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The impact of recreational marijuana sales legalization on workplace injuries

Xiuming Dong
Johns Hopkins University

Abstract

This paper estimates the impact of recreational marijuana sales legalization on workplace injuries. Using restricted-use Workers' Compensation claims as a proxy for injuries and a Difference-in-Differences model, I compare the injury rate before and after sales legalization for high recreational marijuana exposure counties to the same difference for low exposure counties in Oregon. My estimates suggest sales legalization increases workplace injuries. The event study result suggests the medium-term effects appear to equal the short-term effects. Finally, the effect is strongest for: young workers; male workers; construction and transportation occupations; and the increase in the injuries is mainly due to falling.

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Contact: Xiuming Dong - xdong29@jhu.edu.

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1 Introduction

Nearly 1 in 3 USA citizens are residing in a state where recreational marijuana is available. After states pass the recreational marijuana law, workplace drug test positivity rates have shown a strong increase since the passage of the recreational marijuana law. This rise only holds for marijuana and not for other drug categories.[1] The epidemiological literature documents that marijuana use can have adverse health effects, such as impaired cognition, altered judgment, etc. (Volkow et al., 2014; Hall, 2015). This evidence suggests that marijuana use may create negative externalities in the workplace due to the increase in injury risk.

This paper examines the impact of recreational marijuana sales legalization (RML) on workplace injuries. Using restricted-use Workers' Compensation claims as a proxy for injuries and a Difference-in-Differences model, I find the workplace injury rate is about 4% higher for treated relative to control counties after the implementation of RML in Oregon. The event study result suggests the medium-term effects appear to equal the short-term effects. The detailed Workers' Compensation claims data allows for the assessment of heterogeneous effects across workers' age group, gender, occupation, and source of injury. I find the effect is strongest for (i) young workers, (ii) male workers, (iii) construction and transportation occupations, and (iv) the increase in the injury rate after RML are mainly due to falling.

This paper relates to a growing literature that studies how marijuana policies affect social, economic, and public health outcomes (Anderson et al., 2018, 2014; Hansen et al., 2018; Chan et al., 2020; Dong, 2020). Specifically focused on the labor market outcomes Sabia and Nguyen (2018) conclude that the labor market effects of Medical Marijuana Laws (MMLs) are small. Ghimire and Maclean (2020) find a modest reduction in Workers' Compensation claiming post MML, suggesting medical marijuana may allow workers to better manage symptoms associated with workplace injuries and illnesses. Dong (2021) documents the probability of overall Monday injuries increasing by four percentage points after recreational marijuana sales legalization. Abouk et al. (2021) use state-level variation and show that Worker's Compensation benefit receipt among older adults declines after marijuana legalization. This paper also relates to the extensive economic literature with regard to the impact of substance use on workplace injuries. Ohsfeldt and Morrisey (1997) show that alcohol taxes (most commonly beer taxes) are negatively correlated with workdays lost due to industrial injuries. Kaestner and Grossman (1998) show that for young adult males, there is evidence that drug use is positively related to workplace accidents, but for young adult females, the evidence suggests that there is no systematic relationship between drug use and workplace accidents. However, they use self-reported survey data to proxy for drug use and are silent on the causal relationship.

This paper contributes to the current literature by studying the impact of recreational marijuana sales legalization on workplace injuries and highlights several important heterogeneity effects across gender, age group, occupation, and injury source. From a policy perspective, the findings in this study have implications that suggest legalizing recreational marijuana sales may come at the expense of workplace safety, at least in the short run.

[1] As an example, Figure A1 shows marijuana sales and the workplace drug test positivity rate over time in Oregon.

2 Data

The workplace injury data comes from the Oregon Department of Consumer and Business Services, Workers' Compensation Division. It is restricted-use accepted disabling Workers' Compensation claims from 2013-2017. For each claim, the data contains information on the claimant's gender, age group, date of injury, county of injury, claimant's occupation, and detailed information on the injury source. For analysis, I collect employment counts for each county from the American Community Survey (ACS) 2010 5-year estimates to create the monthly injury rate, calculated as the injury number per 1,000 employment.

Next, I use monthly administrative marijuana sales records from the "traceability" system maintained by Oregon Liquor and Cannabis Commission (OLCC). Oregon passed the recreational marijuana law on November 2014, and the sales market opened on October 2015. The sales data has monthly county-level recreational marijuana sales in dollars by product type and quantity of sales. To create a recreational marijuana exposure measure, I define *sales-per-capita* as the total sales of recreational marijuana in the analysis period divided by the population in each county, where the population is also from the ACS 2010 5-year estimates. This measure serves as a proxy for the interaction of actual demand and supply of recreational marijuana.

3 Empirical Analysis

To identify the impact of RML on workplace injuries, I estimate the following Difference-in-Differences (DiD) regression at the county level:

$$InjuryRate_{jt} = \alpha + \lambda_1 HighExp_j * After_t + \lambda_2 HighExp_j + \delta_j + \theta_t + X_{jt} + \varepsilon_{jt}. \quad (1)$$

Where $InjuryRate_{jt}$ represents injury number per 1000 employment for county j in time t. $HighExp_j$ is a dummy variable that takes a value of 1 when counties who have *sales-per-capita* above 75thpercentile, and 0 otherwise.[2] The standard errors are clustered at the county level. The coefficient λ_1 provides a reduced form estimate of the impact of RML on the workplace injury rate.

Table 1 panel A presents baseline results from Equation 1 that analyzes the effect of RML on the overall workplace injury rate. Column (1) shows that RML increases workplace injury rates by 0.034 per 1000 employment among high recreational marijuana exposure counties relative to low recreational marijuana exposure counties after RML. Given the average monthly injury rate in the sample is 0.913 per 1000 employment, the effects translate into about a 4% increase in the workplace injury rate. Since the dependent variable has a small number of zeros, column (2) shows the result is similar when using a Tobit regression. My estimates suggest that RML increases work injury costs roughly by $7 to $25 million per year. With the sum of the treated counties' population being 1.4 million, my results indicate that RML increases injury costs by $5 to $18 per capita per year.

The DiD results above show the impact of RML on injury rate over the analysis period. Next, I implement an event study model to further estimate and visually illustrate the dynamic effect of

[2] Table A1 shows the robustness check result that relaxes the 75th percentile treatment threshold. The coefficients show a consistent magnitude with the main result, and only counties that are "very" exposed to recreational marijuana have statistically significant results from RML.

Table 1: The Effect of Recreational Marijuana Sales Legalization

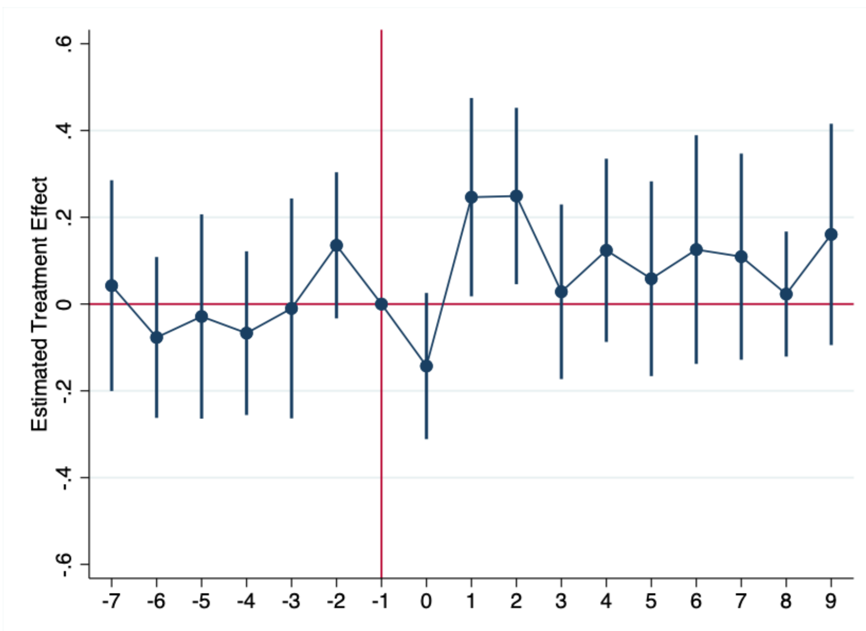
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Baseline	*OLS*	*Tobit*								
HighExp*After	0.034**	0.035**								
	(0.016)	(0.014)								
Control Mean	0.913	0.913								
Panel B: By Gender	*Female*	*Male*								
HighExp*After	0.010	0.024*								
	(0.009)	0.013)								
Control Mean	0.301	0.612								
Panel C: By Age	*Under 18*	*18-24*	*25-34*	*35-44*	*45-54*	*55-64*	*Above 65*			
HighExp*After	0.000	0.006**	0.010*	0.005	0.007	0.001	0.005**			
	(0.001)	(0.003)	(0.005)	(0.004)	(0.006)	(0.007)	(0.002)			
Control Mean	0.008	0.096	0.182	0.192	0.221	0.179	0.035			
Panel D: By Injury Source	*Overexertion*	*Fall*	*Struck*	*Transportation*	*Expose*	*Personal*	*Animal*	*Fire*	*Others*	
HighExp*After	0.004	0.026***	0.006	-0.002	0.001	0.001	-0.001	-0.000	-0.003	
	(0.007)	(0.008)	(0.006)	(0.002)	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	
Control Mean	0.353	0.248	0.180	0.044	0.022	0.027	0.010	0.003	0.026	
Panel E: By Occupation	*Management, Professional*	*Social, Legal, Educational Service*	*Art, Entertainment, Sports*	*Healthcare Support*	*Food, Cleaning, Sales*	*Office, Administrative Support*	*Construction, Installation, Extraction*	*Transportation, Material Moving*	*Military*	*Others*
HighExp*After	0.002	0.003	0.002*	0.001	0.004	0.005**	0.012**	0.013***	-0.000	-0.009
	(0.004)	(0.002)	(0.001)	(0.006)	(0.005)	(0.002)	(0.005)	(0.004)	(0.000)	(0.006)
Control Mean	0.041	0.025	0.003	0.119	0.147	0.036	0.146	0.155	0.000	0.136
Observations	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160

Note: The table reports the DiD estimates from Eq.(1). HighExp is defined as sales-per-capita that are above 75^{th} percentile. After=1 if the injury rate is after October 2015. Standard errors are clustered at the county level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

RML on the overall workplace injury rate over time. Specifically, I decompose the binary $After_t$ time indicator in Equation 1 into a series of leads and lags around the effective date of RML (October 2015). To do this, I construct indicators for more than seven quarters through one quarter in advance of the RML, the effective quarter of the RML, and one through more than nine quarters following the RML. Doing so, I center the data around the implementation of RML, with the quarter prior to the passage as the reference time.

Figure 1 shows the event study results. The x-axis shows the normalized time dimension in quarters. The y-axis shows the estimated treatment effect. I also plot the point estimates with 95% confidence intervals. All estimates for the time prior to RML are small in magnitude and statistically insignificant, suggesting there are no differential trends between treatment and control groups. Additionally, there is an immediate increase in the injury rate after RML. This dynamic pattern of RML effects is important. In particular, this pattern suggests significant increases in injury rate during the first two quarters after RML. In subsequent quarters, I observe positive point estimates, although the statistical power decreases. This suggests the medium-term effects appear to equal the short-term effects.

Figure 1: Event Studies from Difference-in-Differences Models



Note: The graph shows the event study based on Eq.(1). The errors terms are clustered at the county level and the blue bars depict 95% confidence intervals.

To further understand the economic costs of RML on workplace injuries, it is important to discover the disaggregate effects of RML. The detailed Oregon Workers' Compensation claims data allows for the assessment of the heterogeneous effects of RML by age, gender, occupation, and source of injury using the DiD model in Equation 1. Panels B to E of Table 1 show the results to see if particular subsample(s) drives the positive result from the main analysis.

Panel B presents the results by gender. I find that males are most affected by RML. Specifically, column (2) shows that RML increases the injury rate among male workers for 0.024 per 1000 employment in high exposure counties relative to low exposure counties. With the mean injury rate for male workers of 0.612 per 1000 employment, the effect translates into about a 4% increase.

Panel C presents age group results. It shows that RML's impact mainly on those aged 18-34 and over 65 workers. Specifically, RML increases the injury rate among 18-24 years-old workers by approximately 6%. Moreover, RML increases the injury rate by about 14% among 65 years old and above workers. Panel D shows the estimates of RML's impact by the source of injury. The results indicate that the main source of workplace injury after RML is falling. Specifically, falling increased by 10.5% after RML. Lastly, panel E shows the heterogeneity effects of RML by occupation. It demonstrates that construction-related and transportation are the most impacted occupations. The results translate into about 8.2% and 8.4% increase, respectively.

4 Conclusion

The landscape of marijuana policies is changing rapidly. This has led to a heated discussion on its impact on social, economic, and public health outcomes, both positive and negative. This paper estimates the effect of recreational marijuana sales legalization on workplace injuries. Using administrative workers' compensation claims as a proxy for workplace injury rate, I answer this question by exploiting variations in the county-level implementation of recreational marijuana law in Oregon.

To the best of my knowledge, it is the first few studies to analyze the impact of recreational marijuana sales legalization on workplace injury rate that highlights several important heterogeneity effects across gender, age group, occupation, and injury source. From a policy perspective, the findings in this study have implications that suggest legalizing recreational marijuana sales may come at the expense of workplace safety, at least in the short run.

One limitation of this paper is that there are different forms of recreational marijuana sales legalization in the US. Future research on the impact of sales legalization on workplace injuries in different legalization contexts is crucial to understanding the generalized sales legalization impact on workplace injuries. Additionally, future research on the long-run impact of sales legalization on other economic agents' behavior, such as firms, workers, and insurance companies, is important to understand the full labor market impact of sales legalization.

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Appendix

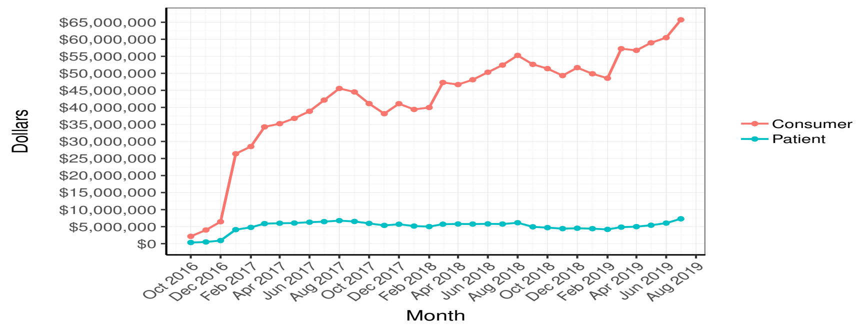
Table A1: The Effect of RML, by Different Treatment Cutoff

	(1)	(2)	(3)
	injuryrate	injuryrate	injuryrate
HighExp50*After	0.012		
	(0.014)		
HighExp75*After		0.034**	
		(0.016)	
HighExp90*After			0.028**
			(0.012)
DV Mean	0.879	0.913	0.880
R-squared	0.578	0.565	0.579
N	2,160	2,160	2,160

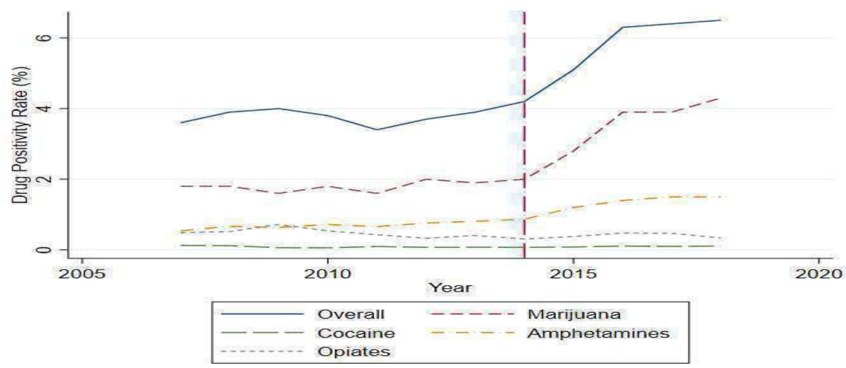
Note: The table reports the DiD estimates from Eq.(1). HighExpX is defined as sales-per-capita that are above X (=50th, 75th, or 90th) percentile. After=1 if the injury rate is after October 2015. Standard errors are clustered at the county level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Figure A1: Oregon Monthly Marijuana Sales and Workplace Drug Positivity Rate

Panel A:



Panel B:



Note: Panel A is the Oregon monthly marijuana sales from the Oregon Liquor and Cannabis Commission. The red line indicates recreational marijuana sales, and the blue line represents medical marijuana sales. Panel B is the workplace drug positivity rate by drug category in Oregon from Quest Diagnostics. The vertical dashed red line is the recreational marijuana law passage year.