The Effect of Medical Marijuana Laws on Child Maltreatment: Evidence from State Panel Data, 1995-2014

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Abstract

This paper looks at one potential risk factor for child maltreatment –marijuana use and liberalization –using evidence from medical marijuana laws (MMLs). I begin by extending the current MML-crime literature by providing a comprehensive evaluation of the impact of MMLs implemented at the state level on reported child victimization rates. I show that specific modes of medical marijuana regulation differentially influence the magnitude of reported incidences of child abuse, a finding which sheds new light on the current literature. More specifically, using fixed effects analysis applied to data from the National Child Abuse and Neglect Database System (NCANDS) and the Uniform Crime Reports (UCR), I show that states that allow for home cultivation in addition to decriminalizing its use see a further increase in the magnitude of reported incidences of child maltreatment rates.

Keywords: Medical Marijuana Laws (MML), child maltreatment, child fatality, crime policy
JEL Codes: D1, I1, J1, K14, K42

I. Introduction

It has been argued that marijuana use is part of a post-modern consumer culture which crosses class, gender, race, age and geographic boundaries (Simpson, 2003). Marijuana is also the most widely used illicit drug in the United States. In 2014, 27 million people aged 12 or older used an illicit drug in the past 30 days – these estimates are driven primarily by marijuana use with 22.2 million Americans reporting the use of marijuana in the past 30 days (SAMHSA, 2014). Public opinion on marijuana use has shifted considerably in the last 40 years, with the majority of Americans (53%) now favoring legalization (PEW Research, 2015). Furthermore, a 2014 Gallup Poll found that 76 percent of Americans favored no jail time for those convicted of minor marijuana possession (PEW Research, 2014). This broader social acceptance of the drug has been reflected by policies being implemented at the state level that have allowed for the use of marijuana to be decriminalized, legalized, or approved for medicinal purposes in 23 states plus the District of Columbia.

How does the legalization of medical marijuana affect child maltreatment?

We might expect that children living with substance-abuse caregivers may experience a greater risk for maltreatment. In fact, the 2010 Fourth National Incidence Study found that illegal drug use was a factor in 9.5% of cases of physical abuse and about 12.5% of all neglect cases (Sedlak et al., 2010). Parents who have substance use problems are more likely to contribute to severe family dysfunction, be physically abusive, and commit child neglect than those without diagnosed substance abuse problems (Ammerman et al., 1999; Appleyard et al., 2011). Caregiver substance misuse has also been documented as a predictor of severity in child maltreatment cases (Sprang, Clark & Bass, 2005; Staton-Tindall, Sprang & Straussner, 2016).

Some studies suggest that cannabis may act as a gateway drug that encourages other forms of illicit drug use such as cocaine and heroin or alcohol use (see Jeffery DeSimone, 1998; Hall & Lynskey, 2009; Wen et al., 2015). While little attention has been paid to marijuana use and family violence, the link between illicit drug abuse, alcohol abuse and child maltreatment has been well documented. For example, Famularo and colleagues (1992) find specific associations between alcohol use and physical maltreatment, and cocaine abuse and sexual maltreatment. Considering the implications of a gateway effect, marijuana use could indirectly elevate the risk of child maltreatment. The gateway effect is one of the principal reasons cited in defense of laws prohibiting the use or possession of marijuana (Morral, McCaffrey & Paddock, 2002). Despite a number of scientific studies disputing this claim (*see* DeSimone, 1998, Tarter et al. 2016), the debate over the most appropriate policy has been generally polarized due to differing positions on the drug's harm.

Though clinical trials have demonstrated the benefits of cannabis in alleviating chronic and neuropathic pain, other scientific studies have indicated significant physical and psychotropic side-effects of the drug (Leung, 2011). Regular marijuana use has been linked to adverse health outcomes, including mental slowness, short-term memory loss, impaired reaction times, and accentuation of anxiety and depression (Crean, Crane & Mason, 2011; Cellucci, Jarchow & Hedt, 2004). Chronic use of marijuana in the long run increases the risk for a number of psychosocial outcomes including diminished relationship quality, lower satisfaction with life, and greater need for economic assistance (Dubowitz et al., 2015; Volkow et al., 2014). These effects can often lead to an unstable and chaotic environment for children, in which case basic needs such as nutrition, supervision and medical care may go unmet (Staton-Tindall et al., 2016). Similarly, parents with depression and anxiety disorders are less likely to prevent injury and

harm to their children and more likely to exhibit stress or aggravation during parenting (Chung etal., 2005).However, mental health problems cannot be causally connected to involvement in drug or marijuana use, even if it can be illustrated that its (ab)use may exacerbate pre-existing psychiatric disorders (Simpson, 2003; Crome, 1999).

So far, studies examining the link between marijuana use and psychosocial disorders have not addressed the nature of the following relationship: does marijuana use lead to such disorders or do issues such as anxiety and depression lead to the (over-) use of marijuana? In fact, one qualitative study found that parents who used marijuana reported that the drug improved their parenting by allowing them to relax and manage difficult emotions relating to parenting – thereby preventing them from yelling at or hitting their children (Thurstone et al., 2013). It must be noted that these results are preliminary in nature and must be interpreted with caution as they only include data from 11 parents in five focus groups. Additionally, conflicting results among most of the studies seem to be a result of differences in the degree of exposure, individual sensitivity, and drug potency (e.g., CBD/THC ratio[1]) (Niesink & Laar, 2013). Thus, research focused on the benefits and consequences of marijuana use merits further investigation.

There is a growing body of empirical research examining the link between illegal drug consumption and intimate partner violence. However, due in part to differences in research design, the empirical support for this notion is rather mixed. While similar efforts exist with respect to marijuana use and child abuse (see Friesthler, Gruenewald & Wolf, 2014), no single analysis has assessed the overall impact of medical marijuana laws (MML) on child maltreatment rates across the United States.

[1] Tetrahydrocannabinol (THC) is the main psychoactive substance in cannabis. Cannabidiol (CBD) is a cannabinoid that appears in cannabis resin but rarely in herbal cannabis.

Several studies have found that legalizing medical marijuana and decriminalizing its use leads to greater access and use of the drug (see Cerda et al., 2012; Anderson, Hansen & Rees, 2015; Freisthler et al., 2013). For example, at the state level, Pacula et al. (2013) conclude that states which allowed medical marijuana distribution through dispensaries or home cultivation had higher levels of past-month marijuana use than states with no such laws. Additionally, legalization reduces the need for judicial and correctional spending on marijuana related offenses and facilitates the reallocation of police resources toward other violent crimes such as domestic violence. Thus this paper seeks to study the link between marijuana use and violence aimed at children, with the main purpose of examining the role that changes in marijuana legislation may play in the incidence of child abuse.

The paper begins by extending the current MML-crime literature by providing a comprehensive evaluation of the impact of MMLs implemented at the state level on reported child victimization rates. I show that specific dimensions of medical marijuana regulation differentially influence the magnitude of reported incidences of child abuse, a finding which sheds new light on the current literature. More specifically, using fixed effects analysis applied to data from the Child Maltreatment Reports (1995-2014) and the FBI's Uniform Crime Reports (UCR), I show that states that allow for home cultivation in addition to decriminalizing its use see an increase in the magnitude of reported incidences of child maltreatment rates This, of course, does not mean that marijuana legislation caused an increase in maltreatment rate. Two factors influence reported incidences of abuse: actual maltreatment and the proportion of maltreated cases that are reported. Establishing a distinction between the two definitions can help understand the true impact of these laws.

There is also an apparent gap between the enforcement of child safety laws and marijuana statutes. For example, there are no formal guidelines instructing child welfare professionals on how to handle cases where marijuana use has been recommended by a physician. Furthermore, reports of abuse and neglect that come to the attention of Child Protective Services (CPS) do not differentiate between specific substances used; thus very little is known about which specific drugs may be more likely to result in maladaptive parenting behaviors (Freisthler et al., 2015). Indeed, marijuana is still considered as an illicit drug by many professionals, and anecdotal evidence exists where CPS workers have removed children or denied custody because of the parents' legal use of marijuana[2]. This speculation of child endangerment due to marijuana use can lead to an increase in the reporting of child maltreatment cases.

To test the reporting hypothesis, I use an alternative proxy for maltreatment rates that is less likely to be biased by reporting: rates of child fatality from abuse and neglect. Child fatalities must always be reported, and using an extreme form of an incident is a common strategy among economists studying crime (*see* Iyengar, 2011; Levitt, 1998). I find that states that allow for home cultivation in addition to decriminalizing its use see a decrease in child fatality rates. This is obviously an imperfect proxy for overall maltreatment, but the fact that there is a consistent decline in fatality rates in states with marijuana regulation is evidence that states with MML do see a reduction in actual maltreatment.

Given that there is limited research on the relationship between marijuana consumption and child maltreatment, estimating the impact of various marijuana laws remains crucial. This paper improves on the existing literature in that it is the first to analyze the impact of drug

[2] Jeanette Daggett v Dustin A. Sternick (2015): Sternick argues that the Maine Supreme Judicial court infringed on the protections afforded to him by the Maine Medical Use of Marijuana Act,22 M.R.S. § 2423-E(3) (2014), by reaching findings related to his marijuana use and that the court abused its discretion in awarding primary residence to Daggett based on Sternick's lawful marijuana use.

regulatory variables on child victimization in a nationally representative, state-level panel dataset spanning 19 years.

The remainder of the paper is organized as follows. Section II provides a brief history of marijuana laws in the U.S. and summarizes the limited research examining the impact of MMLs on family violence. Section III discusses data sources and methodology. I present the results from my analyses of the impact of these laws on child victimization rates in Section IV. Section V concludes.

Section II

Background: Cannabis the drug

Cannabis is largely derived from the female plant of cannabis sativa, with the two main active ingredients being delta-9-tetrahydrocannabinol (THC) and Cannabidiol (CBD).THC accounts for both the physical and psychotropic effects of cannabis, and hence is also the most widely studied. The mechanisms by which CBD exerts its effect are not precisely known, and by itself has almost no effect on normal physiological processes (Niesink & Laar, 2013). Not much is known of the safety and side effects of CBD either. Few studies have described the effects of CBD for therapeutic applications in clinical trials (Bergamaschi et al., 2011). While there is evidence from controlled trials that cannabinoids are effective in relieving nausea, alleviating severe pain, and improving appetite in people with HIV and cancer-related illnesses (Bergamaschi et al., 2011), chronic cannabis use is also associated with psychiatric toxicity and long-term psychiatric conditions (Reece, 2009). However, to date, there is no conclusive evidence to support the relationship between chronic cannabis use and the occurrence of psychosis. In fact, very few studies that have been published distinguish between the types of cannabis used, and none have given an indication of the THC/CBD ratio (Niesink & Laar, 2013).

A Brief History of Medical Marijuana Laws (MMLs) in the United States

America's connection with cannabis dates back to the early 1600s. The cultivation of cannabis (hemp) was the primary reason for America's colonization; it was produced initially by Jamestown settlers who were ordered by King James I in 1619 to grow 100 plants specifically for export (Deitch, 2003). Hemp cultivation remained a prominent industry until the mid-1800s, and throughout this period, the plant was commonly used by physicians to treat a broad spectrum of ailments (Anderson, Hansen & Daniel, 2013; Pacula et al., 2002). From 1850 to 1942, marijuana was listed in the United States Pharmacopeia and National Formulary; the official list of recognized medicinal drugs (Anderson, Hansen & Daniel, 2013). However, in 1937, the Marihuana Tax Act –which did not criminalize marijuana but did impose prohibitive taxes on its use – was passed after research indicated a link between marijuana use and crime (Deitch, 2003). Since then, several other laws were signed, including the Boggs Act (1952), the Narcotic Control Act (1956) and the Federal Controlled Substances Act (1970), which effectively discontinued the use of marijuana for medicinal purposes and ultimately criminalized it at the federal level (Blitz, 1992; Deitch, 2003).

The Controlled Substances Act classified marijuana as a Schedule I drug with high potential for abuse and no currently accepted medical uses in treatment. In 1973, Oregon became the first state to decriminalize cannabis – whereby possession of one ounce or less was treated as a misdemeanor with no jail time. By 1978, Nebraska became the eleventh state to pass the decriminalization legislation. During the Reagan administration, however, Congress passed

several anti-drug legislation bills[3], which effectively ended the wave of states decriminalizing the possession of marijuana.

In 1996, California became the first state to legalize medical marijuana by passing the Compassionate Use Act (California Proposition 215). It removed criminal penalties for using, possessing and cultivating marijuana for medical purposes. The law provided immunity from criminal prosecution or sanction to physicians who recommended or prescribed marijuana to their patients. Despite federal restrictions, since 1996, 23 states have adopted medical marijuana laws, instituting their own specific restrictions for use, cultivation, possession limits, and allowance of dispensaries. While some states did allow doctors to prescribe marijuana before 1996, it had no practical effect since it was against federal law for pharmacies to distribute the drug (Anderson, Hansen & Daniel, 2013)[4].

Marijuana and Interpersonal Violence

The majority of the studies that have examined the co-existence of substance abuse and interpersonal violence have focused on alcohol, without including other commonly used substances such as marijuana[5]. Of recent concern within the study of associations between substance use and violence is intimate partner violence, or IPV. So far, research findings on the association between marijuana use and IPV have been inconsistent. Using data from 96 studies, Moore et al. (2008) conducted a meta-analytic review to quantitatively evaluate the relationship between specific drug use and intimate partner aggression. Their results suggest that the psychopharmacological effects of the drug produces increased aggression between intimate

[3] Federal Bail Reform Act (1984); Anti-Drug Abuse Act of 1988

[4] Doctors in states where medical marijuana is legalized avoid violating federal law by recommending marijuana to their patients rather than prescribing the drug's use (Anderson, Hansen & Daniel, 2013)

[5] *See* Heyman, O'Leary & Jouriles, 1995; Leonard &Senchak, 1996; Schumacher et al., 2008)

partners. Some studies have found that marijuana use is highly correlated with psychological abuse (Bennett et al. 2008), while others have linked more severe forms of IPV and IPV recurrence to marijuana use (Wofordt et al., 1994; Chermack et al. 2001). A major limitation of the previous studies is that most of them have been cross-sectional. It is thus important to test whether marijuana use is predictive of subsequent IPV (Smith et al., 2014). Reingle, et.al. (2012) used longitudinal data from the National Longitudinal Study of Adolescent Health to examine the association between IPV and marijuana use. The authors found that consistent marijuana use, independent of alcohol use, was a strong predictor of intimate partner aggression for both victims and perpetrators.

Contrary to the previous literature some studies have suggested that marijuana use may be inversely associated with IPV. For example, a nine-year longitudinal study examining a community sample of newly married couples found that after controlling for important covariates (e.g., anti-social behavior, alcohol use), frequent use of marijuana generally predicted less frequent partner aggression over the first nine years of marriage (Smith et al., 2014). Additionally, Stuart et al. (2013) found that women were less likely to perpetrate physical aggression on days in which they had used marijuana relative to non-use days. There are also some studies suggesting a weak causal link between marijuana and IPV. The analyses of Fals-Stewart et al. (2003) indicated that the consumption of opiate-based drugs and cannabis were not associated with an increase in the likelihood of male-to-female partner aggression at any level of severity. Testa et al. (2003) reached similar conclusions, albeit being the most common drug used by the survey respondents. The authors reported that within ongoing relationships hard drug use (cocaine, heroin), but not marijuana use alone, predicted severe IPV and recurrence of IPV.

In addition to the lack of association between marijuana use and partner aggression, the authors suggest that marijuana use may help suppress aggressive behavior.

The literature regarding the effects of marijuana use on child abuse and neglect have been limited. Using survey data from respondents living in 50 mid-size cities in California, Freisthler et al. (2015) used linear mixed effects multilevel modeling to assess the impact of marijuana use on abusive/neglectful parenting. They found a significant and positive association between the density of medical marijuana dispensaries and frequency of child physical abuse by parents. Their findings suggest that parents who are current users of marijuana engage in physical abuse more frequently, and may also have higher aggressive tendencies than their counterparts who do not use marijuana. However, the authors found little evidence to suggest that past year marijuana use related to supervisory neglect, and in fact found there was a negative relationship between marijuana use and physical neglect.

The current literature provides mixed and inconclusive evidence about the marijuana and domestic violence nexus, and is uncertain about the effects of MMLs on child victimization. Since the majority of the survey studies have been correlational or cross-sectional, the generalizability of the results may be limited due to over-reliance on self-reported measures, lack of information regarding severity and nature of the offenses, and response biases (e.g. social desirability bias) (Moore & Stuart, 2005). Freisthler et al. (2015) note that reliance on data gathered through a list-assisted telephone sample of only landlines, likely underestimates the abuse and neglect rates among populations with no landlines. Furthermore, due to social desirability bias, some parents may not disclose if they are abusive or neglectful parents, and may even report their abusive practices at lower rates than would be accurate.

The potential externality effect of marijuana legalization on crime and illegal drug consumption has been of primary concern in the current drug policy debate. Studies have shown that legalizing marijuana is associated with an increase in marijuana consumption among all ages[6]. Consequently, the welfare implications will depend largely on whether marijuana use itself generates negative or positive externalities to children, and on the extent to which marijuana serves as a gateway to harder illicit drugs and to substance abuse.

A major societal concern about marijuana intoxication is the psychological and physical effects which may directly affect the well-being of children and other non-users of cannabis. For example, marijuana is known to impair motor skills, trigger psychiatric illnesses including mood disorders and latent schizophrenia, and cause short term memory loss and temporal distortions (Platt et al., 2010; Roser et al., 2012). These effects can increase the potential risk of parental neglect and abuse. On the other hand, preliminary clinical research supports the potential medicinal value of marijuana (Walsh, Nelson & Mahmoud, 2003). Positive impacts on parenting are likely to result if parents used the drug under medical supervision to relieve chronic pain, anxiety, seizures, and other illnesses. Thus, depending on the degree to which these positive and negative effects are experienced across populations on average, marijuana legalization could either increase or decrease the risk of maladaptive parenting.

There is also a possibility of an indirect link to violence. A large body of research has established a positive causal connection between alcohol abuse, illicit drug use (e.g. cocaine and heroin) and domestic violence. A 1998 study by the National Center on Addiction and Substance Abuse found that children whose parents abused illicit drugs and alcohol were three to four times more likely to be severely maltreated than children of parents who were not substance abusers (Reid Macchetto & Foster, 1998).

[6] see Cerda et al., 2012; Anderson, Hansen & Rees, 2015; Freisthler et al., 2013; Pacula et al. 2013

There has also been substantial research on whether marijuana use is likely to precede the use of harder illicit drugs and other addictive substances such as alcohol. The findings thus far have varied. For instance, a longitudinal study found that among adults with no history of alcohol abuse, those who reported marijuana use during the first wave of the survey were more likely to develop an alcohol use disorder within three years relative to those who reported no marijuana use (Pacek, Martins & Crum, 2012). Wen et al. (2015) also found a positive association between MMLs and frequency of binge drinking for adults over 20 years of age. Additionally, a meta-analytic review by Merill et al. (1994) found that cocaine use was 17 times more likely in adults that used marijuana as children. Other studies have also found a significant correlation between marijuana use and illicit drug dependence (see Fergusson, Boden & Horwood, 2006).While these findings appear to support the gateway hypothesis, authors Morral, McCaffrey & Paddock (2002) suggest that factors such as familial relations, social environment, and genetic predisposition to illicit drugs may be more reliable predictors of future drug consumption. Further, using data from the 1993-2010 Behavioral Risk Factor Surveillance System, Anderson et al. (2013) found that MMLs may significantly reduce the probability of past month alcohol use and frequency of binge drinking. Clinical studies have also suggested that smoking marijuana may prevent the development of tolerance to opiates (Cichewicz and Welch 2003) and that MMLs are associated with a significant reduction in prescription opioid-related mortality (Bachhuber et al. 2014). The current debate provides little evidence to support or refute the suggestion that marijuana use and MMLs are causally linked to the subsequent abuse of alcohol and licit-illicit drugs.

Some studies suggest that marijuana may not only be a gateway to harder illicit drugs but also to crime and criminal behavior. According to the research conducted by Evans (2013), the

probability of being arrested for a non-drug violent and income-producing crime is greater for marijuana users than for non-users. If so, parental marijuana use may increase child maltreatment. Indeed, some studies find that severe family dysfunction, such as parental criminality, elevates the risk of child maltreatment (Juby & Farrington, 2001). Additionally, Farrington (2010) suggests that poor parental supervision and parental criminality are the strongest predictors of juvenile delinquency and anti-social behavior. If, however, criminality is explained by marijuana's illegality, rather than from the drug itself, legalization can break marijuana's link to violence. Thus, depending on which pathways are the strongest, marijuana use and its medical availability can negatively or positively influence child welfare outcomes. This highlights the need for rigorous empirical research in this area.

III. Data and Methodology

According to the literature, MMLs should increase both the supply and demand for marijuana, and thus increase the consumption of marijuana unambiguously (Anderson, Hansen & Rees, 2013). Since marijuana is a psychoactive substance, it may influence a perpetrators' perception of the expected costs or payoffs when supplying violence. If marijuana use does increase a caregivers' negligent or abusive behavior, I would expect legalization to lower the cost of engaging in violence. Reducing the cost of violence is expected to raise the amount of violence supplied**;** thus one possible outcome of legalization is a positive relationship between marijuana use and child victimization. It is also quite possible that a caregiver, under the influence of marijuana, may engage in certain types of maladaptive behavior, thus I separately examine the relationship between MMLs and the most common types of maltreatment (neglect and physical abuse).

To study the impact of medical marijuana laws and its different dimensions on child victimization, I employ the use of three major datasets: Child Maltreatment Reports, National Data Archive on Child Abuse and Neglect (NDACAN) and the FBI's Uniform Crime Reports (UCR). Table 2 provides definitions for my outcome measures. Table 3 presents descriptive statistics.

Data taken from the maltreatment reports and NDACAN capture the severity of child victimization. The data assesses overall maltreatment rates, children who were victims of neglect and physical abuse, victims by age, and deaths attributed to child maltreatment (fatality rates). Additionally, publicly available data from the UCR provide information on crime and arrest rates (e.g., offenses against the family, drug offenses, alcohol offenses) and help reinforce the findings from the previous literatures' marijuana-crime link.

In 2014 the CPS received 3.6 million referrals alleging child abuse and neglect, of which more than 50 percent of the cases were investigated. 702,000 children were victims of abuse and neglect (9.4 victims per 1,000 children) and an estimated 1,580 children died due to maltreatment (2.3 per 100,000 children). According to the CPS there are two major risk factors that may increase the likelihood of victimization – caregiver alcohol abuse and caregiver drug abuse. While some states may have legalized marijuana, no formal guidelines exist on how welfare workers should handle a caregivers' recreational or even medicinal use of the drug.

In 2014, 27% of all child maltreatment cases were related to parental drug use (Child Maltreatment Report, 2014). Since marijuana is still classified as a schedule I substance, child welfare agents might not distinguish a parents' use of marijuana from other illegal substances such as heroin or cocaine even if it's used for medical purposes. This could potentially increase

the number of at-risk victims being reported to the CPS – thereby increasing the reported incidences of child maltreatment rates.

I also investigate an alternative proxy for maltreatment that is less likely to be affected by the reporting bias: child fatality rates. Since institutions and authorities (law enforcement, state vital statistics departments, medical examiners, hospitals, etc.) must report any deaths due to maltreatment, and because such a report will be investigated by the CPS, this variable is unlikely to face reporting bias. One limitation, however, is that it is an extreme outcome, and as such could create noise in the proxy.

The primary independent variables of interest are states that have passed medical marijuana laws (MMLs). To determine when a MML was passed within each state, I used the research conducted by Pacula et al. (2015) and updated it with information from the official legislative website of each US state, NCLS[7] and NORML[8]. Specifically, dichotomous indicators are included for whether a state has the following: laws that allow for the medicinal use of marijuana (MML); legal protection for patients to grow their own plants for medicinal purposes (home cultivation laws); provisions for patients to use marijuana to mitigate chronic pain; and decriminalization statutes in conjunction with MMLs.

All state laws allow patients to possess and use small quantities of marijuana without being subjected to state criminal penalties. However there are variations within each state's MML –each have their own specific restrictions for possession limits, home cultivation and qualifying conditions. For example, while only two states – California and Washington – allow the use of marijuana to treat anorexia, the majority of states with MMLs include provisions for conditions such as HIV-AIDS, cancer, cachexia, chronic pain, and other conditions approved by

[7] NCLS – National Conference of State Legislatures
[8] NORML – National Organization for the Reform of Marijuana Laws

the state health department. Possession and cultivation limits can also vary from one ounce and six plants in Alaska to 2.5 ounces and 12 plants in Michigan (Hoffmann & Weber, 2010). Currently, only 15 states allow for home cultivation of medical marijuana by patients.

Users in the states which have decriminalized possession may face a lower expected penalty (Markowitz, 2005) and therefore a lower price of using marijuana. California's decriminalization statute (2010) provides an example of how the possession of small amounts (less than one ounce) of marijuana constitutes a simple misdemeanor:

Except as authorized by law, every person who possesses not more than 28.5 grams of marijuana, other than concentrated cannabis, is guilty of an infraction punishable by a fine of not more than one hundred dollars[9].

States that have home cultivation and decriminalization laws greatly liberalize access for patients and recreational users. It also provides a source of easily accessible marijuana for youth recreational use and broadens the social approval of marijuana use more broadly (Pacula et al., 2015) If as some research suggests that these laws would lead to an increase in marijuana consumption and to an increase in IPV, then one would expect that in states that have the most lenient form of the law (i.e. home cultivation in conjunction with decriminalization) there would be an increased risk in the frequency and severity of child maltreatment. Table (1) gives a summary of the 23 states that have legalized marijuana for medical use and 17 states that have decriminalized its use.

Sociodemographic and economic characteristics may also play a role in determining a perpetrators' propensity toward supplying violence. For example, schooling, employment, and income may alter the perpetrator's risk of offending by increasing the opportunity cost of engaging in violence. As a result, I expect a negative correlation between these variables and

[9] California Law: BILL NUMBER: SB 1449

child maltreatment. To aid in controlling for a variety of time-varying and potentially confounding factors I include each state's unemployment rate, male to female employment ratio, percent population living below the poverty level, college and high school attainment rate, median household income, population density, divorce rates, indicators of race, percent of the state population incarcerated, and violent crime rates. These variables serve as proxies for opportunities available to potential perpetrators. For example, higher unemployment and poverty rates may correspond to higher stress and depression due to fewer opportunities being available; parents then may be less likely to invest time and money in their children. In such cases basic needs can be neglected. Conversely, states with a higher proportion of educated people and higher income (real wages) have more well-paying employment opportunities, and have a higher cost of engaging in violence. As a result, a negative relationship is expected for education and household income.

Additional controls include the percent of the population between the ages of 15-24 and 25-45 (U.S. Census Statistical Abstracts); the number of police officers per 100,000 persons (Census Bureau, UCR); female share of officers per 100,000 persons (Census Bureau, UCR); arrest rates for types of offenses (UCR); and beer and alcohol consumption per capita (Beer Institute). These variables account for other state-level changes that could separately explain maltreatment rates. For example, arrest rates (enforcement) and the number of police officers measure the effectiveness of a state's efforts against crime in general. They are included in all models to measure the risk of punishment for committing a crime. I expect that higher police presence and higher arrest rates for family offenses would increase the cost of violence, thereby reducing maltreatment. Miller & Segal (2014) found lower domestic violence escalation rates as a result of an increase in reporting by female police officers. I expect a similar relationship with

respect to female share of officers and reported child maltreatment rates. Additionally, a number of studies have found that alcohol is a significant contributory factor to child maltreatment, linking alcohol consumption to reduced self-control, mental health issues, antisocial personality characteristics, and thus a higher risk of physical abuse and neglect. Finally, to allow for variation in MMLs, to address time shocks and control for heterogeneity I include state fixed effects, year fixed effects and state-specific linear time trends.

Methodology

In light of the uncertainty of the effects of MMLs, this paper examines whether states that have implemented these laws see a change in child victimization rates. Specifically, to estimate these outcomes, I use the fixed effects model with Driscoll-Kraay standard errors to exploit the within-state variation introduced by the passage of MMLs in 23 states including D.C. over the 19 year observation period.

One limitation of using the standard fixed effects model is that it does not account for cross-sectional dependence. This cross correlation of errors could be due to omitted common effects that may not be quantitatively measured, such as social norms or psychological behavior patterns (Chudik & Pesaran, 2013). In order to test whether the residuals in my fixed effects regression are spatially independent, I perform the Pesaran CD test, as recommended by Hoechle (2007). The null hypothesis of the CD test states that spatial dependence is indeed present. Since spatial dependence could lead to inconsistent coefficient estimates, I estimate the fixed effects model that is robust to heteroscedasticity, autocorrelation, and very general forms of cross-sectional and temporal dependence.

To carry out the fixed effects analysis I estimate equation (1) where each of the child offenses variable (i.e. child maltreatment rates, victims by age, fatality rates, arrest rates for family offenses), is the dependent variable. Formally, my empirical specification may be expressed as:

$$y_{ST} = \beta_o + \beta_1 MML_{ST} + \beta_2 X_{ST} + \gamma_T + \theta_S + \delta_{ST} + \epsilon_{ST} \quad (1)$$

where for each state *S*, in year *T*, y_{ST} is the child offense rate outcome variable; the main explanatory variable MML_{ST} is a dichotomous indicator equal to 1 if a state implemented a medical marijuana provision from year *T* forward, and 0 otherwise; γ_T and θ_S are year and state fixed effects; δ_{ST} is the state-specific time trend; and X_{ST} is a vector of control variables that include sociodemographic, economic, crime and public policy indicators. The coefficient of interest is β_1 which measures the effect of the MML on child victimization rate.

Using the same specification as (1) I estimate four separate regressions where the regressors of interest are states that have implemented home cultivation laws; provisions for pain; and decriminalization laws in conjunction with MMLs and home cultivation laws (HCL). *HCL* is an indicator set to 1 if the state provides legal protection for patients or caregivers to grow marijuana for medicinal purposes, 0 otherwise. *Decrim&HCL* is a dichotomous indicator equal to 1 if a state has implemented both home cultivation laws and decriminalization laws at year *T*, 0 otherwise. Finally, *MMLXDecrim* is an indicator equal to 1 if a state has implemented both MMLs and decriminalization laws at time *T*. As implied earlier, a state's implementation of MMLs is likely to either increase or decrease the likelihood of child victimization rates, thus the impact of MMLs on child abuse is tested in each model.

VI. Results

The estimated relationship between MMLs and child maltreatment rates.

Deterrence theory asserts that reducing the perceived severity of legal sanctions associated with marijuana use will increase the demand for marijuana. However, the changes in legislation (i.e. an increase in demand) could result in significant and negative spillover effects to parents and their children, increasing the risk of child abuse and neglect.

Table 4 presents the impact of MMLs on reported maltreatment rates while controlling for other time-varying explanatory variables. Each column reports the estimated effect of state-level marijuana legalization from a unique regression. In the first column, I present a parsimonious specification that only includes state and year fixed effects. I find that the legalization of medical marijuana is associated with a 13.2% increase in reported child maltreatment rates. Adding state level controls in column (2) reduces the magnitude of the estimated relationship and the significance falls from the 1% to 5% level; more importantly, legalization is associated with a 11.4% increase in the reported incidences of child maltreatment.

I now extend the specification to include state-specific linear time trends to control for the influence of unobserved factors at the state level that trend smoothly over time (e.g., citizen and government sentiment toward marijuana use). Again, I find a statistically significant and positive effect of MMLs on child maltreatment rates. Specifically, the estimates suggest that after the passage of MMLs, states see an increase in reported incidences of child maltreatment by 1.30 per 1,000 children; this translates to a 9.8% increase in reported maltreatment rates.

Table 5 presents the estimates between MMLs and child maltreatment rates by age group. I expect victimization rates to be higher for younger children since they are more vulnerable to abuse and neglect than older children. Additionally, since marijuana is classified as a schedule I

substance at the federal level, it is more likely for parents to get reported and be investigated for abuse and neglect if they use marijuana in the presence of younger children. I find the estimates of reported incidences of abuse for younger children (ages of 0 and 3 years) to be much larger in magnitude and are statistically significant compared to incidences of abuse for older children. More specifically, for younger children between the ages of 0 to 3 (Table 5, column 1), enforcement of MML is associated with a 16.5% increase in reported maltreatment, and for children between ages 12 to 15 (column 4), a (statistically insignificant) 13.73% increase in reported incidences of maltreatment.

If MMLs are associated with an overall increase in the incidence of reported maltreatment rates, what could explain such an effect? There are two likely mechanisms through which MML – legislation that aids patients with chronic health conditions – might affect child maltreatment estimates. First, MMLs caused an increase in actual maltreatment. Second, it may have increased the reporting rate of maltreatment. I employ two measures of child maltreatment to attempt to distinguish between the mechanisms and correct for any potential reporting bias: child fatality rates and arrest rates for family offenses.

First, I test whether reporting and arrest patterns for family offenses changed around the implementation of the policy. Arrest data are frequently used in the crime literature as a measure of crime and to account for changes in police reporting behavior. In column (2) of Table 6, I present estimates of the impact of MMLs on arrest rates for offenses against the family, including all the controls mentioned above. I find that states that adopt MMLs witness a (highly statistically insignificant) 6.1% increase in arrest rates for family violence relative to states with no such policies. However, as Dalbo & Aizer (2014) suggest, the estimated effect of arrest may not just reflect changes in reporting but also changes in arrests conditional on reporting. For

example, police officers are more likely to arrest parents that use marijuana if the Department of Children and Family Services and courts consistently rule that parental usage of medical marijuana places the child at a substantial risk of harm. Indeed, until 2010, public opinion about legalizing marijuana rarely shifted, with a majority believing the drug should be made illegal and usage of the drug should be policed (PEW Research, 2014).

Next, I present regression estimates of the impact of MMLs on actual maltreatment. Albeit a noisy proxy for maltreatment due to its low-frequency, child fatality rates can serve as an appropriate proxy to measure an increase or decrease in actual maltreatment following the implementation of state-level MMLs. The underlying premise of this approach is that child fatalities will always be reported to the police and CPS, and as such it will be immune from any reporting effect (Levitt, 1998).

The main results are shown in Table 7, column (3). Baseline estimates in column (1) show that there is a negative and statistically significant relationship between MMLs and changes in fatality rates. However, these estimates become smaller and insignificant after controlling for socio-demographic factors and state-specific linear time trends (column 3). I find that MMLs have a negative (-0.206) impact on child fatality rates; more specifically, the results suggest that after the passage of the laws, states see a 11.2% reduction in child deaths due to maltreatment. The lack of significance could be explained, in some part, due to noise in the child fatality measure. While this finding does not provide evidence of a strong correlation between MMLs and fatality, it does not necessarily negate the possibility that an economically significant relationship exist. More importantly, the evidence suggests that there may indeed be a reporting effect going on, and not an increase in actual maltreatment.

Tables 8 and 9 (column 2) provide additional evidence that MMLs may be associated with an increase in the reporting of child maltreatment. Interestingly, the results show that there is no significant positive relationship between the adoption of MMLs and rates for physical abuse and neglect. Moreover, the estimates indicate there may be evidence of a drop in physical abuse in states with medical marijuana policies. Specifically, I find that states with MMLs are estimated to have 0.548 fewer children who are physically abused per thousand children relative to states without MMLs, a reduction of 21.4 % when assessed against the sample mean. On the other hand, I find a positive but statistically insignificant relationship between MMLs and neglect, showing a 10.7% increase in the reported incidences of neglect. The pattern of results so far is consistent with the reporting hypothesis: parents who use medical marijuana are more likely to be subject to a child neglect inquiry since social workers may determine that marijuana use would substantially impair a parent's judgement and ability to care for their children's basic needs.

Figure 1 presents graphical evidence of the effect of MMLs on reported maltreatment rates over time. The graph shows the means of yearly maltreatment rates before and after the implementation date of MMLs, with 1 on the X-axis denoting the first full year of the law being in effect. Prior to the implementation of MMLs, the maltreatment rates seem to be relatively stable; however, after the first full year of the law being in effect, there is a sharp increase in the reported incidences of maltreatment. After the fourth year, the treatment effect appears to be decreasing over time, suggesting an initial reporting effect.

In summary, the estimates from the NCANDs and UCR data indicate a 10–13% increase in reported child maltreatment rates after medical marijuana legalization. However, this positive effect largely comes from the increase in the reporting and investigation of cases of child neglect.

More importantly, evidence from the child fatality estimates show that the actual incidence of child maltreatment may be falling in states with MMLs.

Robustness Checks

Table 10 column (1) shows the estimates for pre-and post-legalization trends in child maltreatment rates. I add controls for four years of MML policy leads and three years of policy lags. In the years preceding the law, I find that reported maltreatment rates are negative and stable, but statistically insignificant; suggesting no policy endogeneity, thus lending credibility to the main estimates in Table 4. However, after the first full year of the law being in effect, MMLs are associated with a significant increase in reported maltreatment rates. The estimates for the reported maltreatment rates become even larger in magnitude, but are statistically insignificant, during the third year of post-legislation. However, after four or more years, the estimates become small and are statistically indistinguishable from zero.

It is somewhat surprising that the effect of MMLs do not grow over time; nevertheless this pattern of results is consistent with Figure 1, showing the reported incidences of maltreatment ramping up immediately after the legislation, and slowing down in the years after. One potential reason for this could be due to the nature of the data – since NCANDs aggregates the reports into a single yearly estimate, monthly growth over time may be missed. Additionally, this phenomenon is consistent with the reporting hypothesis; the behavioral response seems to follow immediately after the passage of the law. If , as anecdotal evidence suggests that opinions change, whereby there is a greater social acceptance of marijuana by law enforcement and social workers, especially for parents who use the drug for medicinal purposes, then I would not expect to see growth over time.

Next, Table 4, Column (4) estimates the sensitivity of my results to an alternate specification. Since maltreatment is intrinsically a count of victims within a discrete time period, I use the fixed effects negative binomial fixed model as a specification check for my primary analyses. Tables (4) and (7) presents coefficients on the maltreatment rate variable from the OLS fixed effects and negative binomial specifications for completeness. The estimates confirm the results from my main estimation – states with MMLs see a significant increase in the reported incidences of child maltreatment, and a significant decline in fatality rates (Table 7, column 4). In addition, when I use the coding preferred by Pacula et al. (2015) to obtain the effective dates of the laws, I find a similar pattern of statistically significant results (Appendix Tables 1 & 2).

I now examine the impact of specific policy dimensions to capture the reporting effect and the true maltreatment effect: that is, provisions that allow for home cultivation and prescriptions for chronic pain. Since both provisions instrument for regulatory laxness, they are more likely to increase social availability and access to the drug. As such, these provisions are predicted to affect reporting behavior and consequently reported maltreatment rates through the changing perceived risk associated with the enforcement of parental marijuana use. I thus, expect parents and caregivers who grow marijuana, even if licensed, to be reported and investigated for (risk of) child endangerment.

Column (2) from Tables 11 and 12 show the estimates of home cultivation laws (HCLs) on child maltreatment rates. Overall, I find a positive and statistically significant legislative effect on reported child maltreatment rates. Specifically, the results suggest that states with HCLs are responsible for an additional 3.26 children being reported as maltreated per 1000 children, translating to a 24.6% increase in reported maltreatment rates. Note that these estimates are twice as large as the ones from MMLs (Table 4). More importantly, when I estimate the

effect of HCLs on child fatality rates in Table 12, I find the magnitude of the coefficients to be large and statistically significant, suggesting a 32% reduction in actual maltreatment rates. I find a similar and statistically significant results (Column 3, Tables 11 & 12) when I test the impact of the provisions that allow the use of marijuana for chronic pain. Specifically, the implementation of provisions that allow for chronic pain is associated with a 14% increase in reported maltreatment rates, and a substantial 26.6% reduction in fatality rates.

I continue to explore the differential effects of state-specific medical marijuana regulations by interacting MMLs with states that have decriminalized the possession of marijuana. Tables 13 and 14 provide further evidence that the magnitudes of the interaction terms are much larger in states that impose relatively lax restrictions than those with no such policies. These findings are consistent with my previous estimates from Tables 11 and 12, and build on the work by Pacula et al. (2015) who recognized the heterogeneity in the implementation of state level marijuana regulations. Thus, the binary MML measure in Table 4 misses the heterogeneous effects and dynamics of these policies. Finally, these findings are consistent with the interpretation that MMLs not only influence the reported incidences of maltreatment, but they may also reduce the actual incidences of child maltreatment.

V. Conclusion

Recent research by Friestler and colleagues (2015) suggests that parental marijuana use is related to higher incidences of physical abuse and neglect. However, to my knowledge, no research has examined the relationship between state marijuana legislation and child victimization rates. The central findings gleaned from this paper provide indirect evidence that marijuana use, induced by increased access to medical marijuana, affects the reported incidences

of child maltreatment positively. Specifically, estimates from the fixed effects regression suggest that after the passage of MMLs, states see a statistically significant (9.8%) increase in reported maltreatment rates. Using Driskoll-Kraay standard errors, these results are robust to heteroscedasticity, autocorrelation, and very general forms of cross-sectional dependence.

The findings from my main model raise an important follow-up question: does medical marijuana legalization increase child maltreatment or child maltreatment reporting? I examine one particular outcome of interest to proxy for the true incidence of maltreatment: child fatality rates. I find a negative but statistically insignificant relationship between MMLs and child fatality rates. However, as discussed by Pacula et al. (2015), MMLs vary greatly and can thus generate heterogeneous effects. Indeed, I find the largest estimates when I look at specific dimensions of MMLs, where the coefficients capture not only the reporting effect but also the true effect on maltreatment. For example, states with provisions that allow for home cultivation see a 24.6% increase in the reported incidences of maltreatment and, surprisingly, a statistically significant 32% reduction in the fatality rate. Further, these findings run contrary to the arguments suggesting a positive relationship between the legalization of medical marijuana and violence.

Data limitations do not allow me to explore all of the other channels through which MMLs may affect child outcomes – particularly pharmacological effects of the drug. However, identifying one specific mechanism through which MMLs may affect maltreatment, such as child fatality, does provide one piece of the puzzle. It is important to note that the negative relationship between MMLs and child fatality rates does not necessarily imply a strict causal connection that marijuana use reduces actual maltreatment. For instance, it is possible that marijuana regulation reduces child fatality rates through its positive reporting effect. Even if

growing or consuming marijuana is legal, anecdotal evidence suggests that parental use of marijuana can be controversial. However, with the passage of time, I expect attitudes and behaviors toward parental medical marijuana use to be more tolerant and accepted. As such, it is unlikely that reported maltreatment rates will continue to increase. Indeed, trend analyses provide further evidence that child maltreatment may be decreasing over time. Clearly, distinguishing between child maltreatment and reporting is a subject that warrants further attention. Thus, as the narrative of medical and recreational marijuana legislation unfolds across the country, more substantive research is needed to determine how marijuana use impacts child outcomes and parenting.

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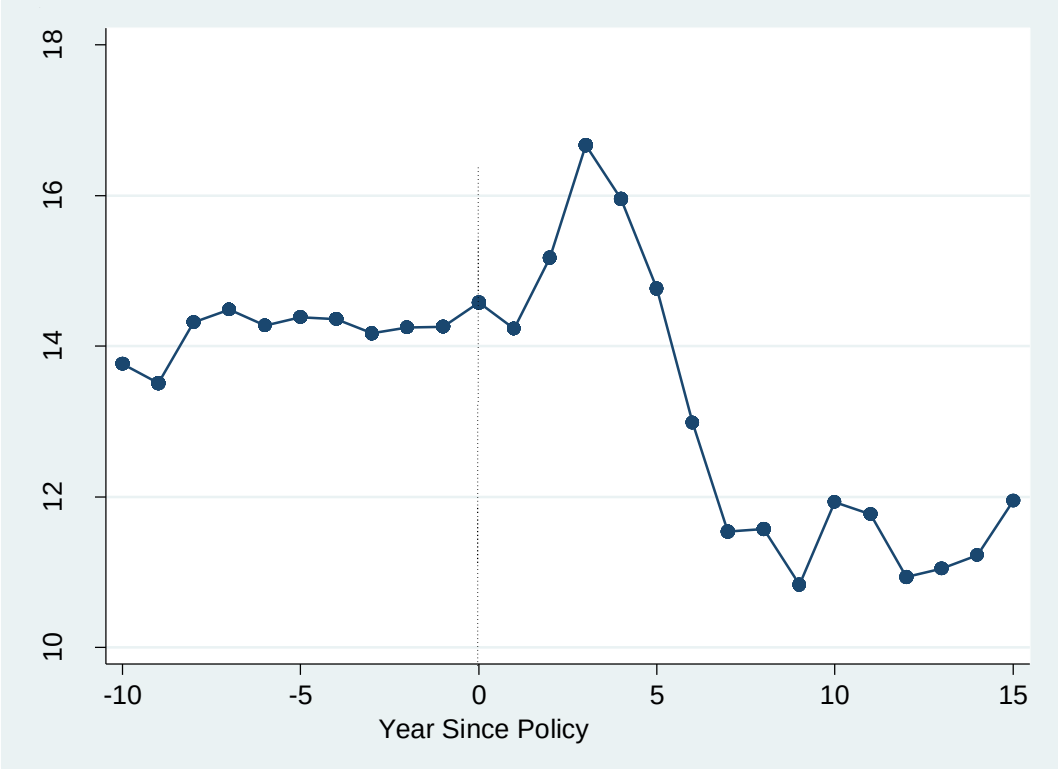
Figure 1. Trends in Child Maltreatment Rates, by State MMLs



Notes and Sources: Data is from the Child Maltreatment Reports and the National Data Archive for Child Abuse and Neglect (NDACAN), which provides prevalence of child maltreatment from 1995-2014. The Dashed line marks the timing of the medical marijuana law. As of 2014, 23 states plus D.C. have implemented MMLs; the law provides protection from criminal penalties for using marijuana for a medical purposes.

Table 1: MML Legislation Policies by State, 1996-2014

			Provisions			
State	**Year Passed**	**Effective date**	**Pain**	**Home Cultivation**	**Marijuana Decriminalized**	**Possession Limit**
Alaska	1998	1999	Yes	Yes	1975	1 oz/6 plants (3 mature, 3 immature)
Arizona	2010	2011	Yes	Yes	2011	2.5 oz/12 plants
California	1996	1996	Yes	Yes	1976	8 oz/ 6 mature or 12 immature
Colorado	2000	2001	Yes	Yes	2011	2 oz/ 6 plants (3 mature, 3 immature)
Connecticut	2012	2012				Not specified
District of Columbia	2010	2010			2014	2 oz/Not specified
Delaware	2011	2011	Yes			6 oz
Hawaii	2000	2000	Yes	Yes		3 oz/ 7 plants (3 mature, 4 immature)
Illinois	2013	2014				2.5 oz
Maine	1999	1999	Yes	Yes	1976	2.5 oz/6 plants
Maryland	2014	2014	Yes		2011	Not specified
Massachusetts	2012	2013		Yes	2009	Not specified
Michigan	2008	2008	Yes	Yes		2.5 oz/ 12 plants
Minnesotta	2014	2014			1976	Not specified
Montana	2004	2004	Yes	Yes		1 oz/ 4 plants (mature)
Nebraska					1977	
Nevada	2001	2001	Yes	Yes	2002	1 oz/ 7 plants (3 mature, 4 immature)
New Hampshire	2013	2013				2 oz
New Jersey	2009	2010	Yes			2 oz/ Not specified
New Mexico	2007	2007		Yes		6 oz/ 16 plants (4 mature, 12 immature)
New York	2014	2014			1977	Not specified
North Carolina					1977	
Ohio					1976	
Oregon	1998	1998	Yes	Yes	1973	24 oz/24 plants (6 mature, 18 immature)
Rhode Island	2006	2006	Yes	Yes	2013	2.5 oz/ 12 plants
Vermont	2004	2004	Yes	Yes		2 oz/ 9 plants (2 mature, 7 immature)
Washington	1998	1998	Yes	Yes	2012	24 oz/15 plants

Notes and Sources: Own data collection. Referred from the following sources: Procon.org; NORML; Pacula et al. 2013

Table 2. Summary of Data Sources

Variables	Definitions	Sources and years
Dependent Variables		
Child maltreatment	Children who have experienced or who were at risk of experiencing abuse or neglect.	NDACAN (1995-1999) Children's Bureau (2000-2014)
Child fatality rate	Children who have died due to abuse or neglect	
Offenses against the family arrest rate	Family violence includes all types of violent crime committed by an offender who is related to the victim either biologically or legally through marriage or adoption.	Bureau of Justice Statistics (1995-2014)
Explanatory variables of Interest		
Medical Marijuana Laws	States that allow for the medical use of marijuana.	NORML; State statutes; Pacula et al. (2013); ProCon.org
Decriminalization Laws	Reduces penalties associated with the use or possession of small amounts of marijuana	
Family and State Environment		
Female labor force participation rate Unemployment rate Median Household income Poverty rate		U.S. Census Bureau - Statistical Abstracts Series, Bureau of Labor Statistics (1995-2014)
Population density per square mile (Proxy for urban rate)	(Total population/ Land area)	
Divorce rate		Wolfers, Justin. 2006. (1995 – 2000) CDC divorce rates (2000-2014)
Beer & Alcohol consumption per capita		Beer Institute (1195-2014)
Fraction of child population that is white Fraction of child population that is black Percent of the population between ages 15-24 Percent of the population between ages 25-44		U.S Census Bureau -Current Population Surveys (1995-2014)
College attainment rate High school attainment rate	Human Capital Index Measures	Frank, Mark. W. (2009) (1995-2014)
State Judicial Environment		
Law enforcement Female Officers Incarceration rates Drug abuse arrest rates	Law enforcement to population ratio Female officers to population ratio Prisoner to population ratio	Bureau of Justice Statistics U.S. Census Bureau - Statistical Abstracts Series (1995-2014)
Crime rate	Crime to population ratio	FBI Uniform Crime Report (1995-2014)

Table 3: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent Variables:					
Child Maltreatment Rate per 1,000 children	964	13.23146	8.424562	0.703636	82.62695
Child Fatality Rate per 100,000 children	957	1.840939	1.269862	0	16.77497
Maltreatment by age: 0-3	957	15.0515	8.757103	0.67	113.901
Maltreatment by age: 4-7	957	12.42606	6.656937	1	103.869
Maltreatment by age: 8-11	957	10.17737	6.656937	1.05	88.9389
Maltreatment by age: 12-15	957	9.98481	6.697933	1.16913	88.9389
Physical Maltreatment Rate per 1,000 children	966	2.561232	2.33376	0	21.79333
Neglect Rate per 1,000 children	967	6.940179	5.448133	0	48.32642
Arrest Rates for Offenses Against the Family, per 100,000 persons	956	39.09395	35.47919	0.020833	230.472
Independent Variables:					
Percent of the population: 15-24	1020	14.23904	1.132571	10.88582	20.21582
Percent of the population: 25-44	1020	28.05253	2.546012	22.88201	36.82647
Beer consumption per Capita	1020	1.245418	0.208968	0.67	1.91
Alcohol Consumption per Capita	1020	2.360402	0.521174	1.2	4.7
Arrest Rates for Drug Abuse per 100,000 persons	986	390.0723	177.7336	4.5833	1105.235
Law Enforcement to Population Ratio	1018	0.003117	0.000964	0.000243	0.009329
Female Officers to Population Ratio	1018	0.000238	0.00022	1.57E-05	0.001773
Violent Crime to Population Ratio	1020	0.004383	0.002549	0.000669	0.026614
Prisoners to Population Ratio	1005	0.004135	0.001829	0.000849	0.017681
Poverty Rate	1020	13.11039	3.722729	4.5	26.4
Percent Black	985	13.86621	13.98246	0.448138	91.26456
Percent White	985	66.12452	20.18823	12.37999	102.3237
Population Density per sq. mile	1020	369.5003	1319.514	1.06	10801.5
Labor force Participation Rate for Females	969	60.49089	4.449323	46.3	71.2
High School attainment Rate	1020	0.577027	0.05557	0.448777	0.743473
College Attainment Rate	1020	0.177827	0.044997	0.083979	0.459317
Median Household Income	1020	53895.13	8260.62	35521	77506
Divorce Rate	919	3.986267	1.07179	1.5	10.44056
Unemployment Rate	1020	5.629779	1.964165	2.3	13.8

Table 4: Effects of MMLs on Child Maltreatment Rates

	(1)	(2)	(3)	(4)
	Child Maltreatment Rate per 1,000 Children			
Dependent variable mean	**13.23146**			
MML = 1	1.758***	1.505**	1.303*	0.104*
	(0.597)	(0.700)	(0.649)	(0.0583)
Estimation method	OLS	OLS	OLS	Neg. Bin
All Controls	N	Y	Y	Y
State fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y
State-specific time trend	N	N	Y	Y
Observations	964	759	759	759
Within R-squared	.20	.25	.52	-
Number of groups	51	49	49	-

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variable for each column is the child maltreatment rate per1000 children. MML=1 if a state implemented a medical marijuana provision. This table provides the coefficient estimates from the regression model in (1) estimated by FE regression. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors.

All controls include:

Crime rate controls use FBI Uniform Crime reports for the number of violent crimes per 100,000 inhabitants. Indexed crimes included in the violent crime variable are murder, robbery, assault, and rape. Other crime controls include, family and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio

State economic control variables include the variables: unemployment rate, female labor force participation rate, and state median household income (BLS and US Statistical Abstracts), college and high school attainment rate, (Frank, 2009), population density per square mile (U.S Statistical Abstracts).

State socio- demographic controls are based on the March Current Population Survey and the U.S Statistical Abstracts. They include variables for the percent of the child population that is black and white; divorce rates, percent of the population that's between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile.

Table 5: Effects of MMLs on Child Maltreatment Rates, by Age Cohort

Child maltreatment rate per 1,000 children, by age groups	(1) 0-3	(2) 4-7	(3) 8-11	(4) 12-15
Dependent variable mean	**15.0515**	**12.426**	**10.177**	**9.985**
MML = 1	2.448*	1.441	1.222	1.371
	(1.395)	(1.200)	(0.965)	(0.973)
All Controls	Y	Y	Y	Y
State fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y
State-specific time trend	Y	Y	Y	Y
Observations	742	742	742	742
Within R-squared	.422	.5062	.5146	.5408
Number of groups	48	48	48	48

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variable for each column is the child maltreatment rate per1000 children, by age cohort. MML=1 if a state implemented a medical marijuana provision. This table provides the coefficient estimates from the regression model in (1) estimated by FE regression. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors.

All controls include:

Crime rate controls use FBI Uniform Crime reports for the number of violent crimes per 100,000 inhabitants. Indexed crimes included in the violent crime variable are murder, robbery, assault, and rape. Other crime controls include, family offenses and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio

State economic control variables include the variables: unemployment rate, female labor force participation rate, and state median household income (BLS and US Statistical Abstracts), college and high school attainment rate, (Frank, 2009), population density per square mile (U.S Statistical Abstracts).

State socio- demographic controls are based on the March Current Population Survey and the U.S Statistical Abstracts. They include variables for the percent of the child population that is black and white; divorce rates, percent of the population that's between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile.

Table 6: The Effect of MMLs on Arrest Rates for Family Offenses

	(1)	(2)
	Arrest rates for family offenses per 100,000 persons	
Dependent variable mean	**39.09395**	
MML=1	0.493	2.397
	(2.246)	(2.391)
All Controls	Y	Y
State fixed effects	Y	Y
Year fixed effects	Y	Y
State-specific time trend	N	Y
Observations	784	784
Within R-squared	.165	.6396
Number of groups	49	49

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variable for each column is the arrest rates for offenses against a family member, per 100,000 persons. MML=1 if a state implemented a medical marijuana provision. This table provides the coefficient estimates from the regression model in (1) estimated by FE regression. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors.

All regressions include state economic, socio-demographic policy and crime controls.

Crime rate controls use FBI Uniform Crime reports for the number of violent crimes per 100,000 inhabitants. Indexed crimes included in the violent crime variable are murder, robbery, assault, and rape. Other crime controls include, drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio

State economic control variables include the variables: unemployment rate, female labor force participation rate, and state median household income (BLS and US Statistical Abstracts), college and high school attainment rate, (Frank, 2009), population density per square mile (U.S Statistical Abstracts).

State socio- demographic controls are based on the March Current Population Survey and the U.S Statistical Abstracts. They include variables for the percent of the child population that is black and white; divorce rates, percent of the population that's between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile.

Table 7: The Effect of MMLs on Child Fatality Rates

	(1)	(2)	(3)	(4)
	Child fatality rate per 100,000 children			
Dependent variable mean	**1.841**			
MML = 1	-0.298*	-0.00326	-0.206	-.1396
	(0.159)	(0.227)	(0.279)	(0.108)
Estimation method	OLS	OLS	OLS	Neg. Bin
All Controls	N	Y	Y	Y
State fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y
State-specific time trend	N	N	Y	Y
Observations	957	752	752	752
within R-squared	.025	.103	.237	-
Number of groups	51	49	49	-

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variable for each column is the child fatality rate, per 100,000 children. MML=1 if a state implemented a medical marijuana provision. This table provides the coefficient estimates from the regression model in (1) estimated by FE regression. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors.

All regressions include state economic, socio-demographic policy and crime controls.

Crime rate controls use FBI Uniform Crime reports for the number of violent crimes per 100,000 inhabitants. Indexed crimes included in the violent crime variable are murder, robbery, assault, and rape. Other crime controls include, family offenses and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio

State economic control variables include the variables: unemployment rate, female labor force participation rate, and state median household income (BLS and US Statistical Abstracts), college and high school attainment rate, (Frank, 2009), population density per square mile (U.S Statistical Abstracts).

State socio- demographic controls are based on the March Current Population Survey and the U.S Statistical Abstracts. They include variables for the percent of the child population that is black and white; divorce rates, percent of the population that's between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile.

Tables 8 & 9: The Effect of MMLs on Maltreatment Types: Physical Abuse and Neglect

Table 8

	(1)	(2)
	Physical abuse rate per 1,000 children	
Dependent variable mean	**2.561**	
MML=1	-0.229	-0.548
	(0.309)	(0.532)
All Controls	Y	Y
State fixed effects	Y	Y
Year fixed effects	Y	Y
State-specific time trend	N	Y
Observations	761	761
within R-squared	.474	.581
Number of groups	49	49

Table 9

	(1)	(2)
	Child neglect rate per 1,000 children	
Dependent variable mean	**6.94**	
MML =1	0.340	0.746
	(0.550)	(0.647)
All Controls	Y	Y
State fixed effects	Y	Y
Year fixed effects	Y	Y
State-specific time trend	N	Y
Observations	762	762
within R-squared	.232	.482
Number of groups	49	49

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variables are child physical abuse and neglect rate, per 1,000 children. MML=1 if a state implemented a medical marijuana provision. This table provides the coefficient estimates from the regression model in (1) estimated by FE regression. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors. **Crime rate controls** include the number of violent crimes per 100,000 inhabitants; family and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio. **State economic contro**l variables include unemployment rate, female labor force participation rate, and state median household income, college and high school attainment rate, population density per square mile. **State socio- demographic controls** include the percent of the child population that is black and white; divorce rates, percent of the population between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile.

Table 10: Robustness of Estimates of the Effect of MMLs on Child Maltreatment Rates to Control for Policy Leads and Lags

VARIABLES	(1) All ages	(2) 0-3	(3) 4-7	(4) 8-11	(5) 12-15
3 Years Prior	-0.150	-0.893	-0.662	-0.905	-0.818
	(0.981)	(0.838)	(0.812)	(0.851)	(0.861)
2 Years Prior	-0.322	-0.404	-0.156	-0.213	-0.140
	(0.775)	(1.221)	(0.953)	(0.790)	(0.790)
1 Year Prior	-0.363	0.884	1.013	0.266	0.359
	(0.994)	(1.330)	(1.148)	(0.856)	(0.802)
Year Effective	0.461	1.086	0.809	0.358	0.518
	(0.684)	(1.109)	(0.910)	(0.765)	(0.731)
1 Year After	-0.00656	1.272	0.595	0.249	0.444
	(0.629)	(1.266)	(0.996)	(0.727)	(0.710)
2 Years After	1.170	2.635*	1.827	1.068	1.304
	(1.042)	(1.503)	(1.422)	(1.189)	(1.142)
3 Years After	3.102	6.360	5.070	3.924	4.290
	(2.798)	(4.930)	(4.406)	(3.680)	(3.622)
4 Years After	0.973	4.354*	2.629	1.888	2.119
	(1.339)	(2.279)	(2.068)	(1.675)	(1.693)
5+ Years After	-1.351	2.664	1.188	0.603	0.721
	(1.508)	(2.440)	(2.227)	(1.807)	(1.738)
Observations	759	742	742	742	742
Number of groups	49	48	48	48	48

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variable for each column is the arrest rates for offenses against a family member, per 100,000 persons. MML=1 if a state implemented a medical marijuana provision. This table provides the coefficient estimates from the regression model in (1) estimated by FE regression. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors. All regressions include state fixed effects, year fixed effects, state specific linear time trends. **Crime rate controls** include the number of violent crimes per 100,000 inhabitants; family and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio. **State economic contro**l variables include unemployment rate, female labor force participation rate, and state median household income, college and high school attainment rate, population density per square mile. **State socio- demographic controls** include the percent of the child population that is black and white; divorce rates, percent of the population between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile.

Tables 11 & 12. Heterogeneity in the Effects of MMLs on Child Maltreatment & Fatalities

	(1)	(2)	(3)
	Child maltreatment rate per 1,000 children		
Dependent variable mean	**13.231**		
MML=1	1.303*		
	(0.649)		
HCL = 1		3.260**	
		(1.432)	
MML-Pain = 1			1.854**
			(0.839)
Observations	759	759	759
Within R-squared	.52	.526	.521
Number of groups	49	49	49
	(1)	(2)	(3)
	Child fatality rate per 100,000 children		
Dependent variable mean	**1.841**		
MML =1	-0.206		
	(0.279)		
HCL = 1		-0.596*	
		(0.330)	
MML-Pain =1			-0.490*
			(0.264)
Observations	752	752	752
Within R-squared	.237	.243	.241
Number of groups	49	49	49

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.
Notes: The dependent variable for Table 10 is child maltreatment rate per 1,000 children. The dependent variable for Table 11 is child fatality rate per 100,000 children. MML=1 if a state implemented a medical marijuana provision. HCL =1 if a state allows for caregivers to grow marijuana for medicinal purposes. MML-Pain =1 if a state has provisions that allow marijuana to be used for chronic pain.

All regressions include state fixed effects, year fixed effects, state specific linear time trends. **Crime rate controls** include the violent crime to population ratio; family and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio. **State economic contro**l variables include unemployment rate, female labor force participation rate, and state median household income, college and high school attainment rate, population density per square mile. **State socio- demographic controls** include the percent of the child population that is black and white; divorce rates, percent of the population between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors.

Tables 13 & 14. Heterogeneity in the Effects of MMLs on Child Maltreatment & Fatalities

	(1)	(2)	(3)
Child maltreatment rate per 1,000 children			
MML =1	1.303*		
	(0.649)		
MML&Decrim =1		3.788**	
		(1.779)	
Decrim&HCL = 1			4.308**
			(2.000)
Observations	759	759	759
Within R-squared			
Number of groups	49	49	49

	(1)	(2)	(3)
Child fatality rate per 100,000 children			
MML =1	-0.206		
	(0.279)		
MML&Decrim =1		-0.267	
		(0.408)	
Decrim&HCL = 1			-0.395
			(0.461)
Observations	752	752	752
Within R-squared			
Number of groups	49	49	49

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variable for Table 10 is child maltreatment rate per 1,000 children. The dependent variable for Table 11 is child fatality rate per 100,000 children. MML=1 if a state has a medical marijuana provision. MML&Decrim =1 if a state has both MML and decriminalization laws. Decrim&HCL =1 if a state has both home cultivation and decriminalization laws.

All regressions include state fixed effects, year fixed effects, state specific linear time trends. **Crime rate controls** include the violent crime to population ratio; family and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio. **State economic contro**l variables include unemployment rate, female labor force participation rate, and state median household income, college and high school attainment rate, population density per square mile. **State socio- demographic controls** include the percent of the child population that is black and white; divorce rates, percent of the population between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors.

Appendix Table 1. Robustness of Estimates with the use of MML Effective Dates Preferred by Pacula et al. (2015)

Child maltreatment rates per 1,000 children	(1) All ages	(2) 0-3	(3) 4-7	(4) 8-11	(5) 12-15
MMLeffective=1	1.429**	3.021**	1.948*	1.630*	1.801*
	(0.606)	(1.234)	(1.081)	(0.908)	(0.897)
Observations	759	742	742	742	742
Number of groups	49	48	48	48	48

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variables are child maltreatment rates, per 1,000 children and maltreatment by age groups. MMLeffective=1 if a state's medical marijuana provision became effective that year. This table provides the coefficient estimates from the regression model in (1) estimated by FE regression. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors.

All regressions include state fixed effects, year fixed effects, state specific linear time trends **Crime rate controls** include the number of violent crimes per 100,000 inhabitants; family and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio. **State economic contro**l variables include unemployment rate, female labor force participation rate, and state median household income, college and high school attainment rate, population density per square mile. **State socio-demographic controls** include the percent of the child population that is black and white; divorce rates, percent of the population between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile.

Appendix Table 2. Robustness of Estimates with the use of MML Effective Dates Preferred by Pacula et al. (2015)

Severity of abuse	(1) Physical abuse rate/1,000 children	(2) Neglect rate/1,000 children	(3) Fatality rate/100,000 children
MMLeffective = 1	-0.489	1.057**	-0.146
	(0.487)	(0.474)	(0.250)
Observations	761	762	752
Number of groups	49	49	49

*, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively.

Notes: The dependent variables are types of maltreatment (physical abuse and neglect), per 1,000 children and child fatality rate per 100,000 children. MMLeffective=1 if a state's medical marijuana provision became effective at year *T*. This table provides the coefficient estimates from the regression model in (1) estimated by FE regression. Robust standard errors (in parentheses) are based on Driscoll-Kraay spatial-autocorrelation and cluster-robust standard errors.

All regressions include state fixed effects, year fixed effects, and state specific linear time trends **Crime rate controls** include the number of violent crimes per 100,000 inhabitants; family and drug abuse arrest rates per 100,000 persons; law enforcement to population ratio; female officers to population ratio; prisoner to population ratio. **State economic contro**l variables include unemployment rate, female labor force participation rate, and state median household income, college and high school attainment rate, population density per square mile. **State socio-demographic controls** include the percent of the child population that is black and white; divorce rates, percent of the population between the ages of 15-24 and 25-44; alcohol consumption per capita; beer consumption per capita; population density per sq.mile.