Medical Cannabis, Opioid Use, and the Opioid Mortality Crisis: Evidence for Kentucky

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Introduction to issues

- Cannabis policy - both medical and recreational - is changing rapidly around the world.
- Most changes to these policies are fairly recent, so there is often not enough time passed for data to be available.
- Still, a rich literature is developing with unique data challenges.

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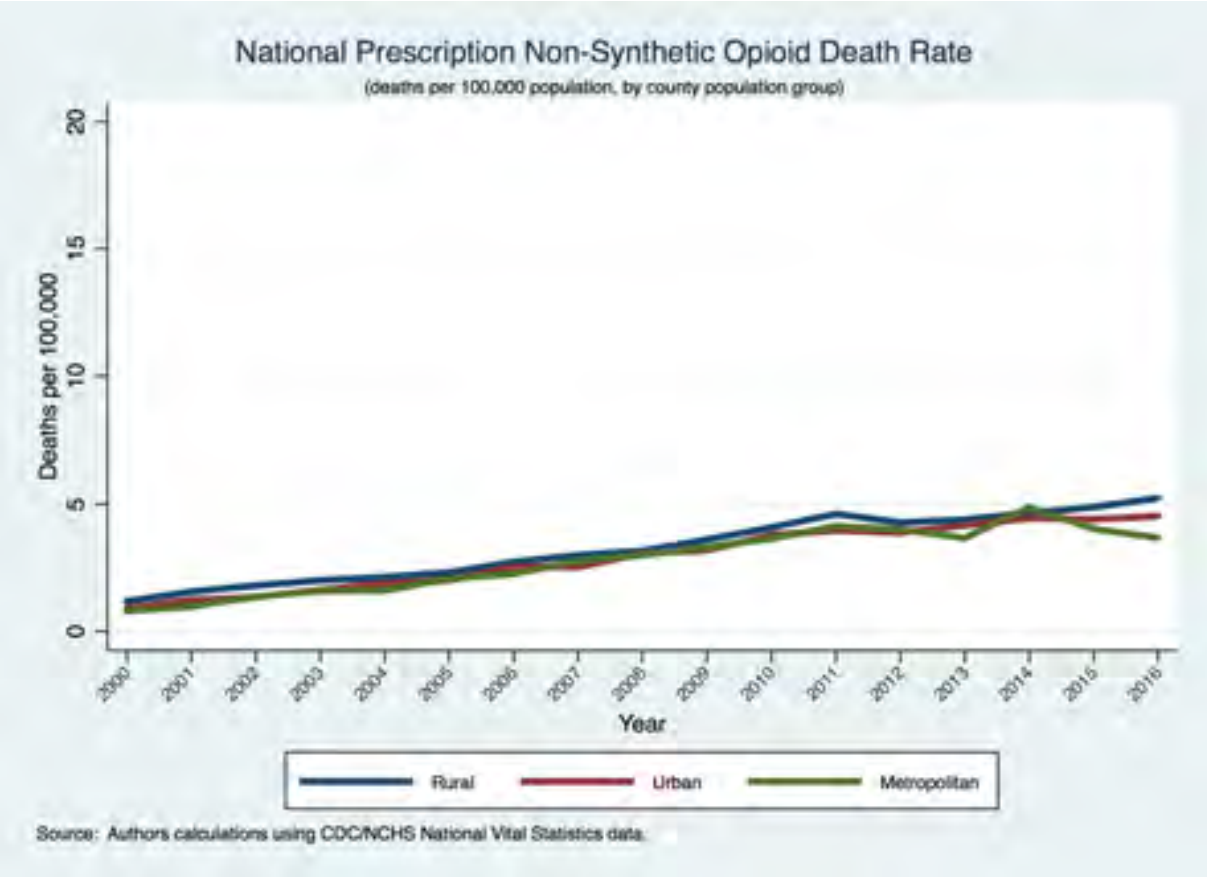
Why is this important?



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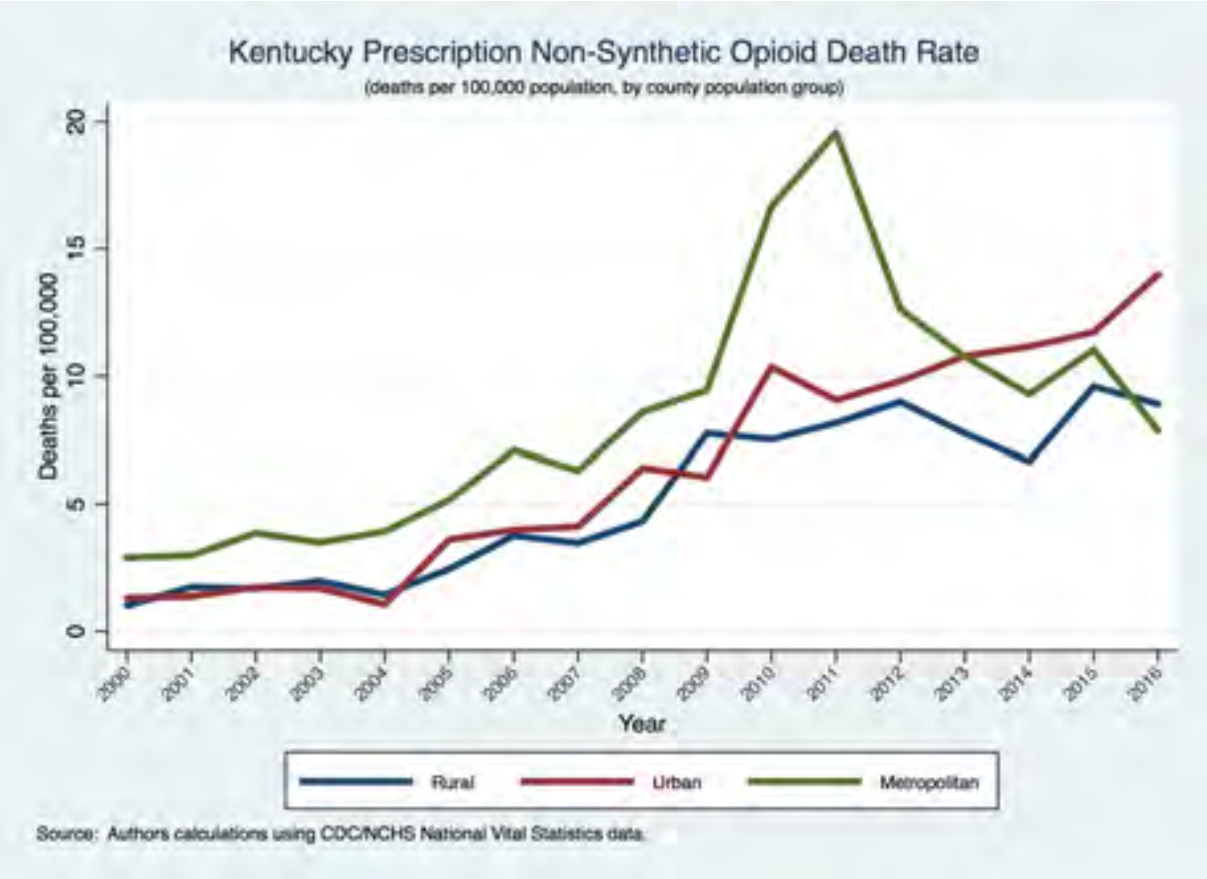

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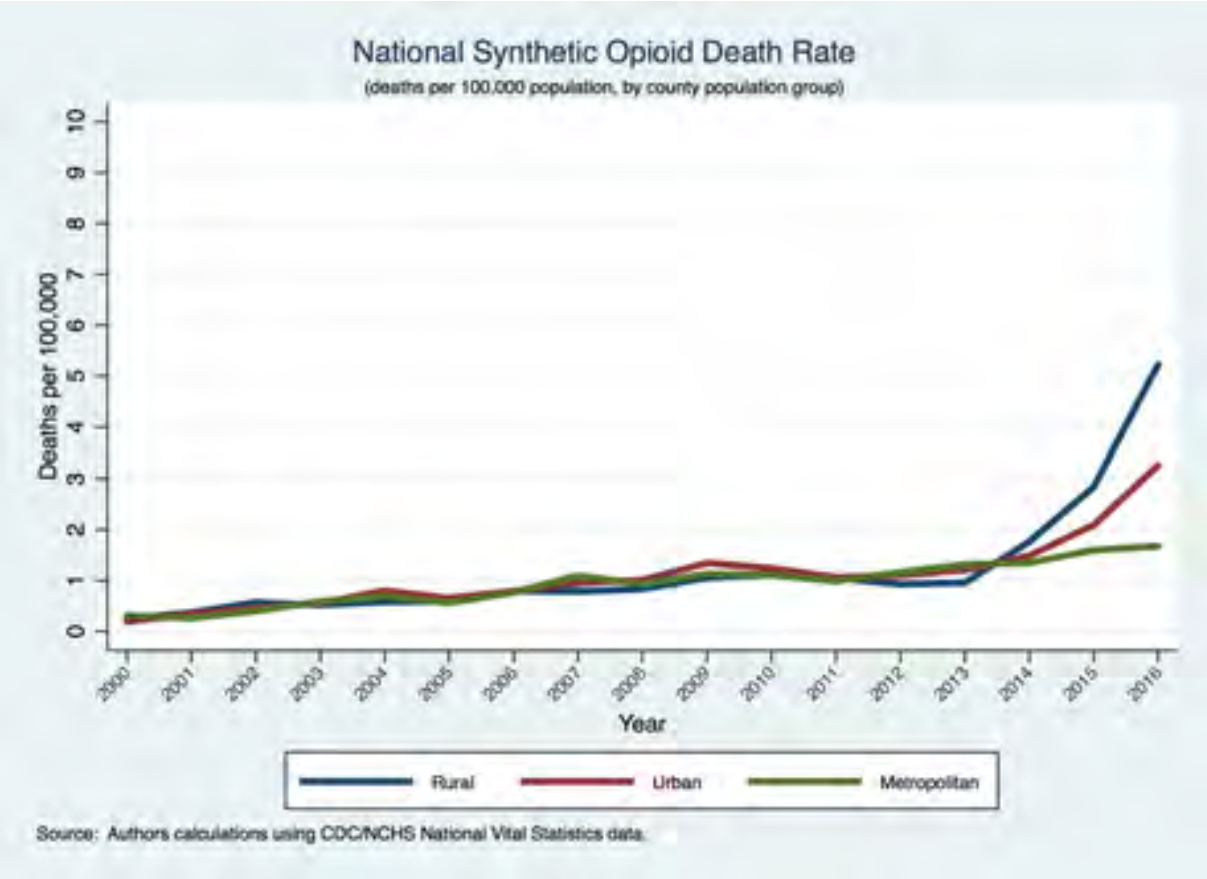

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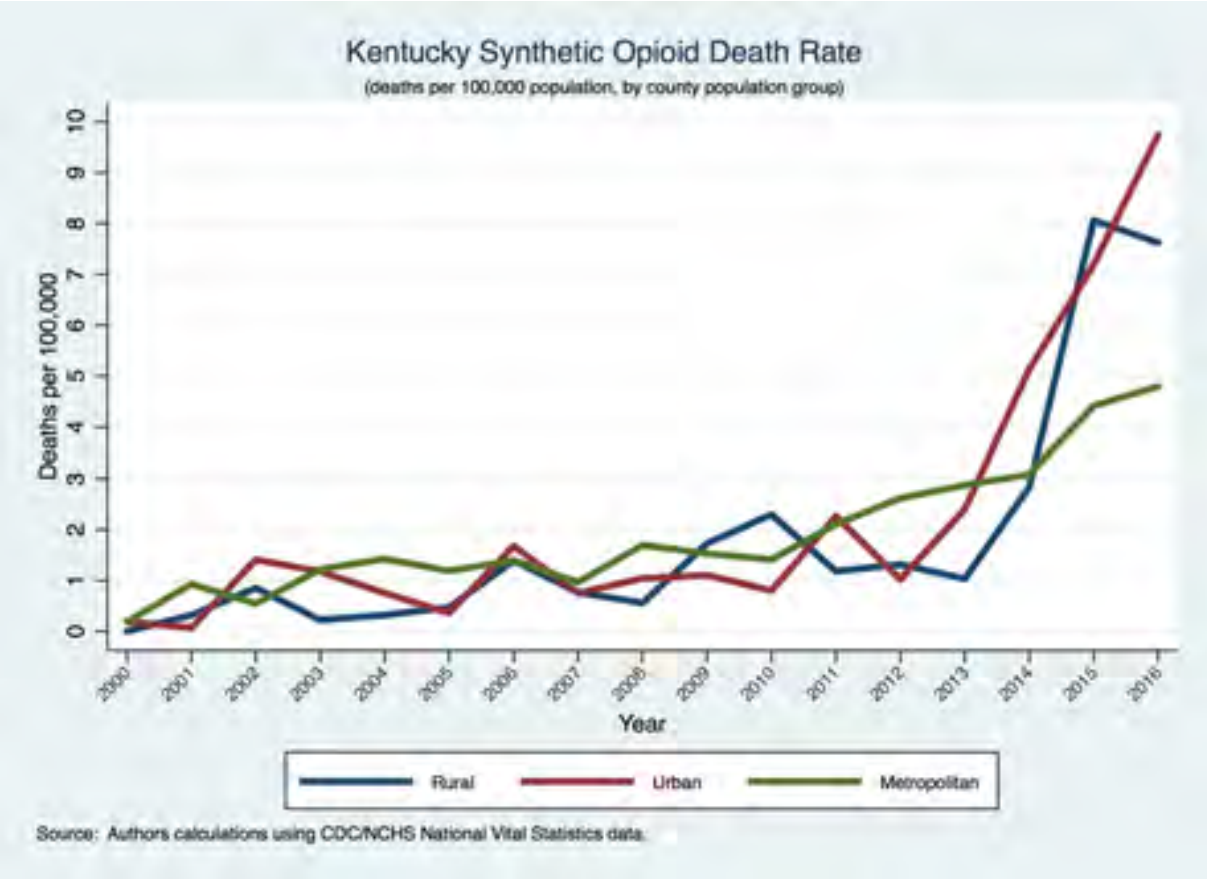
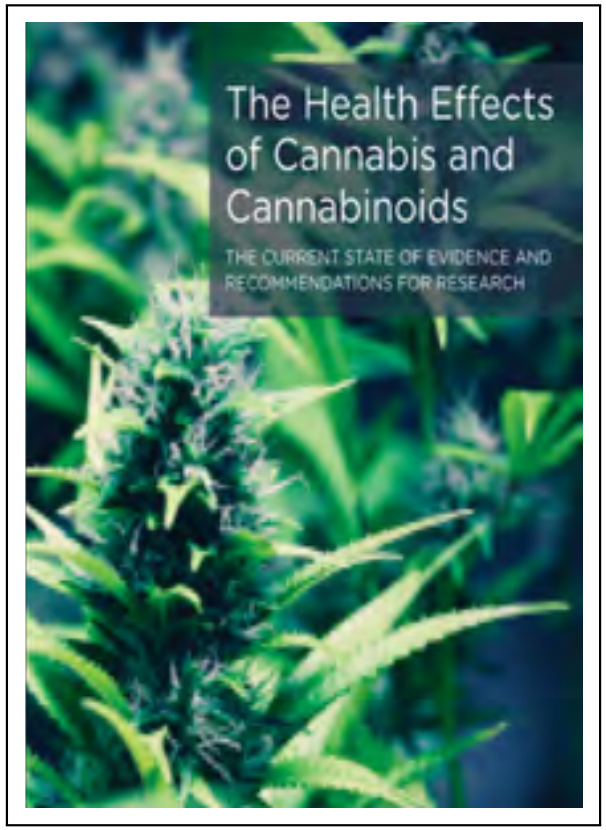


Can Medical Cannabis Help?

History of cannabis prohibition in the U.S.

- January 2017: review of >10,000 peer reviewed studies by the National Academies of Sciences, Engineering and Medicine.
- Conclusive evidence of cannabis effectiveness for:
  - chronic pain,
  - chemotherapy-induced nausea
  - spasticity associated with multiple sclerosis.
- Moderate evidence of cannabis effectiveness for sleep disorders.



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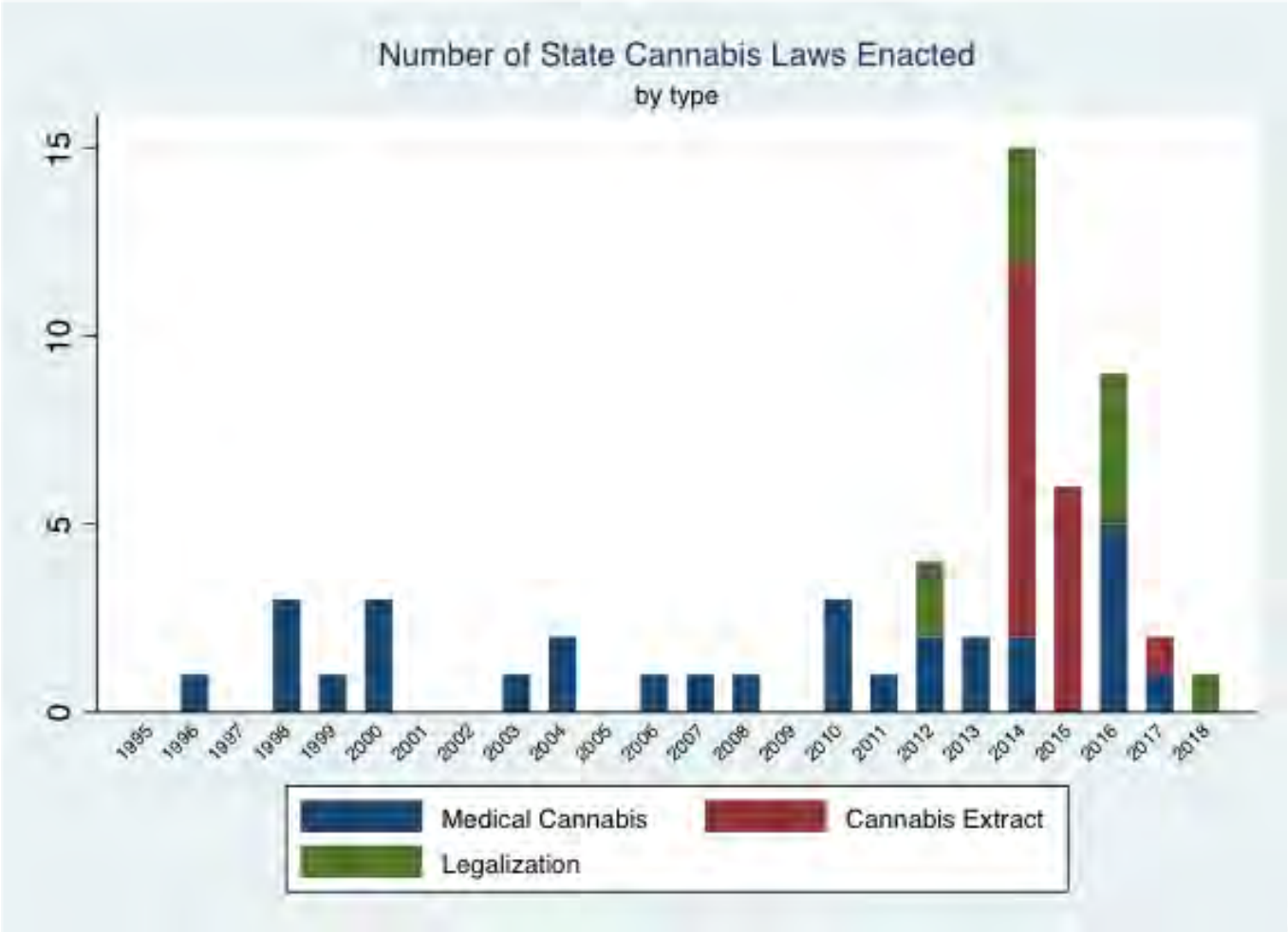
Changes to medical cannabis policy in the U.S.

- Currently, 31 states and the District of Columbia have passed laws that recognized the value "whole plant" medical cannabis.
- As of May 2018, 17 states had legalized Low THC / High CBD extracts
- Pathways for access vary.
  - Home cultivation is permitted in some states.
  - Many state MCLs include a dispensary program (all states since 2009 have this provision).
- Every individual state law included a list of qualifying conditions that must be met before the patient can receive full protection.

Changes to medical cannabis policy in the U.S.



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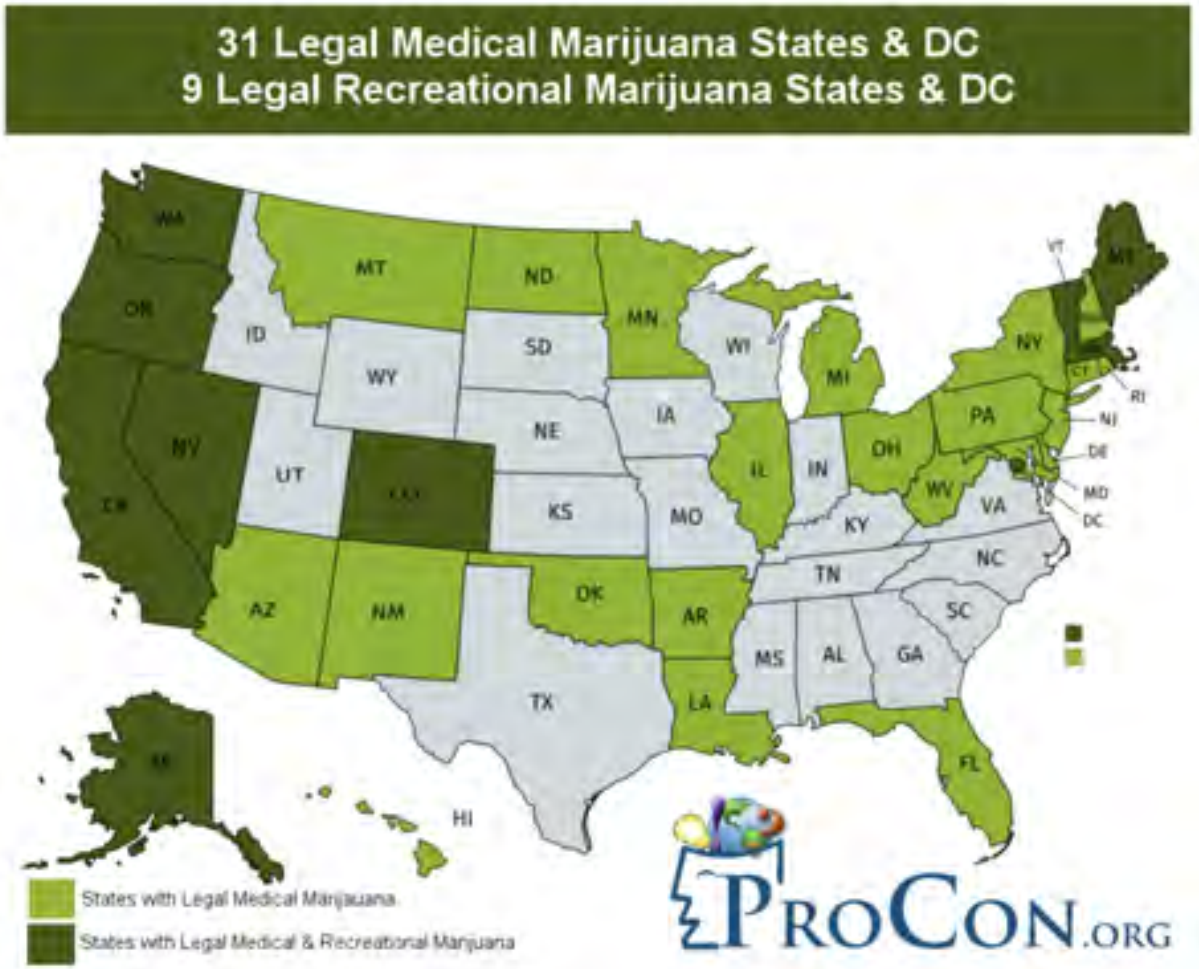
Changes to medical cannabis policy in the U.S.



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MCLs and Prescription Behavior

Our research questions

- One issue that has received surprisingly little attention is the question of whether medical cannabis is actually being used clinically to any significant degree.
- To the extent that cannabis is used by physicians to manage the conditions for which it has clinical evidence, then one would expect it to be primarily a substitute for existing prescription.

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Bradford and Bradford (2016) - Medical Marijuana Laws Reduce Prescription Medication Use in Medicare Part D

Little was known about whether medical cannabis is being used clinically to any significant degree.

Using data on all prescriptions filled by Medicare Part D enrollees in the U.S. from 2010 to 2013 we found that the use of prescription drugs fell significantly once an MCL was put in place.

We have since expanded this work to examine the effect of MCLs on prescription drug spending in both Medicare and Medicaid, up through 2015.


PRESCRIPTION DRUGS

By Ashley C. Bradford and W. David Bradford

Medical Marijuana Laws Reduce Prescription Medication Use In Medicare Part D

ABSTRACT: Legalization of medical marijuana has been one of the most controversial areas of state policy change over the past twenty years. However, little is known about whether medical marijuana is being used clinically to any significant degree. Using data on all prescriptions filled by Medicare Part D enrollees from 2010 to 2013, we found that the use of prescription drugs for which marijuana could serve as a clinical alternative fell significantly, once a medical marijuana law was implemented. National overall reductions in Medicare program and enrollee spending when states implemented medical marijuana laws were estimated to be $165.2 million per year in 2013. The availability of medical marijuana has a significant effect on prescribing patterns and spending in Medicare Part D.

In the past twenty years, the drive to many states to legalize medical marijuana has gained widespread public attention, though there has been no corresponding change in federal marijuana laws. In the late 1980s evidence began to emerge that the use of marijuana has a positive effect on the lives of many people suffering from a variety of ailments. Nevertheless, marijuana is still federally classified as a Schedule I drug (the most restrictive category, according to the Controlled Substances Act of 1971), which means that it is deemed to have "no currently acceptable medical use in treatment in the United States," a high potential for abuse, and "a lack of accepted safety for use...under medical supervision."[1][2] This classification imposes significant barriers not only to obtaining marijuana products for clinical use but also to conducting primary research on the pharmacological and behavioral impacts of marijuana use.

Despite such barriers, twenty-four states and the District of Columbia have adopted laws legalizing the use of marijuana for medical purposes. Surprisingly, although there is a rapidly growing literature about many indirect effects of medical marijuana laws, almost nothing is known about how these state health policies affect clinical care or spending in the health care sector. In this article we investigate how implementing state-level medical marijuana laws changes prescribing patterns and program and patient expenditures in Medicare Part D for prescription drugs approved by the Food and Drug Administration (FDA).

There is significant variation across state medical marijuana policies.[3] Every state that currently allows the use of medical marijuana requires a licensed physician to recommend that use and requires that the recommendation be made only if a patient presents with one or more illnesses from a state-approved list.[4] Home cultivation of marijuana is sometimes permitted, though every state that passed a medical marijuana law since 2009 has included some form of regulated dispensary program.[5] Some states allow caregivers to distribute marijuana.[6] In addition, the legal possession limit differs greatly across states.[7]

The findings from research on the effects of the medical use of marijuana have been extremely mixed. Historically, opponents of medical marijuana legalization have cited addiction, criminal

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Research questions for the updated Medicare research

- Main Questions:
  - Did implementing an effective MCL change the prescribing patterns of physicians in Medicare Part D for FDA-approved prescription medications (for all drugs and for on-label only drugs)?
  - Does the type of MCL (dispensary-based vs. only home-cultivation) affect prescribing patterns?
  - Does the response to MCL vary based on setting (urban vs. rural)?

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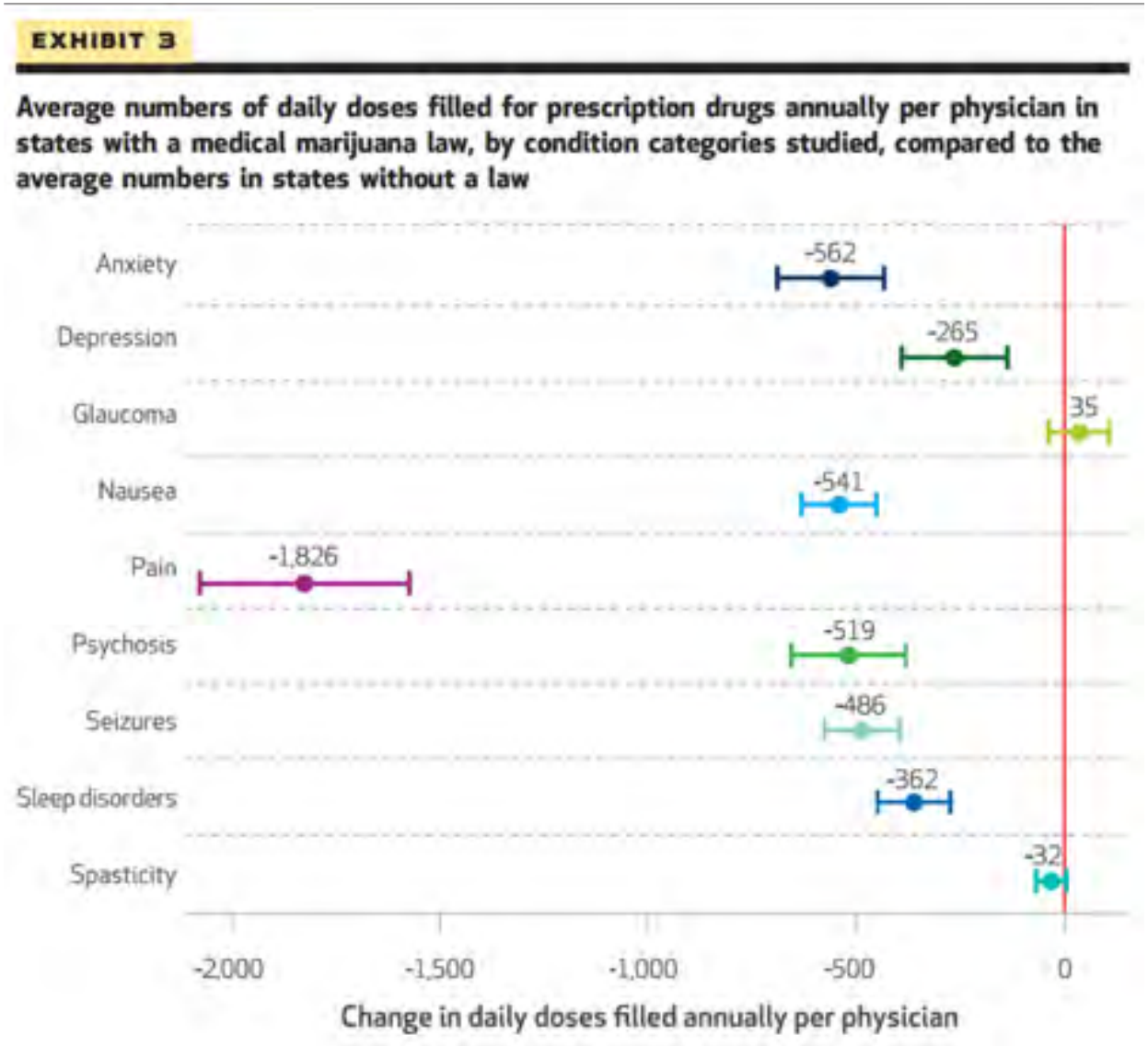
Association of MCL with Medicare Part D daily doses



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Updated study of MCL with Medicare Part D daily doses, *Journal of Law and Economics*, 2018

- We have data from 2010 to 2015, with 133 million observations.
- We control for type of MCL:
  - Indicator for whether states only permit home cultivation
  - Indicator for whether a dispensary is opened.
- We estimate the model separately for urban and rural counties.

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Updated study of MCL with Medicare Part D daily doses, *Journal of Law and Economics*, 2018

- Our overall results were very similar, but...
  - The effect of dispensary-based MCLs were more than twice as effective at reducing pain medications as home cultivation.
  - Nearly all of the benefit was seen in urban counties, and no statistically significant effect was observed in rural counties.

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What could Medicare save if every state had a MCL?

Table 7: Estimated counterfactual annual dollar change in Medicare spending if all states implemented MCL in each year, unduplicated across all conditions by year

	Any Effective MCL		Dispensary and Home Cultivation	
Year	Lower Bound	Upper Bound	Lower Bound	Upper Bound
2010	-425,941,821	-599,183,716	-779,991,636	-1,049,031,384
2011	-440,074,547	-618,536,540	-803,193,277	-1,089,164,907
2012	-496,938,384	-709,132,680	-895,431,038	-1,223,771,606
2013	-591,155,863	-838,447,395	-1,053,938,142	-1,454,152,596
2014	-662,365,465	-956,722,926	-1,158,191,061	-1,680,995,380
2015	-678,018,157	-975,019,859	-1,185,047,518	-1,713,135,106

Data is using all drugs in the classes of confirmed on-label indications. Estimates from base models (all states). Lower bound estimates are found by keeping only lowest estimated change per drug when eliminating duplications. Upper bound estimates are found by keeping only highest estimated change per drug when eliminating duplications.

Bradford and Bradford (2017) - MMLs and Medicaid

We followed up our 2016 study and applied the same methodology to Medicaid.

Using data on all prescriptions filled by Medicaid FFS enrollees in the U.S. from 2007 to 2014 we found that the use of prescription drugs fell significantly once an MCL was put in place.

WEB FIRST

By Ashley C. Bradford and W. David Bradford

Medical Marijuana Laws May Be Associated With Decline In Number Of Prescriptions For Medicaid Enrollees

ABSTRACT In the past twenty years, twenty-eight states and the District of Columbia have passed some form of medical marijuana law. Using quarterly data on all fee-for-service Medicaid prescriptions in the period 2007–14, we tested the association between those laws and the average number of prescriptions filled by Medicaid beneficiaries. We found that the use of prescription drugs in fee-for-service Medicaid was lower in states with medical marijuana laws than in states without such laws in five of the nine broad clinical areas we studied. If all states had had a medical marijuana law in 2014, we estimated that total savings for fee-for-service Medicaid could have been $1.01 billion. These results are similar to those in a previous study we conducted, regarding the effects of medical marijuana laws on the number of prescriptions within the Medicare population. Together, the studies suggest that in states with such laws, Medicaid and Medicare beneficiaries will fill fewer prescriptions.

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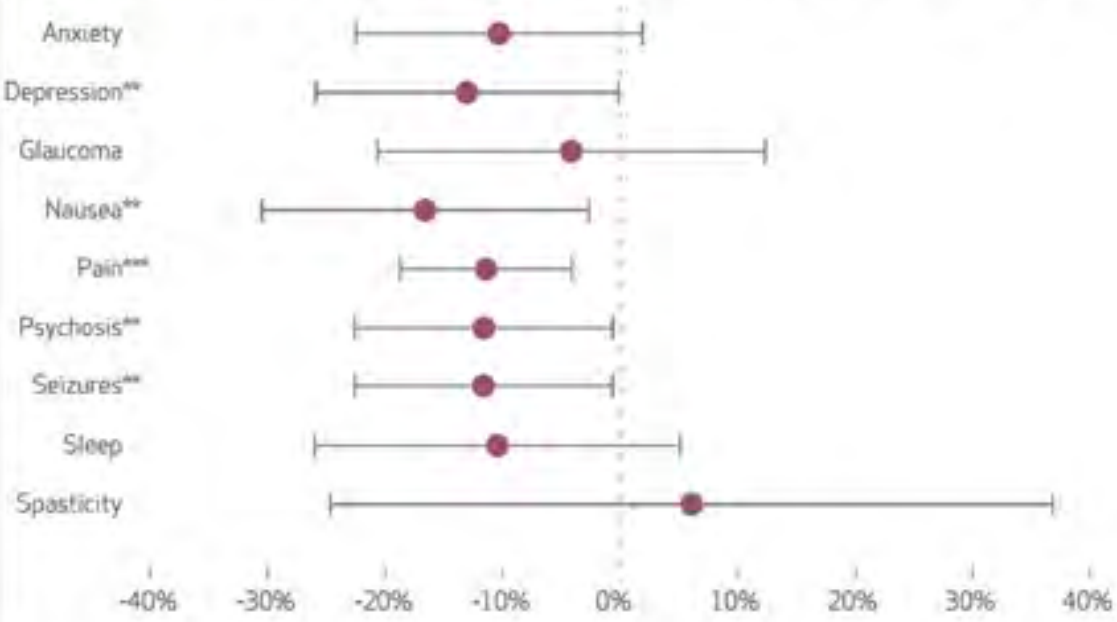
Association of MCL with Medicare Part D daily doses

EXHIBIT 1

Changes associated with a state's having a medical marijuana law in numbers of Medicaid prescriptions for drugs used to treat conditions with medical marijuana indications



SOURCE Authors' analysis of disease-specific data from Medicaid's State Drug Utilization Data files, 2007–14. **NOTES** Medicaid prescribing is measured as the log of the number of doses each quarter divided by the number of Medicaid enrollees, aggregated by drug class, state, and quarter. Prescribed drugs are those approved by the Food and Drug Administration to treat the relevant condition. Error bars represent 95% confidence intervals. "Seizures" means seizure disorders. "Sleep" means sleep disorders. $^{**}p < 0.05$ $^{***}p < 0.01$

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Medical cannabis laws and opioid Use in Medicare Part D

Research team at the University of Georgia expanded on our 2016 *Health Affairs* work to examine association between MCLs and opioids in Medicare Part D.

We used data on all opioid prescriptions filled by Medicare Part D enrollees in the U.S. from 2010 to 2015.

We examined type of opioid and type of MCL.


JAMA Internal Medicine | Original Investigation | HEALTH CARE POLICY AND LAW

Association Between US State Medical Cannabis Laws and Opioid Prescribing in the Medicare Part D Population

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Association of MCL with Medicare Part D opioid doses

Table 1. Daily Doses Prescribed for All Opioids[a]

Variable[b]	Coefficient (95% CI)[c]	Percentage Change	*P* Value
Modeling any type of MCL as 1 variable			
MCL in effect	−2.211 (−4.574 to 0.152)	−8.5	.06
Modeling MCL by type with separate variables			
Medical cannabis dispensary open	−3.742 (−6.289 to −1.194)	−14.4	.005
Medical cannabis home cultivation allowed	−1.792 (−3.532 to −0.052)	−6.9	.04

Abbreviation: MCL, medical cannabis law.

[a] There were 306 observations for each model. Ordinary least-squares regression coefficients from models in which the dependent variables are total opioid prescriptions. Percentage changes from the average "no MCL" state level of prescribing are in parentheses. Data are aggregated to all prescriptions in opioid category by state and year.

[b] The MCL coefficient from a model in which MCL is measured as being any type. Variables included in all models but not shown in this table: whether state has adopted legal recreational cannabis, whether the state has an operational electronic prescription drug monitoring program; Herfindahl index of physician market competition, percentage of the population below the poverty line, percentage of population enrolled in Medicare, percentage of Medicare in Medicare Advantage plans, total state population, a time trend, and state fixed effects.

[c] MCL coefficients from a model in which dispensary-based or home cultivation only MCLs are measured separately.

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Association of MCL with Medicare Part D opioid doses

Table 3. Daily Doses Prescribed for Opioids Distinguishing MCL Policy Types, by Opioid Type[a]

Opioid	Coefficient (95% CI)	Percentage Change	*P* Value
Medical Cannabis Dispensary Open			
Hydrocodone	−2.320 (−3.782 to −0.859)	−17.4	.002
Oxycodone	0.081 (−0.043 to 0.205)	9.1	.19
Fentanyl	−0.152 (−0.332 to 0.028)	−9.7	.10
Morphine	−0.361 (−0.718 to −0.005)	−20.7	.047
Methadone	0.009 (−0.062 to 0.080)	1.3	.80
Other opioid	−0.998 (−2.190 to 0.194)	−12.8	.10
Medical Cannabis Home Cultivation Allowed			
Hydrocodone	−1.256 (−2.319 to −0.193)	−9.4	.02
Oxycodone	0.083 (−0.025 to 0.192)	9.3	.13
Fentanyl	−0.047 (−0.168 to 0.075)	−3.0	.44
Morphine	−0.149 (−0.364 to 0.065)	−8.5	.17
Methadone	0.035 (−0.017 to 0.087)	5.1	.18
Other opioid	−0.458 (−1.174 to 0.258)	−5.8	.20

[a] There were 306 observations for each type of drug. Ordinary least-squares regression coefficients from models in which the dependent variables are total opioid prescriptions. Percentage changes from the average "no MCL" state level of prescribing are in parentheses. Data are aggregated to all prescriptions in opioid category by state and year. Variables included in all models but not shown here: whether state has adopted legal recreational cannabis, whether the state has an operational electronic prescription drug monitoring program, Herfindahl index of physician market competition, percentage of the population below the poverty line, percentage of population enrolled in Medicare, percentage of Medicare in Medicare Advantage plans, total state population, a time trend, and state fixed effects.

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Opioid abuse and mortality crisis

- As we have seen, there is reason to suspect that MCLs can prompt diversion away from opioid use.
- Bachhuber et al. (2014) conducted a state-level analysis of opioid-related deaths using NVS and found that opioid-related mortality fell after any MCL went into effect (diff-in-diff).
- Powell, et al. (2018) find that when active dispensaries are taken into account, opioid-related mortality falls by between 25%-27% also using NVS.

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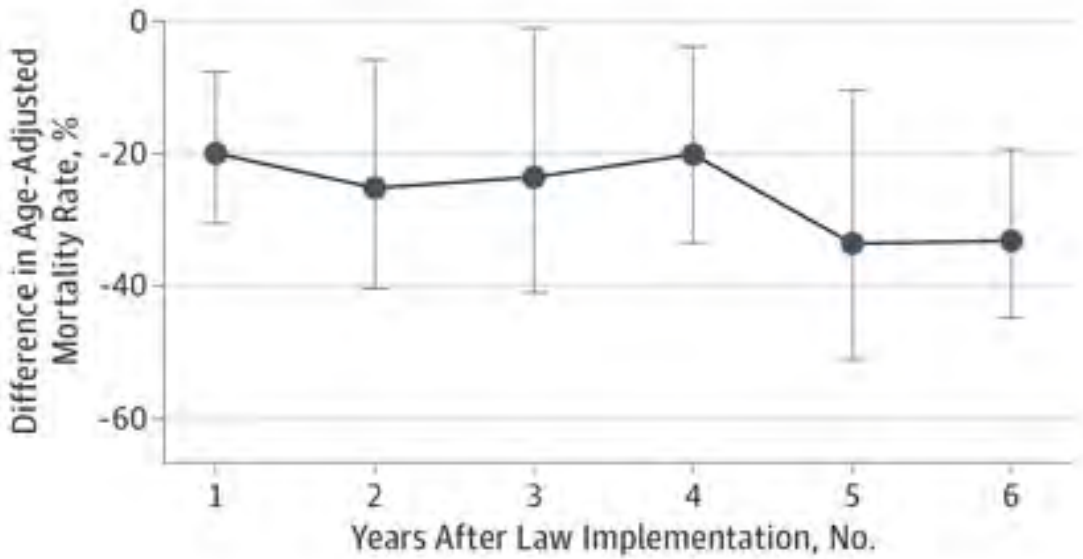
Opioid abuse and mortality crisis - Bachhuber, et al. (2014)

Figure 2. Association Between Medical Cannabis Laws and Opioid Analgesic Overdose Mortality in Each Year After Implementation of Laws in the United States, 1999-2010



Point estimate of the mean difference in the opioid analgesic overdose mortality rate in states with medical cannabis laws compared with states without such laws; whiskers indicate 95% CIs.

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Opioid abuse and mortality crisis - Powell et al. (2018)

Table 3
Log Opioid Related Mortality Rate

	Prescription Opioids Only				Prescription Opioids and Heroin			
Years	1999–2010		1999–2013		1999–2010		1999–2013	
MML	−0.195*	−0.154	−0.073	−0.048	−0.169	−0.195	−0.066	−0.072
	(0.100)	(0.112)	(0.096)	(0.096)	(0.108)	(0.117)	(0.101)	(0.107)
Active + Legal	−0.572***	−0.520***	−0.254**	−0.272**	−0.533***	−0.498***	−0.226*	−0.261**
Dispensaries	(0.082)	(0.131)	(0.117)	(0.112)	(0.099)	(0.163)	(0.117)	(0.119)
Time-varying covariates	No	Yes	No	Yes	No	Yes	No	Yes
Observations	612	612	765	765	612	612	765	765
P-value for sum	0.00	0.00	0.03	0.05	0.00	0.00	0.08	0.06

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.
All regressions include state and year fixed effects. Regressions in the second column for each sample also include a set of time-varying state-specific covariates: share of the population that is male; share that is white; age distribution, state unemployment rate, state alcohol tax rate, an indicator for state-level "must access" prescription drug monitoring program, and an indicator for a state pill mill law. Active + legal dispensaries means that the state allows dispensaries to operate in the state and any regulatory hurdles to do so have been overcome. Standard errors allow for clustering at the state level. P-value for sum is the statistical significance of the sum of the two estimates reported in the column.

What did we learn?

- We have strong evidence that access to medical cannabis can shift people away from pain medications in general, and opioids in particular.
- Other research finds consistent benefit from reduced overdose mortality when medical cannabis laws go into effect.
- The best population-level evidence finds little consistent evidence that MLCs are strongly associated with increases in traffic accidents / fatalities, alcohol abuse, or youth substance use (i.e., a "gateway effect").
- MCL type (dispensaries vs. home cultivation) and setting (urban vs. rural) matters. We know nothing about CBD extracts.
- Appropriately designed MCLs can save both lives and money.

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