



Case report

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# Cannabis Instead of Opiates in a Survey of a PA Medical Marijuana Program

Trent W Nichols\* and Marvin H Berman

Quietmind Foundation, USA

\*Corresponding author: Trent W Nichols Jr. MD., Quietmind Foundation, 721 Ash Dr, Hanover PA 17331, USA.

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## Key Points

**Question:** The goal of the survey was to ascertain the success of using a questionnaire in using MMJ (cannabis) instead of opioids or Suboxone which the MMJ patient on their own volition.

**Findings:** 1257 respondents in the telephone surveys conducted by the authors in 2022 of PA Green Medical and Innovative Health MMJ patients revealed that 204 or 16.57% answered Yes to “Have you been weaned off narcotics or opioids,” instead No or Does Not Apply.

In addition, another 2 % replied they were using a markedly reduced dose of opioids or Suboxone while on cannabis. Anxiety was found to be the most common condition in about 50%, followed by chronic pain. Other Opiate abuse rehabs using Neurofeedback with Photo biomodulation is discussed to increase Drug Rehab efficacy and reduce recidivism.

**Meaning:** When provided access to cannabis, patients in MMJ programs who are currently taking opioids to treat chronic pain report using those drugs 40–60% less frequently and preferring cannabis to opioids over time to wean themselves off narcotics.

## Abstract

Opioids are used to treat and manage chronic and severe pain, but they potentially lead to abuse and cause addiction and unfortunately in too many cases overdose drug deaths. Last year over 79,770 drug overdose deaths were reported and at the height of the epidemic in 2021 over 110,000 overdose deaths. This paper reviews a recent survey on recertification of PA MMJ patients and the recent publications and the use of cannabinoids in patients with chronic pain and opioid addiction. The use of cannabis to reduce opiates in such patients was conducted in a recent survey of over 1500 Medical Marijuana (MMJ) patients in Pennsylvania as well as other recent publications. Opioid addiction's effect on brain metabolism is discussed as well as cannabinoid as well as adverse events which were none. Finally Spotlight misinformation in Newspapers as well as the dangers of cannabis in narcotic addiction is also reviewed and compared to scientific peer reviewed publication and not hearsay. Other modalities in opiate abuse programs supplemented with Neurofeedback and Photo biomodulation to increase success of drug rehab to thwart failure and post rehab recidivism is discussed.

## Introduction

The Pennsylvania Medical Marijuana Program was established in 2018 Feb 15 for patients at dispensaries across the Commonwealth providing long-overdue medical relief to patients with serious medical conditions. A physician must certify that the recipient suffers from one of the 23 medical conditions that qualify for medical marijuana and pay for a card. That certifying physician must have taken a 4-hour course on Medical Cannabis and passed the test and be on PA Health Approved List. As of May 15, 2022, there were

712,421 patients and 37,221 caregivers registered in the Program. Patients who are issued a medical marijuana ID card (ID card) by the Department are responsible for an annual card fee of \$50.

According to this peer reviewed study at Drexel University, compared to the general population of Canada, for instance, those accessing medical cannabis through a government-sanctioned program were older, reported a heavier burden of certain chronic conditions (e.g. HIV, arthritis), had lower rates of mental health



conditions, and higher educational attainment. In states with medical cannabis laws, those using cannabis for medicinal purposes are more likely to be female, older, out of the labor force, and report higher psychological distress than those who use recreationally. Demographic differences among types of patients (rather than compared with non-patients) are largely unknown [1].

## Background

Medical cannabis users experience a higher burden of medical problems, pain, and mobility issues than those who use cannabis recreationally and those who do not use cannabis at all. Compared to recreational users, medical cannabis patients report more pain and gastrointestinal, psychological, and neurological issues [2].

Medical users of cannabis generally report that they began using cannabis recreationally and noticed medicinal benefits of cannabis. In California, where the parameters to receive a medical cannabis recommendation are much broader than in Pennsylvania, most patients report seeking a recommendation to treat a range of psychological and pain problems. Patient profiles in a state system with different qualifying conditions, such as Pennsylvania, may be different. In jurisdictions where medical marijuana is legal, patients who use it for medical reasons are more likely to be female, older, unemployed, and to have greater psychological discomfort than patients who use it recreationally.

Compared to those who use cannabis recreationally or not at all, medical cannabis users have a greater burden of health difficulties, pain, and mobility impairments [2].

Many cannabis users who use it for medical purposes say they first tried it for recreational purposes before realizing it had medicinal properties. The majority of patients claim to seek recommendations to treat a variety of psychological and pain issues in California, where the requirements for receiving a medical cannabis recommendation are far broader than in Pennsylvania [3].

Currently, chronic pain is listed as a qualifying diagnosis for the medical program by up to 90% of patients in state-level medical cannabis registries reported by The National Academies of Science and Medicine have validated the effectiveness of cannabis for treating chronic pain in adults after conducting an assessment.[3] It's interesting to note that when provided access to cannabis, people who are currently taking opioids to treat chronic pain report using those drugs 40–60% less frequently and preferring cannabis to opioids. Patients in these trials claimed that using cannabis had greater quality of life than taking opioids, and that there were less negative effects with cannabis use (including a paradoxical improvement in cognitive function). Cannabis has repeatedly been shown to lower the opioid dose required to obtain desired pain relief, despite the wide variety of cannabis products and administration methods utilized by patients in states with medical cannabis laws [2].

## Methods

### Medical Use of Cannabis in PA Health Program Annual Renewal

A telephone survey of medical marijuana patients from PA

Green Medical in Harrisburg PA and Innovative Medicine in Lebanon was conducted by the authors in 2022 as part of MMJ recertification questionnaire. The survey results were then compared to previous reported publications in Pennsylvania as well as the medical literature in peer reviewed journals. Sinikkal Kyamme in 2022 reported that 2,841 respondents of which the majority (91%) used non-prescribed cannabis for chronic pain, and more than half (54.6%) had used MMJ with the purpose of replacing a prescribed drug [1].

### Mechanism of Interactions between Opioids and Cannabis

a. It is well established that the endocannabinoid and opioidergic systems interact in a variety of ways, from how their receptors are distributed to how their behavioral pharmacology is cross-sensitized. In the same recent publication listed above, *Emerging Evidence for Cannabis' Role in Opioid Use Disorder*, cannabinoid-1 (CB1) receptors and mu opioid receptors (MORs) are distributed in many of the same areas in the brain, including but not limited to the periaqueductal gray, locus coeruleus, ventral tegmental area (VTA), nucleus accumbens, prefrontal cortex (PFC) central amygdala (CeA), nucleus of stria terminalis (BNST) caudate putamen (CP), substantia nigra, dorsal hippocampus, raphe nuclei, and medial basal hypothalamus. These interactions between the opioid and cannabinoid systems in reward and withdrawal have clear anatomical underpinnings due to the degree of this overlapped expression and the frequent colocalization of the CB1 and MOR [2].

b. Wise goes on to emphasize the Bidirectional Relationship between MORs and CB1 receptors in the rewarding properties of drugs of misuse [3-9].

c. MORs and CB1 receptors have a reciprocal interaction that contributes to the rewarding effects of drugs of abuse. In other words, opioids' rewarding characteristics are significantly impacted by CB1 receptor regulation, and vice versa. For instance, drug-induced conditioned place preference (CPP) is developed in a manner that involves both MOR and CB1 receptors. The development of morphine CPP is inhibited by the coadministration of a cannabinoid antagonist, while the development of tetrahydrocannabinol (THC)-induced CPP is prevented by the coadministration of an opioid antagonist. It's interesting to note that subthreshold morphine dosages provide a rewarding effect when CB1 antagonism is present in the medial Pre-Frontal Cortex, whereas CB1 agonists cause an aversion to levels of morphine that are typically rewarding (CPP) [10].

d. Presynaptic cannabinoid and opioid disinhibition of dopamine neurons in the (VTA) Ventral Trigeminal Area, a well-known mechanism in the rewarding characteristics of misused drugs, is at least largely responsible for this reciprocal role in reward. One study discovered CB1 upregulation in the reward pathway of people who use opioids, despite the fact that these processes have not been thoroughly investigated in humans. This finding indicates a role for the endocannabinoid system in the emergence of opioid addiction [11].

## Using Cannabis as a Primary Pain Reliever

A growing body of evidence in the medical literature suggests that cannabis use can lead to a reduction in the use of prescription drugs, alcohol, tobacco, and illicit substances such as cocaine, heroin, and other opioids [12].

As both cannabis and pharmaceutical opioids are primarily used to relieve pain, currently, chronic pain is listed as a qualifying diagnosis for the medical program by up to 90% of patients in state-level medical cannabis registries. The National Academies of Science and Medicine have validated the effectiveness of cannabis for treating chronic pain in adults after conducting a thorough assessment.[13] It's interesting to note that when provided access to cannabis, people who are currently taking opioids to treat chronic pain report using those drugs 40–60% less frequently and preferring cannabis to opioids [5-8]. Patients in these trials claimed that using cannabis had greater quality of life than taking opioids, and that there were less negative effects with cannabis use (including a paradoxical improvement in cognitive function). Cannabis has repeatedly been shown to lower the opioid dose required to obtain desired pain relief, despite the wide variety of cannabis products and administration methods utilized by patients in states with medical cannabis laws [9,10].

New York State Department of Health announced its latest study detailing the association of receiving medical cannabis for 30 days or longer with a reduction in prescription opioid dosages in the (JAMA) Network Open [11]. There is a growing body of evidence suggests that cannabis use can lead to a reduction in the use of prescription drugs, alcohol, tobacco, and illicit substances such as cocaine, heroin, and other opioids suggesting that cannabis-related social harms and benefits should be examined in the context of the public health. Arkell published Assessment of Medical Cannabis and Health-Related Quality of Life in 2023 which confirms this in this Australia report [12].

## Results

1257 respondents in the telephone surveys conducted by the authors in 2022 of PA Green Medical and Innovative Health MMJ patients revealed that 204 or 16.25% answered Yes to "Have You been weaned off narcotics or opioids," instead No or Does Not Apply.

In addition, another 1% replied they were using a markedly reduced dose of opioids or Suboxone while on cannabis. Anxiety was found to be the most common condition in about 50%, followed by chronic pain.

Previous reports to PA Health MMJ program in 2020 were that 3% had been off opioids due to MMJ as reported on the PA Health Website. Out higher response probably reflects the patient population whose own decision was to get off opioids and other pain-relieving drugs.

Previously California, Oregon, and Washington had medical cannabis laws effective prior to 1999. Ten states Alaska, Colorado,

Hawaii, Maine, Michigan, Montana, Nevada, New Mexico, Rhode Island, and Vermont enacted medical cannabis laws between 1999 and 2010. States with medical cannabis laws had a 24.8% lower mean annual opioid overdose mortality rate (95% CI, -37.5% to -9.5%; P = .003) compared with states without medical cannabis laws [13].

Reiman A in 2017 examined the use of cannabis as a substitute for opioid-based pain medication by collecting survey data from 2897 medical cannabis patients. They found that 34 percent of the sample reported using opioid-based pain medication in the past 6 months. Respondents overwhelmingly reported that cannabis provided relief on par with their other medications, but without the unwanted side effects. Ninety-seven percent of the sample "strongly agreed/agreed" that they are able to decrease the number of opiates they consume when they also use cannabis, and 81% "strongly agreed/agreed" that taking cannabis by itself was more effective at treating their condition than taking cannabis with opioids. Results were similar for those using cannabis with nonopioid-based pain medications [12].

The 52 conditions that the CaM respondents could choose from, when reporting conditions treated with CaM, were categorized as either somatic conditions (n = 36) or psychiatric conditions (n = 13), except for "chronic pain", "sleep disturbances", and "stress", which were kept as independent categories [7,12].

## Discussion

This study was initially started because of a poorly researched newspaper report entitled "Unproven, Unsafe," by Ed Mahon a journalist for Spotlight PA claiming "some Pennsylvania cannabis companies are using incomplete or misleading claim to promote marijuana as a treatment for opioid addiction potentially putting lives at greater risk!" [13].

A Canadian study entitled "Cannabis Significantly Reduces the Use of Prescription Opioids and Improves Quality of Life in Authorized Patients: Baseline opioid use was reported by 28% of participants, dropping to 11% at 6 months. Daily opioid use went from 152 mg morphine milligram equivalent (MME) at baseline to 32.2 mg MME at 6 months, a 78% reduction in mean opioid dosage. Similar reductions were also seen in the other four primary prescription drug classes identified by participants, and statistically significant improvements were reported in all four domains was published in 2021 [14].

The Lucas. study adds to the growing body of evidence that medical cannabis use is associated with reductions in the use of prescription drugs [15-20]. Chen X published opioid-sparing effects of cannabinoids on morphine analgesia: Participation of CB1 and CB2 receptors [21] and improvements in quality of life [12,14,22&23].

The Lucas Study of Cannabis for Pain in Canada was criticized because many of the clinics specialize in the treatment of chronic pain, patients affected by chronic pain may be overrepresented in this cohort; however, their results [7,12,21&24] were in line with other Canadian Studies.

Unfortunately, less than 42% of the individuals in USA who enter treatment for drug and alcohol abuse complete it. Individual success in treatment depends on several factors, including: The frequency, duration, and type of drug used. May 11, 2023 [33].

### Dopamine in Opiate Rehabilitation

Previously Dopamine was mentioned by Sagheddu C, et al. [14], and this neurotransmitter has long been recognized to play a critical role in the processing of natural rewards, as well as of motivation that regulates approach and avoidance behaviour. This motivational role of dopamine neurons is also based upon the evidence provided by several studies investigating disorders of dopamine pathways such as drug addiction and Parkinson's disease. Notably, endocannabinoids regulate dopamine neuronal activity and its influence on behavioural output.

### The Dopamine Hypothesis of Drug Addiction and Its Potential Therapeutic Value

Abuse-related chemicals have a significant impact on dopamine (DA) transmission, and changes in DA function play a role in the many stages of drug addiction and may one day be used therapeutically. These investigations are further supported by increases in intracranial self-stimulation (ICSS) thresholds following alcohol, nicotine, opiate, and other drug withdrawal, which indicates a hypofunction of the neuronal substrate of ICSS system when morphological assessments are fed into realistic computational analysis. Human imaging studies have provided visual evidence of the "dopamine-impooverished" addicted human brain by demonstrating a decrease in dopamine receptors along with a lesser release of endogenous DA in the ventral striatum of cocaine, heroin, and alcohol-dependent subjects. The hypothesis that increasing the DA system's activity to return to pre-drug levels could produce major therapeutic improvements (reduction of craving, relapse, and drug-seeking/taking) arises from the long-lasting decrease in physiological activity of the DA system [34].

### Photobiomodulation Transcranially and Neurofeedback in Opiate Drug Rehabilitations

Since that time a small group of Psychologist who had been using Neurofeedback by QEEG mapping in Dopamine Deficiency started adding Transcranial Near Infra-Red Light (tPBM) in patients with this condition [35]. Opiate Drug Rehabilitation Centers have recently followed the above in their drug abuse patients with success.

Robert Thatcher whose software Neuroguide combines Opiate Abuse Rehabs to decrease recidivism and higher success rate when used of 93% [35].

F. Schiffer group described that 39 people with active opioid cravings were enrolled at 2 sites; 19 of them underwent the active treatment, which involved applying a light 4 minutes twice a week (every 3 or 4 days) to the forehead over the left or right dorsolateral prefrontal cortex [36].

### Photobiomodulation in Dopamine Upregulation in Opiate Addiction

Cassandra Peoples, et al. in 2012 using a Rat model demonstrated that near-infrared light (NIR) treatment (photobiomodulation) saves dopaminergic amacrine cells of the retina in an acute and a chronic 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) mouse model of Parkinson disease [37]. Since that time more studies have been completed predominately in Alzheimer's dementia but also in Parkinson's which is of course a movement disorder of diminished dopamine [38-42].

Therefore, substantiating the Dopamine Hypothesis in Opiate Drug Rehabilitation using Cannabis with the combined NIR PBM in these drug rehabs is synergetic! [43]. Among its many benefits, CBD is a natural mood booster and stress reliever, which can be a great complement to laughter. This internal body system consists of receptors on the surface of cells that can interact with THC [45]. Cannabis can also heighten mood, so if you are already in the mood to laugh and use cannabis, you may end up laughing more than usual. It can also make you more sociable [46]. Future clinical trials involving patients with anxiety disorders which also occur in drug users as a complaint when detoxing are warranted due to the small number of available human studies [47].

Epidemiological studies tend to support an anxiolytic effect from the consumption of either CBD or THC, as well as whole plant cannabis. Conversely, the available human clinical studies demonstrate a common anxiogenic response to THC [48]. Robert Thatcher PhD has designed a program with training of staff in house at opiate rehabs to use QEEG with Neurobiofeedback and Photobiomodulation use to ensure better success by increasing dopamine and other neurotransmitters [49].

### Conclusion

It is becoming clear that photobiomodulation (PBM), is an efficient way to improve cell and tissue resilience and repair. Cytochrome C oxidase, a crucial enzyme in the mitochondrial respiratory chain appears to be predominantly responsible for the intracellular effects of PBM [50-52]. It is also apparent that participations of the PA Cannabis Medical Program have discovered that MMJ is effective pain reliever and Dopamine up regulator which can be supplemented with PBM in Drug Rehabilitation! The authors hope that by presenting the science of cannabis therapy in pain and opiate addiction and our survey of MMJ patients, that one may have a more enlightened view of advantages of cannabis has over opioid therapy in pain control and instead of continued narcotic and other drug pain addiction and difficult recovery! The use of medical cannabis therapy to rid the addiction by patients on their own to opioids should also be noted!

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### References

1. Kvamme SL, Pedersen MM, Rømer Thomsen K, Thylstrup B (2021) Ex-

- ploring the use of cannabis as a substitute for prescription drugs in a convenience sample. *Harm Reduct J* 18: 72.
2. Information on Medical Cannabis in Pennsylvania. Drexel University Medical Research Center.
  3. López Moreno JA, López Jiménez A, Gorriti MA, et al. (2010) Functional interactions between endogenous cannabinoid and opioid systems: focus on alcohol, genetics and drug-addicted behaviors. *Curr Drug Targets* 11(4): 406-428
  4. Wilson-Poe AR, Morgan MM, Aicher SA, et al. (2012) Distribution of CB1 cannabinoid receptors and their relationship with mu-opioid receptors in the rat periaqueductal gray. *Neuroscience*.213: 191-200.
  5. Ahmad T, Lauzon NM, de Jaeger X (2013) Cannabinoid transmission in the prelimbic cortex bidirectionally controls opiate reward and aversion signaling through dissociable kappa versus mu-opiate receptor dependent mechanisms. *J Neurosci* 33(39): 15642-15651.
  6. Braida D, Iosue S, Pegorini S (2004) Δ9-Tetrahydrocannabinol-induced conditioned place preference and intracerebroventricular self-administration in rats. *Eur J Pharmacol* 506(1): 63-69.
  7. Singh ME, Verty AN, McGregor IS, et al. (2004) A cannabinoid receptor antagonist attenuates conditioned place preference but not behavioural sensitization to morphine. *Brain Res*. 1026(2): 244-253.
  8. Wills KL, Parker LA (2016) Effect of pharmacological modulation of the endocannabinoid system on opiate withdrawal: a review of the preclinical animal literature. *Front Pharmacol* 7:187.
  9. Yamaguchi T, Hagiwara Y, Tanaka H, et al. (2001) Endogenous cannabinoid, 2-arachidonoylglycerol, attenuates naloxone-precipitated withdrawal signs in morphine-dependent mice. *Brain Res* 909(1-2): 121-126.
  10. Lanckenau SE, Kioumarsis A, Reed M, McNeeley M, Iverson E, Wong CF (2018) Becoming a medical marijuana user. *Int J Drug Policy*. 52: 62-70.
  11. (2023) New York State Department of Health Highlights Publication of Study on the Role of Medical Cannabis for Chronic Pain in Reducing Prescription Opioid.
  12. Wiese B, Wilson-Poe AR (2018) Emerging Evidence for Cannabis' Role in Opioid Use Disorder. *Cannabis Cannabinoid Res* 3(1): 179-189.
  13. Sagheddu C, Muntoni AL, Pistis M, Melis M (2015) Endocannabinoid signaling in motivation, reward, and addiction: influences on mesocorticolimbic dopamine function. *Int Rev Neurobiol* 125: 257-302.
  14. (2017) National Academies of Sciences, Engineering, and Medicine. The health effects of cannabis and cannabinoids: the current state of evidence and recommendations for research. National Academies Press.
  15. Boehnke KF, Litinas E, Clauw DJ (2016) Medical cannabis use is associated with decreased opiate medication use in a retrospective cross-sectional survey of patients with chronic pain. *J Pain* 17(6): 739-744.
  16. Gruber SA, Sagar KA, Dahlgren MK, Racine MT, et al. (2016) Splendor in the Grass? A Pilot Study Assessing the Impact of Medical Marijuana on Executive Function. *Front Pharmacol* 7: 355.
  17. Haroutounian S, Ratz Y, Ginosar Y, Furmanov K, Saifi F, et al. (2016) The Effect of Medicinal Cannabis on Pain and Quality-of-Life Outcomes in Chronic Pain: A Prospective Open-label Study. *Clin J Pain*. 32(12): 1036-1043.
  18. Kral AH, Wenger L, Novak SP, Chu D, Corsi KF, Coffa D, et al. (2015) Is cannabis use associated with less opioid use among people who inject drugs? *Drug Alcohol Depend* 153: 236-241.
  19. Bachhuber MA, Saloner B, Cunningham CO, Barry CL (2014) Medical Cannabis Laws and Opioid Analgesic Overdose Mortality in the United States, 1999-2010. *JAMA Intern Med* 174(10): 1668-1673.
  20. Reiman A, Welty M, Solomon P (2017) Cannabis as a Substitute for Opioid-Based Pain Medication: Patient Self-Report. *Cannabis Cannabinoid Res* 2(1): 160-166.
  21. Brown GW, Ortega TR (2018) Preliminary evaluation of the efficacy, safety, and costs associated with the treatment of chronic pain with medical cannabis. *Ment Health Clin* 8(3): 110-115.
  22. Mahon ED, Spotlight investigation. Unproven, Unsafe.
  23. Lucas P, Boyd S, Milloy MJ, Walsh Z (2021) Cannabis Significantly Reduces the Use of Prescription Opioids and Improves Quality of Life in Authorized Patients: Results of a Large Prospective Study. *Pain Med*. 22(3): 727-739.
  24. Lucas P, Baron EP, Jikomes N (2019) Medical cannabis patterns of use and substitution for opioids & other pharmaceutical drugs, alcohol, tobacco, and illicit substances; results from a cross-sectional survey of authorized patients. *Harm Reduct J* 16(1): 9.
  25. Shi Y, Liang D, Bao Y, An R, Wallace MS, et al. (2019) Recreational marijuana legalization and prescription opioids received by Medicaid enrollees. *Drug Alcohol Depend* 194: 13-19.
  26. Boehnke KF, Scott JR, Litinas E, Sisley S, Williams DA, Clauw DJ (2019) Pills to pot: Observational analyses of cannabis substitution among medical cannabis users with chronic pain. *J Pain* 20(7): 830-841.
  27. Chen X, Cowan A, Inan S, Geller EB, Meissler JJ, et al. (2019) Opioid-sparing effects of cannabinoids on morphine analgesia: participation of CB<sub>1</sub> and CB<sub>2</sub> receptors. *Br J Pharmacol* 176(17): 3378-3389.
  28. Goldenberg M, Reid MW, IsHak WW, Danovitch I (2017) The impact of cannabis and cannabinoids for medical conditions on health-related quality of life: A systematic review and meta-analysis. *Drug and Alcohol Dependence* 174: 80-90.
  29. Walsh Z, Hendricks PS, Smith S, Philippe Lucas, Marc T Swogger, et al. (2016) Hallucinogen use and intimate partner violence: Prospective evidence consistent with protective effects among men with histories of problematic substance use. *J Psychopharmacol* 30(7): 601-607.
  30. Degenhardt L, Lintzeris N, Campbell G, Michael Farrell, Wayne D Hall, et al. (2015) Experience of adjunctive cannabis use for chronic non-cancer pain: findings from the Pain and Opioids IN Treatment (POINT) study. *Drug Alcohol Depend* 147: 144-150.
  31. Arkell TR, Downey LA, Hayley AC, Roth S (2023) Assessment of Medical Cannabis and Health-Related Quality of Life. *JAMA Netw Open* 6(5): e2312522.
  32. Hazekamp A, Ware MA, Muller-Vahl K, Abrams D, Grotenhermen F (2013) The medicinal use of cannabis and cannabinoids—An international cross-sectional survey on administration forms. *J Psychoactive Drugs* 45(3): 199-210.
  33. What is the Standard Rehab Success Rate.
  34. Diana M (2011) The dopamine hypothesis of drug addiction and its potential therapeutic value. *Front Psychiatry* 2: 64.
  35. Sokhadze EM, Trudeau DL, Cannon RL (2014) Rationale for Application of Neurofeedback in Opiate Addicts Enrolled in Maintenance Treatment; Opiate Drug Addiction in Clinical Neurotherapy: Application of Techniques for Treatment, ed. DS Cantir, JR Evans. Waltham MA, Elsevier 273-274
  36. Kwiek J, Andriot T, Michela A, Vuilleumier P, Garibotto V, et al. (2021) PET Imaging of Dopamine Neurotransmission During EEG Neurofeedback. *Front Physiol* 11: 590503.
  37. Schiffer F, Khan A, Bolger E, Flynn E, Seltzer WP, Teicher MH (2021) An Effective and Safe Novel Treatment of Opioid Use Disorder: Unilateral Transcranial Photobiomodulation. *Front Psychiatry* 12: 713686.
  38. Peoples C, Shaw VE, Stone J, Jeffery G, Baker GE, Mitrofanis J (2012) Survival of Dopaminergic Amacrine Cells after Near-Infrared Light Treatment in MPTP-Treated Mice. *ISRN Neurol* 2012: 850150.
  39. Salehpour F, Mahmoudi J, Kamari F, Sadigh-Eteghad S, Rasta SH, et al. (2018) Brain Photobiomodulation Therapy: a Narrative Review. *Mol Neurobiol* 55(8): 6601-6636.

40. Berman MH, Nichols TW (2019) Treatment of Neurodegeneration: Integrating Photobiomodulation and Neurofeedback in Alzheimer's Dementia and Parkinson's: A Review. *Photobiomodul Photomed Laser Surg* 37(10): 623-634.
41. Berman MH, Halper JP, Nichols TW, Jarrett H, Lundy A, Huang JH (2017) Photobiomodulation with Near Infrared Light Helmet in a Pilot, Placebo Controlled Clinical Trial in Dementia Patients Testing Memory and Cognition. *J Neurol Neurosci* 8(1): 176.
42. Liebert A, Bicknell B, Laakso EL, et al. (2021) Improvements in clinical signs of Parkinson's disease using photobiomodulation: a prospective proof-of-concept study. *BMC Neurol* 21(1): 256.
43. Zomorodi R, Loheswaran G, Pushparaj A, Lim L (2019) Pulsed Near Infrared Transcranial and Intranasal Photobiomodulation Significantly Modulates Neural Oscillations: a pilot exploratory study. *Sci Rep* 9(1): 6309.
44. CBD and Laughter: The Ultimate Medicine.
45. Vigil JM, Stith SS, Chanel T (2022) Cannabis consumption and pro-sociality. *Sci Rep* 12(1): 8352.
46. Sarris J, Sinclair J, Karamacoska D, Maggie Davidson, Joseph Firth (2020) Medicinal cannabis for psychiatric disorders: a clinically-focused systematic review. *BMC Psychiatry* 20(1): 24.
47. Sharpe L, Sinclair J, Kramer A, de Manincor M, Sarris J (2020) Cannabis, a cause for anxiety? A critical appraisal of the anxiogenic and anxiolytic properties. *J Transl Med* 18(1): 374.
48. Stanciu CN, Brunette MF, Teja N, Budney AJ (2021) Evidence for Use of Cannabinoids in Mood Disorders, Anxiety Disorders, and PTSD: A Systematic Review. *Psychiatr Serv* 72(4): 429-436.
49. Robrt W Thatcher (2022) CEO at Applied Neuroscience on QEEG brain mapping with Neuroguide and Vialight Photo biomodulation; Personal Communication.
50. Gordon LC, Johnstone DM (2019) Remote photobiomodulation: an emerging strategy for neuroprotection. *Neural Regen Res* 14(12): 2086-2087.
51. Hart NS, Fitzgerald M (2026) A new perspective on delivery of red-near-infrared light therapy for disorders of the brain. *Discov Med* 22(120): 147-156.
52. Bajaj A, Blum K, Bowirrat A, Gupta A, et al. (2022) DNA Directed Pro-Dopamine Regulation Coupling Subluxation Repair, H-Wave® and Other Neurobiologically Based Modalities to Address Complexities of Chronic Pain in a Female Diagnosed with Reward Deficiency Syndrome (RDS): Emergence of Induction of "Dopamine Homeostasis" in the Face of the Opioid Crisis. *J Pers Med* 12(9): 1416.