



# Educational Attainment and Tobacco Harm Knowledge Among American Adults: Diminished Returns of African Americans and Hispanics

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## Abstract

**Background and aims:** Minorities' Diminished Returns (MDRs) refer to the smaller effects of educational attainment for ethnic minorities compared to the majority group. As a result of MDRs, research has documented more than expected tobacco use among Hispanics and African Americans (AAs) with high educational attainment. In theory, some of this increased risk may be due to lower tobacco harm knowledge. Accordingly, the present study compared ethnic groups for the association between educational attainment and tobacco harm knowledge among American adults in order to better understand a potential mechanism behind MDRs of educational attainment on tobacco use of Hispanics and AAs.

**Methods:** The current cross-sectional study used baseline data of 27,405 adults, which were obtained from the Population Assessment of Tobacco and Health (2013) study a nationally representative survey in the United States. The independent and dependent variables were educational attainment and tobacco harm knowledge, respectively. In addition, age, gender, employment, and poverty status were the covariates and ethnicity was the moderator. Finally, linear regression was used to analyze the data.

**Results:** Educational attainment was inversely associated with tobacco harm knowledge in the pooled sample ( $b=0.11$ , 95% CI=0.09 - 0.13). Ethnicity showed a statistically significant interaction with educational attainment ( $b=-0.05$ , 95% CI=-0.10 - 0.00 for AAs and  $b=-0.14$ , 95% CI=-0.19 - -0.09 for Hispanics versus non-Hispanics), suggesting that the effect of educational attainment on tobacco harm knowledge was smaller for Hispanics and AAs compared to non-Hispanics and Whites.

**Conclusion:** In general, although high educational attainment increases tobacco harm knowledge, highly educated Hispanics and AAs still report a disproportionately low level of tobacco harm knowledge. Eventually, the MDRs of educational attainment on tobacco harm knowledge may explain why highly educated Hispanics remain at high risk of tobacco use.

**Keywords:** Population groups, Ethnicity, Socioeconomic status, Socioeconomic position, Education, Smoking, Tobacco use

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## Introduction

Considerable ethnic disparities exist in the burden of tobacco use in the United States.<sup>1</sup> Low acceptability and trust combined with low access to cessation programs<sup>1</sup> have placed Hispanic and African American (AA) individuals at an increased vulnerability to tobacco-related consequences.<sup>2</sup> In addition, a documented higher rate of undesired tobacco outcomes despite a low prevalence of tobacco use in ethnic minorities compared to that of the general population makes undesired tobacco outcomes in ethnic minorities research a paradoxical area of research.

Given that low socioeconomic status (SES) is a major

risk factor for tobacco use<sup>3</sup>, and because ethnicity and SES closely overlap,<sup>4</sup> at least, some of the ethnic differences in the burden of tobacco use are attributed to SES.<sup>4</sup> This becomes important in multiple ways. First, the SES gap in tobacco use has increased despite the overall decline in tobacco use in American adults.<sup>5</sup> From 1966 to 2015, cigarette smoking decreased by 83% in Americans who had a college degree. During this period, the decrease was only half (40%) for individuals who had no high school diploma.<sup>6</sup> Further, knowing the role of SES in explaining the ethnic tobacco disparities has a major implications for the allocation of resources. The elimination of

ethnic inequalities would need the removal of economic inequalities across ethnic groups if SES was responsible for ethnic disparities. However, other non-economic interventions (e.g., tobacco marketing policies) would be also required if tobacco disparities were not all due to SES differences.

Some recent evidence suggests that not all the ethnic differences in tobacco use are due to SES inequalities across such groups.<sup>7</sup> Minorities' Diminished Returns (MDRs),<sup>8</sup> research has shown "higher than expected" tobacco use in highly educated ethnic minorities,<sup>9</sup> which is due to "weaker than expected" effects of educational attainment and other SES indicators on improving the health outcomes of ethnic minority individuals compared to Whites. Greater than expected tobacco use imposes a considerable threat to the highly educated Hispanics AAs.<sup>7</sup> Although similar patterns are shown for various outcomes in AAs<sup>9</sup> and Hispanics,<sup>7</sup> there is a lack of information on potential mechanisms that can explain MDRs for tobacco use outcomes.

To give some examples of MDRs in tobacco use, a study showed a higher risk of e-cigarette use in highly educated AAs. This was despite the observation that for Whites, educational attainment was inversely associated with e-cigarette use.<sup>10</sup> In another study, educational attainment was inversely associated with cigarette smoking for Whites but not AAs.<sup>11</sup> Based on the findings of another study, employment was related to a reduced risk of smoking for non-Hispanic Whites but not Hispanics.<sup>7</sup> All these studies demonstrate the high risk of tobacco use in high SES AAs and Hispanics compared to high SES non-Hispanic Whites.

Given that MDRs are repeatedly shown for Hispanics and AAs,<sup>7,9-11</sup> we need to understand the mechanisms behind MDRs instead of their sole description and then find solutions that can reduce them. In a very recent study, second-hand workplace exposure to cigarette smoking was higher in highly educated Hispanics and AAs, which was attributed to labor market discrimination that worsens job qualities for Hispanics and AAs compared to Whites.<sup>12</sup> One proposed mechanism that has not yet been tested is that highly educated Hispanics and AAs may still lack enough knowledge regarding tobacco harm.<sup>13</sup>

## Objectives

This study explored the ethnic differences in the effects of educational attainment on tobacco harm knowledge in a national sample of American adults. Therefore, a positive association was expected between educational attainment and tobacco harm knowledge, as well as a weaker effect of educational attainment on tobacco harm knowledge in Hispanics and AAs compared to non-Hispanics and Whites.

## Materials and Methods

### Design and Settings

The wave 1 data of the Population Assessment of Tobacco and Health (PATH, 2013-2014) study were analyzed for this cross-sectional study.<sup>14</sup> Jointly funded by the National Institutes of Health and the Food and Drug Administration, PATH is the primary source of epidemiological information regarding tobacco use of the Americans. Moreover, PATH has enrolled about 32,320 adults of 18 years or older.<sup>14</sup>

### Sampling, Sample, and Analytical Sample

The PATH adult sample included civilian, non-institutionalized, and 18 years or older Americans. A multi-stage sampling design was used (four-stage probability sampling). First, a stratified sample of geographical primary sampling units (PSUs) was drawn, followed by selecting smaller geographical segments in each PSU. Then, residential addresses (households) were selected using the US Postal Service data files. Next, one individual was selected from each sampled household.<sup>14</sup> Considering that 2320 adults had no valid answers on tobacco harm knowledge, 31,000 adults could enter our analysis due to valid outcomes. However, from this number, only 27,405 individuals were either Hispanic or non-Hispanic White or AA individuals. Thus, our analytical sample consisted of 27,405 individuals.

### Study Variables

The study variables included ethnicity, age, gender, poverty status, employment, and tobacco harm knowledge. All variables were measured at an individual level.

*Ethnicity (moderator):* Ethnicity was self-identified and operationalized as two dichotomous variables of AAs versus Whites and Hispanics versus non-Hispanics.

*Educational attainment:* Educational attainment was a six-level variable including less than high school, General Educational Development (GED), high school graduate, some college (no degree) or associate degrees, bachelor's degree, and an advanced degree.

*Tobacco harm knowledge:* In this study, an 11-item measurement scale was used to evaluate tobacco harm knowledge. Eight items asked the question "Based on your knowledge/belief, smoking cigarettes can cause which one of the following disorders in the smokers: stroke, lung cancer, heart disease, blindness, poor circulation, bladder cancer, mouth cancer, and lung disease. Participants were also asked "Based on your knowledge/belief, smoking cigarettes can cause which one of the following disorders in non-smokers from second-hand smoke: lung disease, heart attack, and harm to fetuses during pregnancy. The item response included yes/no. A total tobacco harm knowledge score was calculated that ranged from 0 to 11, with higher scores indicating higher tobacco harm knowledge.

*Confounders:* Age was a seven-level variable with the

following intervals: 18-24, 25-34, 35-44, 45-54, 55-64, 65-74, and 75 years old or older. Gender was a dichotomous variable (male 1 and female 0). Finally, poverty status (living out of poverty=1 and poor=0) and employment (full or part-time employment=1 and unemployed=0) were collected as well.

### Statistical Analysis

To adjust the PATH data complex survey design (sample weights), the obtained data were analyzed using SPSS 23.0 (IBM Corporation, Armonk, NY, USA), followed by re-estimating the standard errors using Taylor series linearization. For multivariable modeling, linear regression models were fitted with educational attainment as the independent variable and tobacco harm knowledge as the outcome. Additionally, the models were run in the pooled sample without and with interaction terms between Hispanic and AA ethnicity and educational attainment. Our interaction terms were two multiplicative effects (one for Hispanics and one for AAs) of ethnicity and educational attainment. Ethnicity was coded as 0/1 and education was coded from 1 to 6. Thus, the interaction term was 0 for all non-Hispanics and Whites and varied between 1 to 6 for Hispanics and AAs. Eventually, regression coefficient (B), standard errors (SEs), 95% confidence intervals (CIs), and *P* values were reported.

**Table 1.** Descriptive Statistics Summary of Overall Samples

	No.	%
<b>Hispanic</b>		
No	22971	83.8
Yes	4434	16.2
<b>African American</b>		
No	22725	82.9
Yes	4680	17.1
<b>Gender</b>		
Females	13640	49.8
Males	13765	50.2
<b>Living out of poverty</b>		
No	14807	54.0
Yes	12598	46.0
<b>Any employment (full or part time)</b>		
No	8291	33.2
Yes	16703	66.8
	<b>Mean</b>	<b>SD</b>
Age (1-7)	2.94	1.73
Educational attainment (1-6)	3.54	1.36
Tobacco harm knowledge (0-11)	8.86	2.03

Note. The total number of samples was 27405.

## Results

### Descriptive Statistics

This study included 27,405 adults. From this number, most cases were non-Hispanic ( $n=22,971$ , 83.8%) and Whites ( $n=22,725$ , 82.9%). Table 1 describes the study variables in the pooled sample.

### Multivariable Models in the Pooled Sample

Table 2 presents the results of two linear regression models in the overall sample with educational attainment as the independent variable and tobacco harm knowledge as the dependent variable. *Model 1* (adjusted  $r$  square=0.011,  $df=7$ , sum of squares=1113.952,  $F$  statistic=40.005,  $P < 0.001$ ) showed a positive association between educational attainment and tobacco harm knowledge ( $b=0.11$ , 95% CI=0.09-0.13) while all covariates were adjusted.

Based on *Model 2* (adjusted  $r$  square=0.012,  $df=9$ , sum of square=1241.523,  $F$  statistic=34.720,  $P < 0.001$ ), however, ethnicity demonstrated significant interactions with educational attainment on tobacco harm knowledge, suggesting that the boosting effects of high educational attainment on tobacco harm knowledge are smaller for ethnic minorities ( $b=-0.05$ , 95% CI=-0.10 – 0.00 for AAs and  $b=-0.14$ , 95% CI=-0.19 – -0.09 for Hispanics) compared to non-Hispanics and Whites (Table 2).

## Discussion

Although high educational attainment was associated with high tobacco harm knowledge, this effect was generally smaller for Hispanics and AAs compared to non-Hispanic and White adults.

The findings suggested that highly educated Hispanics and AAs have low tobacco harm knowledge, thus they may remain at the high risk of tobacco use. This finding may provide an explanation (from many potential explanations) for why highly educated Hispanics and AAs tend to smoke more than expected at any given level of educational attainment and other SES indicators.<sup>7</sup>

For several reasons, the MDRs of educational attainment on the tobacco use of AAs and Hispanics may be due to the lower quality of education for ethnic minorities. Individuals with higher education report higher levels of knowledge and lower pro-tobacco attitudes because education is a strong determinant of health literacy and tobacco knowledge.<sup>15</sup> Furthermore, education is of lower quality for people of color and ethnic minorities.<sup>16</sup>

This hypothesis is also supported by the observation that Hispanics and AAs are at a high risk of getting cancer but have a lower perception of this risk.<sup>17</sup> Such a gap in the perceived risk of cancer may explain why AAs and Hispanics continue to smoke cigarettes despite their educational attainment.<sup>7</sup>

More importantly, AAs and Hispanics are also prime targets of predatory marketing practices of the tobacco industry that specifically targets the communities of

**Table 2.** Regression Model on Tobacco Harm Knowledge in the Pooled samples

	Model 2 (Interaction Effects)			Model 1 (Main Effects)		
	B (SE)	95% CI	P	B (SE)	95% CI	P
Hispanics	0.24 (0.04)	0.17 - 0.31	< 0.001	0.67 (0.09)	0.50 - 0.84	< 0.001
African Americans	0.22 (0.03)	0.16 - 0.29	< 0.001	0.40 (0.09)	0.22 - 0.58	< 0.001
Gender (men)	-0.20 (0.03)	-0.25 - -0.15	< 0.001	-0.20 (0.03)	-0.25 - -0.15	< 0.001
Age (1-7)	0.01 (0.01)	0.00 - 0.03	0.122	0.01 (0.01)	-0.01 - 0.02	0.270
Employed (any)	0.05 (0.03)	0.00 - 0.10	0.057	0.05 (0.03)	-0.01 - 0.10	0.094
Living out of poverty	0.05 (0.03)	-0.01 - 0.11	0.084	0.06 (0.03)	0.00 - 0.12	0.052
Educational attainment (1-6)	0.11 (0.01)	0.09 - 0.13	< 0.001	0.15 (0.01)	0.12 - 0.17	< 0.001
African American × educational attainment				-0.05 (0.03)	-0.10 - 0.00	0.050
Hispanic × educational attainment				-0.14 (0.03)	-0.19 - -0.09	< 0.001
Constant	8.40 (0.05)	8.31 - 8.50	< 0.001	8.29 (0.05)	8.19 - 8.39	< 0.001

Note. CI: Confidence interval; B: Regression coefficient; SE: Standard error. The total number of samples was 27405.

color,<sup>18</sup> which may influence their attitude about tobacco. In such a view, the tobacco industry may manipulate ethnic groups' knowledge and attitudes about tobacco products.<sup>19</sup> Thus, it is argued that lower tobacco harm knowledge may be a mechanism that causes a lower protective effect of educational attainment on the tobacco use of AAs and Hispanics.<sup>7</sup> In the presence of the MDRs of educational attainment,<sup>7</sup> however, we may observe disproportionately low tobacco harm knowledge in highly educated Hispanic and AA individuals relative to Whites. This may be because educational attainment has smaller effects on improving the life conditions of Hispanics and AAs compared to Whites. As a result, despite their high educational attainment, Hispanic and AA individuals remain without proper tobacco harm knowledge, which may have an effect on reducing tobacco use.<sup>7</sup>

The MDRs are not specific/limited to tobacco use. Similar MDRs (smaller effects of educational attainment) are reported for a wide range of health outcomes such as depression, anxiety, obesity, chronic disease, diet, and mortality, all of which are greater for high SES Hispanics and AAs compared to Whites.<sup>7</sup>

This highlights the need for understanding the mechanisms by which ethnic tobacco use disparities emerge in high SES people. Moreover, MDRs propose environmental, societal, social, structural, and behavioral processes that reduce the health gains of educational attainment, resulting in less reduction of the risk of tobacco use for highly educated ethnic minorities. Thus, MDRs introduce a paradigm shift for studying tobacco use. In other words, it reconceptualizes the combined effects of race and SES from a mediated path to a moderated one.

As a result of the smaller effect of educational attainment for ethnic minority groups,<sup>20</sup> the relative ethnic gap in tobacco use is widened at higher levels of education levels instead of being narrowed.<sup>7</sup>

Some of the ethnic disparities in tobacco burden are not due to individuals' poor choices but structural factors that shape their risk through social forces. For example, ethnic minorities are at a high risk of exposure to predatory tobacco marketing strategies.<sup>21</sup> Additionally, ethnic minorities are at an increased risk for exposure to point-of-sale advertising, retail display, and coupons/discounts, which may result in pro-tobacco attitudes.<sup>18</sup> Tobacco advertisements are widely recognized as the marketing practices of the tobacco industry in vulnerable communities<sup>22</sup>. Coupons/discounts are among the main risk factors of tobacco use<sup>18</sup> and a potential contributor to tobacco disparities given that people of color and low SES individuals are more likely to be targeted by cigarette coupons.<sup>18</sup>

Research may also explore the role of structural factors such as the quality of schooling, teacher quality, and education curriculum, as well as peer risk, access to various sources of media/information based on the intersection of ethnicity, SES, and place. We also need to study the best strategies for eliminating the diminished returns of SES on tobacco harm knowledge and tobacco use for AAs and Hispanics.

### Implications

These findings are not without policy and public health implications. The results show that enhancing tobacco harm knowledge is a required strategy for reducing racial and ethnic disparities in tobacco use, particularly those due to the MDRs of educational attainment. Although the reported result helps us understand why highly educated Hispanic and AA people are more susceptible to using tobacco products,<sup>23</sup> it may also offer a solution for decreasing such vulnerability. Accordingly, it is argued that tobacco campaigns that emphasize on educating people of color about the harms of tobacco may reduce some of the

tobacco-related disparities that are observed in high SES Hispanics and AAs. Ultimately, reducing disparities is a strategic priority for the Food and Drug Administration and National Institutes of Health.

### Limitations

This study had some methodological limitations. A cross-sectional study only shows associations rather than causations. We had unbalanced sample size of the ethnic groups. To avoid differential statistical power by ethnicity, we did not run regression models that were specific to each ethnicity although we ran models with interaction terms in the pooled sample. In addition, the present study only focused on the MDRs of educational attainment and poverty status. Thus, future research may explore the MDRs of employment, marital status, and neighborhood SES.

### Conclusion

Ethnic minorities experience the weaker effect of educational attainment on tobacco harm knowledge. Although high educational attainment generally means more accurate knowledge regarding tobacco harms, some social processes may reduce this advantage of education for AA and Hispanic Americans. Thus, highly educated AA and Hispanic adults are left with low tobacco harm knowledge. Therefore, more research is needed on social and structural factors that explain why highly educated AAs and Hispanics remain at a high risk of tobacco use.

### Authors' Contribution

SA conceptualized the study, analyzed the data, prepared the first draft of the paper, and acquired the funding. He also acquired the funding. MB contributed to the revision of the paper. Both authors approved the final draft.

### Ethical Approval

All PATH adult participants signed an informed consent. The Institutional Review Board (IRB) of the Westat approved the study protocol. In addition, data were collected, restored, and analyzed anonymously. Given that this study used fully deidentified publicly available data, it was found to be exempt from the review by the IRB of Charles Drew University of Medicine and Sciences.

### Conflict of Interest Disclosures

The authors declare no conflict of interests.

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