

# Social Determinants of Hookah Smoking in the United States

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## Article Info

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## Abstract

**Background:** Educational attainment and income are two socioeconomic status indicators with strong protective effects against cigarette smoking. *Marginalization-related Diminished Returns*, however, refer to less than expected protective effects of socioeconomic status indicators for the members of the racial and ethnic minority groups, particularly Blacks and Hispanics, compared to non-Hispanic Whites.

**Aim:** Borrowing data from a nationally representative study in the US, this study tested whether racial and ethnic differences exist in the effects of educational attainment and poverty status on cigarette smoking of American adults.

**Methods:** This cross-sectional study entered 28,329 adult participants of the Population Assessment of Tobacco and Health (PATH; 2013). Both educational attainment and poverty status were the independent variables. The dependent variable was current hookah smoking. Age, gender, and region were the covariates. Race and ethnicity were the effect modifiers (moderators).

**Results:** Overall, individuals with higher educational attainment were more likely to smoke a hookah. Individuals who lived out of poverty, however, had lower odds of current hookah smoking. Race and ethnicity both showed statistical interactions with both socioeconomic indicators suggesting that Blacks and Hispanics with high educational attainment and those who live out of poverty have disproportionately high odds of hookah smoking, compared to non-Hispanic Whites with high socioeconomic status.

**Conclusions:** In the United States, middle-class racial and ethnic minority people remain at higher risk of smoking hookah. As a result, we should expect a high tobacco burden in middle-class Black and Hispanic adults. We suggest that policymakers should not take an over-simplistic way and reduce the problem of race/ethnic inequalities in tobacco use to gaps in socioeconomic status between groups. Marginalization-related diminished returns generate tobacco disparities in higher socioeconomic status levels. Middle-class racial and ethnic minority people need extra support to stay healthy.

## Introduction

Despite the recent decline in the prevalence of tobacco use in the United States, cigarette smoking remains one of the top preventable causes of morbidity and mortality in this country<sup>1-3</sup>. Each year, about 480,000 Americans die from illnesses that are due to tobacco use. In addition, more than 16 million Americans suffer from diseases that are caused by smoking<sup>4</sup>. As a result, tobacco costs the United States more than \$300 billion each year, which is composed of \$170 and \$156 billion for direct and indirect costs, respectively<sup>5</sup>.

The burden of tobacco use, however, is not randomly distributed in the United States<sup>6-10</sup>. Despite the enormous progress that has been achieved in reducing the overall tobacco-related morbidity and mortality, cigarette smoking has transformed from a health challenge that impacts mainstream populations to a public health challenge that is highly concentrated in the marginalized populations defined by socioeconomic status, race, ethnicity, and sexual orientation<sup>11</sup>. Such social inequalities diminish the achievements of the United States regarding tobacco control<sup>11</sup>.

Racial and ethnic minorities<sup>6-10</sup> and low socioeconomic status individuals<sup>12-14</sup> bear the vast majority of tobacco burden in the US. Some evidence suggests that the socioeconomic status disparities in tobacco use have increased<sup>14-16</sup>. From 1966 to 2015, cigarette smoking declined by 83% in American adults with a college degree. At the same time, the decline was only 40% for Americans who did not have a high school diploma<sup>11</sup>. A large proportion of tobacco disparities may not be due to choices of the individuals but large scale upstream societal processes that place marginalized groups at higher risk of exposure to tobacco. For example, racial, ethnic, and low socioeconomic status individuals are the target of predatory tobacco marketing<sup>17-19</sup>. In a recent study, non-Hispanic Whites with high education remembered the fewest number of tobacco ads<sup>20</sup>. Black and Hispanic people with high education, however, reported a high number of tobacco ads<sup>20</sup>. This finding suggested that tobacco marketing may have a role in explaining why middle-class Hispanic and Black individuals remain at risk of tobacco use<sup>20</sup>. Low socioeconomic status individuals, as well as racial and ethnic minorities, are more frequently exposed to a wide range of environmental tobacco risk factors such as advertisements, retail displays, coupons, and discounts<sup>21</sup>. The result is their increasing vulnerability of racial/ethnic and low socioeconomic status individuals<sup>22</sup>, which is characterized by a more rapid transition from initiation to undesired outcomes, in part due to low access to cessation programs<sup>8,23,24</sup>.

Marginalization – related Diminished Returns (MDRs)<sup>25,26</sup> refer to “weaker than expected” protective effects of socioeconomic indicators, particularly educational attainment on a wide range of health outcomes including but not limited to tobacco use for minority compared to the majority populations<sup>27-29</sup>. According to the MDRs, at least some of the racial/ethnic disparities in health are due to diminishing returns of educational attainment and other socioeconomic resources on securing tangible outcomes for the members of socially marginalized compared to socially privileged groups. This model proposes that: (a) racial/ethnic inequalities in tobacco burden are not all due to socioeconomic gaps, but at least some of it is due to smaller effects of socioeconomic indicators for minority

populations, and (b) the racial and ethnic gap in tobacco use widens as socioeconomic status increases. This model emphasizes a need to study racial/ethnic tobacco disparities across all socioeconomic status levels and suggests that the solution to tobacco disparities is beyond equalizing socioeconomic status<sup>27-29</sup>. There is a need to study if diminished returns are causing racial and ethnic disparities for various tobacco products in the US<sup>27-29</sup>. Previously, such diminished returns were described for tobacco use, tobacco dependence<sup>30</sup>, smoking<sup>29</sup>, vaping<sup>31</sup>, and even alcohol use<sup>28,32</sup>.

While minorities’ diminished returns of education on tobacco, e-cig, tobacco dependence, and even alcohol use, and alcohol binge drinking are shown, these patterns are not shown for other types of substances. While similar to any other country, there are many types of tobacco available in America, these substances and methods of use may have different predictors. They may also be differently influenced by social determinants of health, such as socioeconomic status. Thus, there is a need to test if similar diminished returns also apply to other forms of use. From various tobacco products, hookah has received one of the least amounts of attention by researchers. Thus, there is a need for additional studies on hookah smoking, a method of use with very limited existing knowledge.

This study tested race/ethnic variation in the effects of two socioeconomic status indicators, namely educational attainment and poverty status, on hookah smoking in a nationally representative sample of American adults. We expected smaller protective effects of educational attainment and living out of poverty on hookah use for Black and Hispanic than Non-Hispanic White Americans. As marginalization-related diminished returns are not because of groups’ or individuals’ characteristics but the marginalization of racial and minority populations<sup>25,26</sup>, we expected similar diminished returns for Blacks and Hispanics.

## Methods

### Design and settings

We conducted a cross-sectional study. The source of data for the current secondary analysis came from wave 1 of the Population Assessment of Tobacco and Health (PATH) -Adults. PATH is funded by the National Institute for Health and the Food and Drug Administration and generates valid nationally representative prevalence estimates on tobacco use in the US population. Data collection was conducted in 2013-2014.

### Data retrieval

We used Wave1 of the PATH data for this analysis. Data were downloaded from the University of Michigan Inter-

university Consortium for Political and Social Research. We merged data sets DS0001 and DS1001 for the purpose of this study, using the identifiers in the Master Linkage file. The former is a Master Linkage file and includes 53,178 youth and adults. The later includes 32,320 adults (Wave 1 Adult Questionnaire). This study only includes 28,329 adults. All the data for this proposal is at the individual level.

### Sample & sampling

The PATH sample is composed of non-institutionalized, civilian, American adults. The PATH study used a four-stage stratified and clustered probability sample that introduces the survey weights and nested data.

### Analytical sample

The current analysis was limited to all adults aged 18 or more who had data on our variables (see below for a list). While the original sample size was 32,320 adults, this study includes only 25,654 adults. Individuals who were not included in the current analysis were either from other races and ethnic groups or did not have a valid measure on their study variables.

### Study variables

Variables in this analysis included race, ethnicity, socioeconomic status indicators (poverty status and educational attainment), hookah use, and demographic indicators (age and gender), all measured at the individual level.

**Moderator:** Race and ethnicity were self-identified in this study. These variables were treated as two dichotomous variables: Race (Non-Hispanic Blacks versus Non-Hispanic Whites) and Ethnicity (Hispanics versus Non-Hispanics).

**Independent Variables (socioeconomic indicators):** Educational attainment was a six-level variable as below: 1) Less than High School, 2) General Educational Development, 3) High school graduate, 4) Some college (no degree) or associate degree, 5) Bachelor's degree, and 6) Advanced degree. Poverty status was dichotomous variable 0) below 100% federal poverty line, 1) above 100% federal poverty line.

**Dependent Variable:** The outcome was the current smoking of hookah, which was self-reported. Current hookah smoking was defined as hookah smoked daily or sometimes in the past 30 days.

**Confounders:** Age was a continuous measure, ranging from 1 to 7 as below: 1) 18 to 24 years old, 2) 25 to 34 years old, 3) 35 to 44 years old, 4) 45 to 54 years old, 5) 55 to 64 years old, 6) 65 to 74 years old, and 7) 75 years old or older. Gender was a dichotomous variable with females as the reference group.

### Statistics

To analyze the PATH-Adults data, we used SPSS 23.0 (IBM Corporation, Armonk, NY, USA). To apply the weights, which was necessary to produce results that were generalizable to the US general population, we re-estimated the variance and standard errors using Taylor series linearization. Thus, our analyses addressed the survey design due to sample weight, PSU, clustering, and stratification. For data analysis, first, we tested whether there is any collinearity between race, ethnicity, educational attainment, and poverty status. We did not find any evidence suggesting any collinearity. We ran two logistic regression models in the overall sample; first, a model without (*Model 1*) and second, a model with (*Model 2*) four interaction terms between race, ethnicity, educational attainment, and poverty status.

### Ethics

All the participants provided written informed consent. The Institutional Review Board of the Westat approved the PATH study protocol.

### Results

#### Descriptive statistics

This study included 25,654 American adults who were either Non-Hispanic White (68.0%), Non-Hispanic Black (15.9%), or Hispanic White (14.9%), or Hispanic Black (1.3%). **Table 1** shows descriptive statistics of the overall sample. Participants were almost half men and women.

#### Multivariable models

**Table 2** shows a summary of the output of two logistic regression models. In these models, educational attainment and poverty status were the independent variables, and smoking hookah was the dependent variable. Both models were estimated in the total sample, which included Whites, Blacks, Hispanics, and non-Hispanics. *Model 1* only entered the main effects of socioeconomic status indicators (educational attainment and poverty status) as well as race, ethnicity, and covariates. *Model 2*, however, also added four statistical interaction terms between race and ethnicity with education and poverty status.

Based on *Model 1*, Blacks (OR = 1.17; 95% CI =1.04 - 1.32) and Hispanics (OR = 1.32; 95% CI = 1.18 - 1.48) were more likely than Whites and non-Hispanics to use hookah. There was a positive association between education and hookah smoking (OR = 1.11; 95% CI =1.06 - 1.15). This model also showed a protective effect of income (living out of poverty) on hookah smoking. Other factors that were associated with hookah use included lesbian, gay, bisexual, and transgender status (OR = 1.79; 95% CI = 1.55 - 2.07), male gender (OR = 1.37; 95% CI = 1.25 - 1.51), and age (OR = 0.39; 95% CI = 0.37 - 0.41).

**Table 1.** Descriptive statistics.

	n	%
<b>Race</b>		
Black	4874	17.1
White	23625	82.9
<b>Ethnicity</b>		
Hispanic	4647	16.3
Non-Hispanic	23852	83.7
<b>Gender</b>		
Women	14199	49.8
Men	14300	50.2
<b>Lesbian, Gay, Bisexual</b>		
No	25992	93.3
Yes	1868	6.7
<b>Age</b>		
1 = 18 to 24 years old	7730	27.3
2 = 25 to 34 years old	5524	19.5
3 = 35 to 44 years old	4330	15.3
4 = 45 to 54 years old	4322	15.3
5 = 55 to 64 years old	3561	12.6
6 = 65 to 74 years old	1948	6.9
7 = 75 years old or older	910	3.2
<b>Education</b>		
1 = Less than high school	3635	12.8
2 = General education development	1953	6.9
3 = High school graduate	6695	23.6
4 = Some college (no degree) or associates degree	10068	35.5
5 = Bachelor's degree	3954	14.0
6 = Advanced degree	2024	7.1
<b>Poverty Status</b>		
Living in poverty	8534	33.1
Living out of poverty	17212	66.9
<b>Current Hookah</b>		
Non-Smoker	25962	91.1
Smoker	2537	8.9

*Model 2* suggested that significant interactions exist between the effects of race and ethnicity with education and poverty status on hookah smoking, suggesting that high education and living out of poverty both have smaller inverse associations with smoking of hookah for Blacks and Hispanics than non-Hispanics and Whites. This was evident by the ORs smaller than 1 for the main effects of socioeconomic resources and ORs larger than 1 for the interaction terms between race and ethnicity with socioeconomic resources. Interactions were significant for education and race (OR = 1.31; 95% CI= 1.18 - 1.46), education and ethnicity (OR = 1.12; 95% CI= 1.02 - 1.22), income [living out of poverty] and race (OR = 1.36; 95% CI= 1.06 - 1.74) and income [living out of poverty] and ethnicity (OR = 1.52; 95% CI= 1.21 - 1.92) (**Table 2**).

### Discussion

The current study showed that while education and poverty status are associated with higher odds of hookah smoking, these associations differ based on race and ethnicity. Race and ethnicity seem to interact with both socioeconomic indicators suggesting that middle-class Blacks and Hispanics are at disproportionately high risk of smoking hookah.

Our MDRs work shows that middle-class Blacks and Hispanics remain at a disproportionately high risk of substance use compared to their White counterparts<sup>28,29,32,33</sup>. A similar pattern is shown for almost every socioeconomic indicator and health outcome<sup>25,26</sup>. For example, the magnitude of the effects of education<sup>34</sup>, income<sup>35</sup>, marital status<sup>36</sup>, and employment status<sup>37</sup> on diet<sup>38</sup>, exercise<sup>39</sup>, depression<sup>40</sup>, anxiety<sup>36</sup> and self-rated health<sup>34,41</sup> are smaller for Hispanic and Black compared to non-Hispanic White people. Similar patterns are shown for physical health outcomes such as obesity<sup>42</sup>, hypertension<sup>43</sup>, attention deficit

**Table 2.** Logistic regressions on current hookah smoking models in the pooled sample.

	Model 1 Main Effects			Model 2 Mode 1 + Interactions		
	OR	95% CI	p	OR	95% CI	p
Race (Blacks)	1.17	1.04 - 1.32	0.009	0.39	0.27 - 0.56	<0.001
Ethnicity (Hispanics)	1.32	1.18 - 1.48	<0.001	0.73	0.53 - 1.00	0.051
Lesbian, Gay, Bisexual, and Transgender	1.79	1.55 - 2.07	<0.001	1.82	1.57 - 2.09	<0.001
Gender (Men)	1.37	1.25 - 1.51	<0.001	1.38	1.26 - 1.52	<0.001
Age (1-7)	0.39	0.37 - 0.41	<0.001	0.39	0.37 - 0.41	<0.001
Educational Attainment (1-6)	1.11	1.06 - 1.15	<0.001	1.03	0.98 - 1.08	0.272
Living Out of Poverty	0.87	0.79 - 0.97	0.008	0.74	0.65 - 0.84	<0.001
Educational Attainment (1-6) x Race (Blacks)				1.31	1.18 - 1.46	<0.001
Educational Attainment (1-6) x Ethnicity (Hispanics)				1.12	1.02 - 1.22	0.023
Living Out of Poverty x Race (Blacks)				1.36	1.06 - 1.74	0.014
Living Out of Poverty x Ethnicity (Hispanics)				1.52	1.21 - 1.92	<0.001
Intercept	0.41		<0.001	0.58		<0.001

CI: Confidence Interval;

SE: Standard Error;

OR: Odds Ratio;

Outcome: Current hookah smoking.

hyperactivity disorder<sup>44</sup>, chronic obstructive pulmonary disease<sup>45</sup>, disability<sup>46</sup>, and chronic disease<sup>44</sup> are all smaller for Hispanic and Black than White people.

There is a need to understand the role of predatory marketing practices on racial/ethnic and socioeconomic status disparities in tobacco use. We argue that predatory marketing and advertising may be at least in part responsible for the disproportionately high risk of tobacco use among middle-class Black and Hispanic individuals, relative to middle-class Whites. At least some evidence suggests that minority and vulnerable populations are targets of aggressive tobacco marketing<sup>47-49</sup>. In a recent study, highly educated Blacks and Hispanics reported more tobacco ads, while highly educated Whites reported fewest tobacco ads<sup>20</sup>. Although more research is needed, if such a hypothesis is supported, then introducing more restrictive and tight marketing policies that do not allow point-of-sale advertisement and flavoring, particularly in areas where ethnic minorities live, may reduce the racial and ethnic disparities that are due to MDRs. Such strategies may disproportionately impact Black and Hispanic populations. In other words, restricting predatory marketing may contribute to the elimination of tobacco use disparities by race, ethnicity, and socioeconomic status; however, this hypothesis needs more research<sup>50</sup>.

## Implications

Policies are needed at a national as well as local levels that can reduce the racial/ethnic and socioeconomic disparities in tobacco use, and reducing MDRs of socioeconomic status are among them<sup>26,28,29,33-36,42,51,52</sup>. Banning discounts, coupons, and flavoring in communities of color may reduce the increasing tobacco use of middle-class Blacks and Hispanics<sup>28,29</sup>. It is also unknown how tobacco regulations can reduce the MDRs-related disparities in tobacco use, particularly higher than expected tobacco use of middle-class Black and Hispanic people<sup>28,29,32,33</sup>. We still do not know how marketing strategies disproportionately impact communities of color. To undo racial and ethnic disparities in tobacco use, there might be a need to ban predatory marketing that may be ongoing in the communities of color.

## Limitations

This study has a few methodological limitations. All cross-sectional studies are limited in drawing causal inferences. Thus, our results only suggest association rather than causation. The sample size was smaller for racial and ethnic minority groups. Income, employment, marital status, and area-level socioeconomic status were not a part of this study. Other tobacco products and other ethnic groups were also not included. This study did not measure health. Despite the limitations that were listed, this study still made a unique contribution to the literature.

## Conclusion

In the United States, race and ethnic minority status limit the amount of health gain that usually follows the availability of socioeconomic status indicators such as education and income. While socioeconomic status resources help people avoid behaviors such as smoking hookah, racial and ethnic majority groups gain the most, and racial and ethnic minorities gain the least from their available resources. In the same line, we observe an additional risk of hookah smoking in middle-class Blacks and Hispanics. Policymakers should not reduce the problem of health disparities to low socioeconomic status but also societal mechanisms that reduce the marginal returns of socioeconomic resources. Thus, inequalities remain across all socioeconomic status levels. Policymakers should be aware that health disparities also affect middle-class Blacks and Hispanics, which is one of the major growing sections of the US population.

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## Conflicts of Interest

The authors declare no conflict of interest.

## Author Contributions

S.A. conceptualized the study, analyzed the data, prepared the first draft of the paper, and acquired the funding. M.B. and H.C. contributed to the revision and conceptualization of the study. All authors approved the final draft.

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