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## Cannabis Decriminalization and Racial Disparity in Arrests for Cannabis Possession

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### INTRODUCTION

A large share of drug arrests in the U.S. are cannabis-related offenses. In 2010, cannabis-related offenses represented about 53% of all the drug arrests and over 80% of these offenses were for cannabis possession. (1) It was argued that cannabis illegality wastes public resources, prevents police from focusing on real crimes, and sends an enormous number of individuals to the criminal justice system. (2) Because a criminal record may have prolonged, negative health and socioeconomic impacts particularly on youths, the American Academy of Pediatrics “strongly supports the decriminalization of marijuana use for both minors and young adults and encourages pediatricians to advocate for laws that prevent harsh criminal penalties for possession or use of marijuana”. (3) Several other public health organizations expressed similar opposition to punitive cannabis laws. (4, 5)

Cannabis decriminalization, or reducing the legal consequences of cannabis possession of a small amount from criminal to civil penalties, has a long history in the U.S. The first wave of decriminalization was in the 1970s, starting in Oregon in 1973 and followed by eight other states until 1978 when Nebraska was the last state adopting the laws in this wave. (6) Since then, no other states decriminalized cannabis until Massachusetts did so in 2009. In this new wave of efforts, 11 states adopted laws to decriminalize cannabis as of 2019.

Previous studies on the impacts of cannabis decriminalization mostly focused on laws implemented in the 1970s, providing limited implications in the current legal contexts. (7) Only two studies evaluated the association between the most recent laws and arrests. Gucza et al. (8) found that drug-related arrests were reduced by approximately 75% among both adults and youths in the five states that decriminalized cannabis by 2014. Plunk et al. (9) reported that cannabis possession arrest rates declined by 131.28 per 100,000 adult population and by 60 per 100,000 youth population (about 40–50% decline) after decriminalization was implemented in seven states as of 2016.

Racial biases especially those directed against Blacks in the U.S. criminal justice system have been well documented and acknowledged. (10–12) Such biases are reflected in cannabis possession arrests as the increased disparity between Blacks and Whites: arrest

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rates of Whites had remained stable at around 192 per 100,000 population whereas arrest rates of Blacks rose from 537 to 716 per 100,000 population from 2002 to 2010. (1) In 2010, Blacks were 3.3 times more likely to be arrested for cannabis possession compared to Whites despite a similar rate of cannabis use. (1) Cannabis decriminalization may have the potential to reduce racial disparity in cannabis possession arrests if Blacks and Whites were disproportionately targeted before decriminalization.

Only one study to date examined the impacts of cannabis decriminalization on racial disparity in cannabis possession arrests. In 2014, the county of Philadelphia reclassified cannabis-related offenses from criminal to civil ones. Comparing the arrest rates in Philadelphia before and after decriminalization with the neighboring Daphne county, Tran et al. (13) found a greater reduction in cannabis possession arrests among Blacks than Whites. Adults and youths were not differentiated in this study.

In this study, we assessed the association between cannabis decriminalization and racial disparity in cannabis possession arrests between Blacks and Whites. We used data from 2000 through 2019, including all the 11 states that implemented cannabis decriminalization during this period. We analyzed arrests among adults and youths separately, accounting for the fact that the detailed provisions of decriminalization laws differed for adults and youths in many states.

## METHODS

### Data Sources

The annual number of cannabis possession arrests for each state was obtained from the Uniform Crime Reporting (UCR) Program Data: Arrest by Age, Sex, and Race from 2000 to 2019. (14) The UCR data are maintained by the Federal Bureau of Investigation and assembled from more than 18,000 law enforcement agencies in the U.S.

While widely used, (8, 9, 13) UCR arrest data have limitations that are worth noting. First, the reporting to UCR from law enforcement agencies is voluntary. Some states therefore had incomplete data in some years. Specifically, Florida did not report arrest data to UCR for most years (2000–2016) in the study period. Consequently, we excluded Florida from the analysis. Wisconsin did not report arrest data to UCR in 2000 and Illinois did not report arrest data from 2000 to 2005. We excluded these state-year observations from the analysis.

Second, the Denver Police Department misreported arrest data after recreational cannabis was legalized in Colorado in 2012. (9) As the Denver police department is one of the largest law enforcement agencies in Colorado, its misreporting would lead to incorrect estimates for the entire Colorado. We hence excluded Colorado from the analysis.

Finally, the UCR data has limited information on arrests by race. Other than arrest data for Blacks and Whites, data are only available for American Indians and Asians. Ethnicity information, such as Hispanic origins, is unavailable for most of the years.

### **Outcome: Cannabis Possession Arrest Rates**

The primary outcome was annual cannabis possession arrest rate per 1,000 population at state level. The arrest rates were calculated separately for Blacks and Whites in adult and youth population. This study focused on Blacks and Whites because UCR lacked complete data on other races and by ethnicity. In addition, the differences in cannabis possession arrest rates were most striking between Blacks and Whites than between other races. Arrest rates of adults and youths were analyzed separately because some states with cannabis decriminalization had different penalties for adults and youths (Table 1). Age cutoff 18 was used to define adults and youths because 1) most of cannabis decriminalization laws, except for Vermont, Maryland, and North Dakota, used this cutoff in their provisions; 2) in our data source, (14) the counts of arrests by race are only available in age categories using this cutoff; 3) previous studies used the same cutoff. (8, 9, 13)

To formally examine racial disparity, we calculated the ratio of cannabis possession arrest rates between Blacks and Whites. A lower ratio indicated a smaller disparity.

### **Policy Exposure: Cannabis Decriminalization**

The policy exposure was the implementation of cannabis decriminalization. There were 11 states implementing cannabis decriminalization in our study period of 2000–2019. The details on law provisions and data sources are reported in Table 1. (8, 9, 15, 16) Most states decriminalized cannabis for both adults and youths, with two exceptions: Delaware and North Dakota still regulated cannabis possession by youths as a misdemeanor after decriminalization was implemented. Accordingly, we classified Delaware and North Dakota as non-decriminalization states in the analysis for youths.

Some states without cannabis decriminalization increased or decreased penalties for cannabis possession in the study period. Specifically, two states (Arkansas and Nebraska) increased penalties and nine states (Kansas, Kentucky, Louisiana, Nevada, New York, Maine, Missouri, Ohio, and Montana) decreased penalties (Table 1). Following Grucza et al. (8) and Plunk et al. (9), we excluded these states from the analysis to avoid bias in association estimation.

The policy exposure variable was coded to one if cannabis decriminalization was in effect in a year and a state and zero otherwise.

### **Covariates**

We included state-level time-varying covariates that have been linked with cannabis use or arrests in previous studies. They included the share of the population with less than high school diploma or equivalent, the share of females in the population, the share of non-Whites in the population, the share of youths in the population, the number of officers per 1,000 population, unemployment rate, income per capita in 1999 thousand dollars, and poverty rate. Because a few states implemented medical cannabis legalization (allowing patients who have certain medical conditions to obtain and use cannabis legally) and/or recreational cannabis legalization (removing all the penalties of cannabis possession in a small amount for adult use), we also created two indicators for these laws respectively; the

indicators took the value of 1 if the laws were in effect in a year and a state and zero otherwise.

State population estimates and demographic and economic covariates were obtained from the Integrated Public Use Microdata Series 5% 2000 Census and American Community Survey. (17) The number of police officers was obtained from UCR Program Data: Law Enforcement Officers Killed and Assaulted. (18) Effective dates of medical and recreational cannabis legalization were obtained from [ProCon.org](https://procon.org).

### Statistical Analysis

All the analyses were conducted at state-year level. After removing states with incomplete or invalid data and states implementing changes in penalties for cannabis possession without decriminalization, we had 11 states that implemented cannabis decriminalization (decriminalization states) and 26 states that did not implement cannabis decriminalization (non-decriminalization states) during the study period of 2000–2019 (Table 1). A total of 733 state-year observations entered the final analysis. We summarized outcome and covariate statistics and plotted time trends in cannabis possession arrest rates in decriminalization and non-decriminalization states.

To estimate the association between cannabis decriminalization and cannabis possession arrest rates, we employed a difference-in-differences framework. Empirically, we used log-linear regressions to model the arrest rate as a function of cannabis decriminalization, adjusting for all the covariates mentioned above as well as state and year fixed effects. State fixed effects accounted for state-specific confounding factors that did not vary over time. Year fixed effects accounted for secular trends in arrest rates common to all the states. We tested whether adding state-specific time trends in regressions changed results by including them in some models but not others. State specific time trends could account for confounding factors that varied linearly over time in a state, but they may attenuate the estimate of policy impacts if the policy affects the time trend itself. (19, 20) The standard errors were clustered at state level to account for possible serial correlations within a state. (21)

Because law enforcement agencies' reporting to UCR is voluntary, there might be bias in association estimation if incomplete reporting had systematic measurement errors at state level. Such measurement errors were more severe in areas with small population size, hence we followed the suggestions from previous studies to weight the regressions by state population size averaged over the study period. (22, 23)

Three additional analyses were conducted. First, we performed event studies to determine whether the association estimates were driven by pre-policy differences between decriminalization and non-decriminalization states. Empirically, we replaced the cannabis decriminalization indicator with a series of leads and lags. Evidence on the associations found before the implementation of laws will indicate non-parallel trends in cannabis possessions arrests, which violates the key assumption of parallel time trends in the difference-in-differences study design.

Second, a recent work by Goodman-Bacon (24) suggested that difference-in-differences estimate obtained using variations in the timing of policy implementation is a weighted average of all possible two-group/two-period difference-in-differences estimators. Applying the decomposition to our study, the main difference-in-differences estimate was obtained from the following comparisons: 1) decriminalization states compared to non-decriminalization states (timing vs. never treated in Goodman-Bacon (24)); 2) early decriminalization states compared to later decriminalization states (timing groups in Goodman-Bacon (24)); 3) later decriminalization states compared to early decriminalization states (timing groups in Goodman-Bacon (24)). The weights depend on the share of states that are in treatment and control groups for a given comparison and the variance of treatment status (states that are treated in the middle of evaluation window receive higher weights). Goodman-Bacon (24) showed that in the presence of a dynamic treatment effect (in this study treatment effect was dynamic if the effect of decriminalization on arrests continued over time), the difference-in-differences estimate obtained from the third comparison will be biased. It would be problematic if we used states that decriminalized early, which were still affected by the laws, as a comparison to states that decriminalized later. We conducted Goodman-Bacon decomposition analysis to determine which of the three comparisons was driving the overall difference-in-differences estimate.

Finally, we conducted the leave-one-out exercise by dropping one decriminalization state from the regression at a time. This could help identify a particular decriminalization state that was driving the overall difference-in-differences estimate.

## RESULTS

### Trends in Cannabis Possession Arrest Rates

Tables S1 and S2 summarize baseline statistics. Year 2000–2008 was considered baseline because 2009 was the first year when a state (Massachusetts) decriminalized cannabis in the study period. In the baseline period, the overall arrest rate of Black adults in all the included states was about 4 times greater than that of White adults (Table S1). The racial disparity between Blacks and Whites in arrests rates among youths was lower but still high at 1.88 (Table S2).

Figure S1 plots the time trends in cannabis possession arrest rates by race among adults (Figure S1–a) and youths (Figure S1–b) in decriminalization states. These figures used the implementation year of cannabis decriminalization as the reference year. Among adults, there appeared to be a sudden and sizable decline in arrest rates among both Blacks and Whites following law implementation. The decline seemed to be larger among Blacks than Whites. Among youths, a reduction in arrest rates was also seen after decriminalization, but the magnitude of reduction seemed to be similar among Blacks and Whites.

### Difference-in-differences Analysis

Table 2 reports regression results from the difference-in-differences analysis. Models 1–2 report estimates on arrest rates for Blacks, Models 3–4 report estimates on arrest rates for Whites, and Models 5–6 report estimates on racial disparity measured by Black/White ratio

of arrest rates. Overall, cannabis decriminalization was associated with substantial declines in arrest rates among both Blacks and Whites, regardless of age categories.

Among adults, decriminalization was associated with a 1.492 log points decline in arrest rates of Blacks (~78%; obtained from  $(e^{\beta}-1)*100$ ) and a 1.315 log points decline in arrest rates of Whites (~73%). The racial disparity declined by 0.190 log points (~17%) following decriminalization. The above results considering state-specific time trends (Models 2, 4, 6) were qualitatively similar to the results without considering state-specific time trends (Models 1, 3, 5).

Among youths, decriminalization was associated with a 0.575 log points decline in arrest rates of Blacks (~44%) and a 0.648 log points decline in arrest rates of Whites (~48%). There was no evidence on the association between decriminalization and racial disparity. The above results considering state-specific time trends (Models 2, 4, 6) were qualitatively similar to the results without considering state-specific time trends (Models 1, 3, 5).

Detailed estimates are reported in Table S3 (adults) and Table S4 (youths). What might be noteworthy are the influences of medical and recreational cannabis legalization. We found limited evidence for the association between medical cannabis laws and cannabis possession arrest rates among both adults and youths. Recreational cannabis laws were associated with declines in arrest rates among both Blacks and Whites and among both adults and youths. However, there was no evidence suggesting that recreational cannabis laws were associated with the changes in racial disparity between Blacks and Whites.

### Additional Analysis

Figures 1–2 illustrate the results from event studies (Figure 1 for arrest rates by race and Figure 2 for racial disparity). We did not find evidence for the differences in arrest rates or racial disparity between decriminalization and non-decriminalization states before the implementation of the laws. This offered support for the validity of the difference-in-differences design.

Figure S2 shows the Goodman-Bacon decomposition results. It suggested that the difference-in-differences estimates reported in the main analysis mainly came from the non-problematic comparison between decriminalization and non-decriminalization states (timing vs. never treated), alleviating the concern outlined in Goodman-Bacon (24). However, the association between decriminalization and arrest rates potentially varied across decriminalization states.

Finally, Figure S3 presents findings from the leave-one-out analysis. California seemed to be the one state slightly driving the estimated associations in the main analysis. When California was excluded, the estimated decline among Black adults dropped from about 1.5 to 0.7 log points. A similar drop was also seen among White adults. For racial disparity analysis and youths sample analysis, excluding California led to higher standard errors.

## DISCUSSION

This study has three key findings. First, decriminalizing cannabis was associated with considerable reductions in cannabis possession arrest rates among both adults (over 70% reduction) and youths (over 40% reduction). This finding is consistent with Plunk et al. (9) and Gruzca et al. (8), which used a smaller number of decriminalization states and a shorter study period. Cannabis decriminalization laws had the intended effects of reducing criminal offenses related to cannabis possession.

Second, cannabis decriminalization was associated with roughly 17% lower racial disparity in arrest rates between Blacks and Whites among adults. This finding is supported by the only previous relevant work in Philadelphia county. (13) However, we did not find such evidence among youths. There are several explanations. Decriminalization law provisions differed between adults and youths in many states, potentially leading to differential policy impacts. The racial disparity in arrest rates was also much larger among adults prior to decriminalization, providing a greater room for reduction. It should be noted that the absolute reduction in arrest rates among youths for both Blacks and Whites was large (44–48%), demonstrating the intended effects of cannabis decriminalization in this age group.

Finally, there was some evidence from the Goodman-Bacon decomposition analysis for the varying effects of cannabis decriminalization across decriminalization states. Given the differences in law provisions in these states, this result may not necessarily be surprising. This finding was further corroborated by the result from the leave-one-out analysis, which found that the estimated association was slightly driven by California. This might be because California implemented less stringent punishment and a higher threshold amount of cannabis possession compared to many other states. It is also possible that law enforcement behaviors in California had the greatest changes following decriminalization due to some unobserved factors. We hope that future research can explore the uniqueness of California experience.

Cannabis decriminalization has received scant attention from researchers in the past two decades when the legalization of medical cannabis and recreational cannabis was widely advocated and adopted. Previous studies in the U.S. and other countries have shown that cannabis use was not increased as a result of cannabis decriminalization. (8, 26–31) This study and others provided evidence for the association of cannabis decriminalization with substantial decreases in cannabis possession arrests among both adults and youths. (8, 9) We further suggested that cannabis decriminalization might be also promising to reduce racial disparity between Blacks and Whites in criminal justice system at least for adults. Cannabis decriminalization seemed to be particularly beneficial to Blacks, who were suffering the most from the adverse consequences of criminal penalties. Taken together, we recommend that lawmakers and public health researchers reconsider cannabis decriminalization as an option of cannabis liberalization particularly in states concerning about the unintended consequences and implementation costs of medical and recreational cannabis legalization.

We did not find evidence for recreational cannabis laws being associated with the changes in racial disparity in arrest rates. The interpretation should use caution, however, because the estimates were not based on a difference-in-differences framework specifically designed for



the evaluation of recreational cannabis laws. Keeping this in mind, the lack of evidence may have several explanations. Many states legalized recreational cannabis after cannabis was decriminalized (e.g., Massachusetts, California, and Vermont). The impacts of recreational cannabis laws were therefore attenuated. In addition, most of the states implemented recreational cannabis laws after 2016, while our study period ended in 2019. The impacts of recreational cannabis laws may not be fully realized in our study period.

This study is not without limitations. First, as mentioned before, police agencies' reporting to UCR is voluntary. Although we weighted the regressions by state population since such reporting bias was more salient in smaller states, the estimation bias resulted from systematic measurement errors may not be completely eliminated. Second, we used a difference-in-differences framework to control for time-invariant confounding factors, but time-varying unobserved factors may still confound the estimates. Third, the estimated association may vary across states as noted in our study. Our results from 11 decriminalization states may not apply to other jurisdictions that adopted the laws very early in the 1970s or that will adopt the laws in future. We hope future research could evaluate the impacts of detailed law provisions and the generalizability of our findings. Fourth, we did not investigate disparity in other races or ethnicities due to data limitation.

The final limitation is that with current data we were not able to determine whether the decline in racial disparity among adults was a result of the changes in law enforcement behaviors and/or individual cannabis possession behaviors. It is possible that law enforcement behaviors did not change: Blacks might still be more likely to be stopped, questioned, or searched for cannabis possession than Whites after decriminalization. But if these behaviors did not result in arrests because of decriminalization, racial disparity in arrest rates would still decline. It is also possible that Blacks were more likely to respond to decriminalization by possessing less cannabis - below the threshold amount for the lowest level of criminal offense - compared to Whites. However, this speculation is counterintuitive and we are not aware of empirical evidence from existing studies supporting this possibility. Future studies are warranted.

## CONCLUSIONS

Notwithstanding the limitations, this study is one of the very few studies examining the association between cannabis decriminalization and cannabis possession arrests in the most recent legal contexts in the U.S. We included all the 11 states that implemented cannabis laws from 2000 through 2019. We found that arrest rates declined substantially among both adults and youths following decriminalization, indicating that the laws had their intended effects of reducing the number of people convicted of criminal offenses for cannabis possession.

This study is also the first one examining the association between statewide decriminalization of cannabis and racial disparity in cannabis possession arrests between Blacks and Whites. Decriminalizing cannabis has been advocated as a way to reduce racial disparity, (25) but the evidence supporting this argument is almost non-existent. We provided evidence that about 17% decline in Blacks to Whites ratio in arrest rates among adults may

be attributable to cannabis decriminalization. It appears that cannabis decriminalization does have potential to reduce racial disparity in cannabis possession arrests.

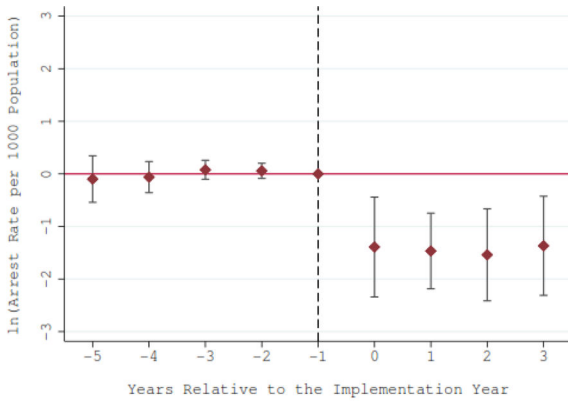
## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

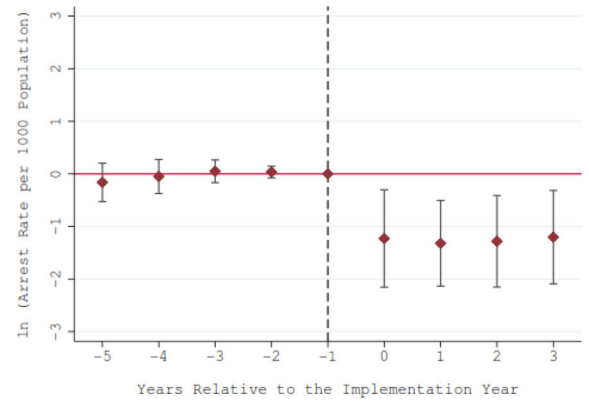
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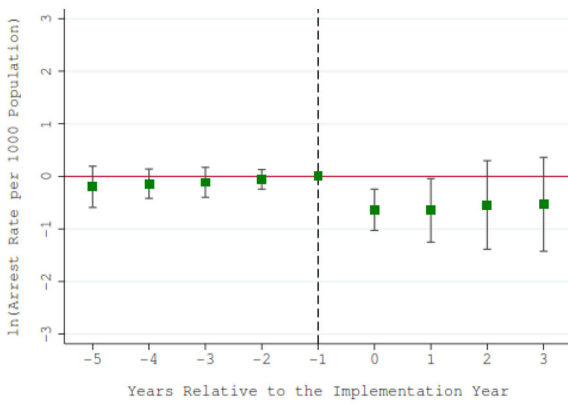
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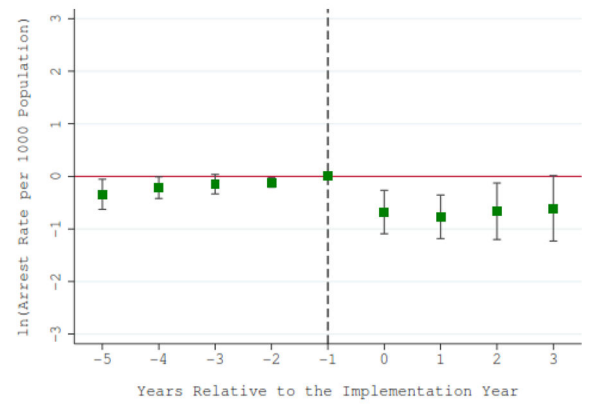
(a) Blacks (Adults)



(b) Whites (Adults)



(c) Blacks (Youths)



(d) Whites (Youths)

**Figure 1: Event Study for Cannabis Possession Arrest Rate among Blacks and Whites**

Notes:

1. Estimated coefficient and 95% CIs are reported.
2. The year prior to the implementation was the reference (omitted) year. The estimated coefficient should be interpreted as relative to this year. The final lag/lead points accumulated all years beyond (i.e., -5 captured year -5 and earlier; 3 captured year 3 and later).
3. All regressions included controls for share of population with less than high school diploma or equivalent, share of females in the population, share of non-Whites in the population, share of youths in the population, officers per 1000 population, unemployment rate, income per capita in 1999 thousand dollars, poverty rate, the presence of medical cannabis laws, the presence of recreational cannabis laws, state and year indicators, and state-specific time trends.
4. Two states reported zero cannabis possession arrests for Blacks in some years (Vermont in 2015 and 2019 for Black adults and in 2003 for Black youths; North Dakota in 2000 for Black youths). We added a small constant (0.01) to all the state-year observations for log transformation. Our findings were not sensitive to this specification choice.
5. All regressions were weighted by state population averaged over the 2000–2019 period.

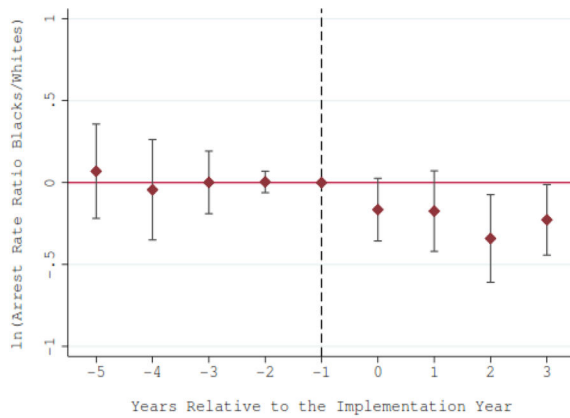
6. Standard errors were clustered at state level.

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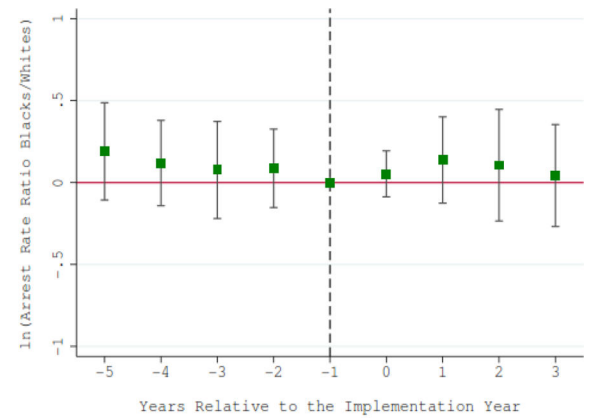
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(a) Adults



(b) Youths

**Figure 2: Event Study for Cannabis Possession Arrest Rate Ratio Blacks/Whites**

Notes:

1. Estimated coefficient and 95% CIs are reported.
2. The year prior to the implementation was the reference (omitted) year. The estimated coefficient should be interpreted as relative to this year. The final lag/lead points accumulated all years beyond (i.e., -5 captured year -5 and earlier; 3 captured year 3 and later).
3. All regressions included controls for share of population with less than high school diploma or equivalent, share of females in the population, share of non-Whites in the population, share of youths in the population, officers per 1000 population, unemployment rate, income per capita in 1999 thousand dollars, poverty rate, the presence of medical cannabis laws, the presence of recreational cannabis laws, state and year indicators, and state-specific time trends.
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5. All regressions were weighted by state population averaged over the 2000–2019 period.
6. Standard errors were clustered at state level.

**Table 1:**

Summary of Cannabis Decriminalization Laws in the Study Period 2000–2019

<u>States Included in the Analysis</u>	<u>Law Provisions</u>	<u>Data Sources</u>
<i>Decriminalization States (11 States)</i> <i>(Effective Date)</i>		
1. Massachusetts (January 2009)	Adults: \$100 fine for possession of 1 oz. or less. Youths: Same as Adults. However, youths must attend drug education program.	Massachusetts Ballot Question 2 (2008), Plunk et al. (2019)
2. California (1/1/2011)	Adults: Not more than \$100 fine for possession of 1 oz. or less. Youths: Same as Adults.	California SB 1449 (2010), Midgette and Reuter (2020)
3. Connecticut (7/1/2011)	Adults: \$150 fine for possession of less than one-half oz. Increases for subsequent offenses. Youths: Same as Adults.	Connecticut Public Act No. 11–71 (2011), Plunk et al. (2019)
4. Rhode Island (4/1/13)	Adults: \$150 fine for possession of 1 oz. or less. However, third conviction within 18 months is a misdemeanor. Youths: Same as adults plus drug education program if aged 17. Status offense for youths aged less than 17.	Rhode Island SB 2253 (2012), Plunk et al. (2019)
5. Vermont (7/1/2013)	Adults ( < 21): Not more than \$200 for possession of 1 oz. or less. Increases for subsequent offenses. Youths (<21): Must attend drug education program. Third offense was a criminal offense until 5/31/2016.	Vermont H. 200 (2013), Plunk et al. (2019)
6. Maryland (10/1/2014)	Adults ( < 21): Not more than \$100 fine for possession of less than 10 grams. Increases for subsequent offenses (must also attend drug education program for subsequent offenses). Youths (<21): Same as adults. However, youths will always be referred to drug education program.	Maryland SB 364 (2014), MPP (2020), Plunk et al. (2019)
7. Delaware (12/18/15)	Adults: \$100 fine for possession of 1 oz. or less. Misdemeanor for subsequent offenses for people 18–20. Youths: Misdemeanor and up to \$100 fine.	Delaware HB 39 (2015), Plunk et al. (2019)
8. Illinois (7/29/2016)	Adults: \$100–200 fine for possession up to 10 grams. Youths: Same as adults.	Illinois SB 2228 (2016)

9. New Hampshire (9/16/2017)	<p>Adults: \$100 fine for possession up to 3/4 oz. Increases for subsequent offenses.</p> <p>Youths: Determined by juvenile court, sentencing including fines, victim restitution, uncompensated public service, supervision by a JPPO, community-based treatment programs, out-of-home placement or any combination of these options. In serious cases, the court can commit the juvenile to the Youth Services Center (YSC) until their 17th birthday.</p>	New Hampshire HB 640 (2017), MPP(2020)
10. New Mexico (7/1/2019)	<p>Adults: \$50 for possession up to 1/2 oz.</p> <p>Youths: Same as adults.</p>	New Mexico SB 323 (2019), MPP(2020)
11. North Dakota (May 2019)	<p>Adults ( &gt;21): Up to \$1000 fine for possession of not more than 1/2 oz. Third infraction within a year may become misdemeanor.</p> <p>Youths (&lt;21): Misdemeanor.</p>	North Dakota HB 1050 (2019), MPP(2020)
<i>Non-Decriminalization (26 States)</i>		

Notes: Delaware and North Dakota decriminalized cannabis for adults but not youths. Therefore, they were classified them as non-decriminalization states in the analysis for youths.

<p><b>States Excluded from the Analysis</b></p> <p><i>States that Increased Penalties for Cannabis Possession (2 States)</i></p> <p><i>States that Decreased Penalties for Cannabis Possession (9 States)</i></p>	<p>Arkansas, Nebraska</p> <p>Kansas, Kentucky, Louisiana, Nevada, New York, Maine, Missouri, Ohio, Montana</p>	<p>Data Sources</p> <p>Gruza et al. (2018), Plunk et al. (2019)</p>
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Notes:

1. Florida was also excluded from the analysis since it did not report arrest statistics to UCR for most years (2000–2016) in the study period.
2. Colorado was also excluded from the analysis because it had reporting errors in UCR in the study period.
3. Wisconsin did not report arrest statistics to UCR in 2000, and Illinois did not report arrest statistics from 2000 to 2005. We excluded these state\*year observations from the analysis.
4. Gruza et al. (2018) and Plunk et al. (2019) excluded North Dakota in their analysis since it increased penalties for cannabis possession before decriminalizing it in 2019. Our findings were not sensitive to the exclusion of North Dakota from the analysis.



