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## Adolescent Marijuana Use and Co-Occurrence with Tobacco Use: Implications for Tobacco Regulation

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## Adolescent Marijuana Use and Co-Occurrence with Tobacco Use: Implications for Tobacco Regulation

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## INTRODUCTION

Marijuana use among high school youth has declined over the past two decades.<sup>1</sup> However, there has been a notable shift in the national landscape with regards to social norms and marijuana legalization,<sup>2,3</sup> with 29 states and Washington D.C. legalizing medical marijuana use and 8 states and Washington D.C. legalizing adult non-medical use.<sup>4</sup> These trends could allow marijuana to become more available and may compete against prevention efforts among youth.

Despite the overall decrease in marijuana use, nationally, marijuana use among current users of cigarettes or cigars increased between 1997 and 2013.<sup>5</sup> Hookah or waterpipe users are more likely to use marijuana than non-hookah users.<sup>6</sup> Emerging research has also shown an increased odds of vaporizing marijuana among e-cigarette users.<sup>7</sup>

There is a documented relationship between marijuana and tobacco use, particularly with the use of blunts.<sup>8–12</sup> Blunts are made by removing the tobacco from a cigar and mixing or replacing it with marijuana. Notably, some youth who use blunts do not identify as tobacco users.<sup>13–16</sup> Co-use of marijuana and tobacco, including in the form of blunts, is of concern as the concurrent use of marijuana with tobacco increases dependence on marijuana<sup>17,18</sup> and nicotine.<sup>19</sup>

Smoking marijuana has been shown to be the most common method of marijuana use for youth,<sup>20</sup> with 90% of youth who use marijuana reporting usually smoking it in a joint, bong, pipe, or blunt;<sup>21</sup> differentiating ways of smoking or consuming marijuana would aid the understanding of youth use. Modes of use are important for users themselves, as research has shown that blunt and joint users should be considered distinct groups.<sup>22</sup> In addition, qualitative research reveals socio-cultural variations in the use of blunts and bongs or pipes, with blunt users identifying with hip hop culture and reporting blunt use as supporting marijuana sharing practices.<sup>23,24</sup> Demographic characteristics also differ between the product user groups, with blunt users more likely to be Hispanic or African American and joint and pipe users more likely to be White.<sup>25</sup> Further, the amount of marijuana used in blunts, joints, and pipes varies, with more marijuana being placed in blunts than joints or pipes, which includes water pipes or bongs.<sup>25</sup>

Despite the documented relationship between tobacco and marijuana use and the distinctions in modes of marijuana use, little is known about mode of marijuana use in relation to concurrent use of different tobacco products among adolescents. With the recent FDA changes bringing cigars, hookah tobacco, and electronic cigarettes under the

purview of the FDA Center for Tobacco Products (CTP),<sup>26</sup> there may be an opportunity for CTP regulations of other tobacco products to impact youth use of both marijuana and tobacco.

The goals of this study are to a) describe the demographic characteristics of youth marijuana users, b) examine modes of marijuana use, and c) assess the relationship between modes of marijuana use and the use of different tobacco products. Findings from this study could inform further research as well as regulatory and other policy efforts.

## METHODS

Data for this study were drawn from the 2015 Cleveland Youth Risk Behavior Survey (n=6197), conducted as a census administration in 26 high schools (100% school participation). A total of 9,316 students were eligible to complete the survey; 6,325 students participated. Questionnaires that failed quality control standards as established by the Centers for Disease Control and Prevention<sup>27</sup> were removed from the data set (n=128), yielding 6,197 usable surveys. Student non-response was due to student refusal, absence on the day of survey administration, or parental refusal. Overall response rate was 66.5%.

The current analyses were restricted to those who reported using marijuana at least once in the past 30 days. This resulted in a sample size of 1,420 (22.9% of final sample). This study was approved by the Institutional Review Board at Case Western Reserve University.

### *Measures*

*Demographic characteristics:* Student self-report of gender (i.e. male or female), grade level (i.e. 9, 10, 11, or 12), race/ethnicity, and family affluence were assessed as demographic characteristics.

Students were asked two questions to determine race/ethnicity. The first asked whether a student was Hispanic or Latino, and the second asked "What is your race?"; students were instructed to select one or more responses to the race question. Response options were: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, and White. Students who reported that they were Hispanic or Latino were coded as such, regardless of their response to the second question. Students who reported that they were not Hispanic or Latino were separated into one of 3 categories: non-Hispanic White, non-Hispanic Black, and other/multiple races.

The Family Affluence Scale (FAS) was used as a proxy for socioeconomic status (SES).<sup>28,29</sup> The FAS sums responses from the following four items, yielding a range from 0-9: sharing a bedroom, family

car ownership, family computer ownership, and number of family vacations in a year. In this study, FAS was categorized as low (0-4), medium (5-6), and high (7-9) family affluence (further referred to as SES).

*Current cigarette use:* To assess current cigarette use, students were asked, "During the past 30 days, on how many days did you smoke cigarettes?" Respondents were considered current users if they reported use on one or more days.<sup>30</sup>

*Current cigar product use:* To assess current cigar product use, students were asked, "During the past 30 days, on how many days did you smoke cigars, cigarillos, little cigars, or flavored cigars, such as Black & Milds, Swisher Sweets, or Phillies?" A survey item that includes cigar brand names has been shown to yield greater endorsement among minority youth.<sup>31-34</sup> Respondents were considered current cigar users if they reported use on one or more days.

*Current hookah use:* To assess current hookah use, students were asked, "During the past 30 days, on how many days did you smoke tobacco out of a water pipe or hookah?" Respondents were considered current users if they reported use on one or more days.

*Current e-cigarette use:* To assess current use of electronic vapor products, youth were provided a brief description of these products and then asked, "During the past 30 days, on how many days did you use an electronic vapor product?" Respondents were considered current users if they reported use on one or more days.<sup>30</sup>

*Any current tobacco use:* Any current tobacco use was a yes/no variable created using participant responses to the current cigarette, current cigar, current hookah, and current e-cigarette use. Students endorsing any one of the four behaviors were considered a current tobacco user; those indicating that they had not used any of the four products were considered not to be a current tobacco user.

*Mode of Marijuana Use (MMU):* Youth were asked, "During the past 30 days, how did you usually use marijuana?" Responses were coded as a blunt; in a joint, bong, or pipe (JBP); vaporized; or some other way (e.g. consumed in a food or beverage). The standard CDC response categories for this item were altered to allow specific examination of blunt use; no definitions of response categories were provided based on CDC's approach.

Analyses were restricted to those who smoked marijuana in the past 30 days and were conducted using SPSSv24. Univariate analyses were conducted to describe the characteristics of the sample. Bivariate analyses, including chi-square tests, were used to test for bivariate associations between MMU and demographic and tobacco use characteristics. Due to

the small proportion of respondents endorsing vaping and other MMU, we developed logistic regression models to ascertain variables associated with blunt use compared to JBP. Variables found to be significantly associated with MMU were entered into logistic regression models. Logistic regression models were fit to determine the relationship between MMU (i.e. blunt vs. JBP) and covariates. First, unadjusted odds ratios were calculated for each variable shown to be significantly associated with MMU, and then a multivariable logistic regression model was run including all variables yielding adjusted estimates.

## RESULTS

Within the full sample, participants who reported current marijuana use were significantly more likely to be male, non-Hispanic, in an upper grade level, have lower grades in school, and a current tobacco user, compared to those who were not current marijuana users (data not shown). Among current marijuana users, just over half of participants (53.2%) identified as male (Table 1). Nearly 60% identified as Black, 19.1% as Hispanic, and 10.9% as White. More participants were identified as low SES (44.3%) compared to medium (35.7%) or high SES (20.0%). While less than 20% of respondents reported smoking cigarettes in the past 30 days, 62.4% reported past 30-day use of cigars, cigarillos or little cigars; over a third reported past 30-day use of hookah (35.5%) or e-cigarettes (36.4%); nearly 80% reported current use of one tobacco product. Overall, 74.6% of past 30-day marijuana users reported usually smoking marijuana as a blunt, 15.1% smoked as a JBP, 2.1% vaped, and 8.2% reported using in some other way.

Table 1. Demographics, Tobacco Use Behavior, and Mode of Marijuana Use of Current Marijuana Users (n=1420)

<i>Demographics*</i>	n	%
<b>Gender</b>		
Male	747	53.2
Female	657	46.8
<b>Race</b>		
White	151	10.9
Black	818	59.1
Hispanic	264	19.1
Other	152	11.0
<b>Grade</b>		
9th	391	27.9

10th	393	28.0
11th	349	24.9
12th	268	19.1
<b>SES</b>		
Low	550	44.3
Medium	443	35.7
High	248	20.0
<i>Tobacco Use Behaviors*</i>		
<b>Current Cigarette Use</b>	260	18.7
<b>Current Cigar, Little Cigar, or Cigarillo Use</b>	806	62.4
<b>Current Hookah Use</b>	477	35.5
<b>Current E-cigarette Use</b>	474	36.4
<b>Any current tobacco use</b>	1073	79.3
<b>Mode of Marijuana Use</b>		
Blunt	1059	74.6
Joint, Pipe, or Bong	214	15.1
Vape	30	2.1
Edibles or other way	117	8.2

\* Totals may not equal 1420 due to missing data.

As shown in Table 2, females were more likely to smoke a blunt (79.5% v 71.1%) and less likely to use some other way (6.7% v 13.1%). Blacks were more likely to smoke a blunt compared to Whites and Hispanics (80.8% v 62.3% and 67.0% respectively); Whites were more likely to smoke a JBP compared to Black and Hispanics (33.8% v. 8.9% and 20.1% respectively). Low SES participants were more likely to smoke a blunt than high SES (76.9% vs. 70.6) and less likely than high SES to smoke a JBP (12.0% vs. 21.0%). No significant differences were observed by grade.

Table 2. Demographics by Mode of Marijuana Use

<i>Demographics</i>	Blunt (n=1059) %	JBP (n=214) %	Vape (n=30) %	Other (n=117) %	p
<b>Gender</b>					
Male	71.1	15.8	2.4	10.7	<.001
Female	79.5	13.9	1.5	5.2	
<b>Race</b>					
White	62.3	33.8	1.3	2.6	<.001
Black	80.8	8.9	2.2	8.1	

Hispanic	67.0	20.1	1.5	11.4	
Other	69.1	19.7	3.3	7.9	
<b>Grade</b>					
9th	75.2	16.1	1.5	7.2	.450
10th	76.8	14.2	1.8	7.1	
11th	72.2	16.3	2.6	8.9	
12th	74.6	13.8	2.2	9.3	
<b>SES</b>					
Low	76.9	12.0	1.6	9.5	.017
Medium	73.4	17.6	2.3	6.8	
High	70.6	21.0	0.8	7.7	

Past 30-day cigarette smokers were less likely to have smoked a blunt and more likely to have smoked a JBP, vaped marijuana, or consumed it in some other way compared to those who weren't current cigarette smokers (Table 3). Conversely, past 30-day cigar smokers were more likely to have smoked a blunt and less likely to have smoked a JBP than those who weren't current cigar smokers; there were no difference in vaping or other use of marijuana. Youth reporting current hookah use and current vaping reported MMU patterns similar to current cigarette smokers. Youth not currently reporting use of any tobacco products (i.e. current use of cigarettes, cigar products, hookah or e-cigarettes) were significantly more likely to have smoked a blunt and less likely to have used marijuana in some other way compared to those who were current tobacco users.

Table 3. Tobacco Use Behaviors and Mode of Marijuana Use

<i>Demographics</i>	Blunt (n=1059) %	JBP (n=214) %	Vape (n=30) %	Other (n=117) %	p
<b>Current Cigarette Smoking</b>					
No	77.5	14.0	1.8	6.7	<.001
Yes	64.2	18.8	3.5	13.5	
<b>Current Cigar Smoking</b>					
No	70.9	19.4	1.9	7.8	.027
Yes	77.2	13.2	2.0	7.7	
<b>Current Hookah Smoking</b>					
No	82.4	12.3	1.2	4.2	<.001

Yes	64.8	18.9	3.4	13.0	
<b>Current E-Cigarette Use</b>					
No	84.0	11.1	0.8	4.1	<.001
Yes	66.2	20.5	3.8	9.5	
<b>Any Current Tobacco Use</b>					
No	83.0	13.3	0.4	3.3	<.001
Yes	72.5	15.6	2.5	9.4	

We examined two multivariable logistic regression models to assess factors that differentiated between JBP use (0) or blunt use (1). In Table 4, the first model included only demographic characteristics; females, non-whites, and low SES respondents had significantly increased odds of endorsing blunt use. The second model included both demographic variables as well as current tobacco use variables. Relationships observed for demographic variables in Model 1 remained significant in Model 2. Current cigar users have two times the odds of being a blunt user; however, current hookah users had a decreased odds of being a blunt user, which could also be interpreted as a greater odds of being a JBP user.

Table 4. Multivariable Models: Factors Associated with Blunt (1) vs. JBP(0) Use

	Model 1		Model 2	
	OR	95%CI	OR	95%CI
Female	1.46 *	1.05, 2.03	1.44 *	1.02, 2.04
Grade (ref = 12)				
9 <sup>th</sup>	1.02	0.65, 1.59	1.06	0.67, 1.67
10 <sup>th</sup>	0.81	0.52, 1.226	0.87	0.55, 1.38
11 <sup>th</sup>	0.82	0.51, 1.33	0.84	0.51, 1.40
Race/Ethnicity (ref=White)				
Black	5.92***	3.80, 9.22	4.91***	3.02, 7.97
Hispanic	2.03 **	1.24, 3.30	2.06 **	1.23, 3.44
Other	2.36 **	1.34, 4.14	1.98 *	1.10, 3.56
SES (ref = High)				
Low	1.90 **	1.23, 2.93	1.89 **	1.20, 2.96
Med	1.23	0.81, 1.89	1.21	0.78, 1.88
Current Cigarette Smoking	--	--	0.98	0.62, 1.56

Current Smoking	Cigar	--	--	1.98***	1.35, 2.92
Current Smoking	Hookah	--	--	0.62 *	0.41, 0.93
Current Use	E-cigarette	--	--	0.71	0.48, 1.03

\*  $p \leq .05$ ; \*\*  $p \leq .01$ ; \*\*\*  $p \leq .001$

## DISCUSSION

The majority of current youth marijuana users reported using cigar products for marijuana delivery, and both current cigar product use and current hookah use were associated with mode of marijuana use in the multivariable model. This demonstrates the ubiquity of the co-use of tobacco and marijuana due to the mode of marijuana use. Federal regulations and other policy approaches to reduce youth access to cigar products and hookah could have significant impact on adolescent marijuana use, particularly among females and Black youth.

Cigar products are an easily accessible vehicle for smoking marijuana.<sup>35</sup> Given the significant proportion of youth marijuana users who smoked marijuana in blunts, it is likely that some regulatory actions affecting cigar products, either by the FDA CTP or state and local governments, could impact mode of marijuana use by reducing access to cigar products. For example, FDA CTP has authority to ban flavored tobacco products, and several cities and states have passed legislation to restrict the sale of flavored tobacco products.<sup>36</sup> This could reduce youth interest in cigar products overall as well as for use as a blunt, given preferences for flavored cigars.<sup>37</sup> If FDA CTP chose to increase the standard package size for cigar products to that of cigarettes (i.e. pack of 20), the cost of cigars may become too expensive for youth.

Reduced access to cigar products could lead to a direct decline in marijuana use. If cigar products become less available, it is possible that this reduced access would be sufficient to discourage marijuana use among some youth.

It is also possible that if cigar products were less accessible, youth may move to other modes of use, including use as a joint or in a bong or pipe. It is not clear from the current literature the extent to which wrapping papers, bongs, or pipes are accessible to youth, and this may vary based on marijuana legalization policies. However, taking a harm reduction perspective, transitioning from a tobacco-based marijuana delivery device (i.e. cigar) to a non-tobacco-based delivery device (i.e. wrapping paper, bong, pipe) would reduce adolescent exposure to nicotine. Blunt smokers

are known to extract nicotine by inhalation and through direct oral contact with the shell of the cigar, potentially contributing to nicotine dependence.<sup>38</sup> A recent study determined that cigar wrappers alone may contain between 1.2 to 6.0 mg of nicotine per cigar.<sup>39</sup> With our findings that 79.3% of marijuana users also co-used a tobacco product, nicotine dependence is particularly of concern as other research has shown that nicotine dependence is more likely among adolescent co-users of cigarettes and marijuana.<sup>40</sup> Moving to a non-cigar delivery of marijuana may also reduce the amount of marijuana consumed, given that cigars can hold substantially more marijuana than a joint, pipe, or bong.<sup>25</sup> Further, eliminating concurrent exposure to nicotine and marijuana may reduce cannabis dependence.<sup>17</sup>

Finally, regulation of cigars may have a greater impact on marijuana use in urban settings compared to suburban or rural areas, as urban areas observe higher rates of cigar use among adolescents than cigarettes, and marijuana use rates are comparable to what was seen in this study.<sup>41,42</sup> More research is needed to understand the mode preferences for marijuana users in other settings.

Although an overwhelming proportion of youth in our study reported using marijuana through a blunt, our multivariable logistic regression indicated that current hookah use was associated with JBP use. It is likely that the mechanism linking hookah use and JBP use is the device and not the shisha tobacco typically smoked in a hookah or waterpipe. Regulation of these devices is outside of the authority of the FDA CTP; policies restricting youth access to shisha tobacco may be less likely to have an impact on youth marijuana use. However, policies which reduce access to hookah or waterpipe devices may affect rates of JBP use.

Results of this study provide little evidence of vaping as a mode of marijuana use among this population. This could be related to a number of factors. Non-combustible forms of marijuana are not yet legally available in Ohio; thus, with changing medical marijuana laws, vaping of marijuana could become more accessible and more popular. However, data from the 2011-2015 Colorado YRBS indicate that despite legalization of recreational marijuana in Colorado, high school youth still overwhelmingly reported smoking marijuana (85.0%-88.9%) compared to vaping (5.1%-6.2%).<sup>20</sup> Thus, legalization and increased access to non-combustible forms of marijuana may not have a critical impact on preferred mode of marijuana use in the current tobacco policy environment, but it is still unclear what the synergistic effect of marijuana legalization and tobacco control policies to reduce youth access to non-cigarette tobacco may be.

There are some limitations to be noted in the current study. First, our analysis is limited to one urban Midwestern city and may not be broadly

generalizable. However, Cleveland is similar to other urban school districts, reporting higher rates of cigar products compared to cigarettes.<sup>41,42</sup> Additionally, the analysis is limited to a single policy environment where marijuana was not legal in any form, although several states in the US mirror the marijuana policy environment of Ohio at the time of data collection (i.e. no legal marijuana use of any kind).<sup>4</sup> Medical marijuana legalization could impact the results regarding tobacco product use among marijuana users, as other research has shown that the co-use of cigarettes and marijuana is higher in states where medical marijuana is legal.<sup>40</sup>

Second, the item used to assess cigar product use combined cigars, cigarillos, and little cigars into a single item. Recent research has found that youth and young adults identify these as unique products used in different situations; untipped cigarillos are more often associated with blunting.<sup>43,44</sup> While there is some evidence that youth who only use cigar products for blunting do not identify as cigar product smokers,<sup>13–16</sup> it is possible that blunt smokers endorsed cigar use in this study, potentially increasing the association seen between cigar product use and blunt use. Finally, students were asked to report the way in which they usually used marijuana; we do not know if youth use marijuana in multiple ways. It is possible that restrictions that limit use of marijuana as a blunt could have unintended consequences of increasing use of marijuana in other ways (e.g. vaping).

Despite these weaknesses, this study still offers a unique contribution to the literature examining marijuana and tobacco co-use. While the mode of marijuana use has been examined among adults,<sup>45</sup> the authors know of no other study that has used representative, population-level surveillance data to examine adolescent blunt use in addition to, and separate from, other types of marijuana smoking and consumption behaviors. National surveillance data currently do not allow for this type of analysis as mode of marijuana use are not separated beyond blunt use from other marijuana use, such as in the Youth Risk Behavior Survey,<sup>30</sup> or modes other than blunt use, such as in the Population Assessment of Tobacco and Health.<sup>46</sup>

This study demonstrates the need for further study on the relationship of modes of marijuana use and tobacco co-use. As FDA CTP has brought cigars, hookah tobacco, and electronic cigarettes under their purview,<sup>26</sup> it will be important to understand if future regulation of these other tobacco products yield unintended consequences with regard to the prevalence of current marijuana use and mode of marijuana use.

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