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Flavored cigar smoking among African American young adult dual users: An ecological momentary assessment

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ABSTRACT

Background: Flavored cigar sales have increased in recent years in the U.S. African American young adults (AAYAs) have high prevalence of smoking flavored cigars and dual use with cigarettes, but the predictors of use are unclear. We examined the predictors of flavored cigar smoking among AAYA dual users.

Methods: We analyzed data from an Ecological Momentary Assessment (EMA) study that captured near real-time affect, smoking cues, and tobacco smoking from eight text-messaging surveys per day over two weeks. Sixty-three AAYA (ages 18–29) dual users of cigarettes and cigars recorded 1205 cigar smoking moments. Multivariable Generalized Estimating Equations were used to assess the predictors of smoking cigars with flavors and specific flavor types.

Results: Half of the participants were women (49.2%) and aged between 18–24 (46.7%). Over the two-weeks, almost all (98.4%) participants smoked flavored cigars, and 64.2% of the cigars smoked were flavored. Alcohol (34.4%) was the most frequently smoked flavor type followed by sweet (23.4%) and mint (5.7%). Feeling stressed (AOR = 1.07) and bored (AOR = 1.10) predicted smoking alcohol flavors. Blunt smoking positively predicted smoking sweet flavors (AOR = 4.79), but negatively predicted smoking alcohol flavors (AOR = 0.40).

Conclusions: Smoking flavored cigars, especially alcohol-flavored cigars, was prevalent among AAYA dual users in this study. This group might use specific flavors for different purposes including smoking blunts and boosting mood. Efforts to reduce cigar use need to tackle these risk factors and the increased marketing and low-cost pricing of cigars. A federal ban of cigar flavors might reduce the appeal of cigar products.

1. Introduction

From 2012–2016, sales of cigar products (i.e., large cigars, cigarillos, and filtered little cigars) increased by 29% in the U.S. (Gammon et al., 2018). Cigar products are particularly popular among young adults (Delnevo et al., 2015; Hinds et al., 2018). Between 2013 and 2014, 14.1% of young adults ages 18–24 smoked cigar products in the past 30 days, as compared to 6.9% of those above 25 years of age (Kasza et al., 2017). Young adults are also more likely than older adults to smoke more than one tobacco product, with cigarettes and cigars being the most prevalent combination (Soneji et al., 2014). In recent years, cigars with characterizing flavors such as menthol, fruit or candy, have become increasingly popular. Flavored cigar sales in convenience stores have increased from \$801.2 million in 2008 to \$1173.7 million in 2015

(Delnevo et al., 2017). Young adults are especially drawn to smoking flavored cigars. Studies have found that more than half of young adult cigar smokers use flavored cigars (King et al., 2013) and that young adults are four times more likely to use flavored cigar brands than older adults (Delnevo et al., 2015). In addition to flavors, the popularity of cigar products among young adults may be due to their lower cost than cigarettes, lack of minimum pack size requirements, and exclusion from the advertising restrictions of the Tobacco Master Settlement Agreement (Delnevo et al., 2017).

African American young adults, in particular, have a high prevalence of smoking cigars and flavored cigars. African American young adults are 50% more likely to smoke cigars in the past 30 days (Cullen et al., 2011) and three times more likely to smoke flavored cigars compared to their white counterparts (Hinds et al., 2018). African

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American adults are more likely to use multiple tobacco products than white adults (Richardson et al., 2012). The tobacco industry has strategically marketed flavored tobacco products like Newport cigarettes to appeal to African Americans (Gardiner, 2004), and emerging research has shown racial/ethnic disparities in cigar marketing at the point-of-sale (Ribisl et al., 2017). Flavored tobacco may play a role in the “smoking paradox” among African Americans, signified by a lower youth smoking rate and late onset of smoking yet comparable smoking prevalence in adulthood to whites (Alexander et al., 2016). Thus, young adulthood presents a critical period for tobacco prevention and control among the African American population.

The popularity of flavored cigars among African American young adults increases their health risk. Cigar smoking is associated with adverse health outcomes including lung, oral, and esophageal cancers (U.S. Department of Health and Human Services (DHHS), 2014). Cigarillos have been found to contain more nicotine and tobacco toxins than regular cigarettes (Pickworth et al., 2017) and may enhance nicotine dependence (Blank et al., 2011). Dual use of cigarettes and cigars, defined as concurrently smoking both tobacco products, may delay smoking cessation (Rostron et al., 2016). Dual users are more likely to inhale cigar smoke more deeply, and smoke cigars with a greater intensity than single product users (Rostron et al., 2016). Furthermore, flavors in tobacco mask harsh taste, reduce throat irritation and make smoke easier to inhale, which increases nicotine intake, addiction potential, and carcinogen exposure (Kostygina et al., 2016). Flavored cigar smoking likely contributes to young people’s tobacco use initiation, subsequent nicotine addiction, and lower intention of quitting tobacco products (Hinds et al., 2018; Sterling et al., 2015). The availability and marketing of cigar flavors may contribute to African Americans’ higher cigar smoking prevalence, potentially perpetuating tobacco-related health disparities. Therefore, efforts are needed to curb flavored cigar smoking among African American young adult dual users to reduce cigar smoking and dual use prevalence and address health disparities rooted in the disproportionate usage of flavored tobacco among this group.

To develop effective prevention efforts and interventions to reduce flavored cigar smoking among African American young adults, research is needed to explore predictors and risk factors in this group. Previous work suggests that socio-demographic factors (e.g., sex, age, income, and education) (Glasser et al., 2017; King et al., 2013; Villanti et al., 2013, 2017), tobacco use history (e.g., flavored cigarette smoking, daily cigar smoking) (Sterling et al., 2015, 2016), blunt smoking (i.e., smoking a hollowed out cigar that contains marijuana) (Sterling et al., 2017), and psychosocial characteristics (e.g., mood and cigar-related perception) (Jolly, 2008; Sterling et al., 2015) all serve as predictors or correlates of flavored cigar smoking in adults. These risk factors, however, have rarely been investigated for African American young adults who also smoke cigarettes. Research on dual users is also necessary because, as cigarettes become more expensive or less reinforcing (e.g., due to reduced nicotine), they may substitute with cigars to satisfy their addiction, rather than quit or cut back (Huang et al., 2018). Furthermore, previous studies examining the predictors of flavored cigar smoking relied on subject recall (Glasser et al., 2017; King et al., 2013; Villanti et al., 2013, 2017). The full range of cigar flavors smoked and specific predictors to be examined during the recall period may not be accurately captured due to potential errors of subject recall. Additionally, these studies did not differentiate by cigar flavor types, making comparisons by flavor impossible. This information is necessary to inform the regulation of cigar flavors by the U.S. Food and Drug Administration (FDA), who has stated their intention to propose a product standard that would ban cigar flavors (U.S. Food and Drug Administration (FDA), 2018).

These above-noted literature gaps may be addressed by Ecological Momentary Assessments (EMAs). EMA studies use repeated measures to collect real-time or near real-time data in real-world environments, and have been used to understand tobacco use patterns and the antecedents

and consequences of tobacco use among a diverse set of populations (Shiffman et al., 2008). This method has advantages including minimizing recall bias and tracking events and behaviors over time rather than a snapshot in time (Shiffman et al., 2008; Shiffman, 2014). Using EMA data on cigar smoking in African American young adult dual users, we investigated the association between EMA predictors (i.e., affect, cues, and substance use) and flavored cigar smoking (including specific flavor types) among the target population.

2. Methods

2.1. Study participants

This study is a secondary analysis of EMA data from a parent study that aimed to understand the dual use of cigarettes and cigars in African American young adults (Mead et al., 2018). Participants were young adults (ages 18–29) who self-identified as African American or black (including Hispanic and non-Hispanic ethnicities) and were recruited from the greater Washington, D.C. metropolitan area. Other eligibility criteria included: (1) in the last two weeks, smoking cigarettes ≥ 4 times and little cigars, cigarillos, or large cigars ≥ 4 times, verified by researchers using brand names; and (2) owning a “smart” phone with a data plan. The literature has not standardized the definition of “dual user.” Therefore, for our purposes, we required participants to smoke cigarettes and cigars at least ≥ 4 times in the past two weeks to ensure we captured enough smoking “moments” for the EMA analysis. Participants were excluded if they planned to quit smoking cigarettes and/or cigars or planned an activity that would take them away from their normal routine in the next 14 days. Participants were recruited via subject referral, newspaper ads, and Craigslist.com, an online advertisement service recommended for recruitment of young adult smokers (Ramo et al., 2010). The University of Maryland Institutional Review Board approved the study.

2.2. Study procedure

Detailed study procedures and compliance figures can be found elsewhere (Mead et al., 2018). In brief, eligibility was confirmed from online and phone screening. Participants signed the consent form and completed the baseline survey on background characteristics online, and were trained on the EMA protocol over the phone. For 14 days, participants were prompted to complete “coverage” and “random” surveys eight times a day during their waking hours. The coverage surveys were pushed to participants’ phones four times at the same times every day. During their waking hours, participants received a coverage survey every 3.5 h. The coverage survey collected information about substances (cigars, cigarettes, and blunts) smoked during the past 3.5 h and smoking cues (location and companionship) when the last cigarette and cigar were smoked. The random surveys were pushed to participants’ phones four times a day at random times, and one random survey always preceded each coverage survey. The random survey collected information about affect (stressed, bored, and relaxed) and craving for cigars. Once prompted, participants had 20 and 30 min to respond to the surveys, respectively. EMAs were programmed and sent by the NYU mHealth team, in coordination with Survos, LLC. At the end of the study, participants attended an in-person visit to complete an interview and collect their compensation.

Sixty-four participants completed the protocol. One participant who did not smoke any cigars was dropped from this analysis. Participants were compensated \$40–\$105 (amount based on EMA completion rates). EMA completion was checked every few days. Researchers texted and called to remind participants with low compliance to complete more surveys. Participants with compliance below 50% were dropped halfway through the EMA protocol. The median EMA compliance rate was 86% (range: 50%–99%).

Table 1
Baseline participant characteristics and tobacco perceptions and use (N = 63).

	%
Socio-Demographic Characteristics¹	
Age group, %	
18–24 years	46.7%
25–29 years	53.3%
Gender, %	
Female	49.2%
Male	50.8%
Education, %	
≤ High school diploma or GED completed	38.1%
Some or completed technical school	33.3%
Some of 4-year college program or higher	28.6%
Weekly Amount of Money to Spend on Self or Save, %	
< \$100	30.7%
≥ \$100	60.3%
Flavored Cigar Perceptions	
Perceived Harm of Smoking Flavored vs. Plain Cigars, %	
Flavored cigars more harmful	27.0%
About the same	38.1%
Plain cigars more harmful	34.9%
Perceived Addictiveness of Smoking Flavored vs. Plain Cigars, %	
Flavored cigars more addictive	23.8%
About the same	38.1%
Plain cigars more addictive	38.1%
Perceived Social Acceptance of Flavored vs. Plain Cigars, %	
Flavored cigars more socially acceptable	25.4%
About the same	33.3%
Plain cigars more socially acceptable	41.3%
Tobacco Use and Cigarette Dependence	
Cigarette Use Frequency, %	
Daily	52.4%
Non-daily	47.6%
Cigar Use Frequency, %	
Daily	27.0%
Non-daily	73.0%
Cigarette Flavor Smoked Most Often, %	
Plain cigarettes	19.0%
Menthol cigarettes	81.0%
Cigar Flavor Smoked Most Often, %	
Plain flavored cigars	12.7%
Alcohol flavored cigars	39.7%
Sweet flavored cigars	39.7%
Mint flavored cigars	7.9%
Cigarette Dependence, ² %	
Very low	41.3%
Low	28.6%
Moderate	15.9%
High or very high	14.2%

1. Only three participants (4.8%) self-reported Hispanic ethnicity. Hispanic ethnicity was not included as a baseline characteristic in the multivariable GEE model.

2. Cigarette dependence was measured by Fagerström Test for Cigarette Dependence. Participants' responses ranged from 0 to 10.

2.3. Measures

The baseline characteristics (sex, education, age, and socioeconomic status) selected for this study were shown previously to influence flavored cigar smoking (Glasser et al., 2017; King et al., 2013; Sterling et al., 2015, 2016; Villanti et al., 2013). The EMA predictors were shown to influence either flavored cigar smoking (affect, companionship, blunt use, and flavored cigarette smoking) (Jolly, 2008; Sterling et al., 2015, 2016) or tobacco use in general (location and tobacco craving) (Pearson et al., 2016; Piasecki et al., 2014; Shiffman et al., 2002).

2.3.1. Participant baseline characteristics

2.3.1.1. Socio-demographic characteristics. Socio-demographic characteristics included age, sex, education, and weekly money spent on self or saved (a proxy for socioeconomic status; Table 1).

2.3.1.2. Flavored cigar perceptions. In three questions, participants were asked whether they considered flavored cigars to be more, about the same, or less harmful/addictive/socially acceptable than plain cigars.

2.3.1.3. Tobacco use and cigarette dependence. Participants were asked what cigarette flavors they smoked most often (menthol vs. plain), what little cigar/cigarillo/large cigar flavor they smoked most often, frequency of cigar use in past 30 days (divided into daily vs. non-daily), and dependence measured by the Fagerström Test for Cigarette Dependence (Fagerström, 2012) with categories of very low (score of 0–2), low (3–4), moderate (5), and high and very high (6–10).

2.3.2. EMA flavored cigar smoking outcomes

In the coverage survey, participants were asked the flavor of the last cigar smoked. Based on formative research (Mead et al., 2017), the answer options were “not flavored/plain tobacco,” “mint or menthol,” “cognac-dipped,” “wine,” “fruit,” and “other,” with a write-in option for “other.” Methods created for classifying e-cigarette flavors were used to categorize “other” cigar flavors and group cigar flavors into four types: (1) alcohol, (2) fruit/dessert/candy/sweets (i.e., sweet flavors), (3) mint/menthol (i.e., mint flavors), and (4) others (Yingst et al., 2017). Four binary variables were created: flavored vs. plain cigar smoking, alcohol-flavored vs. plain cigar smoking, sweet-flavored vs. plain cigar smoking, and mint-flavored vs. plain cigar smoking.

2.3.3. EMA predictors

2.3.3.1. Substance use. In the coverage survey, to measure blunt smoking participants reported whether they “put marijuana in the cigar” when smoking the last cigar (yes/no). Participants also reported their cigarette smoking behavior (including menthol cigarettes), which was categorized as: “did not smoke cigarettes,” “smoked plain cigarettes,” and “smoked menthol cigarettes.”

2.3.3.2. Smoking cues. In the random survey, participants were asked three questions about affect: “On a scale of 1–10, how stressed/bored/relaxed do you feel right now?” (1 = “not at all” to 10 = “extremely”). In the coverage survey, companionship was measured by the question, “Were you with others when you smoked your last cigar?” (“no,” “with others,” and “others in view”) (Piasecki et al., 2014; Shiffman et al., 2002). Location was measured by the question, “Where were you when you smoked your last cigar?” (home, work, bar/restaurants, others' home, outside, vehicles, and other, with a write-in option for “other”) (Piasecki et al., 2014; Shiffman et al., 2002). Based on frequency, locations were categorized as home, outside, vehicle, others' home, and work/restaurants/bars/other. In the random survey, craving for cigars was measured by the question, “How much do you want to smoke cigars right now?” (1 = “not at all” to 10 = “very, very much”) (Pearson et al., 2016).

2.4. Statistical analysis

In this analysis, we included 1205 moments from the coverage survey in which participants reported smoking cigars. First, we examined frequencies for predictors, flavored cigar use, and cigar flavor types. Second, we used Generalized Estimating Equations (GEE) to analyze the associations between EMA predictors and flavored cigar smoking, controlling for baseline characteristics (Shiffman, 2014). The unit of analysis was the individual observation, and the GEE model accounted for nesting of multiple observations within participants and first-ordered autoregressive correlation structure to account for serial correlation of errors (Zeger et al., 1988). We ran multivariable GEE with a binomial distribution modeling the log odds of flavored vs. plain cigar, alcohol vs. plain cigar, sweet vs. plain cigar, and mint vs. plain cigar smoking. The significance level was $p < 0.05$. Analyses were conducted in Stata 14.0.

3. Results

3.1. Participant characteristics

Nearly half of the 63 participants were 18–24 years old (46.7%) (Table 1). About half were women (49.2%). At baseline, 27.0% of participants reported smoking cigars daily. When asked which flavors they smoked most often, most participants reported flavored cigars (39.7% alcohol, 39.7% sweet, and 7.9% mint flavors) compared to plain cigars (12.7%). About half of the participants (52.4%) smoked cigarettes daily, and most participants reported smoking menthol cigarettes (81.0%).

3.2. Flavored cigar use during EMA

Over the 14-day EMA period, 62 (98.4%) participants smoked flavored cigars, and 19 (30.0%) participants smoked only flavored cigars (and no plain cigars). In terms of specific flavors, 44 (69.8%), 34 (54.0%), and 28 (44.4%) participants smoked at least one alcohol, sweet, and mint-flavored cigar, respectively. In terms of the number of flavors, 30 (47.6%), 23 (36.5%), and 10 (15.9%) participants smoked one, two, and three flavor types, respectively. Among all the cigar use moments (*i* = 1205), 774 (64.2%) and 431 (35.8%) of cigars were flavored and plain, respectively (Table 2). Alcohol (*i* = 415, 53.7%) was the most popular cigar flavor type, followed by sweet flavor (*i* = 282, 36.5%), mint flavor (*i* = 69, 6.7%), and other flavors (*i* = 4, 3.1%).

3.3. Predictors of flavored cigar use

In the multivariable GEE models, being a woman (AOR = 2.65, CI = 1.45, 4.84), perceiving flavored cigars as more harmful than plain (AOR = 2.38, CI = 1.06, 5.33), perceiving flavored cigars as more addictive than plain (AOR = 4.02, CI = 1.50, 10.80), perceiving flavored cigars as more socially acceptable than plain (AOR = 3.50, CI = 1.37, 8.91), and low cigarette dependence (AOR = 3.97, CI = 1.81, 9.27) were positively associated with flavored cigar smoking compared to

plain (Table 3). Additionally, being a woman (AOR = 2.82, CI = 1.14, 6.95), perceiving flavored cigars as more addictive (AOR = 4.75, CI = 1.33, 10.23) and socially acceptable (AOR = 6.25, CI = 1.78, 15.23) than plain cigars, and low cigarette dependence (AOR = 6.56, CI = 4.53, 16.79) were positively associated with smoking alcohol flavors. Perceiving flavored cigars more harmful (AOR = 4.72, CI = 1.29, 12.30) and more addictive (AOR = 6.45, CI = 2.41, 15.29) than plain cigars was positively associated with smoking sweet-flavored cigars, whereas moderate dependence was negatively associated (AOR = 0.17, CI = 0.04, 0.62). Low cigarette dependence (AOR = 5.22, CI = 1.09, 12.34) predicted smoking mint flavors. Age, education, weekly spending money, and most-used cigarette flavor were not associated with smoking flavored cigars.

Multiple EMA predictors also influenced flavored cigar smoking. Smoking with other people simply in view (AOR = 1.88, CI = 1.15, 3.06) and in vehicles (AOR = 2.54, CI = 1.52, 4.23) predicted flavored cigar smoking. Feeling stressed (AOR = 1.07, CI = 1.01, 1.14) and bored (AOR = 1.10, CI = 1.05, 1.29) and not using blunts (AOR = 0.40, CI = 0.25, 0.65) predicted alcohol-flavored cigar use. Using blunts (AOR = 4.79, CI = 2.57, 8.91), smoking with others in view (AOR = 2.61, CI = 1.29, 5.31), and smoking in vehicles (AOR = 1.89, CI = 1.05, 3.42) predicted smoking sweet-flavored cigars. Craving for cigars, feeling relaxed, and cigarette smoking did not predict smoking flavored cigars.

4. Discussion

This study was the first to use EMA to investigate the predictors of flavored cigar smoking overall and by specific flavor types in a population of young adult dual users. EMA provided key methodological advantages for capturing participants' flavored cigar smoking in the real-world, as well as potential risk factors for flavored cigar smoking, including affect, smoking cues, and substance use. In addition, we focused on African American young adults, a group with a high prevalence of flavored cigar smoking (Delnevo et al., 2015; Hinds et al., 2018). Understanding the use of flavored cigars in this population is important to inform public health interventions and messages aimed at

Table 2
Description of momentary flavored cigar use and EMA predictors (*i* = 1205 observations, *N* = 63 participants).

	Overall			Flavored Cigar Use		
	Total	Plain Cigar Use (<i>i</i> = 431; <i>n</i> = 63)	Flavored Cigar Use (<i>i</i> = 774; <i>n</i> = 63) ¹	Alcohol Flavored Cigar Use (<i>i</i> = 415; <i>n</i> = 44)	Sweet Flavored Cigar Use (<i>i</i> = 282; <i>n</i> = 35)	Mint Flavored Cigar Use (<i>i</i> = 69; <i>n</i> = 27)
Blunt Smoking, %						
Yes	42.9%	47.9%	40.2%	24.3%	63.5%	32.8%
No	57.1%	52.1%	59.8%	75.7%	36.5%	67.2%
Feel Stressed (Mean, SD)	3.6 (2.8)	3.9 (3.0)	3.6 (2.4)	3.9 (3.0)	3.7 (2.6)	4.3 (2.6)
Feel Bored (Mean, SD)	3.6 (2.7)	3.9 (3.0)	3.6 (2.5)	3.9 (3.0)	3.6 (2.3)	3.6 (2.5)
Feel Relaxed (Mean, SD)	5.7 (2.9)	5.9 (3.0)	5.8 (2.6)	5.9 (3.0)	5.7 (2.6)	4.8 (2.7)
Craving for Cigars (Mean, SD)	4.9 (3.1)	4.9 (3.3)	5.0 (2.9)	4.9 (3.3)	4.5 (3.1)	4.0 (2.6)
Companionship, %						
No one	38.6%	41.2%	37.2%	44.1%	28.6%	33.3%
Yes, with others	48.9%	48.8%	49.0%	43.9%	56.1%	50.0%
Yes, others in view	12.5%	10.0%	13.8%	12.0%	15.4%	16.7%
Location, %						
Home	46.4%	49.1%	44.9%	50.6%	39.9%	35.8%
Outside	18.4%	20.1%	17.5%	17.1%	18.9%	16.4%
Vehicle	12.9%	7.6%	15.9%	8.8%	27.4%	7.5%
Others' home	11.7%	13.7%	10.6%	10.5%	9.6%	14.9%
Work/restaurants/bars/Others	10.6%	9.7%	11.1%	13.0%	4.3%	25.4%
Dual Use with Cigarettes, %						
Did not smoke cigarettes	33.6%	23.4%	24.0%	26.3%	22.0%	20.3%
Smoked plain cigarettes	47.9%	57.8%	56.2%	55.4%	57.8%	56.5%
Smoked flavored cigarettes	18.5%	18.8%	19.8%	18.3%	20.2%	23.2%

Note: *i* is the number of observations, and *n* is the number of participants.

1. Flavors include alcohol flavors (*i* = 415), sweet flavors (*i* = 282), mint flavors (*i* = 69), and other flavors (*i* = 4) and missing responses (*i* = 4). Other flavors and missing responses were dropped for the models comparing alcohol, sweet, and mint flavored cigar smoking with plain cigar smoking.

Table 3
Adjusted odds ratios (AOR) and 95% confidence intervals (CI) for flavored cigar use from multivariate GEE analyses (i = 1205 observations, N = 63 participants).

	Flavored Cigar Use (vs. Plain Cigar Use)		Alcohol Flavored Cigar Use (vs. Plain Cigar Use)		Sweet Flavored Cigar Use (vs. Plain Cigar Use)		Mint Flavored Cigar Use (vs. Plain Cigar Use)	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Baseline Characteristics								
Gender								
Female	2.65	1.45, 4.84*	2.82	1.14, 6.95*	1.77	0.68, 4.63	1.03	0.26, 4.08
Male	Reference		Reference		Reference		Reference	
Perceived Harm of Flavored vs. Plain Cigars								
Flavored cigars more harmful	2.38	1.06, 5.33*	3.01	0.87, 10.38	4.72	1.29, 12.30*	2.03	0.31, 7.89
About the same	Reference		Reference		Reference		Reference	
Plain cigars more harmful	1.25	0.54, 3.54	0.45	0.12, 1.63	2.54	0.69, 9.51	0.30	0.04, 2.53
Perceived Addictiveness of Flavored vs. Plain Cigars								
Flavored cigars more addictive	4.02	1.50, 10.80**	4.75	1.33, 10.23*	6.45	2.41, 15.29**	2.65	0.35, 8.61
About the same	Reference		Reference		Reference		Reference	
Plain cigars more addictive	0.77	0.30, 1.96	1.96	0.54, 7.04	2.32	0.59, 9.14	0.55	0.08, 3.69
Perceived Social Acceptability of Flavored vs. Plain Cigars								
Flavored cigars more socially acceptable	3.50	1.37, 8.91**	6.25	1.78, 15.23**	0.56	0.09, 3.37	0.20	0.01, 2.89
About the same	Reference		Reference		Reference		Reference	
Plain cigars more socially acceptable	2.76	0.95, 9.31	2.67	0.98, 8.45	1.08	0.30, 3.97	3.84	0.76, 9.80
Cigarette Dependence¹								
Very low	Reference		Reference		Reference		Reference	
Low	3.97	1.81, 9.27**	6.56	4.53, 16.79**	1.81	0.60, 5.42	5.22	1.09, 12.34*
Moderate	0.51	0.24, 1.07	0.92	0.30, 2.79	0.17	0.04, 0.62*	3.42	0.87, 9.81
High and very high	0.91	0.37, 2.27	1.89	0.52, 7.08	0.79	0.21, 2.91	0.18	0.02, 1.44
EMA Predictors								
Feel Stressed	1.04	0.97, 1.11	1.07	1.01, 1.14*	0.98	0.89, 1.07	1.09	0.89, 1.33
Feel Bored	1.04	0.98, 1.11	1.10	1.05, 1.29*	1.07	0.98, 1.18	0.93	0.75, 1.16
Blunt Smoking								
No	Reference		Reference		Reference		Reference	
Yes	1.26	0.83, 1.92	0.40	0.25, 0.65***	4.79	2.57, 8.91***	0.83	0.31, 2.23
Companionship								
Alone	Reference		Reference		Reference		Reference	
With others	1.12	0.82, 1.55	1.11	0.80, 1.53	0.88	0.58, 1.34	1.43	0.58, 3.54
Others in view	1.88	1.15, 3.06*	1.00	0.63, 1.59	2.61	1.29, 5.31*	3.26	0.92, 8.98
Location								
Home	Reference		Reference		Reference		Reference	
Outside	0.88	0.59, 1.24	0.81	0.53, 1.23	0.93	0.53, 1.65	0.60	0.18, 2.03
Vehicle	2.54	1.52, 4.23***	1.38	0.81, 2.36	1.89	1.05, 3.42*	2.45	0.45, 8.61
Others' home	1.11	0.68, 1.79	1.48	0.61, 1.57	0.76	0.42, 1.41	1.68	0.48, 4.23
Work/restaurants/bars/others	1.22	0.79, 1.91	1.48	0.96, 2.28	0.71	0.35, 1.42	1.75	0.78, 4.69

Note 1: The following variables were not significant in any of the multivariate GEE models and thus were not included in the table: baseline characteristics including age, education, daily cigar smoking, weekly amount of money to spend on self or save, and cigarette flavor used most often; EMA measures including craving for cigars, feeling relaxed, and cigarettes smoked in the same time bin.

Note 2: Bolded text indicates $p < 0.05$; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

1. Cigarette dependence was measured by Fagerström Test for Cigarette Dependence. Participants' responses ranged from 0 to 10.

reducing cigar use and minimizing tobacco-related health disparities in cessation, morbidity, and mortality.

Almost our entire study sample (98.4%) used flavored cigars over the 14-day period. In a nationally representative sample, 57% of young adult cigar smokers (age 18–24 years) smoked flavored cigars (King et al., 2013). We suspect this discrepancy might be due to a number of factors, including African Americans' high prevalence of flavored cigar smoking (Delnevo et al., 2015; Hinds et al., 2018), the ability of EMA to capture flavored cigar use in near real-time, and our purposive sampling of dual users in D.C. Studies asking about past 30-day flavored tobacco use might be underrepresenting the prevalence of flavored cigar smoking (Centers for Disease Control (CDC, 2013; Hyland et al., 2017). Future research is warranted to compare the differences in flavored tobacco use prevalence by retrospective recall methods versus EMA methods to improve our understanding of the appropriate measure for capturing accurate data on self-reported flavored tobacco use.

Our results indicated that grouping all flavors together, which is the conventional approach for studying flavored tobacco, may mask the heterogeneity of usage patterns and obscure differences in predictors of cigar smoking by flavor types. For example, previous research showed that women were more likely than men to smoke flavored tobacco

(Glasser et al., 2017; King et al., 2013). Our study confirmed these findings and further specified that women had nearly three times greater odds of smoking alcohol-flavored cigars than men. Future research is needed to identify potential reasons for sex-based differences in cigar flavor preference, such as women's sensitivity to the sensory effects of smoking (Perkins, 1996) or marketing strategies that target women (Brown-Johnson et al., 2013).

Results of the EMA predictors of flavored cigar smoking showed how different flavors were used for various purposes. Previous research has shown that blunts were popular among U.S. young adults (Hinds et al., 2018), and that using flavored cigars to smoke marijuana was common (Rosenberry et al., 2017; Sterling et al., 2017). Our study further revealed that sweet-flavored cigars were more likely to be used for blunts, while alcohol flavored were less likely, than plain cigars. Sweet-flavored cigars may be especially effective in masking the smell of burning marijuana (Sifanek et al., 2006). Marijuana and tobacco co-use poses significant problems to users' health including increased addiction to marijuana (Schauer et al., 2017). Thus, interventions or policy actions that help reduce sweet-flavored cigar use may help curb blunt use, and future research is needed to investigate this potential impact. Furthermore, we found that alcohol-flavored cigars were more

likely to be used when participants were stressed or bored. This finding is consistent with previous research showing that flavored cigar use is associated with gratification and boosted mood (Sterling et al., 2015). Future research can examine whether alcohol-flavored cigars are better at relieving negative affect than other flavors. Our findings suggest that, when investigating flavored cigar smoking, researchers need to separate by flavor types to gain an improved understanding of the specific predictors and consequences associated with the use of each flavor.

This study also revealed that alcohol-flavored cigars were popular in our sample of African American young adult dual users. Alcohol flavors include wine, beer, spirits, liquors, and mixed drinks (Jackler et al., 2018). Rather than traditionally popular tobacco flavors such as fruits, desserts, and candy, more than half of the flavored cigars smoked by our sample were alcohol, and about 70% of participants smoked at least one alcohol-flavored cigar. In contrast, other research found that wine and liquor/cocktail flavored cigars constituted less than 20% of the national market share of flavored cigar sales, while flavors that tasted like fruits and sweets captured more than 60% (Delnevo et al., 2015). Therefore, our sample of dual users might have distinct preferences for alcohol-flavored cigars. During the past decade, wine and liquor/cocktail flavored cigars have significantly gained U.S. market shares of flavored cigar products (Delnevo et al., 2017). In 2015, large chain convenience store sales of wine-flavored cigars alone totaled 19.7 million units (CSP Daily News, 2016). The higher use of alcohol-flavored cigars observed in our sample might also be explained by the disproportionately high alcohol marketing towards African American communities (Grier and Kumanyika, 2008). Based on our findings, the continued market growth of alcohol-flavored cigars could increase initiation and regular use of cigars among African American young adults and encourage co-use with cigarettes. Therefore, restricting or banning alcohol flavors might reduce cigar smoking in this group.

Some of our findings present interpretive challenges. For example, we found that smoking flavored cigars in general and alcohol-flavored cigars specifically were more likely to occur in vehicles than at home. Previous EMA research indicated that physical location was often a marker for other contextual variables, such as smoking regulations (Shiffman et al., 2002). We suspect that this phenomenon may be explained by smokers' intention of circumventing marijuana smoking restrictions in the public space or at home. In addition, previous research has shown the impact of social influence on young adults' cigar smoking (Jolly, 2008), and so cigars might be smoked socially regardless of flavor. We found that smoking cigars with others simply in view was associated with flavored cigar smoking. Further research is needed to determine potential differences in these two types of companionship (with others vs. others in view) in regards to flavored cigar smoking. Lastly, we found that participants who perceived flavored cigars as more harmful than plain cigars were more likely to smoke flavored cigars, and this finding contradicts the assumption that perceived harm would reduce the likelihood of use. More research is needed to understand how to turn these perceptions into the engine for smoking cessation in this group.

This study also had limitations. We might not have captured other important social and environmental influences on flavored cigar smoking, such as use by friends and family and exposure to labels and descriptors on cigar packaging and point-of-sale advertisements (Sterling et al., 2015). Moreover, our analyses did not differentiate cigar types (little cigars, cigarillos, and large cigars), which might influence the cigar flavors used (Glasser et al., 2017). We assumed most of the cigars used were little cigars and cigarillos since only one participant reported regularly using large cigars at baseline. The coverage survey approach allowed us to capture all instances of cigar smoking, but we were not able to measure the exact moments of cigar smoking. Therefore, there may be a temporal disconnect between some predictors from the random survey and cigar smoking behaviors. Lastly, our findings might not be generalizable to other populations of young adult dual users. Future research needs to explore whether young adults of other

racial and ethnic backgrounds and geographic areas have similar risk factors for flavored cigar smoking.

5. Conclusions

In the past decade, flavored cigars have contributed substantially to the overall growth of the cigar market (Delnevo et al., 2017). In November 2018, the FDA announced a plan to ban flavored cigars in order to help prevent cigar initiation by young people (U.S. Food and Drug Administration (FDA), 2018). We believe our study can help inform FDA regulations concerning the overwhelmingly high prevalence of flavored cigar use among African American young adults, and the need to restrict characterizing flavors—especially alcohol flavors—in cigar products. The results might also inform preventive initiatives of the need to target sub-populations at risk of smoking flavored cigars (e.g., women) and inform public health interventions, such as ecological momentary interventions, to address the predictors of cigar smoking (e.g., marijuana use with cigars and negative feelings). Furthermore, this study provided unique methodological recommendations for future research to disentangle cigar flavors and adopt shorter recall times for capturing past flavored cigar smoking experiences. This approach might allow researchers to improve our understanding of the specific predictors and risk factors for using specific cigar flavors. Similar methodologies might be applied to other tobacco products that come in a variety of flavors (e.g., e-cigarettes, hookah, and smokeless tobacco). Understanding and addressing the predictors of flavored cigar smoking in African American young adults may help facilitate the elimination of tobacco-related health disparities.

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Contributors

JCC and EM were responsible for study concept. JCC conducted data analysis and drafted the manuscript. EM and KC provided critical revisions to the manuscript for important intellectual content. All authors assisted with the writing of the manuscript and approved the final version for publication.

Conflict of interest

All authors of this article declare they have no conflicts of interest.

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