

THE IMPACT OF RECREATIONAL MARIJUANA LEGALIZATION ON INTIMATE  
PARTNER VIOLENCE

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By

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# THE IMPACT OF RECREATIONAL MARIJUANA LEGALIZATION ON INTIMATE PARTNER VIOLENCE

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## ABSTRACT

State laws governing marijuana usage have been liberalizing rapidly in recent decades. With nearly half of all US states legalizing recreational marijuana as of this writing, the full impact of these policy changes is still being understood. The potential effect of recreational marijuana legalization on intimate partner violence has been researched, but has yet to be conclusively determined. With recent data from the National Incident-Based Reporting System, this paper analyzes the effect of state marijuana legalization on reported rates of intimate partner violence. Using data from 2013 to 2019, I find that legalization of recreational marijuana results in a substantial decrease in rates of intimate partner violence.

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## INTRODUCTION

Intimate partner violence (IPV) affects millions of people and can have lasting consequences (Centers for Disease Control, 2022). According to the National Coalition Against Domestic Violence, 1 in 4 women and 1 in 9 men will experience IPV in their lifetime. Victims of IPV often face associated health problems such as substance use, sexually transmitted diseases, depression, posttraumatic stress disorder, and myriad other mental and physical consequences (Reingle, Staras, Maldonado-Molina, Jennings, & Branchini, 2011). Beyond these negative health effects, IPV is economically harmful to victims and society as a whole. IPV has an estimated cost of \$8.3 billion every year in the United States due to work- and health-related consequences, with significant numbers of victims losing their jobs due to abuse-related issues. Additionally, IPV comprises a significant portion of total violent crime, representing 21 percent of all violent crime reported in the National Crime Victimization Survey between 2003 and 2012 (Truman & Morgan, 2014).

The factors that contribute to IPV are not fully understood, but research has determined that alcohol and drug use do contribute to increased rates of IPV (Reingle et al., 2011). As recreational marijuana becomes increasingly legal across the United States, the effects on rates of IPV are still poorly understood. Research suggests a connection between marijuana usage and IPV, with consistent usage correlated with higher prevalence of IPV (Reingle et al., 2011; Kaplan & Goh, 2020; Shorey et al, 2018; Testa & Brown, 2015). This is consistent with studies that find substance use in general to be a risk factor for IPV, particularly alcohol (Shorey et al., 2018). Evidence that marijuana and alcohol are treated as substitutes complicates greater understanding of the impact increased marijuana usage may have on IPV (Anderson & Rees, 2021). As alcohol consumption is a stronger predictor of IPV than marijuana use alone, increases in IPV from

greater use of marijuana may be somewhat offset by decreasing alcohol consumption (Kaplan & Goh, 2020).

This study will evaluate the impact of recreational marijuana legalization on reported rates of intimate partner violence. Leveraging the variation in state laws on marijuana legalization, this study will employ a fixed effects approach to better assess the causal effect of marijuana legalization on rates of IPV, using the Uniform Crime Reporting Program Data: National Incident-Based Reporting System from the Federal Bureau of Investigation as the primary data source.

## **BACKGROUND**

While marijuana is still illegal at the federal level, legislation and enforcement of marijuana laws have been left to states. Marijuana liberalization takes various forms, with decriminalization, medical legalization, and recreational legalization being the primary types of marijuana legislation. Decriminalization means that marijuana possession remains illegal, but there are no penalties or risk of prosecution for carrying small amounts of marijuana. Medical legalization allows doctors to prescribe marijuana for certain ailments and allows marijuana to be sold by medical dispensaries only to those with a valid prescription. Recreational marijuana legalization (RML) can be implemented in various ways, but typically allows adults aged 21 and over to purchase marijuana from licensed dispensaries for recreational use (FindLaw Staff, 2023).

The first states to pass recreational marijuana legislation were Colorado and Washington in 2012 (Hartman, 2022). Since then, 21 other states, as well as 2 territories and the District of

Columbia, have passed their own laws legalizing recreational marijuana (Reuters, 2023). The liberalization of marijuana laws reflects changing public attitudes towards marijuana. According to the Pew Research Center, 59 percent of US adults approve of recreational marijuana legalization (RML). With higher levels of support among younger populations, the expanded legalization of recreational marijuana is likely to continue (Green, 2022).

Despite the growing acceptance of RML, evidence is mixed on how legalization affects marijuana usage. While some studies have found little impact on overall rates of marijuana use (Berenson, 2019; Smart & Liccardo Pacula, 2019), others have found a statistically significant increase in usage following RML (Hall & Lynskey, 2020; Berenson, 2019). Furthermore, the impact on usage differs among youth and adult populations (Anderson & Rees, 2021; Smart & Liccardo Pacula, 2019; Hall & Lynskey, 2020). Researchers speculate that the collapse of black markets following RML could make youth access to marijuana more difficult, as all states with RML have strict age restrictions in place (Anderson & Rees, 2021).

While the effects of RML on marijuana use are unclear, it is generally accepted that RML has led to a decrease in price and an increase in potency. Today's legal marijuana often contains 20 to 25 percent tetrahydrocannabinol (THC), the active psychoactive chemical in marijuana that produces feelings of euphoria, over 12 times the amount found in marijuana 50 years ago (Berenson, 2019). The impact of these changes is unclear and still be assessed in the literature.

As efforts to legalize recreational marijuana continue, it is crucial we gain a better understanding of how RML impacts individuals and communities. Proponents of legalization of marijuana cite perceived medical benefits and the redirection of law enforcement to more serious criminal activity as two of the most impactful reasons for their support (Schaeffer, 2023). How RML may affect violent crime, and IPV in particular, is therefore relevant to the debate around

marijuana legislation. As liberalization continues, policymakers should attempt to understand and mitigate any potential negative consequences of RML.

## **LITERATURE REVIEW**

Studies analyzing the effects of marijuana use have consistently found a positive correlation with IPV. However, research is limited on how that relationship is impacted by liberalization of marijuana laws. Current evidence suggests that legalization of marijuana increases use for some subgroups while decreasing use in others. The substitutability of marijuana and alcohol further complicates efforts to predict how marijuana legalization may impact IPV, as alcohol is a strong predictor of IPV. Given the small number of studies into the relationship between RML and IPV, additional research is needed to understand the full range of public health effects associated with RML.

### *Marijuana Use and Intimate Partner Violence*

Several studies have found significant evidence of marijuana use being positively correlated with both perpetration and victimization of IPV. Using a nationally representative, longitudinal sample of adolescents and young adults covering the years of 1995 to 2008, Reingle et al. (2011) found that marijuana use was a significant predictor of IPV in youth. The effects increased with consistent use and was found to be statistically significant, even when controlling for alcohol use and other risk factors. In the adult male population, Shorey et al. (2018) similarly determined that marijuana use was positively associated with IPV after accounting for other risk factors.

In their meta-analysis of the effects of marijuana use on IPV, Testa & Brown (2015) found that marijuana use is positively correlated with IPV in both youth and adult populations in studies using cross-sectional and longitudinal data. They also found that Cannabis Use Disorder (CUD)<sup>1</sup> is a significant risk factor for victimization or mutual IPV, but not perpetration. Among those with CUD, IPV may be driven by withdrawal and the interference in daily functioning that characterize CUD, rather than just an increase in aggression. Consistent with similar studies, Testa & Brown (2015) also found that alcohol use was a stronger predictor of IPV than marijuana use alone.

### *Effects of Marijuana Liberalization on Usage*

Evidence on increased usage following marijuana legalization is mixed, with results varying among subgroups and forms of liberalization (decriminalization, medical legalization, and recreational legalization). In their working paper analyzing the public health consequences of legalizing marijuana, Anderson & Rees (2021) found that legalization of marijuana does not increase use in adolescents. Anderson et al. (2019) found an 8 percent decrease in marijuana use among high school students following RML. This finding supports the theory that marijuana becomes harder for youth to access as black market dealers are replaced by legal dispensaries with strict age requirements.

Among three studies included in the meta-analysis by Anderson & Rees (2021), two found an increase in adult marijuana use following medical marijuana legalization while one study found no effect. Meanwhile, Hollingsworth, Wing, & Bradford (2022) found that RML

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<sup>1</sup> Cannabis Use Disorder is the medical name for addiction to marijuana. It can be diagnosed by meeting certain criteria, such as inability to reduce consumption, cravings, and continued use despite significant negative impacts. (Yale Medicine, n.d.)

increased use among young adults (ages 18 to 25) by 15 percent, with adults over age 25 showing an even greater increase of 25 percent. In their review of public health effects of RML, Hall & Lynskey (2020) found that legalization of recreational marijuana increased frequency of use among adults, but not among youth. They suggest that increased use among adults is related to the decrease in cannabis prices. Finally, Burgard et al. (2019) conducted a unique study using wastewater analysis to determine the effects of RML on marijuana consumption in Washington. Their study found a twofold increase in marijuana consumption in the three years included in their study (2014-2016).

### *Marijuana Liberalization and Intimate Partner Violence*

While marijuana legislation varies from state-to-state, liberalization of marijuana laws has generally fallen into three categories: decriminalization, medical marijuana legalization (MML), and recreational marijuana legalization (RML). Using panel data in 24 states over the 12 years between 2005 and 2016, Kaplan & Goh (2020) found that decriminalization had no effect on the total number of intimate partner assaults, but an 18 percent decrease in intimate partner assaults resulting in serious injury. They also found significant declines in the number of assaults in which the perpetrator was under the influence of alcohol or used a weapon, with serious assaults involving alcohol decreasing by 40 percent. These findings support the theory that marijuana acts as a substitute for alcohol. Similarly, Kaplan & Goh (2020) found no effect of MML on either total IPV or IPV incidents involving serious injuries.

Given the relatively recent nature of RML, limited research has been conducted that evaluates the impact of retail marijuana on IPV. In contrast to Kaplan & Goh's (2020) findings of no effects of decriminalization and MML, two recent studies of the impact of RML on IPV found significant increases in rates of IPV. A study from Lin & Lin (2020) focused on differences in

IPV rates within Colorado between 2011 and 2016 and the impact of varying municipal enactment of RML. While recreational marijuana was legalized at the state-level, individual municipalities could prohibit local retail marijuana sales. In this difference-in-difference study, the authors found a 48 percent greater increase in IPV in two “treatment” cities that adopted retail marijuana sales relative to two “control” cities that did not. Contrary to their later study and similar to the findings of Kaplan & Goh (2020), the 2020 Lin & Lin analysis found no effect on IPV involving major injuries, and a slight decrease on aggravated assaults or those with a weapon.

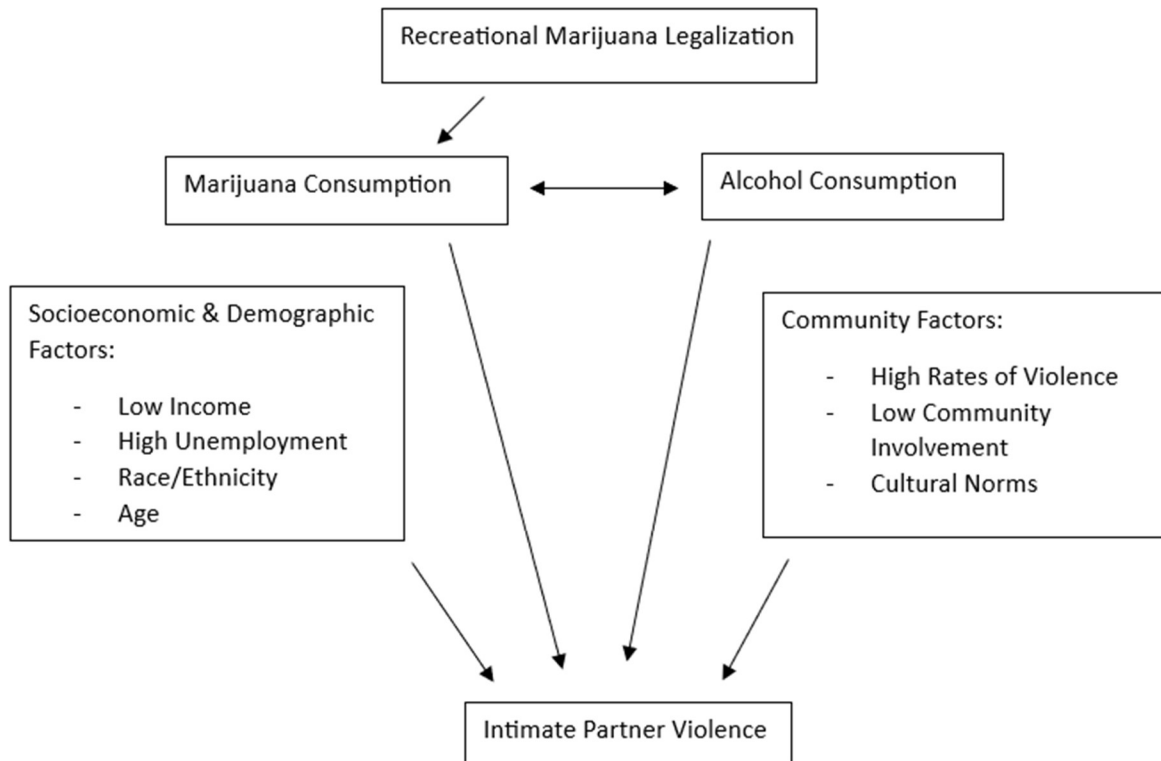
In their later 2022 difference-in-differences analysis, Lin & Lin used data from the National Incident Based Reporting System to evaluate rates of IPV from 2011 to 2016 in Colorado and Kansas. Controlling for county-level income and unemployment rate, housing values, police agency fixed effects and time fixed effects, the authors found a 13.2 percent greater increase in IPV over that time period in Colorado relative to the same time period in Kansas. However, they found no effects of RML on IPV for those under 21, the legal age to buy marijuana in Colorado. This supports their claim that the increase in IPV is related to the passage of RML in Colorado. Further, IPV increased 24 percent in Denver following the passage of RML, where more than 70 percent of marijuana retail stores in Colorado are located. These results remain statistically significant among all assault severity levels and in assaults without the use of alcohol. However, the increases in IPV were greater among mild incidents and those in which alcohol was involved.

Given the evidence that marijuana use is positively correlated with IPV, one might expect an increase in use as a result of marijuana legalization would lead to an increase in IPV. While evidence is mixed, available estimates suggest that marijuana legalization significantly increases

consumption among adults while decreasing use in adolescents. However, the effects of marijuana legalization on IPV seem to rely on the type of liberalization. Decriminalization and MML appear to have no effect on overall rates of IPV, while RML significantly increases IPV rates. Notably, limited studies suggest the increase may be concentrated in mild IPV, with either a decrease or no effect among more serious incidents. Given the limited number of studies and availability of more recent data, further research is needed to better understand the effects of RML on IPV. In particular, the two existing studies on the effects of RML both focused on Colorado. With 23 states having passed RML as of this writing, it is necessary to expand analysis of the impacts of marijuana legalization across broader populations and time periods.

## **CONCEPTUAL FRAMEWORK**

Given this increase in marijuana use following legalization and the positive relationship between its use and intimate partner violence, this study hypothesizes that the legalization of recreational marijuana will increase rates of IPV. This prediction assumes that the effects of marijuana used as a substitute for alcohol are not large enough to counter the effects of increased marijuana use.



**Figure 1: Conceptual Framework**

### *Recreational Marijuana Legalization*

Since 2012, 23 states, 2 territories, and the District of Columbia have legalized recreational marijuana (University of Georgia School of Law, 2023). How this impacts IPV depends on a number of factors, such as the resulting increase in consumption, the demographics of marijuana users, and how much marijuana is being used as a substitute, rather than complement, for alcohol.

### *Substance Use*

As described previously, substance use is a known risk factor for IPV. The overall impact of RML on IPV depends on the increase in marijuana consumption relative to the substitution of alcohol for marijuana.

### *Economic and Demographic Factors*

After controlling for personal risk factors, low incomes and unemployment are two of the most significant contributors to IPV. Multiple studies show this relationship to be more significant than education level (Capaldi, Knoble, Shortt, & Kim, 2012). Minority racial groups also have a greater risk of IPV, particularly African Americans (Capaldi et al., 2012). Age has a protective effect in that risk for IPV decreases as age increases (Capaldi et al., 2012).

### *Community Factors*

High rates of crime and community violence are risk factors for IPV (Centers for Disease Control and Prevention, 2021). Low community involvement and cohesion also affect IPV, as neighbors may be less likely to look out for each other. Cultural norms that have more leniency towards aggression and acceptance of IPV will increase the likelihood of IPV (Centers for Disease Control and Prevention, 2021). While these factors are significant, some of them may be hard to measure. Therefore, the precise impact of these community factors is not known.

## DATA AND METHODS

**Table 1. Definitions of Variables**

| <b>Variable</b>                                              | <b>Description</b>                                                                                                                                                                            | <b>Source</b>                                    |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Incidents of Intimate Partner Violence Per 100k People       | Assaults in which the offender and victim either are or were in a romantic relationship                                                                                                       | National Incident-Based Reporting System (NIBRS) |
| Recreational Marijuana Legality                              | Binary variable indicates whether recreational marijuana is available through retail stores for recreational consumption in a given state-year                                                | Taken from individual state government websites  |
| Median Income                                                | Median income in a given state-year in thousands                                                                                                                                              | American Community Survey                        |
| Unemployment Rate                                            | Number of unemployed people as a percentage of the labor force                                                                                                                                | Bureau of Labor Statistics                       |
| Median Age                                                   | Median age of a state population                                                                                                                                                              | American Community Survey                        |
| Marriage Rate                                                | The percentage of the population ages 15 and above that is married                                                                                                                            | American Community Survey                        |
| % of Population in Poverty                                   | People in households below the federal poverty threshold as a percentage of the population                                                                                                    | American Community Survey                        |
| Population Age 25+ with High School Degree but No Bachelor's | Adults ages 25 and above who have completed a high school degree but have less than a bachelor's degree as a percentage of the population                                                     | American Community Survey                        |
| Population Age 25+ with Bachelor's Degree or Higher          | Adults ages 25 and above who have completed a bachelor's degree or higher as a percentage of the population                                                                                   | American Community Survey                        |
| Proportion of Heavy Drinkers                                 | Adults ages 18 and above that qualify as heavy drinkers (having more than 14 drinks per week for adult men and more than 7 drinks per week for adult women) as a percentage of the population | Behavioral Risk Factor Surveillance System       |

This study is a state-level analysis of the impact of RML on rates of IPV per capita over 12 years. The study uses data from the National Incident-Based Reporting System (NIBRS) from

the Federal Bureau of Investigation to source the dependent variable of rates of IPV per capita. This dataset contains incidents of crime reported to police and includes significant amounts of information about each incident, such as gender, age, and race of both victims and offenders, as well as the relationship between the victim and offender. This makes it possible to determine incidents of IPV by state-year. One limitation of this dataset is that it only contains information from voluntarily participating police precincts and the level of participation varies by state, from no participation at all to more than 95 percent of police precincts reporting.

The independent variable for this study is a dichotomous variable with a value of one if a state has legalized recreational marijuana and zero if not. This variable was created using the Survey of Marijuana Law in the United States from the University of Georgia, cross-referencing state law to determine the years RML went into effect. A state is considered to have legal recreational marijuana if it is legal for adults to purchase, possess, and use marijuana through retail stores.

The dependent variable, IPV, is measured as the continuous rate of IPV per 100,000 people per year. An incident is considered IPV if it is classified as simple or aggravated assault where the offender is a spouse, ex-spouse, boyfriend/girlfriend, ex-boyfriend/ex-girlfriend, or in a homosexual relationship with the victim.

Control variables include economic metrics, demographic data, and heavy alcohol consumption. Economic metrics include median income, unemployment rates, and percentage of the population below the federal poverty line. These are important to incorporate into the model due to their strong correlation with IPV (Capaldi et al., 2012). Median age, marriage rates, and educational attainment are included as demographic factors that are known to be correlated with IPV risk (Capaldi et al, 2012). Population educational attainment is divided into three categories:

less than a high school degree, at least a high school degree but less than a bachelor's degree, and bachelor's degree or higher. Aside from unemployment rates, which are sourced from the Bureau of Labor Statistics, all economic and demographic data comes from the American Community Survey.

Finally, heavy alcohol consumption is included as a control variable because alcohol is known to contribute to IPV risk (Kaplan & Goh, 2020). Heavy alcohol consumption is taken from the Behavioral Risk Factor Surveillance System (BRFSS) and measures the percent of adults ages 18 and above that qualify as heavy drinkers as a percentage of the population. Heavy drinking is defined by the BRFSS as having more than 14 drinks per week for adult men and more than 7 drinks per week for adult women. An interaction variable is also included to determine the different impact of heavy drinking on IPV in states with and without RML.

This analysis uses a state and year fixed effects model to minimize omitted variable bias. Given the large number of factors that contribute to IPV and that some important community factors like cultural norms are hard to measure, a fixed effects model is ideal. Because the analysis is at the state level, identity variables like race, age, and gender are not used as control variables. The regression formula is as follows:

$$\begin{aligned} IPV_{it} = & B_0 + B_1RML_{it} + B_2Income_{it} + B_3Unemployment_{it} + B_4Age_{it} + B_5Marriage_{it} \\ & + B_6Poverty_{it} + B_7High\ School_{it} + B_8Bachelor's_{it} + B_9Heavy\ Drinking_{it} \\ & + B_{10}RML_{it}Heavy\ Drinking_{it} + \alpha_i + t_t + \mu_{it} \end{aligned}$$

In this formula  $i$  represents the state,  $t$  is the year,  $\alpha_i$  is state fixed effects,  $t_t$  is year fixed effects, and  $\mu_{it}$  is the error term.

The analytic sample is made up of 23 unique states over seven years for a total of 161 state-year observations. States were dropped from the sample if they either had a year from 2013 to 2019 in which less than 10 percent of their population was represented in the data, or had on average less than 60 percent of their population covered over the seven years. The 60 percent coverage threshold is consistent with FBI estimation methods (Hanson, 2022). The proportion of the population being represented in the data is based on the total populations of the precincts reporting compared to the total population of the state itself.

## **DESCRIPTIVE STATISTICS**

Table 1 reports descriptive statistics for the dependent, key independent, and control variables included in my study. Values are unweighted as the analysis is a state-level comparison and the dependent variable is measured per 100,000 people. The average number of incidents of IPV per 100,000 people is 297.2 with a minimum of 138.2 (Kentucky in 2013) and a maximum of 600.8 (Tennessee in 2013). RML increases over time, but remains low with only 4 states out of the total 23 having legalized recreational marijuana by 2019. Median income varies considerably with a minimum of \$47,840 (West Virginia in 2014) to \$99,900 (Massachusetts in 2019). Unemployment rate also has a wide range with a minimum of 2.2 percent (North Dakota in 2019) and a maximum of 9.3 percent (Rhode Island in 2013). Median income generally increases over time while unemployment rate declines. Similarly, poverty rates tended to decrease between 2013 and 2019, with a minimum of 7.3 (New Hampshire in 2016 and 2019) and a maximum of 19.7 (Arkansas in 2013).

Marriage rates are generally stable over time but do vary across states with Rhode Island having the seven lowest marriage rates in the dataset and Utah having the seven of the eight highest marriage rates. Age shows similar characteristics with Utah consistently having the lowest median age and New Hampshire, Montana, and West Virginia claiming the fourteen highest median ages. Educational attainment is highly variable by state but tends to increase over time in all states included in the sample. The state with the lowest proportion of bachelor's degree holders (West Virginia in 2013) sees an increase of 2.1 percentage points by 2019. Similarly, the state with the highest proportion of bachelor's degree holders (Massachusetts in 2019) saw an increase of 4.7 percentage points between 2013 and 2019. Finally, states show large differences in the levels of heavy drinking with only modest increases over time. The average proportion of the adult population that qualifies as heavy drinkers is 6.2, with a minimum of 3.3 (Utah in 2014) and a maximum of 9.4 (Montana in 2019).

**Table 2. Descriptive Statistics for Dependent, Key Independent, and Control Variables**

|                                                                                   | Mean  | Minimum | Maximum | Standard Deviation |
|-----------------------------------------------------------------------------------|-------|---------|---------|--------------------|
| <b>Dependent Variable: Incidents of Intimate Partner Violence Per 100k People</b> | 297.2 | 138.2   | 600.8   | 94.8               |
| <b>Independent Variable: Recreational Marijuana Legality</b>                      | 0.1   | 0.0     | 1.0     | 0.316              |
| <b><u>Control Variables</u></b>                                                   |       |         |         |                    |
| Median Income (in thousands)                                                      | 72.1  | 47.8    | 99.9    | 12.0               |
| Unemployment Rate                                                                 | 4.6   | 2.2     | 9.3     | 1.5                |
| Median Age                                                                        | 38.4  | 30.2    | 43.2    | 2.5                |
| Marriage Rate                                                                     | 49.6  | 42.3    | 56.3    | 2.7                |
| % of Population in Poverty                                                        | 13.2  | 7.3     | 19.7    | 2.9                |
| Population Age 25+ with High School Degree but No Bachelor's                      | 58.9  | 46.2    | 66.9    | 4.9                |
| Population Age 25+ with Bachelor's Degree or Higher                               | 31.0  | 18.9    | 45      | 5.7                |
| Proportion of Heavy Drinkers                                                      | 6.2   | 3.3     | 9.4     | 1.2                |

N = 161

Data is from 2013 to 2019.

States included in analysis: Arkansas, Colorado, Connecticut, Delaware, Idaho, Iowa, Kansas, Kentucky, Massachusetts, Michigan, Montana, Nebraska, New Hampshire, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Virginia, Washington, West Virginia, Wisconsin

A state is considered to have legalized recreational marijuana if marijuana is available through retail stores for recreational consumption.

Proportion of heavy drinkers refers to the percent of a state's population that qualify as heavy drinkers (having more than 14 drinks per week for adult men and more than 7 drinks per week for adult women).

Marriage rate measures the percentage of the population that is married.

Table 2 shows a statistical comparison between states that have and have not legalized recreational marijuana. Between 2013 and 2019, the number of states in the sample that have legal recreational marijuana increased from zero to four. This is compared to seven states

nationally that would qualify as having legal recreational marijuana according to the definition used in this study. Within the states included in the analysis, states without RML have 56.6 more incidents of IPV per 100,000 on average. States without RML also show lower average median incomes and higher rates of poverty. The differences in median income are substantial, with median incomes in states with RML being \$11,800 higher on average.

Educational attainment is higher in states with RML with more of their populations having bachelor's degrees on average. States with RML have an additional 0.9 percentage points of heavy drinkers in their population on average. This is a notable difference given the relatively low proportion of heavy drinkers in the populations of states both with and without RML. Unemployment rates, median ages, and marriage rates are relatively similar for states with and without RML in my sample.

**Table 3. Comparison of States by Recreational Marijuana Legality**

| <b>Marijuana Legality</b>                                 | <b>Recreational<br/>Marijuana is Illegal</b> | <b>Recreational<br/>Marijuana is Legal</b> | <b>Difference</b> |
|-----------------------------------------------------------|----------------------------------------------|--------------------------------------------|-------------------|
| Incidents of Intimate Partner<br>Violence Per 100k People | 303.5                                        | 246.9                                      | 56.6**            |
| Median Income (in thousands)                              | 70.7                                         | 82.5                                       | -11.8***          |
| Unemployment Rate                                         | 4.6                                          | 4.3                                        | 0.3               |
| Median Age                                                | 38.4                                         | 38.6                                       | -0.2              |
| Marriage Rate                                             | 49.6                                         | 49.8                                       | -0.2              |
| % of Population in Poverty                                | 13.5                                         | 11.5                                       | 2.0***            |
| Population Age 25+ with High<br>School Degree or Higher   | 59.5                                         | 54.1                                       | 5.4***            |
| Population Age 25+ with<br>Bachelor's Degree or Higher    | 30.2                                         | 37.0                                       | -6.8***           |
| Proportion of Heavy Drinkers                              | 6.1                                          | 7.0                                        | -0.9***           |

\*\*\* $p \leq 0.01$ , \*\* $p \leq 0.05$ , \* $p \leq 0.1$

N = 161

Data is from 2013 to 2019.

States included in analysis: Arkansas, Colorado, Connecticut, Delaware, Idaho, Iowa, Kansas, Kentucky, Massachusetts, Michigan, Montana, Nebraska, New Hampshire, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Virginia, Washington, West Virginia, Wisconsin

A state is considered to have legalized recreational marijuana if marijuana is available through retail stores for recreational consumption.

Proportion of heavy drinkers refers to the percent of a state's population that qualify as heavy drinkers (having more than 14 drinks per week for adult men and more than 7 drinks per week for adult women).

Marriage rate measures the percentage of the population that is married.

## RESULTS

Table 3 reports the regression results. Model (1) is a simple bivariate OLS regression of a state's recreational marijuana legality on the number of reported incidents of intimate partner violence per 100,000 people. Model (2) incorporates median income, unemployment rate, median age, marriage rate, poverty rate, education level, heavy drinkers as a percentage of the population, and an interaction term of legalization and heavy drinkers as control variables.

Model (3) adds state fixed effects to account for unobserved time-invariant characteristics within states. Model (4) includes year fixed effects to control for characteristics that are constant across states in a given year.

The results of Model (1) suggest a statistically significant relationship between recreational marijuana legalization and incidents of IPV. This model indicates that legalization of recreational marijuana results in 56.6 fewer reported incidents of IPV per 100,000 people. Including control variables and fixed effects magnifies the impact of RML on rates of IPV, although the results are only statistically significant at the 90 percent threshold. In Model (4), results indicate that RML leads to a reduction of 101.2 incidents of IPV per 100,000 people.

Although the unemployment rate is statistically insignificant in all models with fixed effects, the direction of the relationship between unemployment rate and IPV is unexpected. In Models (3) and (4), increases in the unemployment rate are associated with decreases in IPV, despite unemployment being a known risk factor for IPV. Alternatively, median income is statistically significant in all models in which it is included. However, the magnitude of the relationship diminishes as fixed effects are introduced, so that in Model (4) a \$1,000 increase in median income causes only one fewer incident of IPV.

In all Models (2) and (4), median age has a statistically significant negative effect on incidents of IPV at the 90 percent threshold. A one-year increase in the state's median age is associated with 6.3 fewer IPV incidents per 100,000 in the multivariate model, or 2.7 fewer incidents in the two-way fixed-effects model. This means that states with older populations experience lower rates of IPV. This is consistent with prior research establishing age as a protective factor for IPV. Marriage also has a statistically significant impact on IPV. In Models (3) and (4), the marriage rate is among the most impactful variables included. In Model (4), an

increase in the proportion of the population that is married of just one percentage point results in 7.2 fewer incidents of IPV per 100,000 people.

In all models in which it is included, poverty has no statistically significant relationship with rates of IPV. Furthermore, the direction of the relationship is the opposite of expectations, with increases in poverty showing a reduction in IPV. However, the small magnitude of the effect in Model (4), along with the statistical insignificance, suggests that poverty is not associated with rates of IPV at the state-level. Education has a similarly insignificant effect on IPV when fixed effects are included. Although showing a statistically significant effect in Model (2), education loses both statistical significance and magnitude in Models (3) and (4).

Contrary to expectations, Models (3) and (4) show that an increase in the proportion of a state's population that qualifies as heavy drinkers has a negative impact on IPV in states without RML. This means that states without legal recreational marijuana actually have lower rates of IPV as heavy drinking increases. In Model (4), a one percentage point increase in the population that qualifies as heavy drinkers results in 5.6 fewer incidents of IPV. This is counter to prior research finding alcohol consumption to be a major risk factor for IPV. In states with RML the relationship is reversed, with Model (4) showing an additional 8 incidents of IPV for every percentage point increase in the proportion of heavy drinkers. Although these results are only significant at the 90 percent threshold, they suggest that RML substantively impacts the relationship between heavy drinking and IPV.

**Table 4. Main Regression Results 2013-2019**

| <b>Dependent Variable: Incidents of Intimate Partner Violence Per 100k People</b> | <b>(1)<br/>Bivariate</b> | <b>(2)<br/>Multivariate</b> | <b>(3)<br/>State FE</b> | <b>(4)<br/>State &amp; Year FE</b> |
|-----------------------------------------------------------------------------------|--------------------------|-----------------------------|-------------------------|------------------------------------|
| <b>Independent Variable:<br/>Recreational Marijuana<br/>Legality</b>              | -56.6**                  | 268.8                       | -101.0*                 | -101.2*                            |
| <b><u>Control Variables</u></b>                                                   |                          |                             |                         |                                    |
| Median Income (in thousands)                                                      |                          | -6.5***                     | -0.9**                  | -1.0**                             |
| Unemployment Rate                                                                 |                          | -21.4***                    | 1.6                     | 3.7                                |
| Median Age                                                                        |                          | -6.3*                       | -2.2                    | -2.7*                              |
| Marriage Rate                                                                     |                          | -5.3                        | -8.5***                 | -7.2**                             |
| % of Population in Poverty                                                        |                          | -11.6                       | -1.5                    | -0.7                               |
| Population Age 25+ with High School Degree but No Bachelor's                      |                          | -14.3**                     | 1.0                     | 0.6                                |
| Population Age 25+ with Bachelor's Degree or Higher                               |                          | -11.1*                      | 2.4                     | -1.1                               |
| Proportion of Heavy Drinkers                                                      |                          | 2.0                         | -4.8*                   | -5.6*                              |
| Interaction of Heavy Drinkers and Recreational Marijuana Legalization             |                          | -40.3                       | 13.3*                   | 13.6*                              |
| Constant                                                                          | 303.5                    | 2700.0                      | 826.8                   | 851.9                              |
| Observations                                                                      | 161                      | 161                         | 161                     | 161                                |
| R-Squared                                                                         | 0.04                     | 0.30                        | 0.97                    | 0.97                               |

\*\*\*p≤0.01, \*\*p≤0.05, \*p≤0.1

States included in analysis: Arkansas, Colorado, Connecticut, Delaware, Idaho, Iowa, Kansas, Kentucky, Massachusetts, Michigan, Montana, Nebraska, New Hampshire, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Virginia, Washington, West Virginia, Wisconsin

A state is considered to have legalized recreational marijuana if marijuana is available through retail stores for recreational consumption.

Proportion of heavy drinkers refers to the percent of a state's population that qualify as heavy drinkers (having more than 14 drinks per week for adult men and more than 7 drinks per week for adult women).

Marriage rate measures the percentage of the population that is married.

### *Sensitivity Analysis*

Despite having access to 2020 data, I chose to limit my analysis to 2013-2019. This is due to the unrepresentative nature of 2020 as the country underwent lockdowns during the COVID-19 pandemic. As seen in Table 4, inclusion of 2020 data alters the magnitude and statistical significance of a number of coefficients, including that of legalization of recreational marijuana. Furthermore, results of Model (5) show that 2020 sees a statistically significant increase in incidents of IPV even when controlling for other factors. Not only is 2020 the only year in either model to show statistical significance, but the magnitude of the effect on rates of IPV is double that of any other year. Finally, including 2020 data would introduce bias, as my model does not account for the differing state responses to COVID-19 and the impact that lockdowns may have had on IPV.

**Table 5. Comparison of Regression Results With and Without 2020 Data**

| <b>Dependent Variable: Incidents of Intimate Partner Violence Per 100k People</b> | <b>(4)<br/>2013-2019 Data</b> | <b>(5)<br/>2013-2020 Data</b> |
|-----------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Independent Variable: Recreational Marijuana Legality</b>                      | -101.2*                       | -70.3                         |
| <b><u>Control Variables</u></b>                                                   |                               |                               |
| Median Income (in thousands)                                                      | -1.0**                        | -1.0*                         |
| Unemployment Rate                                                                 | 3.7                           | -4.6                          |
| Median Age                                                                        | -2.7*                         | -4.2**                        |
| Marriage Rate                                                                     | -7.2**                        | -10.3**                       |
| % of Population in Poverty                                                        | -0.7                          | 3.3                           |
| Population Age 25+ with High School Degree but No Bachelor's                      | 0.6                           | -8.0                          |
| Population Age 25+ with Bachelor's Degree or Higher                               | -1.1                          | -10.8*                        |
| Proportion of Heavy Drinkers                                                      | -5.6*                         | -5.7*                         |

**Table 5. Continued**

|                                                                       |       |         |
|-----------------------------------------------------------------------|-------|---------|
| Interaction of Heavy Drinkers and Recreational Marijuana Legalization | 13.6* | 9.6     |
| <b><u>Year Variables</u></b>                                          |       |         |
| 2014                                                                  | 0.7   | -4.7    |
| 2015                                                                  | 9.6   | 3.0     |
| 2016                                                                  | 14.2  | 10.3    |
| 2017                                                                  | 17.3  | 17.9    |
| 2018                                                                  | 20.9  | 21.6    |
| 2019                                                                  | 20.3  | 26.0    |
| 2020                                                                  |       | 53.0*** |
| Constant                                                              | 851.9 | 1807.2  |
| Observations                                                          | 161   | 184     |
| R-Squared                                                             | 0.97  | 0.96    |

\*\*\* $p \leq 0.01$ , \*\* $p \leq 0.05$ , \* $p \leq 0.1$

States included in analysis: Arkansas, Colorado, Connecticut, Delaware, Idaho, Iowa, Kansas, Kentucky, Massachusetts, Michigan, Montana, Nebraska, New Hampshire, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Virginia, Washington, West Virginia, Wisconsin

A state is considered to have legalized recreational marijuana if marijuana is available through retail stores for recreational consumption.

Proportion of heavy drinkers refers to the percent of a state's population that qualify as heavy drinkers (having more than 14 drinks per week for adult men and more than 7 drinks per week for adult women).

Marriage rate measures the percentage of the population that is married.

## DISCUSSION

With the rapid increase in states legalizing recreational marijuana over the past decade, the full impacts on public health are still being studied. As marijuana use is a known risk factor for IPV and legalization of recreational marijuana typically increases usage, RML could be expected to increase rates of IPV. Reduced alcohol use could complicate this relationship if marijuana acts as a substitute to alcohol. As alcohol consumption is a greater risk factor for IPV

than marijuana use, any reduction in alcohol consumption would lessen the impact of RML on IPV. The results of this analysis show that RML actually reduces rates of IPV; however, the reason for this unexpected result requires further study.

Should these results be confirmed through further research, the causes of this surprising relationship between RML and IPV require careful consideration. As discussed earlier, marijuana usage typically increases following RML. The increased usage could be acting as a substitute for other substances that have a stronger impact on rates of IPV, like alcohol and illicit drugs. Alternatively, marijuana use may be less of a risk factor for IPV than previously thought. There may also be issues of bias in previous studies of the relationship between marijuana and IPV. Because marijuana has been illegal for recreational use until the past decade, those who used it may have been more impulsive and more likely to engage in risky behaviors on average. If so, legalization of marijuana may increase use more populations at lower risk of IPV than those that used marijuana previously. This could complicate the expected increase in IPV, but would not explain the negative results found in this study.

The results of this study contradict much of the previous findings detailed in the literature review. Some key differences between this study and previous analyses could account for the conflicting results. In the two studies referenced earlier, Colorado was the only state included in the analyses that had passed RML. Furthermore, both studies included data only from the years 2011 to 2016. This analysis represents the first attempt to understand the impact of RML on IPV across a wider range of states and with more recent data.

The inclusion of additional states is particularly important to understand the relationship between RML and IPV generally. Colorado is a unique state in which results may be anomalous or ungeneralizable to the broader United States. The years included in previous research are also

notable, as 2016 is just two years after RML was fully implemented in Colorado. There is some evidence that Colorado experienced a wave of marijuana tourism in the years just after legalization that ended in 2016 (Blevins, 2017). This further undermines the generalizability of the study, as it appears that Colorado experienced an initial wave of excitement around RML that faded after a couple of years.

One interesting finding from this study is around the effect of RML on the relationship between heavy drinking and rates of IPV. The increase in rates of IPV associated with heavy drinking in states with RML suggest that states need to consider how legalized marijuana may compound negative effects of alcohol use. States may need to regulate marijuana and alcohol in conjunction when passing RML in order to minimize these effects. For instance, regulation of alcohol outlet density is one way that governments can decrease alcohol consumption and associated risk (Community Preventive Services Task Force, 2018). Retail marijuana outlets may need to be included in those regulations to ensure any reduction in harm from fewer alcohol outlets is not undermined by an increase in marijuana outlets.

Despite controlling for socioeconomic characteristics, demographics, and state-year fixed effects, my results are subject to omitted variable bias. Multiple cultural characteristics are difficult to measure and may be time-varying, such as community involvement and acceptance of IPV. Some evidence suggests community cohesiveness and the willingness of neighbors to intervene, for example, act as a protective factor for IPV (Capaldi et al., 2012), but these characteristics could not be measured in this analysis. It is unlikely that these variables would be fully captured using fixed effects, so some bias would remain from their omission.

One of the greatest limitations of this study relates to access to data. NIBRS reporting has historically been low for many states, requiring their omission from this study. The limited

number of states (23) used in this analysis may impact both the reliability and generalizability of my results. One major concern is that there could be unknown characteristics of states that do not report data to the NIBRS that could be relevant to my study. If this is true, the omission of those states would bias my results. Furthermore, current NIBRS data are only available up to 2020. Since 2019, 11 states have legalized recreational marijuana with 7 having retail marijuana available, 4 of which are included in my analysis. Incorporating more recent data and additional states would strengthen the analysis while making the results more generalizable.

To better understand the impact of retail marijuana sales on IPV, county-level analysis is needed. Even within states that legalize marijuana, many counties ban retail sales. County-level analyses were beyond the scope of the study, but would be beneficial for further research. This is particularly true due to the omitted community-based factors that were discussed previously. These variables could be better captured through county fixed effects rather than state fixed effects, leading to less biased results.

Finally, future research should evaluate how different types of marijuana policies impact IPV. This study focused exclusively on legal recreational marijuana with retail sales. In reality, marijuana legalization exists as a range from fully illegal, decriminalization, MML, to RML. The relationship between marijuana policy and IPV may be more nuanced than these results suggest. Further study is needed to determine whether IPV is impacted by where a state falls in this policy range.

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