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Medical Marijuana Use in Managing the Symptoms of Parkinson's Disease, Crohn's Disease, and Posttraumatic Stress Disorder

(Posted May 2, 2017)

The legalization of marijuana for medical use is rapidly expanding throughout the United States. Twenty-eight states (including Vermont) have public medicinal marijuana treatment programs, while an additional seventeen offer limited access to medical marijuana products.¹ In 2013, a large-scale survey concluded that 76 percent of physicians were in favor of using medicinal marijuana treatment in the U.S.² Nevertheless, due to the federal Controlled Substances Act's classification of marijuana as a Schedule I substance, researchers have been unable to conduct clinical trials to determine the effects of medical marijuana.³ At this time, Vermont's medicinal marijuana program does not include Parkinson's Disease (PD), Crohn's Disease (CD), or Posttraumatic Stress Disorder (PTSD) as qualifying conditions. This report describes current research on the use of medical marijuana in managing the symptoms of these illnesses.

Parkinson's Disease

PD is a chronic and progressive neurodegenerative disease that severely impacts mobility.⁴ Common symptoms of PD are dyskinesia (uncontrollable movement), tremor, bradykinesia (sluggish movement), general loss of motor mobility, weight loss, and low energy.⁵ Approximately one million Americans have PD, making it the second most common neurodegenerative disorder.⁶ In 2013, over 25,000 people died

¹ "State Medical Marijuana Laws," National Conference of State Legislatures, last modified March 1, 2017, <http://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx>.

² Jonathan N. Adler and James A. Colbert, "Medical Use of Marijuana-Polling Results," *New England Journal of Medicine* 368, no. 30 (2013): 1, doi:10.1056/NEJMc1de1305159; Danny Bega et al., "Medical Cannabis for Parkinson's Disease: Practices, Beliefs, and Attitudes Among Providers at National Parkinson Foundation's Center of Excellence," *Movement Disorders Clinical Practice* 4, no. 1 (2016): 90-95, doi:10.1002/mdc3.12359.

³ "Marijuana Research with Human Subjects," U.S. Food & Drug Administration, last modified February 28, 2017, <https://www.fda.gov/newsevents/publichealthfocus/ucm421173.htm>.

⁴ "What is Parkinson's?" National Parkinson Foundation, accessed January 28, 2017, <http://www.parkinson.org/understanding-parkinsons/what-is-parkinsons>; "What is Parkinson's Disease?" Parkinson's Disease Foundation, accessed January 28, 2017, http://www.pdf.org/about_pd.

⁵ "Symptoms," Parkinson's Disease Foundation, accessed March 24, 2017, http://www.pdf.org/about_pd.

⁶ Taylor Andrew Finseth et al., "Self-Reported Efficacy of Cannabis and Other Complementary Medicine Modalities by Parkinson's Disease Patients in Colorado," *Evidence-Based Complementary and Alternative Medicine* 2015, no.

from complications related to PD; there is no cure.⁷ Currently, six states (Connecticut, Illinois, Massachusetts, New Mexico, New York, and Ohio) allow medical marijuana as a treatment option for PD patients.⁸

Studies

Though medicinal marijuana is becoming a common treatment for neurodegenerative diseases, the majority of support for these treatments is based on anecdotal evidence.⁹ In Table 1 we present an overview of studies on PD and medical marijuana.

In a survey administered to medical professionals, the majority of participants endorsed the use of medicinal marijuana in managing symptoms such as nausea, anxiety, and pain; however, there was significantly less support for marijuana treatments for tremor and dyskinesia (Table 1, Row 1).¹⁰ Moreover, this study found that 69.6 percent of physicians believed that medical marijuana is a promising alternative for patients with PD.¹¹

Another study assessed the influence of complementary and alternative medicine (CAM) treatments, including medical marijuana, on PD patients (Table 1, Row 2).¹² Of the 207 subjects surveyed, 4 percent reported using marijuana; within that 4 percent, 78 percent reported improvement in their PD symptoms.¹³ Some clinical trials have suggested that cannabinoids improve motor function and slow disease progression in PD patients.¹⁴ Contrary to these findings, one study involving 24 individuals with PD concluded that a cannabinoid (anandamide) had no effect on subjects' motor symptoms (Table 1, Row 4).¹⁵ Additional research has suggested that medical marijuana could be used to improve irregular

874849 (2015): 1, doi:10.1155/2015/874849.

⁷ Jiaquan Xu et al., "Deaths: Final Data for 2013," *National Vital Statistics Report* 64, no. 2 (2016): 1, 5, https://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_02.pdf; "What is Parkinson's Disease?"

⁸ Mariana Babayeva et al., "Marijuana Compounds: A Nonconventional Approach to Parkinson's Disease Therapy," *Parkinson's Disease* 2016, no. 1279042 (2016): 19, doi:10.1155/2016/1279042.

⁹ Terry D. Fife et al., "Clinical Perspectives on Medical Marijuana (Cannabis) for Neurologic Disorders," *Neurology* 5, no. 4 (2015): 344-351, doi:10.1212/CPJ.000000000000162; Franjo Grotenhermen and Kristen Müller-Vahl, "The Therapeutic Potential of Cannabis and Cannabinoids," *Deutsches Arzteblatt International* 109, no. 29-30 (2012): 495-501, doi:10.3238/arztebl.2012.0495; JH Lange and Albert V. Condello III, "Herbal Marijuana and its Application in the Treatment of Parkinson's Disease," *Journal of Headache and Pain Management* 1, no. 1 (2015): 1-2, <http://headache.imedpub.com/herbal-marijuana-and-its-application-in-the-treatment-ofparkinsons-disease.pdf>.

¹⁰ Bega et al., "Medical Cannabis for Parkinson's Disease," 92-94.

¹¹ Ibid.

¹² Finseth et al., "Self-Reported Efficacy," 1-6.

¹³ Ibid.

¹⁴ Benzi Kulger et al., "The Therapeutic Potential of Cannabinoids for Movement Disorders," *Movement Disorders* 30, no. 3 (2015): 313-327, doi:10.1002/mds.26142; Pal Pacher, Sandor Batkai, and George Kunos, "The Endocannabinoid System as an Emerging Target of Pharmacotherapy," *Pharmacology Reviews* 58, no. 3 (2006): 389-462, doi:10.1124/pr.58.3.2; Babayeva et al., "Marijuana Compounds: A Nonconventional Approach," 1; "Cannabinoids," Learn About Marijuana, last modified June 2013, <http://learnaboutmarijuanawa.org/factsheets/cannabinoids.htm>. Cannabinoids are a classification of specific chemicals found in the cannabis plant; the most well known is Tetrahydrocannabinols (THC). Cannabinoids interact with pain receptors throughout the central nervous system.

¹⁵ V. Mesnage et al., "Neurokinin B, Neurotensin, and Cannabinoid Receptor Antagonists and Parkinson Disease," *Clinical Neuropharmacology* 27, no. 3 (2004): 108-110, http://journals.lww.com/clinicalneuropharm/Abstract/2004/05000/Neurokinin_B,_Neurotensin,_and_Cannabinoid

sleep patterns, pain symptoms, and quality of life in PD patients.¹⁶ Scientists must conduct further experimental trials with higher doses of cannabinoids, larger sample sizes, and longer durations of study in order to properly evaluate the influence of marijuana on PD patients' symptoms.¹⁷

Table 1: PD Study Evaluation

	Title	Source Evaluation	Conclusion	Conclusion Supported by Other Studies	Conflicts of Interest ¹⁸	Randomized	Controlled	Peer Reviewed	Other Relevant Information
1	"Medical Cannabis for Parkinson's Disease: Practices, Beliefs, and Attitudes Among Providers at National Parkinson Foundation Centers of Excellence" (2016) ¹⁹	<i>Movement Disorders</i> , ranked 14/193 in the "Clinical Neurology" category in 2015. ²⁰	"This study provides data on the cannabis-related practices, beliefs, and attitudes of expert PD physicians. There is a lack of consensus that likely reflects a general knowledge gap and paucity of data to guide clinical practice." ²¹	Yes	None	No	No	Yes	Sample Size: 56.
2	"Self Reported Efficacy of Cannabis and Other Complementary Medicine Modalities by Parkinson's Disease Patients in	<i>Hindawi Publishing Corporation</i> was established in 1997 as an Open Access, peer reviewed journal publication with over 400 scientific journals. ²³	"Cannabis was rarely used in our population but users reported high efficacy, mainly for nonmotor symptoms."	Yes	None	No	No	Yes	Sample Size: 207. Duration of Study: 9 months.

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¹⁶ Itay Lotan et al., "Cannabis (Medical Marijuana) Treatment for Motor and Non-Motor Symptoms of Parkinson Disease: An Open-Label Observational Study," *Clinical Neuropharmacology* 37, no. 2 (2014): 41-44, doi: 10.1097/WNF.000000000000016; Marcos Hortes N Chagas et al., "Effects of Cannabidiol," *Psychopharmacology* 28, no. 11 (2014): 1091-1092, doi:10.1177/0269881114550355.

¹⁷ Chagas et al., "Effects of Cannabidiol," 1088-1092; Lange and Condello, "Herbal Marijuana and its Application," 1.

¹⁸ Conflicts of interest were reported by the authors of each study.

¹⁹ Bega et al., "Medical Cannabis for Parkinson's Disease," 90.

²⁰ "Movement Disorders," InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=6.01&year=2015&journalTitle=MOVEMENT%20DISORDERS&edition=SCIE&journal=MOVEMENT%20DISORD>.

²¹ Bega et al., "Medical Cannabis for Parkinson's Disease," 1.

²³ "About Hindawi," Hindawi Publishing Corporation, accessed March, 13, 2017, <https://www.hindawi.com/>.

	Colorado” (2015) ²²		²⁴						
3	“Effects of Cannabidiol [CBD] in the Treatment of Patients with Parkinson’s Disease: An Exploratory Double-Blind Trial” (2014) ²⁵	<i>Psychopharmacology</i> , ranked 76/256 in the “Neurosciences” category, 58/255 in “Pharmacology & Pharmacy” category, 42/193 in “Clinical Neurology” category, and 35/142 in the “Psychiatry” category in 2015. ²⁶	“Our findings point to a possible effect of CBD in improving quality of life measures in PD patients with no psychiatric comorbidities [with patients administered 300 mg of CBD each day]; however, studies with larger samples and specific objectives are required before definitive conclusions can be drawn.” ²⁷	Yes	None	Yes	No	Yes	Sample Size: 21. Duration of Study: 6 weeks.
4	“Neurontin B, Neurotensin, and Cannabinoid Receptor Antagonists and Parkinson Disease” (2004) ²⁸	<i>Clinical Neuropharmacology</i> , ranked 129/193 in the “Clinical Neurology” category in 2015. ²⁹	“Parkinsonian motor disability was not modified by these drugs, which have been shown experimentally to interact with brain dopaminergic transmission.” ³⁰	Yes	None	Yes	No	Yes	Sample Size: 25. Duration of Study: 6 months.
5	“Cannabinoids Reduce Levodopa-	<i>Neurology</i> , ranked 8/193 in the “Clinical	“This study demonstrates that the	Yes	None	Yes	Yes	Yes	Sample Size: 7.

²² Finseth et al., “Self-Reported Efficacy,” 1.

²⁴ Finseth et al., “Self-Reported Efficacy,” 1.

²⁵ Chagas et al., “Effects of Cannabidiol,” 1088-1092.

²⁶ “Journal of Psychopharmacology,” Sage Publishing, accessed March 13, 2017, <https://us.sagepub.com/en-us/nam/journal/journal-psychopharmacology#description>.

²⁷ Chagas et al., “Effects of Cannabidiol,” 1088.

²⁸ Mesnage et al., “Neurokinin B, Neurotensin, and Cannabinoid Receptor,” 108-110.

²⁹ “Clinical Neuropharmacology,” InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=1.748&year=2015&journalTitle=CLINICAL%20NEUROPHARMACOLOGY&edition=SCIE&journal=CLIN%20NEUROPHARMACOL>.

³⁰ Mesnage et al., “Neurokinin B, Neurotensin, and Cannabinoid Receptor,” 110.

Induced Dyskinesia in Parkinson's Disease: A Pilot Study" (2001) ³¹	Neurology" category in 2015. ³²	cannabinoid receptor agonist nabilone can reduce GABA [gamma-aminobutyric] reuptake in the GPI [lateral globus pallidus] and alleviate levodopa-induced dyskinesia in PD." ³³						
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Crohn's Disease

Crohn's Disease (CD) is a type of inflammatory bowel disease (IBD) that causes chronic inflammation of the digestive tract. The primary symptoms of CD are weight loss, malnutrition, diarrhea, abdominal pain, and fatigue.³⁴ Approximately 1.6 million people with CD or ulcerative colitis currently live in the U.S.³⁵ Treatment options for CD patients range from antibiotics to surgery. Although there is no cure for CD, medical treatments can induce and maintain remission and manage the symptoms.³⁶

Studies

Experimental studies suggest that medical marijuana and related tetrahydrocannabinol (THC) treatments reduce specific CD symptoms, such as reduced appetite and weight loss; however, few controlled clinical studies confirm these findings.³⁷ We present and overview of the research on CD and marijuana in Table 2. One eight-week placebo-controlled experiment comprised of twenty-one patients saw a significant decrease in CD activity in individuals receiving a THC treatment (Table 2, Row 1).³⁸ There is also evidence of widespread marijuana use among patients with IBD (including CD) as an individual method of symptom management. For example, in one study, 16 percent of respondents

³¹ K.A. Sieradzan, "Cannabinoids Reduce Levodopa-Induced Dyskinesia in Parkinson's Disease: A Pilot Study," *Neurology* 57, no. 11 (2001): 2110, <https://www.ncbi.nlm.nih.gov/pubmed/11739835>.

³² "Neurology," InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=8.166&year=2015&journalTitle=NEUROLOGY&edition=SCIE&journal=NEUROLOGY>.

³³ Sieradzan, "Cannabinoids Reduce Levodopa-Induced Dyskinesia," 2108-2111.

³⁴ "Crohn's Disease," National Institute of Diabetes and Digestive and Kidney Diseases, accessed March 5, 2017, <https://www.niddk.nih.gov/health-information/digestive-diseases/crohns-disease>.

³⁵ "The Facts About Inflammatory Bowel Diseases," Crohn's & Colitis Foundation of America, accessed March 4, 2017, 10, <http://www.crohnscolitisfoundation.org/assets/pdfs/updatedibdfactbook.pdf>.

³⁶ *Ibid*, 14-15.

³⁷ A. Lahat, A. Lang, and S. Ben-Horin, "Impact of Cannabis Treatment on the Quality of Life, Weight and Clinical Disease Activity in Inflammatory Bowel Disease Patients: A Pilot Prospective Study," *Digestion* 85, no. 1 (2011): 6-8, <https://doi.org/10.1159/000332079>.

³⁸ T. Naftali et al., "Cannabis Induces a Clinical Response in Patients with Crohn's Disease: A Prospective Placebo-Controlled Study," *Clinical Gastroenterology and Hepatology* 11, no. 10 (2013): 1276-1277, <http://dx.doi.org/10.1016/j.cgh.2013.04.034>.

with CD currently use marijuana for IBD-related symptom relief (Table 2, Row 3).³⁹

Some gastroenterologists have expressed concerns regarding the side effects of medical marijuana use in CD patients. For instance, one review argued that without reliable data on medicinal marijuana use, gastroenterologists should not assume that the potential benefits of marijuana outweigh scientifically-confirmed harms, such as impaired immune function and higher risk of abdominal surgery in CD patients.⁴⁰ Another study reported that 82 percent of gastroenterologists were either neutral or not supportive of medicinal marijuana treatments for CD (Table 2, Row 2).⁴¹

Table 2: CD Study Evaluation

	Title	Source Evaluation	Conclusion	Conclusion Supported by Other Studies	Conflicts of Interest	Randomized	Controlled	Peer Reviewed	Other Relevant Information
1	"Cannabis Induces a Clinical Response in Patients with Crohn's disease: A Prospective Placebo-Controlled Study" (2013) ⁴²	<i>Clinical Gastroenterology and Hepatology</i> , ranked 7/79 in the "Gastroenterology and Hepatology" category in 2015. ⁴³	"A short course of THC-rich cannabis produced significant clinical, steroid-free benefits to 10 of 11 patients with active Crohn's disease, compared with placebo, without side effects." ⁴⁴	Yes	Lihi Bar-Lev Schleider is employed at the organization that supplied the cannabis and placebo for the study.	Yes	Yes	Yes	Sample Size: 21. Duration of Study: 8 weeks. The primary goal of the study was to induce remission; this goal was not achieved.
2	"Cannabis Use Provides Symptom Relief in Patients with Inflammatory Bowel Disease but is Associated with Worse Disease Prognosis in	<i>Inflammatory Bowel Diseases</i> , ranked 17/79 in the "Gastroenterology and Hepatology" category in 2015. ⁴⁶	"Cannabis use is common in patients with IBD and subjectively improved pain and diarrheal symptoms. However, Cannabis use was associated with higher risk of surgery in patients	Yes	None	No	No	Yes	Sample size: 313. The information was collected through an anonymous questionnaire.

³⁹ S. Lal et al., "Cannabis Use Amongst Patients with Inflammatory Bowel Disease," *European Journal of Gastroenterology & Hepatology* 23, no. 10 (2011): 892-893, doi: 10.1097/MEG.0b013e328349bb4c.

⁴⁰ W. Ahmed and S. Katz, "Therapeutic Use of Cannabis in Inflammatory Bowel Disease," *Gastroenterology & Hepatology* 12, no. 11 (2016): 675-678, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5193087/>.

⁴¹ M. Storr et al., "Cannabis Use Provides Symptom Relief in Patients with Inflammatory Bowel Disease but is Associated with Worse Disease Prognosis in Patients with Crohn's Disease," *Inflammatory Bowel Diseases* 20, no. 3 (2014): 473, doi: 10.1097/O1.MIB.0000440982.79036.d6.

⁴² Naftali et al., "Cannabis Induces a Clinical Response," 1276-1277.

⁴³ "Clinical Gastroenterology and Hepatology," InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=7.68&year=2015&journalTitle=Clinical%20Gastroenterology%20and%20Hepatology&edition=SCIE&journal=CLIN%20GASTROENTEROL%20H>.

⁴⁴ Naftali et al., "Cannabis Induces a Clinical Response," 1276.

⁴⁶ "Inflammatory Bowel Diseases," InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=2.093&year=2015&journalTitle=EUROPEAN%20JOURNAL%20OF%20GASTROENTEROLOGY%20%26%20HEPATOLOGY&edition=SCIE&journal=EUR%20J%20GASTROEN%20HEPAT>.

	Patients with Crohn's Disease" (2014) ⁴⁵		with Crohn's disease." ⁴⁷						
3	"Cannabis Use Amongst Patients with Inflammatory Bowel Disease" (2011) ⁴⁸	<i>European Journal of Gastroenterology & Hepatology</i> , ranked 54/79 in the "Gastroenterology and Hepatology" category in 2015. ⁴⁹	"Cannabis use is common amongst patients with IBD for symptom relief, particularly amongst those with a history of abdominal surgery, chronic abdominal pain and/or a low quality of life index." ⁵⁰	Yes	None	No	No	Yes	Sample Size: 291. The information was collected through an anonymous questionnaire.
4	"Marijuana Use Patterns Among Patients with Inflammatory Bowel Disease" (2013) ⁵¹	<i>Inflammatory Bowel Diseases</i> , ranked 17/79 in the "Gastroenterology and Hepatology" category in 2015. ⁵²	"A significant number of patients with IBD currently use marijuana. Most patients find it very helpful for symptom control, including patients with ulcerative colitis, who are currently excluded from medical marijuana laws." ⁵³	Yes	None	No	No	Yes	Sample Size: 292. The information was collected through an anonymous questionnaire with a 94% response rate.

⁴⁵ Storr et al., "Cannabis Use Provides Symptom Relief," 472-480.

⁴⁷ Storr et al., "Cannabis Use Provides Symptom Relief," 479.

⁴⁸ Lal et al., "Cannabis Use Amongst Patients," 892-893.

⁴⁹ "European Journal of Gastroenterology & Hepatology," InCites Journal Citation Reports, last modified September 2, 2016,

<https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=2.093&year=2015&journalTitle=EUROPEAN%20JOURNAL%20OF%20GASTROENTEROLOGY%20%26%20HEPATOLOGY&edition=SCIE&journal=EUR%20J%20GASTROEN%20HEPAT.>

⁵⁰ Lal et al., "Cannabis Use Amongst Patients," 892.

⁵¹ J. Ravikoff Allegretti et al., "Marijuana Use Patterns Among Patients with Inflammatory Bowel Disease," *Inflammatory Bowel Diseases* 9, no. 13 (2013): 2809-2814, doi: 10.1097/01.MIB.0000435851.94391.37.

⁵² "Inflammatory Bowel Diseases," InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr-incites-thomsonreuters-com.ezproxy.uvm.edu/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=4.358&year=2015&journalTitle=INFLAMMATORY%20BOWEL%20DISEASES&edition=SCIE&journal=INFLAMM%20BOWEL%20DIS.>

⁵³ Allegretti et al., "Marijuana Use Patterns," 2814.

Posttraumatic Stress Disorder

PTSD is a mental health disorder that people develop following a life-threatening or traumatic event. PTSD diagnoses are typically made using the Clinician-Administered PTSD Scale.⁵⁴ Currently, more than one-third of patients who apply for medical marijuana in the U.S. cite PTSD as the primary reason for their request.⁵⁵ Some research concludes that people with PTSD have elevated availability of cannabinoid type 1 receptors (CB₁), suggesting a higher susceptibility to medical marijuana treatment and marijuana dependence.⁵⁶

Studies

The U.S. Department of Veterans Affairs stated that the only evidence supporting the use of marijuana to treat PTSD is anecdotal.⁵⁷ Nevertheless, a retrospective chart review of 80 patients reported over a 75 percent reduction in all areas of PTSD symptoms while using marijuana (Table 3, Row 2).⁵⁸ In addition, an open label study of oral THC as a supplemental treatment for chronic PTSD reported a statistically significant reduction in PTSD symptoms (Table 3, Row 3).⁵⁹

Seventy percent of patients with PTSD experience sleep disturbance.⁶⁰ A clinical trial evaluated the use of a synthetic cannabinoid (nabilone) in managing PTSD patients' treatment-resistant nightmares (Table 3, Row 4).⁶¹ A majority of the participants (77 percent) experienced a lessening or total cessation of nightmares.⁶² Another clinical trial investigated the capacity of nabilone to reduce the frequency and intensity of treatment-resistant nightmares in military personnel with PTSD (Table 3, Row 5).⁶³ Both

⁵⁴ "Clinician-Administered PTSD Scale for DSM-5 (CAPS-5)," U.S. Department of Veterans Affairs, accessed March 5, 2017, <http://www.ptsd.va.gov/professional/assessment/adult-int/caps.asp>.

⁵⁵ "Benefits and Harms of Cannabis in Chronic Pain or PTSD: A Systematic Review," Veterans Affairs Health Services Research & Development, accessed March 2, 2017, http://www.hsrd.research.va.gov/publications/management_briefs/default.cfm?ManagementBriefsMenu=eBrief-no122.

⁵⁶ A. Neumeister et al., "Elevated Brain Cannabinoid CB₁ Receptor Availability in Post-Traumatic Stress Disorder: A Positron Emission Tomography Study," *Molecular Psychiatry* 18, no. 9 (2013): 1038-1039, doi:10.1038/mp.2013.61.

⁵⁷ Marcel Bonn-Miller and Glenna Rousseau, "Marijuana Use and PTSD Among Veterans," U.S. Department of Veterans Affairs, last modified February 23, 2016, http://www.ptsd.va.gov/professional/occurring/marijuana_use_ptsd_veterans.asp.

⁵⁸ George Greer, Charles Grob, and Adam Halberstadt, "PTSD Symptom Reports of Patients Evaluated for the New Mexico Medical Cannabis Program," *Journal of Psychoactive Drugs* 46, no. 1 (2014): 73-76, doi:10.1080/02791072.2013.873843.

⁵⁹ Pablo Roitman et al., "Preliminary, Open-label, Pilot Study of Add-on Oral Delta⁹-Tetrahydrocannabinol in Chronic Post-Traumatic Stress Disorder," *Clinical Drug Investigation* 34, no. 8 (2014): 587-91, doi:10.1007/s40261-014-0212-3; "NCI Dictionary of Cancer Terms," National Cancer Institute, accessed April 6, 2017, <https://www.cancer.gov/publications/dictionaries/cancer-terms?cdrid=285990>. In open label studies, both the researcher and the patient are aware of the treatment being given.

⁶⁰ George Fraser, "The Use of a Synthetic Cannabinoid in the Management of Treatment-Resistant Nightmares in Posttraumatic Stress Disorder (PTSD)," *CNS Neuroscience & Therapeutics* 15, no. 1 (2009): 84-87, doi:10.1111/j.1755-5949.2008.00071.x.

⁶¹ Fraser, "The Use of a Synthetic Cannabinoid," 47. Nabilone is a synthetic cannabinoid used for over 25 years in Canada and Europe and recently approved in the U.S. for chemotherapy-induced nausea and vomiting.

⁶² Ibid.

⁶³ Rakesh Jetly et al., "The Efficacy of Nabilone, a Synthetic Cannabinoid, in the Treatment of PTSD-Associated Nightmares: A Preliminary Randomized, Double-Blind, Placebo-Controlled Cross-Over Design Study,"

studies demonstrated a statistically significant improvement in participants receiving the nabilone treatment.⁶⁴

These studies suggest that marijuana may be an effective treatment for some PTSD symptoms. Nonetheless, virtually all research, as well as systematic literature reviews, call for controlled, large-scale, and randomized studies in order to determine the efficacy of marijuana in PTSD treatment (Table 3, Row 6). One such study is currently under way (Table 3, Row 1).⁶⁵

Table 3: PTSD Study Evaluation

	Title	Source Evaluation	Conclusion	Conclusion Supported by Other Studies	Conflicts of Interest	Randomized	Controlled	Peer Reviewed	Other Relevant Information
1	"Placebo-Controlled, Triple-Blind, Randomized Crossover Pilot Study of the Safety and Efficacy of Four Different Potencies of Smoked Marijuana in 76 Veterans with Chronic, Treatment-Resistant Posttraumatic Stress Disorder (PTSD)" (2017) ⁶⁶	As the study is ongoing there is no publishing source to evaluate. The organization sponsoring the study is the Multidisciplinary Association for Psychedelic Studies. ⁶⁷	The study is ongoing.	N/A	None	Yes	Yes	N/A	The study will be the first large scale, randomized, controlled study of the efficacy of marijuana in treating PTSD.
2	"PTSD Symptom Reports of	<i>Journal of Psychoactive</i>	"The data reviewed here	Yes	None	No	No	Yes	Sample Size: 80.

Psychoneuroendocrinology 51 (2015): 586-88, accessed March 3, 2017, <http://www.sciencedirect.com/science/article/pii/S0306453014004132#bib0050>.

⁶⁴ Ibid; "Investigative Report," Vermont Human Rights Commission, January 26, 2017, <http://hrc.vermont.gov/sites/hrc/files/Cases/Merriam%20v%20DPS%20Investigative%20Report%20and%20RG%20Final%20Determination.pdf>. In January, 2017, the Vermont Human Rights Commission found that the Department of Public Services discriminated against a patient with PTSD. The Commission concluded that the Department's superimposition of the term "physical" to the statute which requires "severe pain" in order to qualify for the medical marijuana registry disadvantaged mentally or emotionally disabled applicants.

⁶⁵ "Placebo-Controlled, Triple-Blind, Randomized Crossover Pilot Study of the Safety and Efficacy of Four Different Potencies of Smoked Marijuana in 76 Veterans with Chronic, Treatment-Resistant Posttraumatic Stress Disorder," Multidisciplinary Association for Psychedelic Studies, June 28, 2016, https://s3-us-west-1.amazonaws.com/mapscontent/research-archive/mmj/MJP1-Protocol-Amendment5-V1-28Jun2016_Web.pdf;

"Approved Medical Marijuana Research Grants," Colorado Department of Public Health & Environment, accessed March 2, 2017, <https://www.colorado.gov/pacific/cdphe/approved-medical-marijuana-research-grants>; Greer et al., "PTSD Symptom Reports of Patients," 73-76.

⁶⁶ "Placebo-Controlled, Triple-Blind, Randomized Crossover Pilot Study," Multidisciplinary Association for Psychedelic Studies.

⁶⁷ "About MAPS," Multidisciplinary Association for Psychedelic Studies, accessed March 5, 2017, <http://www.maps.org/about>.

	Patients Evaluated for the New Mexico Cannabis Program” (2014) ⁶⁸	<i>Drugs</i> , ranked 57/122 in the “Clinical Psychology” category in 2015. ⁶⁹	supports a conclusion that cannabis is associated with PTSD symptom reduction in some patients, and a prospective, placebo-controlled study of cannabis or its constituents for treatment of PTSD is warranted.” ⁷⁰						The data was collected through a retrospective chart review.
3	“Preliminary, Open-Label, Pilot Study of Add-On Oral Delta ⁹ -Tetrahydrocannabinol in Chronic Post-Traumatic Stress Disorder” (2014) ⁷¹	<i>Clinical Drug Investigation</i> , ranked 165/255 in the “Pharmacology and Pharmacy” category in 2015. ⁷²	“The intervention caused a statistically significant improvement in global symptom severity, sleep quality, frequency of nightmares, and PTSD hyperarousal symptoms.” ⁷³	Yes	None	No	No	Yes	Sample Size: 10. Duration of Study: 3 weeks.
4	“The Use of a Synthetic Cannabinoid in the Management of Treatment-Resistant Nightmares in Posttraumatic Stress Disorder (PTSD)” (2009) ⁷⁴	<i>CNS Neuroscience & Therapeutics</i> was ranked 65/256 in the “Neurosciences” category and 43/255 in the “Pharmacology and Pharmacy” category in 2015. ⁷⁵	“A chart review of patients diagnosed with PTSD who were referred to a private psychiatric clinic suggests that the synthetic cannabinoid, nabilone, has beneficial effects beyond its	Yes	None	No	No	Yes	Sample Size: 47. This study is limited due to participants’ subjective reports of changes in nightmare patterns and by selection bias in the research design.

⁶⁸ Greer et al., “PTSD Symptom Reports of Patients,” 73-76.

⁶⁹ “Journal of Psychoactive Drugs,” InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=1.775&year=2015&journalTitle=JOURNAL%20OF%20PSYCHOACTIVE%20DRUGS&edition=SSCI&journal=J%20PSYCHOACTIVE%20DRUGS>.

⁷⁰ Greer et al., “PTSD Symptom Reports of Patients,” 76.

⁷¹ Roitman et al., “Preliminary, Open-Label, Pilot Study,” 587-91.

⁷² “Clinical Drug Investigation,” InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=1.806&year=2015&journalTitle=CLINICAL%20DRUG%20INVESTIGATION&edition=SCIE&journal=CLIN%20DRUG%20INVESTIGATION>.

⁷³ Roitman et al., “Preliminary, Open-Label, Pilot Study,” 591.

⁷⁴ Fraser, “The Use of a Synthetic Cannabinoid,” 84-87.

⁷⁵ “CNS Neuroscience and Therapeutics,” InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr.incites.thomsonreuters.com/JCRJournalProfileAction.action?pg=JRNLPF&journalImpactFactor=4.019&year=2015&journalTitle=CNS%20Neuroscience%20and%20Therapeutics&edition=SCIE&journal=CNS%20NEUROSCIENCE%20THER>.

			official indication in regard to abolishing or greatly reducing nightmares that persisted in spite of treatment with conventional PTSD medications.” ⁷⁶						
5	“The Efficacy of Nabilone, a Synthetic Cannabinoid, in the Treatment of PTSD-Associated Nightmares: A Preliminary Randomized, Double-Blind, Placebo-Controlled Cross-Over Design Study” (2015) ⁷⁷	<i>Psychoneuroendocrinology</i> , ranked 47/256 in the “Neurosciences” category and 23/142 in the “Psychiatry” category in 2015. ⁷⁸	“NAB provided significant relief for military personnel with PTSD, indicating that it shows promise as a clinically-relevant treatment for patients with nightmares and a history of non-response to traditional therapies.” ⁷⁹	Yes	None	Yes	Yes	Yes	Sample Size: 10. Duration of Study: 7 weeks. The gender composition of this study’s sample limits its applications as it included solely male military personnel.
6	“Cannabinoids as Therapeutic for PTSD” (2017) ⁸⁰	<i>Current Opinion in Psychology</i> , not ranked by the Journal Citation Reports, as it has only been in circulation since 2015. Nevertheless, the journal is part of a larger collection of highly-regarded <i>Current Opinion</i> journal publications. ⁸¹	“CBD and THC + CBD may be capable of modulating fear memory in PTSD. . . CBD may also have acute positive effects on anxiety and anhedonia. . . THC may have an effect on the reduction of nightmares.” ⁸²	N/A	Both authors received consulting fees from private companies, but none of the companies were involved in design or execution of the review.	N/A	N/A	Yes	Systematic review of trials and studies that examine potential uses of cannabis in treating PTSD, broken down by specific symptom. The review noted several limitations of this research on cannabis.

⁷⁶ Fraser, “The Use of a Synthetic Cannabinoid,” 87.

⁷⁷ Jetly et al., “The Efficacy of Nabilone,” 586-588.

⁷⁸ “Psychoneuroendocrinology,” InCites Journal Citation Reports, last modified September 2, 2016, <https://jcr-incites-thomsonreuters-com.ezproxy.uvm.edu/JCRJournalProfileAction.action?pg=JRNLPROF&journalImpactFactor=4.704&year=2015&journalTitle=PSYCHONEUROENDOCRINOLOGY&edition=SCIE&journal=PSYCHONEUROENDOCRINO>.

⁷⁹ Jetly et al., “The Efficacy of Nabilone,” 588.

⁸⁰ Mallory Loflin, Kimberly Babson, and Marcel Bonn-Miller, “Cannabinoids as Therapeutic for PTSD,” *Current Opinion in Psychology* 12 (2017): 78-83, accessed March 4, 2017, <http://dx.doi.org/10.1016/j.copsyc.2016.12.001>.

⁸¹ “Current Opinion in Psychology,” Elsevier, accessed March 8, 2017, <https://www.journals.elsevier.com/current-opinion-in-psychology/>.

⁸² Loflin et al., “Cannabinoids as Therapeutic,” 83.

Conclusion

Overall, current studies suggest that medical marijuana, specifically cannabinoid compounds in marijuana, relieve some symptoms of Parkinson's Disease, Crohn's Disease, and Posttraumatic Stress Disorder. Additional randomized and controlled studies with broader data sets (e.g. larger sample size and longer duration of study) would be beneficial in evaluating the efficacy of marijuana treatment for PD, CD, and PTSD.

This report was completed on May 2, 2017, by Abigail Ames, Catherine Curran-Groome, and Charlotte Gliserman, under the supervision of Professors Eileen Burgin, Alec Ewald and Jack Gierzynski and with the assistance of Research Assistant Laura Felone in response to a request from Senator Claire Ayer.

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Disclaimer: This report has been compiled by undergraduate students at the University of Vermont under the supervision of Professor Anthony Jack Gierzynski, Professor Alec Ewald and Professor Eileen Burgin. The material contained in the report does not reflect the official policy of the University of Vermont.