

Psychological and Biological Responses to Race-Based Social Stress as Pathways to Disparities in Educational Outcomes

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We present the race-based disparities in stress and sleep in context model (RDSSC), which argues that racial/ethnic disparities in educational achievement and attainment are partially explained by the effects of race-based stressors, such as stereotype threat and perceived discrimination, on psychological and biological responses to stress, which, in turn, impact cognitive functioning and academic performance. Whereas the roles of psychological coping responses, such as devaluation and disidentification, have been theorized in previous work, the present model integrates the roles of biological stress responses, such as changes in stress hormones and sleep hours and quality, to this rich literature. We situate our model of the impact of race-based stress in the broader contexts of other stressors [e.g., stressors associated with socioeconomic status (SES)], developmental histories of stress, and individual and group differences in access to resources, opportunity and employment structures. Considering both psychological and biological responses to race-based stressors, in social contexts, will yield a more comprehensive understanding of the emergence of academic disparities between Whites and racial/ethnic minorities.

Keywords: stress, sleep, coping, cortisol, academic achievement

Since the landmark findings published in the Coleman Report in 1966 (Coleman et al., 1966), research has proliferated on the topic of the educational disparities between Whites and disadvantaged racial/ethnic minorities (e.g., Blacks and Latinos). Educational disparities between Whites and racial/ethnic minorities are observed on a number of indicators, including test performance, high school graduation rates, and college enrollment (Burchinal et al., 2011; Snyder & Dillow, 2012).

Clearly, many factors affect educational outcomes. Structural factors such as school and teacher quality have been

found to play a large role in influencing educational disparities between racial/ethnic minorities and Whites (Boyd, Lankford, Loeb, Rockoff, & Wyckoff, 2008; Burchinal et al., 2011; Wiggan, 2007), but these factors do not fully explain the achievement gap. In this article, we propose that psychological stress associated with being a member of a racial/ethnic minority group, and the psychological and biological responses elicited by that stress, may also contribute to the achievement gap found between Whites and racial/ethnic minorities (Steele & Aronson, 1995). Key race-based social stressors include perceived discrimination (the observation or anticipation of unfair treatment based on race/ethnicity)¹ and stereotype threat (the stress of wanting to perform well to overcome negative expectations of one's racial/ethnic group; Clark, Anderson, Clark, & Williams, 1999; Major & O'Brien, 2005; Miller & Kaiser, 2001). Psychological and biological responses to these stressors, in turn, have implications for motivation as well as basic cognitive processes such as attention, memory, and executive functioning, all of which are associated with academic achievement.

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¹ We use the term “perceived discrimination” throughout our review, because of convention in the field of psychology and because perceptions of discrimination whether, present or anticipated, activate the types of behavioral and biological processes of interest in this article. However, we also recognize that discrimination can and often does limit opportunities without being perceived.



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We make the case that the effects of race-based stress on biological responses, including changes in stress hormones and sleep processes, are important and particularly understudied pathways to the emergence of racial/ethnic disparities in educational achievement and attainment. We situate our investigation in the broader contexts of other stressors (for example, stressors associated with socioeconomic status [SES]), relevant developmental histories of stress, and individual and group differences in access to resources, opportunity, and employment structures. These factors may either attenuate or exacerbate the negative impact of race-based stress on academic outcomes. A depiction of how these processes could serve as pathways to disparities in educational and employment outcomes is shown in [Figure 1](#), a model we are calling the race-based disparities in stress and sleep in context model (RDSSC). Evidence for the RDSSC model will be elaborated in the sections that follow.

The Achievement Gap (Defining the Problem)

Gaps in achievement are found both for race and by SES. Research and theory regarding the race-based achievement gap, including the current article, typically consider lower academic achievement and lower levels of academic attainment found, on average, among disadvantaged racial/ethnic minorities, with a particular focus on Blacks and Latinos. For example, [Burchinal and colleagues \(2011\)](#) found in their longitudinal study that Black children had lower reading and math scores in Grades 1, 3, and 5 compared with White children. Similarly, Latino children tend to have lower reading and math scores when entering kindergarten, and these differences persist through at least fifth grade

([Reardon & Galindo, 2009](#)). These differences are also found in levels of academic attainment. Among 25- to 29-year-olds in 2011, the percentage of Blacks (88%) and Latinos (71%) who had completed high school was lower than the percentage of Whites (94%) and Asians (95%; [Snyder & Dillow, 2012](#)).

Socioeconomic achievement gaps refer to differences in performance found between children from families with higher versus lower SES circumstances, typically defined in this literature according to parental occupation, education, and/or income levels ([Sirin, 2005](#)). For example, students from lower SES backgrounds (e.g., lower family income and parental educational attainment) tend to have lower reading, math, and science scores compared with students from higher SES backgrounds ([Reardon, 2011](#); [Sirin, 2005](#)). Further, in 2009, children who attended high-poverty schools (as defined by the percentage of students enrolled in free or reduced-price lunch) had lower National Assessment of Educational Progress math and reading scores and reading achievement levels compared with students who attended low-poverty schools ([Aud et al., 2010](#)).

SES is a robust predictor of educational outcomes (e.g., [Sirin, 2005](#)), and recent research suggests that the SES-based achievement gap (the achievement gap between high-income families at the 90th percentile of the income distribution and low-income families at the 10th percentile of the income distribution) has not only widened since the mid-1970s, but is now twice as large as the Black–White achievement gap ([Reardon, 2011, 2013](#)). Specifically, on both standardized reading and math scores, the SES-based achievement gap has widened from roughly 0.9 of a standard deviation to approximately 1.25 standard deviations, whereas the Black–White achievement gap has narrowed from roughly 0.9 of a standard deviation to approximately 0.75 of a standard deviation ([Reardon, 2013](#)). The Hispanic–White achievement gap in the elementary grades in standardized reading and math scores are similar to the Black–White achievement gap at 0.75 of a standard deviation ([Reardon & Galindo, 2009](#)). Disadvantaged racial/ethnic minorities such as Blacks and Hispanics are overrepresented among the lower social classes in the United States ([Costello, Keeler, & Angold, 2001](#); [Ratcliffe & McKernan, 2010](#)), and in high-poverty schools ([Aud et al., 2010](#)), which might lead scholars to conclude that SES largely drives differences between disadvantaged racial/ethnic minorities and Whites.

Racial/ethnic disparities in educational achievement and attainment, however, persist beyond the effects of SES ([American Psychological Association \[APA\] Presidential Task Force on Educational Disparities, 2012](#))—that is, social class does not fully account for the racial/ethnic achievement gap ([Hedges & Nowell, 1999](#); [Magnuson & Duncan, 2006](#); [Sirin, 2005](#)). Moreover, racial/ethnic minorities have poorer academic achievement at every level of income, with disparities observed even at higher levels of SES ([Williams, 1999](#)), and racial gaps in some academic



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outcomes (e.g., reading and math) have remained stable or even widened since the early 1990s (Kao & Thompson, 2003; Neal, 2006). Taken together, this work suggests that unique facets associated with race-based social experiences, that cannot be attributed to SES, contribute to racial/ethnic disparities in educational achievement and attainment. We suggest that race-based social stress may be one such factor.

Race-Based Social Stress

Complementing the extant research on structural factors that influence racial/ethnic achievement gaps (e.g., Wiggan, 2007), recent work has considered individual/psychological pathways that shape minority students' academic achievement. A growing body of research has linked race-based stressors such as perceived discrimination and stereotype threat to racial/ethnic disparities in educational achievement and attainment (see Stressors and Resources box, left-hand side of Figure 1; Steele, 2010; Steele, Spencer, & Aronson, 2002; Taylor, Casten, Flickinger, Roberts, & Fulmore, 1994). Although we are focusing on these two sources of race-based stress in particular, because of their growing evidence base, other sources of race-related stress, such as awareness of systemic, symbolic, collective, and individual racial prejudice, as well as shock, fear, and mourning in response to racially motivated violence, should set in motion similar biological and psychological coping responses. In the following sections, we highlight evidence that demonstrates the detrimental effects of race-based stress on educational outcomes.

Perceived Discrimination

Perceptions of discrimination have their origins in encountered instances of discrimination as well as the antici-

pation of discrimination that results from a history of past discrimination experiences (Pascoe & Smart Richman, 2009). By adolescence, most members of stigmatized racial/ethnic minority groups are aware of discrimination in their environments (e.g., neighborhood) and in school settings (for review, see Spears Brown & Bigler, 2005). For example, Fisher, Wallace, and Fenton (2000) found that Black and Latino adolescents (between Ages 13 and 19) were more likely than their Asian and non-Hispanic White peers to report being the victims of institutional discrimination. Such experiences with discrimination are related to greater socioemotional difficulties, such as increased anger, depressive symptoms, and conduct problems (Brody et al., 2006; Wong, Eccles, & Sameroff, 2003).

Perceived discrimination is associated with negative academic outcomes. Among Latino and Black adolescents, perceived discrimination from teachers and/or expecting future discrimination are related to lower grades, less academic motivation, lower academic success more generally, and less persistence when encountering an academic challenge (Alfaro, Umaña-Taylor, Gonzales-Backen, Bámaca, & Zeiders, 2009; Eccles, Wong, & Peck, 2006; Neblett, Philip, Cogburn, & Sellers, 2006; Stone & Han, 2005; Taylor et al., 1994).

Stereotype Threat

Stereotype threat occurs when individuals are wary of confirming negative stereotypes held regarding their social identity group in important performance domains (see Steele, 2010, for a compelling review of this body of work). Racial/ethnic minority students are susceptible to experiencing stereotype threat in academic contexts, given their awareness of negative stereotypes that link their racial/ethnic identities to low intellectual ability (Steele et al., 2002). The activation of these negative stereotypes leads to increased cognitive load, possibly related to efforts to suppress these negative stereotypes and/or feelings of anxiety (Beilock, Rydell, & McConnell, 2007; Schmader, Johns, & Forbes, 2008), which, in turn, undermines individuals' ability to perform optimally on academic and other cognitive tasks. In their classic study, Steele and Aronson (1995) found that Black students who were told that an exam was diagnostic of intellectual capacity performed worse on the exam compared with Whites, but the same difference did not appear for Black students who were told that the exam was not diagnostic of intellect. The negative effects of stereotype threat have also been demonstrated in Latino students (Gonzales, Blanton, & Williams, 2002). These studies, bolstered by the rich body of work in this area, suggest that making negative performance stereotypes salient can activate concerns about confirming those stereotypes, which can be detrimental to performance.



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Perceived Discrimination, Stereotype Threat, and Stress

Perceived discrimination and stereotype threat might impact academic performance because these experiences are stressful. In their seminal review article, [Clark and colleagues \(1999\)](#) put forward a theoretical framework that placed racism, discrimination, and other related phenomena in a stress and coping framework, with the aim of understanding health disparities. Using this framework, a rich body of research has since emerged that explores the varied stress reactions and coping responses that unfold in response to race-based social stressors in adolescents (e.g., [Goosby, Malone, Richardson, Cheadle, & Williams, 2015](#); [Phinney & Chavira, 1995](#)) and adults (e.g., [Blascovich, Spencer, Quinn, & Steele, 2001](#); [J. S. Jackson, Knight, & Rafferty, 2010](#); [Williams & Mohammed, 2009](#); see also [Trawalter, Richeson, & Shelton, 2009](#)). The stress associated with race/ethnicity and other forms of stigma may be particularly profound because it is often pervasive, chronic, and tied to stable components of an individual's social identity ([Devos, Huynh, & Banaji, 2012](#); [Major & O'Brien, 2005](#)). Both discrimination and stereotype threat alter how individuals view their everyday situations; for instance, people are more likely to appraise situations in which negative group stereotypes are relevant as threatening ([Trawalter et al., 2009](#)). As described in more detail in the Race-Based Stress and Biological Responses section, these regular perceptions of (or encounters with) threatening environments may activate biological stress systems that are relevant to academic performance.

Resources or Buffers

From a stress and coping framework, the extent to which an external stressor is perceived as stressful may be altered by an individual's appraisal of the stressor and of the resources available to cope with the stressor ([S. Cohen, Kessler, & Gordon, 1995](#); [Lazarus & Folkman, 1984](#)). Thus, perceptions and consequences of race-based stress may be reduced by the presence of individual, school, family, and community resources (see [Figure 1](#), Stressors and Resources box, bottom middle). These resources and buffers may include group identification ([Branscombe, Schmitt, & Harvey, 1999](#); [Eccles et al., 2006](#); [Sellers & Shelton, 2003](#); [Spencer, Noll, Stoltzfus, & Harpalani, 2001](#); [Wong et al., 2003](#)), positive racial socialization messages from caregivers ([Neblett et al., 2006](#); [Neblett, Rivas-Drake, & Umaña-Taylor, 2012](#)), community social capital (e.g., resident stability, service-learning opportunities; [Eccles & Roeser, 2011](#); [Israel, Beaulieu, & Hartless, 2001](#)), smaller school size ([Rumberger & Thomas, 2000](#)), and perceived teacher support ([Fall & Roberts, 2012](#); [Rumberger & Thomas, 2000](#)). Group identification, for instance, can serve as an individual psychological resource that buffers against many of the harmful psychosocial effects of discrimination ([Branscombe et al., 1999](#); [Sellers & Shelton, 2003](#); [Brody, Yu, Miller, & Chen, 2015](#)). Furthermore, in the academic domain, racial/ethnic identification has been shown to attenuate the effects of discrimination on academic outcomes ([Eccles et al., 2006](#); [Wong et al., 2003](#)). Taken together, this work suggests that psychological resources, such as group identification and social support, can buffer against the negative effects of race-based stressors on academic achievement and attainment.

Effects of Coincident SES-Based Stress

The presence of additional stressors, such as those correlated with low SES, are likely to increase the overall levels of stress individuals face and may exacerbate the effects of race-based social stressors (e.g., [Myers, 2009](#)). Increased exposure to neighborhood stress, such as exposure to violence, pollution, and toxins, and disturbances by neighbors ([Ewart & Suchday, 2002](#); [Steptoe & Feldman, 2001](#)), in addition to daily life stressors, such as higher levels of financial strain and associated increases in family conflict, may combine additively or synergistically with race-based stressors to influence educational outcomes (see [Figure 1](#), Stressors and Resources box, right-hand side; [Myers, 2009](#)). For instance, low-SES racial/ethnic minorities may face a "double disadvantage" by being a member of a disadvantaged racial/ethnic minority group and by living in areas of concentrated poverty ([Farmer & Ferraro, 2005](#); [Matthews & Gallo, 2011](#); [Shavers, 2007](#)). Specifically, in the context of academic achievement and attainment, low-SES racial/ethnic minority children are more likely to attend high-minority/high-poverty schools that are more likely to be underfunded, have uncertified teachers, and have higher teacher turnover rates ([Arroyo, 2008](#); [Burchinal et al., 2011](#);



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Uline & Tschannen-Moran, 2008). Furthermore, low-SES racial/ethnic minority youth might have trouble envisioning an academically successful future self because of a lack of successful minority group role models in low-SES contexts (e.g., Oyserman, Bybee, & Terry, 2006; Oyserman & Destin, 2010). This may cause students to be less academically oriented and dedicate less time and resources to academically relevant tasks. These factors are related to underperformance and, thus, are likely to contribute to the racial academic achievement gap (Ronfeldt, Loeb, & Wyckoff, 2013).

Given that educational achievement and attainment disparities between racial/ethnic minorities and Whites are also seen at higher levels of SES (Ferguson, 2002; Ferguson, 2001b; Williams, 1999), racial/ethnic minority youth from higher SES backgrounds may also face unique psychosocial stressors, not necessarily tied to structural constraints, that have bearing on educational outcomes. Specifically, high-SES racial/ethnic minorities are more likely to report experiences with discrimination compared with low-SES racial/ethnic minorities (e.g., P. B. Jackson & Stewart, 2003; Kessler, Mickelson, & Williams, 1999). This might be in part because higher SES racial/ethnic minorities are likely to live in predominantly White neighborhoods and attend more integrated schools with higher proportions of White peers and educators (Brody et al., 2006; Farmer & Ferraro, 2005; Feagin & Sikes, 1995; Hamm, Bradford Brown, & Heck, 2005; Williams, 1999). Although research suggests that racial/ethnic minorities derive many educational benefits by attending more racially diverse schools (APA Presidential Task Force on Educational Disparities, 2012; Rosenbaum, Fishman, Brett, & Meaden, 1992), the racial/ethnic minority students in these schools might also be exposed to more interpersonal discrimination from educators

and peers alike (Ferguson, 2003; Hughes, Gleason, & Zhang, 2005; McKown & Weinstein, 2008; Rosenbaum et al., 1992; Sellers, Copeland-Linder, Martin, & Lewis, 2006). The increased exposure to discrimination, coupled with a lack of access to important social networks that can mitigate the negative effects of discrimination (Colen, Geronimus, Bound, & James, 2006; Hudson, 2015; Lareau, 2011), might contribute to elevated stress and racial/ethnic disparities in attainment among middle- and high-income groups.

The specific combination of stressors and available resources (appraised and actual) determines the extent to which individuals experience stress (Perceived Stress box, middle of Figure 1), which has important downstream impacts on psychological and biological outcomes that, in turn, affect academic outcomes. Specifically, the ways in which individuals respond to race-based stressors, either in terms of their psychological and biological responses, can either attenuate or exacerbate negative outcomes such as poor academic performance (e.g., Steele et al., 2002). Although many of the psychological and biological responses described here also occur for (and may be exacerbated by) non-race-based sources of stress, our review focuses on how responses to race-based stress in particular may contribute to disparities in academic achievement and attainment.

Race-Based Stress and Psychological Coping Responses

Coping responses involve efforts, often under a person's control, to manage thoughts, emotions, and behavior that accompany a stressful experience (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001). Those who experience race-based social stress, such as perceived discrimination, often exhibit increased psychological distress, anxiety, and anger (Figure 1, Psychological and Biological Stress Responses box, top middle; Jamieson, Koslov, Nock, & Mendes, 2013; Pascoe & Smart Richman, 2009). There are a number of distinct ways in which individuals can cope with stress (Lazarus & Folkman, 1984; Skinner, Edge, Altman, & Sherwood, 2003), including race-based stress (Clark et al., 1999). Coping responses have received considerable attention elsewhere (see Major & O'Brien, 2005; Miller & Kaiser, 2001; C. T. Miller & Major, 2000). We focus on two psychological coping responses that stigmatized racial/ethnic minority group members often deploy that have clear implications for academic performance: (a) devaluation or disidentification from a negatively stereotyped domain, and (b) emotion regulation (see Figure 1, Psychological and Biological Stress Responses box, top left).

Devaluation and Disidentification

Despite exposure to race-based stressors, extensive research finds that Black and Latino adolescents and adults

tend to have higher self-esteem relative to White adolescents and adults (for reviews, see Gray-Little & Hafdahl, 2000; Twenge & Crocker, 2002). Although there are many causes of this differential, one relevant factor in adolescence is the tendency for individuals to disengage their self-worth or self-esteem from negatively stereotyped domains as a way of coping with group-based discrimination or other group-based stressors (Major & O'Brien, 2005; Steele et al., 2002). In the academic domain, for instance, this can take the form of racial/ethnic minority students devaluing or discounting performance feedback on tests (Crocker & Major, 1989; Schmader, Major, & Gramzow, 2001). For example, Taylor and colleagues (1994) found that Black adolescents who were more aware of discrimination were more likely to perceive education as less important, and consequently showed more disengagement from their schoolwork compared with their peers who were less aware

of discrimination. The accumulation of these stressful experiences and subsequent efforts to cope can ultimately lead to complete disidentification with the domain—that is, removing one's self-worth from an academic domain—which undermines the motivation to perform well in the domain (Major & O'Brien, 2005; Steele et al., 2002). In other words, although these coping responses may protect self-esteem in the face of negative stereotypes, they can also come at the cost of aspirations, motivation, and persistence in the academic domain (see Figure 1, Psychological and Biological Stress Responses box, bottom left), ultimately affecting performance and educational attainment.

Emotion Regulation

In addition to these shifts in psychological connection with the academic domain, recent work has begun to exam-

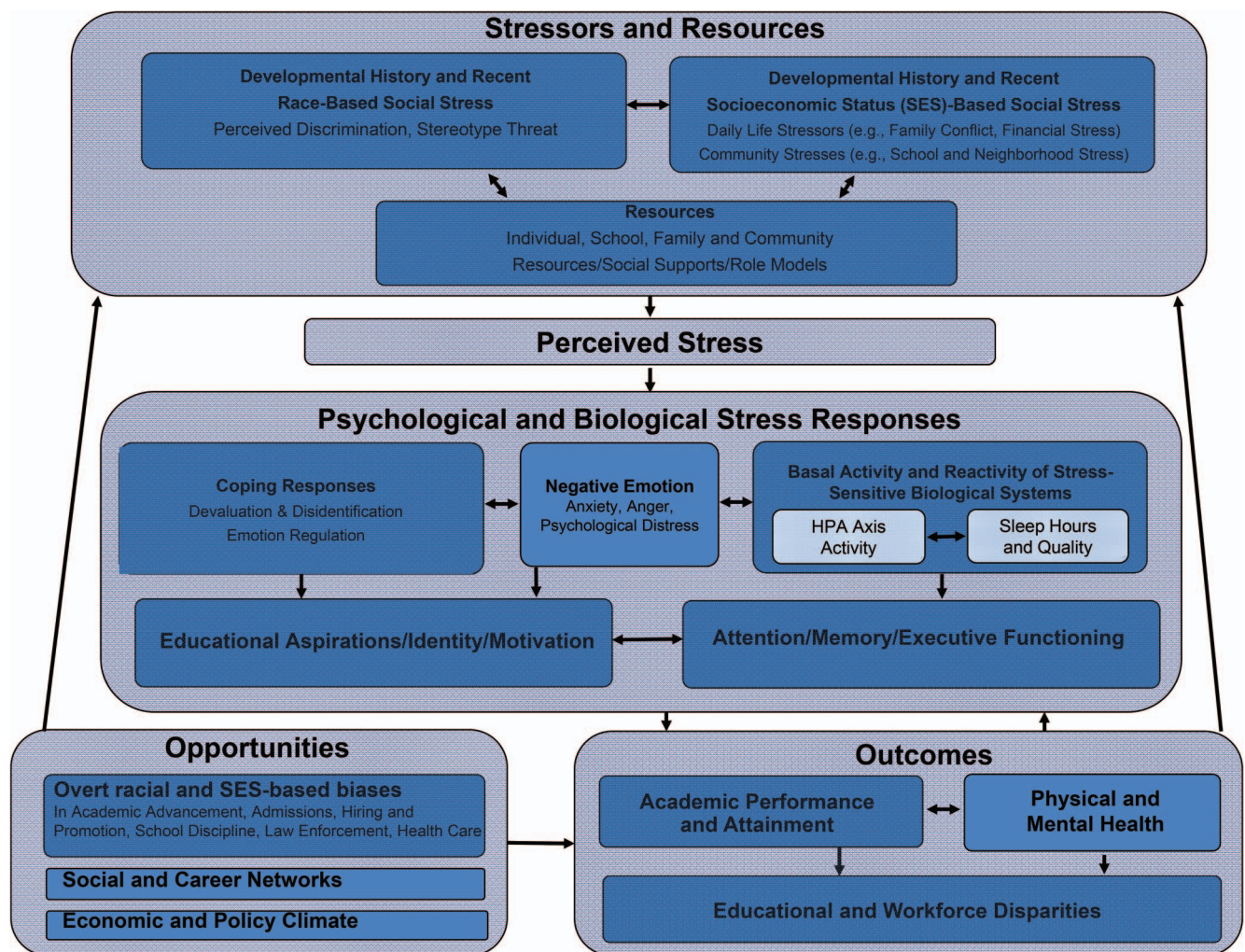


Figure 1. Race-Based disparities in stress and sleep in context model (RDSSC). A depiction of the impact of race-based stressors on psychological and biological responses as potential pathways to disparities in educational outcomes. HPA = hypothalamic-pituitary-adrenal. See the online article for the color version of this figure.

ine the effects of how individuals manage their emotional reactions to race-based stressors on any number of important outcomes. Across a broad range of psychological stressors, research suggests that certain emotion regulation strategies (e.g., cognitive reappraisal) lead to more adaptive emotional, cardiovascular, and cognitive stress responses compared with other emotion regulation strategies (e.g., expressive suppression or rumination; Gross, 2002; Jamieson, Nock, & Mendes, 2012; Webb, Miles, & Sheeran, 2012). Reappraisal involves the reframing or reinterpretation of anxiety and/or physiological stress responses in a more positive light (Gross, 2002; Jamieson et al., 2012) and has been found to buffer the negative effects of stereotype threat. Johns, Inzlicht, and Schmader (2008) found, for instance, that stigmatized college students who were told that anxiety helps performance on certain tasks prior to completing math and working memory tasks performed better than individuals who did not receive the reappraisal instructions or those who were told to suppress their emotions. Researchers posit that engaging in this type of reappraisal reduces the burden of stereotype threat on working memory, thereby reducing negative performance outcomes (Inzlicht & Kang, 2010; Schmader, 2010). Consistent with this work, reappraisal has been found to boost working memory and improve reading comprehension among middle-school children (Autin & Croizet, 2012). Taken together, this work suggests that reappraisal in response to race-based stressors might help to alleviate the negative impact of these experiences on academic outcomes.

Coping Responses: Summary

As argued persuasively in other work (Crocker & Major, 1989; Johns et al., 2008; Schmader et al., 2001), one important pathway from race-based stressors, such as perceived discrimination and stereotype threat, to racial/ethnic achievement gaps involves individuals' coping responses, such as devaluation, and emotion regulation. These coping responses are each associated with variance in academic engagement in general. Consequently, it is important to consider the effects of these coping responses in order to alleviate the negative impacts of race-based stressors on racial/ethnic minority students' academic outcomes. In addition to the effects of these coping responses, however, we highlight important, yet understudied, potential effects of biological stress reactions in response to race-based stressors, on educational attainment and achievement (see Figure 1 right side). In the next section, we review recent research pertaining to this pathway.

Race-Based Stress and Biological Responses

Biological responses to stress are characterized by multiple changes in stress-sensitive biological systems, includ-

ing autonomic nervous system activation, increased activation of the hypothalamic-pituitary-adrenal (HPA) axis, and modulation of immune system activity (McEwen, 1998; G. E. Miller, Chen, & Zhou, 2007; G. E. Miller, Cohen, & Ritchey, 2002; Seeman, Singer, Rowe, Horwitz, & McEwen, 1997). These physiological responses are thought to occur when perceived stress overwhelms the perceived availability of coping resources (for review see Lazarus, 1991).

Activation of the HPA axis, as indicated by increases in its primary hormonal product, cortisol, as well as cardiovascular reactivity, indicated by increases in blood pressure and heart rate, have been found to occur in response to race-based stress (Clark et al., 1999). Sleep is another system that is highly sensitive to stress, including race-based social stress (Åkerstedt, 2006; Kim & Dimsdale, 2007). We focus here on changes in HPA axis activity and sleep, given that each of these two systems is sensitive to race-based social stress, has been found to vary by race/ethnicity, and is known to impact educational outcomes by way of their effects on critical cognitive processes such as attention, memory, and executive functioning (see Figure 1, Psychological and Biological Stress Responses box, right side). Though few studies directly trace the full pathways from race-based stress to physiological reactivity to detriments in academic performance, we argue that there is compelling evidence that these stress response systems contribute to the negative academic outcomes that arise in the wake of race-based stress (Mendes & Jamieson, 2012).

Race-Based Stress and HPA Axis Activity

Extensive research in the human and animal literatures demonstrates a relationship between psychological stressors and the activation of the HPA axis, as indicated by increases in cortisol (Dickerson & Kemeny, 2004).² Further, psychological stressors that are characterized by socioevaluative elements (i.e., being judged by another person) or are deemed uncontrollable—two clear characteristics of many race-based stressors—yield greater cortisol activity than stressors without these elements (Dickerson & Kemeny, 2004; Mendes & Jamieson, 2012; Schmader et al., 2008). Matheson and Cole (2004) found, for instance, that participants whose group identities were threatened in a lab task and used emotion-focused coping strategies (i.e., they typically react very emotionally to acute stressors) had sustained elevated cortisol responses compared with participants who used more problem-focused coping strategies (i.e., they typically try take steps to find solutions to their

² Although cortisol activity is increased by the presence of acute stressors, cortisol also has a diurnal rhythm that is characterized by the highest cortisol levels about 30 min after waking and the lowest cortisol levels in the evening (Adam, Hawkey, Kudielka, & Cacioppo, 2006; G. E. Miller et al., 2007). Chronic stress is associated with changes the diurnal cortisol rhythm (Adam & Gunnar, 2001; G. E. Miller et al., 2007).

problems). In addition, Richman and Jonassaint (2008) found that after an alleged campus racial incident, Black college students had higher and more sustained cortisol levels during a laboratory stress task compared with participants who did the laboratory stress task prior to the alleged campus racial incident. Negative emotional states, such as anger and sadness, have also been linked to increased levels of cortisol in naturalistic settings (Adam, 2006; van Eck, Berkhof, Nicolson, & Sulong, 1996), and youth with higher levels of perceived discrimination have been found to have stronger cortisol reactions to everyday triggers of negative emotions (Doane & Zeiders, 2014).

Furthermore, racial/ethnic minority adolescents and adults typically exhibit non-normative (flatter) patterns of cortisol change across the day (S. Cohen, Schwartz, et al., 2006; DeSantis et al., 2007; Hajat et al., 2010; Martin, Bruce, & Fisher, 2012), perhaps due, at least in part, to experiences with race-based stressors such as perceived discrimination (Adam et al., 2015; Desantis et al., 2007; Zeiders, Hoyt, & Adam, 2014). The flatter diurnal cortisol slopes exhibited by racial/ethnic minority group members compared with Whites are usually due to lower morning cortisol and elevated cortisol levels in the evening (Desantis et al., 2007; Hajat et al., 2010).

Given this work, variations in activation of the HPA axis may be particularly relevant for understanding racial/ethnic disparities in academic outcomes. Indeed, HPA axis activity has been associated with various aspects of executive functioning, including attention and declarative and working memory (Figure 1, Psychological and Biological Stress Responses box, bottom right), all of which are important for academic performance (for reviews, see Lupien, Maheu, Tu, Fiocco, & Schramek, 2007; McEwen, 1998). Research has shown, for example, that acute elevations in cortisol levels (either stress- or treatment-induced) are associated with poorer performance on word-recall and spatial-thinking tasks (Kirschbaum, Wolf, May, Wippich, & Hellhammer, 1996).

Similar to the classic work on social facilitation (Zajonc, 1965), however, research suggests an inverse U-shaped function for the impact of cortisol on executive functioning; although too much cortisol can be harmful for cognitive performance, sufficient basal levels are needed for cognitive engagement (Lupien et al., 2007; Salehi, Cordero, & Sandi, 2010). For example, research has shown that higher morning cortisol levels are associated with better performance on executive functioning tests that assess attention-switching, declarative memory, recognition memory, and immediate and delayed recall (P. D. Evans et al., 2011; P. Evans, Hucklebridge, Loveday, & Clow, 2012; Maldonado et al., 2008). Taken together, this work suggests that stress-related alterations in HPA axis activity could lead to impairments in a number of cognitive processes (Figure 1, Psychological

and Biological Stress Responses box, right side) that affect important educational outcomes.

Race-Based Stress and Sleep

Although sleep is often framed as a behavioral choice, a number of other factors contribute to sleep quality and quantity. Certainly, structural constraints such as school, work, and social schedules play an important role in determining sleep hours and sleep quality. For example, Adam, Snell, and Pendry (2007) found that earlier school start times and longer travel times to school were associated with shorter weekday sleep hours in a nationally representative sample of children and adolescents. Longer travel times to school partially (but not fully) account for shorter sleep hours among Black adolescents (Adam et al., 2007). Sleep is, however, also a stress-sensitive system (Adam et al., 2007; Hanson & Chen, 2010; Zeiders, Doane, & Adam, 2011). Indeed, sleep can be considered a stress response system that may have profound implications for executive functioning and, thus, for academic achievement (Randazzo, Muehlbach, Schweitzer, & Walsh, 1998; Sadeh, 2007; Sadeh, Gruber, & Raviv, 2003; Wolfson & Carskadon, 2003).

Research has revealed both racial/ethnic disparities in sleep and correlations between race-based stress and sleep (Adam et al., 2007; Buckhalt, El-Sheikh, & Keller, 2007; C. L. Jackson, Redline, Kawachi, Williams, & Hu, 2013). A recent National Sleep Foundation (2010) survey revealed notable racial/ethnic differences in self-reported sleep duration between Black and White adults. Specifically, Blacks reported getting an average of 38 min less sleep on workdays or weekdays than Whites. Academic studies using time diaries, representative survey data, and objective measures of sleep such as actigraphy have documented these differences in sleep between Black and White adolescents (e.g., Adam et al., 2007; Buckhalt et al., 2007) and adults (C. L. Jackson et al., 2013). For instance, Matthews, Hall, and Dahl (2014) found that Black, compared with White, adolescents had shorter sleep duration and more fragmented sleep—as assessed with actigraphy—during a full school week. Recent research using polysomnography to monitor sleep has demonstrated that racial/ethnic differences in sleep exist not only for total amount of sleep per night but also in the architecture of sleep (i.e., slow wave sleep [SWS] or deep sleep; different phases of rapid eye movement [REM] sleep or light sleep; Thomas, Bardwell, Ancoli-Israel & Dimsdale, 2006; L. Tomfohr, Pung, Edwards, & Dimsdale, 2012; L. M. Tomfohr, Ancoli-Israel, & Dimsdale, 2010).

Race-based stress has been implicated in shaping the differences in sleep timing and subjective sleep quality between Whites and racial/ethnic minorities (Thomas et al., 2006; L. Tomfohr et al., 2012). For instance, C. L. Jackson

and colleagues (2013) posit that race-based stressors in the workplace and related coping mechanisms that Blacks may enact to deal with these stressors could lead to sleep differences between Black and White professionals. Specifically, discrimination in the workplace and an increased work ethic (also known as “John Henryism”) might lead to shorter sleep durations among Black professionals. Race-based stress, however, also affects involuntary aspects of sleep. Huynh and Gillen-O’Neel (2013) found that among a group of Latino and Asian American adolescents, self-reports of exposure to both overt and subtle discrimination were related to lower subjective sleep quality, and subtle discrimination was related to shorter self-reported sleep times. A similar study found that Black adults reported greater sleep difficulty (e.g., trouble falling asleep) compared with Whites, and that the anticipation of experiencing racism (i.e., racism-related vigilance) accounted for the relation between race/ethnicity and greater sleep disturbances (Hicken, Lee, Ailshire, Burgard, & Williams, 2013). Similarly, Steffen and Bowden (2006) found that perceived racism among Hispanic immigrants was associated with a greater number of self-reported sleep disturbances. Race-based stress has also been found to predict racial/ethnic differences in sleep architecture. L. Tomfohr and colleagues (2012) found, for instance, that perceived discrimination predicted differences in Stage II sleep and SWS among Black adults. Specifically, compared with Whites, Blacks spent more time in Stage II and less time in SWS, and perceived discrimination partially accounted for these racial group differences, even controlling for SES.

Because poor sleep quality and sleep duration are associated with greater daytime fatigue (Steffen & Bowden, 2006; Thomas et al., 2006), it should come as no surprise that poor sleep also predicts academic outcomes. In their review, Wolfson and Carskadon (2003) found that less sleep, as indicated by self-report survey measures among adolescents, was related to increased failure in school, lower self-reported grades, and decreased concentration in classrooms. Furthermore, research has shown that greater daytime sleepiness in children is associated with lower scores in tests of general intellectual ability, as well as on tests of mathematics, language skills, verbal comprehension, and reading performance (Bub, Buckhalt, & El-Sheikh, 2011; Buckhalt, El-Sheikh, Keller & Kelly, 2009). Using an experimental approach and actigraphy to measure sleep, Sadeh and colleagues (2003) conducted a study that examined the effects of sleep extension (sleep extended by an average of 30 min or more for 3 nights) and sleep restriction (sleep reduced by an average of 30 min or more for 3 nights) on several measures of cognitive functioning, all of which are known to predict classroom conduct and achievement. Results revealed that participants in the sleep restriction group performed more poorly on several of the cognitive tasks compared with participants in the sleep extension group.

Interestingly, these effects of sleep on cognitive task and academic performance may be moderated by race/ethnicity (Buckhalt, El-Sheikh, et al., 2009). Specifically, Black children were especially likely to suffer from lower cognitive performance as a result of poor sleep. Lack of sleep and shifts in sleep architecture can also affect cognitive performance in a number of ways (Buckhalt, Wolfson, & El-Sheikh, 2009). For instance, research has implicated SWS in memory consolidation processes (Antony, Gobel, O’Hare, Reber, & Paller, 2012; Dang-Vu et al., 2008; Gais & Born, 2004; Peigneux et al., 2004; Stickgold, 2005; Walker & Stickgold, 2006). Research by Huber, Ghilardi, Massimini, and Tononi (2004) demonstrated, further, that learning a new task is associated with increased slow-wave activity during sleep, suggesting SWS is important for learning.

In sum, we propose that race-related differences in sleep hours, quality, and architecture, all of which are predicted by increased race-based stress, may result in increased daytime sleepiness and decrements in cognitive processes, such as attention, working memory, memory consolidation, and executive functioning (Figure 1, Psychological and Biological Stress responses box, right side). These effects seem to be particularly pronounced among racial/ethnic minorities (Bub et al., 2011; Buckhalt et al., 2007, 2009). We propose that even subtle stress-related impairments in cognitive processes may add up over time, contributing to worse academic outcomes among racial/ethnic minorities.

Interactions Between Sleep and the HPA Axis

Taken together, the research presented thus far suggests that race-based stressors, such as perceived discrimination, contribute to changes in both cortisol (HPA axis reactivity) and sleep processes. Both dysregulated HPA axis activity and sleep are related to impairments in cognitive component processes known to subserve important academic performance outcomes. Although we have heretofore presented these stress-sensitive systems as relatively independent, perceived discrimination might affect sleep, at least in part, through alterations in cortisol levels (Buckley & Schatzberg, 2005) or vice versa given the bidirectional relationship between the two systems (Zeiders et al., 2011). The non-normative diurnal cortisol rhythms often found in racial/ethnic minorities (DeSantis et al., 2007; Fuller-Rowell, Doan, & Eccles, 2012; Hajat et al., 2010) could be a result of race-based stressors such as greater perceived discrimination (Adam et al., 2015), which, in turn, could contribute to differences in sleep time and quality found between Whites and racial/ethnic minorities (Hicken et al., 2013; Zeiders et al., 2011; cf. Fuller-Rowell et al., 2012). On the other hand, disparities in sleep (duration and/or quality) may help to account for racial/ethnic minorities’ non-normative diurnal cortisol rhythms. In other words, HPA

axis activity and sleep may influence each other and exacerbate the effects of the other.

Interactions Between Coping Responses and Biological Stress Responses

Although we previously discussed coping responses and biological responses separately, we certainly do not believe that their influence(s) on executive functioning and subsequent academic performance are independent of one another. As alluded to previously, there is reason to expect that coping strategies in response to anticipated or actual racism, such as striving (i.e., John Henryism), may have a direct influence on sleep quality and/or HPA axis activity that, in turn, influence academic performance (Brody et al., 2013; C. L. Jackson et al., 2013). Similarly, differing emotional responses and emotion-regulation strategies are known to impact biological stress reactions, such as blood pressure and HPA axis reactivity (Clark & Adams, 2004; Gross, 1998a; Jamieson et al., 2012; Lam, Dickerson, Zoccol, & Zaldivar, 2009). In addition to their influence on academic performance, perhaps through motivation, it is possible that regulating emotions regarding race-based stressors also leads to more positive academic outcomes, in part, *because* it attenuates HPA reactivity or improves sleep quality. Furthermore, research suggests that biological regulation and physiological reactivity also influence coping responses. For example, Vriend and colleagues (2013) found that children (8 to 12 years old) randomly assigned to go to sleep 1 hr later than usual exhibited poorer parent-reported emotion regulation compared with children randomly assigned to go to sleep for 1 hr earlier. It is possible that poor sleep can undermine the efficacy of emotion regulation or other proactive forms of coping in the face of race-based stressors, which could exacerbate their negative effects on academic outcomes. Future research is needed to examine these interactive and likely cyclical effects among the coping responses and stress-sensitive biological processes reviewed here.

Race-Based Stress, Health, and Academic Performance

The cumulative effects of dysregulated HPA axis functioning and sleep processes related to race-based stressors can contribute to physiological wear and tear over time (Geronimus, Hicken, Keene, & Bound, 2006; Kaestner, Pearson, Keene, & Geronimus, 2009). This dysregulation of multiple biological systems is called allostatic load (for reviews, see McEwen, 2006, 1998). Allostatic load can lead to impairments in executive functioning (G. W. Evans & Schamberg, 2009; Seeman et al., 1997), which may subsequently lead to adverse academic outcomes. In addition, allostatic load is associated with poorer self-reported and objective physical and mental health status, such as depressive symptoms, hypertension, and diabetes (G. W. Evans,

2003; Juster, McEwen, & Lupien, 2010; Mattei, Demissie, Falcon, Ordovas, & Tucker, 2010). For example, Johnston-Brooks, Lewis, Evans, and Whalen (1998) found that allostatic load was positively related to the number of days a child was ill. Poor physical and mental health and related absenteeism adversely impact academic achievement and attainment (Figure 1, Outcomes box, top right; e.g., Eide, Showalter, & Goldhaber, 2010; Haas & Fosse, 2008).

Developmental Considerations

Most of the research discussed thus far focuses on the effects of concurrent or recent exposure to race-based stressors. However, it is critically important to consider the effects of relevant developmental histories of race and SES-based stress on the pathways outlined in Figure 1 (Figure 1, Stressors and Resources box, top). Specifically, the developmental timing of exposure to race- and SES-based stressors might influence the degree of impact that they have on coping responses, biological regulation, physiological reactivity, cognitive functioning, and subsequent educational attainment and achievement. Research suggests, for example, that early experiences with stressors might become biologically “embedded” and shape the body’s stress physiological response in the future (e.g., Hertzman, 1999; John-Henderson, Rheinschmidt, Mendoza-Denton, & Francis, 2014; G. Miller & Chen, 2007; G. E. Miller & Chen, 2010; G. Miller et al., 2009).

Although most of the research conducted thus far has focused on individuals’ early parenting and early SES, recent work suggests that early experiences with perceived discrimination might also become embedded in HPA axis functioning (Adam et al., 2015). Perceived discrimination may affect development of the HPA axis as early as the prenatal years, with maternal exposure to racism during pregnancy predicting infant cortisol responses prenatally (Thayer & Kuzawa, 2015) and also having impacts on infant birth weight (Collins, David, Handler, Wall, & Andes, 2004; Kuzawa & Sweet, 2009). Infant birth weight, in turn, has implications for any number of important life outcomes, including academic achievement (Hutchinson et al., 2013; Saigal, Szatmari, Rosenbaum, Campbell, & King, 1991). In other words, the implications of exposure to race-based social stress may begin very early, even prior to any noticeable behavioral outcomes in the developing child.³ Other recent evidence suggests that perceived racial discrimination experiences during adolescence may have lasting effects on adult HPA axis activity, with discrimination experiences during adolescence having a larger impact on adult stress biology than discrimination experiences occurring during adulthood (Adam et al., 2015).

³ Of course, earlier exposure to discrimination may also result in earlier introduction to, and experience with, emotion-regulation strategies (both adaptive and maladaptive) in order to cope with these stressors.

Generally, the relative effects of the various processes described in our model may differ based on developmental stage. Specifically, recent meta-analyses suggest that discrimination exerts a more negative impact on children and early adolescents (under 16 years) compared with adults (Lee & Ahn, 2013; Schmitt, Branscombe, Postmes, & Garcia, 2014). That is, the relationship between discrimination and psychological distress is higher for children and adolescents than for adults. This might be in part because children and early adolescents may not have developed effective coping responses that may attenuate the negative outcomes associated with perceived discrimination (Compas, Malcarne, & Fondacaro, 1988; Compas et al., 2001; Griffith, Dubow, & Ippolito, 2000; Vaughn & Roesch, 2003). Furthermore, aspects of racial identification that might buffer against the adverse effects of discrimination might not be fully developed in childhood or early adolescence. Specifically, adolescence represents a critical period during which racial/ethnic identity becomes salient, and racial minority youth explore their identities prior to developing secure and achieved racial/ethnic identities in young adulthood (French, Seidman, Allen, & Aber, 2006; Phinney, 1993; Yip, Seaton, & Sellers, 2006). Furthermore, adolescence is a key neurobiological transition period characterized by increased plasticity of developing biological systems (Dahl, 2004; Spear, 2000). As a result of these developmental changes in the brain and neuroendocrine systems and immature coping resources, perceived discrimination in childhood and adolescence relative to adulthood may have an even greater impact on the pathways outlined in our model and on trajectories of educational and occupational attainment.

Opportunity Structures and Attainment

In our review, we forward the RDSSC model that considers the effects of race-based stressors on both stress-sensitive biological systems and coping responses, and explores their roles as pathways to racial/ethnic disparities in educational outcomes. However, the processes outlined in our model occur within relevant opportunity structures that can serve to maintain disparities in academic performance and exacerbate broader disparities in educational and workforce outcomes. For example, school disciplinary and criminal justice sanctions that disproportionately target racial/ethnic minority youth have a negative impact on their educational and workforce trajectories (A. Gregory, Skiba, & Noguera, 2010; Kirk & Sampson, 2013; Okonofua & Eberhardt, 2015). Poor reading and math scores, and low SAT scores, among racial/ethnic minority students can lead to enrollment in less selective colleges and universities and lower college enrollment rates overall (APA Presidential Task Force on Educational Disparities, 2012).

Even once a certain level of academic attainment is obtained, disparities may be further exacerbated by race-related biases in the workplace, differing social and career networks, and economic and policy climates to determine ultimate educational and workforce outcomes (Link & Phelan, 2001; Pager, Western, & Bonikowski, 2009; Wilson, 1987). For example, negative stereotypes about racial/ethnic minority group members *decrease* the likelihood of being hired and *increase* the likelihood of getting placed in low-status occupations (King, Mendoza, Madera, Hebl, & Knight, 2006; Pager & Shepherd, 2008; Pager et al., 2009). These broader societal inequities can exacerbate the disparities resulting from race-based stressors on the hypothesized pathways outlined in our model. Importantly, awareness and anticipation of these opportunity barriers may themselves be thought of as race-based stressors (Mays, Cochran, & Barnes, 2007; Sawyer, Major, Casad, Townsend, & Mendes, 2012) and contribute to levels of perceived discrimination, stereotype threat, and overall perceived stress.

Summary

Taken together, this review suggests that in addition to the better-known effects of coping responses, changes in stress hormones and sleep processes are important factors to consider in understanding racial/ethnic disparities in academic achievement. Our race-based disparities in stress and sleep in context model (RDSSC) complements previous theoretical work that applies a stress and coping approach to understanding the consequences of race-based social stressors (e.g., Clark et al., 1999; Miller & Kaiser, 2001; C. T. Miller & Major, 2000; Trawalter et al., 2009). Specifically, in addition to focusing on coping responses that have been identified previously as important for educational achievement and attainment, we also consider the role of biological responses—namely, HPA axis activity and sleep—in the emergence of racial/ethnic academic achievement gaps. We also consider the manner in which sleep and stress hormones are related to aspects of cognitive functioning and, in turn, affect academic outcomes. In so doing, this is some of the first theoretical work to jointly consider how multiple psychological processes and multiple biological processes may mediate the effects of race-based stressors, such as perceived discrimination and stereotype threat, on educational outcomes (see also Buckhalt, 2011).

The processes in our model could apply to members of other stigmatized groups who face similar stressors, such as women, sexual minorities, and low-SES individuals (e.g., John-Henderson et al., 2014; Steele et al., 2002). However, given the wealth of research on the adverse effects of race-based stress on the hypothesized pathways outlined in our model, and their possible influence on well-documented racial/ethnic disparities in educational outcomes, we have focused on evidence regarding race-based stress and the

racial/ethnic achievement gap in our current article. In addition, we have focused on two key stress-sensitive biological systems that have known racial disparities and clear connections to cognitive processes. Activation and alteration of additional stress-sensitive biological systems (e.g., inflammatory activity) could be examined and implicated in race-based educational disparities in future research.

The broad perspective forwarded herein is as much a call for research as it is a theoretical and empirical review. Indeed, there is surprisingly little empirical research that includes sufficient psychological and biological data to test most of the hypotheses that emerge from the present review, particularly in children and adolescents. Given the importance of the racial/ethnic achievement gap for the lives of individuals and for the health and productivity of our nation's workforce more generally, it is time to engage in this type of comprehensive work.

The present work highlights the need for additional research to test the hypothesized pathways contributing to race-based disparities in educational outcomes outlined in our model. There are a number of future research directions that can be inspired by our model. For instance, we hypothesize that a reciprocal relationship exists between coping responses to race-based social stressors and biological responses (C. L. Jackson et al., 2013; Lam et al., 2009; Vriend et al., 2013). Future research should test this possibility within disadvantaged racial/ethnic backgrounds.

Research suggests that early adverse life experiences become biologically embedded and program the body's stress systems including HPA axis functioning (G. Miller & Chen, 2007; G. E. Miller & Chen, 2010) and sleep (A. M. Gregory, Caspi, Moffitt, & Poulton, 2006; Koskenvuo, Hublin, Partinen, Paunio, & Koskenvuo, 2010). Recent work suggests that adolescent experiences with perceived discrimination might have similar effects on racial/ethnic minorities' HPA axis functioning (Adam et al., 2015). Future research is needed to assess whether early experiences with discrimination also impact sleep processes in racial/ethnic minorities, and whether earlier experiences with discrimination might also have long-term effects on the HPA axis. In addition, research is needed that considers how developmental stage might influence the impact of race-based stressors on sleep processes and the HPA axis. For instance, similar to the effects of perceived discrimination on psychological distress, perceived discrimination and stereotype threat might exert a more negative impact on biological processes for children and adolescents compared with adults.

Future research is needed to disentangle the effects of race/ethnicity and SES as factors that contribute to gaps in academic performance and attainment. Specifically, racial/ethnic minority status and SES independently predict gaps in academic performance and attainment. As previously mentioned, low-SES racial/ethnic minorities may face a

double disadvantage because of their dual stigmatized social statuses (Farmer & Ferraro, 2005; Matthews & Gallo, 2011; Shavers, 2007), especially given their increased likelihood of living in hypersegregated spaces (Williams, 1999). However, research suggests that educational achievement and attainment disparities between racial/ethnic minorities and Whites are also observed at higher SES levels (Ferguson 2001a; 2001b), likely due to experiences with discrimination (e.g., Brody et al., 2006; Feagin & Sikes, 1995; Kessler et al., 1999). Research is needed to examine the differential processes that might lead to impairments in academic achievement and attainment among racial/ethnic minorities in high- and low-SES contexts.

In addition to inspiring additional and more comprehensive research on both psychological and biological processes involved in shaping academic outcomes in the face of race-based stress, the present work may help guide novel interventions. For instance, a number of social psychological interventions and positive racial socialization messages have been shown to buffer against the negative effects of race-based stressors on academic outcomes (Brannon, Markus, & Taylor, 2015; G. L. Cohen, Garcia, Apfel, & Master, 2006; Neblett et al., 2012; Stephens, Hamedani, & Destin, 2014; Walton & Cohen, 2011; Yeager & Walton, 2011). Perhaps these or similar interventions, particularly if paired with positive sleep hygiene practices such as maintaining a consistent bedtime routine (e.g., Mindell, Meltzer, Carskadon, & Chervin, 2009), could improve sleep quality for racial/ethnic minorities by interrupting negative recursive processes that impact behavioral coping responses, HPA axis activity, and sleep processes. For instance, social psychological interventions and positive racial socialization messages may promote positive coping strategies that reduce the perceptions and consequences of race-based stress. These positive coping responses would, in turn, mitigate the negative effects of race-based stress on sleep processes.

Finally, the ways in which individuals cope with stress can affect sleep time and sleep quality (Sadeh, Keinan, & Daon, 2004; Winbush, Gross, & Kreitzer, 2007). Of particular note, El-Sheikh, Kelly, Sadeh, and Buckhalt (2014) found that higher levels of support coping (e.g., seeking out a trusted other to talk through feelings when stressed) among low-income and Black youth buffered against the negative effects of stress on sleep time and sleep quality. Future research should consider whether these ways of coping with nonracial stressors may also be effective for individuals coping with race-based stress. Most notably, long-term engagement in stress-reduction strategies, such as mindfulness, has been shown to lead to a reduction in cortisol levels and better sleep quality (e.g., Brand, Holsboer-Trachsler, Naranjo, & Schmidt, 2012; Lupien et al., 2013). Could these types of interventions reduce both racial/ethnic disparities in stress hormones, sleep, and aca-

demic performance? Future research should test these intriguing possibilities.

Certainly, however, approaches to reducing the effects of race-based stress on the achievement gap should not be located purely at the individual or psychological level. A myriad of societal, cultural, organizational, and individual factors work together to establish and maintain social disparities in educational outcomes. As such, holistic interventions that simultaneously target broad societal factors that contribute to race-based stressors as well as psychological and biological stress responses may bring us one step closer to solving the problem of the academic achievement gap.

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