

4. HCUP Kids' Inpatient Database (KID). Healthcare Cost and Utilization Project (HCUP). 2012. Agency for Healthcare Research and Quality, Rockville, MD. <https://hcupnet.ahrq.gov/#setup>. Accessed May 26, 2018.
5. Williams DJ, Shah SS, Myers A, et al. Identifying pediatric community-acquired pneumonia hospitalizations: accuracy of administrative billing codes. *JAMA Pediatr*. 2013;167(9):851-858. doi:10.1001/jamapediatrics.2013.186
6. Leyenaar JK, Lagu T, Shieh M-S, Pekow PS, Lindenauer PK. Variation in resource utilization for the management of uncomplicated community-acquired pneumonia across community and children's hospitals. *J Pediatr*. 2014;165(3):585-591. doi:10.1016/j.jpeds.2014.04.062

Prevalence of Cannabis Use in Youths After Legalization in Washington State

In November 2012, voters in Washington legalized nonmedical (retail) cannabis for people aged 21 and older. Markets opened in July 2014. The effect of this change on cannabis use among youths is of public health concern.

Cerdá et al¹ analyzed data from the nationally representative Monitoring the Future survey (MTF) and used difference-in-differences methods to compare cannabis use prevalence trends among youths in Washington with use in states without legalization of recreational marijuana. Because the MTF is not designed to provide state-representative estimates, the article generated covariate-adjusted modeled prevalence estimates for each state. The article suggested complex association between legalization and cannabis use among youths: increases in prevalence among Washington 8th and 10th graders, but not among 12th graders, relative to use in states without legalization of recreational marijuana.

The authors noted that, "the sample design may lead to discrepancies between MTF results and those found in other large-scale surveillance efforts."^{1(p148)} The purpose of the present study was to assess whether trends in cannabis use prevalence among youths from Washington's state-based youth survey are consistent with findings from the MTF.

Methods | The Washington Healthy Youth Survey (HYS)² is an anonymous, school-based survey of 8th, 10th, and 12th graders and the state's primary source of information about health behavior among youths. The HYS has been implemented in the fall of even-numbered years since 2002, using a simple random sample of public schools to generate a state-representative sample. Response rates (incorporating school and student response) in 2016 were 80% for 8th grade, 69% for 10th grade, and 49% for 12th grade. The study was approved by the Washington State Institutional Review Board, whose general policy waives informed patient consent when data are deidentified.

We generated covariate-adjusted prevalence estimates, modeling as closely as possible to Cerdá et al.¹ Prevalence was based on modeled estimates (ie, SUDAAN predMARG [RTI International] postestimation command). Because the postlegalization periods are not identical, we present HYS data from both 2014 alone and 2014-2016 combined (MTF reported 2013-2015). Significance was established at $P < .05$ with unpaired, 2-tailed testing. Analysis was conducted using Stata, version 14.2 (StataCorp).

Results | More schools and students are captured in the HYS than MTF (Table). The MTF included fewer low-socioeconomic status and nonwhite youth in the prelegalization vs postlegalization period.

Estimates from the MTF show statistically nonsignificant change in the prevalence of cannabis use for 8th graders (from 6.2% [95% CI, 4.4%-8.7%] to 8.2% [95% CI, 6.3%-10.7%]; $P = .16$), and a significant increase for 10th graders (from 16.2% [95% CI, 14.0%-18.6%] to 20.3% [95% CI, 16.9%-24.1%]; $P = .02$). In contrast, the HYS shows statistically significant declines in prevalence from 2010-2012 to 2014-2016 among both 8th graders (from 9.8% [95% CI, 9.1%-10.5%] to 7.3% [95% CI, 6.6%-8.0%]; $P < .001$) and 10th graders (from 19.8% [95% CI, 18.6%-21.0%] to 17.8% [95% CI, 16.7%-18.9%];

Table. School-Based Survey Sample Characteristics and Responses, Washington State, 2010-2016

Sample	Healthy Youth Survey ^a			Monitoring the Future Survey ^b				
	2010-2012	2014	P Value ^c	2014-2016	P Value ^c	2010-2012	2013-2015	P Value ^d
Schools, No.	221	116		226		24	23	
Students, No.	47 561	26 133		53 220		2912	2597	
Urban schools, %	74.3	82.1	.12	78.2	.34	78.0	73.1	<.001
Student characteristics, %								
White non-Hispanic	56.3	54.7	.51	53.6	.16	67.2	55.1	<.001
Low SES ^e	14.0	12.8	.38	14.4	.75	8.9	13.3	<.001
Youth cannabis use, % (95% CI)								
All students	19.4 (18.6-20.2)	18.4 (17.3-19.6)	.28	17.9 (17.1-18.8)	.01	13.9 (12.8-15.3)	14.5 (13.2-15.9)	NR
Grade 8	9.8 (9.1-10.5)	8.0 (7.1-8.8)	.003	7.3 (6.6-8.0)	<.001	6.2 (4.4-8.7)	8.2 (6.3-10.7)	.16
Grade 10	19.8 (18.6-21.0)	18.5 (16.9-20.1)	.25	17.8 (16.7-18.9)	.01	16.2 (14.0-18.6)	20.3 (16.9-24.1)	.02
Grade 12	26.6 (25.2-28.0)	27.0 (24.8-29.2)	.72	26.7 (25.2-28.3)	.91	21.2 (17.4-25.6)	21.8 (18.0-26.1)	.83

Abbreviations: NR, not reported; SES, socioeconomic status.

^a Healthy Youth Survey cannabis use prevalence based on modeled estimates (Stata software margins postestimation command). The 2010-2012 cannabis use estimates are from models with 2014-2016 data. Student characteristics weighted by grade and year.

^b Data obtained from Cerdá et al.¹ Prevalence was based on modeled estimates (ie, SUDAAN predMARG [RTI International Inc] postestimation command); number of students by grade was not reported. The 95% CIs for all grade

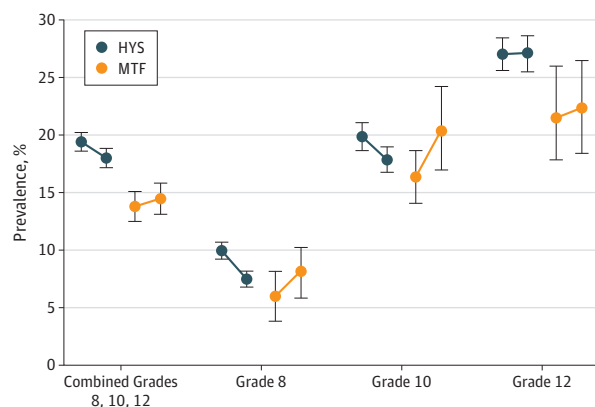
cannabis use were added using z scores.

^c P values from χ^2 tests for school and student characteristics, and from logistic regression for youth cannabis use by period (eg, either 2014 or 2014-2016 vs 2010-2012).

^d P values for school/student characteristics based on z scores for cannabis use.¹

^e Low SES based on mother's highest level of educational level less than high school graduate.

Figure. Past-Month Cannabis Use Prevalence Among Washington State Youth by Survey and Grade Before and After Legalization



Washington Healthy Youth Survey (HYS) modeled estimates in 2010-2012 and 2014-2016 and Monitoring the Future survey (MTF) in 2010-2012 and 2013-2015. Error bars indicate 95% CI.

$P = .01$). Neither MTF nor HYS analysis showed changes among 12th graders (Figure). Findings from HYS comparisons to 2014 alone were of less magnitude but similar direction.

Discussion | In contrast to Cerdá et al,¹ Washington's HYS data suggest that cannabis use among youths declined after legalization among 8th and 10th graders. The main difference is among 10th graders: the MTF suggests a statistically significant increase while HYS suggests a decrease.

These surveys have different purposes: the HYS provides results generalizable to youths in public schools statewide, while the MTF is designed to provide national and US regional (not state-specific) estimates. Hence, the MTF sample may be more influenced by unmeasured characteristics of Washington youths, especially if some subpopulations disproportionately captured are differently affected by legalization. For example, many Washington cities and counties have banned or restricted retail sales following state legalization,³ and differential exposure to local policy contexts may partially explain the varied patterns between the samples. Furthermore, there are differences in sampling error: the smaller MTF sample resulted in larger 95% CIs overlapping between prelegalization and postlegalization periods. In addition, the lack of an HYS comparison group limits the ability to make inferences about specific effects of cannabis legalization.

It is too soon to know the long-term influence that cannabis legalization will have on the prevalence of its use by youths. Further studies are needed with representative state samples, including subgroups; information about patterns of consumption rather than just prevalence; and attention to local implementation.

Julia A. Dilley, PhD, MEd
 Susan M. Richardson, MPH
 Beau Kilmer, PhD
 Rosalie Liccardo Pacula, PhD
 Mary B. Segawa, MS
 Magdalena Cerdá, DrPH, MPH

Author Affiliations: Multnomah County/Oregon Public Health Division, Portland, Oregon (Dilley, Richardson); RAND Corporation, Santa Monica, California (Kilmer, Pacula); Washington State Liquor and Cannabis Board, Olympia (Segawa); Department of Population Health, School of Medicine, New York University, New York (Cerdá).

Accepted for Publication: September 27, 2018.

Corresponding Author: Julia A. Dilley, PhD, MEd, Multnomah County/Oregon Public Health Division, 800 NE Oregon St, Ste 260, Portland, OR 97232 (julia.dilley@state.or.us).

Published Online: December 19, 2018. doi:10.1001/jamapediatrics.2018.4458

Author Contributions: Dr Dilley had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: All authors.

Acquisition, analysis, or interpretation of data: Dilley, Richardson, Kilmer, Pacula, Segawa.

Drafting of the manuscript: Dilley, Richardson.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Dilley, Richardson, Pacula.

Obtained funding: Dilley, Richardson.

Administrative, technical, or material support: Dilley, Richardson, Segawa.

Supervision: Dilley, Pacula, Cerdá.

Conflict of Interest Disclosures: None reported.

Funding/Support: Research reported in this article was supported by the National Institute on Drug Abuse of the National Institutes of Health (NIH) under award number 1R01DA039293.

Role of the Funder/Sponsor: The National Institute on Drug Abuse had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Disclaimer: The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

Additional Contributions: Melanie Wall, PhD (Columbia University), served as a consultant on methods used in Monitoring the Future survey analysis. No compensation was received.

1. Cerdá M, Wall M, Feng T, et al. Association of state recreational marijuana laws with adolescent marijuana use. *JAMA Pediatr*. 2017;171(2):142-149. doi:10.1001/jamapediatrics.2016.3624

2. Washington State Department of Social and Health Services, Department of Health, Office of the Superintendent of Public Instruction, and Liquor and Cannabis Board. Healthy Youth Survey 2016 Analytic Report, Olympia, WA. <http://www.AskHYS.net>. Published June 2017. Accessed April 30, 2018.

3. Dilley JA, Hitchcock L, McGroder N, Greto LA, Richardson SM. Community-level policy responses to state marijuana legalization in Washington State. *Int J Drug Policy*. 2017;42:102-108. doi:10.1016/j.drugpo.2017.02.010

COMMENT & RESPONSE

Implications of Agency in Studies of Self-regulation and Obesity

To the Editor An issue of *JAMA Pediatrics* included an interesting article by Anderson and Whitaker entitled "Association of Self-regulation With Obesity in Boys vs Girls in a US National Sample."¹ While it is important to acknowledge that obesity is a complex phenomenon that involves the interplay of genetic, lifestyle, and environmental factors, this article, especially read out of context, risks overstating the boundaries of individual agency.

Social, political, and environmental factors far outweigh a child's strength of will in determining their body mass index; focusing on self-regulation implies the presence of a choice between healthy and unhealthy behaviors, which in many cases does not exist. While the authors attempted to control for various socioeconomic variables, other important factors shown to be associated with childhood obesity, including, for example, zip code of residence and insurance status, were not considered.^{2,3}