http://www.jhpr.ir
Hosp Pract Res. 2022 Dec;7(4):138-144
doi 10.34172/hpr.2022.27
HPR
Hospital Practices and Research
Original Article

# Racial and Ethnic Differences in the Protective Effect of Educational Attainment on Chronic Pain

**Shervin Assari[1,2,3*], Mona Darvishi[3], Arash Rahmani[3], Seyedeh Mohaddeseh Khatami[3,4], Izadrad Najand[3], Babak Najand[3], Hossein Zare[5,6]**

[1]Department of Medicine, Charles R. Drew University of Medicine and Science, Los Angeles, CA 90059, USA
[2]Department of Urban Public Health, Charles R. Drew University of Medicine and Science, Los Angeles, CA 90059, USA
[3]Marginalization-Related Diminished Returns Center, Los Angeles, CA 90059, USA
[4]Division of General Internal Medicine, Department of Medicine, Toronto General Hospital, Canada
[5]Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, 21205, USA
[6]School of Business, University of Maryland Global Campus (UMGC), Adelphi, 20783, USA

***Corresponding Author:** Shervin Assari, M.D., M.P.H., Associate Professor, Department of Family Medicine, Charles R. Drew University of Medicine and Science, Los Angeles, CA 90059, USA. Tel: +1-734-232-0445; Fax: +1-734-615-8739, Email: assari@umich.edu

**Received** July 10, 2022; **Accepted** November 10, 2022; **Online Published** December 12, 2022

**Abstract**

**Background:** The broad scientific community generally associates high socioeconomic status (SES) with better health. However, the protective effects of high educational attainment on health may be weaker for racial and ethnic minorities than non-Latino White individuals. It is important to study whether this difference holds for chronic pain among Black and Latino individuals.

**Objectives:** To compare the association between educational attainment and chronic pain in the US, considering the racial and ethnic background of individuals.

**Methods:** The current study used baseline data from the Population Assessment of Tobacco and Health (PATH-Adults) study. All participants were 18+years old. A total number of 28204 Non-Latino, Latino, White, and Black individuals were enrolled. The outcome was chronic pain treated as a continuous measure. The predictor was educational attainment. Moderators were race and ethnicity.

**Results:** Our linear regressions in the pooled sample showed that higher educational attainment was associated with a lower level of chronic pain; however, this association was weaker for Latinos and Blacks compared to non-Latino and White individuals. Our stratified models also showed that higher educational attainment was more consistently associated with a lower level of chronic pain for non-Latino White individuals than racial and ethnic minorities.

**Conclusion:** The presumed protective effect of educational attainment against chronic pain among individuals varies between different racial and ethnic groups. Future research should test the role of stressful jobs and working conditions in weakening the protective effects of SES against chronic pain for Blacks and Latinos compared to non-Latino White individuals.

**Keywords:** Population Groups, Disparities, Chronic Pain, Racial and Ethnic Groups

## 1. Background

Although high socioeconomic status (SES) is a protective factor against health problems such as chronic pain across all racial groups,[1-3] its protective effects on risky behaviors such as tobacco use may differ between diverse racial and ethnic individuals. For example, a phenomenon called Marginalization-Related Diminished Returns (MDRs)[4-13] outlines that racism, discrimination, and social stratification can lead to the association of resources and assets with lower economic levels behavioral, developmental, and health outcomes for racially marginalized groups compared to White individuals,[14-16]

Research has indicated that race and ethnicity modulate the role of resources such as SES on health problems.[17-27] For example, the association between educational attainment and health behaviors varies between non-Latino White and non-Latino Black individuals.[28-30] The association between individuals' educational attainment and health is racialized in the US.[28-31] Under racism and discrimination, academic success may be more costly for Black and Latino individuals compared to their non-Latino White counterparts.[28-30] Therefore, while a strong social gradient of health exists for White individuals, the same association may be weaker for Black and Latino individuals who live in racialized environments. These constraints may impose a higher level of psychological tax on the educational success of Black and Latino individuals from childhood.[28-30] Across all SES levels, Black and Latino students are discriminated against,[32,33] attend poor schools,[34] and have high-risk environment.[35] When highly educated Black and Latino individuals move to high SES neighborhoods and schools (that are predominantly non-Latino White), they face even

more discrimination.[36,37] Due to the education system's differential treatment of Black and White individuals,[38,39] correlates of education and chronic pain may vary by race and ethnicity.[28-30]

According to the MDRs, economic resources and assets such as educational attainment may generate fewer behavioral, developmental, and health outcomes for marginalized, stigmatized, and racialized groups such as Black and Latino compared to White populations.[14,15,40] As most of this literature is generated on the effects of educational attainment on health outcomes,[13,17,19,21,27,41-43] more research is needed to test if the association between educational attainment and chronic pain differs between Latino and Black compared to non-Latino White individuals.[44] A potential explanation for our hypothesis is that despite the availability of SES resources, environmental conditions such as social stratification, segregation, racism, and discrimination make it more difficult for Latino and Black individuals to secure positive outcomes compared to non-Latino Whites. In this view, education would generate smaller real-life changes for Latino and Black individuals than for non-Latino Whites.[44,45]

## 2. Objectives

Building on the MDRs literature[46,47] and to expand on what we know about the differential association between SES and social[34] and physical[48] environment, we aimed to test the association between educational attainment and chronic pain overall and by race and ethnicity. Our first hypothesis was that high educational attainment is associated with lower chronic pain. Our second hypothesis was that this inverse association is weaker for Latino and Black individuals compared to non-Latino White individuals.

## 3. Methods

### 3.1. Design and Setting

This was a longitudinal study. For this study, we conducted a secondary analysis of the first four years of the Population Assessment of Tobacco and Health (PATH-Individuals) study data. The PATH-Individuals are a state-of-the-art substance use survey of US individuals.

### 3.2. Sample and Sampling

In the PATH study, participants were selected randomly. Stratified and clustered random samples were selected from all US states. Eligibility was non-institutionalized members of US households. All participants were aged 18+. Only Black and White participants were included in this analysis. Participants could be Latino or non-Latino. A total number of 28204 individuals with non-missing data on our variables entered our analysis.

### 3.3. Variables

Study variables in this analysis included race, ethnicity, educational attainment, age, gender, and chronic pain. Education (as a proxy of SES) was the independent variable with five levels, and chronic pain was the outcome with five levels. Both educational attainment and chronic pain were treated as continuous measures.

### 3.4. Outcome

*Chronic pain.* A single item was used to measure self-rated chronic pain. Item response varied between 1 (none) to 10 (very high). Thus, the score had a potential and actual range from 1 to 10. For our chronic pain measure, higher scores indicated higher levels of chronic pain. The specific item was "What was your pain level, on average, in the past seven days, on a scale of 0 to 10 (low to high)?" Similar measures are used in the literature.[49]

### 3.5. Predictor

*Educational Attainment.* Education was a six-level variable as below: 1 = "Some high school", 2 General Educational Development (GED), 3 = "Completed high school", 4 = "Some college", 5 = "Completed college", 6 = "Graduate or professional school after college". Educational attainment was a continuous variable.

### 3.6. Covariates

Age was a continuous variable. Gender coded as 1 for male and 0 for female. Region of the country was Northeast, South, West, and Midwest.

### 3.7. Moderators

*Race.* Race was self-identified, treated as a nominal variable, and the moderator variable (White and Black). Race was the effect modifier (moderator).

*Ethnicity.* Ethnicity was self-identified as non-Latino, or Latino. Ethnicity was our 2nd moderator.

### 3.8. Data Analysis

Data analysis was performed using Statistical Package for the Social Sciences (SPSS) 24. SPSS was used for univariate, bivariate, and multivariable analyses. Univariate analysis was descriptive statistics such as mean (standard deviation [SD]) and frequency (%). Our bivariate analysis included chi-square and analysis of variance (ANOVA). Chronic pain score was the outcome, and educational attainment (SES) was the predictor. Race and ethnicity were moderators (effect modifiers), and age, gender, and region were covariates. Six linear regression models were applied for multivariable modeling. *Model 1* and *Model 2* were run in the pooled sample. *Model 3* to *Model 6* were performed in non-Latino White, non-Latino Black, Latino White, and Latino Black individuals. *Model 2* had the interaction terms between race and ethnicity and SES (parental education), our predictor variable. B, standard error (SE), 95% confidence interval (CI), and *p* values were reported from each model.

## 4. Results

### 4.1. Descriptive Data

Twenty-eight thousand two hundred-four individuals with

non-missing data on our variables entered our analysis.

Descriptive data are reported in Table 1.

### 4.2. Pooled Sample Models

Table 2 presents the summary of linear regressions for *Model 1* and *Model 2* that were fitted to the pooled sample. As this model shows, higher educational attainment was associated with a lower level of chronic pain. However, this association was stronger for White and non-Latino than Black and Latino individuals.

**Table 1.** Descriptive Data Overall

| | Mean | SD |
|---|---|---|
| Age (1-7) | 3.00 | 1.75 |
| Educational Attainment (1-6) | 3.52 | 1.37 |
| Chronic pain (0-10) | 2.05 | 2.58 |
| | **n** | **%** |
| Race | | |
| White | 23398 | 83.0 |
| Black | 4806 | 17.0 |
| Ethnicity | | |
| Non-Latino | 23651 | 83.9 |
| Latino | 4553 | 16.1 |
| Gender | | |
| Male | 14059 | 49.8 |
| Female | 14145 | 50.2 |
| Region | | |
| Northeast | 4399 | 15.6 |
| Midwest | 6944 | 24.6 |
| South | 10844 | 38.4 |
| West | 6017 | 21.3 |

### 4.3. Racial- and Ethnic-Stratified Models

Table 3 presents the summary of linear regressions for *Model 3* to *Model 6* that were fitted to non-Latino White, non-Latino Black, Latino White, and Latino Black individuals, respectively. As these models show, higher educational attainment was more consistently associated with a lower level of chronic pain for non-Latino White than any other race and ethnic group of individuals.

## 5. Discussion

The current study evaluated the association between educational attainment and chronic pain overall and by race and ethnicity. We found an inverse association exists between educational attainment and chronic pain. However, this association was weaker for Black and Latino individuals when compared to White and Non-Latino individuals.

The inverse association between SES and chronic pain can be explained by fundamental causes and social determinants theories.[50-57] According to these theories, SES resources such as educational attainment reduce exposure to stress and increase the individual's ability to face pressure. Also, SES minimizes the risk of injury and exposure to the conditions or causes of pain.[1-3] However, some disagree on the mechanisms behind the clustering of race, ethnicity, SES, and chronic pain.[1-3]

**Table 2.** Pooled Sample Models

| | Unstandardized B | Unstandardized Std. Error | Standardized Beta | Lower Bound | Upper Bound | *P* Value |
|---|---|---|---|---|---|---|
| **Model 1 (All, Main Effects)** | | | | | | |
| Race (Black) | 0.090 | 0.040 | 0.013 | 0.011 | 0.169 | 0.025 |
| Ethnicity (Latino) | -0.453 | 0.042 | -0.065 | -0.536 | -0.370 | <0.001 |
| Age (1-7) | 0.314 | 0.008 | 0.214 | 0.298 | .331 | <0.001 |
| Male | -0.233 | 0.029 | -0.045 | -0.290 | -0.175 | <0.001 |
| West | 0.019 | 0.050 | 0.003 | -0.079 | 0.116 | 0.708 |
| South | 0.109 | 0.044 | 0.021 | 0.022 | 0.196 | 0.014 |
| Midwest | 0.052 | 0.048 | 0.009 | -0.042 | 0.145 | 0.277 |
| Educational attainment (1-6) | -0.374 | 0.011 | -0.198 | -0.395 | -0.352 | <0.001 |
| **Model 2 (All, M1 + Interaction)** | | | | | | |
| Race (Black) | -0.463 | 0.106 | -0.067 | -0.671 | -0.255 | <0.001 |
| Ethnicity (Latino) | -1.411 | 0.099 | -0.201 | -1.606 | -1.216 | <0.001 |
| Age (1-7) | 0.321 | 0.008 | 0.218 | 0.305 | 0.338 | <0.001 |
| Male | -0.228 | 0.029 | -0.044 | -0.286 | -0.171 | <0.001 |
| West | 0.025 | 0.049 | 0.004 | -0.072 | 0.121 | 0.620 |
| South | 0.093 | 0.044 | 0.017 | 0.006 | 0.179 | 0.036 |
| Midwest | 0.044 | 0.047 | 0.007 | -0.049 | 0.137 | 0.353 |
| Educational attainment (1-6) | -0.455 | 0.013 | -0.241 | -0.481 | -0.429 | <0.001 |
| Educational attainment (1-6) x Race | 0.163 | 0.030 | 0.084 | 0.104 | 0.221 | <0.001 |
| Educational attainment (1-6) x Ethnicity | 0.305 | 0.029 | 0.146 | 0.248 | 0.361 | <0.001 |

Outcome: Chronic Pain Score (0-10); Data: Population Assessment of Tobacco and Health (PATH).

**Table 3.** Stratified Models by Race × Ethnicity Groups

| | Unstandardized B | Unstandardized Std. Error | Standardized Beta | Lower Bound | Upper Bound | *P* Value |
|---|---|---|---|---|---|---|
| **Model 3 (Non-Latino Whites)** | | | | | | |
| Age (1-7) | 0.292 | 0.010 | 0.206 | 0.273 | 0.311 | <0.001 |
| Male | -0.186 | 0.035 | -0.037 | -0.254 | -0.118 | <0.001 |
| West | 0.140 | 0.057 | 0.022 | 0.028 | 0.252 | 0.014 |
| South | 0.227 | 0.051 | 0.043 | 0.127 | 0.328 | <0.001 |
| Midwest | 0.072 | 0.053 | 0.013 | -0.031 | 0.176 | 0.169 |
| Educational attainment (1-6) | -0.459 | 0.013 | -0.241 | -0.485 | -0.434 | <0.001 |
| **Model 4 (Non-Latino Blacks)** | | | | | | |
| Age (1-7) | 0.459 | 0.023 | 0.279 | 0.413 | 0.505 | <0.001 |
| Male | -0.425 | 0.081 | -0.075 | -0.584 | -0.266 | <0.001 |
| West | -0.054 | 0.184 | -0.005 | -0.414 | 0.307 | 0.770 |
| South | -0.116 | 0.126 | -0.020 | -0.363 | 0.131 | 0.357 |
| Midwest | 0.150 | 0.144 | 0.022 | -0.132 | 0.431 | 0.297 |
| Educational attainment (1-6) | -0.264 | 0.031 | -0.122 | -0.325 | -00.203 | <0.001 |
| **Model 5 (Latino Whites)** | | | | | | |
| Age (1-7) | 0.303 | 0.025 | 0.188 | 0.255 | 0.351 | <0.001 |
| Male | -0.228 | 0.075 | -0.046 | -0.376 | -0.080 | 0.003 |
| West | -0.387 | 0.133 | -0.077 | -0.648 | -0.126 | 0.004 |
| South | -0.294 | 0.135 | -0.057 | -0.558 | -0.029 | 0.030 |
| Midwest | -0.278 | 0.174 | -0.032 | -0.619 | 0.063 | 0.110 |
| Educational attainment (1-6) | -0.132 | 0.027 | -0.075 | -0.186 | -0.079 | <0.001 |
| **Model 6 (Latino Blacks)** | | | | | | |
| Age (1-7) | 0.522 | 0.092 | 0.292 | 0.341 | 0.703 | <0.001 |
| Male | -0.023 | 0.280 | -0.004 | -0.574 | 0.528 | 0.934 |
| West | -0.480 | 00.414 | -0.065 | -1.294 | 0.335 | 0.247 |
| South | -0.361 | 0.329 | -0.063 | -1.008 | 0.286 | 0.273 |
| Midwest | 0.296 | 00.461 | 0.036 | -0.611 | 1.203 | 0.522 |
| Educational attainment (1-6) | -0.206 | 0.102 | -0.103 | -0.407 | -0.005 | 0.044 |

Outcome: Chronic Pain Score (0-10); Data: Population Assessment of Tobacco and Health (PATH).

Multiple studies showed racial variation in the association between SES, health, and behaviors, with weaker associations observed in Black and Latino individuals, compared to non-Latino Whites.[58] Some studies also show stronger and weaker associations between SES and risk behaviors in Black and Latinos than non-Latino White individuals.[13,18-26,41,43,59,60] However, we are unaware of past studies on Black-White differences in the association between SES and chronic pain.

Our observation of a weaker association between educational attainment and chronic pain in Black and Latino versus White and non-Latino individuals is also in line with many previous publications on the MDRs. For example, according to Marginalization-related Diminished Returns, resources and assets generate fewer financial, behavioral, developmental, and health outcomes for marginalized groups than non-marginalized White individuals.

This study expanded the MDRs literature from other outcomes to chronic pain.[46,47] Previous work has shown that the association between SES and health is racialized.[46,47] This study showed that the relationship between educational success and chronic pain is also racialized in the US. This finding may be explained by the fact that highly educated White individuals work in better jobs, live in better neighborhoods, have fewer chronic diseases, have more physical activity, and are less likely to be depressed compared to their Black and Latino counterparts.[34] These lead to higher challenges in the lives of highly educated Black and Latino individuals compared to non-Latino White individuals.[32,33] Racial and ethnic differences in the health returns of education may also be because of discrimination,[32,33] particularly in high SES White neighborhoods.[36,37]

### *5.1. Study Limitations*

Our study had a few limitations. Firstly, all variables were measured as self-reports. Thus, our results are subject to social desirability, under-reporting, and possible mismeasurement. Secondly, all our measurements were at the individual level. We did not measure many potential confounders, such as neighborhood SES. We also did not measure chronic pain conditions. In addition, our

## Research Highlights

### What Is Already Known?

- High SES is associated with less chronic pain.
- High education is associated with lower level of chronic pain.

### What Does This Study Add?

- The association between education and pain is weaker for Black and Latino than non-Latino White people.
- High SES Black and Latino individuals experience some unexpected level of pain.

measure was a single item, which is limited. Additionally, this study had an imbalanced sample size (a larger number of participants for White and non-Latino than Black and Latino individuals). However, our main inference was based on the main effect and interaction analysis within pooled samples rather than stratified models with differential power. Our study also did not evaluate gender differences in the relationship between SES and chronic pain.

## 6. Conclusion

To conclude, we tested the association between educational attainment (SES) and chronic pain overall and in consideration of race and ethnicity. We found that overall, high educational attainment (SES) is associated with lower chronic pain. However, this inverse association was weaker for Black and Latinos when compared to Non-Latino and White individuals. Racialized return of SES on chronic pain may reflect structural inequalities in the lives of Latino and Black communities.

### Author Contributions

Conceptualization: SA, AR, SMK, IN, BN, HZ; Data curation: SA; Formal Analysis: SA, AR, IN, BN; Funding acquisition: SA; Investigation: SA, IN; Methodology: SA, AR; Project administration: SA; Resources: SA, MD; Software: SA, AR; Supervision: SA; Validation: SA, AR; Visualization: SA, SMK; Writing original draft: SA, MD, AR, BN; Writing review & editing: SA, MD, AR, SMK, IR, BN, HZ.

### Conflict of Interest Disclosures

All the authors have no conflicts of interest.

### Ethical Approval

This study used publicly available PATH data. All data are fully de-identified. Thus, the study was not human subject research and, therefore, was exempt from a full IRB review.

### Funding/Support

Author SA is supported by the National Institutes of Health (NIH) grant 5S21MD000103 (a scholarship Awarded to Shervin Assari).

### References

1. Feldman CH, Dong Y, Katz JN, Donnell-Fink LA, Losina E. Association between socioeconomic status and pain, function and pain catastrophizing at presentation for total knee arthroplasty. BMC Musculoskelet Disord. 2015;16:18. doi:10.1186/s12891-015-0475-8.
2. Macfarlane GJ, Norrie G, Atherton K, Power C, Jones GT. The influence of socioeconomic status on the reporting of regional and widespread musculoskeletal pain: results from the 1958 British Birth Cohort Study. Ann Rheum Dis. 2009;68(10):1591-1595. doi:10.1136/ard.2008.093088.
3. Cutler DM, Meara E, Stewart S. Socioeconomic Status and the Experience of Pain: An Example from Knees. National Bureau of Economic Research; 2020.
4. Assari S. Parental educational attainment and mental well-being of college students; diminished returns of Blacks. Brain Sci. 2018;8(11):193. doi:10.3390/brainsci8110193.
5. Assari S. Blacks' diminished return of education attainment on subjective health; mediating effect of income. Brain Sci. 2018;8(9):176. doi:10.3390/brainsci8090176.
6. Assari S. Socioeconomic status and self-rated oral health; diminished return among Hispanic Whites. Dent J (Basel). 2018;6(2):11. doi:10.3390/dj6020011.
7. Assari S. Health disparities due to diminished return among Black Americans: public policy solutions. Soc Issues Policy Rev. 2018;12(1):112-145. doi:10.1111/sipr.12042.
8. Assari S. Diminished economic return of socioeconomic status for Black families. Soc Sci (Basel). 2018;7(5):74. doi:10.3390/socsci7050074.
9. Assari S, Caldwell CH, Mincy R. Family socioeconomic status at birth and youth impulsivity at age 15; Blacks' diminished return. Children (Basel). 2018;5(5):58. doi:10.3390/children5050058.
10. Assari S, Caldwell CH, Zimmerman MA. Family structure and subsequent anxiety symptoms; minorities' diminished return. Brain Sci. 2018;8(6):97. doi:10.3390/brainsci8060097.
11. Assari S, Hani N. Household income and children's unmet dental care need; Blacks' diminished return. Dent J (Basel). 2018;6(2):17. doi:10.3390/dj6020017.
12. Assari S, Lapeyrouse LM, Neighbors HW. Income and self-rated mental health: diminished returns for high income Black Americans. Behav Sci (Basel). 2018;8(5):50. doi:10.3390/bs8050050.
13. Assari S, Mistry R. Educational attainment and smoking status in a national sample of American adults; evidence for the Blacks' diminished return. Int J Environ Res Public Health. 2018;15(4):763. doi:10.3390/ijerph15040763.
14. Assari S. Unequal gain of equal resources across racial groups. Int J Health Policy Manag. 2018;7(1):1-9. doi:10.15171/ijhpm.2017.90.
15. Assari S. Understanding America: unequal economic returns of years of schooling in Whites and Blacks. World J Educ Res. 2020;7(2):78-92. doi:10.22158/wjer.v7n2p78.
16. Boyce S, Darvishi M, Marandi R, et al. Racism-related diminished returns of socioeconomic status on adolescent brain and cognitive development. Res Health Sci. 2021;6(4):1-22.
17. Assari S, Caldwell CH. Racism, Diminished Returns of Socioeconomic Resources, and Black Middle-Income Children's Health Paradox. JAMA Pediatr. 2021;175(12):1287-1288. doi:10.1001/jamapediatrics.2021.3277.
18. Assari S. Diminished returns of income against cigarette smoking among Chinese Americans. J Health Econ Dev. 2019;1(2):1-8.
19. Assari S, Bazargan M. Education level and cigarette smoking: diminished returns of lesbian, gay and bisexual individuals. Behav Sci (Basel). 2019;9(10):103. doi:10.3390/bs9100103.
20. Assari S, Bazargan M. Protective effects of educational

attainment against cigarette smoking; diminished returns of American Indians and Alaska natives in the National Health Interview Survey. Int J Travel Med Glob Health. 2019;7(3):105-110. doi:10.15171/ijtmgh.2019.22.
21. Assari S, Mistry R. Diminished return of employment on ever smoking among Hispanic Whites in Los Angeles. Health Equity. 2019;3(1):138-144. doi:10.1089/heq.2018.0070.
22. Assari S, Smith JL, Zimmerman MA, Bazargan M. Cigarette smoking among economically disadvantaged African-American older adults in South Los Angeles: gender differences. Int J Environ Res Public Health. 2019;16(7):1208. doi:10.3390/ijerph16071208.
23. Assari S, Chalian H, Bazargan M. High Education Level Protects European Americans but Not African Americans Against Chronic Obstructive Pulmonary Disease: National Health Interview Survey. Int J Biomed Eng Clin Sci. 2019;5(2):16-23. doi:10.11648/j.ijbecs.20190502.12.
24. Assari S. Socioeconomic status and current cigarette smoking status: immigrants' diminished returns. Int J Travel Med Glob Health. 2020;8(2):66-72. doi:10.34172/ijtmgh.2020.11.
25. Assari S, Boyce S, Caldwell CH, Bazargan M. Parent education and future transition to cigarette smoking: Latinos' diminished returns. Front Pediatr. 2020;8:457. doi:10.3389/fped.2020.00457.
26. Assari S, Mistry R, Caldwell CH, Bazargan M. Protective effects of parental education against youth cigarette smoking: diminished returns of Blacks and Hispanics. Adolesc Health Med Ther. 2020;11:63-71. doi:10.2147/ahmt.s238441.
27. Assari S, Chalian H, Bazargan M. Social determinants of hookah smoking in the United States. J Ment Health Clin Psychol. 2020;4(1):21-27. doi:10.29245/2578-2959/2020/1.1185.
28. Fuller-Rowell TE, Cogburn CD, Brodish AB, Peck SC, Malanchuk O, Eccles JS. Racial discrimination and substance use: longitudinal associations and identity moderators. J Behav Med. 2012;35(6):581-590. doi:10.1007/s10865-011-9388-7.
29. Fuller-Rowell TE, Curtis DS, Doan SN, Coe CL. Racial disparities in the health benefits of educational attainment: a study of inflammatory trajectories among African American and White adults. Psychosom Med. 2015;77(1):33-40. doi:10.1097/psy.0000000000000128.
30. Fuller-Rowell TE, Doan SN. The social costs of academic success across ethnic groups. Child Dev. 2010;81(6):1696-1713. doi:10.1111/j.1467-8624.2010.01504.x.
31. Darvishi M, Saqib M, Assari S. Parental education and functional connectivity between nucleus accumbens (NAcc) and frontoparietal network (FPN). J Educ Cult Stud. 2021;5(5):61-83. doi:10.22158/jecs.v5n5p61.
32. Assari S. Are teachers biased against Black children? A study of race, amygdala volume, and problem behaviors. J Educ Teach Soc Stud. 2021;3(1):1-27.
33. Assari S, Caldwell CH. Teacher discrimination reduces school performance of African American youth: role of gender. Brain Sci. 2018;8(10):183. doi:10.3390/brainsci8100183.
34. Boyce S, Bazargan M, Caldwell CH, Zimmerman MA, Assari S. Parental educational attainment and social environmental of urban public schools in the US: Blacks' diminished returns. Children (Basel). 2020;7(5):44. doi:10.3390/children7050044.
35. Assari S, Caldwell C, Bazargan M. Parental educational attainment and relatives' substance use of American youth: Hispanics diminished returns. J Biosci Med (Irvine). 2020;8(2):122-134. doi:10.4236/jbm.2020.82010.
36. Assari S. Does school racial composition explain why high income Black youth perceive more discrimination? A gender analysis. Brain Sci. 2018;8(8):140. doi:10.3390/brainsci8080140.
37. Assari S, Moghani Lankarani M. Workplace racial composition explains high perceived discrimination of high socioeconomic status African American men. Brain Sci. 2018;8(8):139. doi:10.3390/brainsci8080139.
38. Dantzler K, Altamirano M, Anomo T, et al. Learning While Black: a qualitative analysis of the impact of race in a US high school. World J Educ Res. 2022;9(5):79-91. doi:10.22158/wjer.v9n5p79.
39. Halliwell HA, King E, Gonzalez-Matute M, et al. It's like the elephant in the room" a qualitative analysis of racism in a US high school. World J Educ Res. 2022;9(4):28-41. doi:10.22158/wjer.v9n4p28.
40. Darvishi M, Saqib M, Assari S. Diminished association between parental education and parahippocampal cortical thickness in pre-adolescents in the US. Stud Soc Sci Res. 2021;2(4):34-63. dOI:10.22158/sssr.v2n4p34.
41. Assari S. Diminished returns of income against cigarette smoking among Chinese Americans. J Health Econ Dev. 2019;1(2):1-8.
42. Bazargan M, Cobb S, Castro Sandoval J, Assari S. Smoking status and well-being of underserved African American older adults. Behav Sci (Basel). 2020;10(4):78. doi:10.3390/bs10040078.
43. Harris JC, Mereish EH, Faulkner ML, et al. Racial differences in the association between alcohol drinking and cigarette smoking: preliminary findings from an alcohol research program. Alcohol Alcohol. 2022;57(3):330-339. doi:10.1093/alcalc/agab038.
44. Assari S. General self-efficacy and mortality in the USA; racial differences. J Racial Ethn Health Disparities. 2017;4(4):746-757. doi:10.1007/s40615-016-0278-0.
45. Assari S. Race, sense of control over life, and short-term risk of mortality among older adults in the United States. Arch Med Sci. 2017;13(5):1233-1240. doi:10.5114/aoms.2016.59740.
46. Assari S, Moghani Lankarani M. Education and alcohol consumption among older Americans; Black-White differences. Front Public Health. 2016;4:67. doi:10.3389/fpubh.2016.00067.
47. Assari S, Farokhnia M, Mistry R. Education attainment and alcohol binge drinking: diminished returns of Hispanics in Los Angeles. Behav Sci (Basel). 2019;9(1):9. doi:10.3390/bs9010009.
48. Assari S, Boyce S, Caldwell CH, Bazargan M, Mincy R. Family income and gang presence in the neighborhood: diminished returns of Black families. Urban Sci. 2020;4(2):29. doi:10.3390/urbansci4020029.
49. Gleeson M, Almey J, Brooks S, Cave R, Lewis A, Griffiths H. Haematological and acute-phase responses associated with delayed-onset muscle soreness in humans. Eur J Appl Physiol Occup Physiol. 1995;71(2-3):137-142. doi:10.1007/bf00854970.
50. Marmot MG, McDowall ME. Mortality decline and widening social inequalities. Lancet. 1986;2(8501):274-276. doi:10.1016/s0140-6736(86)92085-4.
51. Carroll D, Davey Smith G, Sheffield D, Shipley MJ, Marmot MG. The relationship between socioeconomic status, hostility, and blood pressure reactions to mental stress in men: data from the Whitehall II study. Health Psychol. 1997;16(2):131-136. doi:10.1037//0278-6133.16.2.131.
52. Marmot M. Social determinants of health inequalities. Lancet. 2005;365(9464):1099-1104. doi:10.1016/s0140-6736(05)71146-6.
53. Marmot M, Wilkinson R. Social Determinants of Health. Oxford: Oxford University Press; 2005.

54. Murphy M, Bobak M, Nicholson A, Rose R, Marmot M. The widening gap in mortality by educational level in the Russian Federation, 1980-2001. Am J Public Health. 2006;96(7):1293-1299. doi:10.2105/ajph.2004.056929.
55. Horvat P, Richards M, Malyutina S, et al. Life course socioeconomic position and mid-late life cognitive function in Eastern Europe. J Gerontol B Psychol Sci Soc Sci. 2014;69(3):470-481. doi:10.1093/geronb/gbu014.
56. Marmot M. The health gap: the challenge of an unequal world. Lancet. 2015;386(10011):2442-2444. doi:10.1016/s0140-6736(15)00150-6.
57. Stringhini S, Carmeli C, Jokela M, et al. Socioeconomic status, non-communicable disease risk factors, and walking speed in older adults: multi-cohort population based study. BMJ. 2018;360:k1046. doi:10.1136/bmj.k1046.
58. Martins SS, Lee GP, Kim JH, Letourneau EJ, Storr CL. Gambling and sexual behaviors in African-American adolescents. Addict Behav. 2014;39(5):854-860. doi:10.1016/j.addbeh.2014.02.002.
59. Bandiera FC, Assari S, Livaudais-Toman J, Pérez-Stable EJ. Latino and Black smokers in the Health and Retirement Study are more likely to quit: the role of light smoking. Tob Induc Dis. 2016;14:23. doi:10.1186/s12971-016-0090-y.
60. Harris JC, Mereish EH, Faulkner ML, et al. Racial Differences in the Association Between Alcohol Drinking and Cigarette Smoking: Preliminary Findings From an Alcohol Research Program. Alcohol Alcohol. 2022;57(3):330-339. doi:10.1093/alcalc/agab038.