



# Structural racism in school contexts and adolescent depression: Development of new indices for the National Longitudinal Study of Adolescent to Adult Health and beyond

Jessica A. Polos<sup>a,b,\*</sup>, Stephanie M. Koning<sup>a</sup>, Taylor W. Hargrove<sup>c</sup>, Kiarri N. Kershaw<sup>d</sup>, Thomas W. McDade<sup>a,e</sup>

<sup>a</sup> Institute for Policy Research, Northwestern University, 2040 Sheridan Road, Evanston, IL, 60208-4100, USA

<sup>b</sup> Public Health Program, DePaul University, 14 East Jackson Boulevard, Chicago, IL, 60604, USA

<sup>c</sup> Department of Sociology, Faculty Fellow, Carolina Population Center, University of North Carolina at Chapel Hill, 155 Pauli Murray Hall, Chapel Hill, NC, 27599-3210, USA

<sup>d</sup> Feinberg School of Medicine, Northwestern University, 680 North Lake Shore Drive, Chicago, IL, 60611, USA

<sup>e</sup> Department of Anthropology, Northwestern University, 1810 Hinman St, Evanston, IL, 60208-1310, USA

## ARTICLE INFO

### Keywords:

Structural racism  
Biosocial  
School contexts  
Life course  
Adolescent depressive symptoms

## ABSTRACT

Racial discrimination is an important predictor of racial inequities in mental and physical health. Scholars have made progress conceptualizing and measuring structural forms of racism, yet, little work has focused on measuring structural racism in social contexts, which are especially relevant for studying the life course consequences of racism for health. Using the National Longitudinal Study of Adolescent to Adult Health, we take a biosocial, life course approach and develop two life stage-specific indices measuring manifestations of structural racism in school contexts in adolescence, a sensitive period of development. The first is a school contextual disadvantage index (CDI), which captures differences in resources and opportunities across schools that have been partly determined by socio-historic structural racism that has sorted Black students into more disadvantaged schools. The second is a school structural racism index (SRI), which measures differences in resources and opportunities between Black and white students within schools. Then, we relate these indices to adolescent depressive symptoms. We find that among both Black and white students of both genders, higher CDI levels are associated with more depressive symptoms. However, Black students are twice as likely to be in schools with a CDI above the median compared to white students. We also find that, controlling for the CDI, the SRI is positively associated with depressive symptoms among Black boys and girls only. Finally, the CDI and the SRI interact to produce a pattern where the likelihood of depressive symptoms increases as the SRI increases, but only among Black boys and girls in low-disadvantage schools. These findings underscore the importance of measuring structural racism in social contexts in multifaceted ways to study life course health inequities.

## 1. Introduction

Racial discrimination consistently predicts racial inequities in health outcomes, including depression, anxiety disorder, hypertension, blood pressure, cancer, poor birth outcomes, and all-cause mortality (Goosby et al., 2015; Lewis et al., 2015; Williams et al., 2019). The bulk of the research linking racial discrimination and health has focused at the level of personally-mediated behaviors and attitudes, entailing, for instance, discriminatory actions against those of another race leading to devaluation (James, 2020). In recent decades scholars have made progress in

theorizing and conceptualizing structural and systemic forms of racism; however, methods of measuring structural racism are still being established (Groos et al., 2018). Given its ubiquity across social systems and social interactions, and the need to bound measures by historical context, domain, space, and time to operationalize it, there is not a single measure to encompass structural racism (Groos et al., 2018; Krieger, 2014). While many scholars have compiled measures of structural racism in particular domains or geographic spaces and related them to health outcomes (Groos et al., 2018), few scholars have measured structural racism in social contexts, a level of aggregation

\* Corresponding author. Master of Public Health Program, DePaul University, 14 East Jackson Boulevard, Chicago, IL, 60604, USA.

E-mail address: [jpolos@depaul.edu](mailto:jpolos@depaul.edu) (J.A. Polos).

<https://doi.org/10.1016/j.ssmph.2022.101237>

Received 15 June 2022; Received in revised form 16 September 2022; Accepted 20 September 2022

Available online 21 September 2022

2352-8273/© 2022 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

relevant to understanding life course health and development.

Using the National Longitudinal Study of Adolescent to Adult Health, we take a biosocial, life course approach and measure the manifestations of structural racism in school contexts during adolescence, a sensitive period of development. To do so, we develop two indices that measure manifestations of structural racism across multiple domains at the school contextual level. First, we develop a contextual disadvantage index that captures variation across schools in absolute student resources and opportunities. We conceptualize this index as capturing, in part though by no means exclusively, manifestations of structural racism attributable to socio-historic structural racism that has concentrated Black students into more disadvantaged schools. Second, we generate a structural racism index that compares the relative balance of resources and opportunities between Black and white adolescents, capturing manifestations of structural racism *within* schools. Then, we investigate whether these indices predict adolescent depressive symptoms independently and interactively using Wave I survey data.

## 2. Background

### 2.1. Structural racism theory and measurement

By one definition, structural racism can be understood as embedded in the interconnected policies, practices, and norms that enable the operation of systemic racism across political, legal, economic, school, and other societal systems (Braveman et al., 2022). This suggests structural racism can be measured as variation or inequities in structures, systems, and institutions, or their manifestations, that produce racially disparate outcomes. Indeed, most work aimed at quantitatively measuring structural racism has aggregated individual-level measures in various domains and at different geographic levels, or within a specific institution. For example, scholars have compared Black and white populations across indicators in multiple state-level domains, e.g., political, economic, and educational, and have used such indicators to create a structural racism index (Brown & Homan, 2022; Lukachko et al., 2014; Mesic et al., 2018). Others have examined the relationship between health outcomes and structurally racialized county-level characteristics or county-level structural racism indicators such as the opportunity for economic mobility, the racial dissimilarity index, and the Black-white ratio of felony incarceration (Chambers et al., 2018; Hargrove & Gaydosch, 2022). Still, others have used residential segregation as a manifestation of historically racist policies and practices (Krieger, 2014; Kershaw et al. 2015). However, this work has tended to overlook or obscure social contexts as places in which structural racism is manifested and operates, despite the relevance of social contexts to understanding health (Visser et al., 2021).

In Bonilla-Silva (1997)'s conceptualization of structural racism, social systems are hierarchically structured by race and differentially distribute rewards accordingly. Moreover, the structure is comprised of the aggregate of social relations and practices based on racial distinctions. This perspective more explicitly links macro-structures to individuals and emphasizes social contexts as important places in which structural racism is reified (Bonilla-Silva, 1997). We build on this perspective also noting that race discrimination structures social contexts and the social connections that occur within them to influence health (Umberson & Montez, 2010). The race discrimination system is also comprised of interlinked subsystems, such that racial disparities are interdependent and mutually reinforcing across subsystems (e.g., education systems, housing markets, labor markets) (Reskin, 2012). This suggests that the impact of racialized social interactions that comprise a social context will not be limited to that context. Indeed, racialized rules are thought to organize racist everyday practices – and hence interactions – across institutions (Gee & Hicken, 2021). Taking these perspectives together, social contexts, as primary places of social interaction, are relevant domains for measuring manifestations of structural racism even when the root causes of those manifestations may have

occurred outside of that context or domain. Further, ecosocial theory suggests that structural racism in social contexts will benefit racially dominant groups as compared to racially minoritized groups, leading to disparities in resources and opportunities that are embodied and manifested as health inequities (Krieger, 2012).

Understanding structural racism in social contexts across specific life stages presents an important complement to the more common measures of geographic context, as it elucidates the relationship between racial inequities and health through a life course lens. For example, a biosocial perspective suggests that health is a result of bidirectional interactions of social factors, which are often stratified at multiple levels, and biological factors across the life course. This perspective conveys that social contexts change across the life course and that the timing of exposure to these contexts is important to the development of human health (McDade & Harris, 2018). This suggests that measuring structural racism in the social contexts most relevant at a particular developmental life stage may be central to understanding its contribution to inequities in life course health.

As individuals progress through the life course, they are exposed to different, potentially discriminatory, institutions that overlap with specific sensitive periods of development, during which they may be particularly vulnerable to adversity and social experiences (Gee et al., 2019). Thus, it is important to conceptualize and test indicators of structural racism specific or most relevant to a given stage of the life course. We argue that manifestations of structural racism within school contexts align well with the adolescent stage of development. We, therefore, introduce measures of structural racism that manifest at the school level and examine their association with adolescent depressive symptoms.

### 2.2. Structural racism in adolescent school contexts

School and family contexts are among the most important contexts for child and adolescent wellbeing, with schools becoming more influential as children develop (Parcel, Dufur and Cornell Zito 2010). Adolescents spend a considerable amount of time in school, which can shape development in various ways. Schools act as both ecological contexts characterized by peer interactions and school climate, and as institutions that have historically segregated students by race and income (Crosnoe & Johnson, 2011; Eccles & Roeser, 2011). Given the significance of school contexts to adolescent wellbeing and development, it is important to study how structural racism manifests in these contexts and its implications in the production of health inequities. We can consider how structural racism manifests in school contexts to influence health inequities in three ways: 1) in the average level of school contextual disadvantage, which is partly structured by socio-historic processes that have concentrated Black students in more disadvantaged schools, 2) through the differential distribution of resources and opportunities among Black students compared to white students within schools, and 3) through the interaction of the average level of school disadvantage and within-school racial inequities in the distribution of resources and opportunities.

First, we examine how structural racism manifests as racialized across-school differences in average levels of contextual disadvantage. Indeed, continued racial segregation has concentrated disadvantage in geographic space (Massey, 1990). For example, Black adolescents tend to be disproportionately exposed to higher levels of school social and economic contextual disadvantage than white adolescents (Boen et al., 2020). Scholars also have linked racialized contextual disadvantage to various domains. Boen et al. (2020), for example, find that schools with a greater proportion of students of color and students of lower socioeconomic status are more likely to be “toxic”, i.e., to have less perceived school safety/more perceived violence, more teacher turnover, and lower school connectedness. Students from more disadvantaged contexts and minoritized students are also more likely to miss school or be chronically absent, in substantial part due to poorer health (U.S.

Department of Education, 2018; Ready, 2010), and also to have reduced life chances (Massey et al., 1991). School socioeconomic status and student race are also associated with increased school suspensions (Anyon et al., 2014; Hemphill et al., 2014).

Building on this work, we measure manifestations of school-level contextual disadvantage in several domains, including school connectedness, disciplinary atmosphere, school attendance, and school quality (e.g., teacher turnover) characteristics. We also consider how structural racism is passed intergenerationally (e.g., through historic racialized inequities in opportunity among students' parents), and is manifested in student background characteristics, such as parent education and parent work patterns. Finally, we measure how contextual disadvantage is manifested in not only objective measures of resources and opportunities, but in students' perceived opportunity structures and life chances.

Second, we consider how structural racism in school contexts is manifested as the inequitable distribution of disadvantage *within* schools based on race. To do so, we compare the mean levels of disadvantage among Black students to the mean levels of disadvantage among white students across the same relevant domains used to measure contextual disadvantage. Third, across-school differences in contextual disadvantage and within-school racial disparities in opportunities and resources can also interact to produce frog pond effects, where racially and economically minoritized students may be at more risk of discrimination if they have more dissimilar peers, leading to disparate outcomes (Crosnoe, 2009).

### 2.3. Racism and depressive symptoms in adolescence

One aspect of health that is particularly consequential during adolescence is depression. Indeed, adolescent depression and depressive symptoms have increased in recent years (Keyes et al., 2019; Mojtabai et al., 2016), raising concern for negative consequences later in life. For example, adolescent depressive symptoms are associated with a higher risk of later life depressive disorders, overweight, (Aalto-Setälä et al., 2002; Liem et al., 2008), reduced educational attainment, and increased unemployment (Clayborne et al., 2019; Fletcher, 2010). The risk of developing depression dramatically increases during adolescence as compared to childhood, and the increased risk is likely partly attributable to heightened vulnerability to stress (Andersen & Teicher, 2008). Additionally, gender differences in depressive symptoms emerge in adolescence, and adolescent girls demonstrate twice the risk of depressive symptoms as do adolescent boys (Andersen & Teicher, 2008).

Racism is a stressor known to be associated with depressive symptoms. Perceived interpersonal ethnic and racial discrimination has been associated with increased risk of depression and depressive symptoms in many studies (Brown et al., 2000; Chen & Mallory, 2021; Karlsen & Nazroo, 2002; Kessler et al., 1999; Mikrut et al., 2022; Noh et al., 1999). In adolescence, perceived racial discrimination is associated with increased depressive symptoms among Black youth, with heterogeneity by gender, age, and ethnicity (Lavner et al., 2022; Seaton et al., 2010). Recent scholarship has begun to examine the association between structural discrimination and depression. It suggests that perceived systemic, or institutional, racial discrimination and residential segregation are positively associated with depression among marginalized groups (Lee, 2009; Ríos-Salas & Larson, 2015; Seaton & Yip, 2009). Moreover, increased risk of exposure to structural adversities, such as low SES in childhood and exposure to stressful life events among racial minorities, and differential responses to structural adversities among girls compared to boys, lead to more depressive symptoms among racial minorities and girls (Adkins et al., 2009). This suggests exposure to structural racism in school might lead to race and gender heterogeneity in depressive symptoms in adolescence.

We extend this small body of work by introducing two novel school-level indices for use in the National Longitudinal Study of Adolescent to Adult Health. The first is the school contextual disadvantage index (CDI), which measures average contextual disadvantage across schools,

which we argue is structured in part by racism in socio-historic processes that have concentrated Black students into more disadvantaged schools. The second is the school structural racism index (SRI), a measure of the distribution of resources and opportunities by race among students within schools. We then ask how these different school contextual indices relate to depressive symptoms. We examine these relationships for race- and gender-based adolescent subgroups as ecosocial theory posits structural racism will lead to inequities in depressive symptoms by race, while scholarship linking structural adversity to adolescent depressive symptoms suggests heterogeneity in outcomes by race and gender.

## 3. Methods

This study uses Wave 1 (W1) data from the National Longitudinal Survey of Adolescent to Adult Health (Add Health), a nationally representative school-based survey with measures encompassing student background characteristics, school contexts, and health outcomes. All W1 surveys in this study were fielded in 1994–1995 when students were aged 11–21. Our outcome variable, depressive symptoms, is from the W1 In-Home Survey (N = 20,745). A feature of the W1 In-Home survey is its oversample of Black students with highly educated parents, giving us additional precision in our estimates of racialized outcomes. This study focuses on self-identified non-Hispanic Black students (N = 3775) and non-Hispanic white students (N = 9589) for a total of 13,364 students with sampling data and data on depressive symptoms (students who self-identified as both Black and white, or biracial, were omitted due to small sample size). Our primary independent variables of interest, whose construction is detailed later, are the CDI and SRI, which use measures from the W1 In-School, In-Home, and School Administrator Surveys. The CDI aggregates school mean variables while the SRI aggregates school Black-white ratio variables. Missingness in the CDI reduces the CDI analytic sample to N = 12,409 and missingness in the SRI reduces the SRI analytic sample size to N = 8500. Missingness in additional covariates (sex, age, grade, and the percentage of Black students in school) further reduces the sample sizes to a final analytic sample of 12,112 in the CDI only analyses and 8020 in SRI analyses (which also drop observations missing the CDI). The CDI and SRI analytic samples differ because the SRI only captures Black-white comparisons and 30 schools with either no Black students (N = 27) or no white students (N = 3) are dropped from this measure and SRI analyses. When limiting CDI-only analyses to the SRI sample (N = 8020), results remain similar.

### 3.1. Dependent variable

Respondents in the Wave I survey were asked 19 out of 20 items from the Center for Epidemiologic Studies Depression Scale (CES-D). However, scholars have demonstrated that the 19-item CES-D is not valid for making comparisons across adolescent racial-ethnic groups in the Add Health Survey (Perreira et al., 2005), which is a key objective of this study. Therefore, we use a 5-item CES-D questionnaire, which was demonstrated to be comparable across racial groups in the Add Health cohort (Perreira et al., 2005). The 5 CES-D items included questions asking respondents “How often was the following true during the past week?: You felt you couldn't shake the blues; You felt depressed; You felt sad; You were happy (reverse-coded); You felt life was not worth living.” Each item was asked on a 4-point scale, ranging from 0 to 3, and points were summed to a maximum total of 15. There is low missingness in each of the CES-D items (<0.5%).

### 3.2. Independent variables (CDI and SRI)

We operationalized the indices for across-school contextual disadvantage and within-school structural racism separately, using distinct sources of variation from variables of overlapping domains where structural racism is manifested. Table 1 describes the variables within

**Table 1**  
Variables in the contextual disadvantage and structural racism indices.

Domain	Variables	Index	Survey
<b>Student Body Background Characteristics</b>	Mother's Education Father's Education	CDI, SRI	In-School
	Mother Works Father Works		
<b>School Connectedness</b>	Feel Close to People Feel Part of School Feel Happy at This School Feel Socially Accepted Feel Safe at School	CDI, SRI	In-School
	Teachers are Fair No Trouble with Teachers No Trouble with Students Students Not Prejudiced		
<b>Perceived Life Chances</b>	Will Live to 35 Will Not Be Killed by 21	CDI, SRI	In-School
	Will Graduate College Will Have Middle Class Income		
<b>Teacher-Student Racial Composition</b>	% Black Teachers - Student Ratio to % White Teacher -Student Ratio	SRI only	In-School and School Administrator
<b>School Attendance</b>	Never Miss School	CDI, SRI	In-School
<b>Disciplinary Atmosphere</b>	Ever Received an Out-of-School Suspension	CDI, SRI	In-Home
<b>School Characteristics</b>	Class Size Teacher Turnover	CDI only	School Administrator
	Percentage of Teachers with a Master's Degree		

each domain and whether they are used to generate the CDI, the SRI, or both. The CDI summarizes harmonized school mean values of the indicated variables as a geometric mean, capturing variation in contextual disadvantage across schools. The SRI summarizes the school Black-white ratio of the indicated variables also as a geometric mean, capturing Black-white inequities in contextual disadvantage within schools. The domains consist of 1) *student body background characteristics*, 2) *school connectedness*, 3) *perceived life chances*, 4) *teacher-student racial composition (SRI only)*, 5) *disciplinary atmosphere*, 6) *school attendance*, and 7) *school quality characteristics (CDI only)*. These domains do not capture all the innumerable ways in which structural racism may be manifesting across and within schools but take advantage of a rich body of data from the Add Health survey to make an approximation.

Within the *student body background characteristics* domain, measures included mother's educational attainment and father's educational attainment and whether students' mothers and fathers worked for pay. The *school connectedness* domain contained survey questions on the frequency during the school year that students had trouble getting along with teachers or trouble getting along with students, as well as how much they agreed with the following statements: felt close to people at school, felt happy to be at this school, felt a part of this school, felt safe in their school, felt socially accepted, felt that students at this school were prejudiced, and felt teachers treated students fairly. Within the *perceived life chances* domain, survey questions asked whether students thought they would live to age 35, be killed by age 21, graduate from college, and have a middle-class income by age 30. Variables in the *student body characteristics*, *school connectedness*, *perceived life chances*, and *school attendance* domains were from the In-School survey of all students enrolled at each school and thus provide an indication of the overall school climate.

The *teacher-student racial composition* domain included a variable to assess teacher racial representation in relation to student racial representation, calculated as the relative percentage of Black teachers to the percentage of Black students divided by the relative percentage of white teachers to the percentage of white students in each school. This variable is only included in the SRI as it is exclusively a race-based comparison. This composite variable was based on self-reported race measures in the In-School Survey, which we used to calculate school mean student racial composition, as well as measures of teacher racial composition from the School Administrator Survey. The *disciplinary atmosphere* domain consisted of a variable that asked whether students had ever received an out-of-school suspension. The *school attendance* domain contained a

variable measuring how often a health or emotional problem caused a student to miss school. Finally, the *school characteristics* domain contained measures of class size, the percentage of teachers with a Master's degree or higher, and the proportion of teachers that have been at the school 5 or more years. *School characteristics* measures were not available by race, so could not be part of the SRI, but they provide important insight into institutional inequities across schools. They are therefore included only in the contextual disadvantage index. Details on the scales of each item can be found in Table S1 of the Online Supplement.

### 3.2.1. Contextual disadvantage index construction

The CDI was calculated based on the variables from all domains except *teacher-student racial composition*. To calculate the CDI, some variables were reverse coded to ensure all items were in the same direction, with higher values signifying more contextual advantage in the input variable. Then, In-School and In-Home survey variables were collapsed to generate school-level means. Details on the process of collapsing and merging are in the Online Supplement and Table S2 summarizes the input variables prior to collapsing.

To aggregate the school-level variables into a single index, we first standardized the scales of the 22 variables by creating quintile measures of each. Then, based on Equation (1), we generated the geometric mean for each school by multiplying the 22 quintile values of each variable in each school,  $x_{is}$ , and taking the 1/22-root of the product, where  $n$  is the total number of quintile variables in the index. Thus, the geometric mean for contextual advantage ranges from 0 to 5.

$$\left( \prod_{i=1}^n x_{is} \right)^{1/n} = \sqrt[n]{x_1 x_2 \dots x_n} \tag{1}$$

We constructed the geometric mean because we do not consider the variables in our index to be fully compensatory, meaning that a surplus in the value of one variable is unlikely to fully outweigh a deficit in the value of another variable when considering their effects on adolescent health and wellbeing (OECD, 2008). For example, we consider that any reductions in depressive symptoms due to low values of student prejudice will not fully compensate for the increases in depressive symptoms due to lower average maternal education level. Geometric means are semi-compensatory and allow us to consider this theoretical distinction, whereas arithmetic means commonly used in the construction of indices do not, as they are fully compensatory.

After generating the geometric mean, we reversed it and subtracted

one to generate the CDI, which ranges from 0 to 4, with higher values representing more disadvantage. Then, we merged the CDI to the W1 In-Home Survey data, which contains our outcome variable, by school identifier. In analyses in which we examine how the CDI interacts with the SRI to influence depressive symptoms, we used a dichotomous version of the CDI variable with the CDI median as the threshold for defining low- and high-disadvantage schools.

### 3.2.2. Structural racism index construction

The school SRI is comprised of school Black-white ratio variables generated from the first 6 domains listed, omitting the school characteristics domain as these did not differ by race. To construct the school SRI, we first calculated the weighted school-level mean values of each variable by race in each of the Wave I In-School and In-Home surveys and then used these to generate school-level Black-white ratios for each variable. We merged the ratio variables from each survey by school identifier, normalized the ratio variables (detail in the Online Supplement), and then calculated the geometric mean as in Equation (1), but where  $x_{is}$  denotes the ratio variables and  $n$  is the total number of ratio variables in the index, 20. Table S3 presents the ratio variables prior to aggregation in the SRI. After generating the geometric mean for each school, we reversed the scale and multiplied by 100, such that higher values of the SRI correspond with greater racial inequity, i.e., greater structural racism, on a scale from 1 to 100. Then, we additionally merged the SRI to the W1 In-Home Survey data by school identifier.

### 3.2.3. Missingness in the index input variables

It is important to note that missingness due to item non-response and attrition in the In-School and In-Home Surveys could create measurement error in both indices to varying degrees. Using appropriate weights in generating the school mean variables alleviates some of the bias due to attrition or survey non-response (Chen & Harris, 2020); however, item non-response remains a concern. By generating our indices based on weighted means, we in effect impute missing values as the mean value for each school or school-by-race subgroup.

### 3.3. Moderators

In all models, we included race (non-Hispanic Black/non-Hispanic white) and biological sex (male/female) as interaction terms. We consider biological sex to encompass both elements of biological sex and socially constructed gender. We also understand race and gender categories as socially constructed identifiers that signify larger systems of oppression that may moderate individual-level impacts of structural racism and school disadvantage. We used self-reported race from W1 In-Home Survey, based on students' responses to "What is your race?" with the option to check all response categories that apply: "white", "black or African American", "Native American or American Indian", "Asian or Pacific Islander", or "other". We only included respondents who self-identified as white or Black or African American. We further limited the study sample to respondents who did not self-identify as Hispanic in a separate question regarding ethnicity. Our gender measure is based on the W1 In-Home survey interviewer confirmed biological sex as reported initially in the In-School survey.

### 3.4. Covariates

We control for student age, grade level, and the proportion of Black students in each school. Age is constructed from the W1 Survey based on reported month and year of birth in relation to the month and year of the survey. Grade level is as reported in the W1 Survey. We generated the proportion of Black students in each school by collapsing self-reported Black only race from the In-School survey data by school. Covariates are not included in initial models in each analysis but are included in subsequent models.

### 3.5. Statistical analysis

First, we use weighted linear regression models to measure the association between the CDI, interacted with race and gender, and depressive symptoms as in Equation (2).

$$Depressive\ Symptoms_{is} = \beta_0 + \beta_1 X_{is} + \beta_2 CDI_s + \beta_3 CDI_s X_{is} + \dots + C_i + \epsilon_{is} \quad (2)$$

where  $Depressive\ Symptoms_{is}$  are the total of the responses based on the 5-item CES-D scale,  $X_{is}$  is a vector of individual race and gender,  $CDI_s$  is the school contextual disadvantage index, and  $C_i$  is a vector of controls including age, grade and the percentage of Black students in each school. Model 1 examines the unadjusted association between the CDI and depressive symptoms fully interacted with race and gender identities, and Model 2 adds the control variables.

Next, we examine the relationship between within-school racial differences in resources and opportunities, measured with the SRI, and race and gender differences in depressive symptoms, first unadjusted and then building in control variables. We achieve this by regressing the SRI, interacted with race and gender, on depressive symptoms per Equation (3).

$$Depressive\ Symptoms_{is} = \beta_0 + \beta_1 X_{is} + \beta_2 SRI_s + \beta_3 SRI_s X_{is} + \dots + \beta_4 CDI_s + C_i + \epsilon_{is} \quad (3)$$

Model 1 measures the unadjusted association between the SRI and depressive symptoms where the SRI is fully interacted with race and gender identities,  $X_{is}$ . Model 2 builds in the control variables  $C_i$ , which again include age, grade, and the percentage of Black students in each school, while Model 3 additionally controls for school contextual disadvantage,  $CDI_s$ .

Finally, we investigate how across-school contextual disadvantage (CDI) and within-school structural racism (SRI) interactively associate with depressive symptoms by race and gender. We measure the association between the dichotomized contextual disadvantage index,  $diCDI_s$ , interacted with the SRI, race, and gender, and depressive symptoms as in Equation (4).

$$Depressive\ Symptoms_{is} = \beta_0 + \beta_1 X_{is} + \beta_2 SRI_s + \beta_3 diCDI_s + \beta_3 SRI_s diCDI_s X_{is} + \dots + C_i + \epsilon_{is} \quad (4)$$

Model 1 estimates an unadjusted model and Model 2 builds in controls for age, grade, and the percentage of Black students in each school,  $C_i$ .

## 4. Results

### 4.1. Measures of structural racism

Summary statistics for the input variables for the CDI and SRI are found in Tables S2 and S3, respectively, of the Online Appendix, along with a brief description. Descriptive statistics for the school CDI, SRI, and covariates are presented in Table 2, for the total samples and broken down by the dichotomized CDI measure, with low or high disadvantage schools being at or below and above the median CDI, respectively. Higher levels of the CDI signify more school disadvantage and higher levels of the SRI signify more within-school structural racism. Schools with higher levels of disadvantage have over double the percentage of Black students as schools with lower levels of disadvantage. Additionally, mean values of the SRI are highest in low disadvantage schools, which also have a lower percentage of Black students. Depression scale scores are higher among students in schools with high contextual disadvantage. Additional descriptive statistics by race, gender, and level of contextual disadvantage are presented in Table S4.

**Table 2**  
Descriptive statistics by level of school disadvantage.

	Low School Contextual Disadvantage			High School Contextual Disadvantage			Total		
	Mean	SE	N	Mean	SE	N	Mean	SE	N
School Contextual Disadvantage Index	1.872	0.064	6927	2.962	0.061	5185	2.309	0.067	12,112
School Structural Racism Index	14.858	1.443	4617	11.851	1.240	3403	13.559	0.982	8020
CES-D 5 Item Depression Scale	2.178	0.048	6927	2.728	0.042	5185	2.398	0.044	12,112
Age	15.173	0.164	6927	15.872	0.193	5185	15.453	0.130	12,112
Grade Wave 1	9.231	0.166	6927	9.780	0.199	5185	9.451	0.130	12,112
School-level Percent Black	0.086	0.020	6927	0.211	0.042	5185	0.136	0.020	12,112

Notes: Initial summary statistics for Wave 1 predictors and controls, by level of school contextual disadvantage and total, where low disadvantage schools are those at or below the median and high disadvantage schools are those above the median. The CDI ranges from 0 to 4, with higher values representing more contextual disadvantage. The SRI ranges from 0 to 100, with higher values representing more within-school structural racism.

Source: Authors' calculations from Add Health Data Wave 1 In-School, In-Home, and Administrator Surveys.

**Table 3**  
Average marginal effects estimates of CDI on depressive symptoms, by race and gender.

VARIABLES	(1)	(2)
White Girls	0.374*** (0.099)	0.285*** (0.098)
White Boys	0.352*** (0.059)	0.270*** (0.052)
Black Girls	0.515** (0.231)	0.442* (0.225)
Black Boys	0.231* (0.117)	0.204* (0.115)
Observations	12,112	12,112
Controls	No	Yes

Standard errors in parentheses. \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

Notes: Model 1 reports marginal effects estimates of the regression of the CDI on depressive symptoms by race and gender. Model 2 additionally includes controls for age, grade at the time of the Wave 1 In-Home survey, and the school percentage of Black students. Regressions accounted for sampling design by including weights (gswgt1) and strata (region) and clusters (psuscid).

Source: Authors' calculations from Add Health Data Wave 1 In-School, In-Home, and Administrator Surveys.

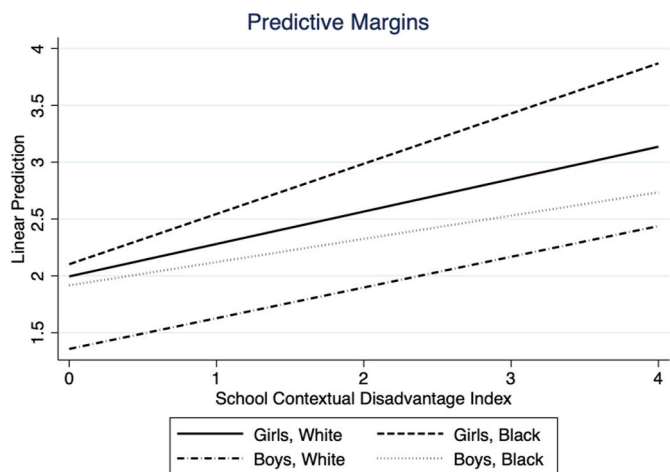
4.2. Relationship between the CDI and depressive symptoms

Marginal effect estimates based on the regression of depressive symptoms on the CDI are presented in Table 3. After introducing our controls, a 1-point increase in the CDI is associated with a 0.285-point

(p < 0.01), 0.270-point (p < 0.01), 0.442-point (p < 0.1) and 0.204-point (p < 0.1) increase in the depressive symptoms scale among white girls, white boys, Black girls, and Black boys, respectively. Marginal differences among Black girls are markedly larger than among other groups. Fig. 1 shows the average marginal comparisons of Model 2, which include controls for age, grade, and the percentage of Black students in schools. Among Black girls, for instance, Fig. 1 demonstrates that moving from school contexts with the lowest disadvantage to the highest disadvantage is associated with an approximately 2-point increase in depressive symptoms in this group.

4.3. Relationship between the SRI and depressive symptoms

Table 4 shows the marginal effects estimates based on the regression of depressive symptoms on the school SRI. Results suggest a modest positive relationship between the SRI and depressive symptoms for Black boys and girls, a slight negative relationship for white girls, and null results for white boys, though none of the marginal comparisons reach statistical significance. For example, a 1-point increase in the SRI is associated with a 0.022-point increase in the depressive symptoms scale in Black girls. Fig. 2 presents the results of Model 3 and demonstrates, for instance, that if Black girls were to hypothetically change from a school context with no within-school structural racism, to one with the highest SRI in the sample (approximately 40), their depressive symptoms would increase by just under 1 point on average.



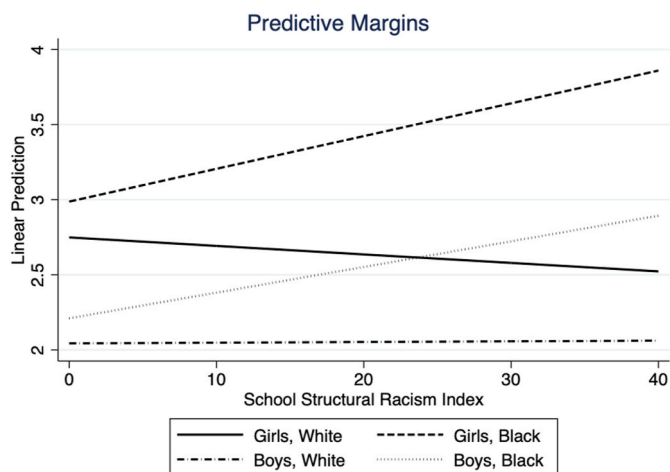
**Fig. 1.** Predicted Level of Depressive Symptoms across Levels of the School CDI, by Race and Gender. Notes: Fig. 1 reflects the predicted level of depressive symptoms based on Model 2 in Table 3, which reports marginal effects from the regression of the CDI on depressive symptoms, interacted with race and gender and controlling for age, grade at the time of the Wave 1 In-Home survey, and the school percentage of Black students. Source: Authors' calculations from Add Health Data Wave 1.

**Table 4**  
Average marginal effects estimates of SRI on depressive symptoms, by race and gender.

VARIABLES	(1)	(2)	(3)
White Girls	-0.008 (0.009)	-0.009 (0.008)	-0.006 (0.009)
White Boys	-0.003 (0.007)	-0.004 (0.006)	0.000 (0.005)
Black Girls	0.019 (0.025)	0.020 (0.025)	0.022 (0.019)
Black Boys	0.012 (0.014)	0.011 (0.016)	0.017 (0.015)
Observations	8020	8020	8020
Controls	No	Yes	
Controls + CDI			Yes

Standard errors in parentheses. \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

Notes: Model 1 reports marginal effects estimates of the regression of depressive symptoms on the SRI by race and gender. Model 2 additionally includes controls for age, grade at the time of the Wave 1 In-Home survey, and the school percentage of Black students. Model 3 additionally includes the controls from Model 2 as well as a control for the school CDI. Regressions accounted for sampling design by including weights (gswgt1) and strata (region) and clusters (psuscid). Source: Authors' calculations from Add Health Data Wave 1 In-School, In-Home, and Administrator Surveys.



**Fig. 2.** Predicted Level of Depressive Symptoms across Levels of the School SRI, by Race and Gender. Notes: Fig. 2 reflects the predicted level of depressive symptoms based on Model 3 in Table 4, which reports marginal effects from the regression of depressive symptoms on the SRI, interacted with race and gender and controlling for age, grade at the time of the Wave 1 In-Home survey, the school percentage of Black students, and the CDI. Source: Authors' calculations from Add Health Data Wave 1.

**Table 5**

Average marginal effects estimates of SRI on depressive symptoms, by race, gender, and school disadvantage.

VARIABLES	(1)	(2)
White Girls, Low School Disadvantage	0.002 (0.010)	-0.001 (0.009)
White Girls, High School Disadvantage	-0.018 (0.016)	-0.020 (0.016)
White Boys, Low School Disadvantage	0.008 (0.008)	0.006 (0.007)
White Boys, High School Disadvantage	-0.010 (0.010)	-0.015* (0.008)
Black Girls, Low School Disadvantage	0.066 (0.040)	0.071** (0.034)
Black Girls, High School Disadvantage	-0.004 (0.018)	-0.006 (0.019)
Black Boys, Low Schools Disadvantage	0.022 (0.026)	0.042* (0.023)
Black Boys, High School Disadvantage	0.010 (0.015)	0.001 (0.018)
Observations	8020	8020
Controls	No	Yes

Standard errors in parentheses. \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

Notes: Model 1 reports marginal effects estimates of the regression of depressive symptoms on the SRI interacted with the CDI, by race and gender. Model 2 additionally includes controls for age, grade at the time of the Wave 1 In-Home survey, and the school percentage of Black students. Regressions accounted for sampling design by including weights (gswgt1) and strata (region) and clusters (psuscid).

Source: Authors' calculations from Add Health Data Wave 1 In-School, In-Home, and Administrator Surveys.

#### 4.4. Relationship between the interaction of the SRI and CDI and depressive symptoms

Table 5 presents the marginal effects estimates based on the regression of depressive symptoms on the interaction of the SRI, the dichotomous CDI variable, race, and gender. Fig. 3 presents the associations from Model 2 of this analysis, which controls for age, grade, and the percentage of Black students in each school. Most striking are the results for Black girls and boys, where there is a large and statistically significant positive association between the SRI and depressive symptoms among those in low disadvantage contexts. For instance, in low

disadvantage contexts, a 1-point increase in the SRI is associated with a 0.07-point increase (p < 0.05) in the depressive symptom scale for Black girls and a 0.04-point (p < 0.1) increase for Black boys. Modest negative relationships between the SRI and depressive symptoms are apparent for white boys (p < 0.1) and girls in high disadvantage contexts (does not reach significance). There are no clear SRI-based differences in depressive symptoms for Black boys and girls in high disadvantage contexts nor white boys and girls in low disadvantage contexts.

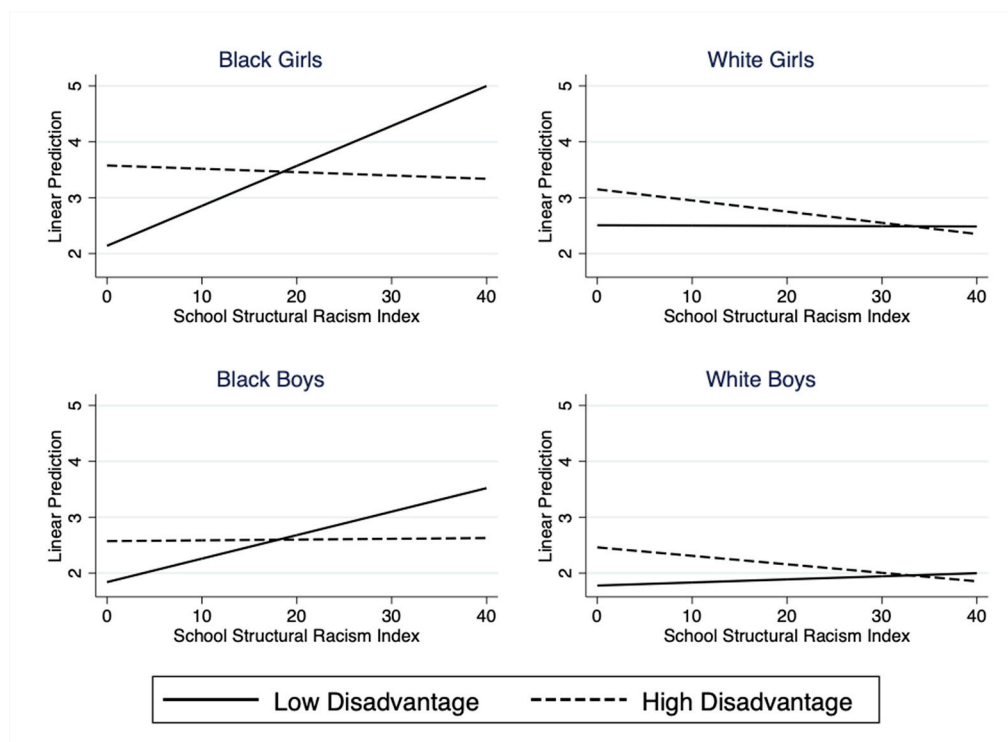
## 5. Discussion

This study combines biosocial, life course, and stratification perspectives to develop life stage-specific indices of contextual disadvantage and structural racism in relevant social contexts. Importantly, we introduce two novel measures that capture manifestations of structural racism in school contexts, which are critical to adolescent development, and link these measures to adolescent depressive symptoms. The initial measure, the CDI, captures variation across schools in aggregate levels of resources and opportunities, which are in part attributable to the socio-historic processes of structural racism that have both concentrated Black students in schools through segregation and deprived Black Americans of resources and opportunities. The second measure, the SRI, compares the relative resources and opportunities of Black and white students within schools. Our results highlight the multifaceted nature of structural racism, demonstrating that contextual disadvantage across schools and structural racism within schools independently predict adolescent depressive symptoms, and interactively produce marked heterogeneity in depressive symptoms by race and gender.

Our findings demonstrate that Black students in our sample are more than twice as likely to attend schools with levels of contextual disadvantage above the median as compared to white students. Moreover, while increases in the CDI were associated with increased depressive symptoms among all race and gender subgroups, the increase was steepest among Black girls. Together these results suggest that at a population level, gaps in depressive symptoms between Black and white students may be explained by Black students' disproportionate exposure to contextual disadvantage. These results add a structural racism component to other work linking elements of school contextual disadvantage, such as low levels of school connectedness, adolescent perceived life chances, school quality, and attendance, to adolescent health risk behaviors and later life health outcomes, including depression, obesity, and self-rated health (Dudovitz et al., 2016; Frisvold & Golberstein, 2013; Griffin et al., 2004; McNeely & Falci, 2004).

Additionally, we find suggestive evidence that when controlling for the CDI, exposure to within-school structural racism, as measured by the SRI, is associated with increased depressive symptoms in Black girls and boys. In other words, even when accounting for socio-historic processes of structural racism that select students into schools, differential distributions of opportunities and resources by race within schools are associated with racial differences in adolescent depressive symptoms. Given that exposure to within-school structural racism is uniquely stressful to Black students, these findings expectedly corroborate prior work linking structural racism to depressive symptoms (Lee, 2009; Ríos-Salas & Larson, 2015; Seaton & Yip, 2009). This work also aligns with studies demonstrating that within-school racial inequities, such as within-school segregation and lack of exposure to a same-race teacher, are associated with negative outcomes among Black students, such as reductions in positive behavior, educational aspirations, and academic success (Redding, 2019; Walsemann & Bell, 2010).

The significant interaction between the school-level CDI and SRI point to an apparent frog pond effect where Black students in low contextual disadvantage schools and with fewer Black students on average, but not high disadvantage schools with more Black students on average, are at increased risk of depressive symptoms as the level of within-school structural racism increases. Other studies have found similar relationships in which students with more dissimilar peers have



**Fig. 3.** Predicted Level of Depressive Symptoms across Levels of the School SRI, by Race, Gender, and Level of School Contextual Disadvantage. Notes: Fig. 3 reflects the predicted level of depressive symptoms based on Model 2 in Table 5, which reports marginal effects from the regression of the depressive symptoms on the interaction of the SRI with the diCDI, additionally interacted with race and gender and controlling for age, grade at the time of the Wave 1 In-Home survey, and the school percentage of Black students. Source: Authors' calculations from Add Health Data Wave 1.

worse health and other outcomes. For instance, Black students in schools with a greater percentage of middle and high income peers suffer reduced psychosocial and academic outcomes compared to white students and those with lower percentages of middle and high income peers (Crosnoe, 2009). Similarly, Black adolescents that attend schools with a greater percentage of white peers report more depressive symptoms in adolescence and through early adulthood (Walsemann, Bell, & Goosby, 2011; Walsemann, Bell, & Maitra, 2011). These findings also support other recent scholarship drawing from intersectionality theory to understand health inequities. For instance, race, gender, and class identities intersect to structure school contexts in ways that shape social interactions and vary health outcomes over the life course (Polos, Koning, & McDade, 2021).

This study has several limitations. First, although our indices capture a range of domains in which structural racism is present in school contexts, structural racism is likely to characterize an immeasurable number of domains, and thus our measures likely suffer from data availability bias (Barclay et al., 2019). If structural racism in immeasurable domains has different consequences for depressive symptoms compared to the domains we measure, our estimates of the associations among school-level contextual disadvantage, school-level structural racism, and adolescent depressive symptoms might be biased, with the direction of bias unclear. Second, although we integrate a geometric mean to address compensability among indicators, to make the indices more interpretable and accessible for future use, we chose not to employ a complicated weighting structure, such as through a confirmatory factor analysis. To address weighting concerns, we conducted a sensitivity check using factor-based indices and found qualitatively similar results.

Third, although we employ a measure of depressive symptoms that has been validated to make comparisons across racial groups, there is some evidence suggesting that Black adolescents conceptualize depression differently than other groups, leading depression to be under-identified in these groups (Lu et al., 2017). To the extent this occurs in our sample, there will be more uncertainty in effect estimates, leading to wider confidence intervals and a higher risk of type II error. Fourth, we only capture exposure to school-level structural racism in adolescence. While this is a particularly important sensitive period for human

development, other sensitive periods exist earlier in the life course. Additional work aimed at more holistically measuring exposure to school structural racism at other ages is merited.

Despite these limitations, this work makes an important contribution to a growing literature on structural racism by integrating measures of structural racism in school social contexts and integrating a life course perspective. Our findings demonstrate clear linkages between high levels of school contextual disadvantage and depressive symptoms, with school contextual disadvantage more likely to be experienced by Black students than white students, contributing to disparities in depressive symptoms. They also link structural racism manifested within schools to increased depressive symptoms in Black girls and boys, most notably among Black students in low disadvantage contexts. Exploration of the mechanisms generating this apparent frog pond effect is warranted. Finally, our results also have important policy implications. Given that the SRI is higher in schools below the median level of contextual disadvantage, which on average have lower percentages of Black students, efforts aimed at reducing school contextual disadvantage through economic school integration must also include mechanisms of support for racially and socioeconomically marginalized students at increased risk of depressive symptoms due to exposure to higher levels of within-school manifestations of structural racism.

**Author statement**

Polos conceptualized the study, developed the methodology, implemented statistical analysis, and drafted and edited the manuscript. McDade conceptualized the study, secured funding, facilitated access to the data and reviewed and edited the manuscript. Koning, Hargrove, and Kershaw reviewed and edited the manuscript.

**Ethics statement**

Conflicts of interest to declare: none. Research reported in this publication was supported by the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the National Institutes of Health under Award Number R21HD101757. Stephanie



Koning additionally received support from NIH Award Number F32 HD102152. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. Add Health is directed by Robert A. Hummer and funded by the National Institute on Aging cooperative agreements U01 AG071448 (Hummer) and U01AG071450 (Aiello and Hummer) at the University of North Carolina at Chapel Hill. Waves I–V data are from the Add Health Program Project, grant P01 HD31921 (Harris) from *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD), with cooperative funding from 23 other federal agencies and foundations. Add Health was designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill.

## Data availability

The data that has been used is confidential.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2022.101237>.

## References

- Aalto-Setälä, T., Marttunen, M., Tuulio-Henriksson, A., Poikolainen, K., & Lönnqvist, J. (2002). Depressive symptoms in adolescence as predictors of early adulthood depressive disorders and maladjustment. *American Journal of Psychiatry*, *159*(7), 1235–1237.
- Adkins, D. E., Wang, V., Dupre, M. E., Edwin, J. C. G., Oord, van den, & Elder, G. H., Jr. (2009). Structure and stress: Trajectories of depressive symptoms across adolescence and young adulthood. *Social Forces*, *88*(1), 31–60.
- Andersen, S. L., & Teicher, M. H. (2008). Stress, sensitive periods and maturational events in adolescent depression. *Trends in Neurosciences*, *31*(4), 183–191.
- Anyon, Y., Jenson, J. M., Altschul, I., Farrar, J., McQueen, J., Greer, E., Downing, B., & Simmons, J. (2014). The persistent effect of race and the promise of alternatives to suspension in school discipline outcomes. *Children and Youth Services Review*, *44*, 379–386.
- Barclay, M., Dixon-Woods, M., & Lyrtzopoulos, G. (2019). The problem with composite indicators. *BMJ Quality & Safety*, *28*(4), 338.
- Boen, C. E., Kozlowski, K., & Tyson, K. D. (2020). "Toxic" schools? How school exposures during adolescence influence trajectories of health through young adulthood. *SSM - Population Health*, *11*, Article 100623.
- Bonilla-Silva, E. (1997). Rethinking racism: Toward a structural interpretation. *American Sociological Review*, *62*(3), 465–480.
- Braveman, P. A., Elaine, A., Dwayne, P., Tina, K., & Nicole, H. (2022). Systemic and structural racism: Definitions, examples, health damages, and approaches to dismantling. *Health Affairs*, *41*(2), 171–178.
- Brown, T., & Homan, P. (2022). Structural racism and health stratification in the US: Connecting theory to measurement. *SocArXiv*, *21*, Mar. 2022. *Web*.
- Brown, T. N., Williams, D. R., Jackson, J. S., Neighbors, H. W., Torres, M., Sellers, S. L., & Brown, K. T. (2000). "Being black and feeling blue": The mental health consequences of racial discrimination. *Race and Society*, *2*(2), 117–131.
- Chambers, B. D., Jennifer Toller Erausquin, Tanner, A. E., Nichols, T. R., & Brown-Jeffy, S. (2018). Testing the association between traditional and novel indicators of county-level structural racism and birth outcomes among black and white women. *Journal of Racial and Ethnic Health Disparities*, *5*(5), 966–977.
- Chen, P., & Harris, K. M. (2020). *Guidelines for analyzing add health data*. Chapel Hill, NC: UNC Carolina Population Center.
- Chen, S., & Mallory, A. B. (2021). The effect of racial discrimination on mental and physical health: A propensity score weighting approach. *Social Science & Medicine*, *285*, Article 114308.
- Clayborne, Z. M., Varin, M., & Colman, I. (2019). Systematic review and meta-analysis: Adolescent depression and long-term psychosocial outcomes. *Journal of the American Academy of Child & Adolescent Psychiatry*, *58*(1), 72–79.
- Crosnoe, R. (2009). Low-income students and the socioeconomic composition of public high schools. *American Sociological Review*, *74*(5), 709–730.
- Crosnoe, R., & Johnson, M. K. (2011). Research on adolescence in the twenty-first century. *Annual Review of Sociology*, *37*(1), 439–460.
- Dudovitz, R. N., Nelson, B. B., Coker, T. R., Biely, C., Ning, L., Wu, L. C., & Chung, P. J. (2016). Long-term health implications of school quality. *Social Science & Medicine*, *158*, 1–7.
- Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of Research on Adolescence*, *21*(1), 225–241.
- Fletcher, J. M. (2010). Adolescent depression and educational attainment: Results using sibling fixed effects. *Health Economics*, *19*(7), 855–871.
- Frisvold, D., & Golberstein, E. (2013). The effect of school quality on black-white health differences: Evidence from segregated southern schools. *Demography*, *50*(6), 1989–2012.
- Gee, G. C., Anna, H., Mohammed, S., Tabor, D. C., & Williams, D. R. (2019). Racism and the life course: Taking time seriously. *American Journal of Public Health*, *109*(S1), S43–S47.
- Gee, G. C., & Hicken, M. T. (2021). Structural racism: The rules and relations of inequity. *Ethnicity & Disease*, *31*(Suppl 1), 293–300.
- Goosby, B. J., Malone, S., Richardson, E. A., Cheadle, J. E., & Williams, D. T. (2015). Perceived discrimination and markers of cardiovascular risk among low-income African American youth. *American Journal of Human Biology*, *27*(4), 546–552.
- Griffin, K. W., Botvin, G. J., Nichols, T. R., & Scheier, L. M. (2004). Low perceived chances for success in life and binge drinking among inner-city minority youth. *Journal of Adolescent Health*, *34*(6), 501–507.
- Groos, M., Wallace, M., Hardeman, R., & Theall, K. P. (2018). Measuring inequity: A systematic review of methods used to quantify structural racism. *Journal of Health Disparities Research and Practice*, *11*(2), 13.
- Hargrove, T. W., & Gaydos, L. (2022). Contextualizing educational disparities in health: Variations by Race/Ethnicity, Nativity, and County-Level characteristics. *Demography*, *59*(1), 267–92.
- Hemphill, S. A., Plenty, S. M., Herrenkohl, T. I., Toumbourou, J. W., & Catalano, R. F. (2014). Student and school factors associated with school suspension: A multilevel analysis of students in victoria, Australia and Washington state, United States. *Children and Youth Services Review*, *36*, 187–194.
- James, D. (2020). Health and health-related correlates of internalized racism among racial/ethnic minorities: A review of the literature. *Journal of Racial and Ethnic Health Disparities*, *7*(4), 785–806.
- Karlsen, S., & Nazroo, J. Y. (2002). Relation between racial discrimination, social class, and health among ethnic minority groups. *American Journal of Public Health*, *92*(4), 624–631.
- Kershaw, K. N., Osypuk, D. P., De Chavez, P. J., & Diez Roux, A. V. (2015). Neighborhood-level Racial/Ethnic residential segregation and incident cardiovascular disease. *Circulation*, *131*(2), 141–48.
- Kessler, R. C., Mickelson, K. D., & Williams, D. R. (1999). The prevalence, distribution, and mental health correlates of perceived discrimination in the United States. *Journal of Health and Social Behavior*, *40*(3), 208–230.
- Keyes, K. M., Gary, D., O'Malley, P. M., Hamilton, A., & Schulenberg, J. (2019). Recent increases in depressive symptoms among US adolescents: Trends from 1991 to 2018. *Social Psychiatry and Psychiatric Epidemiology*, *54*(8), 987–996.
- Krieger, N. (2012). Methods for the scientific study of discrimination and health: An ecosocial approach. *American Journal of Public Health*, *102*(5), 936–944.
- Krieger, N. (2014). Discrimination and health inequities. *International Journal of Health Services*, *44*(4), 643–710.
- Lavner, J. A., Hart, A. R., Carter, S. E., & Beach, S. R. H. (2022). Longitudinal effects of racial discrimination on depressive symptoms among black youth: Between- and within-person effects. *Journal of the American Academy of Child & Adolescent Psychiatry*, *61*(1), 56–65.
- Lee, M.-A. (2009). Neighborhood residential segregation and mental health: A multilevel analysis on hispanic Americans in Chicago. *Social Science & Medicine*, *68*(11), 1975–1984.
- Lewis, T. T., Cogburn, C. D., & Williams, D. R. (2015). Self-reported experiences of discrimination and health: Scientific advances, ongoing controversies, and emerging issues. *Annual Review of Clinical Psychology*, *11*(1), 407–440.
- Liem, E. T., Sauer, P. J. J., Oldehinkel, A. J., & Stolk, R. P. (2008). Association between depressive symptoms in childhood and adolescence and overweight in later life: Review of the recent literature. *Archives of Pediatrics and Adolescent Medicine*, *162*(10), 981–988.
- Lukachko, A., Hatzenbuehler, M. L., & Keyes, K. M. (2014). Structural racism and myocardial infarction in the United States. *Social Science & Medicine*, *103*, 42–50.
- Lu, W., Lindsey, M. A., Irsheid, S., & Nebbitt, Von E. (2017). Psychometric properties of the CES-D among black adolescents in public housing. *Journal of the Society for Social Work and Research*, *8*(4), 595–619.
- Massey, D. S. (1990). American apartheid: Segregation and the making of the underclass. *American Journal of Sociology*, *96*(2), 329–357.
- Massey, D. S., Gross, A. B., & Eggers, M. L. (1991). Segregation, the concentration of poverty, and the life chances of individuals. *Social Science Research*, *20*(4), 397–420.
- McDade, T. W., & Harris, K. M. (2018). The biosocial approach to human development, behavior, and health across the life course. The Russell Sage Foundation. *Journal of the Social Sciences: RSF*, *4*(4), 2–26.
- McNeely, C., & Falci, C. (2004). School connectedness and the transition into and out of health-risk behavior among adolescents: A comparison of social belonging and teacher support. *Journal of School Health*, *74*(7), 284–292.
- Mesic, A., Franklin, L., Cansever, A., Potter, F., Sharma, A., Knopov, A., & Siegel, M. (2018). The relationship between structural racism and black-white disparities in fatal police shootings at the state level. *Journal of the National Medical Association*, *110*(2), 106–116.
- Mikrut, E. E., Keating, L. H., Barnwell, P. V., Cioffi, L., Vega, D., Contrada, R. J., & Brondolo, E. (2022). Pathways from exposure to racial/ethnic discrimination to depression: Testing a social-cognitive model. *Social Science & Medicine*, *292*, Article 114558.
- Mojtabai, R., Olfson, M., & Han, B. (2016). National trends in the prevalence and treatment of depression in adolescents and young adults. *Pediatrics*, *138*(6), Article e20161878.
- Noh, S., Morton, B., Kaspar, V., Hou, F., & Rummens, J. (1999). Perceived racial discrimination, depression, and coping: A study of southeast Asian refugees in Canada. *Journal of Health and Social Behavior*, *40*(3), 193–207.

- OECD. (2008). *Handbook on constructing composite indicators: Methodology and user guide*. OECD publishing.
- Parcel, T. L., Dufur, M. J., & Zito, R. C. (2010). Capital at home and at school: A review and synthesis. *Journal of Marriage and Family*, 72(4), 828–846.
- Perreira, K. M., Deeb-Sossa, N., Kathleen Mullan Harris, Bollen, K. (2005). What are we measuring? An evaluation of the CES-D across race/ethnicity and immigrant generation. *Social Forces*, 83(4), 1567–1601.
- Polos, J., Koning, S. M., & McDade, T. W. (2021). Do intersecting identities structure social contexts to influence life course health? The case of school peer economic disadvantage and obesity. *Social Science & Medicine*, 289, Article 114424.
- Ready, D. D. (2010). Socioeconomic disadvantage, school attendance, and early cognitive development: The differential effects of school exposure. *Sociology of Education*, 83(4), 271–286.
- Redding, C. (2019). A teacher like me: A review of the effect of student–teacher racial/ethnic matching on teacher perceptions of students and student academic and behavioral outcomes. *Review of Educational Research*, 89(4), 499–535.
- Reskin, B. (2012). The race discrimination system. *Annual Review of Sociology*, 38(1), 17–35.
- Ríos-Salas, V., & Larson, A. (2015). Perceived discrimination, socioeconomic status, and mental health among Latino adolescents in US immigrant families. *Children and Youth Services Review*, 56, 116–125.
- Seaton, E. K., Caldwell, C. H., Sellers, R. M., & Jackson, J. S. (2010). An intersectional approach for understanding perceived discrimination and psychological well-being among African American and Caribbean Black youth. *Developmental Psychology*, 46(5), 1372–1379.
- Seaton, E. K., & Yip, T. (2009). School and neighborhood contexts, perceptions of racial discrimination, and psychological well-being among african American adolescents. *Journal of Youth and Adolescence*, 38(2), 153–163.
- Umberson, D., & Montez, J. K. (2010). Social relationships and health: A flashpoint for health policy. *Journal of Health and Social Behavior*, 51(Suppl), S54–S66. Suppl.
- U.S. Department of Education. (2018). Average national assessment of educational progress (NAEP) reading and mathematics scale scores of 4th-, 8th-, and 12th-graders and percentage absent from school, by selected characteristics and number of days absent in the last month: 2015 and 2017. In National Assessment of Educational Progress (NAEP) (Ed.), *Digest of Education Statistics*. National Center for Education Statistics.
- Visser, K., Bolt, G., Finkenauer, C., Jonker, M., Weinberg, D., Gonneke, W., & Stevens, J. M. (2021). Neighbourhood deprivation effects on young people's mental health and well-being: A systematic review of the literature. *Social Science & Medicine*, 270, Article 113542.
- Walsemann, K. M., & Bell, B. A. (2010). Integrated schools, segregated curriculum: Effects of within-school segregation on adolescent health behaviors and educational aspirations. *American Journal of Public Health*, 100(9), 1687–1695.
- Walsemann, K. M., Bell, B. A., & Goosby, B. J. (2011). Effect of school racial composition on trajectories of depressive symptoms from adolescence through early adulthood. *Race and Social Problems*, 3(3), 131.
- Walsemann, K. M., Bell, B. A., & Maitra, D. (2011). The intersection of school racial composition and student race/ethnicity on adolescent depressive and somatic symptoms. *Social Science & Medicine*, 72(11), 1873–1883.
- Williams, D. R., Lawrence, J. A., & Davis, B. A. (2019). Racism and health: Evidence and needed research. *Annual Review of Public Health*, 40(1), 105–125.