *Tetrahydrocannabinol (THC)*. Treasure Island (FL): StatPearls Publishing. Retrieved January 25, 2023, from [Tetrahydrocannabinol \(THC\) - PubMed \(nih.gov\)](#).
- Klein, T. A., & Clark, C. S. (2022). Therapeutic use of cannabis in the US. *The Nurse Practitioner*. 47(12), 16–25. <https://doi.org/10.1097/01.NPR.0000884880.81603.c5>
- Kruger, D.J, Kruger, J.S. (2021). Consumer Experiences with Delta-8-THC: Medical Use, Pharmaceutical Substitution, and Comparisons with Delta-9-THC. *Cannabis and Cannabinoid Research*. 4(1), 347-358. doi: 10.1089/can.2021.0124.
- Mayo Clinic. (2021, December 4). *What you can expect from medical marijuana*. Mayo Foundation for Medical Education and Research. Retrieved March 2, 2023, from <https://www.mayoclinic.org/healthy-lifestyle/consumer-health/in-depth/medical-marijuana/art-2013785>.
- McKenna, G. J. (2014). *The current status of medical marijuana in the United States*. Hawai'i journal of medicine & public health : a journal of Asia Pacific Medicine & Public Health. Retrieved January 20, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3998227>.
- Mücke M, Phillips T, Radbruch L, Petzke F, Häuser W. (2018). Cannabis-based medicines for chronic neuropathic pain in adults. *Cochrane Database Systematic Review*. 3(3):CD012182.

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Population Health and Public Health Practice; Committee on the Health Effects of Marijuana: An Evidence Review and Research Agenda. The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research. Washington (DC): National Academies Press (US).(2017). *Therapeutic Effects of Cannabis and Cannabinoids*. Available from:

<https://www.ncbi.nlm.nih.gov/books/NBK425767/>

National Institute on Drug Abuse [NIDA]. (2021). *Is marijuana safe and effective as medicine?*. Retrieved January 23, 2023, from [Is marijuana safe and effective as medicine? | National Institute on Drug Abuse \(NIDA\) \(nih.gov\)](#).

NIDA. 2021, April 13. What are marijuana's long-term effects on the brain?. Retrieved from <https://nida.nih.gov/publications/research-reports/marijuana/what-are-marijuanas-long-term-effects-brain> on 2023, March 20.

Poli, P., Crestani, F., Salvadori, C., Valenti, I., Sannino, C. (2018). Medical Cannabis in Patients with Chronic Pain: Effect on Pain Relief, Pain Disability, and Psychological aspects. A Prospective Non randomized Single Arm Clinical Trial. *Clinical Trial*. 169(3):e102-e107. doi: 10.7417/T.2018.2062. PMID: 29938740.

Rosenthal, M., Pipitone, R. (2022). Demographics, Perceptions, and Use of Medical Marijuana among Patients in Florida. *Medical Cannabis and Cannabinoids*. 4(1):13-20. doi: 10.1159/000512342.

Russo, E.B. Cannabinoids in the management of difficult to treat pain. *Clinical Risk Management*. (1):245-59.

Schauer, L., Dilley, A., Roehler, R., Sheehy, J., Filley, R., Broschart, C., , Hoots, B. (2021). Percentage of U.S. Adults that used medical cannabis as of 2021, by age. *Medical Cannabis and Cannabinoids*. 71(4), 139–145. <https://doi.org/10.15585/mmwr.mm7104e3>.

Solimini, R., Rotolo, M., Pichini, S., Pacifici R. (2017). Neurological Disorders in Medical Use of Cannabis: An Update. *CNS & neurological disorders drug targets*, 16(5), 527–533. <https://doi.org/10.2174/1871527316666170413105421>.

U.S. Department of Health and Human Services. (2021, April 13). *What are marijuana's long-term effects on the brain?* National Institutes of Health. Retrieved March 4, 2023, from

March 16, 2023

Medical THC Benefits VS Legal & Ethical Barriers in the U.S. - Draft 3 - HCA 695

<https://nida.nih.gov/publications/research-reports/marijuana/what-are-marijuanas-long-term-effects-brain>

- Urits, I., Charipova, K., Gress, K., (2021). Adverse Effects of Recreational and Medical Cannabis. *Psychopharmacology bulletin*, 51(1), 94–109.
- Vidot, D.C., Islam, J., Marlene, C., Harrell, M., Rao, D.R., Chavez, J., Ochoa, L., , Messiah, S. (2021). The COVID-19 Cannabis Health Study: Results from an epidemiologic. *Journal of addictive diseases*, 39(1), 26–36. <https://doi.org/10.1080/10550887.2020.1811455>.
- Volkow, N. D., Baler, R. D., Compton, W. M., & Weiss, S. R. (2014). Adverse health effects of marijuana use. *The New England journal of medicine*, 370(23), 2219–2227. <https://doi.org/10.1056/NEJMra1402309>.
- Webb, C. W., & Webb, S. M. (2019). Therapeutic benefits of cannabis: a patient survey. *Hawai'i journal of medicine & public health : a journal of Asia Pacific Medicine & Public Health*. 73(4), 109–111.
- World Health Organization. (© 2023 WHO from website) *Cannabis*. World Health Organization. Retrieved January 25, 2023, from <https://www.who.int/teams/mental-health-and-substance-use/alcohol-drugs-and-addictive-behaviours/drugs-psychoactive/cannabis>

Percentage of U.S. Adults that used medical cannabis as of 2021, by age*

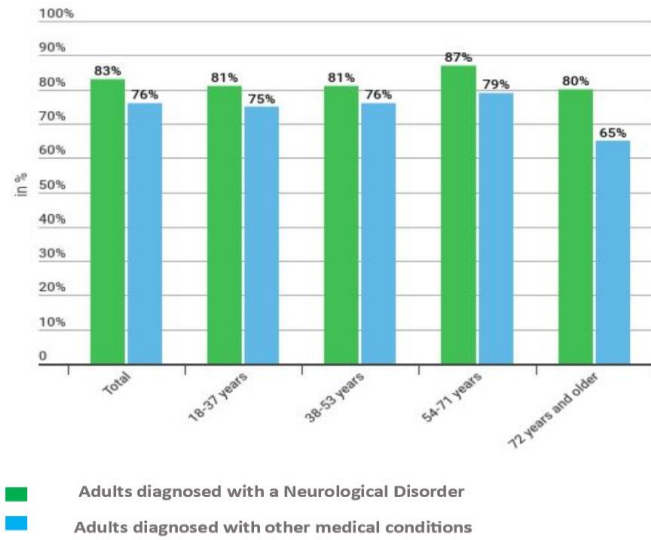


Figure 2: Percentage of U.S. Adults that used medical cannabis as of 2021, by age

Reference: (Schauer et al., 2021)

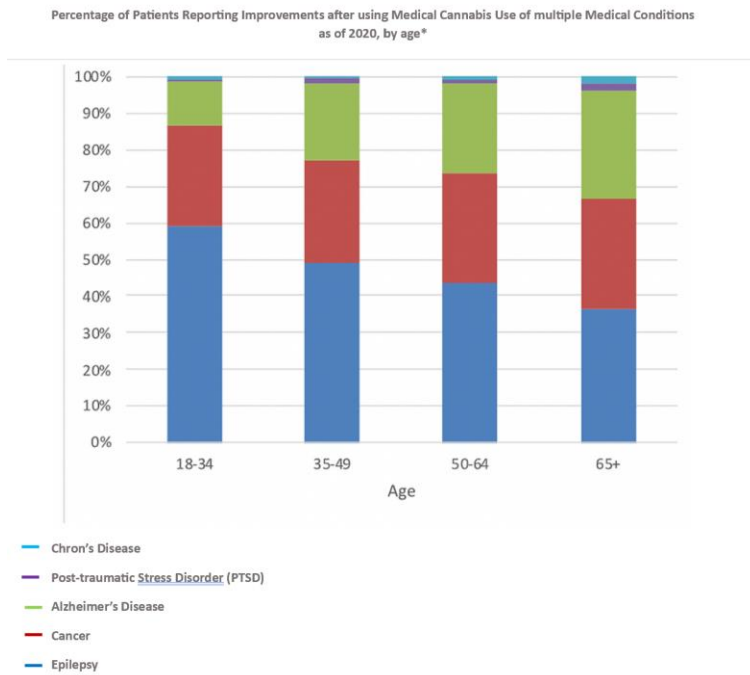


Figure 3: Percentage of Patients Reporting Improvements after using Medical Cannabis Use of multiple Medical Conditions as of 2020, by age*

Reference: (Bandawe, 2022)