

Socioeconomic Determinants of Systolic Blood Pressure; Minorities' Diminished Returns

Shervin Assari^{1,2}

¹Charles R Drew University of Medicine and Science, Los Angeles, CA, USA

*Correspondence: shervinassari@cdrewu.edu; Tel.: +(734)-232-0445; Fax: +734-615-8739

Abstract

Background: Although socioeconomic position (SEP) is associated with better health, the protective effects of high SEP may be smaller for racial and ethnic minorities than Whites, as explained by Minorities' Diminished Returns theory. It is still unknown whether the association between SEP and systolic blood pressure (SBP) differs for racial and ethnic groups. The current study racial and ethnic variation in the association between SEP (education attainment and household income) and SBP among American adults.

Methods: The National Health and Nutrition Examination Survey (NHANES; 2005-2006) included 4773 adults 20 years or older. Education attainment and household income were the predictor variables, SBP was the outcome variable, age and gender were the covariates, and race/ethnicity was the effect modifier. Multiple linear regression models were used in the pooled sample and each race/ethnicity.

Results: In the pooled sample, higher education attainment and household income were associated with lower SBP, net of race, ethnicity, age, and gender. Race/ethnic stratified linear regression models showed protective effects of education attainment and household income against high SBP for Non-Hispanic Whites, a protective effect of household income for Other Hispanics, and no protective effects of education attainment or household income for other race/ethnic groups.

Conclusions: The health gain that follows SEP (education attainment and household income) are simply larger for the socially and economically privileged group (non-Hispanic Whites) and minimized for racial and ethnic groups. Given that the Minorities' Diminished Returns exist, policies and solutions that merely focus on reducing the racial gap in SEP may not eliminate the pervasive racial and ethnic gap in health problems including high SBP.

Keyword: socioeconomic position; ethnic groups; blood pressure

Received: 17 January 2019, Accepted: 6 March 2019

1. Introduction

The effects of socioeconomic position (SEP) on health are well established (1-3), however, equal SEP resources generate unequal health across race/ethnic groups (4, 5). While the high SEP individuals are healthier overall and low SEP (low education, low

income) are well-known causes of poor health (1-3, 6-8), the gradient effect of SEP resources on health seems to be smaller for race/ethnic minorities compared to Whites (4, 5). This pattern is repeatedly shown for African Americans (9-11), however, some



This work is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/).



Health Economics Association of Iran

recent studies suggest that they may also hold for Hispanics(12, 13).

As suggested by the Minorities' Diminished Returns theory (4, 5), inequalities are beyond SEP differences and extend to unequal health gains that follow very same SEP resources, with the socially dominant and privileged group gaining most health and historically oppressed and socially and economically disadvantaged groups gaining least health from their very same SEP resources (9-11, 14-19). Considerable research has provided empirical evidence that supports this theory (4, 5). However, there is more to be known about these patterns.

A wide range of SEP indicators such as education attainment, household income, employment status, and marital status have shown smaller effects for African Americans compared to non-Hispanic Whites(9-12, 16, 17, 19, 20). While there are a few studies on Hispanics versus Whites(12, 13), less is known about what degree this pattern is relevant to various groups of Hispanics and racial and ethnic minority groups that are neither African American or Hispanic.

Another reason for a need for more research is that these effects are shown for many health behaviors (13, 21), mental health outcomes (9, 15, 22), and physical health outcomes (23, 24) but not blood pressure or hypertension. Minorities Diminished Returns are shown for drinking alcohol, smoking, self-rated health, obesity, mental health, depressive symptoms, anxiety, oral health, and premature mortality for African Americans than Whites (9-11, 14, 16-19, 22, 25). Some evidence also suggest that these patterns hold for chronic medical diseases such as asthma, ADHD, obesity, and depression (15, 17, 22, 23, 26). But we are not aware of studies showing same patterns for hypertension or high blood pressure.

In an effort to test the validity of Minorities' Diminished Returns for high systolic blood pressure (SBP), the current study borrowed the National Health and Nutrition Examination Survey (NHANES) data to compare race/ethnic groups for the association between SEP (education attainment and household income) and SBP. NHANES provides data for comparison of Non-Hispanic White, Other

Hispanics, Mexican Americans, African Americans, or Other Race/Ethnicities. Informed by the Minorities' Diminished Returns theory (4, 5), we hypothesized that high education attainment and household income to show larger negative associations with SBP for Whites compared to any non-White groups.

2. Methods

2.1. Settings and Design

The NHANES 2005–2006 was conducted by the Centers for Disease Control and Prevention National Center (CDC) for Health Statistics (NCHS).

2.2. Ethics

All participating adults signed a written informed consent. The NHANES protocol received ethical approval from the NCHS institutional/Ethics Review Board (IRB).

2.3. Participants

Participants of the NHANES were selected using a stratified, multistage probability sample of non-institutionalized U.S. citizen population. Only adults ≥ 20 years old in NHANES 2005-2006 with at least one systolic BP measurements were included.

2.4. Analytical Sample

The current analytical sample was limited to those NHANES individuals who were at least 20 years old and had data on at least one SBP measure. This number included 4773 individuals who were composed of Non-Hispanic White ($n = 2384$), Other Hispanics ($n = 148$), Mexican Americans (959), African Americans ($n = 1090$), or Other Race/Ethnicities ($n = 192$).

2.5. Variable Definitions and Measurement

Systolic Blood Pressure (SBP). In this study, SBP, the outcome variable, was measured up to four times. In NHANES 2005-2006, BP was measured by well-trained physicians, using mercury sphygmomanometry with appropriate size arm cuffs. Participants rested five minutes seated before BP was measured. We operationalized the SBP as a continuous measure. This operationalization was not

based on any threshold such as systolic BP ≥ 140 mmHg, diastolic BP ≥ 90 or history of prescription medication for high BP.

Socioeconomic position (SEP). Two SEP characteristics, predictor variables, were included in this study: Education attainment and household income. Education attainment was a five-level ordinal variable which was operationalized as an interval variable. Levels included 1) Less Than 9th Grade, 2) 9-11th Grade (Including 12th grade with no diploma), 3) High School Grad/GED or Equivalent, 4) Some College or AA degree, and 5) College Graduate or above. Household income was measured as an ordinal variable with 11 levels, operationalized as an interval variable in the current study. The income levels were as following: 1) \$ 0 to \$ 4,999, 2) \$ 5,000 to \$ 9,999, 3) \$10,000 to \$14,999, 4) \$15,000 to \$19,999, 5) \$20,000 to \$24,999, 6) \$25,000 to \$34,999, 7) \$35,000 to \$44,999, 8) \$45,000 to \$54,999, 9) \$55,000 to \$64,999, 10) \$65,000 to \$74,999, and 11) \$75,000 and Over.

Race/Ethnicity. Race and ethnicity were self-identified. They were determined by self-report and categorized into 1) Non-Hispanic Whites, 2) Other Hispanics, 3) Mexican Americans, 4) Non-Hispanic African Americans, and 5) Other Race/Ethnicities.

Demographic Factors. Age and gender were the demographic variables. Age was a continuous variable measured as number of months passed from birth. Gender was a dichotomous variable (1 female, 0 male).

2.6. Data Analysis

Survey Weights. To handle the sampling weights of the NHANES and to generate results that would be nationally representative, we used Stata 15.0 (Stata Corp., College Station, TX, USA) for our data analysis. Taylor series approximation technique was used to estimate the complex design-based standard errors (SEs). As a result, our inferences are generalizable to the US general population. To describe our descriptive statistics in our sample, we reported weighted frequency tables (%) and means, in the pooled sample, and by race/ethnicity. We ran multiple linear regression models for our

multivariable analysis. Model 1 was performed in the pooled sample. Models 2 to 6 were estimated in each race/ethnic group. This includes Non-Hispanic Whites (Model 2), Other Hispanics (Model 3), Mexican Americans (Model 4), Non-Hispanic African Americans (Model 5), and Other Race / Ethnic Groups (Model 6), respectively. Model 1 included race/ethnicity as a dichotomous variable (Non-Hispanic Whites 0, All Other Racial and Ethnic Groups Combined) 1), education attainment, income, and demographic covariates. Models 2 to 6 included education attainment and household income, and the covariates. Education attainment and household income were the predictor variables, SBP was the outcome variable, and age, gender, and smoking before the SBP measurement were the covariates. Race/ethnicity was the effect modifier. Adjusted b, beta, SEs, t, and p values were reported.

3. Results

3.1. Descriptive

This study included 4773 adults over age of 20 who were either Non-Hispanic White (n = 2384), Other Hispanics (n = 148), Mexican Americans (959), African Americans (n = 1090), or Other Race/Ethnicities (n = 192). Table 1 shows the summary of descriptive characteristics in the pooled sample as well as by race/ethnicity. Non-Hispanic Whites had higher and Mexican Americans and African Americans had lower levels of educational attainment (years of schooling) and household income. From all racial and ethnic groups, Non-Hispanic Whites were considerably older. Education attainment and household income were highest in Non-Hispanic Whites and other race/ethnicities and lowest in Mexican Americans. Racial and ethnic groups did differ in SBP, with African American showing the highest SBP compared to other race/ethnic groups (Table 1, Figure 1).

3.2. Pooled sample logistic regressions

Table 2 shows the results of a linear regression model in the pooled sample, with SEP indicators as the predictors and SBP as the outcome variable. *Model 1* showed that higher education level and household

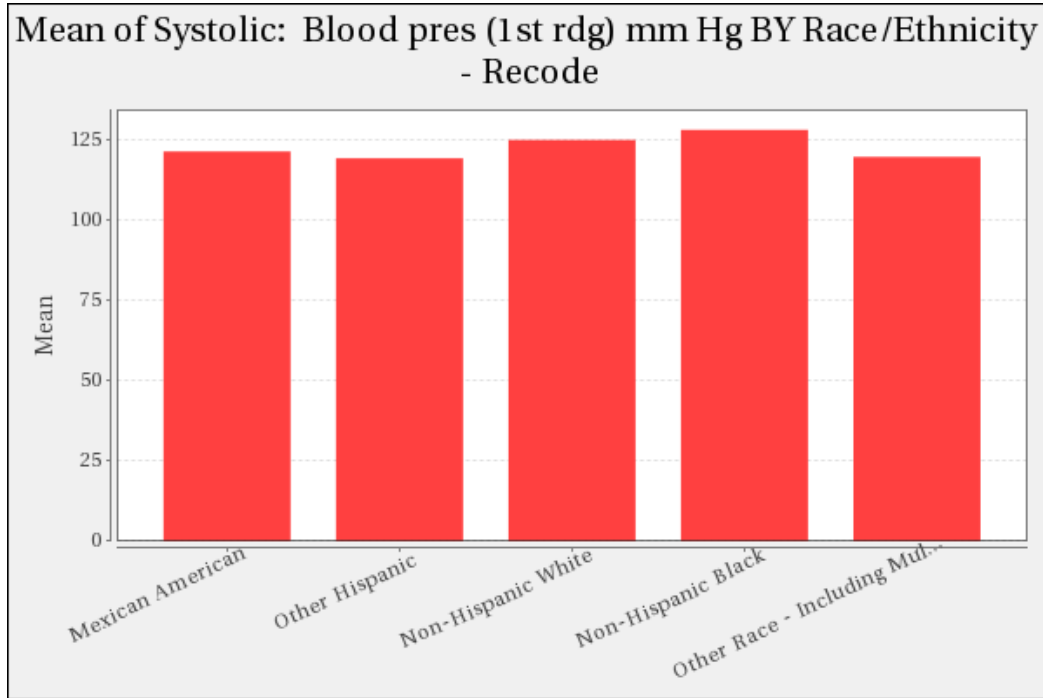


Figure 1: Mean systolic Blood Pressure based on race and ethnicity

income level were both negatively associated with SBP, in the pooled sample, above and beyond race/ethnicity, age, gender, and smoking before SBP measurement. Other factors that were associated with SBP included gender and age. Males and higher age were associated with higher SBP (Table 2).

3.3. Race/ethnic stratified logistic regressions

Table 3 shows the results of five additional linear regression models that were fitted specific to each race/ethnic group. We found protective effects of education attainment and household income for Non-Hispanic Whites (*Model 2*). There was a negative association between household income but not education attainment with SBP in Other Hispanics (*Model 3*). Neither education attainment nor household income were associated with SBP for Mexican Americans (*Model 4*), Non-Hispanic

African Americans (*Model 5*), and Other Race / Ethnic Groups (*Model 6*) (Table 3).

4. Discussion

This study showed two major findings: High education attainment and household income were protective against high SBP in the pooled sample, and only Non-Hispanic Whites showed protective effects of both education attainment and household income against their SBP. Other Hispanics showed a protective effect of their income but not education attainment. African Americans, Mexican Americans, and other race/ethnic groups did not show any gain in terms of low SBP associated with their high education attainment or household income.

The first finding on the protective effects of education attainment and income against asthma is in line with the known effect of SEP in social patterning of

Table 1: Descriptive characteristics in the pooled sample and by race/ethnicity

	Non-Hispanic Whites (n=2,384)		Other Hispanics (n=148)		Mexican Americans (n=959)		African Americans (n=1,090)		Other Race /Ethnicities (n= 192)		All (n=4,773)	
	<i>Mean</i>	<i>SE</i>	<i>Mean</i>	<i>SE</i>	<i>Mean</i>	<i>SE</i>	<i>Mean</i>	<i>SE</i>	<i>Mean</i>	<i>SE</i>	<i>Mean</i>	<i>SE</i>
Age (Months)	607.6	11.49	482.5	*16.62	508.86	10.31	564.23	12.12	518.67	13.49	569.65	8.77
Education Attainment (1-5)	3.6	0.07	2.8	*0.17	2.34	0.06	3.30	0.06	3.77	0.10	3.28	0.06
Household Income (1-11)	7.4	0.17	6.4	*0.37	5.99	0.21	6.61	0.26	7.52	0.29	6.94	0.14
Systolic Blood Pressure	125.2	0.76	119. 4	*2.42	121.57	0.59	128.31	0.95	119.88	1.43		
	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>
Gender												
Male	49.0	1,167	48.6	72	46.8	449	47.9	522	38.5	74	47.9	2,284
Female	51.0	1,217	51.4	76	53.2	510	52.1	568	61.5	118	52.1	2,489

* $p < 0.05$ for comparisons of race/ethnic groups. ^a Pearson Chi square, ^b independent samples t test. Source: The National Health and Nutrition Examination Survey (NHANES; 2005-2006)

Table 2: Summary of linear regression model (Model 1) in the pooled sample

Characteristics	B	SE(B)	Beta	SE(Beta)	t	Probability
Race/Ethnicity (Any Other Race/Ethnic Group)	1.24	0.90	0.03	0.02	1.38	0.188
Gender (Women)	-3.72	0.53	-0.10	0.02	-7.00	<0.001
Age (Years)	0.04	0.00	0.44	0.02	29.73	<0.001
Smoking before the measurement	-0.55	2.66	0.00	0.02	-0.21	0.840
Education Attainment (1-5)	-0.85	0.37	-0.05	0.02	-2.28	0.038
Household Income (1-11)	-0.44	0.11	-0.07	0.02	-4.19	0.001
Constant	113.20	4.85			23.32	<0.001

Outcome: Systolic Blood Pressure, Source: The National Health and Nutrition Examination Survey (NHANES; 2005-2006)

chronic medical conditions and health problems (1-3). Some considerable research has shown that there is a social and economic gradient in SBP, high blood pressure, and hypertension (27-34).

The second finding that equal SEP indicators namely education attainment and income show unequal effects with stronger protective effects for Non-Hispanic Whites than other groups is similar to the results of many previous studies that have shown the same pattern for a wide range of SEP indicators on several health outcomes such as self-rated health, obesity, and behaviors (10, 12, 13, 18, 22, 25, 26).

The current study suggested a social gradient in SEP returns on SBP. The most privileged group, Non-Hispanic Whites, benefited from education attainment and household income. The second most privileged group, Other Hispanics, showed a benefit from their household income on SBP. Then Mexicans and African Americans who are the least privileged groups showed no benefit of their SEP on SBP. We already know that Hispanics such as Cubans are privileged, have the smallest health disparities, and show some patterns that are most similar to the Non-Hispanic Whites. Mexicans, in contrast, live under adversities, and show considerable disparities, and many different patterns compared to Whites. Thus, although there is something common about non-Whites, the diminished gains get smaller as the racial and ethnic minority groups assimilate and live a socially privileged life like Cubans.

A large body of research has shown that African Americans are in a relative disadvantage relative to Whites when it comes to gaining health and wellbeing from their available SEP resources (4). These are robust for chronic conditions such as obesity, depression, ADHD, and asthma (15, 17, 22, 23, 26). The same rule seems to apply to blood pressure. So, these patterns are not specific to diseases and operate for multiple conditions. In addition, these patterns are not specific to African Americans as they are seen for almost all racial and ethnic minority groups.

Minorities' Diminished Returns is documented in all age groups including children(23), adults (24) and older adults(13). Although the exact mechanism for such diminished returns is still unknown, it is mainly attributed to racism and discrimination (25, 35-37). No matter what the cause is, these findings suggest that not all of the racial health disparities are due to SEP differences and at least some of them are due to diminished returns of SEPs in minority groups(4, 38). That is, the rich and wealthy Whites become richer, wealthier, and healthier, far more than their minority counterparts. This is probably another reason why racial and ethnic gaps tend to widen rather than narrow over time. These diminished returns are not inside a generation and contribute to transgenerational transmission of disparities (11, 26, 39).

These differential effects are in part because society differentially treats social groups based on their

Table 3: Summary of five race/ethnic- specific linear regression models (Model 2 to 6)

Characteristics	B	SE(B)	Beta	SE(Beta)	t	Probability
Non-Hispanic Whites (Model 2)						
Gender (Women)	-3.19	0.77	-0.09	0.02	-4.15	0.001
Age (Years)	0.04	0.00	0.43	0.02	28.99	<0.001
Smoking before the measurement	-1.38	3.13	-0.01	0.03	-0.44	0.665
Education Attainment (1-5)	-1.09	0.38	-0.06	0.02	-2.83	0.013
Household Income (1-11)	-0.44	0.13	-0.07	0.02	-3.27	0.005
Constant	115.66	6.02			19.21	<0.001
Other Hispanics (Model 3)						
Gender (Women)	-5.09	2.91	-0.14	0.08	-1.75	0.100
Age (Years)	0.05	0.01	0.42	0.07	5.67	<0.001
Smoking before the measurement	16.61	7.90	0.12	0.06	2.10	0.053
Education Attainment (1-5)	-0.46	1.59	-0.04	0.12	-0.29	0.775
Household Income (1-11)	-1.84	0.53	-0.31	0.09	-3.48	0.003
Constant	86.13	17.14			5.02	<0.001
Mexican Americans (Model 4)						
Gender (Women)	-5.77	0.96	-0.18	0.03	-6.04	<0.001
Age (Years)	0.04	0.00	0.40	0.02	18.12	<0.001
Smoking before the measurement	3.00	5.23	0.02	0.03	0.57	0.575
Education Attainment (1-5)	-0.47	0.58	-0.04	0.05	-0.80	0.435
Household Income (1-11)	0.02	0.15	0.00	0.03	0.15	0.883
Constant	105.38	11.08			9.51	<0.001
African Americans (Model 5)						
Gender (Women)	-4.90	0.89	-0.13	0.02	-5.51	<0.001
Age (Years)	0.04	0.00	0.43	0.03	12.33	<0.001
Smoking before the measurement	2.90	2.45	0.02	0.02	1.18	0.255
Education Attainment (1-5)	-1.19	0.73	-0.07	0.04	-1.63	0.125
Household Income (1-11)	-0.26	0.18	-0.04	0.03	-1.39	0.184
Constant	111.03	6.34			17.51	<0.001
Other Race / Ethnic Groups (Model 6)						
Gender (Women)	-5.32	2.34	-0.16	0.07	-2.27	0.038
Age (Years)	0.05	0.01	0.47	0.10	4.74	<0.001
Smoking before the measurement	-	-	-	-	-	-
Education Attainment (1-5)	-0.34	1.33	-0.03	0.10	-0.25	0.803
Household Income (1-11)	-0.28	0.60	-0.05	0.11	-0.47	0.647
Constant	107.01	7.82			13.68	<0.001

Outcome: Systolic Blood Pressure, Source: The National Health and Nutrition Examination Survey (NHANES; 2005-2006)

race/ethnicity, discriminates and penalizes racial and ethnic minority groups, education is of lower quality for racial and ethnic minorities, and educational attainment generates far more less income and wealth for minority groups than Non-Hispanic Whites, due to labor market preferences and practice, racism, and discrimination. As a result, there are more educated racial and ethnic minorities who stay poor compared to highly educated non-Hispanic Whites (16, 25, 40). The interpretation of the results requires some caution. The observed effects of race/ethnicity are due to social not biological processes. That means we do not suggest that Whites are innately superior or racial and ethnic minority groups are less efficient in translating their resources into tangible outcomes. Such argument would be racist and blaming the historically oppressed and marginalized groups. The results should be seen with respect of the social and historical conditions that racial and minority groups live in. Relative to Whites, racial and minority groups pay more “tax” for their upward social mobility(41, 42), which reduces the gain of their SEP resources. Being a victim of slavery, racism, discrimination, and segregation, race and ethnic minority status bounds and minimizes the gains from SEP (38). With a similar argument, these diminished returns are due to structural racism rather than culture of poverty (43-52).

To minimize the Minorities’ Diminished Returns (4), there is a need to address segregation, and structural and institutional racism (43-52). Racial and ethnic minorities are experiencing far more societal and structural stressors and barriers in their everyday lives that hinder them from gaining health from their available SEP resources. Instead of their culture, it is the current US social, economic, and political system that continues to fail high SEP minority groups by charging them more psychological and physiological tax before, while, and after they climb the social ladder. US is a race and ethnic aware society, meaning that the process of upward social mobility is not equality facilitated for people of various races (14, 41, 42, 53, 54). The current US political system tends to maximize the gain of socially privileged White group, which comes with minimum gain for other social groups. Recent tax cut of the wealthy is an example

of US policies that have the potential to widen the existing gaps between Whites and non-Whites (46, 49, 52).

As a result, public, social, and economic policies should go beyond eliminating race/ethnic gap in SEP and eliminate diminished returns of SEP. Researchers should consider health disparity as a consequence of both differences in access as well as differences in the effects of SEP resources. Addressing one and ignoring the other would not eliminate disparities. There is a need to jointly address race/ethnicity and SEP, as they operate jointly.

An increase in SEP and education may have smaller impact on improving real life conditions and exposure to environmental risk factors and toxins for minority groups compared to Whites. So, more high SEP minority groups are exposed to environmental exposures (e.g. allergens and tobacco smoke) and stress compared to high SEP Whites. In addition, SEP better reduces behavioral risk factors such as obesity, drinking, smoking, and poor sleep for Whites than other racial and ethnic groups (13, 18, 21, 22, 26, 55-57). A diminished protective effect of education on these behaviors may be one of the many mechanisms by which SEP better reduces SBP for Whites than non-Whites.

Thus, inner-city conditions or low quality of education in minority majority areas and urban locations may partially explain why education attainment better protect health of Whites than other race and ethnic groups (24). Residential segregation is also a major component of systemic and structural racism in the US (44, 46, 49-52, 58, 59).

4.1. Limitations

Our study has several methodological limitations. With a cross-sectional design, no any causal conclusion can be made. While SEP can impact chronic *diseases*, illnesses can also impact downward social mobility and SEP. Thus, possibility of reverse causation cannot be ruled out. This study is prone to measurement bias as it collected SEP data using self-reported data. Although self-report is a common way of capturing data on SEP, validity of self-reported SEP may differ across race/ethnic groups. The study is also prone to omitted confounders. Furthermore,

education attainment and household income are not the only SEP measures that impact health. Wealth, personal income, employment, and occupation may have some impact on SBP. The current study did not have granular data on education attainment and individual income. Some ethnic groups such as American Indians, Asian Americans, and Arab Americans, were collapsed to other race and ethnic groups. We did not measure ethnic heterogeneity between other Hispanic groups. Our study also did not cover contextual and neighborhood factors that may explain differential impact of SEP on SBP. In addition, the data were old (13 years old) and there is a need to replicate our findings using other data sets. Finally, the sample size was imbalanced across various racial and ethnic groups, which has implication for statistical power. Despite these possible limitations, this study still contributes to how race and SEP interact on social patterning of SBP.

5. Conclusions

In the United States, the protective effects of education attainment and household income in terms of lower SBP are smaller for racial and ethnic minority groups such as Mexican Americans and African Americans compared to Non-Hispanic Whites. These patterns are in line with the Minorities' Diminished Returns that are shown for a wide range of SEP indicators, health outcomes, settings, and age groups. As possible causes are multi-level and as structural and institutional racism as well as interpersonal discrimination are involved, the solution should be multi-level. The solution should go beyond equalizing SEP gaps and should address the societal and economic barriers that are rampant in the daily lives of racial and ethnic minority groups across generation and over the life course.

Funding: Shervin Assari is in part supported by the grants H0CMS331621 (the Center for Medicare and Medicaid Services; CMS; PI: M. Bazargan); U54MD007598 (PI: J. Vadgama), and U54TR001627 (PIs: S. Dubinett, and R. Jenders), D084526-03 (National Institute of Child Health and Human Development; NICHD), CA201415 02 (the National Cancer Institute; NCI; Co-PI = Ritesh Mistry), and

DA035811-05 (National Institute on Drug Abuse; NIDA; PI = Marc Zimmerman). Special thanks to Hamid Helmi, Wayne State University, for his help in editing this paper.

Acknowledgments: The author wishes to thank Hamid Helmi at Wayne State University, for his input to this paper.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Link BG, Phelan J. Social conditions as fundamental causes of disease. *J Health Soc Behav.* 1995;Spec No:80-94.
2. Link BG, Northridge ME, Phelan JC, Ganz ML. Social epidemiology and the fundamental cause concept: on the structuring of effective cancer screens by socioeconomic status. *Milbank Q.* 1998;76(3):375-402, 304-5.
3. Phelan JC, Link BG, Tehranifar P. Social conditions as fundamental causes of health inequalities: theory, evidence, and policy implications. *J Health Soc Behav.* 2010;51 Suppl:S28-40.
4. Assari S. Unequal Gain of Equal Resources across Racial Groups. *Int J Health Policy Manag.* 2017;7(1):1-9.
5. Assari S. Health Disparities due to Diminished Return among Black Americans: Public Policy Solutions. *Social Issues and Policy Review.* 2018;12(1):112-45.
6. Merkin SS, Karlamangla A, Crimmins E, Charette SL, Hayward M, Kim JK, et al. Education differentials by race and ethnicity in the diagnosis and management of hypercholesterolemia: a national sample of U.S. adults (NHANES 1999-2002). *Int J Public Health.* 2009;54(3):166-74.
7. Brown DC, Hayward MD, Montez JK, Hummer RA, Chiu CT, Hidajat MM. The significance of education for mortality compression in the United States. *Demography.* 2012;49(3):819-40.
8. Montez JK, Zajacova A, Hayward MD, Woolf SH, Chapman D, Beckfield J. Educational Disparities in Adult Mortality Across U.S. States: How Do They Differ, and Have They Changed Since the Mid-1980s? *Demography.* 2019.
9. Assari S, Caldwell CH, Zimmerman MA. Family Structure and Subsequent Anxiety Symptoms; Minorities' Diminished Return. *Brain Sci.* 2018;8(6).
10. 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).

11. 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).
12. Assari S. Socioeconomic Status and Self-Rated Oral Health; Diminished Return among Hispanic Whites. *Dent J (Basel)*. 2018;6(2).
13. 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).
14. Assari S. Parental Educational Attainment and Mental Well-Being of College Students; Diminished Returns of Blacks. *Brain Sci*. 2018;8(11).
15. Assari S. Educational Attainment Better Protects African American Women than African American Men Against Depressive Symptoms and Psychological Distress. *Brain Sci*. 2018;8(10).
16. Assari S, Preiser B, Kelly M. Education and Income Predict Future Emotional Well-Being of Whites but Not Blacks: A Ten-Year Cohort. *Brain Sci*. 2018;8(7).
17. Assari S, Moghani Lankarani M. Poverty Status and Childhood Asthma in White and Black Families: National Survey of Children's Health. *Healthcare (Basel)*. 2018;6(2).
18. Assari S. Family Income Reduces Risk of Obesity for White but Not Black Children. *Children (Basel)*. 2018;5(6).
19. Assari S, Hani N. Household Income and Children's Unmet Dental Care Need; Blacks' Diminished Return. *Dent J (Basel)*. 2018;6(2).
20. Assari S. Life Expectancy Gain Due to Employment Status Depends on Race, Gender, Education, and Their Intersections. *J Racial Ethn Health Disparities*. 2018;5(2):375-86.
21. 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).
22. Assari S. High Income Protects Whites but Not African Americans against Risk of Depression. *Healthcare (Basel)*. 2018;6(2).
23. Assari S, Caldwell CH. Family Income at Birth and Risk of Attention Deficit Hyperactivity Disorder at Age 15: Racial Differences. *Children (Basel)*. 2019;6(1).
24. Assari S, Lankarani MM. Race and Urbanity Alter the Protective Effect of Education but not Income on Mortality. *Front Public Health*. 2016;4:100.
25. Assari S. Blacks' Diminished Return of Education Attainment on Subjective Health; Mediating Effect of Income. *Brain Sci*. 2018;8(9).
26. Assari S, Thomas A, Caldwell CH, Mincy RB. Blacks' Diminished Health Return of Family Structure and Socioeconomic Status; 15 Years of Follow-up of a National Urban Sample of Youth. *J Urban Health*. 2018;95(1):21-35.
27. Basu S, Millett C. Social epidemiology of hypertension in middle-income countries: determinants of prevalence, diagnosis, treatment, and control in the WHO SAGE study. *Hypertension*. 2013;62(1):18-26.
28. Wang Z, Yue X, Wang H, Bao C, Xu W, Chen L, et al. Relation of socioeconomic status to hypertension occurrence. *Int J Cardiol*. 2014;173(3):544-5.
29. Rahman M, H SE, Islam MJ, Mostofa MG, Saadat KA. Association of socioeconomic status with diagnosis, treatment and control of hypertension in diabetic hypertensive individuals in Bangladesh: a population-based cross-sectional study. *JRSM Open*. 2015;6(10):2054270415608118.
30. Baek TH, Lee HY, Lim NK, Park HY. Gender differences in the association between socioeconomic status and hypertension incidence: the Korean Genome and Epidemiology Study (KoGES). *BMC Public Health*. 2015;15:852.
31. Leng B, Jin Y, Li G, Chen L, Jin N. Socioeconomic status and hypertension: a meta-analysis. *J Hypertens*. 2015;33(2):221-9.
32. Sharma SR, Mishra SR, Wagle K, Page R, Matheson A, Lambrick D, et al. Social determinants of common metabolic risk factors (high blood pressure, high blood sugar, high body mass index and high waist-hip ratio) of major non-communicable diseases in South Asia region: a systematic review protocol. *Syst Rev*. 2017;6(1):183.
33. Owolabi EO, Goon DT, Adeniyi OV, Seekoe E. Social epidemiology of hypertension in Buffalo City Metropolitan Municipality (BCMM): cross-sectional study of determinants of prevalence, awareness, treatment and control among South African adults. *BMJ Open*. 2017;7(6):e014349.
34. McClintock HF, Bogner HR. Incorporating Patients' Social Determinants of Health into Hypertension and Depression Care: A Pilot Randomized Controlled Trial. *Community Ment Health J*. 2017;53(6):703-10.
35. Assari S. Does School Racial Composition Explain Why High Income Black Youth Perceive More Discrimination? A Gender Analysis. *Brain Sci*. 2018;8(8).
36. Assari S, Moghani Lankarani M. Workplace Racial Composition Explains High Perceived Discrimination of High Socioeconomic Status African American Men. *Brain Sci*. 2018;8(8).

37. Assari S, Lankarani MM, Caldwell CH. Does Discrimination Explain High Risk of Depression among High-Income African American Men? *Behav Sci (Basel)*. 2018;8(4).
38. Hudson DL, Bullard KM, Neighbors HW, Geronimus AT, Yang J, Jackson JS. Are benefits conferred with greater socioeconomic position undermined by racial discrimination among African American men? *J Mens Health*. 2012;9(2):127-36.
39. Assari S, Caldwell CH, Mincy RB. Maternal Educational Attainment at Birth Promotes Future Self-Rated Health of White but Not Black Youth: A 15-Year Cohort of a National Sample. *J Clin Med*. 2018;7(5).
40. Assari S. Parental Education Better Helps White than Black Families Escape Poverty: National Survey of Children's Health. *Economies*. 2018;6(2):30.
41. Fuller-Rowell TE, Doan SN. The social costs of academic success across ethnic groups. *Child Dev*. 2010;81(6):1696-713.
42. 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.
43. Krieger N, Williams D, Zierler S. "Whiting out" white privilege will not advance the study of how racism harms health. *Am J Public Health*. 1999;89(5):782-3; author reply 4-5.
44. Krieger N. Epidemiology, racism, and health: the case of low birth weight. *Epidemiology*. 2000;11(3):237-9.
45. Rich-Edwards J, Krieger N, Majzoub J, Zierler S, Lieberman E, Gillman M. Maternal experiences of racism and violence as predictors of preterm birth: rationale and study design. *Paediatr Perinat Epidemiol*. 2001;15 Suppl 2:124-35.
46. Krieger N. Does racism harm health? Did child abuse exist before 1962? On explicit questions, critical science, and current controversies: an ecosocial perspective. *Am J Public Health*. 2003;93(2):194-9.
47. Parrott RL, Silk KJ, Dillow MR, Krieger JL, Harris TM, Condit CM. Development and validation of tools to assess genetic discrimination and genetically based racism. *J Natl Med Assoc*. 2005;97(7):980-90.
48. Krieger N, Smith K, Naishadham D, Hartman C, Barbeau EM. Experiences of discrimination: validity and reliability of a self-report measure for population health research on racism and health. *Soc Sci Med*. 2005;61(7):1576-96.
49. Krieger N. Does racism harm health? Did child abuse exist before 1962? On explicit questions, critical science, and current controversies: an ecosocial perspective. *Am J Public Health*. 2008;98(9 Suppl):S20-5.
50. Krieger N. Living and Dying at the Crossroads: Racism, Embodiment, and Why Theory Is Essential for a Public Health of Consequence. *Am J Public Health*. 2016;106(5):832-3.
51. Bassett MT, Krieger N, Bailey Z. Charlottesville: blatant racism, not grievances, on display. *Lancet*. 2017;390(10109):2243.
52. Bailey ZD, Krieger N, Agenor M, Graves J, Linos N, Bassett MT. Structural racism and health inequities in the USA: evidence and interventions. *Lancet*. 2017;389(10077):1453-63.
53. Assari S. Parental Education Attainment and Educational Upward Mobility; Role of Race and Gender. *Behav Sci (Basel)*. 2018;8(11).
54. Assari S. Race, Intergenerational Social Mobility and Stressful Life Events. *Behav Sci (Basel)*. 2018;8(10).
55. Assari S. Education Attainment and Obesity Differential Returns Based on Sexual Orientation. *Behav Sci (Basel)*. 2019;9(2).
56. Assari S, Lankarani MM. Education and Alcohol Consumption among Older Americans; Black-White Differences. *Front Public Health*. 2016;4:67.
57. Assari S, Nikahd A, Malekahmadi MR, Lankarani MM, Zamanian H. Race by Gender Group Differences in the Protective Effects of Socioeconomic Factors Against Sustained Health Problems Across Five Domains. *J Racial Ethn Health Disparities*. 2016.
58. Muhammad M, De Loney EH, Brooks CL, Assari S, Robinson D, Caldwell CH. "I think that's all a lie...I think It's genocide": Applying a Critical Race Praxis to Youth Perceptions of Flint Water Contamination. *Ethn Dis*. 2018;28(Suppl 1):241-6.
59. Ndobu A, Faure A, Boisselier J, Giannaki S. The ethno-racial segmentation jobs: The impacts of the occupational stereotypes on hiring decisions. *J Soc Psychol*. 2018;158(6):663-79.