From High Times to Full Plates:

The Unexpected Benefits of Cannabis Legalization for Food Security

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Abstract: Each year millions of Americans face an uncertain food supply, including families with children. At the same time, the U.S. is experiencing a period of increased legalization of cannabis through state efforts. Cannabis use is disproportionately high among populations at risk for food insecurity, suggesting that legalization may worsen food insecurity through a re-allocation of household resources toward cannabis and away from food. We explore the implications of cannabis legalization on food insecurity. Potentially counter to expectations, we find that legalization reduces food insecurity. An analysis of mechanisms suggests that reduced incarceration and improved labor market outcomes drive this finding. Overall, state efforts to legalize cannabis do not appear to have negative implications for food insecurity.

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I. Introduction

Food insecurity is an ongoing public health problem in the United States. Reducing food insecurity is a nationally-stated health objective (Office of Disease Prevention and Health Promotion, 2020). Despite adequate national food supply, millions of adults and children experience uncertainty around food access that can lead to stress, nutritional deficits, and hunger (Office of Disease Prevention and Health Promotion, 2020). When a household is unable to consistently acquire adequate, healthy food for one or more household members due to insufficient money and other resources, the household is considered food insecure (U.S. Department of Agriculture, 2023a). Those experiencing food insecurity have lower dietary quantity and quality (Gregory et al., 2019; Leung et al., 2014; Leung & Tester, 2019; Zizza et al., 2008) and are more likely to skip meals (Zizza et al., 2008). Food insecurity has serious implications, particularly in families with children, with consequences ranging from reduced school performance (Heflin et al., 2022) to health problems (Thomas et al., 2019) to child maltreatment (Kim et al., 2023). The U.S. Department of Agriculture (USDA) assesses the nation's food security annually, and while there were improvements between 2011 and 2021, the prevalence of food insecurity has been increasing in more recent years. Approximately 18 million U.S. households (13.5%) were food insecure at some point in 2023; 11.2 million households had low food security while 6.8 million households had the more severe condition of very low food security (U.S. Department of Agriculture, 2023b). However, 'point-in-time' estimates understate the true burden of food insecurity in the U.S., as there is a great deal of movement in and out of food insecurity over the life cycle (Hamersma & Kim, 2025). One analysis of the Panel Study of Income Dynamics, using six points in the life cycle (three each in childhood and early adulthood), suggests that by mid-adulthood at least one-third of people experience a period of food insecurity (Insolera et al., 2022).

The primary public policies used to combat this public health crisis are the food and nutrition programs offered through the USDA. For example, the Supplemental Nutrition Assistance Program – now the largest cash-value public assistance program in the U.S. – is a key contributor to improvements in food security, with participants up to 45% less likely to be food insecure than similar non-participants (Gundersen, 2022). These improvements translate into substantial reductions in healthcare costs (Berkowitz et al., 2021) and lifelong improvements in food security (Insolera et al., 2022). In addition, the more targeted Special Supplemental

Nutrition Program for Women, Infants, and Children (WIC) has been demonstrated to reduce food insecurity by at least 20% (Kreider et al., 2016). Finally, the National School Lunch Program (and its companion breakfast program) have been shown to have a protective effect on food security of children and their households (Arteaga & Heflin, 2014; Gundersen et al., 2012).

Beyond programs that are directly intended to affect food insecurity, other public programs and policies can also affect food insecurity, both positively and negatively. For example, assistance programs aimed at housing, healthcare, labor market outcomes, or employment can free up funds for food. Expansions of Medicaid eligibility – a public insurance program for low-income people – is linked with reduced food insecurity (Moellman, 2020) as are expansions of the Earned Income Tax Credit program (Lenhart, 2023), and higher minimum wages are associated with improvements in food security (Freije et al., 2025). In contrast, criminal justice policies can incapacitate adults who might otherwise provide food for children and families, and the direct fees and fines associated with an arrest (regardless of outcome) can impose a financial burden for the arrestee and their family (Turney, 2015).

One such policy that has not yet been examined in this light is the increasingly accessible nature of cannabis in recent years through state government action. In this paper, we investigate possible connections between state laws allowing recreational cannabis use among adults 21 years and older and the food security of families in these states. Cannabis possession has been prohibited in the U.S. since the Marihuana Tax Act of 1937. The Drug Enforcement Agency currently classifies cannabis as a Schedule I substance, which is defined as a drug with no accepted medical use and high potential for abuse (U.S. Drug Enforcement Administration, 2018).

In contrast to federal regulations, over the last half century, public perception of cannabis has changed dramatically in the U.S. In 1969, just 12% of Americans agreed with the statement that cannabis should be legal, this share trended upwards until 1979 when 30% of the population concurred with this statement, and the share declined thereafter before returning to roughly 30% again in 2000, and then increased nearly monotonically and reached a high of 70% in 2023 (Gallup, 2023). The share of Americans reporting past-year cannabis use has steadily climbed as perceptions towards this drug have become more liberal, with 23.0% of those 18 years and older reporting such use in 2023 and 50.3% reporting lifetime use, making cannabis the most widely used drug in the U.S. (Substance Abuse and Mental Health Services Administration, 2023).

State cannabis policy has changed markedly over this same period, with a general trend towards less restriction on cannabis access. In the 1970s and early 1980s, some states decriminalized possession of small amounts of cannabis for personal use, but this trend faltered in the 1980s – potentially due to the 'Parents' Movement' which aimed to curtail all drug use among teens (Caulkins et al., 2015). The 1990s experienced the beginning of a return to a more liberal view of cannabis. In 1996, California became the first state in the nation to legalize medical cannabis use (Caulkins et al., 2015) and by the time of writing, 38 states and the District of Columbia had adopted a medical cannabis law (MCL) (Britannica, 2024). In MCL states, residents with specific health conditions and receiving a recommendation from a healthcare professional can possess and consume cannabis. Over time, different U.S. Attorneys General have placed less emphasis on cannabis crimes -- e.g., the Ogden Memo of 2009 (U.S. Department of Justice, 2009). The federal government has recently signaled a loosening of cannabis restrictions. First, in 2022 when President Biden pardoned federal offenses for simple cannabis possession (U.S. Department of Justice, 2022) and second, in 2023 when the Department of Health and Human Services recommended reclassifying cannabis to Schedule III to the DEA and that agency is reviewing the recommendation at the time of writing (U.S. Drug Enforcement Administration, 2024).

In arguably the most substantial state law changes to date, beginning with Colorado and Washington in 2012, 24 states and DC have adopted laws legalizing adult recreational cannabis (RCLs). These laws allow adults 21 years and older to possess and consume cannabis. A line of economic studies has evaluated RCL effects on cannabis use and finds large increases in adult cannabis use post-law, up to 40% (Sabia et al., 2024). These increases are observed for both moderate use (Abouk et al., 2023; Hollingsworth et al., 2022) and problematic use (Cerdá et al., 2020) of cannabis. In addition to drawing new consumers to the cannabis market, RCLs may induce some consumers to shift consumption from illicit to licit markets (Macha et al., 2022).

A potential concern with the loosening of cannabis regulation through RCLs is that these policy changes could worsen food insecurity through a budget constraint argument; as new consumers allocate income to (newly legal) cannabis purchases, there are less resources available for food. The prevalence of cannabis use is higher among lower-income groups, further raising concerns that newly legal cannabis may crowd-out food purchases. For example, in 2022 18.9% of adults with annual family incomes less than $20,000 reported cannabis use while just 13.2%

of adults with family incomes of $75,000 or more did (Mattingly et al., 2024). Similarly, as cannabis purchased in licit markets tends to be more expensive than cannabis procured in illicit markets (Valdes-Donoso et al., 2020), 'incumbent' consumers who substitute where they procure the product may face higher prices for cannabis post-RCL which could also reduce resources available for food purchases. On the other hand, for those who continue to purchase cannabis in the illicit market post-legalization, RCL adoption may reduce prices and thus free up resources available for food purchases (Meinhofer & Rubli, 2021). In addition, the higher caloric needs associated with regular cannabis use may stretch family food supplies (Sabia et al., 2017; Wilk et al., 2024). Finally, increased incapacitation of particularly heavy users could both reduce earnings and, for those with children, reduce the ability to maintain food security of the children in the household.

The RCL literature to date suggests the presence of spillovers which might offset some of these concerns for food security. For example, RCLs have been linked with reductions in traditional (and for some, especially lower-income families, expensive) healthcare use – e.g., prescription opioids for pain management (McMichael et al., 2020; Wen & Hockenberry, 2018) and emergency department use and inpatient stays (Jayawardhana & Fernandez, 2024; Myran et al., 2023). Healthcare costs are potentially non-trivial for many lower-income families: the average cost of an inpatient stay is $17,680[2] (Centers for Disease Control and Prevention, 2024) and those without insurance are more likely to use cannabis (Substance Abuse and Mental Health Services Administration, 2023). RCLs are associated with improvements in physical health (Abouk et al., 2023), increased labor force participation (Chakraborty et al., 2020; Dave et al., 2023b), and added take-up of government benefits (Maclean et al., 2021). These changes might suggest reductions in the costs of healthcare and increased earnings from labor market participation, which could **reduce** food insecurity. Further, RCLs may reduce crime (Sabia et al., 2024) and the use of other substances (e.g., alcohol, tobacco, and illicit drugs), the latter potentially through economic substitution (Dave et al., 2023a). Since criminal penalties can reduce financial resources (directly through fines and costs associated with a court appearance, and indirectly through incarceration of a householder), a reduction in drug prosecution could also free up resources for families on the margin of food insecurity. Reducing consumption of alcohol and non-cannabis drugs could also allow for higher household expenditures on food necessities

[2] We inflate the original estimate ($14,101) from 2019 dollars to 2024 dollars using the Consumer Price Index.

(if net substance spending falls). These potential effects represent a number of channels by which RCLs could **reduce** food insecurity.

Overall, the impact of RCLs on food insecurity is ex ante ambiguous and likely varies across the population depending on whether, and how, individuals respond to RCLs, in particular lower-income people who are on the margin of experiencing food insecurity. In this paper, we study the net effect of RCL adoption on food insecurity measures using survey data from the Current Population Survey Food Security Supplement (CPS-FSS) over the period 2010-2022 combined with a difference-in-differences approach that is robust to bias associated with a staggered treatment adoption (Gardner, 2022). Our results suggest that RCL adoption, potentially counter to expectations, reduces food insecurity: post-RCL, the probability of any food insecurity declines by about 7% for households, and the probability of very low food security among children falls by an even larger amount. To better understand the net effect of RCLs on food insecurity, we use a variety of national databases to identify several pathways through which RCLs could affect individual's outcomes in ways that have implications for food security. This analysis suggests that reduced involvement with the criminal justice system and improved employment outcomes are potential channels linking RCL adoption with food security. In sum, our findings do not suggest that recent legalization of cannabis by states has worsened food security among American families.

II. Data sources and Descriptive Statistics

Primary Outcome Data

Our primary data source is the 2010-2022 Current Population Survey (CPS), specifically the December Food Security Supplements (CPS-FSS). We use a harmonized version prepared by IPUMS (Flood et al., 2023). The CPS is a monthly survey of over 70,000 households that interviews respondents in a rotation for four months in a row, followed by eight months with no interviews, and then four months again (i.e., the same calendar months in the following year). To supplement the core CPS monthly survey questions, the CPS-FSS is conducted in December each year to offer perspectives on food insecurity. The CPS and associated supplements are nationally and state-representative; this feature is useful for our purposes as we study a state-level policy. We begin the study period in 2010 to avoid confounding from the 2007-2009

recession and end the study period in 2022 (the most recent year of the CPS-FSS available at the time of writing). Since households must have a December survey to be in the CPS-FSS, our analysis utilizes roughly one-third of the full CPS sample.[3] We include adults ages 21-85 years and children ages 0-17 years in the analysis sample. Observations with missing information on food security questions are excluded. Our final sample includes 903,163 adults and 295,949 children.

In the CPS-FSS, adults in each household are asked a series of ten questions related to food security, such as being unable to afford balanced meals, cutting the size of meals because of too little money for food, or being hungry because of too little money for food.[4] Households with minor children are asked eight additional questions about food insecurity conditions and experiences among children, as reported by the adult respondent. The full set of ten (or 18) responses is mapped into discrete measures of household, adult, and child food insecurity according to USDA protocols.[5] Appendix Table A1 reports all questions. We consider two binary outcomes that are standard in the literature (e.g., Hamersma and Kim (2025)) an indicator for low or very low food security (broad), and an indicator for very low food security (severe). While the questions are available in both 30-day and 12-month lookback windows, we use only the 12-month in order to avoid idiosyncratic food security experiences during the holiday season (when the surveys are fielded).

Table 1 provides descriptive statistics for states without RCLs in our sample, and those with RCLs, before and after the policy adoption. In states without RCLs, 12% of the households have low or very low food security and 4.5% have very low food security, over the past 12 months. Food security rates among adults only are similar. Among children, 7.8% have low or

[3] The CPS rotation groups are evenly distributed to start across the 12 months of the year, and since people are interviewed for four months in a row, the December survey is made up of those in the four rotation groups that start in September, October, November, and December.

[4] See the full questionnaire here: https://www.ers.usda.gov/sites/default/files/_laserfiche/DataFiles/50764/26621_hh2012.pdf?v=3672.4

[5] The 2021 report on Food Security in the U.S. provides details on these categorizations. A household without children is considered 'low food security' if three or more of the ten responses to the food security questions are indicative of food insecurity; if six or more are indicated, they are classified as 'very low food security.' For households with children (who answer 18 questions total), the thresholds are three questions for low food security and eight for very low food security. To assess food security among children only, the thresholds for low and very low food security are two questions and five questions, respectively, out of the eight child-focused questions. Please see the following website: https://www.ers.usda.gov/webdocs/publications/104656/err-309.pdf?v=9438.6 (website last accessed February 7th, 2025).

very low food security and 0.7% have very low food security. The prevalence of food security measures among households, adults, and children are very similar in states without RCLs and those with RCLs before the law goes into effect. These estimates are similar to those reported by USDA (Coleman-Jensen et al., 2022), though child food insecurity is known to be underreported by adults (Fram et al., 2011).

Other Data Sources

RCLs are most likely to affect food insecurity indirectly rather than directly, through the pathways discussed in Section 1. We use a variety of data sources to develop evidence on the extent to which RCLs affect these potential pathways, providing suggestive evidence on the means by which they may be affecting food insecurity. Here we describe the data we utilize to examine the six pathways we consider: 1) cannabis use and misuse, 2) cannabis-related arrests, 3) employment, 4) benefit takeup, 5) insurance coverage, and 6) food expenditures.

To investigate the first-order effects of RCLs on cannabis use itself, we use the Behavioral Risk Factor Surveillance Survey (BRFSS) (Centers for Disease Control and Prevention, 2023). The BRFSS is a telephone survey of approximately 400,000 non-institutionalized U.S. residents 18 years and older that is administered annually by the Centers for Disease Control and Prevention (CDC). The purpose of the BRFSS is to track health, health behavior, and healthcare outcomes for the population. Beginning in 2016, questions on cannabis use were included in optional modules of the BRFSS. Not all states provide information in each year. Appendix Table A2 reports the states that provide cannabis use information in each year of the study period (2016-2022). We construct measures of cannabis use in the past 30 days (any use and the number of days used conditional on any use) and retain respondents 21 and older.

We complement our BRFSS analysis with data on treatment for heavy and problematic cannabis use in the Treatment Episode Dataset (TEDS). The TEDS are administered by the Substance Abuse and Mental Health Services Administration (SAMHSA) and include all-payer episodes to specialty treatment programs (Substance Abuse and Mental Health Services Administration, 2025). States are mandated to report data to SAMHSA on specialty substance use disorder treatment episodes by providers receiving public funding or are tracked for some

other state-specific reason. Each year, TEDS include approximately two million episodes with information on patients such as age and substance use. Treatment modalities include detoxification, hospitalization, residential, and both intensive and non-intensive outpatient. We examine the number of annual treatment episodes (across all modalities) for which the patient is 21-64 years of age and the primary substance is cannabis. Data are aggregated to the state-year level, and we convert episode counts to the rate per 100,000 state residents 21-64 years.[6] Examining the impact of RCLs on episode rates in the TEDS allows us to study whether RCL adoption leads to increases in problematic cannabis use.

Prior to RCL adoption, cannabis possession was illegal and thus those consuming this product were at risk for incarceration and associated costs. Following legalization, incarceration related to simple possession was removed and thus we expect arrests to decline. To study the effects of RCLs on cannabis-related arrests, we use the Federal Bureau of Investigation Uniform Crime Reports (UCR) drug violation information (Kaplan, 2023). In particular, we construct the annual rate of cannabis i) possession and ii) sales arrests among those 21 and older per 1,000 state residents. Drug possession and sales arrests are Part II crimes.

To investigate the effects of RCLs on labor market outcomes, health insurance coverage, and benefit take-up, we return to the core monthly CPS as well as its Annual Social and Economic Supplements (CPS-ASEC). The CPS-ASEC is conducted from February through April of each year. The monthly CPS contains a limited set of real-time labor market variables, and the CPS-ASEC provides supplemental data about the previous calendar year as a whole. Collectively, these data allow us to examine labor force, health insurance, and benefit take-up information as well as demographics. Outcomes in the monthly CPS can be examined for the full sample, while those in the CPS-ASEC are limited to those who completed the ASEC questionnaire.

Finally, in addition to food security questions in the CPS-FSS, respondents also provide the amounts their household spends on food last week, and where funds are spent (e.g., restaurants). Households with incomes above 100% FPL are asked the questions if they report

[6] In unreported analyses, we have constructed episode rates using any cannabis listed on the patient record and results (available on request) are not different. TEDS includes up to three endorsed substances.

some level of difficulty in meeting their food needs on the first of the preliminary screener questions.

Policy Data

We use data from ProCon to characterize state RCLs adopted or announced by 2024 (Britannica, 2024). We define an RCL as a binary variable, set to one if a state has legalized cannabis for recreational purposes before the respondents were interviewed in December for the CPS-FSS analysis and March for the CPS-ASEC analysis of a given year in a particular state, and zero otherwise. Figure 1A reports the geographic distribution of RCLs as of 2022 (the final year of our study period) and Figure 1B shows the temporal variation that we exploit in our difference-in-differences methods.

To have a better understanding of how the evolution of cannabis liberalization affects the outcome of interest, we define another binary variable for legalization of cannabis dispensaries, retail settings in which consumers purchase cannabis. Generally, states first adopt an RCL and then dispensaries open after a lag of one to two years. Previous research documents that dispensaries – where most consumers obtain cannabis – are more strongly related to cannabis use than the RCL implementation, which does not necessarily confer the ability to legally obtain cannabis to prospective consumers. Figure 1, Panel A and B report the geographic and temporal distribution of active cannabis dispensaries.

Descriptive Statistics

Table 1 reports the descriptive statistics for the outcome variables for states without RCLs over the full study period, and states with RCLs, before and after the implementation of the law. Overall, the prevalence of the food security measures is comparable in states without RCLs to that in states with RCLs, the latter measured before the laws became effective. For example, 6.6% of adults 21 and older in non-RCL states are food secure and the prevalence is 6.4% in RCL states pre-law. We observe an improvement in food security measures post-legalization in RCL states. For example, the likelihood of a household being food insecure (low or very low food security) falls from 11.7% to 9.3%, suggesting a 20% decline from baseline. In addition, past-month cannabis use in the BRFSS shows an increase from 11.2% to 14.2% in RCL states from before to after the RCL passed, representing a 27%increase. Cannabis possession and sale

arrests also decline after the legalization substantially. Employment outcomes are similar across the two groups of states with 59.0% and 59.6% of adults employed in non-RCL and RCL (pre-policy) states respectively. Overall employment is largely unchanged pre- and post-RCL in adopting states, though part-time employment declines while full-time employment increases post-policy.

Methods

We use a difference-in-differences (DD) framework to study the effect of RCLs on measures of food security and other outcomes. Recent studies have shown that the DD models implemented using traditional two-way fixed-effect (TWFE) regressions to evaluate staggered policy adoptions may result in biased estimates if treatment effects are dynamic or heterogeneous (Goodman-Bacon, 2021). If there are treatment dynamics – for example if effects grow over time, perhaps as people learn about the law or as dispensaries become operational – then using earlier treated units as counterfactuals for later treated units ('forbidden comparisons') can lead to bias. For efficiency, TWFE regression variance weights the data, thus units that take treatment in the middle of the panel (vs. those treated early or late in the panel) receive disproportionate weight. This variance weighting can lead TWFE to recover poor estimates of the average treatment effect on the treated, which is a common target parameter in many policy analyses, if there is heterogeneity in treatment effects across RCL-adopting states. Finally, TWFE requires that covariates are not correlated with any heterogeneity in treatment effects (strict exogeneity).

We utilize the two-stage imputation DD procedure developed by Gardner (2022) which is not subject to these concerns. The Gardner procedure can be expressed with the following equations (Gardner, 2022; Butts and Gardner, 2022):

$$FS_{isy}(0) = X_{isy}\beta + \gamma_s + \tau_y + \varepsilon_{isy} \quad (1)$$

$$FS_{isy}(1) - \widehat{FS_{isy}(0)} = \delta RML_{sy} + \mu_{isy} \quad (2)$$

In the first stage (Equation 1), $FS_{isy}(0)$ represents the food security status in the untreated states, matrix X_{isy} contains the individual-level and state-level dependent variables, and γ_s and τ_y are state and year fixed-effects. This equation is estimated using untreated observations ('not-yet-treated' and 'never-treated') and is utilized to impute counterfactual outcomes for the untreated

states post-policy. In the second stage, Equation (2), we subtract the imputed outcome based on Equation (1) from the actual outcome (for the full set of observations) and regress that gap on the policy of interest. Standard errors account for both within-state clustering and the imputation in the first-stage. Data are weighted by CPS-provided survey weights but we will show that results are not sensitive to removing the weights.

As individual-level variables we control for age in years; race/ethnicity (White, Black, other race, or Hispanic, with White as the omitted category); sex (male and female, with female as the omitted category); highest level of educational attainment (less than high school, high school, some college, college degree, and a graduate degree, with less than high school as the omitted category); marital status (married and not married, with married as the omitted category); and number of children in the household (indicators for zero through eight or more, with zero as the omitted category). As state-level policy variables we control for MCLs (Britannica, 2024); Medicaid expansions to non-elderly, non-disabled and childless adults under the Affordable Care Act; the effective minimum wage (in 2022 dollars), state-to-federal earned income tax credit ratio, and AFDC/TANF benefits for 3-person family (Kaiser Family Foundation, 2025; University of Kentucky Center for Poverty Research, 2025). Descriptive statistics for these covariates are provided in the Appendix. We show in robustness checking that results are not sensitive to excluding time-varying controls.

We modify Equations (1) and (2) when using state-level data (i.e., TEDS and UCR). In particular, we do not include individual-level covariates and we weight the data by the state non-elderly population.

III. Results

Results I: The Net Effect of RCLs on Food Insecurity

Regression results for food security measures are presented in Table 2 for both general food insecurity (low or very low) and severe food insecurity (very low only). Panel A of Table 2 reports the regression results for households, suggesting that there is a reduction in food insecurity of about 0.8 percentage points (ppts), or just under 7% percent of the mean. The estimate is statistically significant at the 90% confidence level. This result is driven mainly by a transition of households from low food security status to food secure status, as there is little

evidence of any change in very low food security. Panel B shows the results for adult food security. Results are similar to those reported in Panel A and are estimated with slightly higher confidence. Overall, Panels A and B suggest a 7-8% decline in the likelihood of a household or an adult having low or very low food security. Findings reported in Panel C, providing child coefficient estimates, are somewhat different. The findings indicate a relatively large and statistically significant decline in the likelihood of a child being severely food insecure (a reduction of about 1/3 of baseline)[7], but there is no clear change in overall food security; children may be moving from severe to less-severe food insecurity, but not escaping food insecurity entirely.

Our DD regression relies on the parallel trends assumption holding in our data. That is, we assume that states adopting and not adopting RCLs would have followed the same trend in food security outcomes had RCL states not adopted the policy. While this assumption is untestable as counterfactual outcomes are not observed, we estimate an event study model to provide suggestive evidence on the ability of our data to satisfy the parallel trends assumption. In particular, we decompose the binary DD variable into a series of five policy leads, the year of policy adoption, and four policy lags.[8] Figure 2 reports the event study graphs. The estimated coefficients for lead variables are small and statistically insignificant, suggesting that pre-RCL states with and without this policy displayed parallel trends in the outcome of interest; this pattern of results suggests that the data do not appear to violate parallel trends. This time delay appears reasonable given that dispensaries – the most common source of legal cannabis – are legalized and operational one to two years following RCL adoption in most states.

Results II: Potential Mechanisms for the Relationship Between RCLs and Food Insecurity

Using multiple data sources, Table 3 presents a series of estimated coefficients for the effect of RCLs on past-month cannabis use, annual cannabis-related treatment episodes, annual cannabis-related possession and sales arrests, employment and income outcomes, health insurance

[7] Childhood food insecurity is relatively rare, thus our effect sizes are non-trivial in size. However, the 95% confidence intervals include much smaller effect sizes.

[8] The Gardner event-study procedure does not have an omitted period. Instead, coefficient estimates are implicitly normalized over the pre-treatment period. States that adopt RCLs beyond 2022 are coded as being in their pre-treatment period. For example, a state adopting an RCL in 2023 would be coded as -1 in survey year 2022.

coverage, and food expenditure measures. Rows 1-3 on Table 3 show that past-month cannabis use increases by 35% percent among adults following RCL adoption, and that most of the change is on the extensive margin as there is little evidence of increases in frequency conditional on any use. These results are consistent with previous findings in the literature reported in Section 1. There is no change in cannabis-related treatment episodes post-RCL (row 4).[9] Rows 5-6 report a substantial decline in cannabis-related arrests, indicating a 48% and 68% decline in cannabis possession and cannabis sale arrests, respectively. The decline in cannabis-related arrests may suggest that those who previously may have been arrested, for example, for cannabis possession will no longer be arrested post-legalization. An arrest has substantial direct and indirect costs for people. In terms of direct costs, an arrested person can face booking, bail, court, and attorney fees. If the individual is convicted, there can be fees associated with probation, drug testing, and monitoring (e.g., house arrest or electronic monitoring) following release. In addition, indirect costs are in the form of lost wages and impeded ability to locate gainful employment upon release as most employers conduct background checks and having a criminal record reduces the probability of employment. Indirect costs are likely larger and more persistent than indirect costs.

We find no change in the probability of any employment post-RCL adoption (shown in row 7). However, post-RCL, there is a pattern of transition from part-time to full-time jobs; in particular, post-policy the probability of full-time work increases by 1.6%. Corresponding to the rise in full-time work, the number of hours worked increases by 0.4% post-RCL.

Rows 11-15 show the effect of RCLs on family income and income from other sources such as Supplemental Security Income, and income from Social Security and Disability Insurance, Worker's Compensation, and poverty (defined as family below 150% FPL). These results suggest a 1.3% increase in the family income, and a 4% decline in poverty post-RCL and a decline in income from Supplemental Security Income and Worker's'= Compensation, notably, Worker's Compensation wage replacement rates are roughly two-thirds the normal wage. In addition to offering higher earnings through increased work-time, the documented increases in full-time employment can have other implications. Most importantly, the type of healthcare coverage might shift from other forms to employer-sponsored coverage, as full-time employment

[9] Appendix Table A3 and Figure A2 present complementary results using TEDS data.

usually includes healthcare benefits that can potentially reduce out-of-pocket healthcare expenses. Rows 16-19 of Table 3 present coefficient estimates supporting this hypothesis, but we cannot reject the null hypothesis of no shift. It appears RCLs may reduce the likelihood of being covered through government-sponsored insurance, while increasing the likelihood of having employer-sponsored coverage, but we do not have sufficient power for a strong conclusion.

To examine the link between RCLs and food spending, we utilize related measures from the CPS-FSS. Rows 20-21 in Table 3 report results for past-week total food expenditure and spending on restaurant meals. While the potential effect on total expenditures is imprecisely estimated, the findings do indicate an increase in restaurant spending by nearly 4%. We conduct a number of robustness checks to assess the stability of our results. Results are reported graphically in Appendix Figure A3. We lag the RCL policy by one year, replace year fixed-effects with region-by-year fixed-effects, estimate the effect for the pre-pandemic period, add a set of SNAP policy covariates available for the 2010-2020 period, control for whether a state borders another state that does not have an RCL in place, estimate an unweighted regression, remove the time-varying covariates, and estimate the regression using Callaway and Sant'Anna (2021). We also estimate a 'leave-one-out' analysis in which we sequentially exclude each RCL state and re-estimate our regression (Appendix Figure A4). Results are robust and do not appear to be driven by any specific state(s).

IV. Discussion

The U.S. faces a food security crisis in that millions of Americans lack reliable, predictable access to food. This crisis persists despite an adequate national food supply and is concentrated mostly among lower income groups. Governments at all levels have adopted policies that attempt to improve food security. Most policies to date directly provide food to those without adequate access or provide targeted funding for food. However, policies adopted to achieve other objectives may also impact food security through spillover effects. We consider one such policy: state legalization of recreational cannabis. The rationale for recreational cannabis law (RCL) adoption is unrelated to food security and instead is motivated by concerns about racial and ethnic disparities in incarceration, the criminalization of a product that many Americans view favorably, potential economic gains, and more.

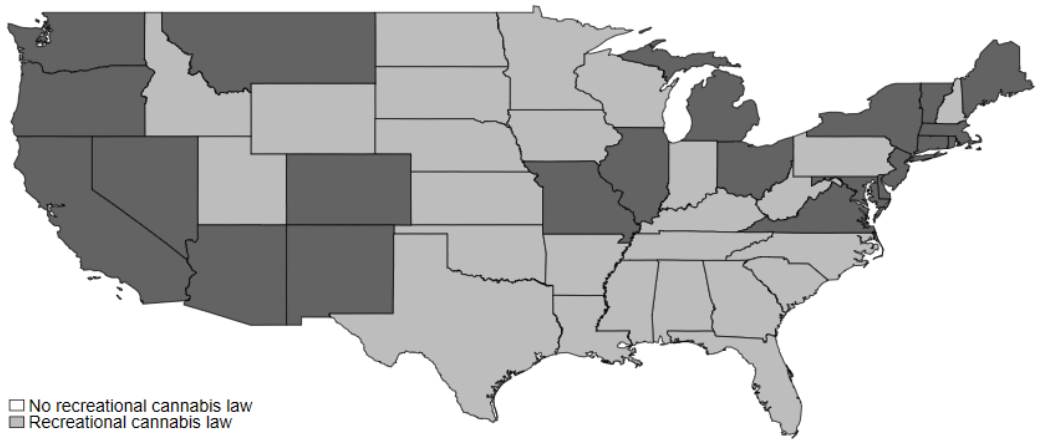
Given that RCLs have been linked with substantial increases in cannabis use, a natural concern is that the policy will have the unintended and negative consequence of worsening food security as scarce household resources are allocated to the (newly) legal cannabis and away from food. However, there are a host of pathways that suggest the opposite relationship. For example, RCLs may reduce costly healthcare use and criminal justice system involvement and may also improve labor market outcomes. Thus, the net impact of RCLs on food insecurity is theoretically ambiguous.

Our findings suggest that recent state cannabis legalization efforts have not led to a worsening of the food security crisis. Instead, such efforts may alleviate food insecurity for both adults and children; there is a 6-7% reduction in any food insecurity for adults and a substantial movement of about 1/3 of severely food insecure children into the less severe category of low food security. We identify improved employment – both in terms of work hours and access to more generous benefits, and less reliance on government programs – and reduced involvement with the criminal justice system as possible channels for these improvements.

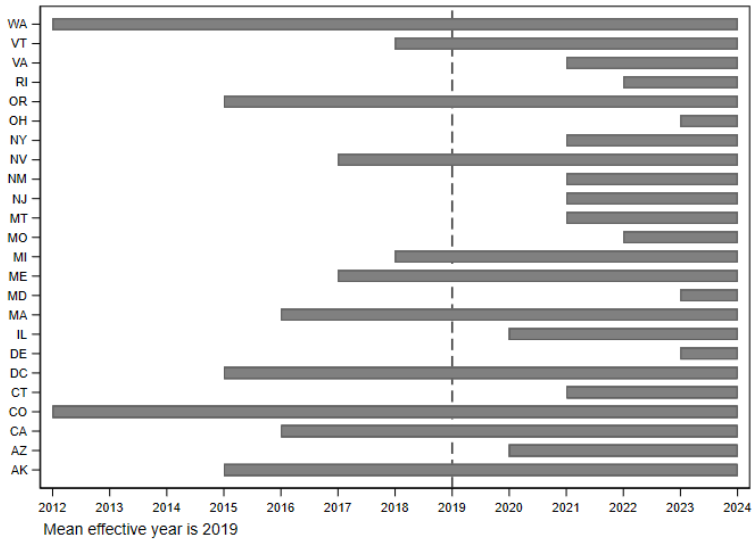
Our findings contribute to both the economic literature examining determinants of food insecurity and the social impacts of RCLs. The findings do not imply that RCL adoption should be passed as a tool to reduce food insecurity, given the complex web of implications the laws have compared to those targeted toward food intake. Recommendations about RCL policy adoption would require a full cost-benefit analysis beyond this scope of this work. However, our findings do suggest that improvements in food security for both adults and children are a positive, and potentially unexpected, spillover from RCL adoption that ought to be included in any analysis of the net impact of RCL adoption on well-being.

Figure 1 shows the geographic and temporal variation in state recreational cannabis laws that we exploit in our difference-in-differences methods

Panel A: Geographic variation in state recreational cannabis laws



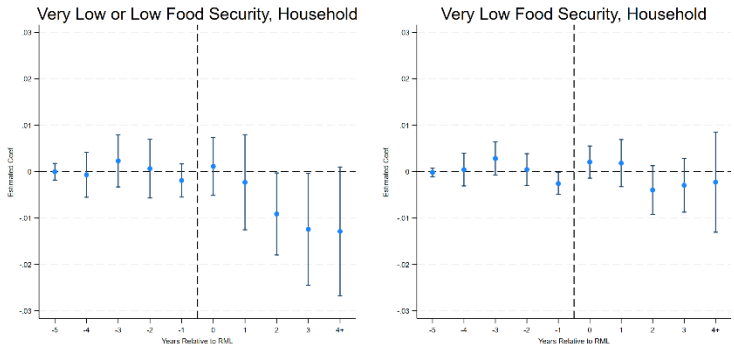
Panel B: Temporal variation in state recreational cannabis laws



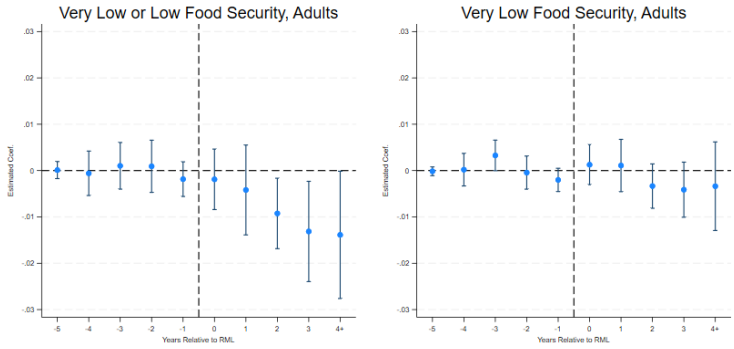
Notes: Data source is ProCon (Britannica, 2024).

Figure 2. Effect of State Recreational Cannabis laws on Food Security Measures using an Event-study: Current Population Survey 2010-2022

Households



Adults



Children

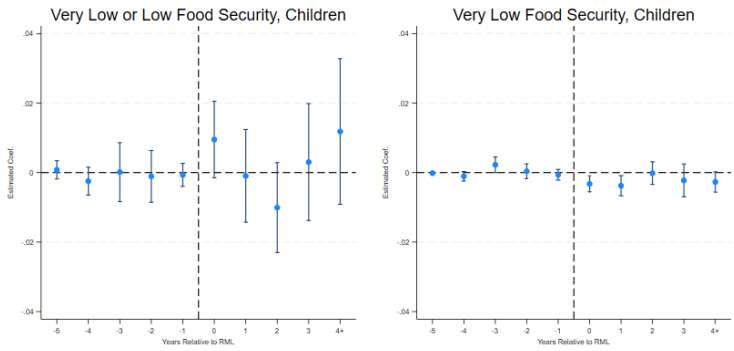


Table 1 Descriptive Statistics

	(1)	(2)	(3)	(4)	(5)	(6)
	No RCL		**RCL**			
			Before		**After**	
VARIABLES	N	Mean	N	Mean	N	Mean
Outcome variables:						
CPS-FSS 2010-2022						
Household Low or Very Low Food Security	516,781	0.121	248,644	0.117	137,738	0.093
Household Very Low Food Security	516,781	0.045	248,644	0.043	137,738	0.034
Adults Low or Very Low Food Security	516,781	0.113	248,644	0.109	137,738	0.087
Adults Very Low Food Security Past Year	516,781	0.047	248,644	0.044	137,738	0.035
Child Low or Very Low Food Security	169,845	0.078	83,382	0.078	42,722	0.062
Child Very Low Food Security Past Year	169,845	0.007	83,382	0.008	42,722	0.006
Mechanism variables:						
BRFSS 2016-2022						
Used MJ Past Month	529,407	0.064	21,178	0.112	136,070	0.142
# of Days Used MJ Past Month	529,407	1.013	21,178	1.858	136,070	2.412
UCR 2010-2021						
Cannabis possession arrests 21+ per 1,000 population	5,016	0.108	1,053	0.063	663	0.008
Cannabis sale arrests 21+ per 1,000 population	5,016	0.013	1,053	0.010	663	0.003
CPS 2010-2022						
Employment	8171279	0.583	3847097	0.584	2223411	0.586
Part-time Employment	8171279	0.126	3847097	0.140	2223411	0.132
Full-time Employment	8171279	0.457	3847097	0.445	2223411	0.453
Hours worked last week	4764627	39.561	2247734	38.827	1302318	38.975
Income from SSI	940,242	235.208	500,366	255.447	230,269	223.174
Income from SSDI	940,242	148.014	500,366	159.303	230,269	171.327
Income from Worker's Compensation	940,234	49.614	500,359	74.387	230,265	55.314
Below 150% Poverty	940,242	0.201	500,366	0.203	230,269	0.171
Uninsured	940,242	0.133	500,366	0.132	230,269	0.081
Government Coverage	940,242	0.312	500,366	0.319	230,269	0.366
Employer-sponsored Health Insurance	940,242	0.557	500,366	0.558	230,269	0.559
Total Expenditures on Food Last Week	513,894	183.098	246,700	198.014	136,771	216.069
Exp. on Food at Restaurants Last Week	496,387	46.071	237,081	48.587	132,036	55.663
Value of SNAP/food Stamp Benefits	514,027	26.464	247,310	26.531	136,961	21.692

Notes: Food security measures are a 12-month recall. Food expenditures and value of SNAP benefits are in Dec 2022 dollars. Employment mechanisms are from Monthly CPS, health insurance mechanisms are from CPS-ASEC, and food expenditures are from CPS-FSS.

Table 2. Effect of State Recreational Cannabis laws on Food Security Measures using Difference-in-differences: Current Population Survey 2010-2022

Column:	(1)	(2)
Outcome:	Low or Very Low Food Security	Very Low Food Security
Panel A: Household-level Food Security		
Recreational Cannabis Law	-0.008*	-0.001
	(0.004)	(0.003)
N	899021	899021
Mean of Dependent Variable	0.11	0.04
% Change	-6.65	-2.26
Panel B: Adult		
Recreational Cannabis Law	-0.009**	-0.002
	(0.004)	(0.003)
N	899021	899021
Mean Y	0.11	0.04
% Change	-8.41	-3.81
Panel C: Child		
Recreational Cannabis Law	0.005	-0.003**
	(0.007)	(0.001)
N	293406	293406
Mean of Dependent Variable	0.08	0.01
% Change	6.57	-33.83

Notes: Each column reports regression results for household, adult, and child outcomes from two-stage difference-in-difference models, weighted using Current Population Survey – Food Security Supplement survey weights. Regressions include individual- and state-level variables, and state and year fixed-effects. Individual-level variables are race and ethnicity (non-Hispanic Black, Hispanic, and other races/ethnicities), sex (male), education (high school, some college, college degree, graduate degree), marital status (married), number of children in the household (indicators for 1 , 2, 3, 4, 5, 6, 7, and 8) and family income (in $1,000s). State-level variables are medical marijuana laws, Affordable Care Act Medicaid expansion, minimum wage, the state-to-federal earned income tax credit ratio, and AFDC/TANF benefits for 3-person family. Standard errors are clustered at the state level.
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Effect of State Recreational Cannabis Laws on Mechanisms using Difference-in-differences: Various Data Sources 2010-2022

Outcomes	Estimated Coeff.	Obs.	Mean Y	% Change	Source
MJ Use Past Month					
(1) Used	0.039*** (0.010)	686655	0.11	34.73	BRFSS
(2) # of Days	0.662** (0.261)	686655	1.86	35.61	BRFSS
(3) # of Day | Used	0.347 (1.249)	55637	16.54	2.10	BRFSS
(4) Treatment Episodes	1.350 (1.150)	638	11.94	11.30	TEDS
Arrests					
(5) MJ Possession	-0.030* (0.018)	6732	0.06	-47.80	UCR
(6) MJ Sale	-0.007** (0.003)	6732	0.01	67.80	UCR
Labor Market Outcomes					
(7) Employment	0.004 (0.003)	14178967	0.59	0.67	CPS Monthly
(8) Full-time	0.007** (0.003)	14178967	0.45	1.61	CPS Monthly
(9) Part-time	-0.003* (0.002)	14178967	0.14	-2.34	CPS Monthly
(10) Hours Worked Last Week	0.147* (0.083)	8314679	38.89	0.38	CPS Monthly
Income					
(11) Family Income x $1000	1.167** (0.589)	14178967	88.97	1.31	CPS Monthly
(12) SSI Income	-28.371* (15.493)	1670877	247.31	-11.47	ASEC-CPS
(13) SSDI Income	-17.465 (10.745)	1670877	161.04	-10.85	ASEC-CPS
(14) Worker's Compensation Income	-21.980** (9.262)	1670858	70.15	-31.33	ASEC-CPS
(15) Poverty Below 150% FPL	-0.008** (0.003)	1670877	0.196	-4.1	ASEC-CPS
Health Insurance Coverage					
(16) Uninsured	0.003 (0.006)	1670877	0.13	2.34	ASEC-CPS
(17) Government Coverage	-0.008 (0.006)	1670877	0.33	-2.36	ASEC-CPS
(18) Employer-sponsored	0.006 (0.004)	1670877	0.56	1.09	ASEC-CPS
(19) Medical Out-of-pocket Expenses	-214.708 (228.294)	1530559	5341.12	-4.02	ASEC-CPS
Food Expenditure Last Week					
(20) Total	3.369 (2.417)	895241	194.91	1.73	CPS-FSS
(21) In Restaurants	1.865* (1.031)	863013	48.25	3.86	CPS-FSS

Note: Each column reports regression results from a two-stage difference-in-difference model, weighted using appropriate survey or population weights. Race and ethnicity (non-Hispanic Blacks, Hispanics, and other races/ethnicities), sex (male), education (high school, some college, college degree, graduate degree), and marital status (married), and number of children in the household (0, 1 , 2, 3, 4, 5, 6, 7, and 8) dummies as well as family income (in $1,000) in 2021 dollars were included as individual-level explanatory variables. In addition, the following state-level policy variables are included: medical marijuana laws, Medicaid expansion, minimum wages in 2021 dollars, earned income tax credit rates, and AFDC/TANF benefits for 3-person family. standard errors are clustered at the state level. state and year dummies are also included. *** p<0.01, ** p<0.05, * p<0.1

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Appendix

Appendix Table A1 Questions Used to Assess the Food Security of Households in the CPS Food Security Supplement

	Question
1	"We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?
2	"The food that we bought just didn't last, and we didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?
3	"We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?
4	In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)
5	(If yes to question 4) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
6	In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)
7	In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)
8	In the last 12 months, did you lose weight because there wasn't enough money for food? (Yes/No)
9	In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)
10	(If yes to question 9) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
11	"We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 12 months?
12	"We couldn't feed our children a balanced meal, because we couldn't afford that." Was that often, sometimes, or never true for you in the last 12 months?
13	"The children were not eating enough because there wasn't enough money for food." Was that often, sometimes, or never true for you in the last 12 months?
14	In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)
15	In the last 12 months, were the children ever hungry because there wasn't enough money for food? (Yes/No)
16	In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/ No)
17	(If yes to question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
18	In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

Note: Questions 11–18 were only asked if the household included children aged 0–17. Source: (Rabbitt et al., 2023)

Appendix Table A2 States that provide cannabis use information in each year in BRFSS, 2016-2022

State	2016	2017	2018	2019	2020	2021	2022
AK	✓	✓	×	×	✓	✓	✓
CA	×	✓	✓	✓	✓	×	×
CO	✓	✓	×	×	×	×	×
CT	×	×	×	×	×	✓	✓
DE	×	×	×	×	✓	✓	✓
FL	✓	✓	✓	×	×	×	×
GA	×	✓	×	×	×	×	×
HI	×	×	×	×	✓	✓	✓
ID	✓	✓	✓	✓	✓	✓	×
IL	×	×	×	✓	✓	✓	✓
IN	×	×	×	×	✓	✓	✓
KY	×	×	×	×	✓	✓	✓
MD	×	×	✓	✓	✓	✓	✓
ME	×	×	×	×	✓	✓	✓
MN	✓	✓	✓	✓	✓	✓	✓
MS	✓	✓	×	×	✓	✓	✓
MT	×	×	✓	✓	×	✓	✓
ND	×	×	✓	✓	✓	✓	✓
NE	✓	✓	×	×	×	×	✓
NH	×	✓	✓	✓	✓	✓	✓
NM	×	×	×	×	×	×	✓
NV	×	×	×	×	×	✓	✓
OH	✓	✓	✓	×	✓	✓	✓
OR	×	×	×	×	×	×	✓
RI	×	×	×	×	✓	✓	✓
SC	×	✓	✓	✓	✓	✓	×
TN	✓	✓	✓	✓	✓	×	×
UT	×	×	×	✓	✓	✓	✓
VA	×	×	×	×	×	×	✓
VT	×	×	×	×	×	✓	✓
WI	×	×	×	×	×	×	✓
WV	×	×	✓	✓	✓	×	×
WY	✓	✓	✓	✓	✓	✓	✓

Table A1 Descriptive Statistics for explanatory variables

	(1)	(2)	(3)	(4)	(5)	(6)
	No RCL		RCL			
			Before		After	
VARIABLES	N	Mean	N	Mean	N	Mean
CPS 2010-2022						
MCL	516,781	0.268	248,644	0.816	137,738	1
RCL	516,781	0	248,644	0	137,738	1
ACA Medicaid expansion	516,781	0.282	248,644	0.425	137,738	0.945
AFDC/TANF Benefit for 3-person family	516,781	383.362	248,644	560.696	137,738	648.712
Refundable State EITC (1=Yes)	516,781	0.251	248,644	0.583	137,738	0.772
Minimum Wages in December 2022 $	516,781	9.256	248,644	10.463	137,738	12.647
Age	516,781	50.339	248,644	49.572	137,738	49.938
Non-Hispanic Black	516,781	0.105	248,644	0.078	137,738	0.068
Hispanic	516,781	0.036	248,644	0.063	137,738	0.047
Other races	516,781	0.063	248,644	0.090	137,738	0.124
Male	516,781	0.475	248,644	0.474	137,738	0.480
High school	516,781	0.309	248,644	0.269	137,738	0.234
Some college	516,781	0.287	248,644	0.269	137,738	0.264
College graduate	516,781	0.201	248,644	0.222	137,738	0.251
Graduate degree	516,781	0.106	248,644	0.140	137,738	0.169
Married	516,781	0.586	248,644	0.563	137,738	0.554

Table A2. Effect of State Recreational Cannabis Dispensaries on Food Security Measures using Difference-in-differences: Current Population Survey 2010-2022

Column:	(1)	(2)
Outcome:	Low or Very Low Food Security	Very Low Food Security
Panel A: Household-level Food Security		
Recreational Cannabis Dispensaries	-0.007	-0.003
	(0.005)	(0.003)
N	899021	899021
Mean of Dependent Variable	0.12	0.04
% Change	-5.58	-6.92
Panel B: Adult		
Recreational Cannabis Dispensaries	-0.005	-0.003
	(0.005)	(0.003)
N	899021	899021
Mean Y	0.11	0.05
% Change	-4.58	-6.69
Panel C: Child		
Recreational Cannabis Dispensaries	0.003	0.003**
	(0.003)	(0.001)
N	293406	293406
Mean of Dependent Variable	0.08	0.01
% Change	3.68	31.70

Notes: Each column reports regression results for household, adult, and child outcomes from two-stage difference-in-difference models, weighted using Current Population Survey – Food Security Supplement survey weights. Regressions include individual- and state-level variables, and state and year fixed-effects. Individual-level variables are race and ethnicity (non-Hispanic Black, Hispanic, and other races/ethnicities), sex (male), education (high school, some college, college degree, graduate degree), marital status (married), number of children in the household (indicators for 1 , 2, 3, 4, 5, 6, 7, and 8) and family income (in $1,000s). State-level variables are medical marijuana laws, Affordable Care Act Medicaid expansion, minimum wage, and the state-to-federal earned income tax credit ratio. Standard errors are clustered at the state level.
*** p<0.01, ** p<0.05, * p<0.1

Table A3. The effect of a recreational cannabis law on admissions to substance use disorder treatment for cannabis among adults 21-64 years per capita using difference-in-differences: Treatment Episodes Dataset 2010-2022

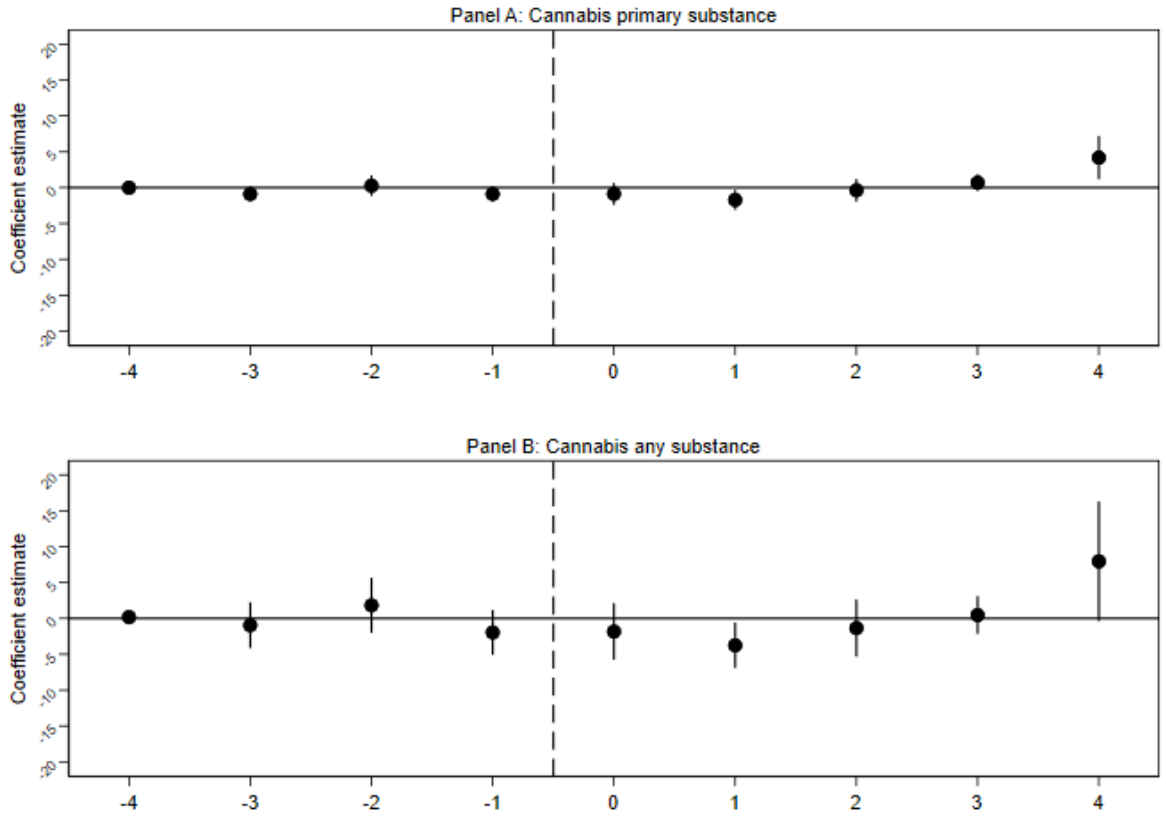
Outcome variable:	Total	Detoxification	Residential	Intensive outpatient	Non-intensive outpatient
Panel A: Primary substance	1.35	0.34**	0.55***	0.38	0.08
	(1.15)	(0.14)	(0.18)	(0.26)	(0.99)
Percent change	11.30	124.91	44.02	17.36	0.97
Pre-treatment mean, treatment states	11.94	0.27	1.25	2.19	8.23
Panel B: Any substance	1.28	1.18**	0.34	0.07	-0.32
	(2.97)	(0.56)	(0.39)	(0.72)	(2.38)
Percent change	3.50	31.97	5.17	1.12	-1.59
Pre-treatment mean, treatment states	36.62	3.69	6.58	6.26	20.10
Observations	638	638	638	638	638

Notes: The outcome variables are the number of admissions among adults 21-64 years per 10,000 adults 21-64 years. The unit of observations is a state in a year. We utilize a Gardner two-step difference-in-differences procedure. All regressions are estimated with ordinary least squares and control for time-varying state characteristics, state fixed effects, and year fixed effects. Data are weighted by the non-elderly adult population per state-year. Standard errors that account for within-state clustering are reported in parentheses.
***,**, and * = statistically different from zero at the 1, 5, and 10 level.

Figure A1 The Event Study Analysis of State Recreational Cannabis Laws on Income Measures using Difference-in-differences: Current Population Survey 2010-2022



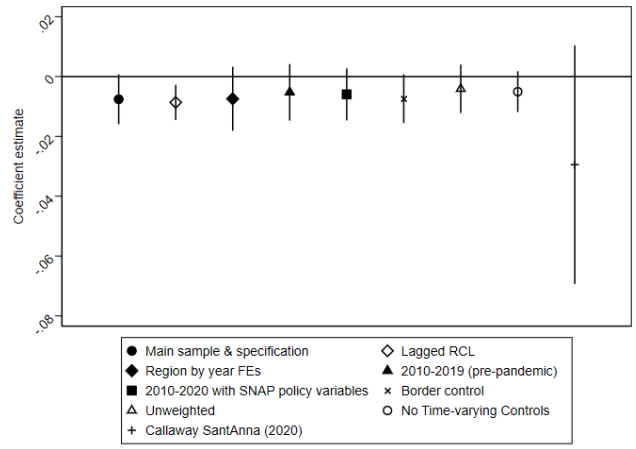
Figure A2. The Event Study Analysis of a recreational cannabis law on admissions to substance use disorder treatment for cannabis among adults 21-64 years per capita using difference-in-differences: Treatment Episodes Dataset 2010-2022



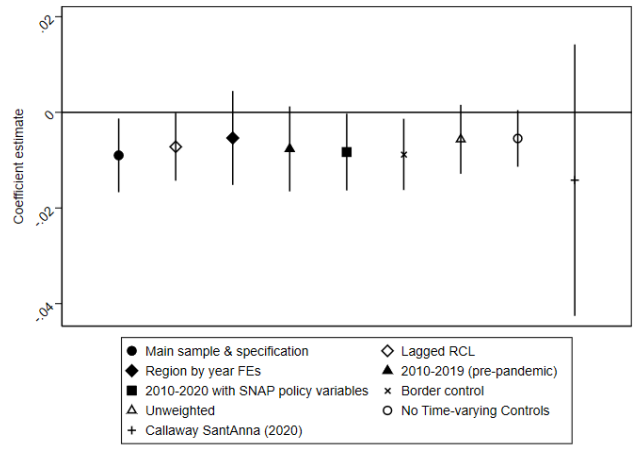
Notes: The outcome variables are the number of admissions among adults 21-64 years per 10,000 adults 21-64 years. The unit of observations is a state in a year. We utilize a Gardner two-step difference-in-differences procedure. All regressions are estimated with ordinary least squares and control for time-varying state characteristics, state fixed effects, and year fixed effects. Data are weighted by the non-elderly adult population per state-year. There is no omitted category in the Gardner event-study. The most distal bins are heterogeneous in time-to-event: -4 includes periods four or more years prior to recreational cannabis law adoption and +4 includes periods four or more years following recreational cannabis law adoption. Standard errors that account for within-state clustering are reported in parentheses.

Figure A3 Robustness Checks

Household-level low or very low food security



Adults low or very low food security



Children low or very low food security

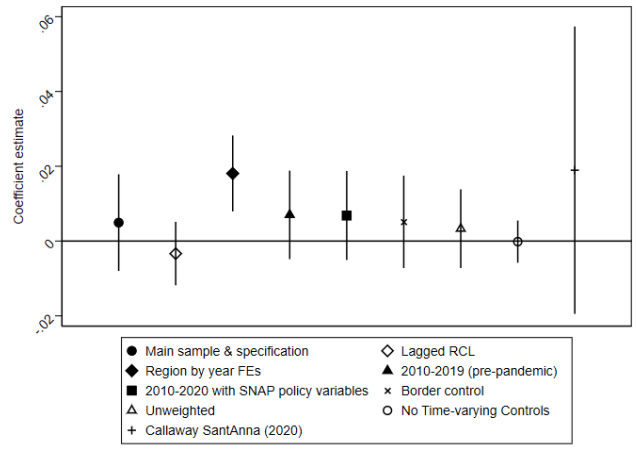
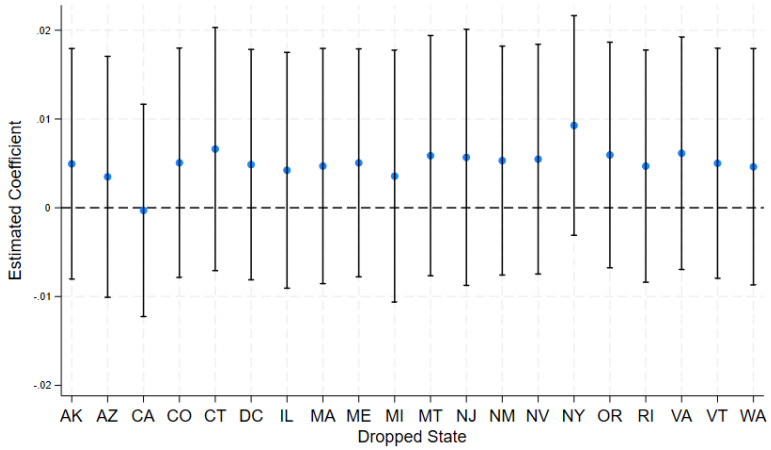
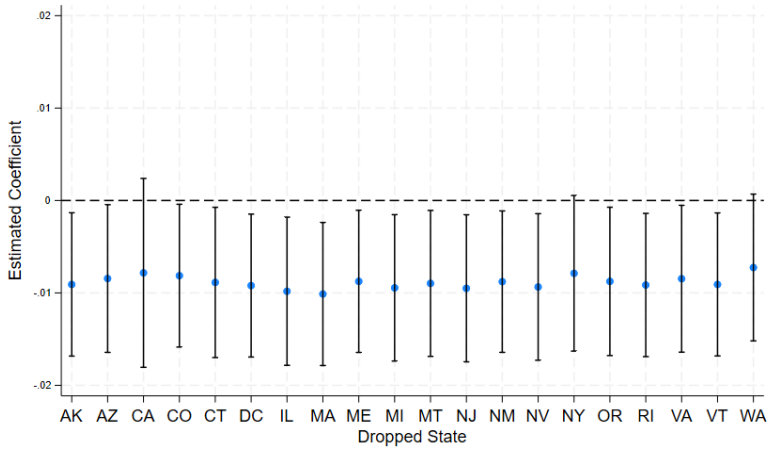


Figure A4 Leave-one-out Analysis

Household-level low or very low food security



Adults low or very low food security



Children low or very low food security

