



# Protective Effects of Educational Attainment Against Cigarette Smoking; Diminished Returns of American Indians and Alaska Natives in the National Health Interview Survey



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## Abstract

**Introduction:** Although educational attainment is protective against health risk behaviors such as smoking, the *Minorities' Diminished Returns* theory posits that these protective effects are smaller for ethnic minorities than majority groups. This study compared the effects of educational attainment on the smoking status of American Indian/Alaska Native (AIAN) and White adults.

**Methods:** Data came from the National Health Interview Survey (NHIS - 2015). A total number of 21 114 individuals entered the current analysis. The independent variable was years of schooling. The dependent variable was current smoking status. Age, gender, region, marital status, and employment were the covariates. Ethnicity was the moderator.

**Results:** Overall, educational attainment was inversely associated with current smoking. Ethnicity showed a significant interaction with educational attainment suggesting that the protective effects of educational attainment against smoking are smaller for AIANs than for Whites.

**Conclusion:** In the United States, while educational attainment helps individuals stay healthy by avoiding high risk behaviors such as smoking, this effect is smaller for AIANs than Whites, resulting in additional risk of smoking in highly educated AIANs. To reduce ethnic disparities in tobacco use, it is important to go beyond SES inequalities and investigate why high SES ethnic minorities remain at high risk of tobacco use.

**Keywords:** Population Groups, American Indian/Alaska Native (AIAN), Socioeconomic Position, Socioeconomic Status, Education, Smoking

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## Introduction

Pervasive disparities in the burden of tobacco use by race/ethnicity<sup>1-5</sup> and socioeconomic status (SES)<sup>6-8</sup> exist in the US. Despite an overall decline in tobacco use, disparities in SES have increased.<sup>8-10</sup> Between 1966 and 2015, smoking declined by 83% in individuals with a college degree, but the decline for individuals without a high school diploma was almost half that figure (40%). A large proportion of such disparities may not be due to individuals making poor choices, but to higher exposure due to predatory marketing.<sup>11-13</sup> Low SES individuals and ethnic minorities are at an increased risk for point-of-sale advertising, retail display, coupons, and discounts.<sup>14</sup> The result is their increasing vulnerability<sup>15</sup> such as higher rates of initiation combined with low access to cessation.<sup>3,16,17</sup>

The Minorities' Diminished Returns (MDRs) theory proposes that at least some of the ethnic disparities in tobacco use is due to "less than expected" protective effects of SES on tobacco use in minority populations. This suggests: (a) ethnic disparities in tobacco use are not all due to SES gaps, but also because of differential health gains that follow high SES for ethnic groups; and (b) the ethnic gap in tobacco use widens at higher SES levels, which emphasizes a need to address ethnic disparities in tobacco use across all SES levels.

The current study was conducted to compare American Indian/Alaska Native (AIAN) and White individuals for the effect of educational attainment, one of the main SES indicators, on tobacco use. It was hypothesized that the protective effects of educational attainment would be smaller

for AIANs than for Whites. That is, MDRs were expected to also be relevant to AIANs. As similar patterns are shown for Blacks and Hispanics,<sup>18-29</sup> the replication of the same patterns in AIANs would suggest that MDRs are not because of groups' or individuals' characteristics but society's differential treatment of all minority groups. As the US society marginalizes non-White people, MDRs result in worse than expected health outcomes among highly educated non-Whites.

## Methods

### Design and Settings

This is a secondary analysis of the NHIS data. Funded by the CDC, NHIS is one of the main national health surveys of Americans. This large nationally representative cross-sectional study is one of the main sources of information regarding the health of the American population. Data used in this study were collected in 2015.

### Data Retrieval

In this study, the publicly available NHIS data set, downloaded from the NHIS website, was used. Personal, individual, and cancer data sets were merged using subject and family IDs. The current analysis included only 21 114 adults who were either Whites or AIANs.

### Sample and Sampling

The NHIS population was the 1) civilian, 2) non-institutionalized US population, 3) 18+ years of age. The NHIS uses a multistage, clustered, stratified area probability sample design. In the NHIS, the probability sampling units (PSUs) are counties or groups of smaller counties.

### Analytical Sample

The current analysis is limited to adults who were either White or AIAN and had valid data on tobacco use. The final analytical sample was 21 114 adults.

### Study Variables

The study variables included demographic factors (age and gender), ethnicity, educational attainment, employment, marital status, region, and tobacco use, all measured at the individual level.

**Educational Attainment.** Educational attainment was a continuous measure varying from 0 to 36 years.

**Ethnicity.** Ethnicity was self-identified and was AIAN versus White (Americans with European decent).

**Current Smoking.** The main outcome was current smoking status. Smoking was self-reported (smoked 100 cigarettes, smokes currently, and smokes daily).

**Demographic Characteristics.** Confounders were age, gender, marital status, employment status, and region. Age was a continuous measure. Gender was a dichotomous variable (male 1 female 0). Marital status was self-reported and a dichotomous variable. Employment status was a dichotomous variable: 1 = employed last week, 0 = unemployed last week. Region was a 4-level categorical variable: 1) Northeast, 2) Midwest, 3) South, and 4) West.

## Data Analytical Plan

Data was analyzed using SPSS 23.0 (IBM Corporation, Armonk, NY, USA). Survey weights were accommodated using SPSS 23.0. First, the distribution of our categorical and continuous variables was examined. Then, Pearson correlation tests were used to explore unadjusted correlations between the study constructs. To perform multivariable analysis, binary logistic regression was applied; however, collinearity between independent variables was first ruled out. Models were run in the pooled sample and each ethnic group.

## Results

### Descriptive Statistics

This study included 21,114 American adults who were either White (n = 20,855) or AIAN (n = 259). [Table 1](#) shows the descriptive statistics of the overall sample as well as for Whites and AIANs. Current smoking was more common in AIANs than Whites (26.1 vs 16.7,  $P < 0.05$ ).

### Multivariable models in the pooled sample

[Table 2](#) presents the summary of the results of logistic regression models with educational attainment as the independent variable and current smoking as the dependent variable. Both models were estimated in the overall sample. *Model 1* only entered the main effects of educational attainment, ethnicity, and covariates. *Model 2* also added an interaction term between ethnicity and educational attainment. Based on *Model 1*, high educational attainment was associated with lower odds of current smoking. *Model 2* showed significant interactions between ethnicity and educational attainment on

**Table 1.** Descriptive Statistics in the Overall Sample

	All		White		AIAN	
	Mean	SD	Mean	SD	Mean	SD
Age*	52.28	18.47	52.36	18.46	45.83	17.56
Educational Attainment*	15.64	2.74	15.66	2.74	14.42	2.85
	n	%	n	%	n	%
<b>Gender</b>						
Women	11402	54.0	11262	54.0	140	54.1
Men	9712	46.0	9593	46.0	119	45.9
<b>Marital Status*</b>						
Not Married	11143	52.8	10964	52.6	179	69.1
Married	9971	47.2	9891	47.4	80	30.9
<b>Employment*</b>						
Unemployed	9688	45.9	10964	52.6	179	69.1
Employed	11426	54.1	9891	47.4	80	30.9
<b>Region</b>						
Northeast	3792	18.0	9552	45.8	136	52.5
Midwest	5521	26.1	11303	54.2	123	47.5
South	6425	30.4	11262	54.0	140	54.1
West	5376	25.5	9593	46.0	119	45.9

Source: National Health Interview Survey (NHIS 2015).

AIAN: American Indian/Alaska Native.

\*  $P < 0.05$  for comparison of Whites and AIANs.

**Table 2.** Logistic Regression in the Pooled Sample

	B (SE)	OR	95% CI	P
<b>Model 1 (All)</b>				
Ethnicity (AIAN)	0.11 (0.15)	1.12	0.83 - 1.51	0.453
Gender (Male)	0.11 (0.04)	1.12	1.04 - 1.21	0.003
Age	-0.02 (0.00)	0.98	0.98 - 0.98	< 0.001
Education	-0.20 (0.01)	0.82	0.81 - 0.83	< 0.001
Married	-0.53 (0.04)	0.59	0.54 - 0.63	< 0.001
Employed	-0.10 (0.04)	0.91	0.83 - 0.99	0.024
Region				0.021
Midwest	0.16 (0.06)	1.17	1.04 - 1.31	0.008
South	0.14 (0.06)	1.15	1.03 - 1.29	0.014
West	0.06 (0.06)	1.06	0.94 - 1.19	0.348
Constant	2.70 (0.14)	14.85		< 0.001
<b>Model 2 (All)</b>				
Ethnicity (AIAN)	-1.96 (0.74)	0.14	0.03 - 0.61	0.008
Gender (Male)	0.11 (0.04)	1.12	1.04 - 1.21	0.003
Age	-0.02 (0.00)	0.98	0.98 - 0.98	< 0.001
Education	-0.20 (0.01)	0.82	0.81 - 0.83	< 0.001
Married	-0.53 (0.04)	0.59	0.54 - 0.63	< 0.001
Employed	-0.10 (0.04)	0.91	0.83 - 0.99	0.025
Region				0.021
Midwest	0.16 (0.06)	1.17	1.04 - 1.32	0.008
South	0.14 (0.06)	1.15	1.03 - 1.29	0.015
West	0.06 (0.06)	1.06	0.94 - 1.19	0.336
Ethnicity (AIAN) × Educational Attainment	0.15 (0.05)	1.16	1.05 - 1.28	0.004
Constant	2.74 (0.14)	15.43		< 0.001

Source: the National Health Interview Survey (NHIS 2015).

AIAN: American Indian/Alaska Native, SE: standard error; CI: confidence interval; OR: odds ratio.

Outcome: Current smoking.

$P < 0.05$  is significant.

SE = 0.00 for age is of rounding.

current smoking, suggesting that high educational attainment has smaller protective effects on current smoking for AIANs than Whites.

### Multivariable Models by Ethnicity

**Table 3** presents a summary of the results of two additional logistic regression models with educational attainment as the independent variable and smoking status as the outcome. Based on *Model 3*, high educational attainment in Whites was associated with lower odds of current smoking. Based on *Model 4*, educational attainment was not associated with smoking status in AIANs.

### Discussion

The current study showed two findings. First, overall, highly educated people were less likely to smoke. Second, ethnicity altered the effect of educational attainment on smoking status with educational attainment showing smaller protective effects against smoking for AIANs than Whites.

Built on our previous work on MDRs, highly educated,

**Table 3.** Logistic Regression in the Ethnic Groups

	B (SE)	OR	95% CI For OR	P
<b>Model 3 (Whites)</b>				
Gender (Male)	0.11 (0.04)	1.12	1.04 - 1.21	0.004
Age	-0.02 (0.00)	0.98	0.98 - 0.98	< 0.001
Education	-0.20 (0.01)	0.82	0.81 - 0.83	< 0.001
Married	-0.53 (0.04)	0.59	0.54 - 0.63	< 0.001
Employed	-0.09 (0.04)	0.91	0.84 - 1.00	0.043
Region				0.021
Midwest	0.16 (0.06)	1.17	1.04 - 1.32	0.008
South	0.15 (0.06)	1.16	1.04 - 1.30	0.011
West	0.07 (0.06)	1.07	0.95 - 1.21	0.275
Constant	2.73 (0.14)	15.38		< 0.001
<b>Model 4 (AIANs)</b>				
Gender (Male)	0.17 (0.30)	1.18	0.66 - 2.13	0.580
Age	-0.02 (0.01)	0.98	0.96 - 1.00	0.028
Education	-0.03 (0.05)	0.97	0.88 - 1.08	0.635
Married	-0.48 (0.37)	0.62	0.30 - 1.27	0.189
Employed	-0.52 (0.32)	0.60	0.32 - 1.11	0.103
Region				0.466
Midwest	-0.08 (0.58)	0.92	0.30 - 2.86	0.888
South	-0.60 (0.59)	0.55	0.17 - 1.76	0.312
West	-0.53 (0.54)	0.59	0.20 - 1.69	0.324
Constant	0.94 (1.05)	2.56		0.370

Source: the National Health Interview Survey (NHIS 2015).

AIAN: American Indian/Alaska Native, SE: standard error; CI: confidence interval; OR: odds ratio.

Outcome: Current smoking.

$P < 0.05$  is significant.

SE = 0.00 for age is of rounding.

high-income, and employed Blacks and Hispanics are at an increased risk of substance use compared to high SES Whites.<sup>19,30-32</sup> We also found that highly educated AIANs remain at high risk for smoking. These patterns are all similar and due to weaker associations between SES indicators and behavioral outcomes for non-Whites than Whites.

This is the first study to show MDRs for AIANs. The effects of educational attainment, income, marital status, and employment on obesity, depression, anxiety, self-rated health, and chronic disease are smaller for Blacks and Hispanics than Whites.<sup>18-28</sup> A contribution of this study is to extend the MDRs literature to AIANs.

The smaller effects of educational attainment on smoking of non-Whites may be due to multiple societal and structural factors.<sup>33,34</sup> Due to residential segregation, highly educated non-Whites are more likely to live in ethnic enclaves that are higher in stress, poverty, and social disorder and lower in resources.<sup>35</sup> In addition, due to the labour market discrimination, highly educated ethnic minorities are less likely to secure employment and income.<sup>36-38</sup> Segregation and lower availability of resources in schools also reduce the effects of educational attainment for people of color, such as Blacks, Hispanics, and AIANs.<sup>33,34</sup>

Predatory marketing practices and availability of tobacco retailers may be other potential mechanisms that cause

ethnic disparities in tobacco use, particularly through MDRs. Predatory marketing and advertising may disproportionately increase the risk of tobacco use among people of color and ethnic groups across SES levels. The experience of highly educated Whites, however, differs.

### Future Research

The results of the current research are limited to the United States. It is still unknown if MDRs exist outside the US or not.<sup>23, 33</sup> Given the existing cross-national differences in the effects of social determinants of health,<sup>39-42</sup> there is a need to study whether ethnic disparities in smoking in other countries are at least in part due to diminished returns of SES indicators, particularly educational attainment. Ethnic disparities in smoking have been well described in other countries outside the United States,<sup>43</sup> and we know that educational level contributes to such disparities across countries.<sup>44-48</sup> Comparative studies of MDRs across the world are very important, particularly because educational attainment operates differently across countries.<sup>39-42</sup>

### Policy Implications

Policies that tighten tobacco marketing regulations may have a role in reducing MDRs. In this view, introducing more restrictive marketing policies that ban point-of-sale advertising and flavoring for poor areas may not only reduce overall smoking rates but may disproportionately impact ethnic disparities. Future research should test if restricting predatory marketing will reduce tobacco use disparities by ethnicity.

There is a need for policy evaluations to compare national and local policies that can potentially reduce or increase the ethnic and SES disparities in tobacco use, particularly those that are due to MDRs of educational attainment.<sup>19,31-33,38,49-53</sup> States vary in point-of-sale advertising, discounts, coupons, and flavoring, which may contribute to MDRs for tobacco use.<sup>19,32</sup> There is a need to study how variation in marketing strategies can undo MDRs<sup>19,30-32</sup> in communities of color.

### Limitations

This study had some methodological limitations. The cross-sectional design of the data does not allow causal inferences. Sample size was imbalanced across ethnic groups. Many SES indicators such as income and wealth were not included. This study was limited to individual level SES, and future research should investigate structural factors such as tobacco policy, density of retails, and area-level SES. Despite these limitations, this is the first study to show MDRs of educational attainment for AIANs. Previous literature has been exclusively limited to Blacks<sup>37,49,54-56</sup> and Hispanics.<sup>21,23,52</sup>

### Conclusion

In the United States, ethnicity alters the effects of educational attainment on smoking. While highly educated Whites show a very low rate of high-risk behaviors such as smoking, highly educated AIANs continue to smoke, regardless of their educational attainment. The result is additional risk of smoking in highly educated AIANs.

## Research Highlights

### What Is Already Known?

Education protects populations against health risk behaviors such as smoking. It is also known that highly educated Black and Hispanic Americans remain at high risk of smoking, a pattern also known as Minorities Diminished Returns (MDRs).

### What This Study Adds?

It was found that MDRs also apply to American Indians and Alaska Native (AIAN) individuals. It seems that MDRs are relevant to all marginalized groups.

### Authors' Contributions

SA: conceptualization, data analysis, first draft, revision, and approval. MB: revision and approval.

### Conflict of Interest Disclosures

The authors declare that they have no conflicts of interest.

### Ethical Approval

All adult participants in the NHIS provided informed consent. Westat's Institutional Review Board approved the National Health Interview Survey (NHIS) study protocol.

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