



*** APPENDIX ***

California NORML Research Report – March, 2025

**STUDIES SHOW MEDICAL CANNABIS EFFECTIVE IN TREATING
CHRONIC PAIN, REDUCING OPIOID DEPENDENCY**

A mounting body of scientific research shows that medical cannabis is an effective harm-reduction substitute for opioids for chronic pain patients. Following is a partial list of studies that have found significant reductions in opioid use and/or fatalities in patients with access to medical cannabis. Another, web-based list of over 120 studies documenting therapeutic benefits of medicinal cannabis for reducing chronic pain and patient demand for opioids and other prescription drugs may be found at: <https://norml.org/marijuana/fact-sheets/relationship-between-marijuana-and-opioids/>

- 1. Clinical outcome data of chronic pain patients treated with cannabis-based oils and dried flower from the UK Medical Cannabis Registry (Tait, Erridge et al., *Expert Review of Neurotherapeutics* Vol. 23 #4, 2023)**

Seven hundred chronic pain patients treated with cannabis oils or flowers recorded improvements in pain and quality of life with significance $p < 0.050$.
- 2. Cannabis Use for Medical Reasons Among Patients in a Large California Health Care System After Legalization for Nonmedical Use (Ruchir Karmali et al, *Journal of Studies on Alcohol and Drugs* :84, Sep 2023)**

Over a third of Kaiser Health patients suffering chronic pain report using cannabis for therapeutic use.
- 3. Cannabis oil extracts for chronic pain: what else can be learned from another structure prospective cohort? (Dorit Pud et al, *Pain Rep.* 26 Apr 2024)**

Prospective Israeli study of 200 chronic pain patients finds cannabis oil extracts deliver “modest overall long-term improvement” with reasonable safety.
- 4. UK medical cannabis registry: A clinical outcome analysis of medical cannabis therapy in chronic pain patients with and without co-morbid**

sleep impairment (Ishita Datta, Simon Erridge et al, *Pain Practice* 15 Nov 2024)

Cohort study of 1139 patients finds cannabis reduced pain severity, especially in sleep-impaired subjects.

5. **Comparative effectiveness of medicinal cannabis for chronic pain versus prescription medication treatment (Ajay Wasan et al, *Pain* 2025 Jan 24).**

Review of 440 patients using medical cannabis for chronic pain finds reduced opioid use, 2.6 odds ratio favoring cannabis over other medication.
6. **Cannabis for medical use versus opioids for chronic non-cancer pain: a systematic review and network meta-analysis of randomized clinical trials (Haron M. Jeddi et al, *BMJ Open*: 14 - 3 Jan 2024)**
7. **Review of 90 trials on 22028 patients finds “cannabis for medical use may be similarly effective and cause fewer discontinuations than opioid for chronic non-cancer pain.”**
8. **Opioid-sparing effect of cannabinoids for analgesia: an updated systematic review and meta-analysis of preclinical and clinical studies (Suzanne Nielsen et al., *Neuropsychopharmacology* 2022)**

Pre-clinical and observational studies support opioid-sparing potential of cannabinoids. Clinical trials show mixed results.
9. **Impact of co-administration of oxycodone and smoked cannabis on analgesia (Ziva Cooper et al, *Neuropsychopharmacology* 43, 2018)**

Cannabis enhances the analgesic effects of sub-threshold oxycodone, suggesting synergy, without increases in cannabis’s abuse liability.
10. **Clinical Practice Guidelines for Cannabis and Cannabinoid-Based Medicines in the Management of Chronic Pain and Co-Occurring Conditions (Alan D. Bell et al, *Cannabis and Cannabinoid Research* Volume X No. X 2023)**

Canadian guidelines for the safe use of cannabis for chronic pain management including in conjunction with opioids
11. **[Benefits and harms of cannabis-based medicines from the viewpoint of patients with chronic pain and their physicians: A cohort study in three pain centers of the German federal state Saarland] [in German] (Claudia Bottge-Wolpers et al., *Schmerz* 38:4. Aug 2024)**

In study of 187 chronic pain patients, 88% reported significant or moderate improvements from cannabis therapy; of those using opioids 65% ceased doing so.
12. **The Effectiveness and Safety of Medical Cannabis for Treating**

Cancer Related Symptoms in Oncology Patients (J. Aviram et al, *Front. Pain Res*, May 2022).

Large-scale, comprehensive, prospective Israeli study found mild-to-modest improvements in pain and importantly reductions in opioid and other drug use.

- 13. Medical Cannabis Used as an Alternative Treatment for Chronic Pain Demonstrates Reduction in Chronic Opioid Use – A Prospective Study (G. Benedict, A. Sabbagh and T. Conermann, *Pain Physician* 2022)**

Prospective study found 67 – 73% decrease in opioid use among patients treated with medical cannabis.

- 14. Medical cannabis for the reduction of opioid dosage in the treatment of non-cancer chronic pain: a systematic review (Okusanya et al, *Systematic Reviews* 2020).**

Review of 9 studies involving 7222 participants finds 64-75% reduction in opioid dosage when used with medical cannabis; more research needed on dosage.

- 15. Does Marijuana Legalization Affect Work Capacity? Evidence from Workers' Compensation Benefits (R Abouk, K Ghimire, JC Maclean, D Powell; Working Paper 28471, National Bureau of Economic Research, Feb 2021).**

Finds workers' comp benefit receipts decline in response to recreational marijuana laws, likely due to improved access to pain management therapy.

- 16. Cannabis Significantly Reduces the Use of Prescription Opioids and Improves Quality of Life in Authorized Patients: Results of a Large Prospective Study (Philippe Lucas et al.) *Pain Medicine*, 27 Dec. 2020.**

Study of 1,145 patients at 21 Canadian medical clinics found 78% reduction in opioid use after six months. 28% of patients used opioids at start, 11% at end.

- 17. Survey on the Effect that Medical Cannabis Has on Prescription Opioid Medication Usage for the Treatment of Chronic Pain at Three Practice Sites (Kevin Takakuwa, Dustin Sulak) *Cureus*.11848 Dec 2, 2020.**

Study of 525 medical cannabis patients finds 40.4% stopped using all opioids and 45.2% reported some reductions in usage; 1.1% reported increase usage.

- 18. Medical Cannabis for the Management of Pain and Quality of Life in Chronic Pain Patients: A Prospective Observational Study (Ramin Safakish et al) *Pain Medicine* 21#11, Nov 2020**

Study of 751 chronic pain patients at a cannabis clinic. Subjects reported significant improvements in pain severity and significant reductions in opioid medication over course of 12 months.

19. Matched pilot study examining cannabis-based dronabinol for acute pain following traumatic injury (E. Schneider-Smith et al., *Trauma Surg Acute Care Open* 2020; 5:e000391)
Matched controlled study of 66 trauma patients found ninefold greater reduction in opioid consumption when given adjunctive dronabinol (THC).
20. The Impact of Cannabis Access Laws on Opioid Prescribing (McMichael, Van Horn, Viscusi, *Journal of Health Economics* 7 Dec 2019)
Review of 1.5 billion opioid prescriptions finds legal adult use and medical cannabis laws reduce the amount of opioids prescribed by 11.8% and 4.2% respectively.
21. Frequency of cannabis and illicit opioid use among people who use drugs and report chronic pain: A longitudinal analysis (Lake et al, *PLoS Med* 2019 Nov 19)
Survey of 1,152 Vancouver patients found daily cannabis use associated with significantly lower odds of daily illicit opioid use.
22. Substitution of Marijuana for Opioids in a National Survey of US Adults: (Julie Ishida et al, *PLOS One* Oct 4, 2019).
Survey of 486 respondents using marijuana with opioids finds 41% report decrease or cessation of opioid use.
23. The Effect of Cannabis Laws on Opioid Use (J. Flexner, L. Stolzenberg, S. D'Alessio, *International Journal of Drug Policy* 74: 152-9 Sep-Dec 2019)
Analysis of data from National Survey on Drug Abuse and Health finds evidence medical marijuana laws may be effective reducing opioid reliance.
24. Medical Cannabis: Effects on Opioid and Benzodiazepine Requirements for Pain Control (O'Connell et al, *Ann Pharmacother.* 2019 Nov 53(11):1081-6)
6-month retrospective study of 77 intractable pain patients finds significant decrease in use of morphine, but not benzodiazepine, with cannabis.
25. Effects of Marijuana Legalization and Dispensing On Opioid Mortality (Nathan Chan, Jesse Burkhardt, Matthew Flyr, *Economic Inquiry* 6 Aug 2019)
Econometric analysis finds state recreational marijuana laws associated

with reduced annual opioid mortality of 20-35%, esp. strong in case of synthetic opioids.

26. Effects of Medical Marijuana Dispensaries on Adverse Opioid Outcomes (Rhet Smith, *Economic Inquiry* 16 Jul 2019)

County-level RX opioid-related fatalities decline 11% following opening of medical marijuana dispensaries.

27. Use of Cannabis to Relieve Pain and Promote Sleep by Customers at an Adult Use Dispensary (Marcus Bachhuber, Julia Arnsten & Glenn Wurm, *Journal of Psychoactive Drugs* 2 Jul 2019).

In a survey of 1,000 adult-use only Colorado dispensary customers, 65% use cannabis to treat chronic pain, 80% of whom find it “extremely helpful,” 88% of whom report stopping or reducing use of opioids.

28. Medical Cannabis Legalization and Opioid Prescriptions: Evidence on US Medicaid Enrollees during 1993-2014 (Di Liang, Yuhua Bao, Mark Wallace, Igor Grant, Yuyan Shi, *Addiction* 10 July 2018).

Medical cannabis legalization associated with a 29.6% reduction in related Medicaid spending for Schedule III (not II) opioid prescriptions.

29. Association of Medical and Adult-Use Marijuana Laws With Opioid Prescribing for Medicaid Enrollees (Hafei Wen, Jason Hockenberry, *JAMA Intern Med.* May 2018)

All-capture Medicaid data for 2011-2016 show medical and adult use marijuana laws associated with 5.88% and 6.38% lower opioid RX rates.

<https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2676999>

30. Intractable Pain Patients in the Minnesota Medical Cannabis Program: Experience of Enrollees During the First Five Months (Minnesota Dept of Health, 2018).

63% of 2,245 intractable pain patients in the state’s medical cannabis program were able to reduce or eliminate opioid usage six months after enrolling.

31. Cannabis Use Associated with Lower Odds of RX Opioid Use Among HIV-Infected Individuals with Chronic Pain, (Nancy Sohler et al. *Journal of Substance Use & Abuse*, 17 Jan 2018)

In multivariate analyses of 505 HIV patients, cannabis use was significantly associated with lower odds of prescribed opioid analgesic use.

32. Medical Marijuana Laws May Be Associated With A Decline In The Number Of Prescriptions For Medicaid Enrollees (Bradford & Bradford, *Health Affairs*, Apr 2017):

Medicaid prescription drug costs were lower in states with medical marijuana laws in five of nine clinical areas, including pain. Est. cost savings > \$1 billion.

<http://content.healthaffairs.org/content/early/2017/04/13/hlthaff.2016.1135>

33. Associations between medical cannabis and prescription opioid use in chronic pain patients: A preliminary cohort study (Vigil, Stith, Adams and Reeves, *Plos One* Nov 16, 2017:

<https://doi.org/10.1371/journal.pone.0187795>)

37 chronic back pain patients in N.M. medical cannabis program showed higher odds of ceasing and reducing opioid use than 29 non-cannabis opioid users.

34. Effects of Legal Access to Cannabis on Scheduled II-V Drug Prescriptions (S. Stith et al, JAMDA, Society for Post-Acute and Long-Term Care Medicine 2017):

Study of 83 chronic pain patients in New Mexico medical cannabis program found 34% quit prescription pharmaceuticals after 10 months.

35. Substitution of medical cannabis for pharmaceutical agents for pain, anxiety, and sleep. (Piper et al, *J. Psychopharmacol*, 1 Mar 2017):

Survey of 1,513 New England dispensary members reported 76.7% reduced use of opiates starting use of medical cannabis

<https://www.ncbi.nlm.nih.gov/pubmed/28372506>

36. Recreational Cannabis Legalization and Opioid-Related Deaths in Colorado 2000-2015 (Livingston et al, *Am J Public Health* Nov. 2017: 127-9):

Colorado's legalization resulted in a 0.7 deaths per month decline in opioid deaths, reversing a prior upward trend.

37. Cannabis as a Substitute for Opioid-Based Pain Medication: Patient Self-Report. (Amanda Reiman et al, *Cannabis and Cannabinoid Research* Vol 2.1 2017)

A survey of 2897 medical cannabis patients found 34% used opioids, 97% of whom "strongly agreed/agreed" that cannabis reduced their opioid consumption.

<http://online.liebertpub.com/doi/pdfplus/10.1089/can.2017.0012>

38. Medical Marijuana Policies and Hospitalizations Related to Marijuana and Opioid Pain Reliever (Y Shi, *Drug Alcohol Depend.* Apr 2017)

Medical marijuana legalization associated with reductions of 23% in hospitalizations due to opioid dependence and 13% due to overdose.

<https://www.ncbi.nlm.nih.gov/pubmed/28259087>

39. Association Between US State Medical Cannabis Laws and Opioid Prescribing in the Medicare Part D Population (Ashley Bradford, W. David Bradford and Amanda Abraham, JAMA Intern Med. May 2018

Medicare Part D opioid RXs decreased 2.11 million daily doses/year from average 23.08 when states institute medical cannabis laws and 3.742 million doses when dispensaries opened.

<https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2676999>

40. Medical Marijuana Laws Reduce Prescription Medication Use In Medicare Part D (Bradford & Bradford, *Health Affairs* Apr 2017)

National overall reductions in Medicare program and enrollee spending in states with medical marijuana laws estimated to be \$165.2 million per year in 2013.

<http://content.healthaffairs.org/content/35/7/1230.abstract>

41. Cannabis as a substitute for prescription drugs – a cross-sectional study (Corroon, Mischley, Sexton, *J of Pain Research*, Mar 2017)

46% of 2,774 cannabis users reported using it as a substitute for RX drugs, the most common being narcotics/opioids (35.8%).

<https://www.dovepress.com/cannabis-as-a-substitute-for-prescription-drugs-ndash-a-cross-sectiona-peer-reviewed-article-JPR>

42. Cannabis and intractable chronic pain: an explorative retrospective analysis of Italian cohort of 614 patients (Fanelli et al. *J of Pain Research* May 2017)

“Even with the heterogeneity of the sample size and limited data available... the treatment seems to be effective and safe in the majority of patients” <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5449133/>

43. Patient perceptions of the use of medical marijuana in the treatment of pain following musculoskeletal trauma. A survey of patients at two trauma centers in Massachusetts. (Heng M et al, *Journal of Orthopaedic Trauma* Aug 18, 2017)

90% of patients using marijuana to treat musculoskeletal trauma thought it reduced pain symptoms; 81% said it reduced their use of opioid pain medication.

http://journals.lww.com/jorthotrauma/Abstract/publishahead/Patient_perceptions_of_the_use_of_medical.98730.aspx

44. Do Medical Marijuana Laws Reduce Addictions and Deaths Related to Pain Killers? (Powell, Pacula, Jacobson, NBER Working Paper Jul 2015)

States permitting medical marijuana dispensaries experience a relative decrease in both opioid addictions and opioid overdose deaths compared to

states that do not. <http://www.nber.org/papers/w21345>

45. Medical Cannabis Laws and Opioid Analgesic Overdose Mortality in the United States, 1999-2010 (Bachhuber et al, *JAMA Intern Med.* Oct 2014)

Conclusion: Medical cannabis laws are associated with significantly lower state-level opioid overdose mortality.

<http://archinte.jamanetwork.com/article.aspx?articleid=1898878>

46. Cannabis Use Is Associated With Decreased Opiate Medication Use in a Retrospective Cross-Sectional Survey of Patients With Chronic Pain (Boehnke, Litinas, Clauw, *J. Pain* Jun 2016.)

Survey of 244 chronic pain patients found medical cannabis use associated with a 64% decrease in opioid use, decreased number and side effects of medications, and an improved quality of life.

<http://www.ncbi.nlm.nih.gov/pubmed/27001005>

47. Splendor in the Grass? A Pilot Study Assessing the Impact of Medical Marijuana (Gruber et al, *Front Pharmacol*, Oct 2016)

Study of 24 medical cannabis patients found notable decrease in use of conventional pharmaceutical agents, with opiate use declining more than 42% <https://www.ncbi.nlm.nih.gov/pubmed/27790138>

48. The Effect of Medicinal Cannabis on Pain and Quality of Life Outcomes in Chronic Pain: A Prospective Open-label Study (Haroutounian et al, *Clin J Pain*, Dec 2016)

The treatment of chronic pain with medicinal cannabis in 176 patients resulted in improved pain and functional outcomes, and a significant reduction in opioid use.

<http://www.ncbi.nlm.nih.gov/pubmed/26889611>

49. NIDA: “Is marijuana safe and effective as medicine?”

<https://www.drugabuse.gov/publications/marijuana/marijuana-safe-effective-medicine> NIDA Release 2019

Existing studies “cumulatively suggest that medical marijuana products may have a role in reducing the use of opioids needed to control pain.”

50. Among veterans, opioid prescription requests down in step with rise in medical pot (Vancouver *Globe and Mail*, Jun 7, 2016)

Fewer Canadian veterans have sought prescription opioids and tranquilizers in recent years while prescriptions for medical marijuana have skyrocketed.

<http://www.theglobeandmail.com/news/national/among-veterans-opioid-prescription-requests-down-in-step-with-rise-in-medical-pot/article30285591/>

51. Smoked cannabis for chronic neuropathic pain: a randomized

controlled trial (Mark Ware et al. 2010. *CMAJ* 182: 694-701).

Smoked cannabis significantly improved measures of pain, sleep quality and anxiety in 23 patients with refractory pain for which conventional therapies had failed.

52. Cannabinoid-opioid interaction in chronic pain (D I Abrams et al, *Clin Pharmacol Ther* Dec 2011)

Vaporized cannabis augmented analgesic effects of opioids without significantly altering plasma opioid levels in 21 clinical subjects.

53. Low-dose vaporized cannabis significantly improves neuropathic pain. (Wilsey B, Marcotte T, et al. *H.J Pain*. 2013 Feb;14(2):136-48.)

Low and moderate dose of cannabis show equal, “clinically significant” analgesic efficacy in relieving neuropathic pain.

54. Medical Cannabis: A Review from the American Society of Pain and Neuroscience (Natalie Strand et al., *J Pain Res*. Dec. 2023)

American Pain Society review notes lack of large-scale randomized studies, but gives a grade C recommendation for use of cannabis in the treatment of neuropathic pain.

55. The clouded debate: A systematic review of comparative longitudinal studies examining the impact of recreational cannabis legalization on key public health outcomes (Maria Athanassiou et al, *Front Psychiatry* 11 Jan 2023)

Evidence is sufficient to establish a potentially beneficial association between recreational marijuana legislation and prescription opioid patterns

56. Medical Marijuana Legalization and Opioid- and Pain-Related Outcomes Among Patients Newly Diagnosed With Cancer Receiving Anticancer Treatment (Yuhua Bao et al, *JAMA Oncology*, Dec 2022.)

Medical marijuana laws associated with 5.5% - 19.2% relative reducing in rate of opioid dispensing.