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"Every Shut Eye, Ain't Sleep": The Role of Racism-Related Vigilance in Racial/Ethnic Disparities in Sleep Difficulty

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Abstract Although racial/ethnic disparities in health have been well characterized in biomedical, public health, and social science research, the determinants of these disparities are still not well understood. Chronic psychosocial stress related specifically to the American experience of institutional and interpersonal racial discrimination may be an important determinant of these disparities, as a growing literature in separate scientific disciplines documents the adverse health effects of stress and the greater levels of stress experienced by non-white compared to white Americans. However, the empirical literature on the importance of stress for health and health disparities specifically due to racial discrimination, using population-representative data, is still small and mixed. In this paper, we explore the association between a novel measure of racially salient chronic stress—"racism-related vigilance"—and sleep difficulty. We found that, compared to the white adults in our sample, black (but not Hispanic) adults reported greater levels of vigilance. This vigilance was positively associated with sleep difficulty to similar degrees for all racial/ethnic groups in our sample (white, black, Hispanic). Black adults reported greater levels of sleep difficulty compared to white adults. This disparity was slightly attenuated after adjustment for education and income. However, this disparity was completely attenuated after adjustment for racism-related vigilance. We found similar patterns of results for Hispanic compared to white adults, however, the disparities in sleep difficulty were smaller and not statistically significant. Because of the importance of sleep quality to health, our results suggest that the anticipation of and perseveration about racial discrimination is an important determinant of racial disparities in health.

An African American proverb/saying derived from Blues Lyrics (but used widely in the African American community) to denote profound distrust, antagonism, or awareness in situations where someone might be deceived (Prahlad 1996).

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Introduction

A large and growing scientific literature in numerous disciplines has documented the disparities in health among different racial/ethnic groups in the USA (Jackson 2005; Mensah et al. 2005; Williams et al. 2010). Despite the attention given to characterizing these disparities, less is known about their causes (Williams et al. 2010). Many researchers theorize that racial/ethnic disparities in social stressors and psychosocial/biosocial stress[1] may contribute to these health disparities (Turner 2009; Geronimus et al. 2010; Jackson et al. 2010; Williams et al. 2010; Hicken et al. 2011). In particular, some argue that racial discrimination is an important source of stress for non-white compared to white Americans (Clark et al. 1999; Williams 1999; Wyatt et al. 2003; Davis et al. 2005; Harrell et al. 2011).

The literature linking racial discrimination to health and health disparities is mixed, with some studies reporting a positive association between discrimination and health and others reporting an inverse association, or no association (Krieger 1990; Paradies 2006; Williams and Mohammed 2009). However, the scientific literature has overlooked an important component of the experience of discrimination that may be particularly salient to health. Specifically, it may be that the anticipation of or perseveration on possible discrimination is particularly deleterious to health.

Social scientists have long documented that individuals mentally prepare for the possibility of experiencing racial discrimination on a day-to-day basis (Du Bois and Eaton 1899; Feagin and Sikes 1994). Researchers have termed this preparation for and anticipation of discrimination, "racism-related vigilance" (Clark et al. 2006) and argue that vigilance is an important determinant of the poor health of black Americans (Williams and Mohammed 2009; Harrell et al. 2011). Indeed, psychologists have shown that perseveration on a stressor results in poor health through the over-activation of the biological stress system (Brosschot et al. 2005, 2006; Brosschot 2010).

We examined the notion that a new measure of racism-related vigilance explains racial/ethnic disparities in sleep difficulty. Research shows that non-whites experience lower sleep quality compared to whites (Hale and Do 2007). Because chronic stress[2]—particularly stress resulting from the rumination and perseveration about stressors—is associated with poor sleep outcomes (Akerstedt 2006; Akerstedt et al. 2007), it may be that the perseveration about and anticipation of racial discrimination is an important determinant of racial/ethnic disparities in sleep quality.

In a population-representative sample of urban adults in Chicago, we found that blacks but not Hispanics reported greater sleep difficulty compared to whites. Adjustment for racism-related vigilance completely attenuated this disparity. Our results support the notion that racism-related vigilance, with its perseverative and anticipatory features, results in sleep difficulty and that the disparities in vigilance explain the disparities in sleep difficulty. Because researchers argue that proper sleep is a critical determinant of a healthy life (Brosschot 2010), our results suggest that racism-related vigilance is an important determinant of racial disparities in health.

Background

Racism-Related Vigilance and Racial/Ethnic Disparities in Health

Racial/ethnic disparities in health have been well characterized in numerous scientific disciplines including social science (Frisbie et al. 2004; Sternthal et al. 2011), public health (Williams 1997; Adler and Rehkopf 2008), and medicine (Hertz et al. 2005; Mensah et al. 2005; Fiscella and Holt 2008). For example, researchers have documented that, compared to white Americans, black Americans have higher rates of infant and adult mortality (James 1993; Geronimus et al. 1996, 2001; Kramer and Hogue 2009) and greater rates of chronic morbidity (Morenoff et al. 2007; Williams et al. 2012). Importantly, some of the largest health disparities are documented for chronic conditions related to sleep difficulty, including cardiovascular disease (Mallon et al. 2002; Ayas et al. 2003a, b) and type 2 diabetes (Cappuccio et al.

[1] We draw from sociological traditions, particularly of Pearlin, Aneshensel, and others, when discussing the stress process. We conceptualize the stress process within the sociological framework with the following components: (1) social stressors, which are the "socio-environmental demands that tax or exceed the individual's ordinary capacity to adapt and/or the absence of the means to attain sought-after ends" (Pearlin 2013); (2) stress, which refers to the "internal dysfunctions that result from these circumstances [social stressors]"; and (3) distress, which refers to the various health outcomes that result from stress. Psychosocial stress is the term used to describe psychological dysfunction with social origins. Biosocial stress is the term used to describe biological dysfunction with social origins. Stress is sometimes also called "stress response" or "strain" in the literature.

[2] Chronic stress refers to the chronic dysfunction resulting from stressors. Chronic stress may not necessarily be linked to a specific event (i.e., acute stressors), but to conditions that arise from more enduring circumstances (i.e., chronic stressors). An acute stressor may result in chronic stress is through rumination and perseveration about that stressor. In this case, the acute stressor is transformed into a chronic stressor through the rumination and perseveration (Brosschot et al. 2006; Brosschot 2010).

2010a, b). While many have documented these disparities, the causes of these disparities are little known. Indeed, despite the considerable investment into research and intervention directed at elimination of these disparities, evidence indicates that they are increasing (National Center for Health Statistics 2012; Williams et al. 2012).

Many theorize that chronic stress is an important cause for these health disparities (Turner 2009; Geronimus et al. 2010; Hicken et al. 2011; Sternthal et al. 2011). Chronic stress is becoming recognized as an important determinant of health outcomes, ranging from cardiovascular disease (Kaplan and Nunes 2003; Dimsdale 2008) and diabetes (Surwit et al. 1992; Heraclides et al. 2009) to cognitive decline (McEwen and Sapolsky 1995) and mood disorders (McEwen 2003; Mirowsky and Ross 2003). Research has shown that, compared to white Americans, black and other non-white Americans experience greater levels of social stressors and report greater levels of psychosocial stress (Williams 1999; Williams et al. 2010). Furthermore, researchers argue that racial discrimination is an important source of psychosocial stress for non-white Americans (Clark et al. 1999; Williams and Mohammed 2009; Borrell et al. 2012). However, the empirical literature linking racial/ethnic disparities in discrimination to disparities in health has been scant (Sternthal et al. 2011).

It may be that important components of the discrimination experience are missing from the empirical literature. One potentially important component is reflected in ethnographic work. Social scientists have, for decades, described thoughts and behaviors, expressed by their study participants, which reflect a potentially critical aspect of the everyday experience of American racial discrimination. For example, in his ethnographic study, Feagin (1991) documented the experiences of racial discrimination in a group of middle-class black Americans. He found that black Americans not only reported prior experiences with discrimination but also discussed ways in which they prepared for the possibility of future experiences with discrimination based not only on their own prior experiences with discrimination, but of those in their community. One black woman reported,

> [One problem with] being black in America is that you have to spend so much time thinking about stuff that most white people just don't even have to think about. I worry when I get pulled over by a cop… I worry when I walk into a store that someone is going to think that I am shoplifting. And I have to worry about that because I am not free to ignore it (Feagin 1991, p. 114).

Another black woman who was interviewed stated, "I feel as though most of the time I find myself being in a guarded position or somewhat on the defense. I somewhat stay prepared to be discriminated against because I never know when it's going to happen to me." (Feagin and Sikes 1994, p. 295) Yet another respondent put it this way: "[blacks] can't sit back and relax at all; you have to be vigilant at all times; if you don't you'll be back in chains." (Feagin and Sikes 1994, p. 295).

Researchers have termed these thoughts and behaviors as "racism-related vigilance" (Clark et al. 2006). Feagin and Sikes (1994) summarize this notion of vigilance derived from their interviews:

> Blacks must be constantly aware of the repertoire of possible responses to chronic burdensome discrimination. One older respondent spoke of having to put on her "shield" just before she leaves the house each morning…she said that for more than six decades, as she leaves her home, she has tried to be prepared for insults and discrimination in public places, even if nothing happens that day (Feagin and Sikes 1994, p. 115).

Vigilance has been conceptualized as a psychological predisposition that might be particularly salient for black Americans, given the group's disproportionate exposure to discrimination, and is defined "as the propensity to attend to environmental events that could be perceived as involving racism" (Clark et al. 2006, p. 563).

Some have begun to examine the notion that the vigilance associated with racial/ethnic discrimination is associated with health. For example, researchers recently reported that the anticipation of ethnic discrimination was inversely associated with self-reported psychological and physical health in a Swedish sample (Lindstrom 2008; Mohseni and Lindstrom 2008). Regarding racial discrimination in the USA, researchers also reported poor cardiovascular outcomes, including lower large arterial elasticity and higher blood pressure reactivity, in response to racism-related vigilance (Clark et al. 2006; Sawyer et al. 2012). Furthermore, researchers reported that the greater reports of vigilance by black compared to white adults completely explained the greater prevalence of hypertension seen in black adults (Hicken et al. in press).

Racial bias and discrimination are embedded in numerous domains of US society relevant to health, ranging from education to employment to neighborhood quality to health care access and quality (Galster 1990; Schulman et al. 1999; Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care 2003; Bertrand and Mullainathan 2004; Williams and Jackson 2005). While discrimination is pervasive, there are elements of uncertainty to the experience of discrimination on any given day. This uncertainty is compounded by the understanding that modern racism is often subtle and ambiguous. For example, psychologists use the term racial microaggressions to describe "brief and commonplace daily verbal,

behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults toward people of color"(Sue et al. 2007, p. 272). Furthermore, researchers argue that modern racism is fraught with "coded" speech that does not specify race or ethnicity specifically, but directly targets racial and ethnic minorities (Bonilla-Silva 2010; Gainous 2012). Researchers argue that this means that non-whites must continually anticipate and prepare for racial discrimination as they negotiate the social spaces necessary for common daily life activities (e.g., banking, grocery shopping, work).

Research in psychology shows that perseveration and rumination about a stressor is facet of chronic stress that is particularly toxic (Brosschot et al. 2005, 2006), as it results in prolonged physiological activation (Brosschot 2010). This prolonged activation results in physiological dysfunction sometimes called "allostatic load" (Seeman et al. 1997). Therefore, racism-related vigilance may result in poor health through this continual activation of the physiological systems (e.g., hypothalamic–pituitary–adrenal (HPA) axis, cardiovascular system, metabolic system). While there is empirical work in the psychology literature on the health effects of general stress-related vigilance (See Brosschot 2010 for a review), there is little empirical work on the health effects of racism-related vigilance (See the following reviews: Williams and Mohammed 2009; Harrell et al. 2011).

Chronic Stress and Racial/Ethnic Disparities in Sleep Quality

Researchers have documented racial/ethnic disparities in sleep quality and duration. For example, using US population-based data, researchers reported that, compared to white adults, black adults were more likely to report shorter and longer sleep duration (Hale and Do 2007), both of which are linked to greater disease risk (Ayas et al. 2003a, b; Patel et al. 2004; Buxton and Marcelli 2010; Knutson 2013). Others have also reported that, in laboratory settings, compared to white adults, non-white (and particularly black) adults experience greater sleep difficulty and interferences with sleep architecture (Mezick et al. 2008; Hall et al. 2009; Baldwin et al. 2010). Racial/ethnic disparities in sleep quality and duration may reflect disparities in exposure to chronic social stressors and experiences of chronic psychosocial stress.

Adequate sleep is essential for optimal health and functioning. Poor sleep quality has been linked to increased risk of obesity (Knutson and Van Cauter 2008), diabetes (Cappuccio et al. 2010a, b), cardiovascular disease (Phillips and Mannino 2007), and mortality (Mallon et al. 2002). In addition, sleep durations of either fewer than six or more than 8 h are associated with multiple adverse health outcomes, including hypertension and cardiometabolic diseases such as obesity and diabetes (Knutson et al. 2011), and increased mortality (Cappuccio et al. 2010a, b).

Research suggests chronic stress is closely related to poor sleep. Several studies have shown that people have worse sleep on nights when they report feeling stressed or worried at bedtime (Akerstedt et al. 2007, 2012) and that the anticipation of stressful events may be a particularly important determinant of sleep quality (Akerstedt 2006). Sleep disturbances may result from stress related to job demands (Burgard and Ailshire 2009; de Lange et al. 2009), family care giving burden (Rowe et al. 2008), and financial hardship (Hall et al. 2008, 2009). Sleep problems may also result from experiencing daytime emotional stressful events, such as interpersonal conflicts with others (Brissette 2002). It is thought that stressful experiences harm sleep because individuals lay awake at night thinking about the events of the previous day and worry in anticipation of future problems. Data from sleep diaries and laboratory-based sleep measurements have been used to show that stress-related intrusive thoughts contribute to sleep disturbances (Hall et al. 2000). Dwelling on negative thoughts and emotions, what some refer to as rumination, may be an important determinant of poor sleep quality.

Because of its perseverative qualities, racism-related vigilance may result in decreased sleep duration and quality—and may contribute to racial/ethnic disparities sleep. There is some evidence linking discrimination or unfair treatment to greater sleep difficulty, problematic sleep architecture, and shorter sleep duration (Steffen and Bowden 2006; Thomas et al. 2006; Beatty et al. 2011; Lewis et al. 2012; Tomfohr et al. 2012). However, this literature on racial discrimination is lacking in some important ways. For example, most of the research in this area is performed with small samples that are not population representative. Furthermore, there have been no studies in which researchers examined the association between racism-related vigilance and sleep quality. As opposed to measures of experiences of discrimination, which are stressors, vigilance is conceptualized as a reflection of an anticipatory stress (i.e., the anticipation of discrimination—but the result of exposure to the stressor of racism[3]) (Williams and Mohammed 2009). Racism-related vigilance may capture the day-to-day worries and rumination faced

[3] Racism and discrimination are conceptually distinct. Racism has been defined as "a system of dominance, power, and privilege based on racial group designations … where members of the dominant group create or accept their societal privilege by maintaining structures, ideologies, values, and behaviors that have the intent or effect of leaving non-dominant-group members relatively excluded from power, esteem, status, and/or equal access to societal resources" (Harrell et al. 2011, p. 43). Racial discrimination is one by-product of racism and refers specifically to behaviors that result in the unfair treatment of one group over another based on racial designation.

by non-white Americans and, therefore, may have specific salience to sleep.

In this study, we examined whether racism-related vigilance was associated with sleep difficulty in a population-representative sample of adults from Chicago. Furthermore, we examined whether any racial/ethnic disparities in sleep difficulty were explained by racial/ethnic disparities in racism-related vigilance.

Data and Methods

Dataset

We used data from the Chicago Community Adult Health Study (CCAHS), a cross-sectional survey designed to examine the biological, social, and environmental correlates of adult physical and mental health. The CCAHS is a multi-stage probability sample of 3,105 adults, aged 18 years and older, living in Chicago. Face-to-face interviews were conducted, and direct physical measurements were taken from one respondent per household between May 2001 and March 2003 with a response rate of 71.8 %.

Variables

Sleep quality was measured using the responses to three questions. Respondents were asked whether, in the past 4 weeks, they had experienced the following: (a) trouble falling asleep, (b) waking in the middle of the night with trouble getting back to sleep, and (c) waking very early with trouble getting back to sleep. Responses were on a Likert-like scale of 0 = rarely or never, 1 = sometimes, 2 = often, or 3 = almost every day. Responses were then recoded as 0 = rarely, never, or sometimes, 1 = often or almost every day. Then, these responses were summed to create a scale with greater values representing greater sleep difficulty with a range of zero to three (Cronbach's alpha = 0.75), with zero indicating that the respondent reported no "often" or "almost every day" responses on any of the three items and three indicating that the respondent reported "often" or "almost every day" on all three items. We operationalized sleep difficulty as chronic or regular difficulty (i.e., "often" and "almost every day"), as it may be chronic sleep disturbances that are harmful to health.[4]

A racism-related vigilance measures were created by one of the authors (DRW) based on ethnographic research describing how participants anticipated and prepared for racial discrimination (Essed 1990; Feagin and Sikes 1994; Clark et al. 2006). An abbreviated version of this scale was created from responses to the following three questions: In your day-to-day life, how often do you do the following things (1) try to prepare for possible insults from other people before leaving home; (2) feel that you always have to be very careful about your appearance to get good service or avoid being harassed; and (3) try to avoid certain social situations and places. Responses were on a Likert-like scale of 1 = at least once a week, 2 = a few times a month, 3 = a few times a year, 4 = less than once a year, and 5 = never. Responses were reverse-coded and summed to create a continuous scale with higher values representing higher levels of vigilance within a range of 0 to 12 (Cronbach's alpha = 0.66).

We included two sets of key control variables (racial/ethnic discrimination and chronic stressors) along with the sociodemographic control variables age, gender, race/ethnicity, and SES, as both of these sources of stress may also result in sleep difficulty. Racial discrimination was measured using abbreviated versions of two scales: the everyday discrimination scale and the major experiences of discrimination scale (Williams et al. 1997; Kessler et al. 1999). Everyday discrimination was measured using five questions. Respondents were asked whether in their day-to-day lives (a) he/she is treated with less courtesy or respect than other people, (b) he/she receives poorer service than others at restaurants or stores, (c) people act as if he/she is not smart, (d) people act as if they are afraid of her/him, and (e) he/she was threatened or harassed. Responses were on a Likert-like scale of 1 = at least once a week, 2 = a few times a month, 3 = a few times a year, 4 = less than once a year, and 5 = never. An index was created from the responses to these four questions in three steps. First, if any of these responses to these questions were more frequent than "never," respondents were asked the reason they believed they experienced the unfair treatment. If the respondent reported that the reason was anything other than due to their race/ethnicity, their responses to the four questions were coded as 0 = never. Second, the responses for each item were reverse-coded and rescaled (from 1–5 to 0–4) on a scale of zero to four, with zero indicating "never." Third, these responses were then summed to create a continuous scale with higher values representing greater racial/ethnic discrimination with a range of 0–20 (Cronbach's alpha = 0.75).

Major experiences of discrimination were measured using six questions. Respondents were asked whether they had ever experienced the following: (a) unfairly fired or denied a promotion, (b) not been hired for unfair reasons, (c) unfairly stopped, searched, questioned, threatened, or abused by the police, (d) unfairly prevented from moving

[4] Although the study of sleep architecture in lab settings on small samples is relatively established, the study of sleep within large population representative samples is novel. Therefore, there is a lack of consensus on state-of-the-art survey measures of sleep quality and no clear recommendations have been made (See Knutson 2013 for example).

into a neighborhood, (e) unfairly discouraged by a teacher or educator from continuing education, (f) unfairly denied a bank loan. Responses were either 0 = no or 1 = yes. For each question with a "yes" response, respondents were then asked (a) the frequency of each of these events and (b) the reason for each of these events. Frequency responses were coded as follows: 1 = one time, 2 = two to three times, 3 = four to five times, and 4 = six or more times. A scale was created by summing the frequency responses that were attributed to race/ethnicity, with a potential range of 0–24 and an actual range of 0–21.

Stressors that are not specifically about race/ethnicity were measured with three scales. First, a financial strain was measured from the responses to two questions: (a) How satisfied are you with your/your family's financial situation? and (b) How difficult is it to meet your/your family's monthly payments or bills? Responses for the first question were on a Likert-like scale of 1 = completely satisfied, 2 = very satisfied, 3 = somewhat satisfied, 4 = not very satisfied, and 5 = not at all satisfied. Responses for the second question were on a Likert-like scale of 1 = extremely difficult, 2 = very difficult, 3 = somewhat difficult, 4 = slightly difficult, and 5 = not at all difficult. A financial strain index was created as the sum of the mean of the first question and the mean of the reverse-coded version of the second question, with greater values representing greater levels of financial strain within a range of one to five (Cronbach's alpha = 0.64)

Second, lifetime experiences of stressful life events were measured with questions about the occurrence of the following events at any point in the respondent's life: (a) death of his/her child, (b) serious physical attack or assault, and a life-threatening illness or accident that happened to (c) him/herself, (d) spouse, or (e) his/her child. A lifetime stressful events index was created as the sum of these events with a range of one to five. Recent experiences of stressful life events were measured with similar questions about the occurrence of the following events within the past 5 years: (a) a life-threatening illness or accident that happened to spouse, (b) to his/her child, or (c) to someone else close; (d) death of someone close; (e) the involuntary job loss of him/herself or (f) of a household member; (g) unemployed and looking for work for more than 3 months for him/herself or (h) for a household member; (i) moved to a worse neighborhood; (j) robbed or house burglarized; (k) serious financial problems or difficulties; and (l) legal trouble for him/herself or someone close. A recent stressful events index was created as the sum of these events with a potential range of 0–12 and an actual range of 0–8.

Race/ethnicity was categorized as non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other (which included American Indian, Asian, and Pacific Islander). Because the last racial/ethnic category comprised only 4 % of the sample and was a mixture of races that make interpretation difficult, we report these results in the descriptive table for completeness, but do not discuss them.

Educational attainment was ascertained from questions on the number of years of education completed and whether or not a high school diploma or general education development (GED) certificate had been earned. Education was coded with three categories: no high school or GED, high school or GED, and greater than high school or GED. Household income was ascertained from questions on the respondent's and spouse's incomes. Responses from these questions were summed to create the household income, which was divided by $10,000, to make the coefficients more meaningful, and natural log-transformed. Sex and age (in years) were also ascertained from survey questions; age was centered at 18 years.

Analytic Approach

For descriptive analyses, we estimated means with standard errors of continuous variables and percentages of categorical variables in the total sample and by race/ethnicity. Standard errors were estimated rather than standard deviations because the latter could not be estimated with multiply imputed data (The multiple imputation is described in the last paragraph of this section). We used *t* tests to test for differences by race/ethnicity.

We then estimated multivariate associations (adjusting for age, gender, education, and natural log-transformed income) between racism-related vigilance and sleep difficulty by regressing the latter on the former in linear regression models. To examine whether vigilance mediates racial/ethnic disparities in sleep difficulty (i.e., race/ethnicity → vigilance → sleep difficulty), we ran a series of three models as recommended in the literature (Baron and Kenny 1986). In separate models, we regressed vigilance on race/ethnicity and sleep difficulty on vigilance in linear regression models. Then, we regressed sleep difficulty on the race/ethnicity in linear regression models, adjusting for age, gender, education, and natural log-transformed income [Model 1] and added racism-related vigilance [Model 2].

Finally, because vigilance is conceptualized as the stress response to the stressor of racism, but not necessarily specific personal acts of discrimination, we examined whether widely used measures of racial discrimination [Model 3] and stressors [Model 4] contributed further to disparities in sleep difficulty by adding them to the models. We reran all models using standardized versions of the stress-related survey scales (vigilance, discrimination, stressors) to facilitate comparisons of effect sizes (shown in Supplemental Table 1).

There was missing information on income and vigilance; we handled the missing information in two ways. First, for those with missing information on income ($n = 501$), data were multiply imputed for these cases

using IVEware (University of Michigan, Ann Arbor, MI) via SAS (SAS Institute, Cary, NC) to create five imputed datasets. We used the multiple imputation suite of commands in STATA, which "adjusts coefficients and standard errors for the variability between imputations according to the combination rules by Rubin (1987)" (Stata Press 2011, p. 43), to analyze the imputed data. Second, those who were missing information on vigilance ($n = 11$) were excluded from final analyses, for a final sample size of 3,094. All analyses were weighted to account for complex survey design, differential selection into the sample, nonresponse, and household size. With respect to age, race/ethnicity, and sex, the distribution of the weighted sample and the 2,000 Census estimates were comparable. All analyses were conducted in STATA 11.0MP (StataCorp, College Station, TX) using survey weights that result in estimates that are representative of the racial/ethnic composition of Chicago. Institutional review board approval was granted at the University of Michigan, and written informed consent was obtained from all participants.

Results

Descriptive characteristics of the CCAHS sample are provided in Table 1. Overall, the mean sleep difficulty index score was 1.30 (standard error, SE = 0.03) out of a range of one to three. The mean vigilance index was 2.67 (SE = 0.08) within a range of 0–12. There is considerable variation in these measures by race/ethnicity, as shown in Table 1. Black but not Hispanic participants reported greater sleep difficulty compared to white participants ($p = 0.001$ for black–white comparison; $p = 0.227$ for Hispanic–white comparison). This difference in overall sleep difficulty appears to be due to both waking in the middle of the night and waking early in the morning and having trouble falling back to sleep. Black participants reported the highest levels of racism-related vigilance compared to both white and Hispanic participants. Hispanic participants also reported higher levels of racism-related vigilance compared to white participants.

To examine the mediating role of vigilance in the association between race/ethnicity and sleep difficulty, we ran a series of three models, as outlined in the literature (Baron and Kenny 1986). The results from the first two we discuss in the text here, and the results from the final model we show in Table 2. In the first model, we regressed vigilance on race/ethnicity and found that non-Hispanic black adults reported greater levels of vigilance compared to non-Hispanic white adults, after controlling for age, gender, education, and ln-transformed income ($b_{\text{non-Hispanic black}} = 1.842$; 95 % CI = 1.543, 2.542; $p = 0.000$). Hispanic adults also reported greater levels of vigilance compared to non-Hispanic white (but less than non-Hispanic black) adults ($b_{\text{Hispanic}} = 0.400$; 95 % CI = 0.039, 0.761; $p = 0.030$). In the second model, we regressed sleep difficulty on vigilance adjusting for age, gender, education, and ln-transformed income and found a positive association ($b_{\text{vigilance}} = 0.049$; 95 % CI = 0.033, 0.064; $p = 0.000$).

The results from the final models examining mediation are shown in Table 2. In the first model, sleep difficulty was regressed on race/ethnicity, age, gender, education, and ln-transformed income. Focusing on the black–white disparities first, black participants showed greater levels of sleep difficulty compared to white participants. After including racism-related vigilance in Model 2, the black–white difference was reduced by 75 % and the difference was no longer statistically significant. This result, along with the results from the two models described in the previous paragraph, suggests that vigilance mediates the association between race/ethnicity and sleep difficulty. When the measures of racial discrimination were added to the models, the black–white disparity in sleep difficulty changes signs, but is still not statistically significant (Table 2, Model 3: $b = -0.089$, 95 % CI = −0.215, 0.038, $p = 0.168$). Further adjustment for other stress measures does not change the difference in sleep difficulty (Table 2, Model 4: $b = -0.085$, 95 % CI = −0.208, 0.038). Results from models using standardized survey measures suggest that the association between vigilance and sleep difficulty is stronger than the other stress measures, including racial discrimination, with the exception of that for recent stressful life events (see Supplemental Table 1).

Regarding Hispanic–white disparities in sleep difficulty, the pattern of results across the models was similar to those seen when comparing black with white participants. However, the coefficients were smaller, and the minimally adjusted coefficient (Model 1) only approached statistical significant ($p = 0.116$).

We conducted several sensitivity analyses to check the robustness of our results to the inclusion of additional potential confounders. First, we examined alternate functional forms of the models using ordinal, poisson, and negative binomial regression. The results were qualitatively similar to those we present. Second, we examined an alternate operationalization of the sleep measure that simply summed the responses from each of the three items in the score. Results were qualitatively similar to those presented. Third, we operationalized vigilance in quartiles to account for potential nonlinear associations. Results were very similar to those presented. Fourth, we also ran models that included health conditions and behaviors that have been shown to interfere with sleep quality: hypertension, current smoking status, obesity status, and heavy alcohol use. While these factors may provide a competing explanation for our results, we also argue that they may be

Table 1 Descriptive characteristics in the total sample and by race/ethnicity, Chicago Community Adult Health Survey ($n = 3{,}094$)

Characteristic	Total sample	Non-Hispanic white	Non-Hispanic black	Hispanic	Racial/ethnic comparisons (p values)		
	Mean (SE) or %	Mean (SE) or %	Mean (SE) or %	Mean (SE) or %	W–B	W–H	B–H
Age (years)	42.44 (0.42)	44.38 (0.75)	44.12 (0.58)	38.14 (0.71)		***	***
Female	53	50	58	52	**		*
Race/ethnicity							
Non-Hispanic white	38						
Non-Hispanic black	32						
Hispanic	26						
Non-Hispanic other	4						
Household income/$10,000	10.25 (0.04)	10.63 (0.06)	9.92 (0.05)	10.11 (0.05)	***	***	***
Education							
<HS/GED	21	9	23	41	***	***	***
=HS/GED	26	22	29	28			
>HS/GED	53	69	48	31			
Racism-related vigilance index	2.67 (0.08)	1.85 (0.10)	3.84 (0.12)	2.52 (0.13)	***	***	***
Vigilance quartile							
1 (low)	37	45	27	44	***	*	***
2	8	10	6	6			
3	20	23	17	16			
4 (high)	34	22	51	34			
Everyday discrimination index	1.46 (0.08)	0.37 (0.06)	2.73 (0.14)	1.45 (0.13)	***	***	***
Major events discrimination index	0.71 (0.05)	0.13 (0.02)	1.59 (0.10)	0.48 (0.07)	***	***	***
Financial strain	2.49 (0.02)	2.29 (0.03)	2.71 (0.04)	2.52 (0.04)	***	***	***
Stressful life events, lifetime experiences	0.68 (0.02)	0.57 (0.03)	0.93 (0.04)	0.58 (0.04)	***		***
Stressful life events, recent experiences	1.22 (0.03)	1.11 (0.05)	1.51 (0.05)	1.10 (0.06)	***		***
Sleep difficulty index	1.30 (0.03)	1.23 (0.04)	1.41 (0.04)	1.31 (0.05)	***		

Results are weighted to account for sampling design. p values for racial/ethnic comparisons were calculated from the regression of each variable on the categorical race/ethnicity variable with either non-Hispanic white or non-Hispanic black as the omitted category, using linear (for continuous outcomes), logistic (for dichotomous outcomes), or ordinal logistic (for ordinal outcomes) regression models

W non-Hispanic white, *B* non-Hispanic black, *H* Hispanic, *HS* high school; *GED* general education development

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

mediators that link the chronic stress of racism-related vigilance to sleep quality. When we adjusted for these factors, our results did not change. Fifth, we ran models that included adjustment for either depressive symptoms or other personality traits that might be related to both the perceptions of discrimination and sleep quality. Further adjustment to any of the models in Table 2 that already contain vigilance (Models 2–4) by any of the psychological measures yielded qualitatively similar results. Finally, we also replaced the everyday racial discrimination measure with an unattributed unfair treatment measure. This was essentially made from the same questions, but we did not restrict the responses to those attributed only to race/ethnicity. The results did not change from those presented.

Finally, we examined whether the association between vigilance and sleep difficulty varied by race/ethnicity by regressing the interaction between race/ethnicity and vigilance on sleep difficulty. We found that the positive association was similar across racial/ethnic groups, as shown by the interaction terms between race/ethnicity and vigilance. Neither of the interaction terms (black vs. white or Hispanic vs. white) was large or statistically significant, indicating that the association between vigilance and sleep difficulty for neither blacks nor Hispanics was different from that positive association seen for whites.

Discussion

We set out to examine the notion that racism-related vigilance contributed to racial/ethnic disparities in sleep difficulty. We found that compared to white adults, blacks reported higher levels of racism-related vigilance. We also found that vigilance was positively associated with sleep difficulty—and that this positive association was similar across racial/ethnic groups. Finally, we found that black,

Table 2 Association between racism-related vigilance and sleep difficulty, Chicago Community Adult Health Survey ($n = 3{,}094$)

	–1– b (95 %CI)	–2– b (95 %CI)	–3– b (95 %CI)	–4– b (95 %CI)
Race/ethnicity[a]				
White	Ref	Ref	Ref	Ref
Black	0.122*	0.034	−0.089	−0.085
	(0.004, 0.240)	(−0.090, 0.158)	(−0.215, 0.038)	(−0.208, 0.038)
Hispanic	0.044	0.025	−0.029	0.000
	(−0.099, 0.188)	(−0.115, 0.165)	(−0.171, 0.112)	(−0.136, 0.137)
Racism-related vigilance index		0.048***	0.040***	0.028***
		(0.031, 0.064)	(0.023, 0.057)	(0.011, 0.045)
Everyday discrimination			0.025**	0.022*
			(0.007, 0.043)	(0.004, 0.040)
Major events discrimination			0.044***	0.026
			(0.017, 0.070)	(−0.001, 0.053)
Financial strain				0.066*
				(0.007, 0.125)
Stressful life events, lifetime experiences				−0.023
				(−0.095, 0.049)
Stressful life events, recent experiences				0.123***
				(0.085, 0.162)
Intercept	0.967***	1.447***	1.481***	0.960***
	(0.849, 1.085)	(0.964, 1.930)	(0.998, 1.963)	(0.459, 1.461)

Results weighted to account for sampling design. All models include adjustment for age (years), gender, education, and ln-transformed income

Tests for difference from zero: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

[a] One additional category of "non-Hispanic other," which included multiple other race/ethnicities and which were approximately four percent of the sample, was included in the analyses. However, because the sample size of this category was small and is not easily interpretable due to the inclusion of multiple race/ethnicities, we do not include it in this table or discuss it in the text

but not Hispanic, adults reported greater sleep difficulty compared to white adults—and that adjusting for racism-related vigilance attenuated the black-white disparities in sleep difficulty. Our results also suggest that the three race-related measures (the two race-related stressor measures of discrimination and the one race-related stress measure of vigilance) capture different aspects of racial discrimination experience. After accounting for racism-related vigilance and the two measures of racial discrimination, there is a suggestion that black adults actually have *lower* sleep difficulty compared to white adults.

Our results are consistent with research on perseverative stress and sleep quality and duration. Research has shown an association between stress-related intrusive thoughts or worry and both survey and laboratory measures of sleep (Hall et al. 1997, 2008, 2009; Brosschot et al. 2006). Notably, however, ours is the first study to examine the perseverative and anticipatory features of the American racial discrimination experience in relation to both sleep difficulty and racial/ethnic disparities in sleep difficulty. There is some research on the positive association between the personal experiences of unfair treatment and sleep difficulty (Steffen and Bowden 2006; Thomas et al. 2006; Beatty et al. 2011; Lewis et al. 2012; Tomfohr et al. 2012). Our results extend this literature in two ways—first by showing that the anticipation of racial discrimination, even in the absence of actual interpersonal discriminatory experiences, is a form of chronic stress that is detrimental to healthy sleep. Furthermore, most of the literature on unfair treatment and sleep is based on studies in small laboratory settings. On the other hand, our sample was a population representative.

Our results suggest that the notion (and measurement) of racism-related vigilance is distinct from the notion (and measurement) of interpersonal experiences with racial discrimination. It may be that the anticipation of or perseveration on racial discrimination does not necessarily only result from personal experiences of racial (or other forms of) discrimination. For example, research in psychology and child development suggests that a critical component of ethno-racial socialization practices among black parents includes preparing their children for future encounters with racial discrimination and coping strategies to deal with these experiences (i.e., "preparation for bias") (Hughes and DuMont 1993; Hughes and Chen 1997;

Hughes 2003; Lewis et al. 2012). Indeed, vigilant behaviors may be an important part of the social landscape of African Americans starting at an early age. An important area of future research would be on the association between vigilance and sleep in children, as well as the compounding impacts of vigilance across the life course. While researchers have shown racial/ethnic disparities in sleep quality and duration in children (Crosby et al. 2005; McLaughlin Crabtree et al. 2005), most (if not all) focus on the effects of the sleep environment (McLaughlin Crabtree et al. 2005; Milan et al. 2007).

While this is the first examination of racism-related vigilance and sleep difficulty in the literature and we were able to benefit from a population-based sample, this study is not without limitations. First, we used a survey measure of sleep difficulty. While there is no consensus on state-of-the-art survey measures of sleep quality, it may be that our sleep measure does not capture important aspects of sleep quality that would be particularly important to racial/ethnic disparities. Our analyses should be replicated using other survey measures of sleep. Our sample included only residents of Chicago and may not be generalizable to other areas of the USA. Further research is needed to examine the association between racism-related vigilance and sleep in samples from other areas.

We also used a measure of racism-related vigilance that had been developed based on ethnographic work specifically in black Americans. Research documents that the American racial/ethnic experience varies by racial/ethnic group, due to the sociopolitical and historical formation and meaning of each of these groups(Omi and Winant 1994; Bonilla-Silva 2010). Future research on racism-related vigilance would benefit from measurement development based on ethnographic work done with the different Hispanic groups.

In addition to replicating these analyses in other samples, future research should also explore the biological mechanisms linking racism-related vigilance and sleep difficulty. These studies would include work in sleep laboratory settings to determine which aspects of sleep quality are most affected by vigilance. Furthermore, research on the neuroendocrine system linking vigilance and sleep would also clarify these biological mechanisms. In addition to the biology, research should be conducted using longitudinal datasets to examine the temporal ordering and scale of the association between vigilance and sleep.

In sum, our results suggest that racism-related vigilance is an important determinant of racial disparities in sleep quality. Furthermore, because of its connection to both factors, it may be that sleep quality and duration may be an important link between chronic stress and health (Ribet and Derriennic 1999; Knudsen et al. 2007; Burgard and Ailshire 2009; Hall et al. 2009; Mezick et al. 2009). Our results contribute to the understanding of the ways in which race/ethnicity is linked to health through chronic stress.

References

Adler, N. E., & Rehkopf, D. H. (2008). US disparities in health: Descriptions, causes, and mechanisms. *Annual Review of Public Health, 29*, 235–252.

Akerstedt, T. (2006). Psychosocial stress and impaired sleep. *Scandinavian Journal of Work, Environment & Health, 32*(6), 493–501.

Akerstedt, T., Kecklund, G., et al. (2007). Impaired sleep after bedtime stress and worries. *Biological Psychology, 76*(3), 170–173.

Åkerstedt, T., Nordin, M., et al. (2012). Predicting changes in sleep complaints from baseline values and changes in work demands, work control, and work preoccupation–the WOLF-project. *Sleep Medicine, 13*(1), 73–80.

Ayas, N. T., White, D. P., et al. (2003a). A prospective study of self-reported sleep duration and incident diabetes in women. *Diabetes Care, 26*(2), 380–384.

Ayas, N. T., White, D. P., et al. (2003b). A prospective study of sleep duration and coronary heart disease in women. *Archives of Internal Medicine, 163*(2), 205.

Baldwin, C. M., Ervin, A.-M., et al. (2010). Sleep disturbances, quality of life, and ethnicity: the sleep heart health study. *Journal of clinical sleep medicine: JCSM: Official Publication of the American Academy of Sleep Medicine, 6*(2), 176.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173–1182.

Beatty, D. L., Hall, M. H., et al. (2011). Unfair treatment is associated with poor sleep in African American and Caucasian adults: Pittsburgh SleepSCORE project. *Health Psychology, 30*(3), 351–359.

Bertrand, M., & Mullainathan, S. (2004). Are Emily and Greg more employable than Lakisha and Jamal? A field experiment on labor market discrimination. *American Economic Review, 94*(4), 991–1013.

Bonilla-Silva, E. (2010). *Racism without racists: Color-blind racism and the persistence of racial inequality in America*. Lanham, MD: Rowman & Littlefield.

Borrell, L. N., & Kiefe C. I. et al. (2012). "Racial discrimination, racial/ethnic segregation, and health behaviors in the CARDIA study." *Ethnicity and Health*. doi:10.1080/13557858.2012.713092.

Brissette, I. (2002). The contribution of individual differences in hostility to the associations between daily interpersonal conflict, affect, and sleep. *Personality and Social Psychology Bulletin, 28*(9), 1265–1274.

Brosschot, J. F. (2010). Markers of chronic stress: Prolonged physiological activation and (un)conscious perseverative cognition. *Neuroscience and Biobehavioral Reviews, 35*(1), 46–50.

Brosschot, J. F., Gerin, W., et al. (2006). The perseverative cognition hypothesis: A review of worry, prolonged stress-related physiological activation, and health. *Journal of Psychosomatic Research, 60*(2), 113–124.

Brosschot, J. F., Pieper, S., et al. (2005). Expanding stress theory: Prolonged activation and perseverative cognition. *Psychoneuroendocrinology, 30*(10), 1043–1049.

Burgard, S. A., & Ailshire, J. A. (2009). Putting work to bed: Stressful experiences on the job and sleep quality. *Journal of Health and Social Behavior, 50*(4), 476–492.

Buxton, O. M., & Marcelli, E. (2010). Short and long sleep are positively associated with obesity, diabetes, hypertension, and cardiovascular disease among adults in the United States. *Social Science and Medicine, 71*(5), 1027–1036.

Cappuccio, F. P., D'Elia, L., et al. (2010a). Sleep duration and all-cause mortality: A systematic review and meta-analysis of prospective studies. *Sleep, 33*(5), 585–592.

Cappuccio, F. P., D'Elia, L., et al. (2010b). Quantity and quality of sleep and incidence of type 2 diabetes: A systematic review and meta-analysis. *Diabetes Care, 33*(2), 414–420.

Clark, R., Anderson, N. B., et al. (1999). Racism as a stressor for African Americans—a biopsychosocial model. *American Psychologist, 54*(10), 805–816.

Clark, R., Benkert, R. A., et al. (2006). Large arterial elasticity varies as a function of gender and racism-related vigilance in black youth. *Journal of Adolescent Health, 39*(4), 562–569.

Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care. (2003). *Unequal treatment: Confronting racial and ethnic disparities in health care (with CD)*. Washington, DC: The National Academies Press.

Crosby, B., LeBourgeois, M. K., et al. (2005). Racial differences in reported napping and nocturnal sleep in 2-to 8-year-old children. *Pediatrics, 115*(Supplement 1), 225–232.

Davis, S. K., Liu, Y., et al. (2005). Stress-related racial discrimination and hypertension likelihood in a population-based sample of African Americans: The Metro Atlanta Heart Disease Study. *Ethnicity and Disease, 15*(4), 585–593.

de Lange, A. H., Kompier, M. A., et al. (2009). A hard day's night: A longitudinal study on the relationships among job demands and job control, sleep quality and fatigue. *Journal of Sleep Research, 18*(3), 374–383.

Dimsdale, J. E. (2008). Psychological stress and cardiovascular disease. *Journal of the American College of Cardiology, 51*(13), 1237–1246.

Du Bois, W. E. B., & Eaton, I. (1899). *The Philadelphia Negro : A social study*. Philadelphia: Published for the University.

Essed, P. (1990). *Everyday racism: Reports from women of two cultures*. CA, Hunter House: Claremont.

Feagin, J. R. (1991). The continuing significance of race—antiblack discrimination in public places. *American Sociological Review, 56*(1), 101–116.

Feagin, J. R., & Sikes, M. P. (1994). *Living with racism: The black middle-class experience*. Boston: Beacon Press.

Fiscella, K., & Holt, K. (2008). Racial disparity in hypertension control: Tallying the death toll. *The Annals of Family Medicine, 6*(6), 497–502.

Frisbie, W. P., Song, S. E., et al. (2004). The increasing racial disparity in infant mortality: Respiratory distress syndrome and other causes. *Demography, 41*(4), 773–800.

Gainous, J. (2012). The new "new racism" thesis limited government values and race-conscious policy attitudes. *Journal of Black Studies, 43*(3), 251–273.

Galster, G. (1990). Racial steering by real estate agents: Mechanisms and motives. *The Review of Black Political Economy, 19*(1), 39–63.

Geronimus, A. T., Bound, J., et al. (1996). Excess mortality among blacks and whites in the United States. *New England Journal of Medicine, 335*(21), 1552–1558.

Geronimus, A. T., Bound, J., et al. (2001). Inequality in life expectancy, functional status, and active life expectancy across selected black and white populations in the United States. *Demography, 38*(2), 227–251.

Geronimus, A., M. T., & Hicken, et al. (2010). "Do US Black women experience stress-related accelerated biological aging?". *Human Nature, 21*(1), 19–38.

Hale, L., & Do, D. P. (2007). Racial differences in self-reports of sleep duration in a population-based study. *Sleep, 30*(9), 1096.

Hall, M., Buysse, D. J., et al. (1997). Intrusive thoughts and avoidance behaviors are associated with sleep disturbances in bereavement-related depression. *Depression and Anxiety, 6*(3), 106–112.

Hall, M., Buysse, D. J., et al. (2000). Symptoms of stress and depression as correlates of sleep in primary insomnia. *Psychosomatic Medicine, 62*(2), 227–230.

Hall, M., Buysse, D. J., et al. (2008). Financial strain is a significant correlate of sleep continuity disturbances in late-life. *Biological Psychology, 77*(2), 217–222.

Hall, M. H., Matthews, K. A., et al. (2009). Race and financial strain are independent correlates of sleep in midlife women: The SWAN sleep study. *Sleep, 32*(1), 73–82.

Harrell, S. P. (2000). A multidimensional conceptualization of racism-related stress: Implications for the well-being of people of color. *American Journal of Orthopsychiatry, 70*(1), 42–57.

Harrell, C. J., Burford, T. I., et al. (2011). Multiple pathways linking racism to health outcomes. *Du Bois Review, 8*(1), 143–157.

Heraclides, A., Chandola, T., et al. (2009). Psychosocial stress at work doubles the risk of type 2 diabetes in middle-aged women: Evidence from the Whitehall II study. *Diabetes Care, 32*(12), 2230–2235.

Hertz, R. P., Unger, A. N., et al. (2005). Racial disparities in hypertension prevalence, awareness, and management. *Archives of Internal Medicine, 165*(18), 2098–2104.

Hicken, M., Gragg, R., et al. (2011). How cumulative risks warrant a shift in our approach to racial health disparities: The case of lead, stress, and hypertension. *Health Affairs (Millwood), 30*(10), 1895–1901.

Hicken, M. T., & Lee, H. et al. "Racial/ethnic disparities in hypertension prevalence: Reconsidering the role of chronic stress." *American Journal of Public Health*.

Hughes, D. (2003). Correlates of African American and Latino parents' messages to children about ethnicity and race: A comparative study of racial socialization. *American Journal of Community Psychology, 31*(1), 15–33.

Hughes, D., & Chen, L. (1997). When and what parents tell children about race: An examination of race-related socialization among African American families. *Applied Developmental Science, 1*(4), 200–214.

Hughes, D., & DuMont, K. (1993). Using focus groups to facilitate culturally anchored research. *American Journal of Community Psychology, 21*(6), 775–806.

Jackson, P. B. (2005). Health inequalities among minority populations. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences, 60*, 63–67.

Jackson, J. S., Knight, K. M., et al. (2010). Race and unhealthy behaviors: Chronic stress, the HPA axis, and physical and mental health disparities over the life course. *American Journal of Public Health, 100*(5), 933–939.

James, S. A. (1993). Racial and ethnic differences in infant mortality and low birth weight. A psychosocial critique. *Annals of Epidemiology, 3*(2), 130–136.

Kaplan, M. S., & Nunes, A. (2003). The psychosocial determinants of hypertension. *Nutrition Metabolism and Cardiovascular Diseases, 13*(1), 52–59.

Kessler, R. C., Mickelson, K. D., et al. (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.

Knudsen, H. K., Ducharme, L. J., et al. (2007). Job stress and poor sleep quality: Data from an American sample of full-time workers. *Social Science and Medicine, 64*(10), 1997–2007.

Knutson, K. L. (2013). Sociodemographic and cultural determinants of sleep deficiency: Implications for cardiometabolic disease risk. *Social Science and Medicine, 79*, 7–15.

Knutson, K. L., & Van Cauter, E. (2008). Associations between sleep loss and increased risk of obesity and diabetes. *Annals of the New York Academy of Sciences, 1129*, 287–304.

Knutson, K. L., Van Cauter, E., et al. (2011). Cross-sectional associations between measures of sleep and markers of glucose metabolism among subjects with and without diabetes: The coronary artery risk development in young adults (CARDIA) sleep study. *Diabetes Care, 34*(5), 1171–1176.

Kramer, M. R., & Hogue, C. R. (2009). What causes racial disparities in very preterm birth? A biosocial perspective. *Epidemiology Reviews, 31*, 84–98.

Krieger, N. (1990). Racial and gender discrimination: Risk factors for high blood pressure? *Social Science and Medicine, 30*(12), 1273–1281.

Lewis, T. T., Troxel, W. M., et al. (2012). Chronic exposure to everyday discrimination and sleep in a multiethnic sample of middle-aged women. *Health Psychology,*. doi:10.1037/a0029938.

Lindstrom, M. (2008). Social capital, anticipated ethnic discrimination and self-reported psychological health: A population-based study. *Social Science and Medicine, 66*(1), 1–13.

Mallon, L., Broman, J. E., et al. (2002). Sleep complaints predict coronary artery disease mortality in males: A 12-year follow-up study of a middle-aged Swedish population. *Journal of Internal Medicine, 251*(3), 207–216.

McEwen, B. S. (2003). Mood disorders and allostatic load. *Biological Psychiatry, 54*(3), 200–207.

McEwen, B. S., & Sapolsky, R. M. (1995). Stress and cognitive function. *Current Opinion in Neurobiology, 5*(2), 205–216.

McLaughlin Crabtree, V., Beal Korhonen, J., et al. (2005). Cultural influences on the bedtime behaviors of young children. *Sleep Medicine, 6*(4), 319–324.

Mensah, G. A., Mokdad, A. H., et al. (2005). State of disparities in cardiovascular health in the United States. *Circulation, 111*(10), 1233–1241.

Mezick, E. J., Matthews, K. A., et al. (2008). Influence of race and socioeconomic status on sleep: Pittsburgh SleepSCORE project. *Psychosomatic Medicine, 70*(4), 410–416.

Mezick, E. J., Matthews, K. A., et al. (2009). Intra-individual variability in sleep duration and fragmentation: Associations with stress. *Psychoneuroendocrinology, 34*(9), 1346–1354.

Milan, S., Snow, S., et al. (2007). The context of preschool children's sleep: Racial/ethnic differences in sleep locations, routines, and concerns. *Journal of Family Psychology, 21*(1), 20–28.

Mirowsky, J., & Ross, C. E. (2003). *Social causes of psychological distress*. New York: Aldine de Gruyter.

Mohseni, M., & Lindstrom, M. (2008). Ethnic differences in anticipated discrimination, generalised trust in other people and self-rated health: A population-based study in Sweden. *Ethnicity and Health, 13*(5), 417–434.

Morenoff, J. D., House, J. S., et al. (2007). Understanding social disparities in hypertension prevalence, awareness, treatment, and control: The role of neighborhood context. *Social Science and Medicine, 65*(9), 1853–1866.

National Center for Health Statistics. (2012). *Healthy people 2010 final review*. Hyattsville, MD: Centers for Disease Control and Prevention.

Omi, M., & Winant, H. A. (1994). *Racial formation in the United States: From the 1960s to the 1990s*. Psychology Press: New York.

Paradies, Y. (2006). A systematic review of empirical research on self-reported racism and health. *International Journal of Epidemiology, 35*(4), 888–901.

Patel, S. R., Ayas, N. T., et al. (2004). A prospective study of sleep duration and mortality risk in women. *Sleep, 27*(3), 440–444.

Pearlin, L., & Bierman, A. (2013). Current issues and future directions in research into the stress process. In C. S. Aneshensel & J. C. Phelan (Eds.), *Handbook of the sociology of mental health* (2nd ed., pp. 325–340). New York: Springer.

Phillips, B., & Mannino, D. M. (2007). Do insomnia complaints cause hypertension or cardiovascular disease? *Journal of Clinical Sleep Medicine, 3*(5), 489–494.

Prahlad, A. (1996). *African-American proverbs in context.* Jackson: University Press of Mississippi.

Press, Stata. (2011). *STATA multiple imputation reference manual college station*. TX: StataCorp.

Ribet, C., & Derriennic, F. (1999). "Age, working conditions, and sleep disorders: A longitudinal analysis in the French cohort ESTEV." *Sleep*: *Journal of Sleep Research & Sleep Medicine, 22*(4), 491–504.

Rowe, M. A., McCrae, C. S., et al. (2008). Sleep pattern differences between older adult dementia caregivers and older adult noncaregivers using objective and subjective measures. *Journal of Clinical Sleep Medicine, 4*(4), 362–369.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: Wiley.

Sawyer, P. J., Major, B., et al. (2012). Discrimination and the stress response: Psychological and physiological consequences of anticipating prejudice in interethnic interactions. *American Journal of Public Health, 102*(5), 1020–1026.

Schulman, K. A., Berlin, J. A., et al. (1999). The effect of race and sex on physicians' recommendations for cardiac catheterization. *New England Journal of Medicine, 340*(8), 618–626.

Seeman, T. E., Singer, B. H., et al. (1997). Price of adaptation–allostatic load and its health consequences. MacArthur studies of successful aging. *Archives of Internal Medicine, 157*(19), 2259–2268.

Steffen, P. R., & Bowden, M. (2006). Sleep disturbance mediates the relationship between perceived racism and depressive symptoms. *Ethnicity and Disease, 16*(Winter), 16–21.

Sternthal, M. J., Slopen, N., et al. (2011). Racial disparities in health: How much does stress really matter? *Du Bois Review, 8*(01), 95–113.

Sue, D. W., Capodilupo, C. M., et al. (2007). Racial microaggressions in everyday life: implications for clinical practice. *American Psychologist, 62*(4), 271–286.

Surwit, R. S., Schneider, M. S., et al. (1992). Stress and diabetes mellitus. *Diabetes Care, 15*(10), 1413–1422.

Thomas, K. S., Bardwell, W. A., et al. (2006). The toll of ethnic discrimination on sleep architecture and fatigue. *Health Psychology, 25*(5), 635–642.

Tomfohr, L., Pung, M. A., et al. (2012). Racial differences in sleep architecture: The role of ethnic discrimination. *Biological Psychology, 89*(1), 34–38.

Turner, J. R. (2009). Understanding health disparities: The promise of the stress process model. In W. R. Avison (Ed.), *Advances in the conceptualization of the stress process* (pp. 3–21). New York: Springer.

Williams, D. R. (1997). Race and health: Basic questions, emerging directions. *Annals of Epidemiology, 7*(5), 322–333.

Williams, D. R. (1999). Race, socioeconomic status, and health. The added effects of racism and discrimination. *Annals of the New York Academy of Sciences, 896*, 173–188.

Williams, D. R., & Jackson, P. B. (2005). Social sources of racial disparities in health—Policies in societal domains, far removed from traditional health policy, can have decisive consequences for health. *Health Affairs, 24*(2), 325–334.

Williams, D. R., John, D. A., et al. (2012). Research on discrimination and health: An exploratory study of unresolved conceptual and measurement issues. *American Journal of Public Health, 102*(5), 975–978.

Williams, D. R., & Mohammed, S. A. (2009). Discrimination and racial disparities in health: Evidence and needed research. *Journal of Behavioral Medicine, 32*(1), 20–47.

Williams, D. R., Mohammed, S., et al. (2010). Race, socioeconomic status, and health: Complexities, ongoing challenges, and research opportunities. *Annals of the New York Academy of Sciences (The Biology of Disadvantage: Socioeconomic Status and Health), 1186*, 69–101.

Williams, D. R., Yan, Y., et al. (1997). Racial differences in physical and mental health: Socio-economic status, stress and discrimination. *Journal of Health Psychology, 2*(3), 335–351.

Wyatt, S. B., Williams, D. R., et al. (2003). Racism and cardiovascular disease in African Americans. *American Journal of the Medical Sciences, 325*(6), 315–331.