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Original Paper

Analysis of the Impact of Marijuana Legalization on Smoking among Adolescents before the Age of 13

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Abstract

Adolescent smoking, with its detrimental effects on working memory and increased likelihood of heavy smoking when initiated at a younger age, this paper examines whether marijuana decriminalization policies affect adolescents' likelihood of smoking before age 13. This paper mainly uses the stack Difference In Difference method to judge the relationship between the two and further proves the time-invariant through the stack event study method. Moreover, the CS model (double robust) was used to observe the different effects of different periods. This study attempts to discover the causes of early adolescent smoking and, to some extent, verify the possibility that cigarettes and marijuana are complementary commodities. This study found that marijuana decriminalization policies increased adolescents' likelihood of smoking before age 13 by about 0.173%. At the same time, the time study shows that the policy may have a lag effect.

Keywords

adolescent, early smoking, marijuana decriminalization, stack Difference In Difference

1. Introduction

Adolescent smoking is a significant concern for adolescent health. Research has demonstrated that adolescent smokers exhibit impaired working memory performance, with the decline worsening the earlier they begin smoking. Additionally, adolescent smokers experience further impairment of working and verbal memory during quitting. However, quitting is undeniably a better option than becoming a long-term smoker. Successfully delaying the onset of smoking may increase the likelihood of quitting, thus helping to reduce smoking-related mortality and morbidity. The rate at which adolescents begin smoking rapidly increases after age ten and peaks at ages 13 to 14. Students who start smoking at age 12

or younger are more likely to become heavy, regular smokers than those who begin at an older age. While it may be unrealistic to eliminate smoking among young people, the focus should be on preventing early initiation. From an economic perspective, it is worth considering the relationship between cigarettes and marijuana as complementary or substitutable goods, especially in light of research suggesting that higher cigarette prices effectively decrease youth smoking while not leading to an increase in marijuana use. This prompts speculation regarding the potential impact of marijuana policy changes on reversing adolescent smoking behavior.

Marijuana legalization policies can be categorized into three types: medical marijuana, decriminalized marijuana, and recreational marijuana. Although more than 70% of states have legalized medical marijuana, access to medical marijuana remains highly restricted for teenagers. Similarly, legalizing recreational marijuana and providing easy access to commercial marijuana sales could lead to extreme outcomes. In contrast, decriminalization is a relatively moderate policy proposal that would not increase access to marijuana or permit advertising for its use, thus avoiding the influence of unobservable omitted factors on the outcome. This paper focuses on marijuana decriminalization. The author will explore the relationship between marijuana decriminalization and the likelihood of adolescents smoking before age 13. In this study, stack Difference in Difference will be used as the main method for analysis, and stack event study will be used to further verify the influence of time-invariant. And the double robust method is used to observe the differences between different time points under different policy release times. Based on the findings, recommendations for adolescent health and policy development will be provided to create a more comprehensive and practical approach to address this crucial issue.

2. Methodology

2.1 Data Acquisition

The Youth Risk Behavior Surveillance System (YRBSS) is a large-scale surveillance program developed and implemented by the Centers for Disease Control and Prevention (CDC). The project aims to gather information on critical health risk behaviors among U.S. middle and high school students, encompassing areas such as physical activity, poor diet, obesity and weight control, tobacco use, alcohol and other drug use, sexual behavior, and unintentional injuries and violence. Initiated in 1991, YRBSS has conducted surveys every two years, employing stratified cluster sampling to draw representative samples from secondary school students across the nation. The extensive data and extended time span offer flexibility for data construction and utilization in various forms. This study utilizes YRBSS survey data from middle school students in Alabama, California, Colorado, Delaware, Florida, Hawaii, Illinois, Kentucky, Maine, Maryland, Mississippi, Nevada, New Mexico, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, West Virginia, Wisconsin, and Wyoming, spanning from 1999 to 2019. The data have been processed and analyzed, adhering to rigorous academic standards, to provide insights into the health risk behaviors of middle school students and inform future research and policy development.

Table 1. Summary Statistic

Variables									
Age						Stratum			
Group	Stack	Mean	Max	Min	Sd	Mean	Max	Min	Sd
0	1	14.76	18	12	1.03	15.22	69	1	13.13
1	1	14.67	18	12	0.99	10.83	64	1	9.91
0	2	14.7	18	12	1.03	14.82	69	1	12.25
1	2	14.68	18	12	1.02	6.77	12	1	3.29
0	3	14.64	18	12	1.02	15.2	69	1	11.9
1	3	14.9	18	12	1.04	18.99	46	1	13.05
0	4	14.68	18	12	1.02	15.63	69	1	12.67
1	4	14.42	18	12	0.96	60.04	127	1	35.06
Sex						PSU			
Group	Stack	Mean	Max	Min	Sd	Mean	Max	Min	Sd
0	1	0.49	1	0	0.5	2.24	36	1	2.5
1	1	0.49	1	0	0.5	2.56	15	1	2.12
0	2	0.49	1	0	0.5	2.53	44	1	3.5
1	2	0.5	1	0	0.5	1.7	9	1	1
0	3	0.49	1	0	0.5	2.93	44	1	3.99
1	3	0.5	1	0	0.5	2.5	9	1	1.49
0	4	0.49	1	0	0.5	2.68	44	1	3.8
1	4	0.49	1	0	0.5	4.89	31	1	4.86

Note. Group 0 is the clean control group, and Group 1 is the treatment group. Stack is the number of sub-experiments classified by the year of policy released.

2.2 Empirical Strategy

This paper employs the Stack Difference in Difference method to investigate the relationship between marijuana decriminalization and teenagers smoking before 13 years old. Marijuana decriminalization policies have been enacted at different times; several steps have been taken to ensure a sufficient time horizon and minimize the impact of other policies. First, we define a time window K_a and K_b, with $K_a = K_b = 4$. This means that for each policy issuance, the data includes at least four years of pre-treatment data and four years of post-treatment data. Second, all policy adoption years that comply with the event window $\Omega_A = \{A_s | T_0 + K_a \leq A_s \leq T_t - K_b\}$, where T_0 is the earliest calendar period in the data, and T_t is the latest calendar year in the data, are considered. Only marijuana decriminalization policies meeting this condition are used. Let d=1…D index the collection of sub-experiments in Ω_A. Each sub-experiment is regarded as a stack h, with hd representing the policy adoption date of the d'th sub-experiment. In each sub-experiment, all "treated units" share the same adoption date, and only units with $A_s > h_d + K_b$ are included as controls in sub-experiment d. In each stack, the same clean control group is employed. Finally, all observations in sub-experiment d, $h_d - K_a \leq t \leq h_d + K_b$ must come from periods that fall inside the sub-experiment event window. After organizing the data, the research begins by presenting reduced-form estimates of the impact of marijuana decriminalization on whether adolescents will smoke before age 13. In particular, the following regression equation is utilized:

$$Y_{isth} = \beta_1 T_{ih} * YAE_{isth} + \beta 2 X_{isth} + \alpha_{sh} + \lambda_{th} + e_{isth}$$

Where i represent the unit index, s represents the state index, t represents the year index, and h represents the stack index. Y_{isth} is a binary variable indicating whether unit I at time t in state s and stack h smokes. Tih is the treatment dummy variable, denoting whether unit i in stack h is treated. YAE_{isth} is the number of years affected by the policy when unit i at year t in state s, and stack h is age 13, represented by YAE $\in$ [13 - (Wh - ti) - agei] $\geq$ 0. X is a set of other covariates, including age, sex, PSU, and stratum. αsh is the state-fixed effect in stack h, and λth is the year-fixed effect in stack h. The analysis focuses on β_1.β_1 represents the correlation between marijuana decriminalization policy and whether adolescents will smoke before age 13. The Stack Difference in Difference specification averages all time-varying effects into a single averaged effect, free from new biases. However, it does not "reveal" time-varying effects. To obtain a clearer picture of time changes, the STACK event study is used, with the regression equation taking the following form:

$$Y_{isth} = \sum_{n=-3}^{3} \beta_n YSE_{isth} + \sum_{m=-3}^{3} \beta_m (T_{ih} * YSE_{isth}) + \beta_2 X_{isth} + \alpha_{sh} + \lambda_{th} + e_{isth}$$

YSE is the number of year has been affected by policy when the unit is 13 , represent as simple YSE_{isth} = [13-(Wh-ti)-agei].

3. Results and Analysis

Table 2. Regression Results

	Dependent variable:	
	Smoke	Smoke
Years since effect post	-0.00641***	0.00606***
	(0.00046)	(0.00056)
Marijdecrim: years since effect post	0.00141*	0.00173**
	(0.00076)	(0.00076)
Age		0.01152***
		(0.00029)
Sex		0.00408***
		(0.00046)
PSU		0.00006
		(0.00007)
Stratum		0.00006***
		(0.00002)
Year stack fixed effect	YES	YES
State stack fixed effect	YES	YES
Observations	609,822	
R2	0.00033	
Adjusted R2	0.00019	
F Statistic	100.15160*** (df = 2; 609736)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

In the first column of Table 2, the coefficient of years since the effect post for the treatment group is positive and significant at the 10% level. When no control covariates are included, the marijuana decriminalization policy increases the likelihood of adolescents smoking before age 13 by approximately 0.1%. In the second column of Table 2, after controlling for fixed effects and covariates, the coefficient for the treatment group of years since effect post remains positive and significant at the 5% level. This suggests that the marijuana decriminalization policy notably impacts adolescent smoking behavior.

Simultaneously, age and gender are positively correlated with smoking before age 13, both significant at the 1% level. This is consistent with previous research findings, which indicate that males are more likely to smoke than females and the likelihood of smoking increases with age or grade level. To further investigate the time-invariant effect on the experiment, the results of the STACK event study provide valuable insights into the dynamic relationship between the marijuana decriminalization policy and the likelihood of adolescents smoking before the age of 13.

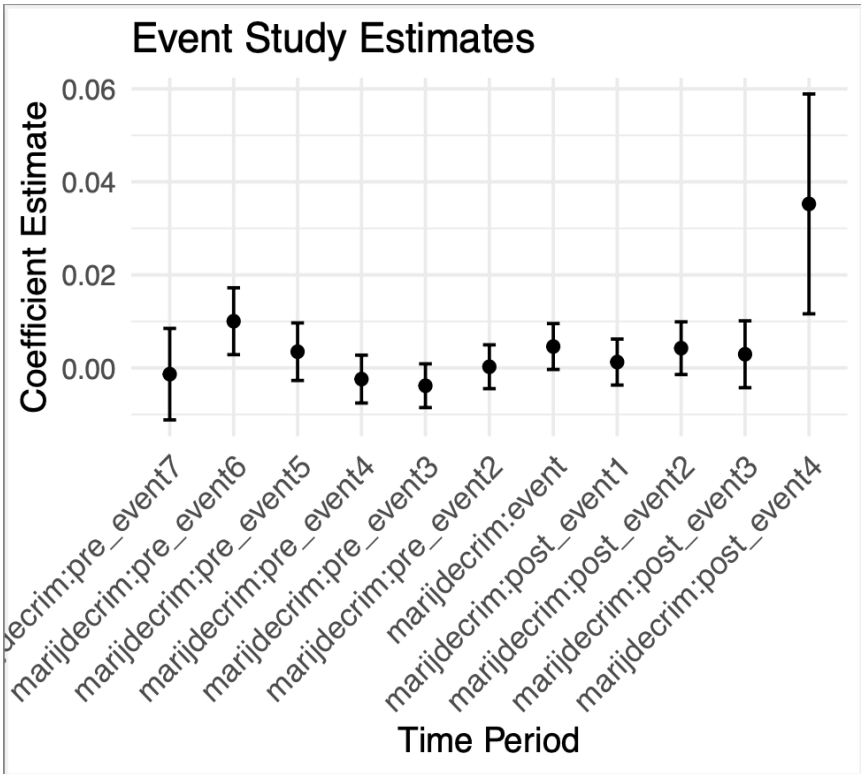

Figure 1. Stack Event Study Results

The study reveals that the policy's impact is not immediate but becomes evident in the fourth year after its implementation. This delayed effect may be attributed to various factors, such as the time required for the policy change to permeate society, shifts in public perception, and the gradual dissemination of information about the policy. It could also be related to the time it takes for adolescents to become aware of the changes in marijuana regulations and adapt their behaviors accordingly due to the

decriminalization of marijuana policy. Moreover, the study's findings emphasize the importance of considering the temporal aspects of policy implementation when evaluating the effectiveness of such interventions. By providing insights into the time required for the policy's impact to manifest, policymakers and researchers gain a deeper understanding of the complex dynamics between marijuana decriminalization and adolescent smoking behavior. This understanding enables them to fine-tune future policies to effectively address these nuances and their potential consequences. The stack event study highlights the significance of accounting for time-invariant effects in policy evaluation, demonstrating that the marijuana decriminalization policy's influence on adolescent smoking behavior becomes apparent four years after its enactment. This finding underscores the necessity of incorporating time dynamics into policy analysis and development, ensuring more effective and targeted interventions to curb adolescent smoking. Furthermore, the study sheds light on different factors' varying degrees of influence on adolescent smoking behavior. For instance, the marijuana decriminalization policy may shape social norms and perceptions surrounding marijuana use, thereby indirectly affecting adolescents' smoking decisions. This also confirms that criminalizing marijuana is a moderate policy, as the stack event study confirms (figure 1), particularly since the effect on whether teens smoke at age 13 does not appear until the fourth year.

Although stack employs the "average" logic, the CS method provides a more detailed examination of the impact changes at different time points, enabling the study of multiple time points simultaneously.

Table 3. CS Model Result

Group-Time Average Treatment Effects:

Group	Time	ATT(g,t)	Std. Error	[95% Simult.	Conf. Band]
2010	1995	-0.4914	0.1887	-2.3368	1.3540
2010	1996	-0.2283	0.1862	-2.0491	1.5925
2010	1997	0.0213	0.0180	-0.1549	0.1975
2010	1998	0.0276	0.0123	-0.0926	0.1478
2010	1999	-0.0294	0.0084	-0.1118	0.0531
2010	2000	-0.0004	0.0074	-0.0724	0.0716
2010	2001	0.0100	0.0075	-0.0630	0.0830
2010	2002	0.0034	0.0084	-0.0787	0.0856
2010	2003	-0.0064	0.0085	-0.0891	0.0762
2010	2004	0.0101	0.0076	-0.0640	0.0841
2010	2005	0.0088	0.0068	-0.0579	0.0756
2010	2006	-0.0060	0.0057	-0.0621	0.0502
2010	2007	-0.0026	0.0053	-0.0549	0.0497
2010	2008	0.0043	0.0058	-0.0527	0.0613
2010	2009	0.0081	0.0059	-0.0495	0.0657
2010	2010	0.0009	0.0052	-0.0502	0.0519
2010	2011	-0.0038	0.0050	-0.0528	0.0452
2010	2012	-0.0055	0.0052	-0.0566	0.0456
2010	2013	-0.0028	0.0058	-0.0600	0.0544
2010	2014	-0.0005	0.0064	-0.0626	0.0616
2010	2015	-0.0082	0.0055	-0.0623	0.0460
2010	2016	-0.0055	0.0049	-0.0538	0.0427
2010	2017	-0.0028	0.0046	-0.0474	0.0418
2010	2018	-0.0090	0.0047	-0.0546	0.0365
2010	2019	-0.0171	0.0059	-0.0743	0.0402
2010	2020	0.0817	0.1167	-1.0597	1.2230
2013	1995	NA	NA	NA	NA
2013	1996	NA	NA	NA	NA
2013	1997	NA	NA	NA	NA
2013	1998	NA	NA	NA	NA
2013	1999	NA	NA	NA	NA
2013	2000	NA	NA	NA	NA
2013	2001	NA	NA	NA	NA
2013	2002	NA	NA	NA	NA
2013	2003	-0.4323	0.1409	-1.8106	0.9460
2013	2004	-0.0037	0.0365	-0.3607	0.3534
2013	2005	-0.0032	0.0136	-0.1358	0.1294
2013	2006	-0.0018	0.0103	-0.1029	0.0993
2013	2007	0.0058	0.0088	-0.0800	0.0916
2013	2008	-0.0160	0.0083	-0.0967	0.0648
2013	2009	-0.0005	0.0073	-0.0715	0.0704
2013	2010	-0.0033	0.0063	-0.0646	0.0579
2013	2011	-0.0041	0.0058	-0.0610	0.0527
2013	2012	0.0127	0.0076	-0.0619	0.0874
2013	2013	0.0486	0.0170	-0.1176	0.2149
2013	2014	0.1721	0.0637	-0.4511	0.7954
2013	2015	NA	NA	NA	NA
2013	2016	NA	NA	NA	NA
2013	2017	NA	NA	NA	NA
2013	2018	NA	NA	NA	NA
2013	2019	NA	NA	NA	NA
2013	2020	NA	NA	NA	NA
2014	1995	NA	NA	NA	NA
2014	1996	NA	NA	NA	NA
2014	1997	NA	NA	NA	NA
2014	1998	NA	NA	NA	NA
2014	1999	NA	NA	NA	NA
2014	2000	NA	NA	NA	NA
2014	2001	NA	NA	NA	NA
2014	2002	NA	NA	NA	NA
2014	2003	NA	NA	NA	NA
2014	2004	NA	NA	NA	NA
2014	2005	NA	NA	NA	NA
2014	2006	NA	NA	NA	NA
2014	2007	NA	NA	NA	NA
2014	2008	NA	NA	NA	NA

2014	2009	-0.3695	0.0625	-0.9806	0.2416
2014	2010	-0.0217	0.0154	-0.1724	0.1290
2014	2011	-0.0065	0.0053	-0.0587	0.0458
2014	2012	-0.0008	0.0038	-0.0383	0.0368
2014	2013	-0.0013	0.0039	-0.0393	0.0367
2014	2014	0.0004	0.0043	-0.0420	0.0429
2014	2015	0.0010	0.0041	-0.0387	0.0406
2014	2016	0.0122	0.0039	-0.0263	0.0507
2014	2017	0.0050	0.0036	-0.0306	0.0407
2014	2018	-0.0047	0.0038	-0.0415	0.0321
2014	2019	-0.0129	0.0049	-0.0608	0.0350
2014	2020	-0.0031	0.0768	-0.7537	0.7474
2015	1995	NA	NA	NA	NA
2015	1996	NA	NA	NA	NA
2015	1997	NA	NA	NA	NA
2015	1998	NA	NA	NA	NA
2015	1999	NA	NA	NA	NA
2015	2000	NA	NA	NA	NA
2015	2001	NA	NA	NA	NA
2015	2002	NA	NA	NA	NA
2015	2003	-0.0655	0.0798	-0.8454	0.7145
2015	2004	-0.0364	0.0206	-0.2380	0.1653
2015	2005	0.0263	0.0095	-0.0669	0.1196
2015	2006	-0.0183	0.0083	-0.0995	0.0630
2015	2007	0.0150	0.0074	-0.0576	0.0876
2015	2008	-0.0246	0.0072	-0.0949	0.0456
2015	2009	0.0121	0.0067	-0.0538	0.0781
2015	2010	0.0006	0.0067	-0.0649	0.0661
2015	2011	-0.0024	0.0063	-0.0636	0.0587
2015	2012	0.0007	0.0052	-0.0504	0.0518
2015	2013	-0.0066	0.0052	-0.0576	0.0443
2015	2014	-0.0050	0.0048	-0.0517	0.0417
2015	2015	0.0076	0.0049	-0.0407	0.0560
2015	2016	0.0145	0.0054	-0.0384	0.0674
2015	2017	0.0144	0.0051	-0.0351	0.0639
2015	2018	0.0140	0.0064	-0.0490	0.0770
2015	2019	0.0266	0.0126	-0.0966	0.1498
2015	2020	-0.0144	0.2025	-1.9943	1.9656
2016	1995	NA	NA	NA	NA
2016	1996	NA	NA	NA	NA
2016	1997	NA	NA	NA	NA
2016	1998	NA	NA	NA	NA
2016	1999	NA	NA	NA	NA
2016	2000	NA	NA	NA	NA
2016	2001	NA	NA	NA	NA
2016	2002	NA	NA	NA	NA
2016	2003	NA	NA	NA	NA
2016	2004	NA	NA	NA	NA
2016	2005	-0.4643	0.0541	-0.9935	0.0650
2016	2006	0.0188	0.0350	-0.3231	0.3607
2016	2007	0.0013	0.0150	-0.1453	0.1480
2016	2008	-0.0221	0.0116	-0.1359	0.0917
2016	2009	0.0210	0.0102	-0.0784	0.1204
2016	2010	0.0065	0.0112	-0.1034	0.1165
2016	2011	-0.0049	0.0111	-0.1138	0.1040
2016	2012	-0.0103	0.0111	-0.1186	0.0979
2016	2013	-0.0080	0.0106	-0.1119	0.0959
2016	2014	-0.0144	0.0075	-0.0877	0.0589
2016	2015	0.0049	0.0035	-0.0297	0.0395
2016	2016	0.0379	0.0097	-0.0572	0.1330
2016	2017	0.0358	0.0082	-0.0443	0.1160
2016	2018	0.0343	0.0073	-0.0367	0.1053
2016	2019	0.0209	0.0119	-0.0958	0.1377
2016	2020	-0.1792	0.0735	-0.8978	0.5394
2019	1995	NA	NA	NA	NA
2019	1996	NA	NA	NA	NA
2019	1997	NA	NA	NA	NA
2019	1998	NA	NA	NA	NA
2019	1999	NA	NA	NA	NA
2019	2000	NA	NA	NA	NA
2019	2001	NA	NA	NA	NA
2019	2002	NA	NA	NA	NA
2019	2003	NA	NA	NA	NA
2019	2004	NA	NA	NA	NA
2019	2005	-0.3279	0.1315	-1.6143	0.9585
2019	2006	-0.0684	0.0309	-0.3703	0.2335
2019	2007	-0.0046	0.0095	-0.0973	0.0880
2019	2008	-0.0163	0.0065	-0.0798	0.0473
2019	2009	0.0064	0.0061	-0.0535	0.0663
2019	2010	-0.0030	0.0058	-0.0597	0.0537
2019	2011	0.0076	0.0063	-0.0544	0.0696
2019	2012	-0.0130	0.0054	-0.0658	0.0398
2019	2013	-0.0011	0.0051	-0.0511	0.0488
2019	2014	0.0181	0.0065	-0.0456	0.0818
2019	2015	0.0019	0.0068	-0.0644	0.0682
2019	2016	-0.0051	0.0059	-0.0624	0.0522
2019	2017	0.0133	0.0049	-0.0346	0.0612
2019	2018	-0.0134	0.0046	-0.0581	0.0314
2019	2019	-0.0071	0.0059	-0.0643	0.0502
2019	2020	-0.1187	0.0935	-1.0335	0.7961
2020	1995	NA	NA	NA	NA
2020	1996	NA	NA	NA	NA
2020	1997	NA	NA	NA	NA
2020	1998	NA	NA	NA	NA
2020	1999	NA	NA	NA	NA
2020	2000	NA	NA	NA	NA
2020	2001	NA	NA	NA	NA
2020	2002	NA	NA	NA	NA
2020	2003	NA	NA	NA	NA
2020	2004	0.1148	0.0407	-0.2834	0.5130
2020	2005	-0.0862	0.0408	-0.4854	0.3130
2020	2006	0.0062	0.0090	-0.0814	0.0938
2020	2007	0.0044	0.0088	-0.0813	0.0902
2020	2008	0.0003	0.0085	-0.0828	0.0834
2020	2009	0.0073	0.0067	-0.0577	0.0724
2020	2010	0.0041	0.0059	-0.0533	0.0615
2020	2011	0.0050	0.0050	-0.0443	0.0544
2020	2012	-0.0006	0.0046	-0.0452	0.0441
2020	2013	0.0008	0.0050	-0.0477	0.0494
2020	2014	0.0057	0.0056	-0.0492	0.0607
2020	2015	0.0025	0.0056	-0.0527	0.0576
2020	2016	0.0023	0.0054	-0.0509	0.0555
2020	2017	0.0037	0.0047	-0.0424	0.0497
2020	2018	-0.0096	0.0049	-0.0570	0.0378
2020	2019	-0.0053	0.0064	-0.0677	0.0570
2020	2020	-0.0863	0.0893	-0.9593	0.7867

Signif. codes: `*' confidence band does not cover 0

P-value for pre-test of parallel trends assumption: 0

Control Group: Never Treated, Anticipation Periods: 0

Estimation Method: Doubly Robust

The results of the double robust analysis can be found in Table 3. Table 3 presents the findings from the CS method, revealing variations in the effects of marijuana decriminalization policies on adolescent smoking behavior at different time points. As can be seen from the results in Table 3, the marijuana decriminalization policy does not significantly affect youth smoking before the age of 13 at the 5% level at the time point. However, at the same time, it should be noted that due to the particularity of the data

(the collection time of different states is different, so the release time of the policy year determines the year included in the data; meanwhile, the YRBSS database is collected every two years, so that the data does not maintain a continuous and complete year), the experimental results may be affected to some extent. Therefore, in this study, the conclusion of stack Difference In Difference may be more accurate because the requirement of secondary data construction is especially emphasized. But by examining the specific impact of the policy across multiple time points, researchers and policymakers can gain valuable insights into the timeline of policy effects and the potential lag in responses among the target population. Understanding these time-varying effects can help inform the development and implementation of more targeted and effective public health strategies. For instance, it may be necessary to increase public awareness campaigns about the risks of adolescent smoking immediately following the enactment of a decriminalization policy or to reinforce ongoing prevention efforts over time. Additionally, monitoring and evaluating the policy's effectiveness regularly may help identify unintended consequences or improvement areas.

4. Conclusion

In conclusion, this study has explored the relationship between marijuana decriminalization and the likelihood of adolescents smoking before age 13. The findings suggest that marijuana decriminalization positively and significantly affects the probability of early smoking initiation among adolescents. Additionally, age and gender are crucial in shaping adolescents' smoking behaviors. Given these findings, policymakers and stakeholders need to consider a multifaceted approach to address the issue of early smoking initiation among adolescents. They are developing targeted interventions to address peer pressure and promote a smoke-free culture among young people, discouraging early smoking initiation. Reviewing and potentially revising marijuana decriminalization policies to ensure that they do not inadvertently increase the likelihood of early smoking initiation among adolescents. It is implementing educational programs that effectively inform adolescents about the negative consequences of smoking, tailored to their developmental stage and cognitive abilities, and utilizing interactive and engaging methods to maximize impact. By adopting a comprehensive approach that considers the factors influencing adolescent smoking behaviors, policymakers and public health professionals can work together to reduce early smoking initiation rates and improve adolescents' overall health and well-being. This study has certain limitations. Controlling potential influencing factors, although the two-way fixed effect helps people avoid some problems, many factors still need to be entirely controlled. The impact of removing marijuana decriminalization policies on the likelihood of adolescents smoking before the age of 13 remains uncertain due to the binary nature of these policies. Additionally, while the study employed an average after stacking approach to increase the sample size, further refinement is necessary. This is evident from the results in Table 3, where the CS model did not yield more detailed outcomes. In the future studies, more diverse and complete data could help people get a better cause-and-effect relationship for issues affecting early teen smoking.

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