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Regional Disparities in Youth Marijuana Use Before and After Recreational Marijuana Legalization: A Longitudinal Examination from 2010 to 2020

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ABSTRACT

Studies have argued that the recent recreational marijuana legalization should increase the accessibility and acceptability of marijuana for youth and elevate youth marijuana use. While many empirical studies have supported this argument and presented the increase in youth marijuana use after the legalization, there has been no study that examines regional disparities in the effect of legalization on youth marijuana use. The examination of regional disparities is important because the different sub-culture and attitudes across regions should cause differentiated situations for youth marijuana use. The current study analyzes eleven-year datasets, "Monitoring the Future: A Continuing Study of American Youth - 12th-Grade Survey" from 2010 to 2020, and investigates the distinctive temporal changes in youth marijuana use across regions before and after marijuana legalization. The results show that the legalization effect is critical in some regions without pre-existing availability of marijuana but not in the other regions with pre-existing availability. This study concludes that policymakers should consider local situations to discourage youth marijuana use more effectively.

Introduction

Since the States of Colorado and Washington legalized recreational marijuana use in 2012, several other states have also adopted this liberal policy on recreational marijuana use. As of May 2022, a total of 17 states[1] and Guam have legalized recreational marijuana sales and consumption, and the State of Vermont and the District of Colombia begin the legitimate sales of recreational marijuana in August 2022 (Hansen, Alas, & Davis, 2022). At the federal level, the House of Representatives has passed the Marijuana Opportunity Reinvestment and Expungement Act in April 2022, and this act is currently waiting for Senate's decision. One of the most important concerns about these legalization trends is their potential negative effect on youth (Lachance, Belanger, Riva, & Ross, 2021; O'Grady, Iverson, Suleiman, & Rhee, 2022). Studies have argued that recreational marijuana legalization should increase the availability of marijuana, reduce its cost, and create a more positive perception of marijuana use, which results in facilitating youth marijuana use (Leung, Chiu, Chan, Stjepanovic, & Hall, 2019; Lachance et al., 2021).

While some scholars insist that the negative effects of marijuana use is minimal and limited (Carliner, Brown, Sarvet, & Hasin, 2017), it is commonly argued that youth marijuana use can cause diverse negative effects. Youths consuming marijuana frequently have experienced adverse health results, which impact their cognitive, biological, and educational performance (Lorenzetti, Hoch, & Hall, 2020). There are also studies showing that youths with heavy marijuana use retain unbalanced brain development, disrupted brain functions,

[1] Alaska, Arizona, California, Colorado, Connecticut, Illinois, Maine, Massachusetts, Michigan, Montana, Nevada, New Jersey, New Mexico, New York, Oregon, Virginia, Washington

and decreased intelligence functioning and I.Q. compared to those who do not consume marijuana (Lees, Debenham, Squeglia, 2021). Furthermore, behavioral studies have revealed psychotic negative moods and addictive behaviors among youths with earlier onset of marijuana use (Hammond, Chaney, Hendrickson, & Sharma, 2020). Considering these critical adverse effects, many studies have examined and tried to clarify if the legalization of recreational marijuana influences youth marijuana consumption (Lachance et al., 2021; O'Grady et al., 2022).

Despite these efforts to clarify the effect of marijuana legalization on youth marijuana use, the findings from studies are not consistent and even conflict with each other. In their recent meta-analysis, Lachance and colleagues (2021) have examined a total of 32 academic studies (11 higher quality and 21 lower quality) and revealed that 40% of higher-quality studies showed an increase in youth/young adult marijuana use after legalization, while 55% did not report any change, and 5% reported a decrease. One systematic review study has also examined 22 research articles on youth marijuana use after legalization and reported that ten studies found no change, six reported a decrease, and seven of them identified an increase (O'Grady et al., 2022). The current study posits that these differentiated effects of legalization should be partially originated from social and cultural traits that differ from region to region. For example, the different social atmospheres across the U.S. regions (i.e., northeast vs. south states) can influence the effect of legalization on youth marijuana consumption. However, the current study has failed to find any previous academic studies that consider these regional impacts in their examination.

To fill this vacancy, the current study intends to examine the temporal changes in youth marijuana use across four different regions in the U.S. from 2010 to 2020. For the examination, this study collects the data from the U.S. states with regard to their legalization statutes. Also, it employs the representative youth survey sample from the Monitoring the Future: A Continuing Study of American Youth (12-Grade Survey) from 2010 to 2020 (11-year data). For the data analysis, the explorative data analysis (EDA) with graphs and tables is introduced. The findings and implications of this study, as well as limitations, are discussed for future studies.

Regional Disparity in Marijuana Use and Legalization

Studies have argued that the percentages of marijuana users differ across states and metro/rural areas (Hughes, Lipari, & Williams, 2016). It is mainly because residents in different areas have disparate attitudes to marijuana use and different perception about the risk of using marijuana (Hughes et al., 2016). Furthermore, these state differences show regional disparities across census regions. According to the U.S. Census Bureau, the U.S. states are grouped into four census regions: (1) Northeast, (2) Midwest, (3) South, and (4) West. The detailed list of states and their geographical locations are presented in Figure 1. And residents in these regions retain significantly different attitudes to marijuana use and disparate marijuana use. For example, Hughes et al. (2016) have found that 32.60 percent in the South region respondents perceive a great risk of harm from using marijuana monthly, while only 25.64 percent in the West, 26.11 percent in the Midwest, and 26.56 percent in the Northeast perceive the risk. These perceptional differences across regions are reflected in their marijuana use. The percentage of marijuana use is highest in the West (9.70%), where the perception of marijuana use risk is lowest, and the percentage of marijuana use is lowest in the South, where the perception of marijuana use risk is highest (Hughes et al., 2016). Other regions have shown the percentages between these two regions, such as 7.28% in Midwest and 8.36 in the Northeast (Hughes et al., 2016). In sum, these findings show that the perception of marijuana use risks and actual marijuana use are different across these census regions.

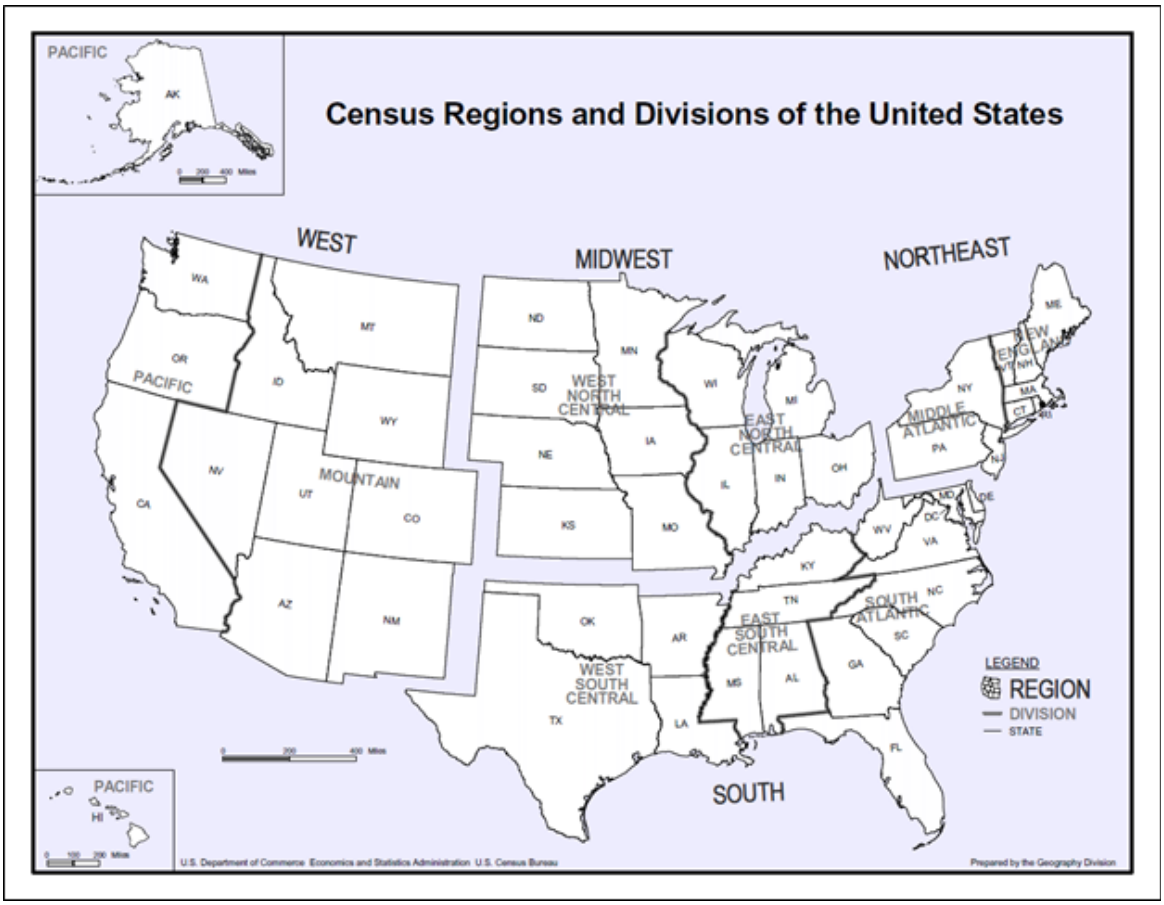

Figure 1. Census Regions and Divisions in the U.S. (From https://www.census.gov/geographies/reference-maps/2010/geo/2010-census-regions-and-divisions-of-the-united-states.html)

These regional disparities in the perception of the marijuana use risk across census regions also influence the public policy of marijuana use legalization. The current study has investigated state legislatures regarding recreational marijuana legalization in each census region and its yearly changes and presents the findings in Tables 1 and 2.

Table 1. The States with or without Recreational Marijuana Legalization by Census Region

Region	Northeast (N.E.)	Midwest (M.W.)	South	West
State with Legalization (% of Total)	Connecticut Maine Massachusetts New Jersey New York Vermont (66.7%)	Illinois Michigan (16.7%)	District of Columbia Virginia (11.8%)	Alaska Arizona California Colorado Montana Nevada New Mexico Oregon Washington (69.2%)

State without legalization (% of Total)	New Hampshire Pennsylvania Rhode Island (33.3%)	Indiana Iowa Kansas Minnesota Missouri Nebraska North Dakota Ohio South Dakota Wisconsin (83.3%)	Alabama Arkansas Delaware Florida Georgia Louisiana Kentucky Maryland Mississippi North Carolina Oklahoma South Carolina Tennessee Texas West Virginia (88.2%)	Hawaii Idaho Utah Wyoming (30.8%)
States Total	9	12	17	13

Table 2. Yearly Changes in Number of States with Marijuana Legalization by Census Region

Region	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
NE					2				1	2	1[2]	6
MW							1	1				2
South										1	1[3]	2
West	2		2		2				2	1		9
Total	2		2		4		1	1	3	4	2	19

As shown in Table 1, the regional disparities in marijuana legalization are apparent across census regions. While 69.2 % of states in the West region – the one with the lowest perception of marijuana use risk - have legalized marijuana use, only 11.8% of the states in the South region – the one with the highest perception of marijuana use risk – have the legalization legislatures. In the yearly changes, the West region has shown the earliest introduction of marijuana legalization with two states in 2012 (Colorado, Washington) and two in 2014 (Alaska, Oregon), but only one state in the South region (Virginia) has legalized recreational marijuana in 2021, and the District of Columbia plans to start the sale of recreational marijuana in August 2022. The Northeast region has also shown a relatively higher percentage of recreational marijuana legalization: 66.7% of its states (6 out of 9) have enacted recreational marijuana legalization by 2022. Two of them (Maine, Massachusetts) joined this legalization policy as early as 2016, while the other four states started to legalize after 2020. On the contrary, the Midwest region remains a relatively lower legalization percentage. While two states in Midwest

[2] The State of Vermont enacted the legalization of recreational marijuana in 2018; however, the sales of recreational marijuana are still illegal due to the absence of administrative regulation process. According to the Vermont Cannabis Control Board, the retails of recreational marijuana should start in fall 2022.

[3] While the District of Columbia legalized recreational marijuana in 2014, the sales of recreational marijuana is still illegal because politicians prevent the District of Columbia from establishing an independent regulatory board. According to the City Council, the sales of recreational marijuana is set up to start in August 2022.

(Illinois, Michigan) adopted recreational marijuana legalization in 2018 and 2019, the other ten states still keep recreational marijuana use/sales illegal. These findings from the investigation show regional disparities in the attitude to marijuana use across census regions, and these disparities also influence the status of recreational marijuana legalization.

Hypotheses on Regional Disparities in Youth Marijuana Use

Based on the findings of regional disparities in recreational marijuana legalization, this study hypothesizes that youth marijuana use should also be significantly different across census regions. According to a recent meta-analysis, the legalization of recreational marijuana is associated with an increase in youth marijuana use (Lachance et al., 2022). This meta-analysis attributed this increase to several factors, including acceptability and accessibility. Lachance and colleagues pointed out that marijuana legalization changed youth attitudes toward marijuana into more favorable and allowed them to normalize its consumption. They also insisted that the legal availability of marijuana to adults in many different forms – edibles, drinkables, and vapes – should make it easy for youths to obtain and use marijuana products (Lachance et al., 2022). For example, one type of marijuana product was manufactured in the form of candy bars, and one of the elementary students in Texas obtained and shared this marijuana candy bar at school[4]. Therefore, the differentiated legalization statuses across census regions should generate disparities in youth marijuana use.

Moreover, this study also hypothesizes that youth marijuana use should be different between rural and urban areas. Studies on youth marijuana use have revealed a significant disparity between rural and urban areas (Ousey & Maume, 2012). As for a reason for this difference, Ousey & Maume (2012) presented that the different levels of social integration and subcultural factors between rural and urban areas should cause more behavioral deviations. Furthermore, marijuana retail stores should be concentrated in urban areas, and, therefore, the accessibility and acceptability of marijuana use are expected to be higher in urban areas. Considering these expected regional disparities, this study proposes the following hypotheses.

First, youths in the West and Northeast regions, where more states have legalized marijuana use, are more likely to use marijuana than those in the South and Midwest regions, where a fewer number of states have introduced marijuana legalization.

Second, youths in the urban region, where youths can access marijuana products and accept their use more easily, are more likely to use marijuana than those in rural regions, where youths cannot access marijuana products and accept their use easily.

Third, there should be an interaction effect between census regions and urban/rural areas, and, therefore, youths in urban areas of the West and Northeast regions are more likely to use marijuana than those in other areas.

Methods

Data

For the examination of the given hypotheses, this study employs eleven-year survey datasets from "Monitoring the Future: A Continuing Study of American Youth - 12th-Grade Survey (MFCSAY), 2010 – 2020." This MFCSAY survey is conducted by the University of Michigan's Institute for Social Research with the support of the National Institute on Drug Abuse and has investigated the trends of American youths' illegal drug use

[4] https://www.newsweek.com/cannabis-candy-9-year-old-student-suspended-school-texas-1702613

and their perception of the drug use risk annually since 1975 (Miech, Johnston, Bachman, O'Malley, Schulenberg, & Patrick, 2020). In order to secure a nationally representative sample of high school seniors, the MFCSAY study introduced a multi-stage sampling process. In the first stage, the MFCSAY employed geographical areas that were selected by the Sampling Section of the Survey Research Center. Secondly, the MFCSAY study sampled high schools in the selected geographical regions. Lastly, the MFCSAY study randomly selected 350 senior students from the sampled high schools and surveyed these students (Miech et al., 2020). The MFCSAY datasets are appropriate for the purpose of the current study because they provide nationally representative sample data for the identification of youth marijuana use by census and urban/rural regions. The current study has obtained these data sets from the Inter-university Consortium for Political and Social Research (ICPSR) database.

Variable

Marijuana Use

For the measurement of youth marijuana use, this study employs a question, "how many occasions (if any) have you used marijuana (grass, pot) or hashish (hash, hash oil) during the last 12 months?" For this question, respondents were given choices of "(1) 0 occasion, (2) 1 – 2 times, (3) 3 – 5 times, (4) 6 – 9 times, (5) 10 – 19 times, (6) 20 to 39 times, and (7) 40 times or more." For the purpose of mean calculation, respondents' responses are recoded as "(1) 0 occasion into 0, (2) 1 – 2 times into 1, (3) 3 – 5 times into 3, (4) 6 – 9 times into 6, (5) 10 – 19 times into 10, (6) 20 to 39 times into 20, and (7) 40 times or more into 40." This recoding process can generate a less average value than the actual average youth marijuana use; however, there should be no bias in examining temporal changes as long as the current study employs consistent measurement across all observations. After recoding these responses, this study calculates the annual means of youth marijuana use in eleven datasets from 2010 to 2020 and introduces as a variable of *Marijuana Use*.

Region

The MFCSAY study has investigated the locational information of respondents with two types of questions. First, the MFCSAY study investigates the region of the country, based on Census categories, in which the respondents' schools are located. This locational information is introduced as "(1) Northeast, (2) North Central, (3) South, and (4) West." As the "North Central" region was designated as the "Midwest" region in 1984, the current study coded "North Central" into "Midwest" and introduced this question into a variable of *Census Region*. Secondly, the MFCSAY introduces two questions to identify the population density information of the respondents' locations. In the first question, the MFCSAY identifies "if the respondents' schools are located in a larger Metropolitan Statistical Area (MSA)." In the second one, the MFCSAY determines "if the respondents' schools are located in a standard MSA that contains at least 50,000 inhabitants or more." According to the MFCSAY, these two questions measure three-category population density for regions. The regions with the largest population density should be identified by answering yes to both questions. The medium-sized regions should be given as answering no to larger MSA but yes to standard MSA. The smallest density regions are given as answering no to both questions. The current study introduces these three categories as attributes of a variable of "*Rural/Urban Region*" and identifies regions with "smallest density regions" as "rural," "medium-sized regions" as "mid-urban," and "regions with the largest population density" as "high-urban" in the analysis.

Results

Average Change in Youth Marijuana Use by Census Regions

The results from the analysis of average changes in youth marijuana use by census region are presented in Table 3 and Figure 2. Contrary to the findings from previous studies (i.e., Lachance et al., 2022), the overall average changes (given as Total in the bottom row of Table 3 and Figure 2) do not show any increasing pattern as more and more states have legalized recreational marijuana use. Indeed, the overall average of youth marijuana use has slightly decreased from 2010 to 2020, such as 5.60 to 5.17 in three-year averages. As hypothesized, however, the Northeast and West regions show higher average youth marijuana use levels than the Midwest and South regions (6.04 & 5.37 vs. 5.25 & 4.91). Especially, the South region, which retains the greatest perception about the risk of using marijuana and the lowest percentage of states with legalization, has shown the lowest average in youth marijuana use. Furthermore, only the West region, which retains the smallest perception about the risk of using marijuana and the highest percentage of states with legalization, has shown an increase in average youth marijuana use, while all other three regions present an average decrease.

Table 3. Youth Marijuana Use Average by Region from 2010 to 2020

Re-gion	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**Total**
NE	5.68	6.88	5.73	6.53	6.44	5.93	5.98	6.34	5.97	5.74	5.25	**6.04**
MW	5.74	6.22	5.15	5.24	5.29	4.59	4.75	4.61	5.50	5.28	5.38	**5.25**
South	5.00	5.68	5.43	5.13	4.88	4.66	4.69	4.57	4.07	4.93	5.03	**4.91**
West	4.20	5.26	6.41	5.59	4.69	5.79	5.28	5.56	5.30	6.11	4.84	**5.37**
Total	**5.16**	**5.95**	**5.68**	**5.55**	**5.26**	**5.10**	**5.08**	**5.16**	**5.02**	**5.37**	**5.12**	**5.31**

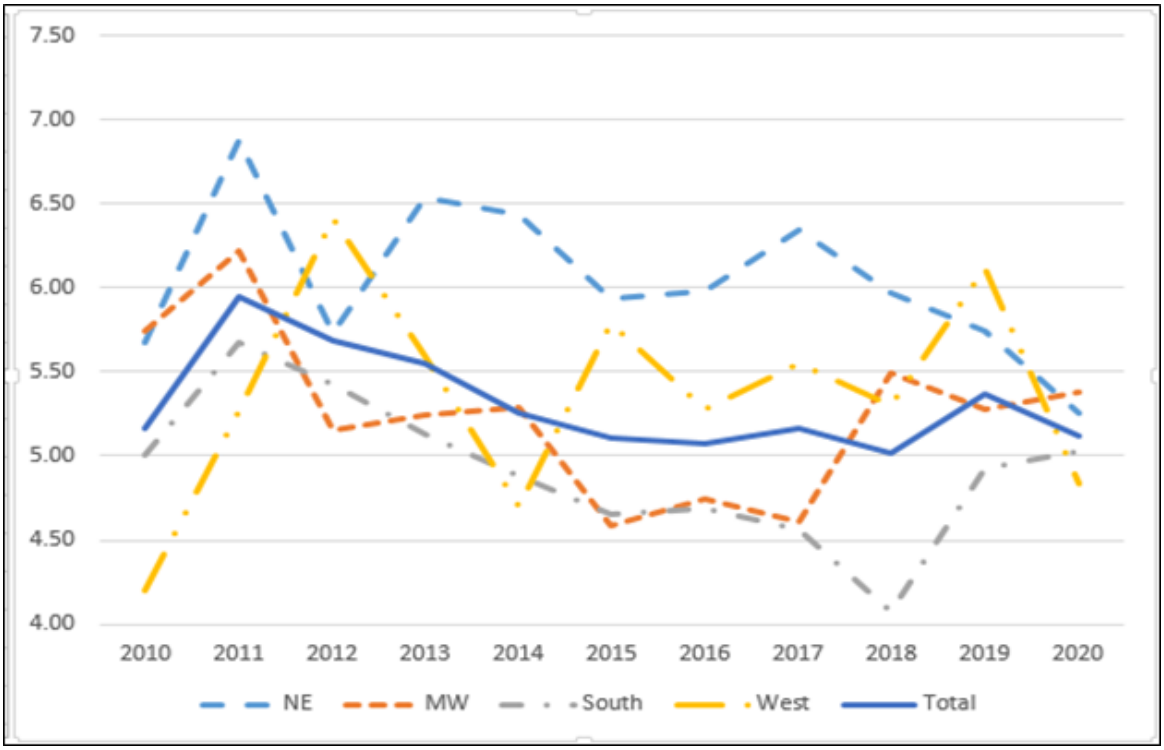

Figure 2. Line Graphs for Youth Marijuana Use Average by Region from 2010 to 2020

Average Change in Youth Marijuana Use by Rural/Mid-Urban/High-Urban Regions

The results from the analysis of average changes in youth marijuana use by rural/mid-urban/high-urban regions are presented in Table 4 and Figure 3. As hypothesized, the overall marijuana use average is found to be lowest in the rural region. While mid- and high-urban regions show a higher youth marijuana use average than the overall average, only the rural region shows a lower average than the overall one. However, the temporal change of youth marijuana use in the rural region indicates that this difference gets smaller as more states have adopted recreational marijuana legalization. In the early 2010s, the rural region showed significantly lower youth marijuana use average than those in urban regions. However, the average in the rural region continuously increased during the mid-2010s and reached the same level as those in urban regions in the late 2010s. Considering that the recreational marijuana legalization policy was adopted more intensively during the late 2010s, this finding indicates that this policy influenced youth marijuana use in the rural region more seriously. Additionally, it is also noteworthy that youth marijuana use in the mid-urban region also substantially increased during the late 2010s, while that in the high-urban region slightly decreased during the same period. In sum, in the high-urban area where marijuana was more readily available even before legalization, youth marijuana was not critically influenced by legalization. However, in the rural and mid-urban areas, where there was limited accessibility to marijuana before legalization, recreational marijuana legalization impacted youth marijuana use more critically.

Table 4. Youth Marijuana Use Average by Rural/Mid-Urban/High-Urban from 2010 to 2020

Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**Total**
Rural	3.76	5.16	4.68	4.42	4.42	4.91	4.98	5.18	5.44	5.25	5.10	4.85
Mid-Urban	5.23	6.25	5.89	5.97	5.57	5.22	5.06	5.17	4.89	5.69	5.79	5.52
High-Urban	5.82	6.01	5.98	5.56	5.35	5.05	5.16	5.14	4.97	5.06	4.72	5.35
Total	5.16	5.95	5.68	5.55	5.26	5.10	5.08	5.16	5.02	5.37	5.12	5.31

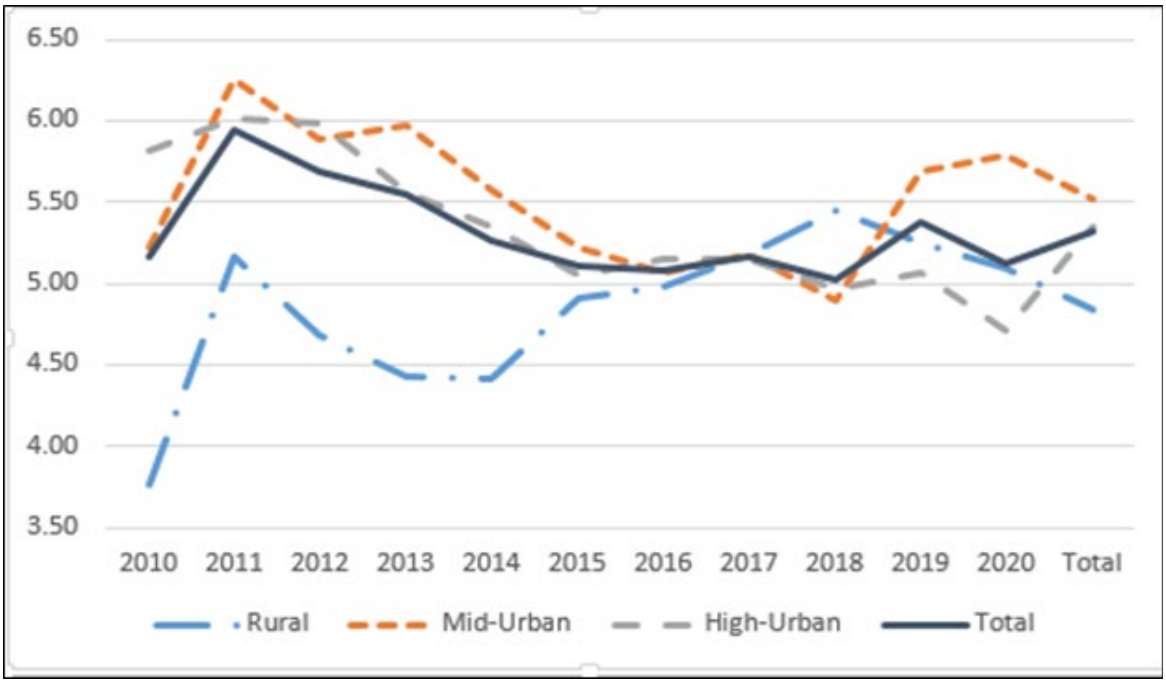

Figure 3. Line Graph for Youth Marijuana Use Average by Rural/Mid-Urban/High-Urban from 2010 to 2020

Average Change in Youth Marijuana Use by Both Regions

To clarify regional differences more in detail, this study merged two types of regions into a total of twelve regional categories and examined temporal patterns of youth marijuana use across these regional categories. The results from this examination are presented in Table 5 and Figure 4. The result from this examination with detailed categories clearly shows that the effect of marijuana legalization on youth marijuana use is clearly distinct across regions. The finding indicates that the youth marijuana use increase in rural areas (the result from the average changes in youth marijuana use by rural/mid-urban/high-urban regions) happened mainly in the Northeast and West rural regions. The Midwest and South rural regions did not show any evident changes during the same period. However, the Northeast and West rural regions exhibit a noticeable increase after the legalization. Especially in the West rural region, the average youth marijuana use increased more than two times, from 2.9 to 6.08. The same increasing pattern was found in the West mid-urban region. While all other three mid-urban regions did not demonstrate any significant change, the average youth marijuana use in the West min-urban region remarkably increased more than four times, from 3.14 to 13.07. The average of 13.07 in the West min-urban region is more than two times higher than the overall average. Contrary to these increases in the West rural and mid-urban regions, the average youth marijuana use in the West high-urban region decreased from 5.82 to 3.49 during the same periods. As observed in the examination in rural/mid-urban/high-urban regions, all four high-urban areas do not show any noticeable changes during the given period.

Table 5. Youth Marijuana Use Average by Both Regions from 2010 to 2020

Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**Total**
Rural NE	**4.77**	**6.86**	**7.06**	**6.93**	**6.03**	**8.41**	**6.05**	**5.46**	**7.2**	**6.12**	**6.5**	**6.49**
Rural MW	3.43	3.33	2.55	4.49	4.49	4.88	4.73	5.14	4.77	4.94	3.61	4.21
Rural South	3.85	5.71	5.3	3.67	3.84	4.07	4.83	4.12	4.25	4.83	4.13	4.42
Rural West	**2.9**	**4.59**	**4.11**	**3.3**	**4.35**	**5.32**	**5.18**	**7.09**	**8.46**	**6.34**	**6.08**	**5.25**
Mid-Urban NE	**5.45**	**6.58**	**5.97**	**7.01**	**6.25**	**5.92**	**6.7**	**6.07**	**5.11**	**5.98**	**5.68**	**6.07**
Mid-Urban MW	6.02	6.92	5.00	5.20	5.91	4.98	4.93	5.1	5.79	5.34	5.65	5.53
Mid-Urban South	5.69	5.69	5.51	5.72	5.14	4.58	4.07	4.75	4.38	5.03	5.52	5.10
Mid-Urban West	**3.14**	**5.93**	**7.12**	**6.17**	**5.33**	**5.74**	**4.97**	**5.15**	**4.75**	**7.65**	**13.07**	**6.27**
High-Urban NE	6.25	7.22	5.21	5.8	6.81	4.9	4.87	6.79	6.65	5.26	4.36	5.83
High-Urban MW	6.27	6.48	6.73	5.94	5.25	4.1	4.54	3.96	5.52	5.36	8.19	5.67

High-Urban South	4.49	5.61	5.47	5.28	5.41	5.39	5.44	4.62	3.26	4.87	4.92	4.98
High-Urban West	5.82	4.88	6.45	5.27	3.4	6	5.73	5.41	4.77	4.96	3.49	5.11

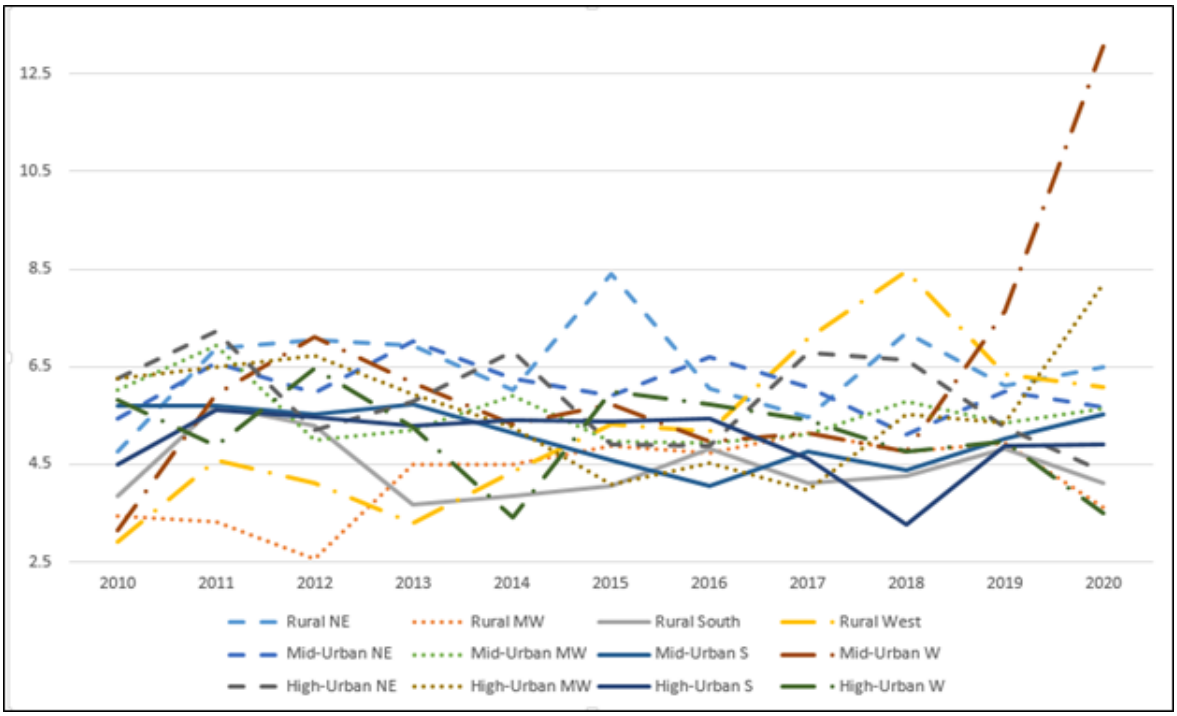

Figure 4. Line Graph of Youth Marijuana Use Average by Both Regions from 2010 to 2020

Discussion

This study intends to examine the regional disparities in the effect of recreational marijuana legalization on youth marijuana youth. Previous studies have revealed that the perception of the risk of using marijuana is different across census regions, and the percentage of marijuana use is also differentiated accordingly (Hughes et al., 2016). Studies also have found that there exists a significant disparity between rural and urban areas (Ousey & Maume, 2012). Based on these findings, this study hypothesizes that youth marijuana use should also be disparate across census regions and rural/urban areas. For the examination, this study employs eleven-year datasets, "Monitoring the Future: A Continuing Study of American Youth - 12th-Grade Survey (MFCSAY), 2010 – 2020," and tracks the temporal changes in average youth marijuana use across regions during the corresponding period.

The results from the multiple analyses have shown that the regional difference in the effect of legalization on youth marijuana use is evident. In the analysis of average changes in youth marijuana use by census region, this study has found the lowest average in youth marijuana use in the South region, where the greatest perception about the risk of using marijuana and the lowest percentage of states with legalization were identified. On the contrary, only the West region, which retains the smallest perception about the risk of using marijuana and the highest percentage of states with legalization, has shown an increase in average youth marijuana use, while all other regions reported a decrease. However, this study fails to find any noticeable overall temporal change before and after recreational marijuana legalization. These findings should indicate that the effect of

recreational marijuana legalization on youth is distinct across different regions. As pointed out in the previous studies (Ousey & Maume, 2012), the different perceptions about marijuana and distinctive sub-cultures across regions generate different attitudes to marijuana use and also impact youth marijuana use.

The second analysis of average changes in youth marijuana use by rural/mid-urban/high-urban regions also supported the hypothesis of this study. The overall youth marijuana use was found to be lower in the rural region than in urban regions. However, the examination of the temporal change of youth marijuana uses in the rural region revealed a steady increase of youth marijuana use in rural areas while urban areas show stable youth marijuana use. This increase of youth marijuana uses in the rural region caused all three regions to have identical levels in the late 2010s. Furthermore, youth marijuana uses in the mid-urban region showed a noticeable increase during the late 2010s, while the high-urban region presented a decrease. As pointed out previously, this finding indicates that marijuana legalization impacted youth marijuana use in the rural and mid-urban regions more seriously. Youths in the high-urban area, where marijuana was more readily available even before legalization, were not significantly influenced by marijuana availability from the legalization. However, the findings from this analysis indicated that youths in the rural and mid-urban areas, where there was limited accessibility to marijuana before legalization, were more vulnerable to the impact of marijuana legalization.

Lastly, the third analysis of youth marijuana use in twelve regional categories has suggested that the influence of marijuana legalization on youth marijuana use should be critical in specific areas. For instance, while the Midwest and South rural regions did not show any evident changes after legalization, the Northeast and West rural regions exhibited a noticeable increase in youth marijuana use. The West mid-urban region also shows a notable increase in average youth marijuana use. However, other regions do not present any noticeable changes during the study period. Again, these findings imply that the impact of marijuana legalization is differentiated across different regions in the U.S. The different levels of accessibility and acceptability, as well as different sub-cultures across regions, generate different settings for youth marijuana youth, and accordingly, the effects of recreational marijuana legalization are also diversified across regions.

Conclusion

The findings of this study have demonstrated that the recreational marijuana legalization policy impacts youth marijuana use in some regions with certain conditions. In the regions where marijuana products are more available – that is, with a higher level of pre-existing accessibility – even before the legalization, the impact of the legalization policy is limited and does not cause a noticeable increase in youth marijuana use. However, in the regions with limited pre-existing accessibility, such as rural and mid-sized urban areas, the effect of this policy is evident. Especially in the late 2010s, when the legalization became more prevalent, the impact of this policy became remarkable in some regions, such as Northeast rural, West rural, and West mid-urban areas. These findings imply that the impact of marijuana legalization is local rather than universal. Therefore, policymakers about youth marijuana use should consider local sub-cultures, accessibility, attitude, and acceptability in specific regions and introduce tailored policies to deter youth marijuana use more effectively.

Limitation

While this study employs nationally representative sample data, there are several limitations. First, during the analysis, this study did not introduce any other control variables. For example, the increase or decrease in youth marijuana use in the late 2010s in some regions could be caused by other factors such as demographic changes or the breakout of COVID-19 rather than the legalization of recreational marijuana. Especially the COVID-19 situation brought many changes in social and economic environments in the late 2010s and the year 2020. Therefore, the findings of this study should be reexamined by considering the effect of these changes in future

studies. Second, while this study has tried to narrow down the scope of regions, the twelve categories of regions in the U.S. are still too broad and unspecified to identify detailed regional circumstances. This study suggests future studies to introduce more specific and fragmented regions to identify more detailed effects of sub-cultures and regional attitudes. Lastly, this study does not introduce any statistical inference for the conclusions. To make a general statement about the population, it is required to employ statistical inference. Therefore, future studies should extend this study by using statistical inference.

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