Temporal Trends in Young Adult Cannabis and Tobacco Use in States with Different Cannabis Policies

Cannabis
2025

researchmj.org
10.26828/cannabis/2025/000288
Volume 8, Issue 2

Allison M. Glasser[1], Caitlin Uriarte[1], Jessica King Jensen[1,2], Kymberle Sterling[1,3], Ce Shang[4], David Hammond[5], & Andrea C. Villanti[1,3]

[1]Rutgers Institute for Nicotine & Tobacco Studies, Rutgers University
[2]Department of Family Medicine and Community Health, Rutgers Robert Wood Johnson Medical School
[3]Department of Health Behavior, Society and Policy, Rutgers School of Public Health
[4]Department of Internal Medicine, Ohio State University Wexner Medical Center
[5]School of Public Health Sciences, University of Waterloo

ABSTRACT

Objective: Cannabis legalization may impact both cannabis and tobacco use, given the high prevalence of co-use (including blunt use) among young adults (YAs) in the United States. The objective of this descriptive ecological study was to examine trends in YA cannabis and tobacco use from 2002-2018 in states that passed adult and medical use (AMU) or medical use only (MUO) cannabis laws during that time (N= 16). **Method:** Using data from the National Survey on Drug Use and Health, we conducted a segmented regression analysis to calculate absolute percent change in past 30-day cannabis, blunt, cigarette, and cigar use between time points. We descriptively compared points of slope inflection with key legalization dates. **Results:** All states showed a decline in YA cigarette smoking over time, a slight decline in cigar smoking, and increases in cannabis and blunt use. Cannabis use increased following opening of MUO retail outlets and, in several states, increased following adult use law implementation and/or opening of retail outlets. For example, in Maine, cannabis use plateaued after a MUO law was adopted (2009) until about 1-2 years after retail outlets opened (2011), when YA cannabis use increased by 22.4% (95% CI: 19.0, 29.4) and continued increasing steadily after adult use was adopted (2017). **Conclusions:** Cannabis and blunt use increased more in states where AMU laws were in place compared to those with MUO laws, though causality was not assessed. Varying trends may correlate with cannabis policies, tobacco policies and other political, economic, or social factors at the state level.

Key words: = cannabis; tobacco; young adult

Cannabis is legal to sell to adults 21 years of age or older for medical use in 38 states, and 'recreational' use in 24 US states and the District of Columbia (DC; National Conference of State Legislatures, 2024). However, the group with the highest prevalence of past-month cannabis use are young adults (YAs; ages 18-25 years), who span the legal age of cannabis sales (National Academy of Sciences Engineering and Medicine [NASEM], 2017) and who may be more susceptible to the neurocognitive effects of cannabis due to continued brain development (Jacobus & Tapert, 2014). Most studies on the impact of cannabis laws suggest that they lead to

Corresponding Author: Allison Glasser, PhD, MPH, Rutgers University, 303 George Street. New Bruswick, New Jersey, 08901. Email: allison.glasser@rutgers.edu

non-significant changes or small increases in cannabis use among YAs following implementation (Lachance et al., 2022). Data from the International Cannabis Policy Study and other cross-sectional studies suggest that non-combustible modes of cannabis delivery, primarily vaping and consuming edibles, are more prevalent where cannabis is legal to sell (Borodovsky et al., 2016; Borodovsky et al., 2017; Goodman et al., 2020; Hammond et al., 2022; Shi, 2021). The prevalence of cannabis use has increased over time, with 28.8% of YAs reporting past-month use in 2022 (Patrick et al., 2023) and a high prevalence of tobacco and cannabis co-use in this age group (Cohn & Chen, 2022). Blunt use (modified cigar with tobacco filling replaced or mixed with cannabis) is a particularly important form of cannabis and tobacco co-use, given its unique health impacts. People who use blunts initiate cannabis use earlier (Seaman et al., 2019), smoke more frequently (Reboussin et al., 2021), develop greater dependence or problem use (Timberlake, 2009), and are more likely to use other substances (Montgomery & Mantey, 2018) than people who use cannabis in other ways.

Evidence is mixed on whether tobacco and cannabis are substitutes or complements (Agrawal et al., 2012; Lemyre et al., 2019), yet cannabis legalization may lead to change in both cannabis and tobacco use, and particularly, co-use of these products among YAs. Research on the impact of cannabis legalization on tobacco use has primarily focused on cigarette smoking among adolescents (Schlienz & Lee, 2018). These studies have had mixed findings, with one showing no effect (Vuolo et al., 2022), one showing increases in adolescent cigarette use (Cerda et al., 2018), and one showing a reduction (Mason et al., 2016). Other US-based studies found no evidence of an association between medical or recreational cannabis legalization and changes in cigarette sales per capita (Veligati et al., 2020) or tobacco retail availability (Timberlake et al., 2021). Studies of non-cigarette tobacco products found an increase in adolescent e-cigarette use in states with cannabis legalization (Bhatia et al., 2022; Coley et al., 2020; Nicksic et al., 2020), while another study found reduced cigar sales in legalized states (Giovenco et al., 2018). Only one study has assessed the impact of cannabis policy on blunt use, which found increased blunt use in states with recreational cannabis, but only in those states with a smokefree indoor air tobacco policy (Orsini et al., 2024).

Cannabis policy evaluation using trend data has primarily involved statistically comparing trends pre- and post-policy enactment or implementation. However, an alternative approach can allow the data to show where there are changes in trends over time, informing whether change observed corresponds to policy events and if there are lag times. Joinpoint trend analysis uses this approach and can characterize significant changes in trends of prevalence of tobacco and cannabis use over time at the state level and allow researchers to observe how these changes correspond descriptively with cannabis policy enactment and implementation (National Cancer Institute, 2023). The objective of this descriptive ecological study was to examine trends among YAs for cannabis, blunt, cigarette, and cigar use over a 16-year period (2002-2018), using the National Survey on Drug Use and Health (NSDUH), in states that passed adult and medical use (AMU) or medical use only (MUO) cannabis laws during that time (N= 15 and DC). We use a regression technique to identify inflection points rather than make a priori assumptions about time periods when change should occur. Given greater access to legal cannabis for sale in AMU states, we hypothesized that there would be greater increases in cannabis and blunt use in states with AMU than MUO laws; additionally, more inflection points would be observed in AMU states due to more policy changes over time. Given the mixed evidence on cannabis policy's impact on tobacco use, we did not have specific a priori hypotheses regarding cigarette or cigar use trends.

METHODS

Data Sources

National Survey on Drug Use and Health (NSDUH) Restricted-use Data Analysis System 2-year state estimates of tobacco and cannabis use are publicly available and were obtained from the Substance Abuse and Mental Health Services Administration (SAMHSA) Data Archive (https://rdas.samhsa.gov/#/). NSDUH is an annual nationally representative survey of the US population aged 12 and older and measures use of tobacco, alcohol, and illicit drugs; substance use

disorders; receipt of substance use treatment; mental health issues; and the use of mental health services. This analysis is limited to YAs ages 18-25 years residing in states with AMU (N= 7 and DC) or MUO (N = 8) laws that were passed between 2002-2016, to allow for at least two data points following the policy event (policy adopted, policy effective, and retailer permitted). While data were collected annually, small area estimates are available in two-year pooled datasets, which are available for the following years: 2002/2003, 2004/2005, 2006/2007, 2008/2009, 2010/2011, 2012/2013, 2014/2015, 2016/2017, and 2018/2019. The average sample size ranged from 461 to 602 across years in states except California, Florida, Ohio, and Pennsylvania (states in which NSDUH recruits a larger sample), in which the sample size ranged from 1499 to 2404. Detailed sample size by state and year is presented in Supplemental Table A.

Cannabis Legalization Data

AMU states (N = 8; Alaska, California, Colorado, Maine, Nevada, Oregon, Washington, and DC) included states that have passed both medical use and adult use cannabis laws, while MUO states (N= 8; Arkansas, Delaware, Florida, Minnesota, New Hampshire, North Dakota, Ohio, and Pennsylvania) have only passed medical use laws. As we were interested in observing the timing of when change in trends occurs, we included states that allowed for the possibility of changes in use after passage of a law, even if it had not yet gone into effect. We recorded key policy events (Table 1), including the date a law was adopted and went into effect, as well as when retail outlets were permitted. These data were obtained from the Marijuana Policy Project (Marijuana Policy Project, 2021) and the National Conference of State Legislatures (National Conference of State Legislatures, 2023).

Table 1. *Key Cannabis Legalization Dates*

State	MU Law Adopted	MU Law Effective	MU Retail Permitted	AU Law Adopted	AU Law Effective	AU Retail Permitted
AMU						
Alaska	Nov. 1998	Jun. 1999	-	Nov. 2014	Feb. 2015	Oct. 2016
California	Nov. 1996	Jan. 2004	-[a]	Nov. 2016	Nov. 2016	Jan. 2018
Colorado	Nov. 2000	Jun. 2001	Jun. 2010	Nov. 2012	Nov. 2012	Jan. 2014
Maine	Nov. 2009	May. 2010	Mar. 2011	Nov. 2016	Jan. 2017	Oct. 2020
Nevada	Jun. 2001	Oct. 2001	Aug. 2015	Nov. 2016	Jan. 2017	Jul. 2017
Oregon	Nov. 1998	May. 1999	Mar. 2014	Nov. 2014	Jul. 2015	Oct. 2016
Washington	Nov. 1998	Nov. 1998	-[b]	Nov. 2012	Dec. 2013	Jul. 2014
Wash, DC	May. 2010	Jan. 2011	Jul. 2013	Nov. 2014	Feb. 2015	-
MUO						
Arkansas[c]	Nov. 2016	May. 2017	May. 2019	-	-	-
Delaware	May. 2011	Jul. 2011	Jun. 2015	-	-	-
Florida[c]	Nov. 2016	Jul. 2017	Sept. 2016	-	-	-
Minnesota	May. 2014	Jun. 2015	Jul. 2015	-	-	-
New Hampshire	Jul. 2013	Dec. 2015	Apr. 2016	-	-	-
North Dakota[c]	Nov. 2016	Oct. 2018	Mar. 2019	-	-	-
Ohio[c]	Jun. 2016	Dec. 2018	Jan. 2019	-	-	-
Pennsylvania[c]	Apr. 2016	Nov. 2017	Feb. 2018	-	-	-

[a]Retail operated in a legal grey area until 2018; [b]Endorsement in Jul. 2016; [c]Excluded from sensitivity analysis focused only on states with post-implementation data (after the policy went into effect); AMU/AU=adult and medical use; MUO/MU = medical use only

Measures

Past 30-day use of the following products was assessed.

Cannabis. "Sometimes called pot, weed, hashish, or concentrates. Some of the ways these products can be used are smoking (such as in joints, pipes, bongs, blunts, or hookahs), vaping (using vape pens, dab pens, tabletop vaporizers, or portable vaporizers), dabbing, eating or drinking, or applying as a lotion."

Blunts. "Smoked part or all of a cigar with marijuana in it." Blunts were not assessed in 2002/2003. Blunt use, by definition, may overlap with cannabis use.

Tobacco. Cigarettes and cigars ("Made only of tobacco, such as cigarillos, big cigars, and little cigars that look like cigarettes").

Analysis

First, we conducted a segmented regression analysis to calculate absolute percent change (APC) in past 30-day use of each product between time points using the National Cancer Institute's Joinpoint software (National Cancer Institute, 2023). Points of inflection (Joinpoints) are specific points in time in which the slope of a trend in product use significantly changes. Separate models were estimated for each product by state, measuring within-state changes, as well as for each product in states combined by policy type (AMU or MUO); in all models, time was the independent variable measured in years. Homoscedastic variance was assumed and controlled for first-order autocorrelation. Two datapoints were allowed from a Joinpoint to the first or the final datapoint and between two Joinpoints. Up to two Joinpoints per model were allowed (except for blunts, for which only one Joinpoint was allowed due to having one less datapoint; Irimata et al., 2022). The model with optimal Joinpoints was determined using a model selection criterion via a permutation test. Slopes and slope changes were considered statistically different from zero if the p value was < .05. Average changes over the full study period were also calculated using a weighted average of the slope coefficients of the underlying joinpoint regression line with the weights equal to the length of each segment over the interval.

Pairwise comparisons were made to determine whether trends in product use differed significantly between combined AMU and MUO states through tests for parallelism. Joinpoints and APCs were descriptively compared with key cannabis legalization dates to describe patterns within and across states with varying cannabis policies. Finally, as change may not be expected until after implementation of a policy, we conducted a sensitivity analysis including only those states with post-effective data (see footnote in Table 1 for exclusions). Individual state trends are presented in Supplemental Figures B-Q.

RESULTS

Most states showed increases in cannabis and blunt use over the 16-year period (2002/2003-2018/2019). AMU states had greater increases than MUO states (Table 2) in cannabis (AMU: 6.5%; MUO: 2.5%) and blunt use (AMU: 6.2%; MUO: 3.4%), though trends were statistically parallel (cannabis use trends: p = .099; for blunt use trends: p = .162; Supplemental Table B). States showed similar declines by AMU vs. MUO status in YA cigarette smoking (AMU: -9.5%; MUO: -9.3%) and cigar smoking (AMU: -7.0%; MUO: -3.8%) over time (test for parallelism for cigarette use trends: p = .097; for cigar use trends: p = .104). Trends across products were parallel between AMU and MUO states in sensitivity analyses conducted in states with post-effective data (Supplemental Table B and Supplemental Figure A).

Table 2. *Average Absolute Percent Change in Past 30-Day Product Use Over the 16-Year (2002-2018*) Study Period and Joinpoints, by State*

State	Cannabis	Blunts	Cigarettes	Cigars
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
AMU	6.5 (4.3, 8.7)	6.2 (5.3, 7.3) 2004-2010: 17.7 (14.7, 21.1) 2010-2018: -1.6 (-3.4, 0.0)	-9.5 (-10.9, -8.2) 2002-2012: -4.0 (-5.5, -2.6) 2012-2018: -18.0 (-22.0, -13.8)	-7.0 (-11.8, -1.9) 2002-2006: 5.7 (-51.9, 132.6) 2006-2014: -8.2 (-29,8, 20.0) 2014-2018: -15.9 (-69.0, 128.1)

Alaska	2.2 (-4.5, 9.1)	**7.8 (2.4, 11.4)** 2002-2008: **24.0 (9.0, 44.0)** 2008-2018: 1.9 (-14.0, 4.7)	**-8.7 (-16.0, -0.7)** 2002-2014: **-2.9 (-5.2, -0.5)** 2014-2018: -24.1 (-52.5, 21.5)	**-5.4 (-9.7, -0.9)** 2002-2006: 14.7 (-38.1, 112.6) 2006-2014: -5.2 (-21.6, 14.6) 2014-2018: -22.2 (-70.5, 105.3)
California	**6.2 (3.9, 9.0)**	**6.5 (4.9, 8.3)** 2004-2010: **20.0 (14.0, 27.9)** 2010-2018: -2.7 (-6.2, 0.6)	**-10.6 (-11.7, -9.5)** 2002-2012: **-3.3 (-4.3, -2.3)** 2012-2018: **-21.5 (-24.8, -18.1)**	**-7.6 (-13.9, -0.8)** 2002-2006: 5.8 (-27.2, 53.7) 2006-2018: **-11.7 (-15.8, -7.3)**
Colorado	**6.4 (5.6, 7.2)** 2002-2006: 1.2 (-1.8, 5.1) 2006-2012: **10.6 (8.8, 12.6)** 2012-2018: **5.7 (1.6, 7.1)**	**6.1 (3.3, 8.5)** 2004-2012: **12.8 (9.2, 21.2)** 2012-2018: -2.3 (13.7, 3.0)	**-9.6 (-14.9, -4.0)** 2002-2014: **-5.4 (-7.0, -3.9)** 2014-2018: -21.0 (-43.7, 10.8)	**-6.1 (-9.2, -2.9)** 2002-2012: 1.8 (-1.9, 5.6) 2012-2018: **-17.9 (-26.6, -8.2)**
Maine	**7.3 (6.2, 8.4)** 2002-2006: **6.3 (1.1, 11.3)** 2006-2010: **-5.3 (-7.8, -1.9)** 2010-2018: **22.4 (19.0, 29.4)**	**8.1 (1.0, 16.2)** 2004-2012: -0.4 (-26.4, 31.9) 2012-2018: 20.5 (-6.1, 53.7)	**-8.2 (-11.1, -5.1)** 2002-2008: -2.8 (-11.6, 6.9) 2008-2018: **-11.2 (-15.3, -6.9)**	**-7.3 (-11.0, -3.5)** 2002-2010: -0.5 (-8.2, 7.9) 2010-2018: **-13.8 (-20.4, -6.5)**
Nevada	**9.9 (4.1, 15.7)** 2002-2014: 2.6 (-20.8, 15.8) 2014-2018: **35.0 (8.4, 65.7)**	**9.8 (1.5, 19.8)**	**-9.5 (-13.7, -5.0)** 2002-2012: -2.6 (-6.5, 1.5) 2012-2018: **-19.9 (-32.3, -5.1)**	-1.9 (-15.1, 13.4) 2002-2006: 3.1 (-91.8, 1203.2) 2006-2012: -9.4 (-52.9, 74.1) 2012-2018: 9.7 (-90.4, 1158.8)
Oregon	**7.0 (1.8, 12.8)**	5.2 (-2.5, 10.9) 2004-2008: **22.2 (3.0, 53.4)** 2008-2018: -0.9 (-24.5, 5.9)	**-8.0 (-12.5, -3.2)** 2002-2010: -4.1 (-11.6, 4.1) 2010-2018: **-11.7 (-21.5, -0.6)**	-6.6 (-17.8, 6.2) 2002-2014: -2.8 (-6.5, 1.1) 2014-2018: -17.0 (-59.5, 69.8)
Washington	5.4 (-4.6, 17.3)	5.4 (-0.2, 12.2) 2004-2010: **16.6 (7.2, 53.3)** 2010-2018: -2.3 (-22.5, 3.1)	**-10.5 (-14.4, -6.4)** 2002-2010: -1.7 (-8.8, 5.9) 2010-2018: **-18.5 (-26.3, -9.8)**	0.0 (-10.7, 12.0) 2002-2006: 29.8 (-30.3, 141.8) 2006-2018: **-8.3 (-13.0, -3.3)**
Wash, DC	**6.2 (4.5, 7.7)** 2002-2008: -3.6 (-12.4, 0.9) 2008-2018: **12.6 (9.5, 17.1)**	-3.8 (-6.5, 15.8)	-7.9 (-20.1, 6.0) 2002-2014: -3.6 (-9.1, 2.2) 2014-2018: -19.7 (-63.3, 75.3)	**-6.1 (-10.8, -1.1)** 2002-2014: **4.5 (1.4, 7.7)** 2014-2018: **-31.8 (-48.4, -9.9)**
MUO	**2.5 (1.3, 4.3)** 2002-2008: -1.1 (-7.4, 5.7) 2008-2014: 6.2 (-8.7, 23.6) 2014-2018: 2.4 (-14.4, 22.5)	**3.4 (2.4, 4.2)**	**-9.3 (-10.3, -8.2)** 2002-2006: -3.2 (-15.8, 11.3) 2006-2012: -6.3 (-19.3, 8.9) 2012-2018: **-15.9 (-23.1, -7.9)**	**-3.8 (-5.2, -2.3)** 2002-2008: -0.3 (-4.9, 4.5) 2008-2018: **-5.8 (-7.5, -4.0)**
Arkansas	-0.8 (-3.1, 1.4)	0.5 (-4.5, 5.0) 2004-2010: **8.1 (1.3, 30.7)** 2010-2018: **-4.9 (-22.9, -0.7)**	**-9.4 (-10.8, -7.9)** 2002-2008: **-5.7 (-9.8, -1.4)** 2008-2018: **-11.5 (-13.6, -9.4)**	**-7.9 (-11.4, -4.2)** 2002-2008: **-14.1 (-23.7, -3.2)** 2008-2018: **-4.0 (-8.9, 1.2)**
Delaware	3.3 (-0.0, 4.7) 2002-2014: 0.2 (-6.9, 6.6) 2014-2018: 13.2 (-0.9, 28.1)	**3.0 (0.8, 5.0)**	-12.1 (-23.8, 1.4) 2002-2010: **-3.7 (-6.9, -0.5)** 2010-2018: -33.0 (-69.9, 49.2)	-0.8 (-9.7, 9.0) 2002-2014: **-6.3 (-9.5, -3.0)** 2014-2018: 18.0 (-30.1, 99.1)
Florida	**3.5 (0.8, 6.4)** 2002-2008: -3.6 (-16.0, 4.8) 2008-2018: **8.1 (2.3, 21.2)**	3.3 (-1.5, 7.7)	**-12.1 (-13.6, -10.6)** 2002-2006: -0.4 (-19.4, 23.2) 2006-2014: **-9.0 (-16.7, -0.7)** 2014-2018: -27.7 (-49.2, 2.9)	**-4.7 (-8.7, -0.5)** 2002-2006: -0.4 (-21.5, 26.3) 2006-2018: **-6.1 (-8.1, -4.0)**
Minnesota	**3.6 (2.7, 4.2)** 2002-2006: **13.7 (11.0, 16.4)** 2006-2012: **-4.3 (-5.7, -2.6)** 2012-2018: **5.3 (2.9, 10.9)**	5.0 (-1.6, 13.4)	**-9.9 (-11.7, -8.1)** 2002-2010: **-4.5 (-7.6, -1.4)** 2010-2018: **-15.0 (-18.8, -11.1)**	**-2.9 (-5.3, -0.4)** 2002-2010: **6.4 (1.7, 11.3)** 2010-2018: **-11.3 (-16.1, -6.3)**
New Hampshire	**1.7 (0.9, 2.6)**	**6.8 (1.4, 10.8)** 2004-2008: **28.9 (10.3, 51.8)** 2008-2018: -1.0 (-11.4, 1.8)	**-6.8 (-8.5, -5.1)** 2002-2008: -1.4 (-6.6, 4.0) 2008-2018: **-9.9 (-12.4, -7.4)**	1.0 (-2.8, 4.9) 2002-2008: 3.9 (-0.2, 8.2) 2008-2018: -3.7 (-15.1, 9.4)
North Dakota	0.4 (-3.1, 4.6) 2002-2006: -12.8 (-24.5, 4.9) 2006-2018: 4.7 (-9.8, 22.6)	**12.8 (5.1, 21.3)**	**-7.8 (-9.8, -5.8)** 2002-2012: **-4.3 (-6.5, -2.2)** 2012-2018: **-13.3 (-19.4, -6.7)**	-5.2 (-16.4, 7.4) 2002-2006: 12.5 (-42.2, 118.9) 2006-2018: **-10.5 (-17.6, -2.8)**
Ohio	**3.9 (2.7, 4.8)** 2002-2012: 1.8 (-1.9, 3.3) 2012-2018: **7.5 (3.9, 13.3)**	**5.5 (1.9, 8.3)** 2004-2008: **12.8 (1.6, 26.6)** 2008-2018: 2.7 (-9.9, 9.2)	**-7.1 (-8.8, -5.4)** 2002-2006: -0.1 (-18.1, 21.8) 2006-2014: -6.8 (-14.3, 1.4) 2014-2018: -14.2 (-41.7, 26.1)	-2.6 (-9.7, 5.2) 2002-2008: 1.2 (-24.0, 34.7) 2008-2014: -8.8 (-59.3, 104.3) 2014-2018: 1.7 (-77.4, 356.9)
Pennsylvania	**1.8 (0.7, 3.4)** 2002-2006: -5.7 (-10.2, 1.3) 2006-2018: **4.5 (2.5, 9.8)**	1.8 (-0.0, 3.4)	**-8.5 (-10.4, -6.5)** 2002-2012: **-4.7 (-6.2, -3.3)** 2012-2018: **-14.4 (-20.8, -7.5)**	**-2.3 (-3.4, -1.1)** 2002-2010: 1.8 (-0.3, 3.9) 2010-2018: **-6.1 (-8.5, -3.6)**

Note. Blunt use was not measured until 2004; AMU = adult and medical use; MUO = medical use only; Bolded estimates are statistically significant at $p < .05$; for spaces without data, there were no Joinpoints.

In 2018/2019, AMU states had lower average prevalence of cigarette smoking than MUO states (16% vs. 19%) and higher cannabis use (29% vs. 21%; Supplemental Table C). All states with AMU laws had higher prevalence of cannabis use than cigarette smoking by 2018/2019, as well as the three MUO states with post-effective data. In all AMU states, blunt use surpassed cigar smoking over time, while in most MUO states, the prevalence of blunt and cigar use were similar.

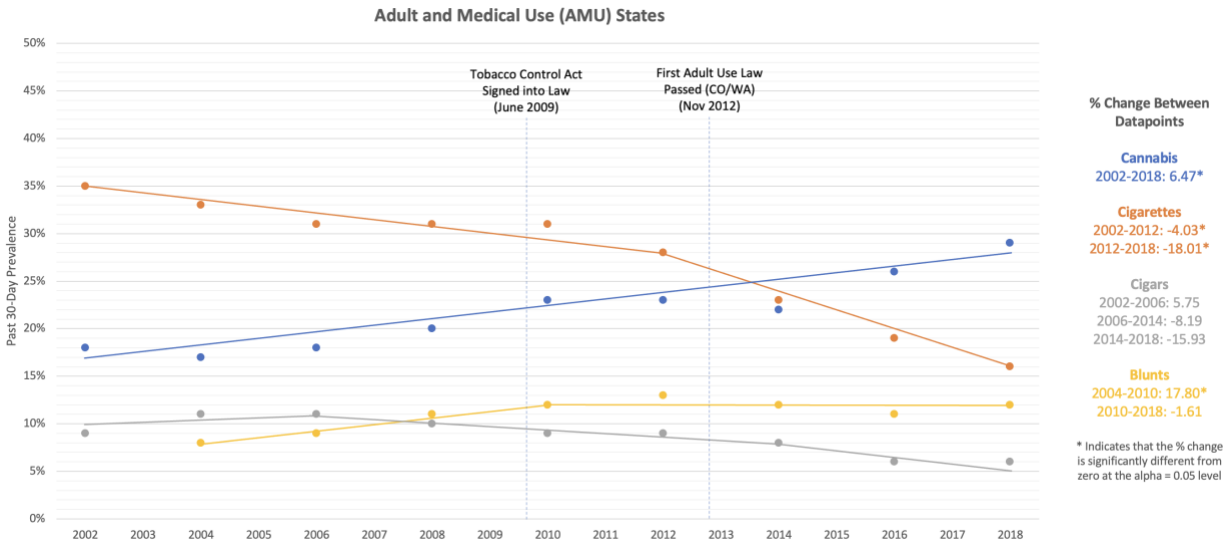
Trends in Relation to Policy Changes

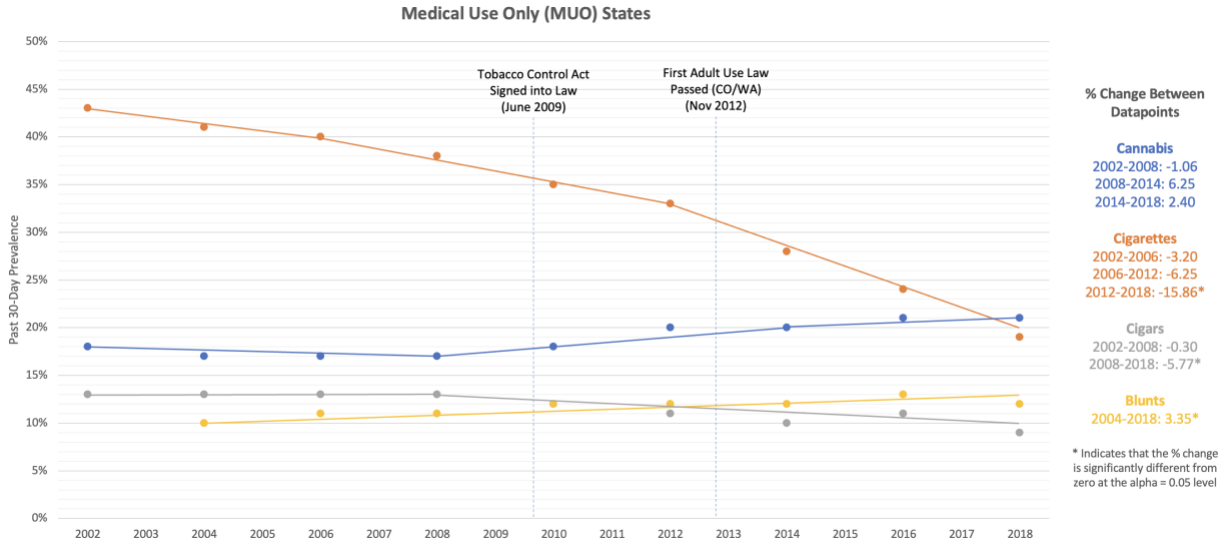
Cannabis Use

There were two Joinpoints in trends of cannabis use over time across MUO states (Figure 1), but none of these correspond with an apparent policy change. In state-specific analyses, six MUO states showed at least one Joinpoint in cannabis use trends over time (Table 2), and one of these appeared to correspond with a cannabis policy event. In Delaware (Supplemental Figure C), cannabis use was flat from 2002/2003 to 2012/2013, then increased by 13.3% (95% CI: -1.0, 28.1) from 2014/2015 to 2018/2019, about two years after a medical use law went into effect in July 2011 and at about the same time as MUO retail outlets opened in June 2015.

Despite a steady increase in cannabis use, there were no Joinpoints in trends in AMU states (Figure 1). State-specific analyses showed four AMU states with at least one Joinpoint in cannabis use trends, three of which may correspond with a policy event. These changes show increased cannabis prevalence after medical use laws go into effect and/or permitting of retail outlets and continued increases after passage of adult use laws. In Maine (Supplemental Figure M), cannabis use plateaued after a medical use law was adopted in November 2009 until about 1-2 years after retail outlets opened in March 2011, when YA cannabis use increased from 23% (2010/2011-2012/2013) to 39% (2018/2019), which was an increase of 22.4% (95% CI: 19.0, 29.4) and a trend that continued after the adult use law was adopted. Similarly, Nevada (Supplemental Figure N) showed an increase (35.0%; 95% CI: 8.4, 65.7) in cannabis use prevalence after 2014/2015, corresponding with when MUO retail outlets opened in August 2015 and subsequently, an adult use law was adopted. In Colorado, increases in cannabis use prevalence slowed after MUO retail outlets opened in June 2010 (5.7% from 2012/2013 to 2018/2019 vs. 10.6% from 2006/2007 to 2010/2011; Supplemental Figure L), also corresponding with passage of an adult use law in November 2012.

Figure 1. Prevalence of Past 30-Day Cannabis, Cigarette, Cigar, and Blunt Use Among Young Adults in US States with Adult and Medical Use (AMU) Cannabis Laws (n = 8) and Laws Permitting Medical Use Only (MUO; n = 8) from 2002-2018





Note. Data collection occurred annually, but data were pooled into 2-year estimates (2002/2003, 2004/2005, 2006/2007, 2008/2009, 2010/2011, 2012/2013, 2014/2015, 2016/2017, 2018/2019). Datapoints are shown on the first year of the 2-year period. Time periods described on the right correspond to periods of constant slope and with Joinpoints (inflection points in trend slope) in the final selected model for each product.

Blunt Use

There were no Joinpoints in combined MUO states; only three MUO states showed a Joinpoint in blunt use trends over time (Table 2), and none appeared to correspond with a cannabis policy event. There was one Joinpoint in the blunt use observed among combined AMU states (Figure 1), although this does not appear to relate to policy changes. Six AMU states showed Joinpoints, two of which may related to cannabis policy. In Maine, blunt use prevalence increased by 20.5% (95% CI: -6.1, 53.7) from 2012/2013 to 2018/2019, following the opening of MUO retail outlets in March 2011. In Colorado, blunt use changed from an increasing trend to a plateau in 2012/2013 (-2.3%; 95% CI: -13.7, 3.0) following passage of an adult use law in November 2012.

Tobacco Use

All states showed at least one Joinpoint in cigarette and cigar use trends over time (Table 2). The observed Joinpoints mostly correspond with two points in time: 2009-2012 and 2014/2015. Eight states (Arkansas, Minnesota, North Dakota, Pennsylvania, California, Nevada, Oregon, Washington) showed a significant decline in cigarette use prevalence, and four states (Minnesota, New Hampshire, Pennsylvania, Colorado, Maine) showed a decline in cigar use prevalence that began between 2009-2012. This Joinpoint pattern was also observed for cigarette use over time among AMU and MUO states combined (Figure 1). Second, five states (Delaware, Florida, Ohio, Alaska, Colorado) and DC showed a decline in cigarette use prevalence, and two states (Alaska, Oregon) and DC showed a decline in cigar use prevalence around 2014/2015. Conversely, two states (Delaware and Ohio) showed an increase in cigar use around this time.

For some states, declines in cigarette smoking in 2014/2015 corresponded with MUO (Delaware, DC) or adult use law implementation (Alaska, Colorado). In Maine, after a long period of a flat cigar use prevalence (-0.5%; 95% CI: -8.2, 7.9), prevalence declined by 13.8% (95% CI: -20.4, -6.5) from 2010/2011-2012/2013 to 2018/2019, following MUO implementation and opening of retail outlets. Similarly, cigar use prevalence in Oregon (Supplemental Figure O) began a decline (2014/2015) of 17.1% (95% CI: -59.5, 69.7) when MUO retail outlets opened (March 2014), followed by adult use law passage (November 2014). Cigar use also declined by 17.9% (95% CI: -26.6, -8.2) in 2012/2013 in Colorado following MUO retail outlet opening and at the beginning of an adult use passage law, and by 31.8% (95% CI: -48.4, -9.9) in DC (Supplemental Figure Q) in 2014/2015, beginning when an adult use law went into effect. Conversely, the increase in cigar use in Delaware starting in 2014/2015 (18.0% ; 95% CI: -30.1, 99.1)

occurred after a formerly steady decline (-6.3%; 95% CI: -9.5, 3.0; since 2002/2003) and 2-3 years after MUO was implemented.

DISCUSSION

This is one of the first studies to assess change in blunt use following cannabis policy implementation, by allowing the data to show where change occurred over time, and focused on YAs. From 2002-2018, MUO and AMU states experienced increases in past 30-day cannabis and blunt use among YAs and declines in cigarette and cigar smoking. These patterns are consistent with the direction of national trends, and MUO trends mirror those in the US overall (Substance Abuse and Mental Health Services Administration, 2023). Changes over time in cigar and cigarette smoking did not differ between MUO and AMU states, and while AMU states experienced steeper increases in cannabis and blunt use than MUO states, trends were considered to be parallel. This is consistent with a review which concluded that MUO laws have had minimal impact on cannabis use among young people, but that adult use laws may result in a small increase in cannabis use (Melchior et al., 2019). These patterns are expected, as adult use cannabis laws increase the availability and accessibility of cannabis for YAs without need for a medical card.

As of 2018, the prevalence of cannabis use had surpassed that of cigarette smoking in all states with AMU laws. Similarly, the prevalence of blunt use surpassed cigar smoking in all AMU states. As tobacco laws have become more restrictive over time, cannabis laws have become more permissive in states that allow the legal use of cannabis. Although some evidence suggests that tobacco and cannabis may not be economic substitutes (Cooper et al., 2023), a common liability, or shared propensity, to use these substances supports greater use of cannabis as it becomes more available and reduced tobacco use prevalence as accessibility/appeal decline (van Leeuwen et al., 2011; Vanyukov et al., 2012). In addition, social acceptability of cannabis use has increased, while acceptability of tobacco has declined; furthermore, perceptions of harm of cannabis are lower than tobacco, corresponding with use patterns observed in this analysis (Chambers et al., 2023; Romm et al., 2022). Some research also shows more positive perceptions of cannabis in states with AMU laws compared with MUO states (Steigerwald et al., 2020), although these perceptions may be present prior to policy change and due to other social and political factors that differentiate states (McCarthy, 2022; Spetz et al., 2019).

AMU and MUO states, in aggregate, showed a greater decline in cigarette smoking prevalence following the passage of the 2009 Federal Tobacco Control Act, which imposed stricter restrictions on cigarette smoking, including marketing and sales to youth, requiring disclosure of product ingredients, and banning the sale of flavored cigarettes (except menthol; Tobacco Control Act, 2009). There did not appear to be as consistent of an impact of this major legislation on YA cigar smoking, which is likely due to the fact that cigars were not included as tobacco products under the rule until 2016 (U.S. Food & Drug Administration, 2016). Although some states showed declines in cigarette smoking in 2014/2015 after medical (Delaware, DC) or adult use (Alaska, Colorado) law implementation, there were no apparent changes in cigarette use trends based on cannabis policy. The timing of these Joinpoints may have more to do with tobacco-related factors; the steep decline coincides with the introduction and increased prevalence of e-cigarettes. Another study using three national datasets found that youth cigarette smoking sharply declined from 2013-2022. and that the emergence of e-cigarettes coincides with this period (Delnevo & Villanti, 2023). However, it is not possible to evaluate whether these trends would have been observed had e-cigarettes not existed.

Only one Joinpoint in cannabis or blunt use in a MUO state appeared to follow a policy change (Delaware). In AMU states, trends in relation to policy changes varied across states, but a few patterns were observed. One of the more consistent patterns across states was an increase in YA cannabis use following the opening of MUO retail outlets (Delaware, Maine, Nevada). Although no Joinpoints were detected, similar patterns were reflected in Minnesota, New Hampshire, Oregon, and DC, with an increased cannabis use prevalence in the 1-2 years following this policy event. Relatedly, in states where YA cannabis use prevalence surpassed cigarette smoking over time, this typically occurred within 1-2 years of the opening of MUO retail outlets.

This finding is inconsistent with previous studies that found no change in cannabis use before/after medical use laws (Lachance et al., 2022). However, these evaluations may not have accounted for the delay in opening of retail outlets after the laws were adopted. Greater availability of cannabis retail outlets are associated with greater cannabis use (Manthey et al., 2023), which may contribute to the pattern observed in this study.

Few Joinpoints corresponded with adult use laws, yet several states showed increases following adult use laws going into effect and/or the opening of retail outlets (Alaska, California, Washington) or a continuation of increasing prevalence previous to and following adult use laws (Joinpoints: Colorado and Maine; no Joinpoints: Nevada and Oregon). For states that had MUO laws and then adopted adult use laws, there were no notable fluctuations in product use, but cannabis and blunt use continued to increase. The delay in seeing change in cannabis use after a cannabis policy may explain the high number of policy evaluations with null results, as most have measured change within a year of policy implementation (Lachance et al., 2022). Change may be occurring in the long-term, and cumulative over time with progression of medical to adult use cannabis law enactment.

Blunt use trends mirrored overall cannabis use trends, often increasing after medical use retail outlets opened (Nevada, Oregon), and in some states, initially declining after adult use law passage, then increasing (DC), or increasing steadily through passage of adult use laws (Maine, Nevada). A key relationship of interest in this study was the comparison of cigar use and blunt use trends, where we did not see consistent relationships between policy events and changes in use of these products. In two states (Maine and Oregon), as blunt use increased following medical use dispensaries opening, cigar use declined. In other states (Nevada, Colorado, Delaware, and DC), blunt and cigar use trends followed a similar pattern to each other, but varied in whether they decreased or increased after a policy event. About half of YAs who smoke cigars report using cannabis, and two-thirds of YAs who co-use these products smoke blunts (Glasser et al., 2023; Schauer et al., 2016; Strong et al., 2018). Therefore, one might expect changes in the prevalence of cigars and blunts to follow similar patterns. On the other hand, the availability of a range of products in a legal cannabis market may shift use from cigars to blunt wraps, pre-rolled blunts, or other modes of cannabis administration. Limited evidence suggests that non-combustible modes may be more prevalent in states with adult use cannabis (Smart & Pacula, 2019), though there is a greater availability of blunt wraps and cigarillos co-marketed with cannabis in those states (Giovenco et al., 2018; Henriksen et al., 2018). Given the diverging patterns shown in the current study in relationship to cannabis policy, further research is needed on the impact of policy on blunt and cigar use.

Limitations

This study has several limitations to note. First, although there is substantial overlap in vaping of cannabis and nicotine among YAs (Mattingly et al., 2022), vaping was not assessed in NSDUH until 2019-2020, and due to the COVID-19 pandemic, state-level estimates from this time period are not available due to methodological concerns. Therefore, patterns of YA vaping in relation to cannabis policy were not explored in this study; the impact of cannabis policy on YA use of both cannabis and nicotine vaping is needed in future research. Second, the analysis does not include the full scope of states with cannabis legalization, nor do we compare to non-policy states, resulting in a small sample size of states. Several states passed medical cannabis laws prior to 2002, and other states passed adult use laws after 2018 but were not able to be included in this analysis because NSDUH 2-year estimates of product use prevalence after that time were not yet available. Third, due to the common conflating of cigar products and blunts, misclassification of cigar and/or blunt use is possible, so it cannot be assumed that reporting use of cigars always means use of cigars containing tobacco (Jackson et al., 2022). Fourth, legal age of sale of cannabis is 21 years (and tobacco after 2019), so there may be heterogeneity in patterns of use by YAs under the legal age compared to those 21 years and up; however, given the small cell sizes, especially for use of blunts and cigars, SAMHSA suppressed these estimates. For the same reasons, we were not able to examine any differences by sex or gender.

Future research should examine moderation of policy effects for different groups of YAs. Fifth, given the number of datapoints, we were only able to permit modeling of two Joinpoints (one for blunts), so some variability in trends could have been masked. Last, this study is a descriptive ecological study, so we are unable to determine causal relationships between policy and changes in YA product use. However, not making a priori assumptions about the timing and magnitude of trends based on policy is a strength of the current study.

Conclusions

States with cannabis laws vary in prevalence of YA cannabis and tobacco use over time in relation to policy changes. Cannabis and blunt use increased more in states where AMU laws were in place compared to those with MUO laws. Increased cannabis use appears to occur following opening of MUO retail outlets and continues to increase following AMU policy implementation. There were no clear patterns in relationships between cannabis policies and cigarette or cigar use. Trends observed may correlate with cannabis policies, as well as tobacco policies and other political, economic, or social factors at the state level. Study findings show that future research should account for potential lags in cannabis policy impacts on behavior.

REFERENCES

Agrawal, A., Budney, A. J., & Lynskey, M. T. (2012). The co-occurring use and misuse of cannabis and tobacco: a review. *Addiction*, *107*(7), 1221-1233. https://doi.org/10.1111/j.1360-0443.2012.03837.x

Bhatia, D., Hinckley, J., Mikulich, S., & Sakai, J. (2022). Cannabis legalization and adolescent use of electronic vapor products, cannabis, and cigarettes. *Journal of Addiction Medicine*, *16*(1), e16-e22. https://doi.org/10.1097/ADM.0000000000000831

Borodovsky, J. T., Crosier, B. S., Lee, D. C., Sargent, J. D., & Budney, A. J. (2016). Smoking, vaping, eating: Is legalization impacting the way people use cannabis? *International Journal of Drug Policy*, *36*, 141-147. https://doi.org/10.1016/j.drugpo.2016.02.022

Borodovsky, J. T., Lee, D. C., Crosier, B. S., Gabrielli, J. L., Sargent, J. D., & Budney, A. J. (2017). U.S. cannabis legalization and use of vaping and edible products among youth. *Drug and Alcohol Dependence*, *177*, 299-306. https://doi.org/10.1016/j.drugalcdep.2017.02.017

Cerda, M., Sarvet, A. L., Wall, M., Feng, T., Keyes, K. M., Galea, S., & Hasin, D. S. (2018). Medical marijuana laws and adolescent use of marijuana and other substances: Alcohol, cigarettes, prescription drugs, and other illicit drugs. *Drug and Alcohol Dependence*, *183*, 62-68. https://doi.org/10.1016/j.drugalcdep.2017.10.021

Chambers, J., Keyhani, S., Ling, P. M., Hoggatt, K. J., Hasin, D., Nguyen, N., Woods, A., Ryder, A., & Cohen, B. E. (2023). Perceptions of safety of daily cannabis vs tobacco smoking and secondhand smoke exposure, 2017-2021. *JAMA Network Open*, *6*(8), e2328691. https://doi.org/10.1001/jamanetworkopen.2023.28691

Cohn, A. M., & Chen, S. (2022). Age groups differences in the prevalence and popularity of individual tobacco product use in young adult and adult marijuana and tobacco co-users and tobacco-only users: Findings from Wave 4 of the population assessment of tobacco and health study. *Drug and Alcohol Dependence*, *233*, 109278. https://doi.org/10.1016/j.drugalcdep.2022.109278

Coley, R. L., Kruzik, C., Ghiani, M., Carey, N., Hawkins, S. S., & Baum, C. F. (2020). Recreational marijuana legalization and adolescent use of marijuana, tobacco, and alcohol. *Journal of Adolescent Health*. https://doi.org/10.1016/j.jadohealth.2020.10.019

Cooper, M., Panchalingam, T., Ce, S., & Shi, Y. (2023). Behavioral economic relationship between cannabis and cigarettes: Evidence from hypothetical purchase tasks. *International Journal of Drug Policy*, *112*, 103951. https://doi.org/10.1016/j.drugpo.2022.103951

Delnevo, C. D., & Villanti, A. C. (2023). Dramatic reductions in cigarette smoking prevalence among high school youth from 1991 to 2022 unlikely to have been undermined by e-cigarettes. *International Journal of Environmental Research and Public Health*, *20*(19). https://doi.org/10.3390/ijerph20196866

Family Smoking Prevention and Tobacco Control Act, Pub. L. No. 111-31, 123 Stat. 1776 (2009).

Giovenco, D. P., Spillane, T. E., Mauro, C. M., & Martins, S. S. (2018). Cigarillo sales in legalized marijuana markets in the U.S. *Drug and Alcohol Dependence*, *185*, 347-350. https://doi.org/10.1016/j.drugalcdep.2017.12.011

Glasser, A. M., Nemeth, J. M., Quisenberry, A. J., Shoben, A. B., Trapl, E. S., & Klein, E. G. (2023). The role of cigarillo flavor in the co-use of cigarillos and cannabis among young adults. *Substance Use & Misuse*, *58*(5), 717-727. https://doi.org/10.1080/10826084.2023.2184206

Goodman, S., Wadsworth, E., Leos-Toro, C., Hammond, D., & International Cannabis Policy Study, t. (2020). Prevalence and forms of cannabis use in legal vs. illegal recreational cannabis markets. *International Journal of Drug Policy*, *76*, 102658. https://doi.org/10.1016/j.drugpo.2019.102658

Hammond, D., Goodman, S., Wadsworth, E., Freeman, T. P., Kilmer, B., Schauer, G., Pacula, R. L., & Hall, W. (2022). Trends in the use of cannabis products in Canada and the USA, 2018 - 2020: Findings from the International Cannabis Policy Study. *International Journal of Drug Policy*, *105*, 103716. https://doi.org/10.1016/j.drugpo.2022.103716

Henriksen, L., Schleicher, N. C., Ababseh, K., Johnson, T. O., & Fortmann, S. P. (2018). Marijuana as a 'concept' flavour for cigar products: Availability and price near California schools. *Tobacco Control*, *27*(5), 585-588. https://doi.org/10.1136/tobaccocontrol-2017-053961

Irimata, K. E., Bastian, B. A., Clarke, T. C., Curtin, S. C., & Rui, P. (2022). Guidance for selecting model options in the National Cancer Institute Joinpoint Regression Software. National Center for Health Statistics. *Vital Health Stat*, *2*(194). http://dx.doi.org/10.15620/cdc:118050

Jackson, D. D., Sanders, E. C., Barry, M., Wagner, D. E., Vigorita, M. W., & Navarro, M. A. (2022). Unpacking cigar product familiarity and terminology among black and hispanic youth: It's all about blunts. *International Journal of Environmental Research and Public Health*, *19*(3). https://doi.org/10.3390/ijerph19031689

Jacobus, J., & Tapert, S. F. (2014). Effects of cannabis on the adolescent brain. *Current Pharmaceutical Design*, *20*(13), 2186-2193. https://doi.org/10.2174/13816128113199990426

Lachance, A., Belanger, R. E., Riva, M., & Ross, N. A. (2022). A systematic review and narrative synthesis of the evolution of adolescent and young adult cannabis consumption before and after legalization. *Journal of Adolescent Health*, *70*(6), 848-863. https://doi.org/10.1016/j.jadohealth.2021.11.034

Lemyre, A., Poliakova, N., & Belanger, R. E. (2019). The relationship between tobacco and cannabis use: A review. *Substance Use & Misuse*, *54*(1), 130-145. https://doi.org/10.1080/10826084.2018.1512623

Manthey, J., Jacobsen, B., Hayer, T., Kalke, J., Lopez-Pelayo, H., Pons-Cabrera, M. T., Verthein, U., & Rosenkranz, M. (2023). The impact of legal cannabis availability on cannabis use and health outcomes: A systematic review. *International Journal of Drug Policy*, *116*, 104039. https://doi.org/10.1016/j.drugpo.2023.104039

Marijuana Policy Project. (2021). *Medical Cannabis Program Implementation Timelines*. https://www.mpp.org/issues/medical-marijuana/state-by-state-medical-marijuana-laws/medical-marijuana-program-implementation-timeline/

Mason, W. A., Fleming, C. B., Ringle, J. L., Hanson, K., Gross, T. J., & Haggerty, K. P. (2016). Prevalence of marijuana and other substance use before and after Washington State's change from legal medical marijuana to legal medical and nonmedical marijuana: Cohort comparisons in a sample of adolescents. *Substance Use & Addiction*

Journal, *37*(2), 330-335. https://doi.org/10.1080/08897077.2015.1071723

Mattingly, D. T., Patel, A., Hirschtick, J. L., & Fleischer, N. L. (2022). Sociodemographic differences in patterns of nicotine and cannabis vaping among US adults. *Preventative Medicine Reports*, *26*, 101715. https://doi.org/10.1016/j.pmedr.2022.101715

McCarthy, J. (2022). *The short answer: What percentage of Americans smoke marijuana*? Gallup. https://news.gallup.com/poll/284135/percentage-americans-smoke-marijuana.aspx

Melchior, M., Nakamura, A., Bolze, C., Hausfater, F., El Khoury, F., Mary-Krause, M., & Azevedo Da Silva, M. (2019). Does liberalisation of cannabis policy influence levels of use in adolescents and young adults? A systematic review and meta-analysis. *BMJ Open*, *9*(7), e025880. https://doi.org/10.1136/bmjopen-2018-025880

Montgomery, L., & Mantey, D. (2018). Racial/Ethnic Differences in Prevalence and Correlates of Blunt Smoking among Adolescents. *Journal of Psychoactive Drugs*, *50*(3), 195-205. https://doi.org/10.1080/02791072.2017.1401186

National Academy of Sciences Engineering and Medicine (NASEM). (2017). *The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research*. https://www.ncbi.nlm.nih.gov/pubmed/28182367

National Cancer Institute. (2023). *Joinpoint Trend Analysis Software*. Division of Cancer Control & Population Sciences, National Cancer Institute. https://surveillance.cancer.gov/joinpoint/

National Conference of State Legislatures. (2023). *State Cannabis Policy Enactment Database*. https://www.ncsl.org/health/state-cannabis-legislation-database

National Conference of State Legislatures. (2024). *Cannabis Overview*. Retrieved April 4 from https://www.ncsl.org/civil-and-criminal-justice/cannabis-overview

Nicksic, N. E., Do, E. K., & Barnes, A. J. (2020). Cannabis legalization, tobacco prevention policies, and Cannabis use in E-cigarettes among youth. *Drug and Alcohol Dependence*, *206*, 107730. https://doi.org/10.1016/j.drugalcdep.2019.107730

Orsini, M. M., Vuolo, M., & Kelly, B. C. (2024). Cannabis liberalization is only associated with increased blunt use if states lack strong tobacco control. *Addictive Behaviors*. https://doi.org/10.1016/j.addbeh.2024.108100

Patrick, M. E., Miech, R. A., Johnston, L. D., & O'Malley, P. M. (2023). *Monitoring the Future Panel Study annual report: National data on substance use among adults ages 19 to 60, 1976-2022.* https://monitoringthefuture.org/wp-content/uploads/2023/07/mtfpanel2023.pdf

Reboussin, B. A., Wagoner, K. G., Ross, J. C., Suerken, C. K., & Sutfin, E. L. (2021). Tobacco and marijuana co-use in a cohort of young adults: Patterns, correlates and reasons for co-use. *Drug and Alcohol Dependence*, *227*, 109000. https://doi.org/10.1016/j.drugalcdep.2021.109000

Romm, K. F., Wang, Y., Ma, Y., Wysota, C. N., Blank, M. D., Huebner, D. M., Roche, K. M., & Berg, C. J. (2022). The reciprocal relationships of social norms and risk perceptions to cigarette, e-cigarette, and cannabis use: Cross-lagged panel analyses among US young adults in a longitudinal study. *Drug and Alcohol Dependence*, *238*, 109570. https://doi.org/10.1016/j.drugalcdep.2022.109570

Schauer, G. L., Berg, C. J., Kegler, M. C., Donovan, D. M., & Windle, M. (2016). Differences in tobacco product use among past month adult marijuana users and nonusers: Findings from the 2003-2012 National Survey on Drug Use and Health. *Nicotine and Tobacco Research*, *18*(3), 281-288. https://doi.org/10.1093/ntr/ntv093

Schlienz, N. J., & Lee, D. C. (2018). Co-use of cannabis, tobacco, and alcohol during adolescence: policy and regulatory implications. *International Review of Psychiatry*, *30*(3), 226-237. https://doi.org/10.1080/09540261.2018.1465399

Seaman, E. L., Green, K. M., Wang, M. Q., Quinn, S. C., & Fryer, C. S. (2019). Examining prevalence and correlates of cigarette and

marijuana co-use among young adults using ten years of NHANES data. *Addictive Behavior*, *96*, 140-147. https://doi.org/10.1016/j.addbeh.2019.04.014

Shi, Y. (2021). Heterogeneities in administration methods among cannabis users by use purpose and state legalization status: findings from a nationally representative survey in the United States, 2020. *Addiction*, *116*(7), 1782-1793. https://doi.org/10.1111/add.15342

Smart, R., & Pacula, R. L. (2019). Early evidence of the impact of cannabis legalization on cannabis use, cannabis use disorder, and the use of other substances: Findings from state policy evaluations. *The American Journal of Drug Alcohol Abuse*, *45*(6), 644-663. https://doi.org/10.1080/00952990.2019.1669626

Spetz, J., Chapman, S. A., Bates, T., Jura, M., & Schmidt, L. A. (2019). Social and political factors associated with state-level legalization of cannabis in the United States. *Contemporary Drug Problems*, *46*(2), 165-179. https://doi.org/10.1177/0091450919827605

Steigerwald, S., Cohen, B. E., Vali, M., Hasin, D., Cerda, M., & Keyhani, S. (2020). Differences in opinions about marijuana use and prevalence of use by state legalization status. *Journal of Addiction Medicine*, *14*(4), 337-344. https://doi.org/10.1097/ADM.0000000000000593

Strong, D. R., Myers, M. G., Pulvers, K., Noble, M., Brikmanis, K., & Doran, N. (2018). Marijuana use among US tobacco users: Findings from wave 1 of the Population Assessment of Tobacco Health (PATH) study. *Drug and Alcohol Dependence*, *186*, 16-22. https://doi.org/10.1016/j.drugalcdep.2017.12.044

Substance Abuse and Mental Health Services Administration. (2023). *Data Tools: Welcome to the Data Analysis System for SAMHSA Studies*. https://datatools.samhsa.gov/

Timberlake, D. S. (2009). A comparison of drug use and dependence between blunt smokers and other cannabis users. *Substance Use & Misuse*, *44*(3), 401-415. https://doi.org/10.1080/10826080802347651

Timberlake, D. S., Rhee, J., Silver, L. D., Padon, A. A., Vos, R. O., Unger, J. B., & Andersen-Rodgers, E. (2021). Impact of California's tobacco and cannabis policies on the retail availability of little cigars/cigarillos and blunt wraps. *Drug and Alcohol Dependence*, *228*, 109064. https://doi.org/10.1016/j.drugalcdep.2021.109064

Deeming Tobacco Products To Be Subject to the Federal Food, Drug, and Cosmetic Act, as Amended by the Family Smoking Prevention and Tobacco Control Act; Restrictions on the Sale and Distribution of Tobacco Products and Required Warning Statements for Tobacco Products, FDA-2014-N-0189 (2016). https://www.federalregister.gov/d/2016-10685

van Leeuwen, A. P., Verhulst, F. C., Reijneveld, S. A., Vollebergh, W. A., Ormel, J., & Huizink, A. C. (2011). Can the gateway hypothesis, the common liability model and/or, the route of administration model predict initiation of cannabis use during adolescence? A survival analysis--the TRAILS study. *Journal of Adolescent Health*, *48*(1), 73-78. https://doi.org/10.1016/j.jadohealth.2010.05.008

Vanyukov, M. M., Tarter, R. E., Kirillova, G. P., Kirisci, L., Reynolds, M. D., Kreek, M. J., Conway, K. P., Maher, B. S., Iacono, W. G., Bierut, L., Neale, M. C., Clark, D. B., & Ridenour, T. A. (2012). Common liability to addiction and "gateway hypothesis": theoretical, empirical and evolutionary perspective. *Drug and Alcohol Dependence*, *123* (Suppl 1), S3-17. https://doi.org/10.1016/j.drugalcdep.2011.12.018

Veligati, S., Howdeshell, S., Beeler-Stinn, S., Lingam, D., Allen, P. C., Chen, L. S., & Grucza, R. A. (2020). Changes in alcohol and cigarette consumption in response to medical and recreational cannabis legalization: Evidence from U.S. state tax receipt data. *International Journal of Drug Policy*, *75*, 102585. https://doi.org/10.1016/j.drugpo.2019.10.011

Vuolo, M., Lindsay, S. L., & Kelly, B. C. (2022). Further consideration of the impact of tobacco control policies on young adult smoking in light of the liberalization of cannabis policies. *Nicotine & Tobacco Research*, *24*(1), 60-68. https://doi.org/10.1093/ntr/ntab149

Funding and Acknowledgements: This work was supported by the National Center for Advancing

Translational Sciences of the National Institutes of Health under Award Number TL1TR003019 (AMG) and P30CA072720-5931 (AMG, ACV). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The authors have no conflicts of interest to declare.

Citation: Glasser, A. M., Uriarte, C. King Jensen, J., Sterling, K., Shang, C., Hammond, D., & Villanti, A. C. (2025). Temporal trends in young adult cannabis and tobacco use in different states with different cannabis policies. *Cannabis, 8*(2), 98 - 111. https://doi.org10.26828/cannabis/2025/000288

Issue Date: July 15, 2025