Impacts of Medical Marijuana Policies on Initiation of Marijuana Use
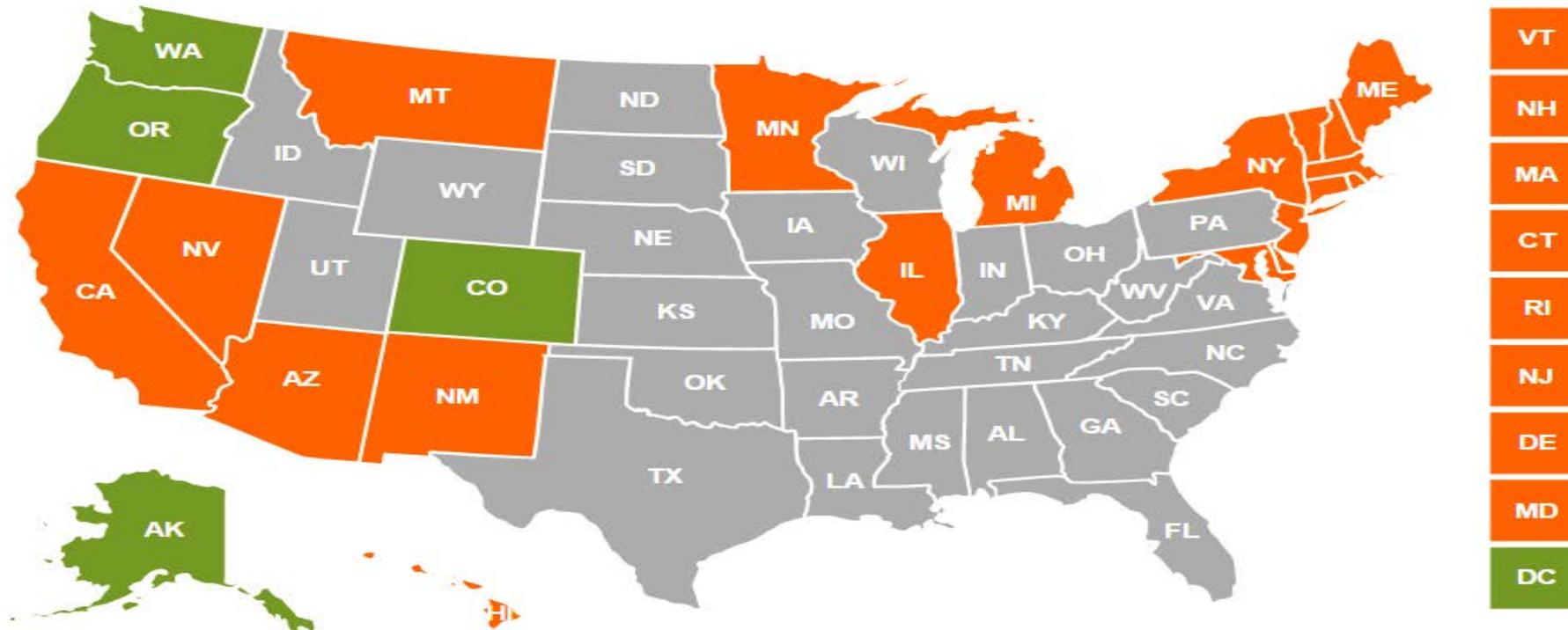
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Background

- 23 states and DC have legalized marijuana use for medical purpose.

States that: ■ Allow recreational and medical use ■ Allow medical marijuana use

Sources: National Organization for the Reform of Marijuana Laws (NORML); National Conference of State Legislatures (NCSL)

Previous Literature on Policy Impacts

- Relied on cross-sectional data.
- Focused on prevalence of use.
- Provided mixed findings regarding impacts of policy on marijuana use in adolescents:
  - Increased prevalence (Wen et al., 2015, Stolzenberg et al., 2015).
  - Reduced prevalence (Hasin et al., 2015, Pacula et al., 2014).
  - Insignificant change (Anderson et al., 2015, Choo et al., 2014, Lynne-Landsman et al., 2013).

Limitations in Previous Literature

- Prevalence is a static measure, but marijuana use behavior is dynamic.

Initiation

Cessation

Prevalence
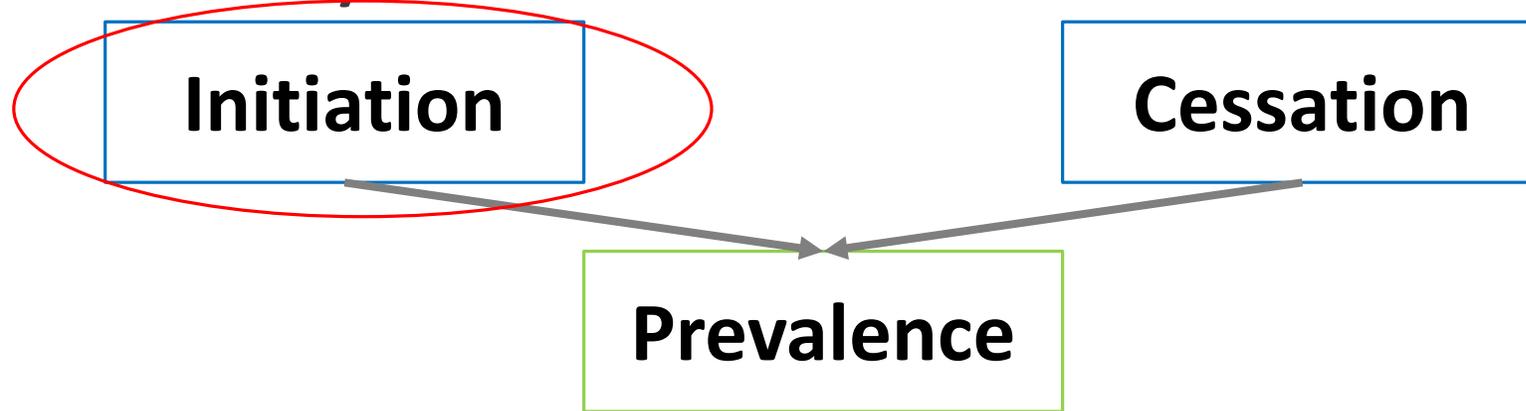
- Cross-sectional data used geographic immobility assumption.
- Primarily focused on generic policy indicators.

Objectives

1. To examine the associations of initiation of marijuana use and regular use to:
   a. Generic medical marijuana legalization policies.
   b. Detailed policy provisions including patient registry, retail dispensary, and home cultivation.
2. To explore heterogeneities in policy impacts by:
   a. Interstate mobility status.
   b. Duration of policy implementation.

Sample

- National Longitudinal Surveys of Youth 1997.
  - A nationally representative cohort of adolescents (born in 1980-1984).
  - Repeated surveys since 1997.
  - Latest survey 15th round in 2011.
  - N=8984.

Methods: Difference-in-Difference

- A quasi-experimental design: exploit heterogeneities across states regarding where, when, and how medical marijuana policies were implemented.
- Difference-in-difference analysis:
  - Treatment states: states that implemented medical marijuana policies.
  - Control states: states that did not implement medical marijuana policies.

Methods: Duration Analysis

- Cox Proportional Hazards Model:

$$h_{ij} = h_0(j)\exp(\gamma \, legal_{ij} + \beta_1' IND\_INVARIANT_{ij} + \beta_2' IND\_VARIANT_{ij}$$

$$+ \tau' STATE\_VARIANT_{ij} + \delta' STATE_{ij} + \theta' YEAR_{ij})$$

  - $legal_{ij}$: medical marijuana policy indicator.
  - $STATE_{ij}$: state fixed effects.
  - $YEAR_{ij}$: year fixed effects.

- Individuals entered the estimation from the earliest age they were at risk of starting:
  - Marijuana use (age 0).
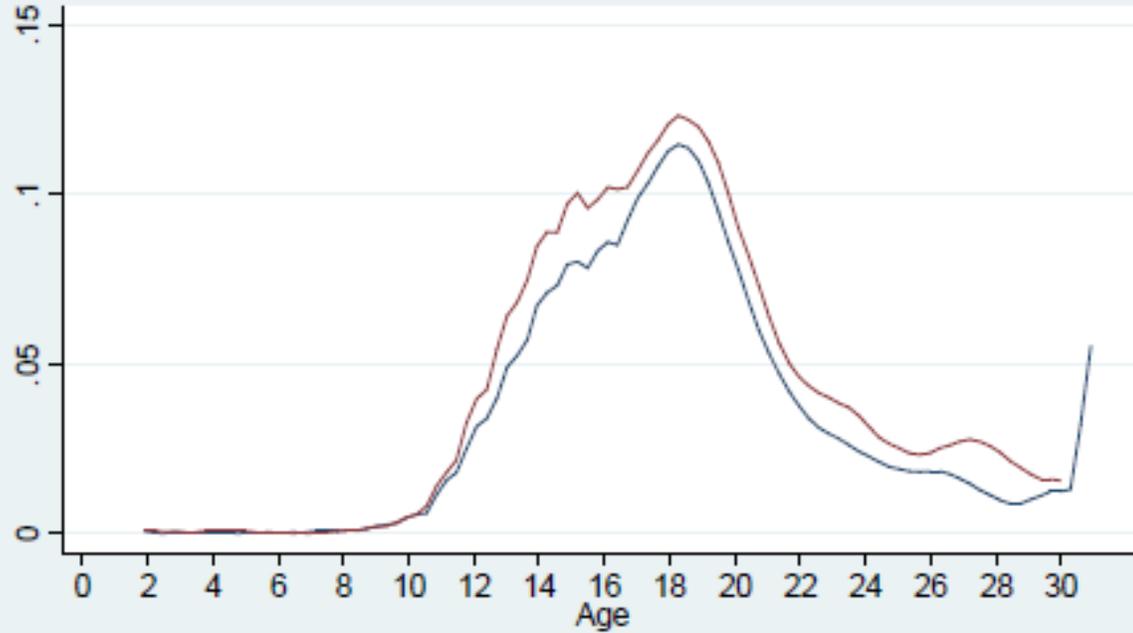 - Regular use (age at first interview).

Covariates

- $IND\_INVARIANT_{ij}$ <u>time-invariant individual variables</u>: gender, age categories at baseline interview, race/ethnicity categories, highest education level obtained, whether or not living with both biological parents at baseline interview, paternal education categories and material education.

- $IND\_VARIANT_{ij}$ <u>time-variant individual variables</u>: household size, marital status, whether earning income, whether relatives being present at interview, whether living in MSA, and whether living in urban area.

- $STATE\_VARIANT_{ij}$ <u>state time-variant variables</u>: unemployment rate, median household income, an indicator for Blood Alcohol Concentration (BAC) limit=0.08, and beer tax rate per gallon.

Descriptive Statistics

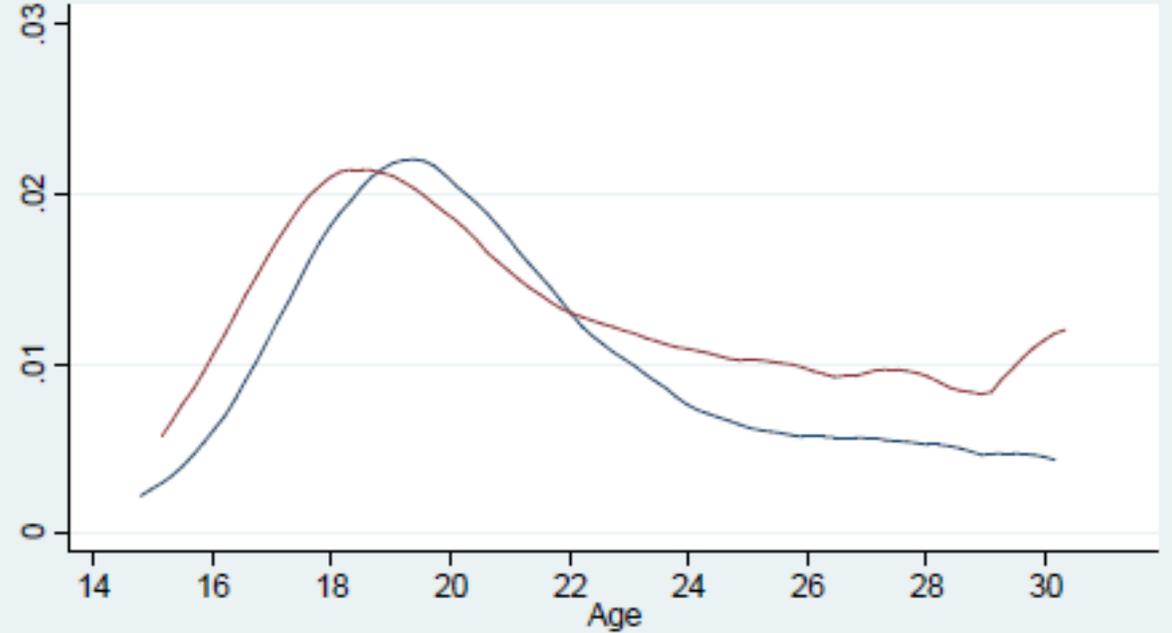|	Full sample	Sample who were living in treatment states at the last interview	Sample who were living in control states at the last interview
Marijuana use behaviors as of latest interview			
Ever initiated marijuana	61.46%	66.17%	59.49%
Initiation age of marijuana use	16.98	16.87	17.03
Ever initiated regular use	14.36%	16.17%	13.65%
Initiation age of regular use	20.72	20.87	20.65

Hazard Rates Plot

Policy Reduced Initiation of Marijuana Use

	Model 1	Model 2	Model 3	Model 4
Implementation of generic medical marijuana policies	1.01 (.054)	.81*** (.040)		.91** (.040)
Implementation of specific medical marijuana policy provisions				
Patient registry			.78 (.11)	.78 (.11)
Retail dispensary			1.23 (.20)	1.24 (.21)
Home cultivation			.70** (.11)	.76* (.12)

*p < .05,
**p < .01,
***p < .001

- Model 1 investigated generic policy implementation in association with marijuana use uptake, controlling for individual time-invariant and time-variant characteristics.
- Model 2 added state- and year-specific effects and state time-variant characteristics in addition to individual characteristics.
- Model 3 replaced generic policy variable with specific policy provisions in Model 2, accounting for all individual, state, and year covariates.
- Model 4 estimated independent effects of both generic policies and specific policy provisions, accounting for all covariates.

No Impacts on Initiation of Regular Use

	Model 1	Model 2	Model 3	Model 4
Implementation of generic medical marijuana policies	1.14** (.075)	1.05 (.27)		.81 (.16)
Implementation of specific medical marijuana policy provisions				
Patient registry			.38 (.28)	.38 (.28)
Retail dispensary			2.12 (1.27)	2.12 (1.27)
Home cultivation			1.51 (.44)	1.84* (.63)

*p < .05,
**p < .01,
***p < .001

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Differential Policy Impacts in Short- and Long-term

	Length of generic policy implementation	Hazard ratio (standard error)
Initiation of marijuana use	Legalized medical marijuana for 0-2 years	.72*** (.078)
	Legalized medical marijuana for 2-5 years	.88** (.052)
	Legalized medical marijuana for 5-9 years	.73*** (.081)
	Legalized medical marijuana for more than 9 years	1.31*** (.13)

*p < .05,
**p < .01,
***p < .001

Differential Policy Impacts by Interstate Mobility Status

	Model specification	Generic medical marijuana policy implementation
Initiation of marijuana use	Stayers	.77*** (.062)
	Movers	.83 (.097)
	Utilizing state of residence at the last interview	.94 (.061)

*p < .05,
**p < .01,
***p < .001

- Stayers were defined as those who never changed state of residence while being at risk of marijuana use initiation.
- Movers were defined as those who ever changed state of residence while being at risk of marijuana use initiation.

Conclusion about Policy Impacts

- Overall, our findings did not lend support to the concern that medical marijuana policies have led to increased uptake of marijuana.
  - Implementing medical marijuana policies significantly reduced the hazard rates of marijuana use initiation.
  - Policies had no impacts on initiation of regular use.

Conclusion about Differential Policy Impacts

- Reduced initiation of marijuana use only in stayers who never moved across states.
  - Interstate immobility status is not valid.
  - Cross-sectional data underestimate policy impacts.
- Reduced initiation of marijuana use only in short-term or medium-term.

Limitations

- Most states implemented policies in the adulthood of the cohort when initiation rate is typically lower.
- Findings not generalizable to other cohorts or countries.
- Self-report bias.
- Not able to explore mechanisms behind the observed associations.
- Medical and recreational marijuana were not distinguished.