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Original Paper

Minorities' Diminish Returns of Parental Education in Reducing Childhood Body Mass Index

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Abstract

Background: *Considerable research has documented the effects of race and socioeconomic status (SES) on childhood body mass index (BMI) and obesity. However, less is known about the intersectional effects of race and family SES on childhood BMI.*

Purpose: *This study tested racial by SES variation in BMI among American 9-10 years old children. Built on Minorities' Diminished Returns (MDRs), we expected a weaker family SES effect on childhood BMI for non-White than White and children.*

Methods: *For this cross-sectional study, data came from the Children Brain Cognitive Development (ABCD) study, a national multi-center investigation of child development in the US. This study included* 14881 *BMI observations, 9-11-year-old children. The independent variables were family SES (parental education). Moderator was race. The primary outcome was BMI. Age, sex, ethnicity, and parental marital status were the covariates. To analyze the data, we used mixed-effect regression models.*

Results: *High parental education and race were associated with BMI. We found an interaction between race and parental education with non-White children with highly educated parents still having a high BMI.*

Conclusions: *For American children, BMI is shaped by the intersection of race, gender, and family SES. Children from highly educated families remain at risk of high BMI. Disparities in BMI and obesity should be approached through an intersectionality lens.*

Keywords

socioeconomic status, socioeconomic position, body mass index, gender

1. Background

In the United States, marginalization-related diminished returns (MDRs) refer to the weaker effects of socioeconomic status (SES) on outcomes for members of marginalized than non-marginalized groups (Assari, 2017c; Assari, 2018). As a result of MDRs, racial minority children from high SES families remain at risk of poor developmental outcomes (Spera, Wentzel, & Matto, 2009) such as school performance (Spera et al., 2009), mental health (Goodman, Slap, & Huang, 2003), emotion regulation (Morris, Silk, Steinberg, Myers, & Robinson, 2007; Park & Holloway, 2013), aggression (Pabayo, Molnar, & Kawachi, 2014), substance use (Goodman et al., 2003; Wills, McNamara, & Vaccaro, 1995), and depression (Assari & Caldwell, 2018a).

A growing literature has shown MDRs as a significant cause of poor health of middle-class racial minorities (Assari, Boyce, Bazargan, Mincy, & Caldwell, 2019; Assari, Caldwell, & Bazargan, 2019; Assari, C. H. Caldwell, & R. Mincy, 2018a; Assari, C. H. Caldwell, & R. B. Mincy, 2018b; Assari, Thomas, Caldwell, & Mincy, 2018). For example, high SES Black children remain at risk of anxiety (Assari, Caldwell, & Zimmerman, 2018), depression (Assari & Caldwell, 2018a), poor health (Assari, 2018h), poor school performance (Assari, 2019; Assari & Caldwell, 2019b), and engage in high-risk behaviors (Assari et al., 2019), such as aggression (Assari et al., 2019) and tobacco use (Assari & Mistry, 2018; Assari, Mistry, & Bazargan, 2020). Similar diminished returns of family SES in racial minority groups of children (Assari, 2018f, 2018g, 2018h, 2018i; Assari & Moghani Lankarani, 2018a) and shown in the Fragile Families and Child Wellbeing Study (FFCWS) (Assari, 2018f, 2018j; Assari & Caldwell, 2019a; Assari, Thomas, et al., 2018), which has shown high parental education and family income better impact impulsivity, school performance, school bonding, Attention-deficit/hyperactivity disorder (ADHD), obesity, aggression, depression, and self-rated health of White than non-White American children (Assari, 2018f, 2018j; Assari & Caldwell, 2019a; Assari, Thomas, et al., 2018).

The societal and structural causes of these MDRs are partially known. It has been known that high SES racial minority families experience high levels of discrimination (Assari, Lankarani, & Caldwell, 2018). High SES racial minority families also show an increased vulnerability to discrimination (Assari, Preiser, Lankarani, & Caldwell, 2018). Racial minority families with high SES live and work at increased proximity to Whites (Assari, 2018b; Assari & Moghani Lankarani, 2018b), which increases their exposure to discrimination. As a result, there is a positive rather than a negative association between SES and discrimination for non-White families (Assari, 2018b; Assari, Lankarani, et al., 2018; Assari & Moghani Lankarani, 2018b; Hudson et al., 2012; Hudson, Neighbors, Geronimus, & Jackson, 2016; Hudson, Puterman, Bibbins-Domingo, Matthews, & Adler, 2013). As a result, neighborhood (Assari, 2016a) and social contacts (Assari, 2017d) show weaker protective health effects for non-White than White children.

There is also a growing literature on MDRs of family SES on childhood obesity and BMI. A 15 year-follow-up study used the FFCWS data; high family SES at birth reduced BMI of White but not Black children at age 15 (Assari, Thomas, et al., 2018). In another study, a high family income better reduced the BMI of White than Black children (Assari, 2018d). In another study using Health and Retirement Study (HRS), education better reduced BMI for White than Black people (Assari, Nikahd, Malekahmadi, Lankarani, & Zamanian, 2016). Although these findings suggest that SES better reduces the BMI of Whites than Blacks across age groups, there is limited knowledge on whether this pattern applies to all racial groups, or it is only specific to Black people.

To extend the existing knowledge on the MDRs and complexities regarding social determinants of childhood BMI in the US, this study explored race by family SES variation in BMI among 9-10 years old American children. We expected race by SES differences in BMI due to weaker SES effects on BMI for non-White than White children (Assari, 2017c; Assari, 2018; Assari et al., 2019).

2. Methods

2.1 Design and Settings

We conducted a secondary analysis of the ABCD study data (Alcohol Research: Current Reviews Editorial, 2018; Casey et al., 2018; Karcher, O'Brien, Kandala, & Barch, 2019; Lisdahl et al., 2018; Luciana et al., 2018). With a cross-sectional design, we applied data from wave 1 of the ABCD study. ABCD is a national, state-of-the-art brain imaging study of childhood brain development (Alcohol Research: Current Reviews Editorial, 2018; Auchter et al., 2018). The ABCD study's advantages include **a** national sample, a large sample size, a large sample of Blacks and Latinos, available data, robust brain development measures, and considerable socioeconomic factors (Alcohol Research: Current Reviews Editorial, 2018; Casey et al., 2018; Karcher et al., 2019; Lisdahl et al., 2018; Luciana et al., 2018).

2.2 Sample and Sampling

Our analysis unit was 14881 BMIs that belonged to 11,000+ children who had participated in the ABCD study. BMIs were nested to individuals who were nested to families nested to 21 sites (across states). This ABCD sample was primarily recruited through the school systems with sampling (school selection) informed by race, ethnicity, sex, SES, and urbanicity. More details of ABCD sampling are published elsewhere (Garavan et al., 2018). Eligibility criteria for this study were complete data for our study variables, regardless of race, ethnicity, or sex. All participants were children between the ages of 9 and 11 and had valid data on BMI, race, SES, and our confounders.

2.4 Study Variables.

The study variables included race, age, gender, family SES (parental education), parental marital status, and BMI.

2.4.1 Primary Outcome

The primary outcome was BMI, measured rather than self-reported. Children's BMI was measured based on participants' height and weight. Height and weight were measured in feet/inches and pounds, respectively. Measures occurred between two or three times. The ABCD data has already calculated a BMI measure in the DEAP data set. After converting height and weight to meters and kilograms, BMI is calculated by dividing weight (kilograms) by height squared (meters squared). In this study, each individual could have one or two BMI observations. If present, the 2nd BMI measurement one was one year later than the baseline measurement. Given the observations' nested nature, we ran models that allow adjustment for the data's non-independence (nested) nature.

2.4.2 Moderator

Race. Race, self-identified, was a nominal variable: Black, Asian, Other/Mixed, and White (reference).

Independent Variable

Parental educational attainment. Parents reported their years of schooling. This variable was operationalized as a categorical variable: Less than high school diploma (reference), high school diploma, some college, college graduation, graduate-level education.

2.4.3 Confounders

Age. Age was a continuous measure in months. Parents reported the age of the children.

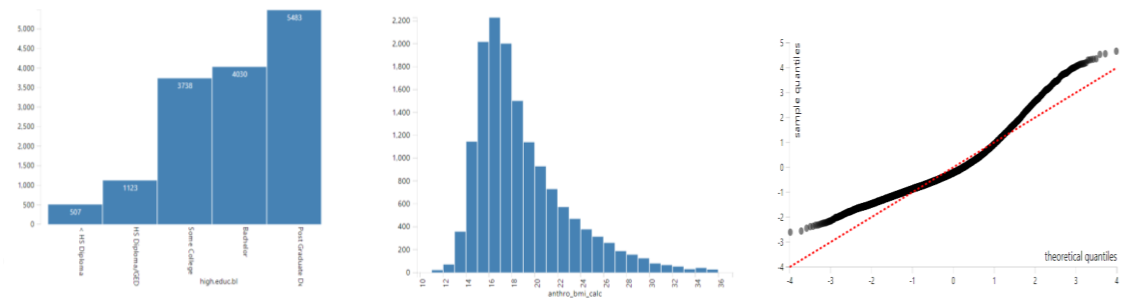
Sex. Sex was 1 for males and 0 for females.

Parental marital status. Parental marital status was 1 for married and 0 for any other condition (reference).

Ethnicity. Parents were asked if they are of Latino ethnic background. This variable was coded as = 1 for Latino and 0 for non-Latino.

2.5 Data Analysis

*W*e used the Data Analysis and Exploration Portal (DEAP) for data analysis. Frequencies (n and %) and mean [standard deviations (SDs)] were reported to describe the variables in the pooled sample and by race. We used the ANOVA test and Chi-square in the pooled sample to estimate bivariate analyses between the study variables. To perform our multivariable analyses, we performed mixed-effect regression models. Figure 1 shows the distribution of our independent variable, dependent variable, and the assumption test for our regression model. The independent variable was the family SES (parental education). The outcome was BMI. All these models controlled for ethnicity, age, sex, and parental marital status. All models were performed in the pooled sample. *Model 1* did not have interaction effects. *Model 2* was performed with interaction terms between parental education and race. Unstandardized regression coefficient (b), SE, and p-values were reported for each model. A p-value of equal or less than 0.05 was significant.



(a) (b) (c)

Figure 1. Distribution of Our Independent Variable (a), Dependent Variable (b), and Quantiles

2.6 Ethical Aspect

Our analysis was exempt from a full review. However, the ABCD study protocol was approved by the University of California, San Diego (UCSD) Institutional Review Board (IRB) (Auchter et al., 2018).

3. Results

3.1 Descriptives

The sample included 14881 BMI observations from 9-11 years old children. Table 1 presents the descriptive statistics of the pooled sample and also by race. White children had the highest income and parental education, and Black children had the lowest parental education and income.

Table 1. Descriptive Data Overall (*n* = 14881)

Level	Overall	All	White	Black	Asian	Other/Mix	
N		14881	10188	1919	335	2439	p
		n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	
Race	White	10188 (68.5)	10188 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	< 0.001
	Black	1919 (12.9)	0 (0.0)	1919 (100.0)	0 (0.0)	0 (0.0)	
	Asian	335 (2.3)	0 (0.0)	0 (0.0)	335 (100.0)	0 (0.0)	
	Other/Mixed	2439 (16.4)	0 (0.0)	0 (0.0)	0 (0.0)	2439 (100.0)	
Ethnicity	Non- Hispanic	12135 (81.5)	8517 (83.6)	1823 (95.0)	307 (91.6)	1488 (61.0)	< 0.001
	Hispanic	2746 (18.5)	1671 (16.4)	96 (5.0)	28 (8.4)	951 (39.0)	
Sex	Female	7129 (47.9)	4792 (47.0)	958 (49.9)	174 (51.9)	1205 (49.4)	0.014
	Male	7752 (52.1)	5396 (53.0)	961 (50.1)	161 (48.1)	1234 (50.6)	
Married family	No	4353 (29.3)	2085 (20.5)	1301 (67.8)	48 (14.3)	919 (37.7)	< 0.001
	Yes	10528 (70.7)	8103 (79.5)	618 (32.2)	287 (85.7)	1520 (62.3)	
Household income	< 50K	4042 (27.2)	1829 (18.0)	1214 (63.3)	47 (14.0)	952 (39.0)	< 0.001
	50-100K	4348 (29.2)	3136 (30.8)	457 (23.8)	78 (23.3)	677 (27.8)	

	> =100K	6491 (43.6)	5223 (51.3)	248 (12.9)	210 (62.7)	810 (33.2)	
Parental Education	< High school Diploma	507 (3.4)	209 (2.1)	138 (7.2)	7 (2.1)	153 (6.3)	< 0.001
	HS Diploma/GED	1123 (7.5)	463 (4.5)	409 (21.3)	2 (0.6)	249 (10.2)	
	Some College	3738 (25.1)	2139 (21.0)	764 (39.8)	26 (7.8)	809 (33.2)	
	Bachelor	4030 (27.1)	3072 (30.2)	302 (15.7)	88 (26.3)	568 (23.3)	
	Post Graduate Degree	5483 (36.8)	4305 (42.3)	306 (15.9)	212 (63.3)	660 (27.1)	
		mean (SD)	**mean (SD)**	**mean (SD)**	**mean (SD)**	**mean (SD)**	
Age (Months)		122.81 (9.57)	123.17 (9.67)	121.57 (8.89)	123.61 (9.90)	122.19 (9.52)	< 0.001
Body Mass Index (BMI)		18.87 (3.99)	18.45 (3.66)	20.64 (4.90)	17.86 (3.20)	19.36 (4.20)	< 0.001

3.2 Pooled-Sample: Main Effects Associations

Table 2 reports the results of a pooled sample regression model. *Model 1*, which only included the main effects, showed that high parental education was associated with lower BMI levels (Figure 2).

Table 2. Mixed Effect Regressions on the Effects of Parental Education and Race on Childhood Body Mass Index (BMI)

	Estimate	Std. Error	t value	Pr(> | t|)	sig
High School Diploma/GED	-0.006	0.24196	-0.02	0.98032	
Some College	-0.6126	0.2213	-2.77	0.00564	* *
Bachelor	-1.325	0.2353	-5.63	< 1e-6	* * *
Graduate Degree	-1.5271	0.23829	-6.41	< 1e-6	* * *

**p<0.01, ***p<0.001

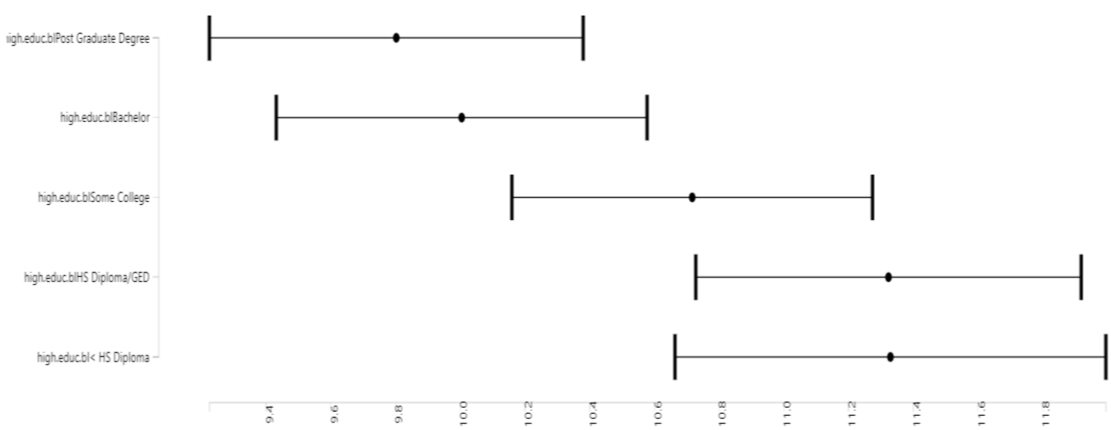


Figure 2. Association between Parental Education and Childhood Body Mass Index

3.2 Pooled-Sample: Interactional Effects Associations

Table 3 reports the results of *Model 2*. This model showed that parental education and race interact, meaning that the effect of parental education on BMI was weaker for non-White than White children (Figure 3).

Table 3. Mixed Effect Regressions on the Intersectional Effects of Parental Education and Race on Childhood Body Mass Index (BMI)

	Estimate	Std. Error	t value	Pr(> | t|)	Sig
High School Diploma/GED	-0.63912	0.38716	-1.65	0.098803	#
Some College	-1.23821	0.34603	-3.58	0.0003468	* * *
Bachelor	-2.14576	0.35160	-6.10	< 1e-6	* * *
Graduate Degree	-2.27272	0.35186	-6.46	< 1e-6	* * *
Race (Black)	0.22455	0.48852	0.46	0.6457643	
Race (Asian)	-2.25539	1.52694	-1.48	0.1396797	
Race (Mixed/Other)	-0.84062	0.47709	-1.76	0.078096	#
Black × High School Diploma/GED	1.18221	0.56689	2.09	0.0370474	*
Black × Some College	0.84421	0.51937	1.63	0.1040927	
Black × Bachelor	1.66779	0.55829	2.99	0.0028191	* *
Black × Graduate Degree	1.39006	0.55810	2.49	0.0127602	*
Asian × High School Diploma/GED	0.29965	3.08653	0.10	0.9226627	
Asian × Some College	1.32695	1.77688	0.75	0.4552067	
Asian × Bachelor	2.50253	1.59896	1.57	0.1175797	
Asian × Graduate Degree	1.76772	1.56119	1.13	0.2575298	
Mixed/Other Race × High School Diploma/GED	0.68677	0.59286	1.16	0.2467254	
Mixed/Other Race × Some College	1.01157	0.51360	1.97	0.0489071	*
Mixed/Other Race × Bachelor	1.36380	0.52291	2.61	0.0091146	* *
Mixed/Other Race × Graduate Degree	1.17220	0.51609	2.27	0.023143	*

# $p<0.1$, *$p<0.05$, **$p<0.01$, ***$p<0.001$

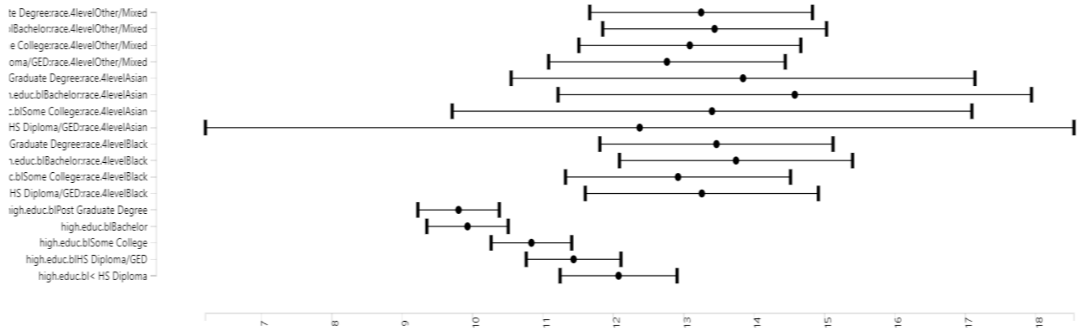


Figure 3. Association between Parental Education and Childhood Body Mass Index by Race

4. Discussion

Although higher family SES (parental education) is associated with a reduced childhood BMI (1st finding), family SES shows a weaker effect for non-White and White children (2nd finding).

Our 1st result is in line with what we know about parental education's role as a social determinant of health in general (Cuevas et al., 2020; Williams, 1999) and obesity in particular (Chaparro & Koupil, 2014; Cook & Tseng, 2019; Eidsdottir, Kristjansson, Sigfusdottir, Garber, & Allegrante, 2013; Elinder, Heinemans, Zeebari, & Patterson, 2014; Lamerz et al., 2005; Matthiessen et al., 2014) Marmot (2005), Singh-Manoux, Richards and Marmot (2005), Stringhini et al. (2018), Link and Phelan (1995, 2009), Phelan, Link, Diez-Roux, Kawachi and Levin (2004), Mirowsky and Ross (2015), Ross and Mirowsky (2011) and many other investigators (Cuevas et al., 2020; Williams, 1999) have theorized and discussed the effects of SES indicators such as parental education on health outcomes of various age groups. An extensive research body has also linked high SES to lower BMI across age groups (Ahmad, Zulaily, Shahril, Syed Abdullah, & Ahmed, 2018; Arias et al., 2018; Cook & Tseng, 2019). This effect is partly because high family SES reduces behavioral risk factors of obesity, such as a sedentary lifestyle, poor diet, and fast food intake (de Mestral, Chatelan, Marques-Vidal, Stringhini, & Bochud, 2019; Giskes, Avendano, Brug, & Kunst, 2010; Showell et al., 2017; Stewart-Knox et al., 2012). High family SES also reduces the environmental risk of obesity, as high SES families live in less obesogenic environments (Choi et al., 2016; Crespi, Wang, Seto, Mare, & Gee, 2015; Dulin-Keita, Kaur Thind, Affuso, & Baskin, 2013; Forsyth et al., 2015).

Our 2nd results can be explained through three lenses. First, our finding is a reflection of MDRs. Many studies have shown more significant effects of SES on outcomes for White than Black American children (Assari, 2018c, 2018g, 2018h). For example, family SES has shown larger effects on ADHD (Assari & Caldwell, 2019a), anxiety (Assari, Caldwell, & Zimmerman, 2018), aggression (Assari et al., 2019), tobacco dependence (Assari et al., 2019), school bonding (Assari, 2019b), school performance (Assari, 2019c; Assari & Caldwell, 2019b), obesity (Assari, Thomas, et al., 2018), and health (Assari, Caldwell, & Mincy, 2018b) for White than Black American children. Family SES has also shown a more salient role in shaping White's impulsivity than Black American children (Assari, Caldwell, & Mincy, 2018a).

As a result of this pattern, higher than expected risk of poor self-rated health, obesity, poor mental health, chronic disease, impulsivity, aggression, smoking, and low school performance are observed in high SES Black American children (Assari, 2018f; Assari & Caldwell, 2019a; Assari, Thomas, et al., 2018). These patterns are also called MDRs and seem robust as they hold across SES indicators, outcomes, population groups, birth cohorts, age groups, and settings (Assari, 2017c; Assari, 2018). The findings observed in this analysis, however, did not support MDRs. As shown by this study and previous work (Assari, 2017c), family SES may differently influence the outcomes of Black and White children (Assari, 2018d; Assari & Moghani Lankarani, 2018a), children (Assari, F. X. Gibbons, & R. Simons, 2018), adults (Assari, 2018a), and older adults (Assari & Lankarani, 2016b; Assari, Moghani Lankarani, Caldwell, & Zimmerman, 2016). In an unequal society, parental education (Assari et al., 2019) and their own educational attainment (Assari, 2018j; Assari, 2019a; Assari & Mistry, 2018), employment (Assari & Caldwell, 2018b), marital status (Assari, 2018i), and even coping style (Assari, 2017a; Assari & Lankarani, 2016c) generates unequal outcomes for Blacks and Whites. Regardless of their types, SES resources seem always to generate unequal effects for Blacks and Whites, a pattern that may indicate social stratification, segregation, and deeply rooted societal inequalities (Bailey et al., 2017; Bassett, Krieger, & Bailey, 2017; Krieger, 2000, 2003, 2008, 2016; Krieger, Smith, Naishadham, Hartman, & Barbeau, 2005; Krieger, Williams, & Zierler, 1999; Parrott et al., 2005; Rich-Edwards et al., 2001).

Second is an intersectional perspective (Bowleg, 2008; Carbado, Crenshaw, Mays, & Tomlinson, 2013; Cole, 2009; Strompolis, Tucker, Crouch, & Radcliff, 2019; Viruell-Fuentes, Miranda, & Abdulrahim, 2012). According to an intersectionality framework, social identities such as race, ethnicity, SES, and gender do not have additive but multiplicative effects. History, life experiences, exposures, and vulnerabilities are distinct across groups defined by more than one social identity (Bowleg, 2008; Carbado et al., 2013; Cole, 2009; Strompolis et al., 2019; Viruell-Fuentes et al., 2012). As a result, the intersection of race, SES, and gender shape health through variation in risk factors and vulnerabilities (Assari, 2016b, 2017b; Assari, 2018e; Assari & Caldwell, 2018b; Assari & Lankarani, 2016a).

The third is high exposure to racial and ethnic discrimination in high SES Black families. Racial and ethnic discrimination affect various aspects of health (Chekroud, Everett, Bridge, & Hewstone, 2014; Clark, Miller, & Hegde, 2018; Fourie, Stein, Solms, Gobodo-Madikizela, & Decety, 2019; Han et al., 2020; Phelps et al., 2000; Wheeler & Fiske, 2005). As high SES is a proxy of high not low discrimination (Assari, 2018b; Assari & Caldwell, 2018b; Assari, F. X. Gibbons, & R. L. Simons, 2018; Assari, Lankarani, et al., 2018; Assari & Moghani Lankarani, 2018b; Assari, Preiser, et al., 2018; Hudson et al., 2012; Hudson et al., 2016; Hudson et al., 2013), high SES Black American children still report higher than expected BMI because of the effect of discrimination and stress.

Weaker health effects of family SES indicators for non-White than White families contribute to the transmission of health inequalities (Assari et al., 2019; Assari et al., 2019; Assari, Caldwell, & Mincy, 2018a; Assari, Caldwell, & Mincy, 2018b; Assari, Thomas, et al., 2018). SES's differential effect means the same SES may generate unequal outcomes for the next generation, which means the reproduction of inequalities across generations. However, most of the previous studies on MDRs have relied on self-reported outcomes. Thus, the evidence lacked biological studies that test the differential effects of SES on children's brain imaging. This paper extended the existing literature by testing such patterns on brain development.

5. Conclusions

In summary, in this study with a large national sample, high family SES correlates with lower childhood BMI. However, this protective effect is weaker for non-White than White children. That means childhood BMI is shaped by the intersection of race and SES rather than their separate and independent effects. As such, eliminating the racial and economic disparities in childhood BMI and obesity requires an intersectional approach.

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