

Article

# School Poverty Partially Mediates the Effects of Structural Racism on Youth Tobacco Use Initiation

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## Abstract:

**Background.** Although youth from high socioeconomic status (SES) backgrounds are generally protected against tobacco use, this protection is weaker for racialized and marginalized families, particularly Black youth. While Minorities' Diminished Returns (MDRs) of household income on tobacco use have been documented for Black youth, the mechanisms underlying these effects are not well understood. **Objective.** This study investigates whether school poverty and associated peer deviance and delinquent behaviors explain the disproportionately higher tobacco use among Black youth from high-income backgrounds, using data from the Adolescent Brain Cognitive Development (ABCD) study. **Methods.** We conducted a longitudinal analysis of Black youth from high-income families within the Adolescent Brain Cognitive Development (ABCD) study. A total of 8,777 youth was included in our analysis. We examined the associations between household income and tobacco use, with school poverty and associated peer deviance and delinquent behaviors as mediators. Race was considered as a moderator. **Results.** Compared to their high-income White counterparts, Black youth from high-income backgrounds were more likely to live in areas with higher school poverty, which exposed them to increased levels of peer deviance and delinquent behaviors compared to their White counterparts. These exposures, in turn, were associated with higher rates of tobacco use among Black youth. Thus, higher school poverty, along with the related peer deviance and delinquent behaviors, contributed to the elevated tobacco use observed among Black adolescents from high-income backgrounds. **Conclusion.** The study suggests that residing in areas with school poverty, peer deviance, and youth delinquency may explain Minorities' Diminished Returns, which are defined as the weaker protective effects of socioeconomic status on tobacco use among Black youth. Interventions aiming to prevent tobacco use need to include structural components addressing these broader social determinants of health.

**Keywords:** Social Determinants of Health, Socioeconomic Status, Income, Tobacco, Ethnic Groups, School Poverty

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## 1. Introduction

Socioeconomic status (SES) indicators such as household income are typically associated with reduced risk behaviors, including tobacco use [1, 2, 3, 4, 5, 6, 7, 8, 9]. These protective effects of SES indicators are primarily due to several factors that come with higher SES, such as better access to health information, enabling individuals to make informed decisions about their health and the risks associated with tobacco use [10, 11, 12, 13]. Additionally, higher SES often correlates with increased parental monitoring, which can deter risky behaviors such as smoking [14, 15, 16]. Furthermore, youth from high SES

backgrounds are generally exposed to fewer peers who smoke, reducing social pressure and opportunities to engage in tobacco use [17, 18, 19].

However, as shown by an extensive body of literature on the theory of Minorities' Diminished Returns (MDRs), these protective effects of SES are weaker for racialized groups, including Black youth [20, 21]. Systemic racism and its pervasive effects diminish the benefits typically associated with higher SES [22, 23, 24, 25, 26, 27]. MDRs imply that despite having access to the same resources, Black individuals do not experience the same level of protective effects against health risk behaviors as their White counterparts [28, 29, 30, 31, 32, 33, 34, 35, 36, 37].

Despite high income, Black youth exhibit disproportionately higher tobacco use compared to their White peers [38, 39, 40, 41, 42, 43, 44]. This pattern aligns with the MDRs framework, which has been consistently observed across various populations and outcomes [38, 42, 45]. For example, studies have shown that high-income Chinese [46], Latino [47], and Lesbian, Gay, Bisexual, and Transgender (LGBT) individuals also display higher rates of smoking. [48] Among Black adults and youth, high tobacco use persists even in the context of high SES, indicating that the protective benefits of income do not translate equally across different racial and ethnic groups.

We propose that school poverty and associated peer deviance and delinquent behaviors may operate as some potential mechanisms explaining this phenomenon among high SES Black youth. Research has demonstrated elevated risk at social environment of Black youth from high SES backgrounds.

In this longitudinal study, we used the ABCD data to test if school poverty and associated peer deviance and delinquent behaviors explain disproportionately higher tobacco use among Black youth from high-income backgrounds. We hypothesize that these factors, influenced by various types of adversity, contribute to increased tobacco use in this population. By examining these mechanisms, we aim to shed light on the unique challenges faced by high SES Black youth and inform interventions that address these specific risk factors.

## **2. Methods**

### ***2.1. Design and Sample***

We conducted a secondary analysis using data from the Adolescent Brain Cognitive Development (ABCD) study, a national longitudinal study of a racially and economically diverse cohort of pre-adolescent children. The ABCD study's methodology has been thoroughly documented elsewhere. Advantages of the ABCD dataset include its longitudinal design, national scope, large and diverse samples in terms of race, SES, and geographic distribution. Participants were primarily recruited from schools.

### ***2.2. Analytical Sample***

The analytical sample consisted of any tobacco naïve youth who could belong to either White or Black race or ethnic background. Participants were 9–10-year-old at baseline. Overall, 8,777 youth entered our analysis.

### ***2.3. Ethics***

The study was approved by the Institutional Review Board (IRB) of the University of California, San Diego (UCSD). Assent was obtained from all participating adolescents, and informed consent was obtained from their parents.

### ***2.4. Study Variables***

The study variables included race, demographic and socioeconomic factors, adversities, and substance use.

### ***2.5. Predictors***

### 2.5.1. Socioeconomic Status

*Family Structure:* Parents reported the number of parents in the household and their relationship. This was categorized as 0 for not married and 1 for married households.

*Family Income:* Family income was measured on a 1-10 scale, where higher scores indicated higher income. The scale ranged from less than \$5000 to \$200,000+, as categorized by the ABCD study. This variable was treated as continuous.

*Race.* Parents reported the race and ethnicity of their children. This was a categorical variable with White as the reference category.

### 2.5.2. Mediators

*Peer Deviance:* This variable was a continuous measure ranging from 1 to 9, with higher scores indicating greater peer deviance. It was measured using items self-reported by the adolescent in a confidential setting.

*Delinquency (1-10):* This variable was a continuous measure ranging from 1 to 10, with higher scores indicating more delinquent behaviors enacted by the adolescent. This scale was measured using items reported by the parents in a confidential setting.

*School Poverty:* This variable was derived from the Child Opportunity Index (COI) based on the residential history of the ABCD data. The COI measures neighborhood resources and conditions that matter for children's healthy development. It measured school poverty, using the percentage of students at each school who receive free meals. A higher score indicates greater school poverty (i.e., lower school socioeconomic status).

### 2.5.3. Outcome

*Tobacco Use.* Tobacco use was measured semi-annually using instruments such as the iSay Sipping Inventory and a web-based Timeline Follow-Back (TLFB). These tools assessed substance use over the past six months or since the last study session. The analysis focused on tobacco use initiation, defined as reporting more than one puff of nicotine.

## 2.6. Data Analysis

Data analysis was conducted using SPSS. Univariate analysis involved reporting the mean and standard deviation (SD) of continuous measures. Structural equation models (SEM) were used for multivariable analysis, with tobacco use initiation as the outcome. Predictors included race, household income, and race  $\times$  household interaction and mediators were school poverty and associated peer deviance and delinquent behaviors. Age and gender were confounders. Collinearity between variables was checked and ruled out (all correlations were below .6). From SEMs, Standardized Beta, 95% confidence intervals (CI), and p-values were reported.

## 3. Results

Overall, 8,777 youth entered our analysis. As shown by [Table 1](#) and [Figure 1](#), our findings indicate that Black youth from high-income backgrounds experience school poverty and associated peer deviance and delinquent behaviors compared to their White counterparts. These factors were significantly associated with higher rates of tobacco use in this population, suggesting they may be mechanisms for Minorities' Diminished Returns of family income on youth tobacco use in Black families.

### Model 1 (Without Mediator, Without Moderator):

In the basic model, higher household income was significantly and negatively associated with early tobacco initiation ( $\beta = -0.08$ ,  $p < 0.001$ ). Male sex was positively associated with early tobacco use ( $\beta = 0.03$ ,  $p = 0.005$ ), and being Black was associated with a lower likelihood of tobacco initiation ( $\beta = -0.02$ ,  $p = 0.043$ ). Age was not significantly associated with tobacco use initiation in this model ( $p = 0.249$ ).

**Model 2 (Without Mediator, With Moderator):**

With the introduction of an interaction term between race (Black) and household income, the protective effect of household income on tobacco initiation strengthened ( $\beta = -0.10, p < 0.001$ ). The interaction term for Black race and household income was positive and significant ( $\beta = 0.07, p = 0.008$ ), suggesting diminished protective effects of household income for Black individuals. The effects of age and sex remained similar to Model 1.

**Model 3 (With Mediator, Without Moderator):**

Incorporating mediators (school poverty, peer deviance, and delinquency), household income was significantly negatively associated with school poverty ( $\beta = -0.43, p < 0.001$ ). Higher school poverty was associated with increased peer deviance ( $\beta = 0.06, p = 0.004$ ), which in turn was linked to early tobacco initiation ( $\beta = 0.09, p < 0.001$ ). Delinquency also showed a positive association with tobacco initiation ( $\beta = 0.05, p = 0.002$ ). The direct effect of household income on early tobacco initiation remained negative and significant ( $\beta = -0.07, p < 0.001$ ), though attenuated compared to Model 1. Notably, Black race had a significant positive association with school poverty ( $\beta = 0.21, p < 0.001$ ), suggesting systemic disadvantages impacting Black youth.

**Model 4 (With Mediator, With Moderator):**

Adding the interaction between Black race and household income in the model with mediators, household income remained inversely associated with school poverty ( $\beta = -0.50, p < 0.001$ ), with the interaction term between Black race and household income reaching positive and significance ( $\beta = 0.23, p < 0.001$ ). This indicates a weaker inverse association between household income and school poverty for Black individuals. Peer deviance and delinquency remained strong predictors of tobacco use initiation ( $\beta = 0.09, p < 0.001$  and  $\beta = 0.05, p = 0.002$ , respectively), and household income continued to show a protective effect on tobacco initiation ( $\beta = -0.09, p < 0.001$ ). The interaction term for Black race and household income in predicting tobacco initiation was significant ( $\beta = 0.08, p = 0.004$ ), reinforcing the diminished protective effect of household income among Black individuals.

**Table 1. Mediators of MDRs of Household Income on Tobacco Use Initiation**

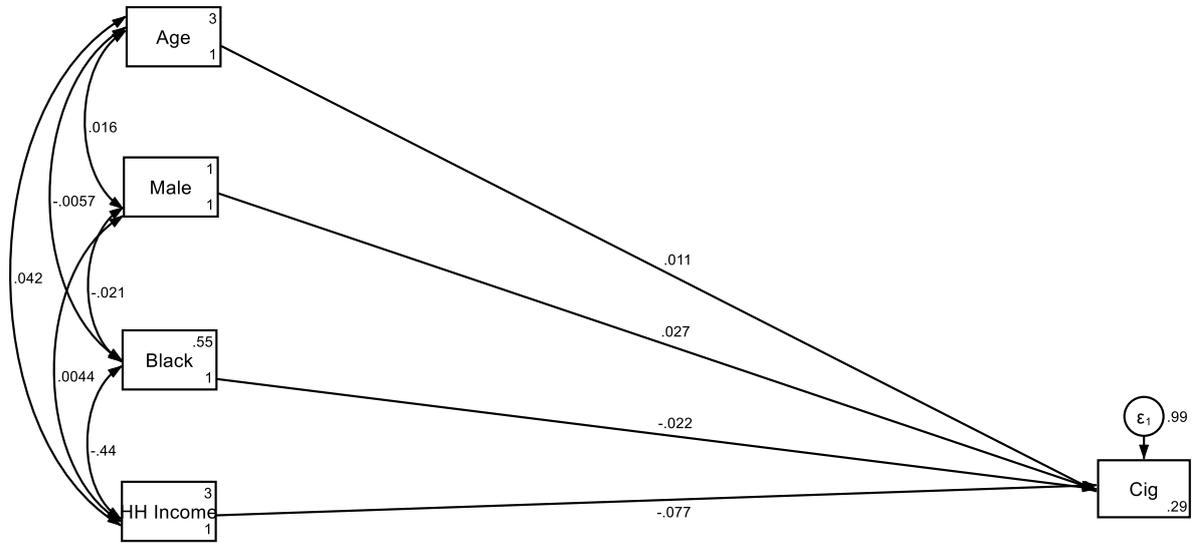
	Beta Coefficient	std. err.	95% CI	P
<b>Model 1 (Without Mediator, Without Moderator)</b>				
Early Initiation of Tobacco				
Household Income	-0.08	0.01	-0.10 -0.06	< 0.001
Age (10)	0.01	0.01	-0.01 0.03	0.249
Sex (Male)	0.03	0.01	0.01 0.05	0.005
Race (Black)	-0.02	0.01	-0.04 0.00	0.043
<b>Model 2 (Without Mediator, With Moderator)</b>				
Early Initiation of Tobacco Use				
Household Income	-0.10	0.01	-0.13 -0.07	< 0.001
Age (10)	0.01	0.01	-0.01 0.03	0.244
Sex (Male)	0.03	0.01	0.01 0.05	0.005
Race (Black)	-0.09	0.03	-0.15 -0.04	0.001
Race (Black) x HH Income	0.07	0.03	0.02 0.12	0.008

Intercept	0.36	0.05	0.25	0.47	< 0.001
<b>Model 3 (With Mediator, Without Moderator)</b>					
COI School Poverty					
Household Income	-0.43	0.01	-0.45	-0.41	< 0.001
Age (10)	-0.02	0.01	-0.04	0.00	0.028
Sex (Male)	-0.01	0.01	-0.03	0.00	0.130
Race (Black)	0.21	0.01	0.19	0.23	< 0.001
Intercept	3.06	0.04	2.98	3.14	< 0.001
Early Initiation of Tobacco Use					
School Poverty	0.00	0.01	-0.02	0.03	0.824
Peer Deviance (1-9)	0.09	0.02	0.05	0.12	< 0.001
Delinquency (1-10)	0.05	0.02	0.02	0.08	0.002
Household Income	-0.07	0.01	-0.09	-0.04	< 0.001
Age (10)	0.01	0.01	-0.01	0.03	0.353
Sex (Male)	0.02	0.01	0.00	0.04	0.063
Race (Black)	-0.03	0.01	-0.05	-0.01	0.010
Intercept	0.23	0.06	0.11	0.35	< 0.001
Peer Deviance (1-9)					
School Poverty	0.06	0.02	0.02	0.10	0.004
Household Income	-0.05	0.02	-0.09	0.00	0.029
Age (10)	0.03	0.02	-0.01	0.06	0.113
Sex (Male)	0.04	0.02	0.01	0.08	0.006
Race (Black)	0.02	0.02	-0.02	0.06	0.235
Intercept	0.06	0.11	-0.15	0.27	0.590
Delinquency (1-10)					
School Poverty	0.06	0.02	0.03	0.10	< 0.001
Peer Deviance (1-9)	0.10	0.02	0.07	0.13	< 0.001
Household Income	-0.02	0.02	-0.06	0.02	0.262
Age (10)	0.00	0.01	-0.03	0.03	0.871
Sex (Male)	0.10	0.01	0.07	0.13	< 0.001
Race (Black)	0.05	0.02	0.02	0.09	0.003
Intercept	0.20	0.10	0.01	0.39	0.037
<b>Model 4 (With Mediator, With Moderator)</b>					
School Poverty					
Household Income	-0.50	0.01	-0.52	-0.48	< 0.001
Age (10)	-0.02	0.01	-0.03	0.00	0.033
Sex (Male)	-0.01	0.01	-0.03	0.00	0.114
Race (Black)	-0.03	0.02	-0.08	0.02	0.224
Race (Black) x Household Income	0.23	0.02	0.19	0.28	< 0.001
Intercept	3.30	0.05	3.21	3.39	< 0.001
Peer Deviance (1-9)					

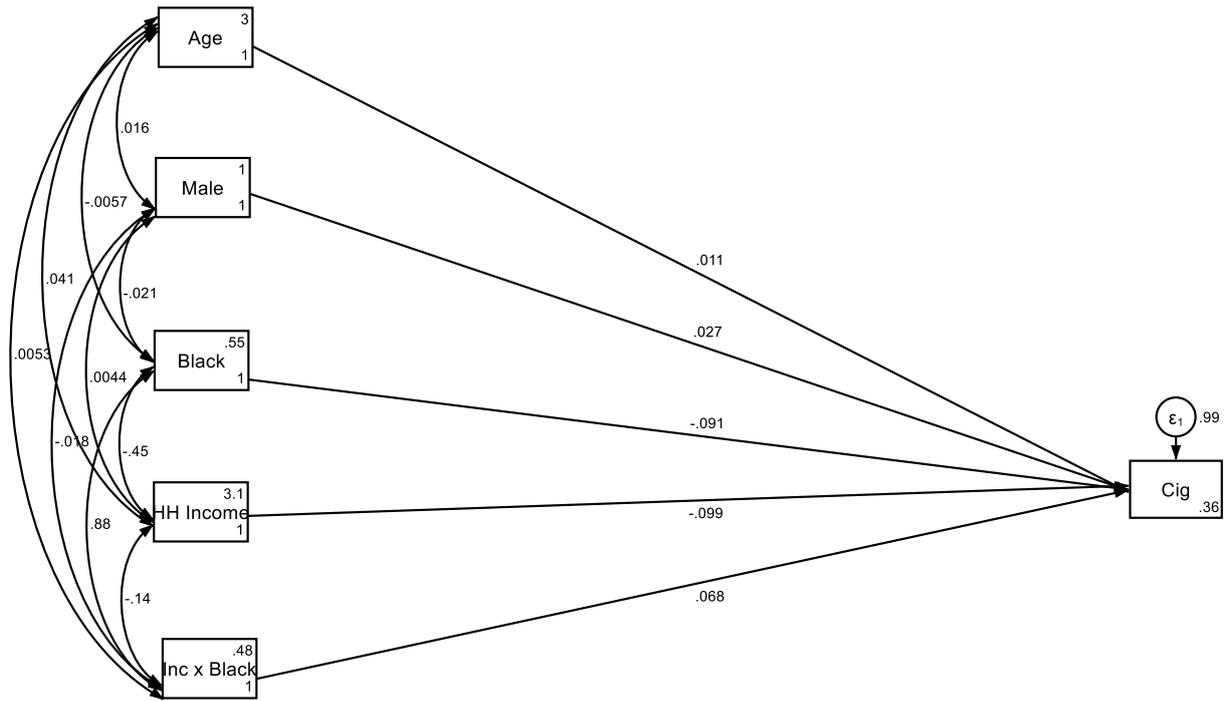
School Poverty	0.06	0.02	0.02	0.10	0.003
Household Income	-0.04	0.03	-0.09	0.01	0.165
Age (10)	0.03	0.02	-0.01	0.06	0.111
Sex (Male)	0.04	0.02	0.01	0.08	0.007
Race (Black)	0.09	0.06	-0.02	0.20	0.112
Race (Black) x Household Income	-0.06	0.05	-0.17	0.04	0.212
Intercept	0.01	0.12	-0.21	0.24	0.908
<b>Delinquency (1-10)</b>					
School Poverty	0.07	0.02	0.03	0.10	< 0.001
Peer Deviance (1-9)	0.10	0.02	0.07	0.13	< 0.001
Household Income	-0.01	0.02	-0.06	0.03	0.650
Age (10)	0.00	0.01	-0.03	0.03	0.865
Sex (Male)	0.10	0.01	0.07	0.13	< 0.001
Race (Black)	0.10	0.05	0.00	0.20	0.040
Race (Black) x Household Income	-0.05	0.04	-0.13	0.04	0.298
Intercept	0.16	0.10	-0.05	0.36	0.127
<b>Early Initiation of Tobacco Use</b>					
School Poverty	0.00	0.01	-0.03	0.02	0.913
Peer deviance (1-9)	0.09	0.02	0.05	0.12	< 0.001
Delinquency (1-10)	0.05	0.02	0.02	0.08	0.002
Household Income	-0.09	0.02	-0.12	-0.06	< 0.001
Age (10)	0.01	0.01	-0.01	0.03	0.352
Sex (Male)	0.02	0.01	0.00	0.04	0.066
Race (Black)	-0.10	0.03	-0.16	-0.05	< 0.001
Race (Black) x Household Income	0.08	0.03	0.02	0.13	0.004
Intercept	0.32	0.07	0.18	0.46	< 0.001

#### Summary of All Models:

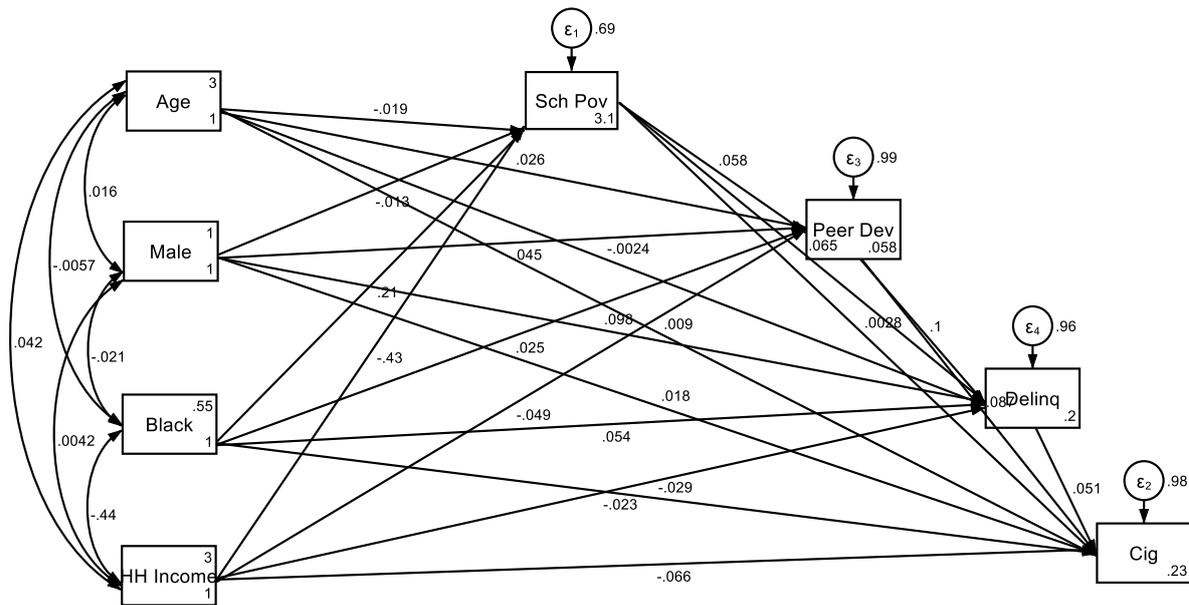
As [Figure 1](#) shows, across models, household income consistently showed a protective effect against early tobacco initiation. However, the effect of household income was weaker for Black individuals, as shown by the significant interaction terms. Additionally, mediators like school poverty, peer deviance, and delinquency played significant roles in early tobacco initiation, with Black individuals experiencing higher school poverty levels despite income, underscoring the complex interplay between socioeconomic factors and racial disparities in tobacco use initiation.



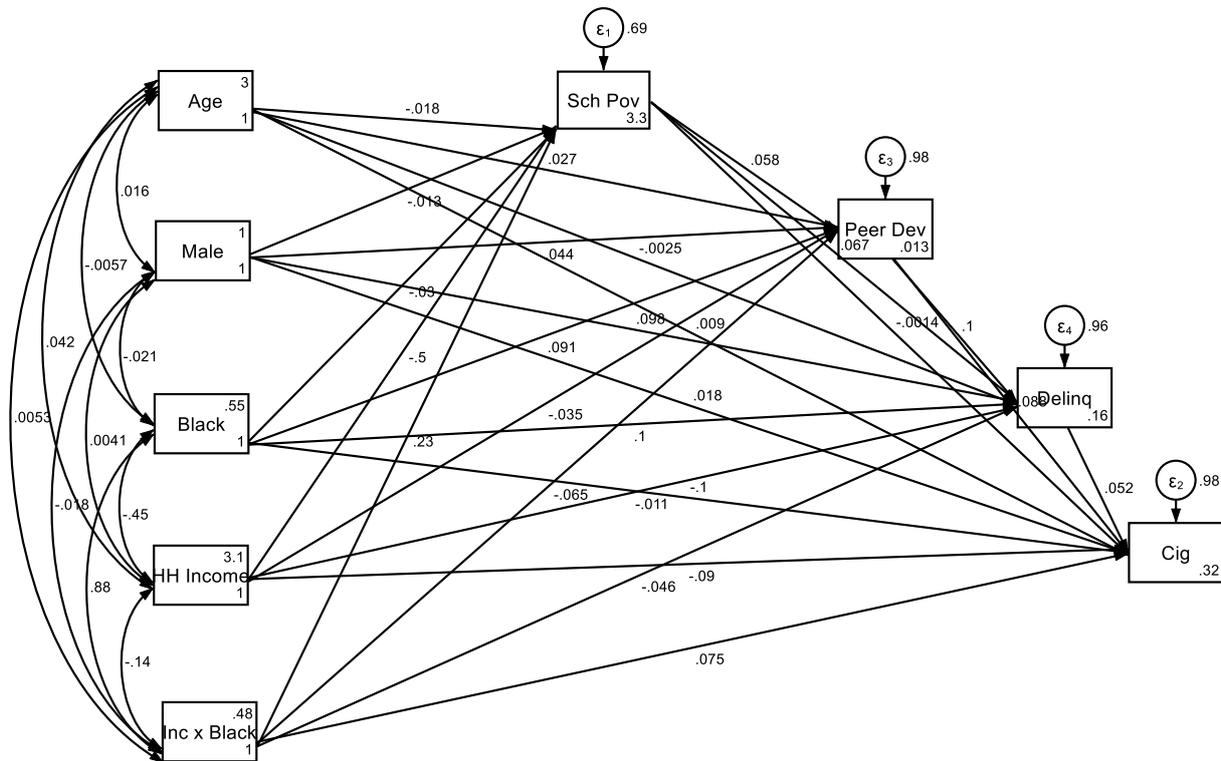
Model 1



Model 2



Model 3



Model 4

Figure 1. Mediators of Minorities' Diminished Returns of Household Income on Adolescents' Tobacco Use Initiation

#### 4. Discussion

Our study reveals that school poverty and associated peer deviance, and delinquent behaviors may explain why Black youth from high-income backgrounds exhibit significantly higher rates of tobacco use. This finding provides a mechanism for the theory of Minorities' Diminished Returns (MDRs), which posits that SES indicators offer fewer protective benefits against tobacco use for Black youth compared to Whites. The persistence of these risk factors, despite high income, underscores the unique challenges faced by Black youth, increasing their tobacco use risk. Three primary mechanisms—school poverty and associated peer deviance and delinquent behaviors—appear to explain the disproportionately higher tobacco use among high-income Black youth.

The concept of MDRs refers to weaker protective effects of SES for racialized groups than for non-Latino Whites [48, 49, 50, 51, 52, 53, 54]. Despite achieving high income, Black youth continue to face systemic barriers that reduce the benefits typically associated with SES [33, 55, 56, 57, 58, 59, 60, 61]. This is partly because race is more visible than high SES in US society. Such visible identity increases the cost of upward mobility and being of high SES for Black families [62, 63]. The persistent effects of racism, both structural and interpersonal, diminish the potential health advantages that come with higher SES. This study provides further evidence of MDRs by demonstrating that high-income Black youth are not shielded from the factors that contribute to tobacco use, unlike their White peers.

Several societal, historical, and structural causes contribute to MDRs, including racism, segregation, poor schools, and labor market discrimination [22, 23, 25, 26, 64, 65]. Racism pervades various aspects of life, influencing the experiences and opportunities available to Black individuals. Segregation, both residential and educational, confines Black families to environments with fewer resources and higher stressors. Social stratification may block opportunities for Black youth from high SES backgrounds. Poor schools in predominantly Black neighborhoods often lack the funding and support needed to provide quality education and safe environments. Labor market discrimination limits economic opportunities, even for those with high levels of education and income [66, 67, 68, 69]. These systemic issues create an environment where high SES does not equate to reduced risk behaviors for Black youth, as they continue to face significant challenges that their White counterparts do not.

##### 4.1. Implications

The findings of this study have important implications for interventions targeting tobacco use among Black youth. It is essential to address the unique stressors faced by high SES Black youth, even when they appear to be financially secure. Programs and policies should focus on reducing systemic racism and its associated stressors, such as neighborhood violence, financial insecurity, life traumas, and discrimination. Mental health support tailored to the experiences of Black youth is crucial, as is promoting resilience and coping strategies that do not involve substance use [70, 71, 72, 73]. Schools, communities, and policymakers must work together to create inclusive environments that support the well-being of Black youth.

##### 4.2. Future Research

Future studies should explore additional mechanisms of various types of stressors on the tobacco use of high SES Black youth. It is important to investigate how these factors interact over time and whether interventions can mitigate their impact. Research should also consider the role of other protective factors, such as supportive family dynamics and positive peer influences, in reducing tobacco use among Black youth. These patterns may not be limited to Black youth, income levels, or tobacco use, so MDRs should be tested for other SES indicators, substances, and marginalized population groups. Exploring the experiences of other marginalized groups can provide a more comprehensive understanding of MDRs and inform more effective interventions. The school environment,

family environment, peers, and access to tobacco or tobacco harm knowledge may also have roles that need future investigation.

## 5. Conclusion

This study highlights the need to consider systemic factors in understanding why we observe high tobacco use in high SES Black youth. Addressing structural factors and fundamental causes is crucial for reducing tobacco use in this population. The findings emphasize the importance of targeted interventions and policies that account for the unique challenges faced by Black youth due to systemic racism and associated stressors. By addressing these issues, we can work towards reducing health disparities and promoting better outcomes for all youth, regardless of their racial or socioeconomic background.

### Authors' Contributions:

Conceptualization, SA; methodology, SA; validation SA and HZ; formal analysis, SA.; resources, SA, and HZ; data curation, SA; writing—original draft preparation, SA; writing—review and editing, HZ, visualization, SA; supervision HZ, project administration, SA; Both authors have read and agreed to the published version of the manuscript.

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