Commentary

Prevalence of marijuana use does not differentially increase among youth after states pass medical marijuana laws: Commentary on Stolzenberg et al. (2015) and reanalysis of US National Survey on Drug Use in Households data 2002–2011

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A B S T R A C T

There is considerable interest in the effects of medical marijuana laws (MML) on marijuana use in the USA, particularly among youth. The article by Stolzenberg et al. (2015) "*The effect of medical cannabis laws on juvenile cannabis use*" concludes that "implementation of medical cannabis laws increase juvenile cannabis use". This result is opposite to the findings of other studies that analysed the same US National Survey on Drug Use in Households data as well as opposite to studies analysing other national data which show no increase or even a decrease in youth marijuana use after the passage of MML. We provide a replication of the Stolzenberg et al. results and demonstrate how the comparison they are making is actually driven by differences between states with and without MML rather than being driven by pre and post-MML changes within states. We show that Stolzenberg et al. do not properly control for the fact that states that pass MML during 2002–2011 tend to already have higher past-month marijuana use before passing the MML in the first place. We further show that when within-state changes are properly considered and pre-MML prevalence is properly controlled, there is no evidence of a differential increase in past-month marijuana use in youth that can be attributed to state MML.

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Introduction

There is considerable interest in the effects of medical marijuana laws (MML) on marijuana use in the USA, particularly among youth. The article by Stolzenberg, D'Alessio, and Dariano (2015) "*The effect of medical cannabis laws on juvenile cannabis use*" reports an analysis of data from the U.S. National Survey on Drug Use in Households (NSDUH). The article concludes that "implementation of medical cannabis laws increase juvenile cannabis use" and that there is "compelling evidence supporting the

assertion that medical cannabis legislation amplifies recreational juvenile cannabis use because the percent of juveniles using cannabis increased substantially following the passage of a medical cannabis law." This conclusion of a substantial increase in marijuana use from pre to post-MML passage in youth is contrary to the findings from other publications analysing similar NSDUH data (Harper, Strumpf, & Kaufman, 2012; Wall et al., 2011, 2012; Wen, Hockenberry, & Cummings, 2015) and is also contrary to additional findings from analyses of other large national sources of data on youth, specifically the Monitoring the Future (Hasin et al., 2015), the Youth Risk Behavior Surveys (YRBS) (Anderson, Hansen, & Rees, 2015; Pacula, David, Paul, & Eric, 2015), and the National Longitudinal Survey of Youth (Pacula et al., 2015). These other studies found that the prevalence of marijuana use was higher in MML states compared to states without MML regardless of when the MML was passed. However, these other studies

uniformly found either no difference in the prevalence of adolescent marijuana use comparing before to after the passage of MML (Anderson et al., 2015; Harper et al., 2012; Pacula et al., 2015; Wen et al., 2015), or a decrease in marijuana use comparing before to after the passage of MML (Hasin et al., 2015). Careful assessment of the analytical strategy chosen by Stolzenberg et al. indicates that the statistically significant increased association they report between MML and past-month marijuana use is the result of a biased comparison and thus, the conclusions of Stolzenberg et al. are not supported by the data.

In this commentary, we provide a replication of the Stolzenberg et al. results and demonstrate how the comparison they are making is actually driven by differences between states with and without MML rather than being driven by pre and post-MML changes within states. We show that Stolzenberg et al. do not properly control for the fact that states that pass MML during 2002–2011 (the years of NSDUH data that are available) tend to already have higher past-month marijuana use before passing the MML in the first place. We further show that when within-state changes are properly considered and pre-MML prevalence is properly controlled, there is no evidence of an increase in past-month marijuana use in youth that can be attributed to state MML.

The available NSDUH state-level data

A limitation of using the NSDUH data to examine the effects of MML state policy, i.e., whether rates of marijuana use change within states after passage of MML, is that the NSDUH state-level data used by Stolzenberg et al. were only available for a relatively short time frame, 2002–2011, although states have been passing MML since 1996. Of the 23 states that currently (as of 2015) have MML, only eight passed their laws between 2002 and 2011. This leaves 15 states with either no pre-MML or no post-MML data

available between 2002 and 2011 for analysing within state pre and post-MML comparisons.

Fig. 1 shows the raw state NSDUH data used by Stolzenberg et al. in the analysis (not shown in the original article). The data are organized into 3 panels to emphasize the 3 different types of states (from left to right): (1) the 34 states that did not pass MML by 2011 (note 7 of these states passed laws after 2011 up until 2015 but are treated as in Stolzenberg et al. as "No Law" states); (2) the 8 states that passed MML between 2002 and 2011, for which NSDUH pre- and post-MML data are available; and (3) the 8 states that already had MML prior to 2002 (in these states, NSDUH data can only inform about post-MML levels of use since no pre-MML data are available). Note that the 5 observations plotted over time for each state are collapsed by NSDUH into 2-year intervals (i.e. 2002–2003, 2004–2005, 2006–2007, 2008–2009, 2010–2011). In the second panel, representing the 8 states in which MML was passed between 2002 and 2011, the dots represent the specific year in which the MML was passed, specifically: Arizona (2010), Delaware (2011), Michigan (2008), Montana (2004), New Jersey (2010), New Mexico (2007), Rhode Island (2006), and Vermont (2004). In the Stolzenberg et al. article and also in this re-analysis of data, a state was treated as having the law in the year the law was passed, and in all subsequent years. Because of the two-year collapsing of the data by NSDUH, Rhode Island (2006) and New Mexico (2007) are treated as passing their MML at the same time (i.e. 2006–2007) and Delaware (2011) is treated as passing the MML at the same time as Arizona (2010) and New Jersey (2010) (i.e. 2010–2011), leading to less pre and post-MML passage information.

Descriptive statistics replication and re-analysis

The average past month marijuana use among 12–17 year olds of the 34 states without MML across the 5 time points (10 years) is
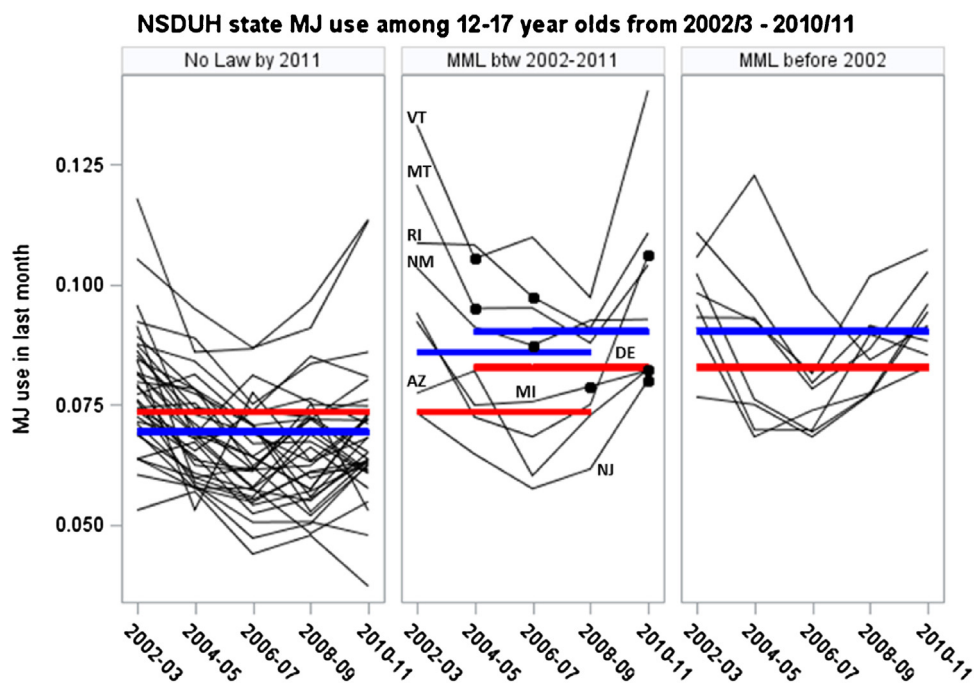
Fig. 1. State level NSDUH prevalence of past month marijuana (MJ) use for 12–17 year olds in all 50 states from 2002 to 2011 stratified by MML status with overlay of fitted means from regression Model 1 (red) and Model 2 (blue). * Dots in middle panel indicate year MML passed for those 8 specific states (abbreviation of states shown) that passed during 2002–2011. The two fitted regression lines for each Model in the middle panel indicate pre and post-MML passage fitted mean values. Pre is the line staggered to the left, post is the line staggered to the right. Note: State-level NSDUH data used herein for 2002–2003, 2004–2005, 2006–2007, 2008–2009 were compiled at an earlier date from SAMHSA http://www.samhsa.gov/samhda. As of 11/9/2015 the web archive is unavailable. Data for 2010–2011 are available from http://archive.samhsa.gov/data/NSDUH/2k11State/NSDUHsae2011/ChangeTabs/NSDUHsaeChangeTabs2011.htm. (For interpretation of the references to colour in this legend, the reader is referred to the web version of the article.)