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Race, Ethnicity, Education, Poverty, and First Cigarette Flavor

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Abstract
Introduction: Research shows that race, ethnicity, and socioeconomic status (SES) have multiplicative rather than additive effects on the risk of cigarette smoking. In a national sample of American adult smokers, this study tested (1) the effects of race, ethnicity, educational attainment, and poverty status on first cigarette flavor in a national sample of American adult smokers, and (2) racial and ethnic differences in the effects of educational attainment and poverty status on first cigarette flavor.
Methods: This cross-sectional study entered 22,144 ever-smoker adults who had participated in the Population Assessment of Tobacco and Health (PATH; 2013), a nationally representative study in the US. Independent variables were race, ethnicity, educational attainment, and poverty status. There were three dependent variables: initiating smoking using any, menthol/mint, and candy/fruit-flavored cigarettes. Age, sex, and region were the covariates.
Results: Black individuals had higher odds of initiating smoking using menthol/mint-flavored cigarettes (OR = 3.86, 95% CI = 3.55-4.20), and Hispanics had higher odds of initiating smoking using candy/fruit-flavored cigarettes (OR = 1.79, 95% CI = 1.44-2.21). Overall, individuals with higher education had lower odds of initiating smoking using menthol/mint-flavored cigarettes (OR = 0.94, 95% CI = 0.92-0.96), but higher odds of candy/fruit-flavored cigarettes (OR = 1.35, 95% CI = 1.26-1.45). Living out of poverty was not associated with initiating smoking using flavored cigarettes.
Conclusion: In the US, race, ethnicity, and SES show multiplicative rather than additive effects on first cigarette flavor.
Keywords: Population Groups, Socioeconomic Status, Tobacco Use, Smoking

Introduction

Tobacco use is one of the main causes of morbidity and mortality both globally and in the US.[1,2] Not only is tobacco use associated with a wide range of cancers[3,4,5] it can also deteriorate oral health.[6,7] As such, prevention of tobacco use may be an important strategy to improve population health.[8]

Despite a considerable decline, tobacco use remains the leading preventable cause of morbidity and mortality in the US, especially for populations with a low socioeconomic status (SES).[9-11] Each year, tobacco takes 480,000 lives in the US and causes 16 million tobacco-related chronic diseases.[12] Additionally, in the US, tobacco imposes 300 billion dollars each year for combined direct and indirect costs.[13]

Although the US has successfully reduced the overall rate of tobacco use,[9-11] the same success is not achieved in reducing social inequality in tobacco use.[9-11] More than ever before, tobacco use is unequally impacting social groups of Americans; the prevalence and burden of tobacco use do not follow a pattern of random distribution in the US.[14-18] As a result of a massive success in reducing tobacco-related morbidity and mortality in high SES populations, tobacco use has shifted from a mainstream public health challenge to one that mainly affects marginalized populations based on their SES, race, and ethnicity.[19] Such wideing of social inequalities in the US poses a major threat to the country's progress towards tobacco control.[19]

Racial and ethnic minorities[14-18] and low SES groups[20-22] have remained at an increased risk of tobacco burden in the US.[22-24] Black and Latino advantages have narrowed, while SES disparities in tobacco use have widened.[22-24] From 1966 to 2015, cigarette smoking declined by 83% and 40% in American adults with a college degree and those who did not graduate from high school, respectively.[19] More recent research has shown that some racial, ethnic, and SES disparities in tobacco use are due to predatory tobacco marketing in low SES Black and Hispanic neighborhoods.[25-27] As a result of predatory marketing, low SES, Black, and Hispanic individuals are frequently exposed to environmental risk elements (e.g., point-of-sale advertisement, retail display, coupons, and discounts).[28] This increases the vulnerability of racial/ethnic and low SES individuals,[29] a vulnerability that can be summarized as a rapid transition from tobacco initiation, due to addiction, to the development of tobacco-related diseases and undesired outcomes.[16,30,31]

Recent research on Minorities' Diminished Returns (MDRs)[32,33] has proposed a new mechanism to explain racial and ethnic health disparities. MDRs refer to the systemically weaker protective effects of SES indicators on health outcomes of racial and ethnic minorities than Whites. According to this theory, at least some of the racial and ethnic disparities in health outcomes are due to the "*less than expected*" protective health effects of SES indicators. The MDRs model proposes that (a) racial/ethnic inequalities in health are not all due to SES gaps, as some health inequalities persist even at high SES levels, and that (b) in some instances, the racial and ethnic gap in health may widen, rather than narrow, as SES increases.[32,33] This model highlights the need to study health disparities across all SES levels, and suggests that proposed solutions to health disparities must go beyond merely equalizing SES. They must work to enable high SES ethnic minorities to actualize their potential, and translate their SES into better health.[32,33]

Similar MDRs are shown for tobacco use in Americans.[34-36] Several studies have documented weaker protective effects of SES indicators on tobacco use in racial and ethnic minorities than Whites.[34-36] For example, Black people showed a diminished effect of high education levels on cigarette use than Whites.[36] A similar pattern has been observed for e-cigarette use.[37] Another study showed a weaker protective effect of employment on Hispanic individuals' smoking status compared to non-Hispanic people.[34] These patterns are not specific to tobacco and are also observed for alcohol. This suggests that these patterns may be systemic.[35,38]

One of the proposed explanations for more than expected tobacco use in highly educated and high-income Blacks and Hispanics (i.e., MDRs) is flavoring and other marketing strategies of tobacco products.[34-36] This hypothesis has never been tested before. The hypothesis is based on the observation that Black and Hispanic people may be more likely to use flavored tobacco products.[24,39,40] Flavored tobacco imposes a higher level of risk to the individual[26,28,41-43] and, thus, might be a mechanism for some of the racial and ethnic disparities in the tobacco burden.[28,42,44,45] It has been shown that the use of flavored tobacco products increases addiction, and reduces individuals' ability to quit smoking.[28,42,44,45] However, we are not aware of any studies that have tested the relevance of MDRs for SES indicators' effects on smoking initiation using flavored cigarettes.[34-36]

This study tested racial and ethnic variations in the effects of two SES indicators—educational attainment and poverty status—on initiating smoking using flavored cigarettes in a nationally representative sample of American adults. We explored the patterns for any flavored cigarette, and specifically for menthol/mint and candy/fruit flavors (three distinct outcomes). We hypothesized that there would be an inverse association between high SES and smoking initiation using a flavored cigarette. We also expected to observe significant effects of race and ethnicity on smoking initiation using a flavored cigarette. Finally, in line with the MDRs, we expected weaker educational attainment and living out of poverty effects on initiating smoking using a flavored cigarette for Black and Hispanic than for non-Hispanic White Americans. In other words, we expected higher SES Black and Hispanic people to report disproportionately higher odds of initiating smoking using flavored cigarettes, a pattern that would not be observed for non-Hispanic Whites. Such findings would suggest the relevance of initiating smoking using a flavored cigarette as a possible explanation for the MDRs of SES on tobacco use (i.e., high prevalence of tobacco use in high SES non-Whites).[34-36]

Methods
PATH Design
This study was a secondary analysis of existing data. Data came from the Population Assessment of Tobacco and Health (PATH) study. The PATH study is funded by the NIH and FDA to collect updated information on epidemiology and transitions in tobacco use in the US. PATH has approximately 32,000 adults (age 18 years or older). For our study, we used the wave 1 PATH data that was collected in 2013.

PATH Sampling
The PATH sample was (1) civilian, (2) non-institutionalized, (3) US population, and (4) 18 years of age or older. The PATH study used a four-stage sampling process that included clustering and stratification to recruit an area probability sample of American adults. As a result of this sampling, there is a need to adjust for the sampling weights.

Analytical Sample
The current analysis only included adults with valid data on our study variables (listed below). Our final analytical sample consisted of 22,144 adults who were ever-smokers.

Study Variables
The study variables were demographic characteristics (age, gender, and region), race/ethnicity, SES indicators (poverty status and educational attainment), and initiation of smoking using a flavored cigarette. These varaibles were all measured at the individual level.

Confounders

Confounders were age, gender, and region. Age was continuous, with a range between 1.0 and 7.0: 1 for 18-24 years old, 2 for 25-34 years old, 3 for 35-44 years old, 4 for 45-54 years old, 5 for 55-64 years old, 6 for 65-74 years old, and 7 for 75+ years old. Gender was a 0/1 dichotomous variable, and was coded with male as the reference group.

Independent Variables

Educational attainment was a continuous variable ranging from 1 to 6: 1 for less than high school, 2 for GED, 3 for high school graduate, 4 for some college (no degree) or associate's degree, 5 for bachelor's degree, and 6 for advanced degree. Poverty status was a 0/1 dichotomous variable: 0 for living below the 100% federal poverty line, and 1 for living above the 100% federal poverty line.

Dependent Variable

Our outcomes were initiating smoking using flavored cigarettes. These outcomes were measured by asking participants these two items: 1) "Was your first cigarette smoked flavored to taste like menthol or mint?" and 2) "Was your first cigarette smoked flavored to taste like clove, spice, candy, fruit, chocolate, alcohol, or other sweets?" We operationalized these outcomes as binary outcomes: 1 = initiating smoking using a flavored cigarette, 0 = initiating smoking using a non-flavored cigarette. Outcomes were 1) menthol/mint, 2) candy/fruit, and 3) any (either).

Moderators

Race and ethnicity were self-identified and operationalized as binary (0/1) variables: race (Black vs. White) and ethnicity (Hispanic vs. non-Hispanic).

Statistical Analysis

We analyzed the data using SPSS 23.0 (IBM Corporation, Armonk, NY, US). To adjust for sampling weights, we applied Taylor series linearization. This enabled us to re-estimate the variance of all study variables. By applying weight, the results became generalizable to the US general population. For multivariable analysis, we applied binary logistic regression. We ran two logistic regression models without (*Model 1*) and with (*Model 2*) two by four interaction terms between race, ethnicity, educational attainment, and poverty status.

Results

Descriptive Statistics

This study included 22,144 American adults who were ever-smokers. They were either non-Hispanic (85.1%), Hispanic (14.9%), White (84.7%), or Black (15.3%).

Table 1 describes demographic, SES, and tobacco use data of the overall sample (Table 1). Participating adults were almost 47% women and 53% men. Although most smokers' (60.7%) first cigarette was non-flavored, most of the flavored cigarettes were mint/menthol (39.3% of total), which was considerably higher than people who had started their first smoke with a candy/fruit-flavored product (4.5% only).

Table 1. Descriptive Data in the Overall Sample

	n	%
Race		
White	18760	84.7
Black	3384	15.3
Ethnicity		
Non-Hispanic	18845	85.1
Hispanic	3299	14.9
Poverty Status		
Living in poverty	6652	32.9
Living out of poverty	13579	67.1
Gender		
Women	10501	47.4
Men	11643	52.6
Initiating smoking using a flavored cigarette-Mint/Menthol		
No	14068	63.5
Yes	8074	36.5
Initiating smoking using a flavored cigarette-Candy/Fruit		
No	13436	95.5
Yes	634	4.5
Initiating smoking using a flavored cigarette-Any		
No	13436	60.7
Yes	8708	39.3
	Mean	**SD**
Age (1-7)	3.11	1.71
Education (1-6)	3.49	1.37

Multivariable Models

Table 2 summarizes the output of two logistic regression models with race, ethnicity, educational attainment, and poverty status as the independent variables; and smoking initiation using a flavored cigarette as the dependent variable. Three models were performed for any, menthol/mint, and candy/fruit flavors. All models were estimated in the overall sample and were statistically significant. *Model 1* only allowed the main effects of poverty status, race, ethnicity, educational attainment, and covariates. *Model 2* also added four interaction terms: race x educational attainment, ethnicity x educational attainment, race x poverty status, and ethnicity x poverty status.

Based on *Model 1*, race and ethnicity were associated with initiating smoking using any flavored cigarettes, with Black (odds ratio [OR] = 3.77, 95% CI = 3.47-4.11) and Hispanic (OR = 1.48, 95% CI = 1.36-1.61) people being more likely to report such behavior than non-Hispanic Whites. However, the type of flavor was menthol/mint for Black (OR = 3.86, 95% CI = 3.55-4.20) and candy/fruit for Hispanic (OR = 1.79, 95% CI = 1.44-2.21) people. Overall, individuals with higher educational attainment had lower odds of initiating smoking using a menthol/mint (OR = 0.94, 95% CI = 0.92-0.96) flavored

Table 2. Summary of Logistic Regression Models on Initiating Smoking Using a Flavored Cigarette in the Pooled Sample

	OR	95% CI	*P*	OR	95% CI	*P*
Any Flavored						
Race (Black)	3.77	3.47-4.11	<0.001	5.16	4.12-6.46	<0.001
Ethnicity (Hispanic)	1.48	1.36-1.61	<0.001	1.25	1.02-1.54	0.032
Gender (male)	0.60	0.57-	<0.001	0.60	0.57-0.64	<0.001
Age (1-7)	0.83	0.82-0.85	<0.001	0.83	0.82-0.85	<0.001
Education (y)	0.98	0.95-1.00	0.041	0.99	0.96-1.01	0.316
Living out of poverty	0.96	0.89-1.03	0.216	0.92	0.85-1.00	0.065
Education (y) * race (Black)				0.88	0.82-0.94	<0.001
Education (y) * ethnicity (Hispanic)				1.05	0.99-1.12	0.111
Living out of poverty * race (Black)				1.19	1.00-1.43	0.050
Living out of poverty * ethnicity (Hispanic)				1.02	0.86-1.22	0.785
Constant	1.26		<0.001	1.25		<0.001
Menthol/Mint Flavored						
Race (Black)	3.86	3.55-4.20	<0.001	5.04	4.03-6.30	<0.001
Ethnicity (Hispanic)	1.41	1.30-1.53	<0.001	1.09	0.89-1.34	0.404
Gender (Male)	0.59	0.55-0.62	<0.001	0.59	0.55-0.62	<0.001
Age (1-7)	0.86	0.85-0.88	<0.001	0.86	0.85-0.88	<0.001
Education (y)	0.94	0.92-0.96	<0.001	0.94	0.91-0.97	<0.001
Living out of poverty	0.95	0.89-1.02	0.157	0.92	0.84-1.00	0.050
Education (y) * race (Black)				0.90	0.84-0.96	0.002
Education (y) * ethnicity (Hispanic)				1.08	1.01-1.14	0.023
Living out of poverty * race (Black)				1.14	0.96-1.36	0.145
Living out of poverty * ethnicity (Hispanic)				1.06	0.89-1.27	0.519
Constant	1.17		0.006	1.18		0.008
Fruit and Candy Flavored						
Race (Black)	1.35	1.03-1.78	0.031	1.41	0.59-3.35	0.442
Ethnicity (Hispanic)	1.79	1.44-2.21	<0.001	3.98	2.19-7.25	<0.001
Gender (male)	0.91	0.77-1.08	0.274	0.90	0.76-1.07	0.222
Age (1-7)	0.66	0.62-0.70	<0.001	0.66	0.62-0.70	<0.001
Education (y)	1.35	1.26-1.45	<0.001	1.43	1.31-1.56	<0.001
Living out of poverty	1.04	0.85-1.27	0.692	1.02	0.79-1.31	0.904
Education (y) * race (Black)				0.91	0.72-1.15	0.431
Education (y) * ethnicity (Hispanic)				0.82	0.69-0.97	0.020
Living out of poverty * race (Black)				1.76	0.96-3.23	0.067
Living out of poverty * ethnicity (Hispanic)				0.85	0.54-1.34	0.482
Constant	0.04		<0.001	0.04		<0.001

CI: confidence interval; SE: standard error; OR: odds ratio.

cigarette, but higher odds of using a candy/fruit (OR = 1.35, 95% CI = 1.26-1.45) flavored cigarette. Living out of poverty did not have any association with smoking initiation using either flavored cigarettes.

Based on *Model 2*, education had a larger protective effect for Blacks against initiating their smoking using any (OR = 0.88, 95% CI = 0.82-0.94) or menthol/mint (OR = 0.90, 95% CI = 0.84-0.96) flavored cigarettes. However, race did not alter educational attainment on initiating smoking using candy/fruit-flavored cigarettes. Hispanic ethnicity showed a significant interaction with education on initiating smoking using menthol/mint cigarettes (OR = 1.08, 95% CI = 1.01-

1.14), suggesting that education may lose some of its protective effects on reducing the odds of initiating smoking using menthol/mint-flavored cigarettes for Hispanics than for non-Hispanics. Hispanic ethnicity also showed a significant interaction with education on initiating smoking using candy/fruit-flavored cigarettes (OR = 0.82, 95% CI = 0.69-0.97), suggesting that education may better protect Hispanics than non-Hispanics against initiating smoking using candy/fruit-flavored cigarettes. Living out of poverty showed a significant interaction with race on odds of initiating smoking using any flavored cigarettes (OR = 1.19, 95% CI = 1.00-1.43) as well, suggesting that living out of poverty has a larger protective

effect for White than for Black people.

Discussion

The current study produced several findings. First, racial and ethnic minority adults were more likely to report that they had initiated smoking using a flavored cigarette. However, Blacks and Hispanics were at risk of initiating smoking with different flavors of cigarettes. Blacks had a higher tendency to initiate with menthol/mint-flavored cigarettes, whereas Hispanics more frequently initiated with candy/fruit-flavored cigarettes. Second, overall, educational attainment reduces the odds of initiating smoking using flavored cigarettes. However, living out of poverty was not directly associated with initiating smoking using a flavored cigarette after controlling for education. Third, we found interactions between race and ethnicity from one side, and education and poverty status from the other side, on our outcomes. However, these interactions were complex and were specific to race, ethnicity, SES indicator, and type of flavor.

In our study, Black (OR = 3.86) and Hispanic (OR = 1.79) people had higher odds of initiating smoking using menthol/mint and candy/fruit-flavored cigarettes, respectively. Although tobacco researchers have noted cigarette flavoring as a marketing strategy that places racial and ethnic minorities and low SES people at risk,[34-36] less is known about the nuances on how each race and ethnic group initiate smoking using flavored cigarettes, and how people from various contexts differ in this regard. Our findings are in line with the general observation that Black and Hispanic people are more likely to use flavored tobacco products.[24,39,40]

Building on our previous work on MDRs, we expected a higher risk of tobacco use initiation with flavored products in high SES Black and Hispanic people. We found some support for our hypothesis. Our study confirmed that (a) education showed a weaker (OR = 1.08) protective effect on reducing the odds of initiating smoking using menthol/mint-flavored cigarettes for Hispanics, and that (b) living out of poverty had a weaker protective effect for Blacks than Whites on the odds of initiating smoking using any flavored cigarettes (OR = 1.19).

At the same time, some findings did not confirm our hypothesis. Contrary to our expectations, our study found that (a) education had a larger protective effect for Blacks against smoking initiation using any (OR = 0.88) or menthol/mint (OR = 0.90) flavored cigarettes, and that (b) education better protected Hispanics than non-Hispanics against smoking initiation using candy/fruit-flavored cigarettes (OR = 0.82). More research is needed on the circumstances in which MDRs hold and the contexts, situations, and populations in which MDRs do not hold. In this view, MDRs proposed a framework that may not fully apply to all SES indicators, tobacco products, age groups, ethnic groups, and locations.

Our results demonstrate the high level of complexity in the interplays between race, ethnicity, SES indicator, and flavor type. For example, individuals with higher educational attainment had lower odds of smoking initiation using menthol/mint (OR = 0.94) flavored cigarettes, but higher odds of smoking initiation using candy/fruit (OR = 1.35) flavored

cigarettes. Simultaneously, living out of poverty did not have any residual effect on initiating smoking using either flavored cigarettes after controlling for education.

Previous studies have documented an increased risk of substance use in high SES Black and Hispanic individuals compared to high SES White people.[35,36,38,46] These patterns are not limited to tobacco and are observed for a wide range of health, mental, physical, and behavioral outcomes as well.[32,33]

More research is needed on the role of predatory tobacco marketing practices in increasing the risk of initiating smoking using a flavored cigarette in high-income Blacks. Predatory marketing practices have been mentioned as a mechanism behind the racial, ethnic, and SES health disparities in tobacco use. It can be hypothesized that such marketing practices may potentially generate MDRs. That is, predatory marketing and advertising have the potential to disproportionately impact flavored tobacco use in high SES Blacks. If this hypothesis proves true, we would need to introduce more restrictive marketing policies that reduce point-of-sale advertisements and flavoring. Not only would these policies reduce the overall smoking rate, they would also greatly reduce smoking in high SES Black people. Restrictions and bans on predatory marketing may also be needed to eliminate tobacco disparities by race and ethnicity. That said, more research is needed to explore this hypothesis.[47]

Implications

For the FDA, NIH, and CDC, eliminating racial, ethnic, and economic health disparities is a strategic goal. A research priority of the FDA is to "[understand] why people become susceptible to using tobacco products." Knowing why subgroups become more prone or vulnerable to tobacco may have some policy and public health implications, and help the FDA, NIH, and CDC act on their priorities. We have argued that public health policies aimed at reducing tobacco-related disparities need to go beyond reducing SES gaps to addressing MDRs of SES in Blacks and Hispanics. Policies that more tightly regulate the advertisement of flavored tobacco products may be needed. US policymakers should not overemphasize individual choices. Instead, they should seek to tighten regulations that can limit the effects of structural risk factors.[48] The good news is that, in general, the American public do not perceive restrictive tobacco policies as a threat to their individual freedom and agency.[48]

There is a need for regulatory policies at both the national and local levels to reduce the racial, ethnic, and SES disparities in tobacco use. We still do not know if these policy changes would reduce or increase SES's existing MDRs on tobacco use. There is a need to study the role of discounts, coupons, and flavoring in shaping MDRs of SES on tobacco use for high SES Blacks and Hispanics.[35,36] The exact type of tobacco regulations and policies that can undo the MDRs of SES on tobacco use for high SES Blacks and Hispanics are still unknown as well.[35,36,38,46]

Since flavored tobacco imposes a higher risk to the individual,[26,28,41-43] there is a need to ban marketing strategies that increase the risk of Black, Hispanic, and other

Research Highlights

What Is Already Known?
Use of flavored tobacco products may vary across social groups. Race, ethnicity, and SES are among social determinants of use of flavored tobacco products.

What Does This Study Add?
Social groups by race and ethnicity differ in the effects of their SES on their use of flavored tobacco products at first cigarette smoking. The effects of race, ethnicity, and SES on the use of flavored tobacco products at first cigarette smoking are not additive but multiplicative.

marginalized and vulnerable groups. Furthermore, since using flavored tobacco products may increase addiction and reduce individuals' ability to quit smoking,[28,42,44,45] there is a need to boost ethnic minorities' access to tobacco cessation treatments (given their higher needs because of the flavored nature of their initiation). It is unknown if more restrictive policies would reduce the racial and ethnic disparities in the tobacco burden,[28,42,44,45] and whether they would have an effect on disparities that are shaped by MDRs (i.e., reduced effects of SES on high SES racial and ethnic minorities).

Limitations
This study had some methodological and conceptual limitations. Cross-sectional studies do not show causal effects but associations instead. The PATH sample size was imbalanced with a higher n in non-Hispanic Whites than in Hispanics and Blacks. Another limitation was a lack of information on income, employment, marital status, wealth, and area-level SES indicators. Although these limitations exist, the results of this study still contribute to the existing literature.

Conclusion
In the US, race and ethnicity modify the association between SES indicators (such as education and income) on first tobacco flavor. The association between SES and first cigarette flavor is complicated and depends on the intersections of race, ethnicity, and SES. More research is needed on the complex interplays between these social constructs in shaping racial, ethnic, and economic disparities in tobacco use. Such research may help promote population health.

Conflicts of Interest Disclosures
The author declares no conflicts of interest.

Ethical Approval
This analysis was not considered human research because it used fully de-identified publicly available data. Thus, Charles R Drew University excepted the current study from a full IRB review. Participants of PATH provided written consent, and the Westat Institutional Review Board (IRB) approved the original (i.e., PATH) study protocol.

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