



# The effect of medical marijuana laws on adolescent and adult use of marijuana, alcohol, and other substances<sup>☆, ☆☆</sup>



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## ABSTRACT

We estimate the effect of medical marijuana laws (MMLs) in ten states between 2004 and 2012 on adolescent and adult use of marijuana, alcohol, and other psychoactive substances. We find increases in the probability of current marijuana use, regular marijuana use and marijuana abuse/dependence among those aged 21 or above. We also find an increase in marijuana use initiation among those aged 12–20. For those aged 21 or above, MMLs further increase the frequency of binge drinking. MMLs have no discernible impact on drinking behavior for those aged 12–20, or the use of other psychoactive substances in either age group.

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As of February 2015, 23 states and the District of Columbia have implemented medical marijuana laws (MMLs), which permit marijuana use for medical purposes. Three states (i.e., Maryland, Minnesota, and New York) adopted MMLs during 2014, and an additional 11 states<sup>1</sup> passed pro-medical marijuana legislation. Medical marijuana bills have also been considered in many of the remaining states and are likely to land on the legislative agenda in more states in the near future. Understanding the behavioral and public health implications of this evolving regulatory environment is critical for the ongoing implementation of MMLs and future iterations of marijuana policy reform. Despite the growing

consensus about the relief medical marijuana can bring for a range of serious illnesses, concerns have been voiced that MMLs may give rise to increased marijuana use in the general population and increased use of other substances. Legislative and public attention have focused on these issues, but the empirical evidence is limited.

We contribute to the literature on the effects of marijuana liberalization policies by examining the effect of the implementation of MMLs in ten states between 2004 and 2012 on a variety of substance use outcomes including marijuana use, alcohol use, pain medication misuse, and hard drug use in both adolescent and adult populations. To tease out the potential causal effect of MML implementation, we exploited the geographic identifiers in a restricted-access version of the National Survey on Drug Use and Health (NSDUH) micro-level data and estimated two-way fixed effects models with state-specific linear time trends and a rich set of individual- and state-level covariates.

We find that implementation of an MML leads to a relative 14 percent increase in the probability of past-month marijuana use and a 15 percent increase in the probability of almost daily/daily marijuana use among adults aged 21 or above. For this age group, MML implementation also results in a 10 percent increase in the probability of marijuana abuse/dependence. Among adolescents and young adults aged 12–20, we find a 5 percent increase in

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<sup>1</sup> 11 states with pro-medical marijuana legislation include Alabama, Florida, Iowa, Kentucky, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Utah, and Wisconsin.

the probability of past-year marijuana use initiation attributable to MML implementation.

In addition to the increases in marijuana use, implementation of an MML also increases the frequency of binge drinking among those aged 21 or above, partially through increasing simultaneous use of the two substances. In contrast, MML implementation does not affect underage drinking among those aged 12–20. In both age groups, non-medical use of prescription pain medication, heroin use, and cocaine use are unaffected.

Overall, our findings indicate that state implementation of an MML increases marijuana use, but has limited impacts on other types of substance use (i.e., underage drinking, pain medication misuse, and hard drug use), except for binge drinking among adults of legal drinking age.

The article proceeds as follows. Section 1 provides background information on medical marijuana and MMLs, outlines the theoretical framework, and summarizes the existing literature. Section 2 describes the data sources, variable measurement, and identification strategy. Section 3 presents the estimated policy effects, and the robustness checks. Concluding remarks are given in the last section of the article.

## 1. Background

### 1.1. Medical marijuana law and potential risks and medical value of marijuana

In the last two decades, growing evidence has lent support to the efficacy and safety of marijuana as medical therapy to alleviate symptoms and treat diseases (see, for instance, Ben Amar, 2006; Campbell and Gowran, 2007; Krishnan et al., 2009; Pertwee, 2012; Gloss and Vickrey, 2012). This growing body of clinical evidence on marijuana's medicinal value has propelled many states toward a more tolerant legal approach to medical marijuana. In 1996, California signed the Compassionate Use Act into law (Proposition 215) and became the first state in the U.S. to permit the medical use of marijuana. And since then a total of 23 states and the District of Columbia have passed MMLs. These laws are intended to protect patients from state prosecution for their medical marijuana use (Hoffmann and Weber, 2010).<sup>2</sup>

Typically under an MML, a patient with an eligible condition should first obtain recommendation from a qualified doctor for the use of marijuana in medical treatment. With the doctor's recommendation for medical marijuana use, the patient can then be issued a medical marijuana patient identification card by the state. The patient ID cardholder and his/her caregivers are allowed to possess a certain amount of marijuana through cultivation at home and/or purchase from a nonprofit retail dispensary licensed by the state (in some states called "compassionate center").<sup>3</sup> As such, MMLs in principle should only provide restricted legal protection

and access to marijuana for a select group of patients. In practice however, the laws may have a spillover effect on marijuana use in the non-patient population.

The spillover effect may arise from four dimensions of the existing MMLs that create a de facto legalized environment for marijuana use in the general population (Pacula et al., 2013). First, although all MMLs specify a list of conditions that are eligible for medical marijuana,<sup>4</sup> most MMLs include in the list a generic term "chronic pain", rather than specific diseases causing the pain (e.g., neuropathy, fibromyalgia, rheumatoid arthritis, etc.) (Pacula et al., 2013). The interpretation of "chronic pain" can go far beyond the original legislative intent, analogous to the practice of off-label prescribing of other medications. Because pain can often be non-descript and difficult to verify clinically, a recreational user may pretend to be a pain patient in order to obtain a prescription for medical marijuana.

Second, some MMLs do not require establishment of a registry/renewal system to assess and monitor patient eligibility for medical marijuana. This, coupled with the loosely-defined eligibility criteria, further blurs the boundary between the patient and the non-patient population (Cohen, 2010).

Third, MMLs provide medical marijuana patients with access to the drug by allowing licensed retail dispensaries and/or home cultivation. These supply channels exist in a legal grey area and may proliferate as a result of the reduced threat of prosecution under the MMLs (Pacula et al., 2010). In particular, Anderson et al. (2013) provided empirical evidence that MMLs have led to a substantial increase in the supply of high-grade marijuana. As marijuana supply rises, it may become prohibitively expensive for law enforcement to ensure that the entire supply of marijuana intended for medical purpose ends up in the hands of legitimate patients, akin to how prescription opioids eventually find their way into the street drug market. This spillover to the non-patient population is likely to occur in places where marijuana possession is decriminalized, prosecution of a marijuana offense is local law enforcement's "lowest priority", and federal interference in marijuana regulation is limited (Sekhon, 2009).

In addition to those specific components of the law, an MML as a whole symbolizes liberalization of marijuana policy, which in turn, may give rise to the underestimation of the risks associated with marijuana use and the normalization of marijuana use for recreational purposes (Hathaway et al., 2011).

### 1.2. Literature on the effect of MML on marijuana use in the general population

Empirical evidence is inconclusive with respect to the effect of an MML on marijuana use in the general population. A review of this line of literature is beyond the scope of our paper. We direct readers to Chu (2014) for a comprehensive review. Briefly, however, we note that the mixed findings from the previous studies can be explained by the heterogeneity between different age groups examined and the variation in specific state laws covered by the studies.

Studies on youths generally find no significant effect of an MML on youth marijuana use (e.g., Harper et al., 2012; Lynne-Landsman et al., 2013; Anderson et al., 2011, 2012). The most comprehensive evidence comes from Anderson et al. (2011, 2012), which brings

<sup>2</sup> In contrast to the state MMLs, federal law continues to prohibit marijuana use for any purpose since the enactment of the Controlled Substances Act (CSA) of 1970. A 2005 Supreme Court decision (Gonzales v. Raich) reaffirmed that federal law enforcement has the authority to prosecute patients for medical marijuana use in accordance with state laws (Gostin, 2005). It is only recently that the Obama administration and the Department of Justice clarified the position that federal law enforcement resources should not be dedicated to prosecuting persons whose actions comply with their states' permission of medical marijuana (Hoffmann and Weber, 2010). This change in the prosecutorial stance would strengthen the legitimacy of existing MMLs and pave the way for the passage of new MMLs.

<sup>3</sup> Several more recent MMLs have taken innovative twists that are intended to tighten the regulation on access to medical marijuana. For instance, New York's 2014 MML is the first in the U.S. to allow doctors in qualified hospitals to prescribe medical marijuana instead of recommending it. By allowing for medical marijuana prescription, the law in effect imposes more responsibility on the participating

doctors for certifying patients' medical need, as a doctor can be charged with a felony for prescribing marijuana to an ineligible patient.

<sup>4</sup> California is the only exception that allows medical marijuana for any condition "for which marijuana provides relief" and leaves the interpretation almost entirely to the discretion of doctors.

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