Research Article

Non-Hispanic Black Americans' Diminished Protective Effects of Educational Attainment and Employment against Cardiometabolic Diseases: NHANES 1999-2016

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Abstract

Background: While Socioeconomic Status (SES) indicators such as educational attainment and employment are among the major drivers of health and illness, the health returns of SES indicators may differ across racial groups. Built on the Marginalization-Related Diminished Returns framework (MDRs) that refers to weaker health effects of SES indicators for marginalized and minoritized groups than non-Hispanic White people, we conducted this study with two aims: First, to test the association between educational attainment and employment with Cardio Metabolic Diseases (CMDs), and second, to test racial variations in these associations.

Methods: This cross-sectional study used the National Health and Nutrition Examination Survey (NHANES 1999-2016) data. Participants included 29,230 adults who were either non-Hispanic White or non-Hispanic Black. We measured the following: race, demographic factors (age and sex, and marital status), SES (educational attainment and employment), behaviors (smoking, drinking, and exercise), health insurance, and CMDs (diabetes, stroke, hypertension, and congestive heart failure). Weighted Poisson regression models were used in Stata to adjust for the complex sample design of the NHANES. Models without and with interactions were performed in the pooled sample. We also ran race-stratified models.

Results: Overall, high educational attainment and employment showed inverse associations with some CMDs. As documented by statistical interactions between race and our SES indicators, we observed weaker inverse associations between educational attainment and employment with some CMDs. Race-stratified models also confirmed our main analysis; however, the results varied across CMD conditions.

Conclusion: We observed that SES indicators such as educational attainment and employment have differential associations for racial groups. Compared to non-Hispanic White people, non-Hispanic Black people remain at CMDs risk across the full SES spectrum. This finding is in line with the MDRs framework and may be due to the structural racism, social stratification, and marginalization of non-Hispanic Black Americans.

Keywords: Cardiometabolic disease; Diabetes; Stroke; Hypertension; Congestive heart failure; Education; Employment; Socioeconomic status; Population groups

Background

As shown and discussed by Marmot [1,2], Hayward [3-5], Link and Phelan [6], Ross and Miroswky [7-9], and others [10], Socioeconomic Status (SES) indicators such as educational attainment and employment are among the primary drivers of health, including but not limited to Cardio Metabolic Diseases (CMDs) such as diabetes, hypertension, stroke, and heart disease [11]. However, a growing body of research by Kaufman [12], Braveman [13], Shapiro [14,15], Williams [16,17], Ceci [18], and Navarro [19-21] has shown that SES indicators may not be comparable across racial groups; thus, the health effects of SES indicators are not equal across various social groups. To describe this phenomenon, Kaufman referred to a poor overlap between SES of racial groups as well as residual confounding of race due to unmeasured SES indicators [12]. Navarro mentions that "race and SES"-not "race or SES"-influence health disparities, which refers to the complex interplays between race and SES [19-21]. Ceci highlighted the differences between the Haves and the Have-Nots in their capacity to uptake SES indicators [18]. His work argues that when resources become available, Have-Nots may be at a relative disadvantage for turning those resources into outcomes [18]. Assari recently described this phenomenon as a Marginalization-Related Diminished Returns (MDRs) phenomenon [22,23].

The MDRs phenomenon refers to weaker economic and health effects of SES indicators, particularly educational attainment and

employment, for marginalized communities, particularly racial minorities, than for US-born heterosexual non-Hispanic Whites [22,23]. These MDRs are also reported by Ferarro [24], Thorpe [25-27], Hudson [28-30], and others [31]. These studies have all documented weaker effects of SES on health for non-Hispanic Blacks than for non-Hispanic Whites. While other racial and ethnic minorities may also show some similar patterns, these MDRs are most robust for comparing non-Hispanic Blacks than for non-Hispanic Whites [22,23].

While these MDRs hold across SES indicators and health outcomes, they are best described for parental education, education, and income on mortality, self-rated health, and substance use. Less is known about the MDRs of other education and employment on Cardiometabolic Diseases (CMDs). This is important because these MDRs may be more robust for more distant (e.g., education) than proximal social determinants (e.g., employment). This is probably because more social processes can hinder the effects of educational attainment than employment on health [32]. In other terms, by the time individuals have secured employment, they have probably overcome some of the societal injustices. However, educational attainment may not result in the same employment for non-Hispanic Black and non-Hispanic White people because of labor market discrimination [33]. As such, we expect stronger MDRs for educational attainment than for employment. Besides, we expect that some of the MDRs of education to be due to differential employment opportunities, thus controlling for employment may reduce the significance of MDRs due to educational attainment [32].

MDRs framework [22,23] can be regarded as a paradigm shift in health disparities research. While these MDRs are not unknown [22,23] and well-established for education of non-Hispanic Blacks [34,35], they are different from most of the existing literature that has traditionally focused on the role of poverty and low SES as the mechanism for racial health inequalities. Moreover, these MDRs are a paradigm shift because they: (a) seek how economic and health effects of available SES indicators vary across non-Hispanic Whites and non-Blacks, (b) explore racial disparities across the full SES spectrum and allow SES returns to vary by race, (c) use a moderated-mediation rather than a mediation model, (d) test non-linear and non-additive effects of race and SES, which are more realistic than universal average effects, and (e) explain why the racial health gap may widen rather than narrow as SES increases [22,23].

Aims

In response to the gap in the literature, we conducted a secondary multilevel analysis of the National Health and Nutrition Examination Survey (NHANES) to determine the associations between education and employment and CMDs by race. First, we hypothesize inverse associations between educational attainment and employment with CMDs. Second, built on the MDRs framework, we hypothesize that the inverse associations between educational attainment and employment with CMDs would be weaker for non-Hispanic Black than for non-Hispanic White adults. As a result, we expect a high prevalence of CMDs in non-Hispanic Blacks across educational attainment and employment levels. This will be in contrast to non-Hispanic White people for whom the prevalence of CMDs would be low in highly educated and employed individuals.

Materials and Methods

We used the National Health and Nutrition Examination Survey (NHANES) data between 1999-2016 [36]. The NHANES is a cross-sectional survey that provides nationally representative health and nutritional status estimates for the US population. The response rate for this data between 1999-2016 reported 73.2% [37,38]. For this analysis, we included 29,230 individuals who were 20 years old and older. From this number, 31% were non-Hispanic Black, and 69% were non-Hispanic White.

Outcome variable

We used five outcomes. The first four outcome variables included stroke, hypertension, diabetes, and Congestive Heart Failure (CHF). The last outcome was the presence of any CMDs, regardless of their type. We used a dummy variable for each chronic condition if the condition had been diagnosed by a doctor or any other health professional. Following the American Heart Association Guidelines, hypertension has been defined as systolic blood pressure ≥140mmHg or diastolic blood pressure ≥90; the AHA modified hypertension 2017 guidelines are the most recent [39]. But, the NHANES data was collected before 2017. Therefore, in addition to the four mentioned conditions, we created a composite measure, including any of the four conditions.

Main independent variable

The main independent variables of interest were the educational level and employment. Education was defined as a categorical variable (less than high school graduate, high school graduate, or general equivalency diploma, more than high school education or some college and above). Employment was a dummy variable (=1, If the individual was working at a job or business or with a job or business but not at work and =0, if looking for a job or not working at a job or business).

Covariate

For the demographic variables, we included age (years), sex, and marital status (1 = married, 0 = otherwise). For socioeconomic status, we included income ($0-$34,999, 35,000-$74,999 and ≥75,000). We also included a dummy variable: having health insurance (1 = yes; 0 = no). We also controlled for health behavior, including smoking (never smoked, a former smoker or current smoker), drinking (never drink, former drinker, or current drinker), and physical activity (vigorous activity).

Race

The moderator was racial/ethnic group. This was a dichotomous variable (non-Hispanic White = 0 and non-Hispanic Black =1).

Analytic strategy

We used descriptive analysis to compare the mean and proportional differences between non-Hispanic White and non-Hispanic Black people for all four conditions. Demographics, SES, and health behaviors were evaluated using unequal variances t-tests and chi-square. We used the weighted modified Poisson regression analysis [40-42] to produce Prevalence Ratios (PR) and the corresponding 95% confidence intervals (CI) [40,41]. For the first set of analyses, we ran sets of adjusted models. To find the impact of education and employment interaction on CMDs, we ran the 2nd set of

analyses with two interactions between race/ethnicity and education and race/ethnicity and employment status. Finally, for the last set of analyses and because the interaction between race/ethnicity and education and race/ethnicity and employment status were significant (p<0.001), we stratified the analyses by race. All analyses were weighted using the NHANES individual-level sampling weights for 1999-2016 (8 waves of data) to make the estimates representative at the national level for the US civilian population [43]. We considered P-values <0.05 as statistically significant, and all tests were two-sided. We used STATA statistical software version 15 to perform all analyses.

Results

Descriptive data

A total of 29,230 individuals entered our analysis. From all participants, 12.89% (n = 9,023) were non-Hispanic Black and 77.11% (n = 20,207) were non-Hispanic White. The prevalence was diabetes (7.76%), stroke (2.68%), hypertension (14.13%), CHF (2.37%), and any CMDs (22.29%). The mean age of the participants was about 49 years (SD = 11). Of all the participants, 64.87% were employed and 65.11% had education more than a high school degree (Table 1).

Bivariate analysis

As Table 1 shows, non-Hispanic Black participants were younger than non-Hispanic White participants. Education, income, and employment was also higher in non-Hispanic White than non-Hispanic Black participants. The prevalence of smoking and drinking were also different in non-Hispanic Black and non-Hispanic White participants. While non-Hispanic Blacks were more likely to be female than non-Hispanic Whites, non-Hispanic Whites were more likely to be married. Non-Hispanic Black individuals had a higher prevalence than White participants of any CMDs and individual

Table 1: Descriptive Analysis.

	Non-Hispanic White (n = 20,207)		Non-Hispanic Black (n = 9,023)		All (n = 29,230)		*p*-value
	Mean	(SD)	Mean	(SD)	Mean	(SD)	
Age (years) (Mean/SD)	48.64	(11.22)	44.32	(18.5)	48.09	(12.54)	< 0.001
Chronic diseases							
Diabetes %	7.76	(17.79)	12.64	(38.73)	8.39	(20.68)	< 0.001
Stroke %	2.68	(10.73)	3.38	(21.06)	2.77	(12.23)	0.001
Hypertension %	14.13	(23.16)	20.19	(46.78)	14.91	(26.56)	< 0.001
CHF %	2.37	(10.11)	2.95	(19.73)	2.44	(11.51)	0.013
Any of above %	22.29	(27.67)	30.62	(53.71)	23.36	(31.55)	< 0.001
Female %	50.64	(33.24)	53.15	(58.15)	50.96	(37.28)	< 0.001
Married %	66.94	(31.27)	45.07	(57.98)	64.12	(35.77)	< 0.001
Education %							
Less than high school	10.99	(20.79)	23.04	(49.07)	12.54	(24.7)	< 0.001
High school graduate/GED	23.9	(28.35)	25.46	(50.76)	24.11	(31.9)	
More than high school	65.11	(31.69)	51.5	(58.24)	63.35	(35.93)	
Income %							
$0-$34,999	26.79	(29.44)	46.53	(58.13)	29.33	(33.95)	< 0.001
35,000-$74,999	33.8	(31.45)	33.23	(54.89)	33.73	(35.26)	
>=75,000	39.37	(32.48)	19.94	(46.56)	36.86	(35.98)	
Missing, DK, NA	0.04	(1.37)	0.3	(6.35)	0.08	(2.04)	
Covered by health insurance %	87.53	(21.96)	76.54	(49.38)	86.12	(25.79)	< 0.001
Did not have vigorous or Moderate Activities %	37.79	(32.23)	47.92	(58.22)	39.1	(36.39)	< 0.001
Smoking %							
Never smoked	50.19	(33.24)	58.79	(57.36)	51.3	(37.27)	< 0.001
Former smoker	27.92	(29.82)	15.26	(41.9)	26.29	(32.83)	
Current smoker	21.88	(27.49)	25.95	(51.09)	22.41	(31.09)	
Drinking %							
Never drink	9	(19.03)	16.73	(43.49)	10	(22.37)	< 0.001
Former drinker	11.06	(20.85)	17.5	(44.28)	11.89	(24.14)	
Current drinker	79.94	(26.62)	65.78	(55.29)	78.12	(30.83)	
Have a job/business %	64.87	(31.74)	62.02	(56.56)	64.51	(35.68)	0.005

Notes: 1) P-value shows the unequal variances t-tests between NHW and NHB; 2) For the categorical variables (education, income, smoking, and drinking), the p-values show the chi-sq test results. 3) All values have been weighted.

conditions, namely diabetes, stroke, hypertension, and CHF (Table 1).

Pooled sample models

Table 2 shows the regression models in the pooled sample. According to the models without an interaction term (Models 1), age was positively associated with CMDs overall and individual conditions. Female sex was associated with a lower prevalence of any CMD, diabetes, and CHF conditions. Marital status was not associated with any of the outcomes. The year of the study was positively correlated with any CMDs and diabetes and inversely associated with CHF. Being employed was inversely associated with any CMDs as well as with all individual conditions, with hypertension being the only exception. Smoking status was associated with any CMDs as well as with all individual conditions. Not having vigorous physical activity was associated with higher odds of CMDs as well as with all individual conditions. Having health insurance was associated with higher diabetes and stroke and lower odds of hypertension. Drinking status was associated with diabetes and any CMDs, but not with stroke, hypertension, and CHF. High income was associated with lower odds of any CMDs as well as with all individual conditions.

Being employed was associated with lower odds of any CMDs as well as with all individual conditions, with hypertension being the only exception. Higher than high school education was associated with lower odds of any CMDs, diabetes, or CHF but not with stroke and hypertension. According to the models without an interaction term (Models 1), the inverse associations between education and diabetes and CHF were significantly weaker for non-Hispanic Black than for non-Hispanic White individuals. According to this model, the inverse associations between employment and hypertension and any CHFs were significantly weaker for non-Hispanic Black than for non-Hispanic White individuals (Table 2).

Race-stratified models

Table 3 shows regression results specific for each race. For non-Hispanic Whites, there were inverse associations between education higher than high school and diabetes, CHF, and any CMDs. For non-Hispanic Blacks, no association was found between education higher than high school and any of the outcomes. For non-Hispanic Whites, there were inverse associations between employment and all outcomes, with hypertension being the only exception. For non-Hispanic Blacks, there was a positive association between employment

Table 2: Poisson regression estimates overall.

	Models 1					Models 2				
	Diabetes PR/ci95	Stroke PR/ci95	Hyper-tension PR/ci95	CHF PR/ci95	All PR/ci95	Diabetes PR/ci95	Stroke PR/ci95	Hyper-tension PR/ci95	CHF PR/ci95	All PR/ci95
Age (years)	1.03*** [1.03-1.04]	1.04*** [1.03-1.05]	1.05*** [1.05-1.06]	1.05*** [1.05-1.06]	1.03*** [1.03-1.04]	1.03*** [1.03-1.04]	1.04*** [1.03-1.05]	1.05*** [1.05-1.06]	1.05*** [1.05-1.06]	1.03*** [1.03-1.04]
Female	0.77*** [0.69-0.85]	1.01 [0.84-1.22]	0.95 [0.89-1.01]	0.70*** [0.59-0.82]	0.93** [0.89-0.97]	0.77*** [0.69-0.85]	1.01 [0.83-1.22]	0.95 [0.89-1.01]	0.70*** [0.59-0.83]	0.93** [0.89-0.97]
Non-Hispanic Black	1.81*** [1.66-1.96]	1.33*** [1.15-1.55]	1.71*** [1.60-1.83]	1.45*** [1.24-1.69]	1.42*** [1.37-1.48]	1.58*** [1.37-1.83]	1.2 [0.92-1.57]	1.59*** [1.40-1.81]	1.18 [0.94-1.47]	1.32*** [1.23-1.42]
Married	1.04 [0.94-1.15]	1.1 [0.94-1.28]	1.02 [0.94-1.10]	0.9 [0.76-1.05]	1.02 [0.98-1.07]	1.04 [0.94-1.15]	1.1 [0.94-1.28]	1.01 [0.94-1.10]	0.9 [0.76-1.06]	1.02 [0.98-1.07]
Education (Ref. If less than high school)										
High school graduate/GED	0.93 [0.82-1.06]	0.99 [0.82-1.19]	1.09 [1.00-1.20]	0.89 [0.73-1.08]	1.02 [0.97-1.08]	0.9 [0.77-1.05]	0.99 [0.80-1.22]	1.1 [0.98-1.23]	0.81 [0.64-1.03]	1.01 [0.95-1.09]
More than high school	0.89* [0.80-1.00]	0.84 [0.68-1.04]	0.99 [0.91-1.08]	0.81* [0.67-0.99]	0.95* [0.90-1.00]	0.83** [0.72-0.96]	0.79 [0.62-1.02]	0.99 [0.90-1.10]	0.74** [0.59-0.92]	0.93* [0.87-0.99]
Income (Ref. if $0-$34,999)										
35,000-$74,999	0.87* [0.79-0.97]	0.77** [0.66-0.90]	0.98 [0.91-1.05]	0.75** [0.62-0.92]	0.93* [0.88-0.98]	0.88* [0.79-0.97]	0.77** [0.66-0.91]	0.98 [0.90-1.05]	0.76** [0.62-0.92]	0.93* [0.88-0.98]
>=75,000	0.72*** [0.63-0.83]	0.52*** [0.40-0.68]	0.86** [0.77-0.95]	0.42*** [0.31-0.58]	0.80*** [0.75-0.86]	0.73*** [0.64-0.83]	0.52*** [0.40-0.69]	0.86** [0.78-0.96]	0.42*** [0.31-0.58]	0.81*** [0.75-0.87]
Missing, DK, NA	0.26 [0.06-1.07]	0.63 [0.08-4.76]	1.13 [0.48-2.67]	1.63 [0.42-6.27]	0.86 [0.50-1.47]	0.26 [0.06-1.09]	0.62 [0.08-4.69]	1.16 [0.49-2.75]	1.68 [0.43-6.52]	0.87 [0.50-1.52]
Covered by health insurance	1.48*** [1.25-1.76]	1.39* [1.01-1.91]	0.80*** [0.70-0.90]	1.24 [0.85-1.80]	1 [0.91-1.09]	1.48*** [1.24-1.75]	1.39* [1.01-1.91]	0.80*** [0.71-0.91]	1.23 [0.85-1.79]	1 [0.91-1.09]
Did not have vigorous or Moderate Activities	1.42*** [1.28-1.56]	1.48*** [1.24-1.77]	1.09* [1.02-1.17]	1.40*** [1.16-1.69]	1.12** [1.08-1.17]	1.41*** [1.28-1.56]	1.48*** [1.24-1.76]	1.09* [1.02-1.17]	1.40*** [1.16-1.69]	1.12*** [1.08-1.17]
Smoking (Ref. never smoked)										
Former smoker	1.21*** [1.09-1.34]	1.28** [1.09-1.52]	0.99 [0.91-1.07]	1.49*** [1.20-1.84]	1.07* [1.02-1.12]	1.21*** [1.09-1.33]	1.28** [1.08-1.52]	0.99 [0.91-1.07]	1.48** [1.19-1.83]	1.07* [1.02-1.12]
Current smoker	0.97 [0.84-1.12]	1.77*** [1.42-2.22]	1.11* [1.00-1.22]	1.63*** [1.25-2.12]	1.12** [1.04-1.20]	0.97 [0.84-1.12]	1.77*** [1.42-2.21]	1.11* [1.01-1.23]	1.62*** [1.24-2.11]	1.12** [1.04-1.21]
Drinking (Ref. never drunk)										
Former drinker	1.04 [0.89-1.20]	0.88 [0.67-1.14]	1.04 [0.94-1.14]	1.25 [0.95-1.64]	1.03 [0.97-1.09]	1.03 [0.89-1.20]	0.87 [0.67-1.14]	1.04 [0.94-1.14]	1.25 [0.95-1.64]	1.03 [0.97-1.09]
Current drinker	0.75*** [0.65-0.86]	0.81 [0.63-1.03]	0.94 [0.85-1.03]	0.96 [0.75-1.23]	0.90** [0.85-0.96]	0.75*** [0.65-0.86]	0.81 [0.63-1.03]	0.94 [0.85-1.03]	0.96 [0.75-1.23]	0.90*** [0.85-0.96]
Have a job/business	0.81** [0.70-0.92]	0.36*** [0.28-0.46]	1.04 [0.95-1.13]	0.50*** [0.38-0.67]	0.87*** [0.82-0.93]	0.81* [0.69-0.96]	0.35*** [0.27-0.46]	1 [0.90-1.10]	0.54*** [0.39-0.74]	0.84*** [0.78-0.91]
Race x Education										
non-Hispanic Black with high school graduate/GED						1.11 [0.92-1.35]	0.93 [0.64-1.35]	0.95 [0.81-1.12]	1.53* [1.05-2.24]	1 [0.91-1.11]
non-Hispanic Black with more than high school						1.33** [1.10-1.62]	1.37 [0.94-2.00]	0.97 [0.84-1.12]	1.64** [1.15-2.33]	1.07 [0.98-1.17]
Race x Employment										
non-Hispanic Black who has business						0.94 [0.79-1.12]	1.04 [0.70-1.54]	1.24*** [1.10-1.39]	0.67 [0.43-1.03]	1.17*** [1.07-1.28]
N	22,762	23,224	22,550	23,197	23,252	22,762	23,224	22,550	23,197	23,252

*p<0.05, **p<0.01, ***p<0.001. We controlled models for year.

Table 3: Poisson regression estimators by race.

	Non-Hispanic White					Non-Hispanic Black				
	Diabetes PR/CI95	Stroke PR/CI95	Hypertension PR/CI95	CHF PR/CI95	All PR/CI95	Diabetes PR/CI95	Stroke PR/CI95	Hypertension PR/CI95	CHF PR/CI95	All PR/CI95
Age (years)	1.03*** [1.03-1.03]	1.04*** [1.03-1.05]	1.05*** [1.05-1.06]	1.06*** [1.05-1.07]	1.03*** [1.03-1.04]	1.04*** [1.03-1.04]	1.04*** [1.03-1.05]	1.05*** [1.04-1.05]	1.04*** [1.03-1.05]	1.03*** [1.03-1.03]
Female	0.73*** [0.64-0.82]	1 [0.80-1.25]	0.95 [0.88-1.03]	0.66*** [0.54-0.80]	0.92** [0.88-0.97]	0.97 [0.86-1.11]	1.04 [0.81-1.32]	0.94 [0.85-1.03]	0.95 [0.72-1.26]	0.98 [0.91-1.04]
Married	1.02 [0.90-1.16]	1.1 [0.91-1.32]	1 [0.91-1.10]	0.93 [0.77-1.11]	1.02 [0.97-1.07]	1.14* [1.01-1.28]	1.12 [0.87-1.45]	1.07 [0.96-1.19]	0.8 [0.61-1.03]	1.05 [0.98-1.12]
Education (Ref. If less than high school)										
High school graduate/GED	0.91 [0.78-1.06]	0.99 [0.80-1.23]	1.1 [0.99-1.23]	0.83 [0.65-1.05]	1.02 [0.95-1.09]	1 [0.88-1.15]	0.9 [0.66-1.22]	1.02 [0.90-1.15]	1.18 [0.87-1.60]	0.99 [0.92-1.07]
More than high school	0.85* [0.74-0.98]	0.8 [0.62-1.03]	1 [0.90-1.10]	0.76* [0.61-0.95]	0.94* [0.88-1.00]	1.05 [0.91-1.22]	1 [0.75-1.34]	0.94 [0.84-1.06]	1.02 [0.76-1.39]	0.96 [0.90-1.02]
Income (Ref. if $0-$34,999)										
35,000-$74,999	0.84** [0.74-0.96]	0.78** [0.65-0.93]	1 [0.91-1.09]	0.71** [0.57-0.89]	0.93* [0.88-1.00]	1 [0.89-1.13]	0.75 [0.55-1.03]	0.9 [0.80-1.03]	1.03 [0.77-1.38]	0.93 [0.86-1.00]
>=75,000	0.70*** [0.59-0.83]	0.51*** [0.37-0.69]	0.89 [0.79-1.00]	0.38*** [0.26-0.55]	0.80*** [0.74-0.88]	0.82* [0.68-0.99]	0.68 [0.47-1.00]	0.80* [0.66-0.96]	0.88 [0.58-1.33]	0.84** [0.76-0.93]
Missing, DK, NA	0.00*** [0.00-0.00]	1.42 [0.16-12.70]	0.00*** [0.00-0.00]	0.00** [0.00-0.00]	0.34 [0.04-2.69]	0.45 [0.12-1.74]	0.00*** [0.00-0.00]	1.63 [0.80-3.33]	3.37 [0.97-11.64]	1.14 [0.77-1.68]
Covered by health insurance	1.54*** [1.20-1.96]	1.44 [0.95-2.18]	0.84* [0.71-0.99]	1.28 [0.78-2.10]	1.04 [0.91-1.18]	1.31** [1.09-1.58]	1.26 [0.88-1.80]	0.74*** [0.67-0.83]	1.21 [0.76-1.94]	0.94 [0.86-1.02]
Did not have vigorous or Moderate Activities	1.47*** [1.31-1.66]	1.48*** [1.21-1.81]	1.11* [1.02-1.21]	1.37*** [1.10-1.70]	1.14*** [1.08-1.20]	1.16* [1.03-1.32]	1.44** [1.12-1.86]	1.02 [0.93-1.12]	1.47** [1.12-1.93]	1.06 [1.00-1.12]
Smoking (Ref. never smoked)										
Former smoker	1.20** [1.07-1.35]	1.26* [1.04-1.53]	1.01 [0.92-1.11]	1.54*** [1.21-1.95]	1.08** [1.02-1.14]	1.23** [1.06-1.42]	1.48** [1.12-1.95]	0.9 [0.79-1.03]	1.23 [0.85-1.78]	1.03 [0.95-1.12]
Current smoker	0.97 [0.81-1.17]	1.86*** [1.43-2.41]	1.11 [0.98-1.26]	1.78*** [1.29-2.47]	1.13** [1.03-1.24]	0.95 [0.80-1.12]	1.52** [1.15-1.99]	1.11 [0.97-1.28]	1.28 [0.88-1.86]	1.1 [1.00-1.21]
Drinking (Ref. never drunk)										
Former drinker	1.04 [0.86-1.27]	0.77 [0.57-1.06]	1.04 [0.92-1.17]	1.40* [1.02-1.92]	1.02 [0.95-1.10]	0.99 [0.84-1.17]	1.45* [1.00-2.10]	1.03 [0.92-1.17]	0.84 [0.54-1.31]	1.04 [0.97-1.12]
Current drinker	0.73*** [0.61-0.88]	0.77 [0.58-1.02]	0.91 [0.81-1.02]	1.02 [0.75-1.39]	0.89*** [0.83-0.95]	0.84* [0.71-0.99]	1.06 [0.73-1.55]	1.06 [0.94-1.21]	0.89 [0.62-1.27]	0.99 [0.92-1.07]
Employed	0.80* [0.67-0.95]	0.36*** [0.27-0.48]	1.02 [0.92-1.13]	0.59** [0.43-0.83]	0.86*** [0.80-0.93]	0.78*** [0.68-0.90]	0.34*** [0.24-0.49]	1.15** [1.04-1.28]	0.25*** [0.17-0.37]	0.93 [0.85-1.01]
N	**15,862**	**16,165**	**15,757**	**16,148**	**16,190**	**6,900**	**7,059**	**6,793**	**7,049**	**7,062**

*p<0.05, **p<0.01, ***p<0.001. We controlled models for year.

and hypertension in non-Hispanic Black people. For non-Hispanic Blacks, there were inverse associations between employment and diabetes, stroke, CHF, and any CMDs.

Discussion

Educational attainment and employment were associated with lower odds of several CMDs; however, race moderated these associations, and we observed weaker associations for non-Hispanic Black than for non-Hispanic White people. As a result, highly educated and employed non-Hispanic Black people remain at higher-than-expected CMDs risk.

These findings align with some recent observations that the effects of SES indicators, particularly education on obesity, heart disease, and hypertension are weaker for NHB than NHW. These MDRs also hold for chronic diseases [44-46], disability, hospitalization, and mortality. As a result of these MDRs, we observe premature mortality of highly educated and employed non-Hispanic Blacks.

As a result of the existing MDRs, highly educated racial/ethnic minority individuals show worse mental [47], behavioral [48,49], and physical health [17], and underutilize preventive healthcare [50,51]. In addition, poor mental health [52,53], high substance use [49,54,55], poor sleep [56], and poor diet [57] may result in a higher risk of CMDs in highly educated non-Hispanic Black and Hispanic people [32,58].

While most research on this topic has focused on differential effects of education, at least some research was conducted that showed that employment may also be associated with higher health advantages for non-Hispanic Whites than for non-Hispanic Blacks [59,60]. In one study, employment showed higher protection again all-cause mortality during a 25-year follow-up for non-Hispanic Whites than for non-Hispanic Blacks. While the highest life expectancy gain from employment went to highly educated non-Hispanic White men, and non-Hispanic White and non-Hispanic Black women still gained some life expectancy from their employment; non-Hispanic Black men did not show any protection against all-cause mortality from employment. In another study [48], employed non-Hispanic White people reported the lowest rate of smoking. Employed ethnic minority people, however, reported higher smoking [48]. Along the same lines, education has been shown to generate more income, wealth, and financial stability for non-Hispanic Whites than for non-Hispanic Blacks [32,61-63]. In one study, income showed a larger increase over time for non-Hispanic Whites than for non-Hispanic Blacks [64].

Our diminished returns of education and employment are related. As education is more distal than employment, and due to labor market discrimination, education may generate worse employment and occupations for non-Hispanic Blacks than for non-Hispanic Whites; the MDRs of education may be due in part to MDRs of employment. Previous work has also shown diminished health returns of employment [32] for substance use and life expectancy for non-Hispanic Blacks [59] and Hispanics [54,65].

A wide range of structural, social, and behavioral mechanisms may explain these MDRs. It is difficult to decompose the mechanism,

particularly because educational attainment, employment, income, behaviors, and health are all associated, and most of these associations are racialized (weaker for non-Hispanic Black) [22,23]. We propose that highly educated non-Hispanic Blacks work in jobs with lower pay and lower occupational prestige, which are associated with higher stress and exposure to toxins [66]. Racial compositions of jobs may also be associated with discrimination for highly educated non-Hispanic Black employees [67]. As a result, highly educated and employed non-Hispanic Blacks [22,23] remain at risk of economic insecurity [61], stress [68], poor residential areas [69], and low wealth [63]. These complexities suggest that multiple, interwoven, complex social processes may explain why highly educated and employed non-Hispanic Black people remain at behavioral, economic, and health risk.

More research should test whether work conditions and occupational prestige are why education and employment are associated with fewer health returns for non-Hispanic Blacks than for non-Hispanic Whites. More is known about the role of diet, exercise, sleep, and substance use. These behaviors are shown to be worse for highly educated and employed non-Hispanic Black people. What remains unknown is whether work conditions also explain these diminishing returns.

Limitations

This study had a few limitations. First, it used cross-sectional data, so the causal inference is not possible. While the association between employment and CMDs is bidirectional, and poor health can also reduce the likelihood of employment, this is less the case for education. Thus, the results should be interpreted with more caution about the directionality of an employment-health association. Another limitation is that the sample size was much more limited for non-Hispanic Black than for non-Hispanic White people. This is, however, the case in almost any national study. In addition, CMDs were self-reported and were not verified by health claims or laboratory data. Finally, this study did not include some confounders such as sexual orientation, diet, and other proxies of marginalization and determinants of CMDs. Despite these limitations, this paper makes a strong contribution by showing that while MDRs hold for both education and employment, these effects may depend on CMD type.

Implications

The results suggest that to eliminate racial CMDs inequalities, we may need policies beyond poverty elimination and address occupational situations that may equalize the health return of educational attainment and employment by race. Such policies that address social inequalities such as labor market discrimination or differential quality of education are hoped to reduce racial health disparities due to MDRs. This is important because solutions to health disparities due to low returns of educational attainment and employment for non-Hispanic Black people (i.e., MDRs) are different from those due to inadequate education, unemployment, and associated poverty. Thus, unless we develop policies that address MDRs in non-Hispanic Black people, and unless we go beyond poverty elimination to address CMD racial health inequalities, educational attainment and employment may continue to operate as

'a solution' as well as 'a source' of racial health disparities.

Conclusion

As shown here, SES indicators such as educational attainment and employment do not have similar associations with CMDs across racial groups. Highly educated and employed non-Hispanic Black people remain with some additional CMDs risk, a pattern different from their non-Hispanic White counterparts. Thus, racial disparities in CMDs sustain across the full SES spectrum. As proposed by the MDRs, racial health disparities should not be reduced to the problem of poverty, low education, or unemployment. These MDRs may reflect structural racism, social stratification, and marginalization that hinder non-Hispanic Black Americans across SES levels.

Declaration

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