

**EXAMINING THE UNIQUE AND INTERACTIVE EFFECTS OF PERCEIVED
GENDER AND RACE BASED DISCRIMINATION ON EXECUTIVE
FUNCTION AND DEPRESSIVE SYMPTOMS**

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ABSTRACT

Depression is a significant public health concern characterized by pronounced gender and racial and ethnic differences. One potential mechanism underlying these differences is the role of discrimination. Yet, our understanding of how experiences of race- and gender-based discrimination impact depression is limited by the slow acceptance of intersectional theory into psychological research. Further, models overlook the role of executive function in the discrimination – depression association, despite growing evidence that executive dysfunction is associated with both experiences of discrimination and depression. The current study sought to address these gaps in the literature by examining the independent and interactive effects of race-based and gender-based experiences of discrimination on executive function and depression separately, and to fully elucidate the direct and indirect pathways among discrimination, executive function, and depressive symptoms.

Results suggested that lifetime, but not recent experiences of racial discrimination were significantly associated with current depressive symptoms. Further, results indicated that among White, but not Black participants, lifetime experiences of racial discrimination were associated with higher levels of current depressive symptoms. There was no significant association between experiences of gender discrimination and current depressive symptoms, experiences of either racial or gender discrimination and executive functioning, or combined experiences of racial and gender discrimination on either depressive symptoms or executive functioning. Exploratory analyses suggested that there was not a significant indirect effect between experiences of discrimination and current depressive symptoms via executive dysfunction. Although results did not fully support

study hypotheses, they do suggest that among emerging adults' experiences of racial discrimination constitute a salient risk factor for depressive symptoms, as opposed to experiences of discrimination more broadly. Further, day to day executive functioning may be more resilient to experiences of discrimination than previously suggested by the literature.

An extensive systematic literature review also was conducted to examine the association between sociocultural stress broadly (i.e., experiences of stereotypes, prejudice, and/or discrimination) and executive functioning. Sociocultural stressors including stereotypes, prejudice, and discrimination have been shown to have detrimental effects on the executive functioning of stigmatized individuals. One potential explanation for this association can be found in the allostatic load model. Following this model, experiences of stress contribute to physiological changes in one's body in an effort to maintain homeostasis. Although these changes may be beneficial in the short-term, chronic exposure to stress can result in lasting changes to one's physiological and, as a result, one's cognitive functioning. Yet, our understanding of allostatic load as it pertains to culturally derived, social stressors may be limited due to the examination of stereotypes, prejudice, and discrimination as disparate processes in the literature. The current systematic review aimed to 1) systematically review empirical studies regarding the impact of stereotypes, prejudice, and discrimination on executive function, 2) synthesize findings as they pertain to allostatic load within and across these sociocultural stress categories, 3) synthesize findings across different domains of oppression, and 4) identify current methodological weaknesses in the literature that warrant further study. Thirty-seven empirical studies met inclusion criteria. Support for allostatic load was

found across all three sources of stress and in the context of several different domains of oppression, particularly gender, age, race, and ethnicity-based stressors. Further research is needed to more comprehensively evaluate this model longitudinally and across additional domains of oppression.

DEDICATION

To my parents. Your years of struggle and sacrifice opened the doors to previously unimaginable opportunities, and your unwavering support enabled me to walk through them. Thank you for everything.

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CHAPTER 1

MANUSCRIPT IN JOURNAL ARTICLE FORMAT

Introduction

Characterized by low mood, anhedonia, and accompanying changes in motivation, cognition, and physical symptoms (APA, 2013), depression is a significant public health concern that accounts for the largest share of global disease burden (Ferrari et al., 2013; Smith & De Torres, 2014) and the second leading cause of years lived with disability (Ferrari et al., 2013). Although depression may be experienced at any point across the lifespan, emerging adulthood has emerged as a particularly vulnerable period (Rohde et al., 2013). As conceptualized by Arnett (2000, 2007), emerging adulthood is defined as the developmental period spanning from the late teens through the twenties, with a particular focus on the ages of 18-25. In the United States alone, the 12-month prevalence rate of depression among emerging adults is 9.6%, with this rate noted to be on the rise since 2005 (Mojtabai et al., 2016). Although it should be acknowledged that emerging adulthood largely is rooted in western and industrialized ideologies, this period is posited to be a time of significant change, exploration, and diversity of experience (Arnett, 2000, 2007), which may account, at least in part, for the risk associated with this period. Moreover, the early identification of those most at risk for the development of depression, particularly among emerging adults, becomes paramount for the implementation of prevention and early intervention efforts.

Yet, to fully contextualize risk for depression in emerging adulthood, one also must consider the influence of race, ethnicity, and gender. Regarding race and ethnicity, studies have found that emerging adults reporting an instance of depression within a 12-

month period were significantly less likely to identify as male and non-Hispanic Black (Mojtabai et al., 2016) and that White individuals report higher rates of depression than their racial and ethnic minority peers (Bailey, Mokonogho & Kumar, 2019; McGuire & Miranda, 2008; Patil et al., 2018; Williams et al., 2007). However, although risk for depression is lower among racial and ethnic minority individuals overall, Black and Hispanic individuals report more chronic and debilitating experiences of depression (Bailey et al., 2019; McGuire & Miranda, 2008; Williams et al., 2007), thereby increasing their experience of burden associated with the disorder (Bailey et al., 2019).

Gender differences in experiences of depression also have been well documented. Indeed, females are approximately 2.5 times more likely to experience depression than their male counterparts beginning in early adolescence (Salk, Hyde, & Abramson, 2017). Moreover, although risk for depression peaks in adolescence, when women/girls are three times more likely to experience depression than men/boys, this increased risk persists throughout adulthood (Salk et al., 2017). Given these findings, race, ethnicity, and gender may serve as critical markers for risk in emerging adulthood.

Discrimination and Depression

One potential mechanism underlying both gender and racial and ethnic differences in depression is experiences of discrimination. Defined as the unfair treatment of individuals based on one or more identities, characteristics, or categories, discrimination has a profound impact on the psychological functioning of members of stigmatized identities including racial and ethnic minority individuals, women, and members of the LGBTQ+ community (Assari, Moazen-Zadeh, Howard Caldwell, & Zimmerman, 2017; Bostwick, Boyd, Hughes, & West, 2014; Pascoe & Richman, 2009;

Schmitt et al., 2014). When thinking about gender, race, and ethnicity in the context of depression, two specific types of discrimination warrant consideration, racism and sexism.

Racial discrimination, often used interchangeably with racism in the literature, refers to the differential treatment, disadvantage, exclusion, and unequal power distribution of individuals in a society due to conceptions of phenomenological, ancestral, or cultural differences associated with the social construct of race (Burger & Sarnyai, 2015). Although individuals from any racial and ethnic background(s) may experience racial discrimination, non-White respondents experienced higher rates of racial discrimination compared to their White peers, with a recent study estimating that 63% of Black, Hispanic, and Asian individuals report experiencing racial discrimination compared to 29.61% of White individuals (Lee et al., 2019). Further, Black respondents endorsed the highest rates of racial discrimination compared to all other racial and ethnic groups examined (Lee et al., 2019).

Gender discrimination, or sexism, also may play an important role in experiences of depression. Although any individual may experience gender discrimination, higher rates of discrimination have been reported among women compared to men (Manzi, 2019), and among transgender individuals (Miller & Grollman, 2015). Rates of gender discrimination also have been shown to vary based on other aspects of one's identity outside of gender. Specifically, in a nationally representative sample of American women, SteelFisher and colleagues (2019) found that among women, Black, Native American, and Hispanic/Latina women report higher levels of discrimination compared to their White counterparts, with Native American women significantly more likely to

experience sexual harassment, threats or nonsexual harassment, and gender-based violence than White women. Further, LGBTQ identifying women reported higher rates of gender discrimination in the workplace, sexual harassment, experiences of threatening or nonsexual harassment, and experience higher rates of violence compared to their straight and cis-gender peers.

Taken together, racial, ethnic, and/or gender-based discrimination are relatively common experiences, which is troubling when we consider the role of stress in depression. Broadly speaking, stress has been identified as a critical etiological factor in the development of depression and constitutes a key feature in determining which individuals may be most at-risk (Hammen, 2015; Hammen, 2005; Hyde, Mezulis & Abramson, 2008; Liu & Alloy, 2010; Vrshek-Schallhorn et al., 2015). Furthermore, interpersonal forms of stress have been shown to be particularly predictive of depression (Hammen, 2015; Slavich & Irwin, 2014). Given that 1) experiences of perceived discrimination can be conceptualized as an acute, interpersonal form of stress, 2) studies have found a positive association between perceived discrimination, specifically racial discrimination, and reported levels of chronic stress (Burger & Sarnyai, 2014), and 3) the suggestion that with repeated exposure, perceived discrimination can itself become a chronic stressor (Pascoe & Richman, 2009), individuals reporting higher levels of discrimination may be especially vulnerable to experiences of depression.

Consistent with stress-based models of depression, experiences of racial discrimination are associated with worse physical and mental health outcomes (for a review see Carter et al., 2018). Moreover, experiences of racial discrimination have been found to have a deteriorating, cumulative effect, such that participants who reported

instances of discrimination across multiple time points and/or multiple domains had worse mental health outcomes over time (Wallace et al., 2016). Although the literature is more limited, experiences of gender-based discrimination also have been found to be associated with poorer mental health outcomes, notably increased experiences of stress, anxiety, and depression (Feight et al., 2022; Nadal & Haynes, 2012). Thus, discrimination may be a key component in understanding racial and gender differences in depression.

Depression and Intersectional Theory

More recently, psychological studies also have examined the role of both race and gender in experiences of depression, thereby taking a more intersectional approach to conceptualizing risk (Lewis & Grzanka, 2016). Intersectional theory, born from the work of Black legal scholar Kimberlé Williams Crenshaw (1989), highlights the need to understand the influence of multiple, intersecting marginalized identities to comprehend underlying inequalities in health more fully (Bauer, 2014; Lewis & Grzanka, 2016). In their chapter examining the application of intersectional theory to research on perceived discrimination, Lewis and Grzanka (2016) argue that the majority of research examining perceived discrimination examines only one domain of oppression, what they term a single axis approach. They go on to suggest a spectrum of approaches that apply more of an intersectional lens to research, spanning the comparative approach, additive approach, interaction or multiplicative approach, and finally, the fully intersectional approach in which two forms of oppression are measured and analyzed jointly out of recognition that these constructs are intimately linked.

Of the studies on perceived discrimination that have adopted a more intersectional approach, both race and gender have emerged as important factors in the relationship between discrimination and depression. In a longitudinal study, Assari and colleagues (2017) found that whereas experiences of racial discrimination were associated with more adverse mental health outcomes for both Black men and Black women, among Black male youths, increased experiences of perceived discrimination between the ages of 20-23 predicted increases in depressive and anxiety symptoms in adulthood, whereas, for Black female participants, changes in racial discrimination did not predict future changes in depressive or anxiety symptoms. In a separate study examining both the additive and interactive effects of racism and sexism on levels of psychosocial distress, Szymanski and Stewart (2010) found that in a sample of Black women, only sexist events emerged as a positive predictor of depressive symptoms when perceived racial and gender-based discrimination were examined together. Finally, in a study of race, gender, and sexual orientation, Bostwick and colleagues (2014) found that although each type of discrimination was differentially associated with mental health experiences over the past year, only experiences of sexual orientation discrimination increased the odds of mental health distress when examined in combination with some other form of discrimination. Taken together, these findings highlight the need to adopt a more intersectional approach when exploring the association between perceived discrimination and depression, which is currently limited in the literature.

Executive Functioning and Depression

Another critically unexplored aspect of the association between perceived discrimination and depression is the role of cognitive processing. It is well established

that cognitive impairment in depression is an important component of the disorder (for a review, see Rock et al., 2014). Cognitive impairment has been found to be associated with depressive symptom severity, such that more severe symptoms are associated with increased cognitive impairment in episodic memory, executive functioning, and processing speed (McDermott & Ebmeier, 2009), and cognitive impairments have been found to persist following remission (Hasselbalch, Knorr, & Vedel Kessing, 2011). Given these findings, scholars have suggested that cognitive impairment may play a particularly salient role in the etiology of depression (Roiser, Elliott, & Sahakian, 2011).

Although cognitive impairment can emerge in several domains, executive function (EF) has been highlighted as a particularly significant area of impairment among depressed individuals (Snyder, 2013). Meta analyses estimate a moderate to strong effect for the association between depression and EF impairment across studies (Rock et al., 2014; Snyder, 2013), although it should be noted that these studies relied exclusively on behavioral tasks of cognition. Neuroimaging studies also have identified the medial prefrontal cortex, a region highly associated with executive function (Euston, Gruber, & McNaughton, 2012; Snyder, 2013), as an implicated brain region in depression (Yang et al., 2015).

Interestingly, neuroimaging studies of racial discrimination also have highlighted the prefrontal cortex as an area of interest, notably the right ventral prefrontal cortex (Burger & Sarnyai, 2014), and right dorsolateral prefrontal cortex (Richeson et al., 2003). Thus, there is some suggestion that overlapping pathways are associated with perceived discrimination and executive function. Consistent with these findings, associations between experiences of racial discrimination and executive functioning impairment have

been demonstrated (Ozier et al., 2019). A recent study in an ethnically diverse sample of adults also found that recent experiences of discrimination were associated with impairments in some aspects of executive functioning (i.e., cognitive flexibility and working memory), but not others (inhibitory control; Keating et al., 2021). There also is a suggestion in the literature that the impact of discrimination on executive functioning may be particularly detrimental among younger and middle-aged adults compared to older adults (Parker et al., 2018). Thus, there is emerging support for the association between discrimination and executive function impairment, and reason to believe that this association is particularly important when conceptualizing depression in emerging adulthood.

The Current Study

There remain, however, considerable gaps in our knowledge of discrimination, executive function, and depression. Although experiences of discrimination are a robust predictor of depression, it remains unclear how race and sex may intersect to influence these outcomes. It also is important to consider how sampling may influence our understanding of sexism, as the majority of participants in the studies reviewed identified as White. Finally, the literature on perceived discrimination and executive function, though promising, is small and typically adopts a single-axis approach. The current study seeks to address these gaps in the literature by examining both the independent and interactive effects of race-based and gender-based discrimination on executive function and depressive symptoms cross-sectionally in emerging adults.

Study Aims and Hypotheses

Using a single axis approach, the first aim of the current study was to examine the independent associations between recent experiences of perceived racial discrimination and perceived gender discrimination with the endorsement of depressive symptoms. Given the robust association between racial discrimination and depression in the literature (Carter et al., 2018), we hypothesized that (1a) individuals who experience higher levels of racial discrimination would report higher levels of depressive symptoms concurrently. Moreover, given reported racial and ethnic differences in experiences of racial discrimination (Lee et al., 2019), we also hypothesized that this association would be more robust for Black participants in the study (1b).

As gender discrimination also has been shown to be associated with poorer mental health outcomes (Feight et al., 2021, Nadal & Haynes, 2012), we hypothesized that (2a) individuals experiencing higher levels of gender discrimination would report higher levels of depressive symptoms. Given racial and ethnic differences evidenced within experiences of gender-based discrimination (SteelFisher et al., 2019), we also hypothesized that (2b) associations would be more robust for female compared to male participants, and for (2c) Black females compared to White females.

The second study aim, also utilizing a single-axis approach, was to examine the independent associations between recent experiences of perceived racial discrimination and perceived gender discrimination with executive functioning. Given the association between racial discrimination and executive dysfunction (Keating et al., 2021; Ozier et al., 2019; Parker et al., 2018), and the role of executive functioning in social behavior and cognition (Burgess, 2003), we hypothesized that (3a) individuals reporting higher levels

of racial discrimination would report higher levels of executive function impairment. Further, this association would be significant for Black as opposed to White participants (3b). Although examinations of gender discrimination and executive functioning are more limited, we hypothesized that individuals reporting higher levels of gender-based discrimination would report higher levels of executive functioning impairment (4a). Further, we hypothesized that associations would be more robust for female as opposed to male participants (4b), and for Black females compared to White females (4c).

The third aim of the study was to examine the interaction between experiences of race- and gender-based discrimination utilizing a multiplicative approach. Specifically, we hypothesized that participants who experienced higher rates of discrimination would endorse higher rates of depressive symptoms (5a) and higher rates of executive functioning impairment (6a). Given racial and gender-based differences in experiences of discrimination, we hypothesized that Black female participants would endorse the highest rates of discrimination and subsequently depressive symptoms (5b) and executive functioning impairment (6b).

Given the strong association between executive functioning and depression in the literature (Snyder, 2013), an exploratory aim of the study was to examine the indirect association between experiences of discrimination and depressive symptoms via executive functioning. Specifically, we hypothesized that there would be a significant indirect relationship between experiences of racial discrimination and current depressive symptoms through executive functioning (exploratory hypothesis 1, see Figure 1) and a significant indirect relationship between experiences of gender discrimination and current

depressive symptoms through executive functioning (exploratory hypothesis 2, see Figure 2).

Figure 1. Exploratory Model 1 – Indirect effect of executive functioning on experiences of racial discrimination and depressive symptoms

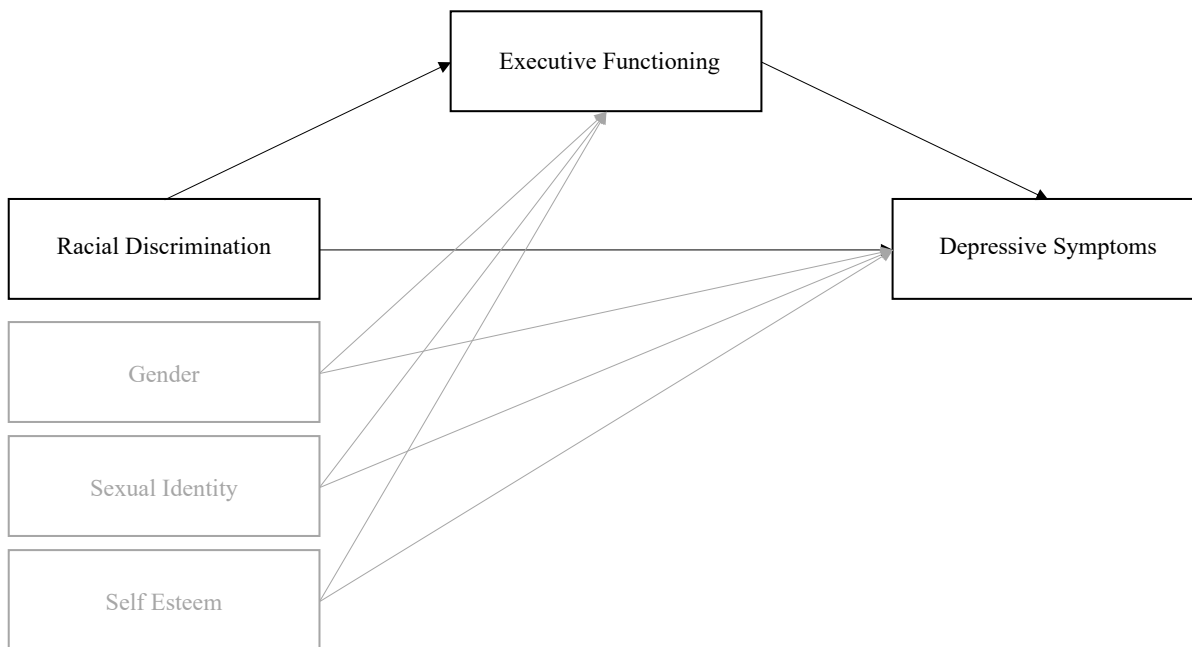
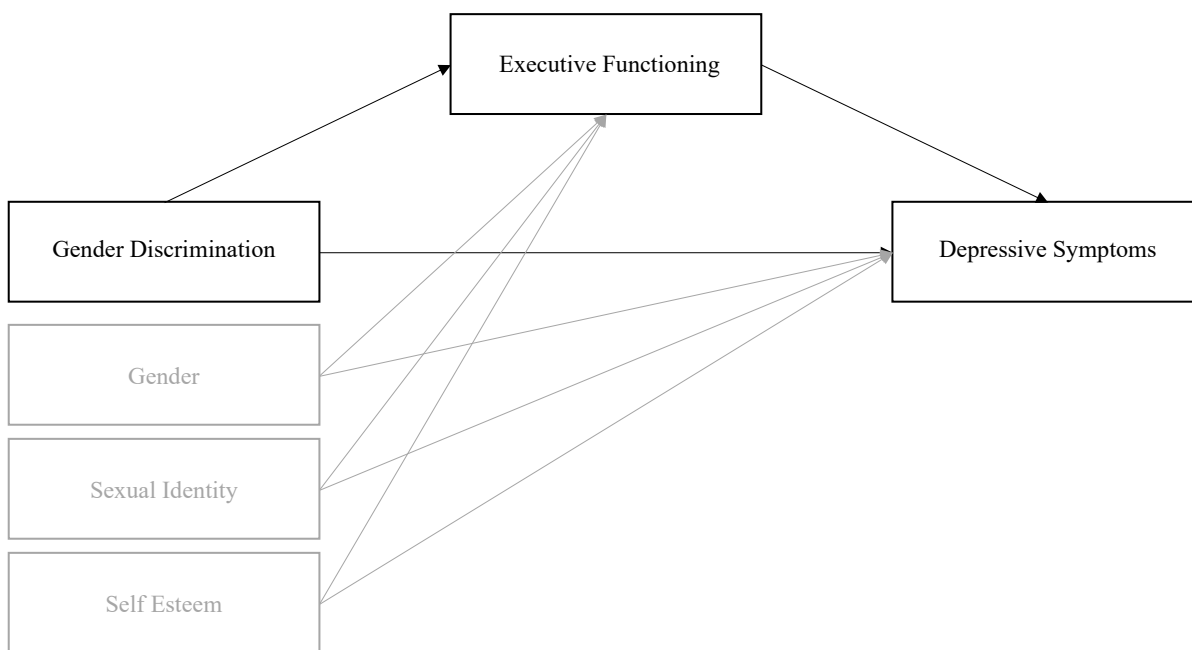


Figure 2. Exploratory Model 2 – Indirect effect of executive functioning on experiences of gender discrimination and depressive symptoms



Method

Recruitment and Procedures

Participants for the current study were recruited via the Temple University Psychology Research Participation System (Sona Systems) as part of an online study examining discriminatory experiences among college undergraduates (Intersectional Discrimination Study; Project ID). All interested participants (N = 838) completed a brief screener questionnaire to determine study eligibility. Eligible participants were currently enrolled Temple University undergraduates who were: 1) 18 years of age or older, 2) self-identified as cisgender male or female, and 3) self-identified as White/Caucasian or Black/African American. Participants were excluded if they were unable to complete assessments in English. All participants received research participation credits for participation in the baseline study. Participants also were invited to indicate if they were willing to be contacted for a follow-up assessment. Participants who expressed interest were contacted six months following completion of the baseline assessment to complete the follow-up assessments and were offered research participation credit (if desired) and were automatically entered to win one of two \$25 Amazon gift cards for participation.

At the baseline assessment, participants reported on demographic characteristics (i.e., self-reported gender, racial and ethnic identity, sexual identity) and date of birth, used to calculate participants' age at baseline and any follow-ups, and completed self-report measures assessing experiences of racial and gender discrimination, self-esteem, and depressive symptoms. Approximately halfway through recruitment, a self-report measure assessing day-to-day executive functioning was added to the baseline assessment. At the first follow-up, approximately six months following baseline,

participants again reported demographic characteristics and date of birth, and completed self-report measures assessing experiences of racial and gender discrimination, self-esteem, depressive symptoms, and executive functioning.

Current Study Participants

For the current project, two samples were derived to facilitate the exploration of study hypotheses using the maximal number of participants available. The first sample contained all eligible individuals who completed at least some portion of the initial assessment at baseline. Participants were classified into one of four categories based on self-report: Non-Hispanic Black Male, Non-Hispanic Black Female, Non-Hispanic White Male or Non-Hispanic White Female. As sample sizes were too small for meaningful comparison, participants we identified as Hispanic / Latino/a ($n = 28$), Arab/Middle Eastern ($n = 12$), or Bi/Multi-Racial ($n = 12$) were not included in the current study. In total, baseline data were collected from 558 participants who met eligibility criteria. Participants in the first sample were an average age of 18.98 years ($SD = 2.56$).

As the measure of executive functioning was added midway through data collection, a second study sample was derived consisting of a subset of the above 558 individuals who completed a self-report questionnaire assessing executive functioning (*see Measures section*) as part of the baseline or first follow-up assessment. As with the first sample, participants were classified into one of four categories based on self-report: Non-Hispanic Black Male, Non-Hispanic Black Female, Non-Hispanic White Male or Non-Hispanic White Female. In total, 188 participants had available executive functioning data. Of these participants, 135 had usable executive functioning data (as determined by all three embedded validity scales being within the Acceptable range) and

complete demographic information. Participants in the second sample were an average age of 19.06 years ($SD = 2.22$).

Full demographic information for all participants in samples 1 and 2 of the current study can be found in Table 1. Participants in samples 1 and 2 were significantly different in terms of gender ($\chi^2(1) = 6.06, p = 0.014, \phi = -.10$), with participants in the second sample more likely to identify as male. There were no significant differences in sexual orientation ($\chi^2(1) = 9.01, p = 0.11, \phi = .13$), racial and ethnic identity ($\chi^2(1) = 3.71, p = 0.054, \phi = -.08$), age ($t(540) = 1.42, p = .16, d = .13$), recent experiences of racial discrimination ($t(488) = -.02, p = .99, d = -.002$), lifetime experiences of racial discrimination ($t(487) = -1.42, p = .16, d = -.14$), recent experiences of gender discrimination ($t(480) = 0.38, p = .702, d = .04$), lifetime experiences of gender discrimination ($t(467) = -0.09, p = .93, d = -.01$), self-esteem ($t(538) = 1.42, p = .08, d = .14$), or current symptoms of depression ($t(437) = -.85, p = .39, d = -.10$).

Table 1. Sociodemographic Characteristics of Participants

	Study Sample 1 (N=558)		Study Sample 2 (N=135)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age (years)	18.98	2.56	19.06	2.22
	<i>n</i>	%	<i>n</i>	%
Gender				
Cis-Gender Male	145	26.0	46	34.1
Cis-Gender Female	413	74.0	89	65.9
Race				
Non-Hispanic Black	221	39.6	63	46.7
<i>African American</i>	182	32.6	47	34.8
<i>African</i>	16	2.9	6	4.4
<i>Afro-Caribbean</i>	23	4.1	10	7.4
Non-Hispanic White	337	60.4	72	55.3
<i>European</i>	282	50.5	57	42.2
<i>Non-European White</i>	55	9.9	15	11.1
Sexual Orientation				
Heterosexual / Straight	439	78.7	102	75.6
Homosexual / Gay/Lesbian	24	4.3	4	3.0
Bisexual	70	12.5	25	18.5
Pansexual	12	2.2	3	2.2
Asexual	3	0.5	0	0.0

Some other sexual identity	7	1.3	1	0.7
Prefer Not to Answer	3	0.5	0	0.0

Measures

Discrimination

Recent and lifetime experiences of racial discrimination were assessed using the Schedule of Racist Events (SRE, Landrine & Klonoff, 1996). The SRE is an 18-item self-report inventory that assesses the frequency and appraisals of race-based discrimination in the past year and over one's lifetime. Items are rated on a 1 (racist events "never happened") to 6 (racist events occurred ">70% of the time") scale. In the current study, the measure was modified also to assess for frequency in the past 6 months. Further, the appraisal scale was not included in analyses as it was outside the scope of the current study aims. The measure demonstrates good psychometric properties with high internal consistency demonstrated across the three subscales (ranging from Cronbach's $\alpha = .94$ to $.95$), high split-half reliability coefficients (Pearson's r reliability coefficients ranging from $.91$ to $.94$), and a single factor structure observed in the literature. In the current study, internal consistency was excellent (Cronbach's $\alpha = .94$ (recent) to $.95$ (lifetime)).

Recent and lifetime experiences of gender discrimination were assessed via the Schedule of Sexist Events (SSE, Klonoff & Landrine, 1995). The SSE is a 20-item inventory that measures lifetime and past year experiences of sexist discrimination. The measure has an underlying four factor structure, demonstrates high internal consistency across scales (ranging from Cronbach's $\alpha = .90$ to $.92$), and has good split-half reliability (Pearson's r reliability coefficients range from $.83$ to $.87$). In the current study, internal consistency was excellent (Cronbach's $\alpha = .94$ (recent) to $.95$ (lifetime)).

Current experiences of both racial and gender discrimination also were assessed using a study-modified version of the Daily Life Experiences Scale (DLE), a subscale of the Racism and Life Experiences Scales (RaLES; Harrell, 1994, 1997). There are two subscales of the measure, the Racial Discrimination Subscale, which assesses the frequency and impact of microaggressions, or daily life stressors, that are directly attributable to one's race, and the Gender Discrimination Subscale, which assesses the frequency and impact of microaggressions, or daily life stressors, that are directly attributable to one's gender. Although the current measure is unvalidated, the original RaLES has demonstrated high internal consistency, with Cronbach's alpha ranging from $\alpha = .88$ to $.90$ (Utsey, 1998). Moreover, among African American adolescents, the DLE has demonstrated an internal consistency of $.92$ to $.93$ (Seaton, Yip, & Sellers, 2009). Exploratory analyses were conducted to determine the validity of this measure (*See Supplemental Material*). As factor loadings were counter to expectations, the DLE was not included in study analyses.

Self-Esteem

Self-esteem was assessed using the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965). The RSES is a 10-item inventory that measures global self-esteem, or one's overall sense of worth as an individual. The measure can be divided further into two separate facets of self-esteem, self-competence, and self-liking, with each facet indicated by five individual items on the measure (Sinclair et al., 2010). Items are scored using a Guttman scale with four response categories (*Strongly Disagree, Disagree, Agree, Strongly Agree*), and higher scores are indicative of higher self-esteem (Rosenberg, 1965, 2015). The measure has demonstrated sound psychometric properties

across demographic groups of American adults including excellent internal consistency ($\alpha = .91$ overall, $\alpha = .93$ to $.84$ across groups), and good convergent ($r = .57$ to $.79$ overall) and discriminant validity ($r = .29$ to $.67$) (Sinclair et al., 2010). Internal consistency in the current study was excellent ($\alpha = .90$).

Depression

Depressive symptoms were assessed via the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a 21-item measure that assesses depressive symptoms over a two-week period. Responses are provided on a 0-3 scale with higher scores indicating more severe depressive symptoms. The measure has demonstrated sound psychometric properties with an average internal consistency in the high range (Cronbach's $\alpha = 0.90$), good to excellent test-retest reliability (Pearson's r range from 0.73 to 0.96), and good concurrent, content, and structural validity (Wang & Gorenstein, 2013). Internal consistency in the current study was excellent (Cronbach's $\alpha = 0.92$).

Executive Functioning

Executive functioning was assessed using the Behavior Rating Inventory of Executive Function – Adult Version (BRIEF-A; Roth, Isquith, & Gioia, 2005). The BRIEF-A is a 75 item self-report questionnaire that assesses behavioral manifestations of executive function within the past month across nine clinical scales: Inhibit, Self-Monitor, Plan/Organize, Shift, Initiate, Task Monitor, Emotional Control, Working Memory, and Organization of Materials. Items are rated on a 3-point scale (1 = “never”, 2 = “sometimes”, 3 = “often”). Raw scores then are converted to age-adjusted T-scores and percentiles. The BRIEF-A has demonstrated internal consistency in the moderate to high

range across subscales in normative and clinical samples, and test-rest reliability was high ($r = 0.89$) (Roth, Isquith, & Gioia, 2014). Internal consistency for the measure in the current study was excellent (Cronbach's $\alpha = 0.97$). For the current study, only the General Executive Composite (GEC) will be included in analyses.

Demographic Information

Self-reported gender, race, sexual orientation, and birth date were collected at baseline and follow-up.

Data Analysis Plan

Preliminary Analyses

Bivariate correlations were run on all study variables to determine inclusion as covariates in the analyses below. Preliminary analyses also were conducted to examine whether regression assumptions were satisfied. Specifically, descriptive analyses were run to examine distributions of the data including tests of skewness and kurtosis, and residual plots were used to examine the linearity of the variables, homogeneity of variances, and to examine the data for outliers.

Primary Analyses

Hypotheses 1a, 2a, 3a, 4a, 5a and 6a were examined via hierarchical multiple regressions. Group differences were examined via moderation analyses (hypotheses 1b, 2b, 2c, 3b, 4b, 4c), and univariate analysis of covariance (ANCOVA) with planned Games-Howell post-hoc contrasts (hypotheses 5b, and 6b).

Exploratory Analyses

Exploratory analyses were examined via simple mediation models to explore whether there were indirect effects through executive functioning.

Preliminary, primary, and exploratory analyses were conducted in SPSS (Version 28.0.1.0). Moderation and mediation analyses utilized the PROCESS Macro V4.1 (Hayes, 2018).

Power Analyses

Power analyses for hierarchical multiple regression, moderation, and ANCOVA hypotheses were conducted using G*Power (version 3.1). Given that prior meta-analyses estimate the effect of overall perceived discrimination on mental health outcomes to be $d = -.16$ (Pascoe & Richman, 2009), $d = -.21$ when examining the impact of racism independently, and $d = -.18$ when examining the effect of sexism independently (Schmitt et al., 2014), a medium effect size was utilized. Anticipated effect sizes for executive functioning ranged from $d = 0.45-0.58$ across domains (Snyder, 2013). Assuming a medium effect size (.15), 6 predictors, Type 1 error probability of .008, when accounting for correlations between predictors, power of .80, and 6 predictors, a sample of 139 participants was required for hierarchical multiple regressions to be sufficiently powered. For subsequent moderation analyses, a sample of 166 participants was needed. For ANCOVA analyses, assuming a medium effect size (.25), 4 groups, and 5 covariates, a sample of 279 participants was needed for analyses to be sufficiently powered.

Results

Descriptive Statistics

Descriptive statistics and bivariate correlations for all study variables, stratified by sample, are presented in Tables 2 and 3. In sample one, depression was minimally significantly associated with gender identity ($r = .14, p < .05$), sexual identity ($r = .24, p < .01$), recent experiences of gender discrimination ($r = .13, p < .05$), and lifetime

experiences of gender discrimination ($r = .13, p < .05$), and moderately to strongly associated with self-esteem ($r = -.64, p < .001$). In sample two, overall executive functioning (GEC) was minimally to moderately significantly associated with sexual identity ($r = .32, p < .01$), and moderately associated with depression ($r = .47, p < .01$), and self-esteem ($r = -.44, p < .01$).

Given the whole sample bivariate correlations, sexual identity and self-esteem were included as covariates for analyses in which depressive symptoms were the dependent variable. Gender identity was included as a covariate where appropriate. For analyses in which executive functioning was the dependent variable, sexual identity, depressive symptoms, and self-esteem were included as covariates.

When stratified by race and sex, correlations in sample 1 revealed that among Black males, depression was not significantly associated with any study variables. Among Black males in sample 2, overall executive functioning was significantly strongly associated with recent experiences of racial discrimination ($r = .70, p < .05$) and lifetime experiences of racial discrimination ($r = .72, p < .05$). Among Black females in sample 1, depression was minimally to moderately significantly associated with sexual identity ($r = .31, p < .001$) and moderately to strongly associated with self-esteem ($r = -.67, p < .01$). Among Black females in sample 2, executive functioning was moderately associated with depression ($r = .50, p < .001$) and self-esteem ($r = -.54, p < .001$). Among White males in sample 1, depression was minimally to moderately significantly associated with sexual identity ($r = .30, p < .01$), recent experiences of racial discrimination ($r = .25, p < .05$), recent experiences of gender discrimination ($r = .25, p < .05$), recent experiences of gender discrimination ($r = .29, p < .01$), and lifetime experiences of gender

discrimination ($r = .22, p < .01$), and moderately associated with self-esteem ($r = -.68, p < .001$). Among White males in sample 2, executive functioning was minimally to moderately significantly associated with sexual identity ($r = .38, p < .05$), and moderately associated with depression ($r = .46, p < .01$) and self-esteem ($r = -.50, p < .01$), behavior regulation ($r = .86, p < .001$). Finally, among White females in sample 1, depression was minimally significantly associated with sexual identity ($r = .16, p < .05$) and moderately associated with self-esteem ($r = -.66, p < .001$). Among White females in sample 2, executive functioning was moderately significantly associated with sexual identity ($r = .51, p < .01$), depression ($r = .52, p < .01$) and self-esteem ($r = -.50, p < .01$).

Descriptive statistics of primary study variables stratified by race and gender are presented in Tables 4 and 5. In sample 1 (see Table 4), participants significantly differed in terms of sexual identity ($\chi^2(15) = 26.82, p = 0.03, \phi = .22$) such that participants who identified as homosexual/gay/lesbian, bisexual, or some other sexual identity were more likely to identify as a White Female in the sample. Given unequal sample sizes, one-way ANOVAs using a nonparametric Welch test were used to examine group differences in age, self-esteem, experiences of discrimination, and depressive symptoms. The Games-Howell post hoc test was applied. Data are presented as means \pm standard deviation.

A Welch's one-way ANOVA was run to examine group differences in age and self-esteem. In sample one, there were no statistically significant differences between groups in age, $F(3, 131.08) = 2.22, p = .09, d = .01$. There was a significant difference between groups for self-esteem, $F(3, 138.34) = 10.00, p < .001, d = .05$. Games-Howell post-hoc tests revealed that White female participants (28.08 ± 9.02) reported lower self-esteem of -3.05 , 95% CI $[-5.98, -.13]$ compared to Black Male (31.14 ± 6.21) participants

Table 2. Means, standard deviations, and correlations for main study variables in sample 1

	Age	Gender Identity	Sexual Identity	R&E	RD-Recent	RD-Lifetime	GD-Recent	GD-Lifetime	Depression	Self-Esteem
Gender Identity	-.107*									
Sexual Identity	.016	.113**								
R&E	-.009	-.171**	.077							
RD-Recent	.008	.028	-.062	-.484*						
RD-Lifetime	.060	.071	-.038	-.600**	.891**					
GD-Recent	-.061	.363**	.109*	-.100*	.495**	.436**				
GD-Lifetime	.004	.427*	.131*	-.116*	.425**	.450**	.923**			
Depression	-.002	.138*	.236**	.042	.055	.031	.133*	.127*		
Self-Esteem	-.004	-.035	-.200**	-.216**	.084	.134**	-.062	-.043	-.642**	-
<i>Mean</i>	18.98	.26	.79	.40	26.98	31.38	34.93	43.53	10.25	29.47
<i>SD</i>	2.56	.44	1.02	1.84	13.61	17.35	17.37	21.36	9.08	5.74

Note R& E = Race and Ethnicity, R&E Mean = Percentage of Black Identifying Participants, Gender Identity Mean = Percentage of Male Identifying Participants, Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime. N = 558.

* p<.05 level

** p<.01 level

Table 3. Means, standard deviations, and correlations for main study variables for Black Males in sample 1

	Age	Sexual Identity	RD- Recent	RD- Lifetime	GD- Recent	GD- Lifetime	Depression	Self- Esteem
Sexual Identity	-.10							
RD-Recent	-.12	.13	.					
RD-Lifetime	.22	.19	.85**					
GD-Recent	-.02	.14	.45*	.30				
GD- Lifetime	.04	.27	.41	.38	.95**			
Depression	-.05	.15	-.08	.06	-.28	-.21		
Self-Esteem	-.24	.17	-.12	-.08	.07	.02	-.29	-
<i>Mean</i>	19.42	.89	35.06	41.03	25.46	29.33	4.96	31.14
<i>SD</i>	3.24	.42	16.45	19.64	12.45	14.32	5.84	6.21

Note Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime. N = 37.

* p<.05 level
**p<.01 level

Table 4. Means, standard deviations, and correlations for main study variables for Black Females in sample 1

	Age	Sexual Identity	RD- Recent	RD- Lifetime	GD- Recent	GD- Lifetime	Depression	Self- Esteem
Sexual Identity	-.02							
RD-Recent	.07	-.07	.					
RD-Lifetime	.09	-.04	.84**					
GD-Recent	-.06	-.07	.73**	.65**				
GD- Lifetime	.01	-.11	.64**	.72**	.92**			
Depression	.03	.31**	.10	.02	.04	.05		
Self-Esteem	.04	-.33**	.01	.05	.07	.04	-.67**	-
<i>Mean</i>	18.93	.83	35.73	45.94	39.62	50.00	10.61	31.00
<i>SD</i>	2.92	1.00	17.17	19.73	19.83	23.03	9.12	5.66

Note Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime. N = 184.

* p<.05 level
**p<.01 level

Table 5. Means, standard deviations, and correlations for main study variables for White Males in sample 1

	Age	Sexual Identity	RD- Recent	RD- Lifetime	GD- Recent	GD- Lifetime	Depression	Self- Esteem
Sexual Identity	.04							
RD-Recent	.05	-.07	.					
RD-Lifetime	.09	-.06	.94**					
GD-Recent	.07	-.12	.86**	.82**				
GD- Lifetime	.12	-.13	.80**	.82**	.95**			
Depression	-.03	.30**	.25*	.19	.30**	.22*		
Self-Esteem	.05	-.17	-.05	-.01	-.18	-.12	-.68**	-
<i>Mean</i>	19.46	.82	23.73	25.78	24.44	28.30	9.02	29.36
<i>SD</i>	2.78	.81	11.20	13.09	11.84	13.85	9.36	5.77

Note Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime. N = 108.

* p<.05 level
**p<.01 level

Table 6. Means, standard deviations, and correlations for main study variables for White Females in sample 1

	Age	Sexual Identity	RD- Recent	RD- Lifetime	GD- Recent	GD- Lifetime	Depression	Self- Esteem
Sexual Identity	.10							
RD-Recent	-.02	.06	.					
RD-Lifetime	.06	.07	.88**					
GD-Recent	-.01	.22**	.19*	.28**				
GD- Lifetime	.11	.27**	.14*	.29**	.89**			
Depression	.05	.16*	.03	.09	.10	.09		
Self-Esteem	-.05	-.12	-.03	-.03	-.14	-.09	-.66**	-
<i>Mean</i>	18.74	.72	21.11	22.33	38.24	48.52	11.27	28.08
<i>SD</i>	1.91	1.17	4.65	5.53	15.81	19.48	9.02	6.21

Note Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime. N = 229.

* p<.05 level
**p<.01 level

Table 7. Means, standard deviations, and correlations for main study variables in sample 2

	Age	Gender Identity	Sexual Identity	R&E	Depression	Self-Esteem	RD-Recent	RD-Lifetime	GD-Recent	GD-Lifetime	GEC
Gender Identity	-.101										
Sexual Identity	-.076	.080									
R&E	-.015	-.359**	.017								
Depression	-.003	.249*	.386**	-.051							
Self-Esteem	-.180*	-.012	-.133	-.037	-.608**						
RD-Recent	-.108	.038	.035	-.458**	.145	-.009					
RD-Lifetime	.051	.141	.065	-.578**	.106	.069	.834**				
GD-Recent	-.091	.329**	.131	-.031	.241*	-.034	.497**	.380**			
GD-Lifetime	-.026	.566**	.113	-.152	.165	.063	.353**	.440**	.884**		
GEC	.025	-.017	.316**	.081	.467**	-.437**	.117	.045	.080	.033	-
<i>Mean</i>	19.06	.34	.76	.47	11.60	28.95	26.31	32.19	33.41	42.23	57.99
<i>SD</i>	2.22	.48	1.02	.50	9.53	5.78	11.45	17.54	15.84	20.98	11.32

Note. R& E = Race and Ethnicity, R& E Mean = Percentage of Black Identifying Participants, Gender Identity Mean = Percentage of Male Identifying Participants, Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime, GEC = General Executive Composite T-Score. N = 135.

* p<.05 level

**p<.01 level

Table 8. Means, standard deviations, and correlations for main study variables for Black Males in sample 2

	Age	Sexual Identity	Depression	Self-Esteem	RD-Recent	RD-Lifetime	GD-Recent	GD-Lifetime	GEC
Sexual Identity	-.12								
Depression	-.21	.97**							
Self-Esteem	-.54	-.07	-.06						
RD-Recent	-.37	-.01	.19	-.05					
RD-Lifetime	.29	.09	.50	.001	.60				
GD-Recent	-.16	-.24	-.32	.07	.85**	.41			
GD-Lifetime	.026	-.25	-.31	.02	.78*	.56	.98**		
GEC	-.15	.16	.17	.17	.70*	.72*	.57	.57	-
<i>Mean</i>	20.70	.90	3.71	28.67	38.33	45.56	32.22	35.00	52.80
<i>SD</i>	4.81	.32	7.41	8.53	16.67	19.22	19.10	18.23	11.38

Note. Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime, GEC = General Executive Composite T-Score. N = 10.

* p<.05 level

**p<.01 level

Table 9. Means, standard deviations, and correlations for main study variables for Black Females in sample 2

	Age	Sexual Identity	Depression	Self-Esteem	RD-Recent	RD-Lifetime	GD-Recent	GD-Lifetime	GEC
Sexual Identity	-.09								
Depression	.18	.18							
Self-Esteem	-.32*	-.04	-.66**						
RD-Recent	-.22	.13	.09	.03					
RD-Lifetime	-.06	.12	-.08	.09	.78**				
GD-Recent	-.17	.04	.004	.13	.52**	.52**			
GD-Lifetime	.23	-.04	-.14	.16	.45**	.70**	.83**		
GEC	.17	.13	.50**	-.54**	.22	.77	-.11	-.13	-
<i>Mean</i>	18.79	.72	13.71	29.26	30.94	42.88	34.28	47.73	57.81
<i>SD</i>	2.16	.99	8.34	5.34	11.45	18.14	12.99	18.20	11.38

Note. Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime, GEC = General Executive Composite T-Score. N = 53.

* p<.05 level
** p<.01 level

Table 10. Means, standard deviations, and correlations for main study variables for White Males in sample 2

	Age	Sexual Identity	Depression	Self-Esteem	RD-Recent	RD-Lifetime	GD-Recent	GD-Lifetime	GEC
Sexual Identity	.15								
Depression	-.03	.51**							
Self-Esteem	.25	-.20	-.65**						
RD-Recent	.01	.15	.35	-.11					
RD-Lifetime	.03	.16	.27	.02	.92**				
GD-Recent	.08	.21	.34	-.17	.96**	.83**			
GD-Lifetime	.11	-.08	.14	.11	.65**	.72**	.80**		
GEC	.09	.38*	.46*	-.49**	.17	.20	.22	.19	-
<i>Mean</i>	19.00	.81	9.45	29.14	22.46	24.51	24.65	25.94	59.78
<i>SD</i>	1.74	1.11	9.87	5.97	10.71	13.53	16.41	8.80	11.75

Note. Sexual Identity Mean = Percentage of Straight Identifying Participants, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime, GEC = General Executive Composite T-Score. N = 36.

* p<.05 level
**p<.01 level

Table 11. Means, standard deviations, and correlations for main study variables for White Females in sample 2

	Age	Sexual Identity	Depression	Self-Esteem	RD-Recent	RD-Lifetime	GD-Recent	GD-Lifetime	GEC
Sexual Identity	-.26								
Depression	.03	.39**							
Self-Esteem	-.02	-.22	-.79**						
RD-Recent	.28	-.13	.002	-.02					
RD-Lifetime	.15	-.08	-.01	.11	.89**				
GD-Recent	-.23	.18	.29	-.08	.40*	.50**			
GD-Lifetime	-.22	.39	.30	-.12	.55**	.61**	.81**		
GEC	-.04	.51**	.520**	-.50**	-.08	-.16	.12	.31	-
<i>Mean</i>	19.06	.72	12.81	28.36	20.75	21.47	41.06	61.21	57.92
<i>SD</i>	1.11	1.11	10.04	5.65	3.35	4.78	14.19	21.94	11.24

Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime, GEC = General Executive Composite T-Score. N = 36.

* p<.05 level
**p<.01 level

($p = .04$), and lower self-esteem of -2.92 , 95% CI $[-4.36, -1.48]$ compared to Black female participants (31.00 ± 5.66 ; $p < .001$).

Results suggested significant differences in depressive symptoms $F(3, 111.30) = 7.82$, $p < .001$, $d = .03$. Specifically, Black Male participants (4.96 ± 5.84) reported lower depressive symptoms of -5.65 , 95% CI $[-9.36, -1.93]$ compared to Black Female participants ($p = .001$), lower depressive symptoms of -4.06 , 95% CI $[-8.12, -.01]$ compared to White Male participants ($p = .05$), and lower depressive symptoms of -6.31 , 95% CI $[-9.91, -.271]$ compared to White Female participants ($p < .001$), all of which were statistically significant. There were no significant differences in current depressive symptoms between Black Female (10.61 ± 9.13), White Male (9.02 ± 9.36), or White Female (11.27 ± 9.02) participants (all $ps > .05$). See Supplemental Figure 1.

Welch's ANOVAs also were run to examine group differences in experiences of discrimination, which revealed significant differences between groups on measures of recent experiences of racial discrimination ($F(3, 105.53) = 41.05$, $p < .001$, $d = .24$), lifetime experiences of racial discrimination ($F(3, 108.16) = 73.56$, $p < .001$, $d = .37$), recent experiences of gender discrimination ($F(3, 119.80) = 33.92$, $p < .001$, $d = .13$), and lifetime experiences of gender discrimination ($F(3, 105.22) = 49.95$, $p < .001$, $d = .18$). Games-Howell post-hoc tests revealed that for recent experiences of racial discrimination, Black Male participants (35.06 ± 16.45) reported higher experiences of discrimination of 11.34 , 95% CI $[2.87, 19.81]$ compared to White Male participants (23.73 ± 11.20), which was statistically significant ($p = .005$). Black Male participants also reported higher experiences of discrimination of 13.95 , 95% CI $[5.88, 22.02]$ compared to White Female participants (21.11 ± 4.65), which was statistically significant

Table 12. Descriptive statistics of primary study variables by race and gender for sample 1

	Black Male (N=37)		Black Female (N=184)		White Male (N=108)		White Female (N=229)		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age (years)	19.42	3.24	18.93	2.92	19.46	2.78	18.74	1.91	2.22
RD-Recent	35.06	16.45	35.73	17.17	23.73	11.20	21.11	4.65	41.05**
RD-Lifetime	41.03	19.64	45.94	19.73	25.78	13.09	22.33	5.53	73.56**
GD-Recent	25.46	12.45	39.62	19.83	24.44	11.84	38.24	15.81	33.92**
GD-Lifetime	29.33	14.32	50.00	23.03	28.30	13.85	48.52	19.48	49.95**
Depression	4.96	5.84	10.61	9.12	9.02	9.36	11.27	9.02	7.82**
Self-Esteem	31.14	6.21	31.00	5.66	29.36	5.77	28.08	9.02	10.00**
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	χ^2
Race									
Non-Hispanic									
Black									
<i>African</i>	32	86.5	150	81.5					
<i>American</i>									
<i>African</i>	2	5.4	14	7.6					
<i>Afro-</i>	3	8.1	20	10.9					
<i>Caribbean</i>									
Non-Hispanic									
White									
<i>European</i>					95	88.0	187	81.7	
<i>Non-</i>					13	12.0	42	18.3	
<i>European</i>									
Sexual Orientation									
<i>Heterosexual /</i>	33	89.2	152	82.6	89	82.4	165	72.1	26.82*
<i>Straight</i>									
<i>Homosexual /</i>	3	8.1	3	1.6	6	5.6	12	5.2	
<i>Gay/Lesbian</i>									
<i>Bisexual</i>	1	2.7	20	10.9	8	7.4	41	17.9	
<i>Pansexual</i>			6	3.3	2	1.9	4	1.7	
<i>Asexual</i>			1	0.5	1	0.9	1	0.4	
<i>Some other</i>			1	0.5			6	2.6	
<i>sexual identity</i>									
<i>Prefer Not to</i>					2	1.9			
<i>Answer</i>									

Note. RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime. *Significant differences between groups at $p < .05$
**Significant differences between groups at $p < .01$

Table 13. Descriptive statistics of primary study variables by race and gender for sample 2

	Black Male (N=10)		Black Female (N=53)		White Male (N=36)		White Female (N=36)		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age (years)	20.70	4.81	18.79	2.16	19.00	1.74	19.06	1.11	0.57
RD-Recent	38.33	16.67	30.94	11.45	22.46	10.71	20.75	3.35	13.92**
RD-Lifetime	45.56	19.22	42.88	18.14	24.51	13.53	21.47	4.78	23.24**
GD-Recent	32.22	19.10	34.28	12.99	24.65	16.41	41.06	14.19	6.33**
GD-Lifetime	35.00	18.23	47.73	18.20	25.94	8.80	61.21	21.94	25.12**
Depression	3.71	7.41	13.71	8.34	9.45	9.87	12.81	10.04	3.87*
Self-Esteem	28.67	8.53	29.26	5.34	29.14	5.97	28.36	5.65	.20
BRI	51.20	11.02	55.83	10.59	56.64	11.11	56.72	10.40	.71
MI	53.90	11.19	58.38	11.30	60.89	12.64	57.72	12.20	1.00
GEC	52.80	11.38	57.81	11.06	59.78	11.75	57.92	11.24	.94
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	χ^2
Race									
Non-Hispanic									
Black									
<i>African</i>	8	80.0	39	73.6					
<i>American</i>									
<i>African</i>			6	11.3					
<i>Afro-</i>	2	20.0	8	15.1					
<i>Caribbean</i>									
Non-Hispanic									
White									
<i>European</i>					31	86.1	26	72.2	
<i>Non-</i>					5	13.9	10	27.8	
<i>European</i>									
									13.23
Sexual Orientation									
<i>Heterosexual /</i>									
<i>Straight</i>	9	90.0	38	71.7	29	80.6	26	72.2	
<i>Homosexual /</i>									
<i>Gay/Lesbian</i>	1	10.0	1	1.9			2	5.6	
<i>Bisexual</i>			13	24.5	5	13.9	7	19.4	
<i>Pansexual</i>			1	1.9	2	5.6			
<i>Asexual</i>									
<i>Some other</i>							1	2.8	
<i>sexual identity</i>									
<i>Prefer Not to</i>									
<i>Answer</i>									

Note. RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 Months; GD-Lifetime = Experience(s) of Gender Discrimination Lifetime, BRI = Behavioral Regulation Index T-Score, MI = Metacognitive Index T-Score, GEC = General Executive Composite T-Score. *Significant differences between groups at $p < .05$ **Significant differences between groups at $p < .01$.

($p < .001$). Similarly, Black Female participants (35.73 ± 17.17) reported higher experiences of discrimination of 12.01, 95% CI [7.37, 16.64] compared to White Male participants and higher experiences of discrimination of 14.62, 95% CI [7.37, 16.64] compared to White Female participants, both of which were statistically significant ($ps < .001$).

A similar pattern of findings emerged for lifetime experiences of racial discrimination. Specifically, Black Male participants (41.03 ± 19.64) reported higher lifetime experiences of discrimination of 15.25, 95% CI [5.33, 25.18] compared to White Male participants (25.78 ± 13.09), which was statistically significant ($p = .001$). Black Male participants also reported higher lifetime experiences of discrimination of 18.70, 95% CI [9.23, 28.17] compared to White Female participants (22.33 ± 5.53), which was statistically significant ($p < .001$). Black Female participants (45.94 ± 19.73) reported higher lifetime experiences of discrimination of 20.16, 95% CI [14.79, 25.53] compared to White Male participants and higher lifetime experiences of discrimination of 23.61, 95% CI [19.26, 27.95] compared to White Female participants, both of which were statistically significant ($ps < .001$).

Regarding recent experiences of gender discrimination, Black Female participants (39.62 ± 19.83) reported higher experiences of gender discrimination of 14.16, 95% CI [6.53, 21.78] compared to Black Male participants (25.46 ± 12.45), and higher experiences of gender discrimination of 15.18, 95% CI [9.93, 20.43] compared to White Male participants (24.44 ± 11.84), both of which were statistically significant ($ps < .001$). White Female participants (38.24 ± 15.81) reported higher experiences of gender discrimination of 12.78, 95% CI [5.82, 19.74] compared to Black Male participants, and

higher experiences of gender discrimination of 13.80, 95% CI [9.67, 19.93] compared to White Male participants, both of which were statistically significant ($ps < .001$).

The same pattern of results was evidenced for lifetime experiences of gender discrimination. Black Female participants (50.00 ± 23.03) reported higher lifetime experiences of gender discrimination of 20.67, 95% CI [11.29, 30.04] compared to Black Male participants (29.33 ± 14.32), and higher lifetime experiences of gender discrimination of 21.70, 95% CI [15.52, 27.88] compared to White Male participants (28.30 ± 13.85), both of which were statistically significant ($ps < .001$). White Female participants (48.52 ± 19.48) reported higher lifetime experiences of gender discrimination of 19.19, 95% CI [10.47, 27.90] compared to Black Male participants, and higher lifetime experiences of gender discrimination of 20.22, 95% CI [15.23, 25.21] compared to White Male participants, both of which were statistically significant ($ps < .001$).

In sample 2 (see Table 5), there were no group differences based on sexual identity ($\chi^2(12) = 13.23, p = .35, \phi = .31$), age ($F(3, 35.02) = .57, p = .64, d = .05$), or self-esteem ($F(3, 32.20) = .20, p = .90, d = .004$). There was a significant difference on depressive symptoms based on group, $F(3, 27.14) = 3.87, p = .02, d = .08$. Specifically, Games-Howell post-hoc tests revealed that Black Male participants (3.71 ± 7.41) reported lower depressive symptoms of -10.00, 95% CI [-19.70, -.30] compared to Black Female participants (12.71 ± 8.34), which was statistically significant ($p = .04$).

There also were significant differences between groups on measures of recent experiences of racial discrimination ($F(3, 30.12) = 13.92, p < .001, d = .24$), lifetime experiences of racial discrimination ($F(3, 30.38) = 23.24, p < .001, d = .34$), recent experiences of gender discrimination ($F(3, 32.23) = 6.33, p < .01, d = .15$), and lifetime

experiences of gender discrimination ($F(3, 27.538) = 25.12, p < .001, d = .39$). Games-Howell post-hoc tests revealed that for recent experiences of racial discrimination, Black Female participants (38.33 ± 16.67) reported higher experiences of racial discrimination of 8.48, 95% CI [2.07, 14.89] compared to White Male participants (22.46 ± 10.71), and higher experience of racial discrimination of 10.19, 95% CI [5.62, 14.76] compared to White Female participants (20.75 ± 3.35), both of which were statistically significant ($ps < .01$). For lifetime experiences of racial discrimination, Black Male participants (42.88 ± 18.14) reported higher experiences of racial discrimination of 21.04, 95% CI [.28, 41.80] compared to White Male participants (24.51 ± 13.53), which was statistically significant ($p = .05$) and higher experiences of racial discrimination of 24.08, 95% CI [3.56, 44.61] compared to White Female participants (21.47 ± 4.78) which also was statistically significant ($p = .02$). Black Female participants (42.88 ± 18.14) reported higher experiences of racial discrimination of 18.36, 95% CI [9.24, 27.48] compared to White Male participants, and higher experiences of racial discrimination of 21.40, 95% CI [12.14, 28.67] compared to White Female participants both of which were statistically significant ($ps < .001$).

Regarding recent experiences of gender discrimination, Black Female participants (34.28 ± 12.99) reported statistically significantly higher experiences of gender discrimination of 9.63, 95% CI [.67, 18.59] compared to White Male participants (24.65 ± 13.53), $p = .03$. White Female participants (41.06 ± 14.19) reported statistically significantly higher experiences of gender discrimination of 16.41, 95% CI [6.66, 26.16] compared to White male participants, $p < .001$. Regarding lifetime experiences of gender discrimination, Black Female participants (47.73 ± 18.20) reported statistically

significantly higher experiences of gender discrimination of 21.79, 95% CI [13.24, 30.35] compared to White Male participants (25.94 ± 8.80), $p < .001$. White Female participants (61.21 ± 21.94) reported higher experiences of gender discrimination of 26.21, 95% CI [4.00, 48.42] compared to Black Male participants (35.00 ± 18.23), which was statistically significant ($p = .02$). White Female participants also reported statistically significantly higher experiences of gender discrimination of 35.27, 95% CI [20.62, 49.93] compared to White Male participants ($p < .001$).

Results suggested that there were no statistically significant differences in overall executive functioning between groups, $F(3, 37.43) = .94, p = .43$ (Black Male participants (52.80 ± 11.38), Black Female participants (57.81 ± 11.06), White Male participants (59.78 ± 11.75), and White Female participants (57.92 ± 11.24)). Similarly, there were no statistically significant differences on the behavior regulation $F(3, 37.32) = .71, p = .55$ (Black Male participants (51.20 ± 11.02), Black Female participants (55.83 ± 10.59), White Male participants (56.64 ± 11.11), and White Female participants (56.72 ± 10.40)), or metacognition subscales, $F(3, 37.76) = 1.00, p = .40$ (Black Male participants (53.90 ± 11.19), Black Female participants (58.38 ± 11.30), White Male participants (60.89 ± 12.64), and White Female participants (57.72 ± 12.20)).

Racial Discrimination and Depressive Symptoms

A hierarchical multiple regression was run to determine if the addition of recent experiences of racial discrimination improved the prediction of depressive symptoms over and above gender identity, sexual identity, self-esteem, and lifetime experiences of racial discrimination alone. Contrary to hypothesis 1a, the main effect of recent experiences of racial discrimination was not statistically significant, $R^2 = .00, F(1, 373)$

= .001, $p = .98$ (Model 3). However, consistent with this hypothesis, the main effect of lifetime experiences of racial discrimination controlling for gender identity, sexual identity, and self-esteem was significantly associated with depressive symptoms concurrently, $R^2 = .01$, $F(1, 380) = 4.52$, $p = .034$ (Model 2) See Table 6 for full details about these models.

Differences by Race

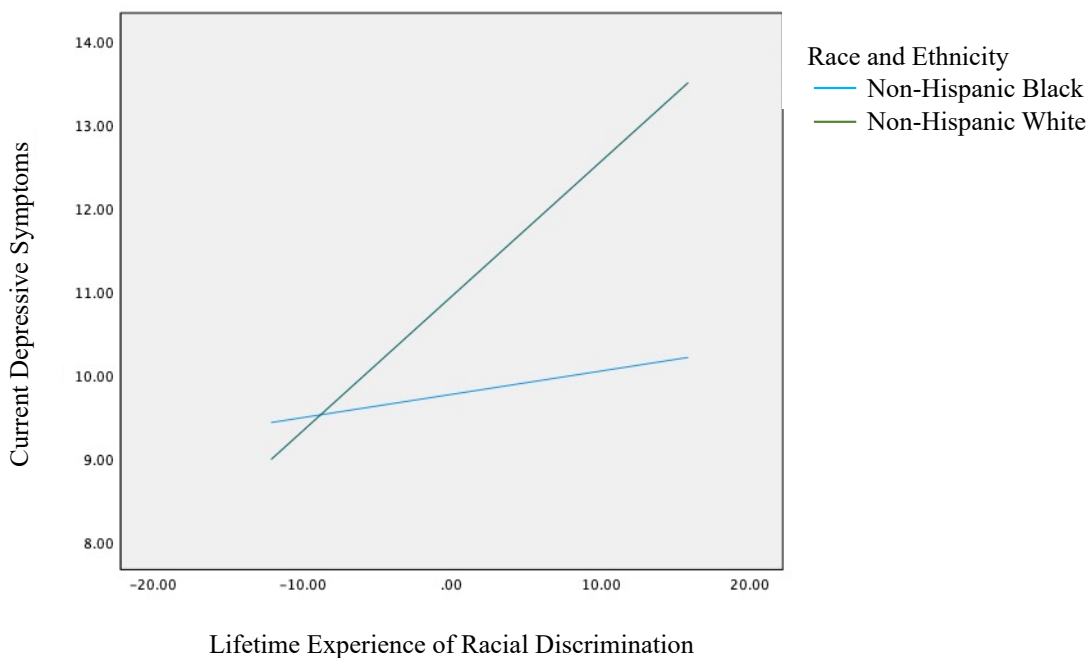
There was no significant interaction between recent experiences of racial discrimination and race predicting depressive symptoms concurrently, with the interaction term only explaining an additional 0.3% of the variance, $F(1, 371) = 1.90$, $p = .17$, contrary to hypothesis 1b. Consistent with hypothesis 1b, there was a significant interaction between lifetime experiences of racial discrimination and race predicting depressive symptoms concurrently, $F(1, 378) = 4.47$, $p = .04$, with the interaction term explaining an additional 0.6% of the variance. However, surprisingly, simple slopes analysis revealed that there was a statistically significant positive linear relationship ($b = .16$, $SE = .06$) between lifetime experiences of racial discrimination and current depressive symptoms among White participants, $p = .004$, but not among Black participants ($b = .03$, $SE = .03$), $p = .35$ (Figure 3).

Table 14. Hierarchical Multiple Regression Predicting Depressive Symptoms from Gender, Sexual Identity, Self-Esteem, Lifetime and Recent experiences of Racial Discrimination

Variable	Current Depressive Symptoms					
	Model 1		Model 2		Model 3	
	B (SE)	β	B (SE)	β	B (SE)	β
Constant	32.98 (2.41)**		32.48 (2.41)**		32.47 (2.48)**	
Gender	2.01 (.76)**	.11	1.83 (.76)*	.09	1.94 (.77)*	.10
Sexual Identity	1.46 (.36)**	.16	1.49 (.36)**	.16	1.55 (.36)**	.17
Self Esteem	-.96 (.06)**	-.60	-.97 (.06)**	-.61	-.98 (.06)**	-.61
RD- Lifetime			.04 (.02)*	.08	.04 (.05)	.08
RD- Recent					.001 (.06)	.002
R^2	.67		.67		.66	
F	102.75**		78.91**		62.52**	
ΔR^2	.45		.01		.000	
ΔF	102.75**		4.54*		.001	

Note. RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime
* $p < .05$ level
** $p < .01$ level

Figure 3. Interaction between lifetime experiences of racial discrimination and race on depressive symptoms



Gender Discrimination and Depressive Symptoms

A hierarchical multiple regression was run to determine if the addition of recent experiences of gender discrimination improved the prediction of depressive symptoms over and above gender identity, sexual identity, self-esteem, and lifetime experiences of gender discrimination alone. Contrary to hypothesis 2a, the main effect of recent experiences of gender discrimination was not statistically significant, $R^2 = .001$, $F(1, 351) = .74$, $p = .39$ (Model 3). Similarly, the main effect of lifetime experiences of gender discrimination controlling for gender identity, sexual identity, and self-esteem also was not significantly associated with depressive symptoms concurrently, $R^2 = .005$, $F(1, 362) = 3.02$, $p = .08$; adjusted $R^2 = .44$ (Model 2), which also was counter to hypothesis 2a. See Supplemental Table 2 for full details on each regression model.

Differences by Gender

Counter to hypothesis 2b, there was no significant interaction between recent experiences of gender discrimination and gender identity predicting depressive symptoms concurrently, $F(1, 350) = 0.67, p = .41$, with the interaction term explaining an additional .11% of the variance. There was no significant interaction between lifetime experiences of gender discrimination and gender identity predicting depressive symptoms concurrently, with the interaction term explaining an additional .02% of the variance, $F(1, 361) = 1.16, p = .28$, which also was counter to hypothesis 2b.

Differences by Race and Gender

Among women, there was no significant interaction between recent experiences of gender discrimination and race predicting depressive symptoms concurrently, with the interaction between these variables only explaining an additional .03% of the variance, ($F(1, 251) = .15, p = .70$), counter to hypothesis 2c. The interaction between lifetime experiences of gender discrimination and race predicting concurrent depressive symptoms was nonsignificant, with the interaction explaining an additional .04% of the variance, ($F(1, 262) = .18, p = .67$), also contrary to hypothesis 2c. Due to small sample sizes, this interaction was not examined among male participants.

Racial Discrimination and Executive Functioning

A hierarchical multiple regression was run to determine if the addition of recent experiences of racial discrimination improved the prediction of current experiences of executive dysfunction over and above sexual identity, depressive symptoms, self-esteem, and lifetime experiences of racial discrimination alone. Contrary to hypothesis 3a, the main effect of recent experiences of racial discrimination was not statistically significant,

$R^2 = .00$, $F(1, 111) = 0.00$, $p = .99$ (Model 2). Similarly, the main effect of lifetime experiences of racial discrimination controlling for sexual identity, depressive symptoms, and self-esteem was not significantly associated with executive dysfunction concurrently, $R^2 = .001$, $F(1, 112) = 0.13$, $p = .72$ (Model 3), which also was counter to hypothesis 3a. See Supplemental Table 3 for full details on each regression model.

Differences by Race

Contrary to hypothesis 3b, there was no significant interaction between recent experiences of racial discrimination and race predicting current experiences of executive dysfunction, ($F(1, 90) = 1.08$, $p = .30$), with the interaction accounting for .78% of the additional variance in executive functioning. Similarly, there was no significant interaction between lifetime experiences of racial discrimination and race predicting current experiences of executive dysfunction, ($F(1, 91) = .15$, $p = .70$), with the interaction accounting for .11% of the additional variance, which also was counter to hypothesis 3a.

Gender Discrimination and Executive Functioning

A hierarchical multiple regression was run to determine if the addition of recent experiences of gender discrimination improved the prediction of current experiences of executive dysfunction over and above sexual identity, depressive symptoms, self-esteem, and lifetime experiences of gender discrimination alone. Counter to hypothesis 4a, the main effect of recent experiences of gender discrimination was not statistically significant, $R^2 = .00$, $F(1, 91) = .02$, $p = .90$ (Model 3). The main effect of lifetime experiences of gender discrimination controlling for sexual identity, depressive symptoms, self-esteem was not significantly associated with executive dysfunction

concurrently, $R^2 = .00$, $F(1, 95) = .01$, $p = .92$ (Model 2), which also was contrary to hypothesis 4a. For full details on these regression models, see Supplemental Table 4.

Differences by Gender

Contrary to hypothesis 4b, there was no significant interaction between recent experiences of gender discrimination and gender identity predicting executive functioning concurrently, $F(1, 89) = 2.11$, $p = .15$, with the interaction explaining an additional 1.59% of the variance in executive functioning. Similarly, there was no significant interaction between lifetime experiences of gender discrimination and gender identity predicting executive dysfunction concurrently, $F(1, 93) = 1.16$, $p = .28$, with the interaction explaining an additional .85% of the variance in executive functioning, counter to hypothesis 4b.

Differences by Race and Gender

Among women, there was no significant interaction between recent experiences of gender discrimination and race predicting executive dysfunction concurrently, ($F(1, 37) = .001$, $p = .97$), with the interaction explaining less than an additional .01% of the variance in executive functioning, which was counter to hypothesis 4c. Similarly, the interaction between lifetime experiences of gender discrimination and race predicting executive dysfunction concurrently also was nonsignificant, ($F(1, 41) = .04$, $p = .85$), with the interaction explaining an additional .05% of the variance, contrary to hypothesis 4c. Due to small sample sizes, this interaction was not examined among male participants.

Multiplicative Experiences of Discrimination and Depression

Controlling for gender identity, sexual identity, self-esteem, lifetime experiences of racial discrimination and lifetime experiences of gender discrimination, the interaction between recent experiences of racial discrimination and recent experiences of gender discrimination was not significantly associated with depressive symptoms, $R^2 = .002$, $F(1, 329) = 1.15$, $p = .29$, counter to hypothesis 5a. For full model information see Supplemental Table 5. Controlling for gender identity, sexual identity, and self-esteem, the interaction between lifetime experiences of racial discrimination and lifetime experiences of gender discrimination also was not significantly related to current depressive symptoms, $R^2 = .002$, $F(1, 346) = 1.52$, $p = .22$, which also was counter to hypothesis 5a. See Supplemental Table 6 for full model information.

Differences by Race and Gender

Given unequal sample sizes and heterogeneity of variances, the proposed ANCOVA analysis could not be performed to explore differences in the multiplicative experience of racial and gender discrimination predicting current depressive symptoms by race and gender, while controlling for sexual identity and self-esteem (Hypothesis 5b). An exploratory, one-way Welch ANOVA was used to examine group differences in multiplicative experiences of discrimination and current depressive symptoms. The Games-Howell post hoc test was applied. Participants were classified into 4 groups: Black Male ($n = 25$), Black Female ($n = 142$), White Male ($n = 88$), and White Female ($n = 184$). Data are presented as means \pm standard deviation.

Results suggested significant differences in recent, multiplicative experiences of discrimination, $F(3, 90.68) = 15.52$, $p < .001$, $d = .08$. Black Male participants ($12.91 \pm$

268.85) reported lower multiplicative experiences of discrimination of -290.29 , 95% CI $[-486.51, -58.30]$ compared to Black Female participants (285.32 ± 724.63), which was statistically significant ($p = .007$). There were no significant differences between Black Males and either White Male (149.37 ± 282.01) or White Female (-4.96 ± 103.64) participants (all $ps > .05$). See Supplemental Figure 2.

White Female participants reported lower multiplicative experiences of discrimination of -290.29 , 95% CI $[-454.83, -125.74]$ compared to Black Female participants, and lower multiplicative experiences of discrimination of -154.34 95% CI $[-231.07, -77.60]$ compared to White Male participants, both of which were statistically significant ($ps < .001$). See Supplemental Figure 2.

Similarly, there were significant differences in reported lifetime, multiplicative experiences of discrimination, $F(3, 84.64) = 26.23, p < .001, d = .13$. Specifically, Black Male participants (-50.22 ± 413.12) reported lower lifetime multiplicative experiences of discrimination of -471.88 , 95% CI $[-774.55, -169.21]$ compared to Black Females (421.66 ± 849.61), which was statistically significant ($p < .001$). Black Male participants also reported lower lifetime multiplicative experiences of discrimination of -285.12 , 95% CI $[-535.60, -34.64]$ compared to White Males (234.90 ± 313.85), which also was statistically significant ($p = .02$). White Female participants (-13.16 ± 186.00) reported lower lifetime multiplicative experiences of discrimination of -434.82 , 95% CI $[-634.76, -234.87]$ compared to Black Female participants and lower lifetime multiplicative experiences of discrimination of -248.05 , 95% CI $[-337.50, -158.61]$ compared to White Male participants, both of which were statistically significant decreases ($ps < .001$). See Supplemental Figure 3.

Multiplicative Experiences of Discrimination and Executive Functioning

Contrary to hypothesis 6a, controlling for sexual identity, depression, self-esteem, lifetime experiences of racial discrimination and lifetime experiences of gender discrimination, the interaction between recent experiences of racial discrimination and recent experiences of gender discrimination on executive functioning was not significant, $R^2 = .02$, $F(1, 81) = 2.92$, $p = .09$. Full model information is presented in Supplemental Table 7. Similarly, controlling for sexual identity, depression, and self-esteem, the interaction between lifetime experiences of racial discrimination and lifetime experiences of gender discrimination on executive functioning also was not significant, $R^2 = .01$, $F(1, 86) = .93$, $p = .34$, which also was counter to hypothesis 6a. Supplemental Table 8 presents full model information.

Differences by Race and Gender

An ANCOVA could not be conducted due to a small overall sample size, unequal sample sizes, and heterogeneity of variance; thus, Hypothesis 6b could not be directly tested. An exploratory, one-way ANOVA using a nonparametric Welch test was used to examine group differences in multiplicative experiences of discrimination. The Games-Howell post hoc test was applied. Participants were classified into four groups: Black Male ($n = 10$), Black Female ($n = 53$), White Male ($n = 36$), and White Female ($n = 36$). Data are presented as means \pm standard deviation.

As with prior analyses, significant differences were noted in recent, ($F(3, 26.56) = 4.26$, $p = .01$, $d = .05$), and lifetime, ($F(3, 25.66) = 14.22$, $p < .001$, $d = .15$), combined experiences of discrimination. Specifically, Black Female participants (78.71 ± 214.85) reported higher multiplicative experiences of discrimination of 104.96, 95% CI [12.12,

197.79] compared to White Female participants (-26.25 ± 79.68), which was statistically significant ($p = .02$). There were no other statistically significant differences between groups (all $ps > .05$). Group differences in recent experiences of discrimination are illustrated in Supplemental Figure 4. Regarding lifetime experiences of discrimination, White Female participants (-145.73 ± 198.11) reported lower lifetime multiplicative experiences of discrimination of -446.16 , 95% CI $[-731.62, -160.69]$ compared to Black Female (300.43 ± 587.95) and lower lifetime multiplicative experiences of discrimination of -340.91 , 95% CI $[-486.82, -194.99]$ compared to White Male participants ($195.18, 144.14$), both of which were statistically significant ($ps < .001$). Group differences in lifetime experiences of discrimination are presented in Supplemental Figure 5.

Executive Functioning as a Mediator of Discrimination and Depression

Racial Discrimination

A simple mediation analysis was performed to investigate the indirect association between recent experiences of racial discrimination and current depressive symptoms through executive functioning. Gender identity, sexual identity, self-esteem, and lifetime experiences of racial discrimination were included as covariates. The indirect effect was not statistically significant, (Effect = $-.02$, 95% C.I. $(-.13, .05)$), which was contrary to exploratory hypothesis 1. Supplemental Table 9 presents full model information.

A second mediation analysis was performed to investigate the indirect association between lifetime experiences of racial discrimination and current depressive symptoms via executive functioning. Gender identity, sexual identity, and self-esteem were included as covariates. Results indicated no significant indirect effect, (Effect = $-.01$, 95% C.I.

(-.02, .06)), counter to exploratory hypothesis 1. Full model information is presented in Supplemental Table 10.

Gender Discrimination

A simple mediation analysis was performed to investigate the indirect association between recent experiences of gender discrimination and current depressive symptoms through executive functioning. Gender identity, sexual identity, self-esteem, and lifetime experiences of gender discrimination were included as covariates. Counter to exploratory hypothesis 2, the indirect effect was not significant, (Effect = .01, 95% C.I. (-.07, .10)), see Supplemental Table 11.

A second mediation analysis was performed to investigate the indirect association between lifetime experiences of gender discrimination and current depressive symptoms via executive functioning. Gender identity, sexual identity, and self-esteem were included as covariates. Results indicated no significant indirect effect, (Effect = -.01, 95% C.I. (-.04, .07)), which also was counter to exploratory hypothesis 2. See Supplemental Table 12 for additional model information.

Discussion

The current study examined associations of race- and gender-based experiences of discrimination, separately and in interaction, with experiences of depressive symptoms and executive functioning. Results suggested that lifetime, but not recent, experiences of racial discrimination were positively associated with current depressive symptoms. Notably, when findings were stratified by race, this positive association remained significant for White but not Black participants. Counter to hypotheses, neither recent nor lifetime experiences of gender discrimination were significantly associated with current

experiences of depressive symptoms. Also counter to hypotheses, neither race nor gender-based discrimination were associated with executive functioning. Moreover, interactive experiences of discrimination were not significantly associated with either depressive symptoms or executive functioning. Finally, exploratory analyses suggested that there was not a significant indirect association between experiences of either race- or gender-based discrimination and depressive symptoms via executive functioning.

Interestingly, exploratory analyses suggested that Black female participants experienced the highest rates of discrimination compared to the other groups examined, which is consistent with prior studies (Lee et al., 2019; SteelFisher et al., 2019). Yet, in the context of this increased risk, Black women demonstrate considerable resilience, and did not experience higher depressive symptoms or executive dysfunction. Indeed, coping style has been shown to be a significant moderator between experiences of racial discrimination and mental health outcomes in prior studies (Mekawi et al., 2022), and constitutes a potentially unexplored mechanism contributing to findings in the current study.

Another potential explanation for our unsupported hypotheses may relate to the way in which discrimination was quantified in the current study. Experiences of discrimination were measured via the frequency of discriminatory events experienced (e.g., how often) as opposed to perceived severity of events. Thus, self-perceptions of the discriminatory event itself may play a more important role in the development of mood and cognitive symptoms as opposed to sheer frequency of events experienced.

Yet, that is not to say that the frequency of discriminatory events isn't important. Indeed, results suggested that lifetime, but not recent, experiences of racial discrimination

was significantly associated with more depressive symptoms. As more discriminatory events are reported over the course of the lifetime, it may be that a specific threshold of discriminatory experiences needs to be reached before these experiences have meaningful impacts on emotional and cognitive functioning. This also may explain findings from prior studies suggesting that experiences of racial discrimination have a deteriorating, cumulative effect on mental health outcomes over time (Wallace et al., 2016). Thus, it may be the combination of frequency and duration of racial discrimination that contributes to the increased risk for cognitive and mental health concerns, thereby making lifetime experiences more predictive of outcomes as opposed to the mere frequency of events experienced over a limited timeframe.

Perceived salience also may explain the observed racial differences in lifetime experiences of racial discrimination and associated depressive symptoms in the current study. Counter to study hypotheses, the association between experiences of racial discrimination and depressive symptoms was significant for White but not Black participants. Given that White individuals are less likely to experience racial discrimination compared to their minority peers (Lee et al., 2019), it stands to reason that although experiences of racial discrimination are less frequent, they may be more distressing when they do occur. Thus, we find additional support for the notion that appraisals of discriminatory events are more predictive of mood and cognitive outcomes than event frequency.

Moreover, it could be argued that a numbing effect may occur in the face of repeated experiences of discrimination, such that the perceived salience of more routinely experienced discriminatory events decreases as their frequency increases. Indeed, studies

have found that racial discrimination can be perceived as a form of psychological trauma, and that the frequency of experiences of discrimination is positively associated with dissociative symptoms seen in trauma-based disorder like posttraumatic stress disorder (Polanco-Roman, Danes & Anglin, 2016). Thus, experiences of dissociation may impact the perceived salience of events, and subsequently, the impact they have on mood and cognition.

It also should be noted that there are several limitations to the current study. First, due to the ongoing COVID-19 pandemic, the current study was conducted completely online utilizing self-report questionnaires. As the literature to date examining executive functioning and discrimination exclusively utilizes performance-based measures of cognition, it is possible the self-report measures assessing day-to-day executive functioning are not sensitive enough to capture the degree of executive dysfunction that may be associated with discrimination. Recruitment challenges because of the pandemic also resulted in smaller than expected sample sizes, which resulted in underpowered analyses, notably those involving executive functioning. It is also important to consider the cross-sectional nature of these analyses. Indeed, although lifetime measures were used, recency biases may impact the subjective recall of these experiences (Choi & Pak, 2005).

Further, it is important to consider the larger geopolitical context in which the current study was conducted. Indeed, study recruitment spanned July 2019 to May 2022, spanning the entirety of the COVID-19 pandemic (see Ciotti et al, 2020), the longstanding systematic suppression and murder of Black Americans, the Black Lives Matter protests of the late spring and summer of 2020 (see Francis & Wright-Rigueur,

2021), and the #MeToo movement (see O’Neil et al., 2018). Given this unique period of social upheaval, it is difficult to discern the full extent to which these experiences may have impacted study findings, although increases in discrimination towards marginalized communities has been evidenced in prior pandemics (Dionne & Turkmen, 2020). Thus, additional replication is needed to better conceptualize the findings of the current study. Additionally, the current study did not include a measure of socioeconomic status (SES). Given the robust association between SES and experiences of discrimination (Jokela & Fuller-Rowell, 2022) and the interaction between subjective measures of SES and discrimination on both lifetime and recent experience of depressive symptoms in youth (Assari et al., 2018), an examination of SES is warranted to fully understand the relationship between discrimination, executive functioning, and depression.

In the context of these limitations, the study was novel in that it sought to examine combined experiences of race- and gender-based discrimination during emerging adulthood. It also sought to build upon the limited body of literature examining experiences of gender discrimination and executive functioning. The study also was novel in its attempt to incorporate experiences of discrimination, executive functioning, and depression within a single model. Finally, by examining both experiences of race and gender-based discrimination within a single model, the current study accounts for multiple aspects of identity within a more ecologically valid and nuanced framework.

Conclusions and Future Directions

Emerging adulthood constitutes a unique period of development that may carry with it unique vulnerabilities for experiences of depression and executive dysfunction. Although prior work has suggested that experiences of race- and gender-based

discrimination are associated with depressive symptoms, results from the current study suggest that it may be the salience and duration as opposed to frequency of these experiences alone that may be associated with mood symptoms and cognition. Thus, future studies should examine associations of both the frequency and severity of discriminatory experiences with subsequent changes in mood and cognition. Moreover, although executive functioning may be a more preserved area of cognition when encountering experiences of discrimination during emerging adulthood, additional work is needed with sufficiently powered samples to determine if this is really the case, and, if so, if this resilience is evidenced in other aspects of cognition such as attention and memory.

Although results did not support most of the study hypotheses, the findings add to the relatively scant body of literature examining experiences of gender discrimination and executive functioning. Additional work is needed to better discern how the association between gender discrimination and cognition may change over the lifespan. Moreover, future studies should examine the association between discrimination, depression, and executive functioning longitudinally, to elucidate these relationships more fully over time, thereby enabling more sensitive prediction models and prevention efforts. Finally, while a multiplicate approach was adopted in the current study, further work is needed to adopt a full intersectional framework in which to examine these constructs.

Supplemental Material

Rationale

As the study modified version of the Daily Life experiences Scale (DLE) utilized in the current study was unvalidated, planned validation analyses were conducted prior to inclusion of the measure in the proposed study analyses.

Participants

All participants in study sample 1 were included in the DLE validation analyses.

Analysis Plan

Internal consistency for all three DLE subscales (racial hassles, gender hassles, and bothersomeness) was determined using Cronbach's alpha. Concurrent validity was examined via correlation with the Schedule of Racist Events (SRE) for the racial discrimination subscale and with the Schedule of Sexist Events (SSE) for the gender discrimination subscale. Discriminant validity was established via correlation with the Rosenberg Self-Esteem Scale (RSES). Given the cross-sectional nature of the current study, reliability was assessed using split half estimates. Factor structure of the measure was determined via confirmatory factor analysis. Given the nature of the measure, a three-factor structure would be expected. All analyses were run in SPSS.

Results

Internal Consistency

Internal consistency was excellent for the racial hassles subscale (Cronbach's $\alpha = .91$), and good for the gender hassles (Cronbach's $\alpha = .83$) and bothersomeness subscales (Cronbach's $\alpha = .85$).

Concurrent Validity

To establish concurrent validity, correlations were run between the racial hassles subscale and both the recent and lifetime subscales of the SRE. The racial hassles subscale was found to be highly, positively correlated with both recent ($r(486) = .72, p < .001$) and lifetime ($r(485) = .73, p < .001$) experiences of racial discrimination on the SRE. Correlations also were run between the gender hassles subscale and both the recent and lifetime subscales of the SSE. The gender hassles subscale was found to be highly, positively correlated with both recent ($r(479) = .70, p < .001$) and moderately, positively associated with lifetime ($r(467) = .68, p < .001$) experiences of gender discrimination on the SSE. Concurrent validity for the bothersomeness scale could not be established using available study measures.

Discriminant Validity

To establish discriminant validity, correlations were run between the racial hassles, gender hassles, and bothersomeness subscales and the RSES. The racial hassles subscale ($r(507) = .07, p = .14$), and bothersomeness subscale ($r(507) = -.06, p = .17$) were uncorrelated with the RSES. A weak, negative correlation was found between the gender hassles subscale and the RSES ($r(507) = -.09, p = .04$).

Reliability

Reliability was established using split half estimates. Split half reliability for the racial hassles ($r(520) = .87, p < .001$), gender hassles ($r(520) = .72, p < .001$), and bothersomeness subscales ($r(520) = .76, p < .001$) was high.

Factor Structure

A confirmatory factor analysis was performed using the Maximum Likelihood method of extraction. Bartlett's test of sphericity, which examines the overall significance of all correlations in the matrix, was significant ($\chi^2(528) = 17520.98$, $p < 0.001$), suggesting an appropriate factor model for the data. The Kaiser-Meyer-Olkin measure of sampling adequacy ($KMO = .876$) was high, suggesting that it was appropriate to proceed with the factor analysis. Given the three-subscale construction of the measure, three factors were tested. As factors were expected to be correlated, an Oblimin rotation was performed. The obtained pattern matrix is displayed in Supplemental Table 1 below.

The first factor was robust, with a high eigenvalue of 10.94, and accounted for 32.28% of the variance. The eigenvalue of the second factor was 1.87 and accounted for 5.65% of the variance. The eigenvalue of the third factor was 3.465 and accounted for 10.50% of the variance. In total, 49.43% of the variance was accounted for by a three-factor model.

Factor analysis of the DLE items used in the current study revealed that the hypothesized three factor structure was sufficient to explain the underlying structure of the measure. The pattern matrix (see Supplemental Table 1 below) revealed one factor consisted of 24 items (spanning 8 individual questions). The factor was labeled perceived discrimination and demonstrated a high internal consistency (Cronbach's $\alpha = .94$). The second factor consisted of three items, spanning one question, pertaining to perceived perceptions of fear from others. This factor also demonstrated a high internal consistency (Cronbach's $\alpha = .93$). The third factor also consisted of three items, spanning one

question, pertaining to perceptions of discipline. Internal consistency for the third factor was high (Cronbach's $\alpha = .94$). One question (being mistaken for someone else of your race or gender) poorly loaded onto any of the three factors but was most associated with factor one. In summary, the three factors were perceived discrimination, perceived fear, and perceived discipline.

Supplemental Table 1. DLE Confirmatory Factor Structure

Items	Factor		
	1	2	3
1a. Being ignored, overlooked, treated rudely, disrespectfully, or not given service due to race	.48	-.32	-.02
1b. Being ignored, overlooked, treated rudely, disrespectfully, or not given service due to gender	.58	-.13	.07
1c. How bothersome was being ignored, overlooked, treated rudely, disrespectfully, or not given service due to your race or gender	.59	-.17	-.08
2a. Being accused of something, treated suspiciously, or being observed or followed while in public places due to your race	.46	-.39	-.02
2b. Being accused of something, treated suspiciously, or being observed or followed while in public places due to your gender	.40	-.18	-.04
2c. How bothersome was being accused of something, treated suspiciously, or being observed or followed while in public places due to your race or gender	.51	-.25	.04
3a. Others reacting to you as if they were afraid or scared of you due to your race	-.03	-.94	-.07
3b. Others reacting to you as if they were afraid or scared of you due to your gender	-.08	-.84	-.11
3c. How bothersome was others reacting to you as if they were afraid or scared of you due to your race or gender	.02	-.89	-.06
4a. Being treated as if you were 'stupid,' being 'talked down to,' having your ideas ignored, or not being taken seriously due to your race	.64	-.22	-.05
4b. Being treated as if you were 'stupid,' being 'talked down to,' having your ideas ignored, or not being taken seriously due to your gender	.80	.14	.03
4c. How bothersome was being treated as if you were 'stupid,' being 'talked down to,' having your ideas ignored, or not being taken seriously due to your race or gender	.79	.14	.04
5a. Overhearing or being told a joke that offended you due to your race	.50	-.18	-.14
5b. Overhearing or being told a joke that offended you due to your gender	.69	.11	-.001
5c. How bothersome was overhearing or being told a joke that offended you due to your race or gender	.66	.06	-.04
6a. Being insulted, called a name, harassed, laughed at, made fun of, or taunted due to your race	.42	-.18	-.29

6b. Being insulted, called a name, harassed, laughed at, made fun of, or taunted due to your gender	.55	.09	-.15
6c. How bothersome was being insulted, called a name, harassed, laughed at, made fun of, or taunted due to your race or gender	.55	.07	-.14
7a. Others expecting your work to be inferior (not as good as others) due to your race	.52	-.24	-.16
7b. Others expecting your work to be inferior (not as good as others) due to your gender	.56	.01	-.18
7c. How bothersome was having others expecting your work to be inferior (not as good as others) due to your race or gender	.60	-.02	-.10
8a. Being left out of conversations or activities, or having others avoid due to your race	.40	-.22	-.24
8b. Being left out of conversations or activities, or having others avoid due to your gender	.39	-.07	-.26
8c. How bothersome was being left out of conversations or activities, or having others avoid due to your race or gender	.42	-.03	-.20
9a. Being stared at by strangers due to your race	.53	-.33	.09
9b. Being stared at by strangers due to your gender	.71	.15	.12
9c. How bothersome was being stared at by strangers due to your race or gender	.72	.04	.10
10a. Being mistaken for someone else of your race	.32	-.09	-.20
10b. Being mistaken for someone else of your gender	.31	.01	-.23
10c. How bothersome was being mistaken for someone else of your race or gender	.34	-.08	-.27
11a. Being disciplined unfairly due to your race	.01	-.15	-.85
11b. Being disciplined unfairly due to your gender	.01	-.01	-.95
11c. How bothersome was being disciplined unfairly due to your race or gender	-.01	.02	-.93
Percentage of Variance	33.28	5.65	10.50
Eigenvalue	10.98	1.87	3.47
Cronbach's Alpha	.94	.93	.94
<i>Note.</i> Extraction Method: Maximum likelihood; Rotation Method: Oblimin with Kaiser Normalization. Loadings larger than .40 are in bold.			

Supplemental Table 2. Hierarchical multiple regression predicting depressive symptoms from gender, sexual identity, self-esteem, lifetime and recent experiences of gender discrimination

Variable	Current Depressive Symptoms					
	Model 1		Model 2		Model 3	
	B (SE)	β	B (SE)	β	B (SE)	β
Constant	34.88 (2.48)**		34.85 (2.45)**		34.52 (2.54)**	
Gender	1.88 (.80)*	.09	1.20 (.89)	.06	1.31 (.90)	.07
Identity						
Sexual	1.20 (.36)**	.13	1.14 (.36)**	.13	1.19 (.37)**	.13
Identity						
Self	-1.00 (.07)**	-.62	-1.00 (.06)**	-.21	-1.00 (.07)**	-.62
Esteem						
GD-			.03 (.02)	.08	-.004 (.05)	-.01
Lifetime						
GD-					.05 (.06)	.09
Recent						
R^2	.44		.44		.44	
F	94.55**		72.06**		55.49**	
ΔR^2	.44		.005		.001	
ΔF	94.55**		3.02		.74	

Note. GD-Recent = Experience(s) of Gender Discrimination Last 6 months, GD-Lifetime = Experience(s) of Gender Discrimination Lifetime
 * $p < .05$ level
 ** $p < .01$ level

Supplemental Table 3. Hierarchical multiple regression predicting executive functioning from gender, sexual identity, self-esteem, lifetime and recent experiences of racial discrimination

Variable	Current Depressive Symptoms					
	Model 1		Model 2		Model 3	
	B (SE)	β	B (SE)	β	B (SE)	β
Constant	60.12 (7.58)**		59.73 (7.69)**		59.73 (7.89)**	
Sexual Identity	2.26 (.96)*	.20	2.26 (.96)*	.20	2.26 (.98)*	.20
Depression Self Esteem	.39 (.14)**	.31	.36 (.14)**	.31	.39 (.14)**	.31
RD-Lifetime	-.37 (.22)	-.18	-.38 (.02)	-.18	-.38 (.22)	-.18
RD-Recent			.02 (.06)	.03	.02 (.12)	.03
					.000 (.16)	.000
R^2	.30		.30		.30	
F	15.97**		11.92**		9.45**	
ΔR^2	.30		.001		.000	
ΔF	15.97**		.13		.000	

Note. Depression = Current Depressive Symptoms, RD-Recent = Experience(s) of Racial Discrimination Last 6 months, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime
 * p<.05 level
 **p<.01 level

Supplemental Table 4. Hierarchical multiple regression predicting executive functioning from gender, sexual identity, self-esteem, lifetime and recent experiences of gender discrimination

Variable	Current Depressive Symptoms					
	Model 1		Model 2		Model 3	
	B (SE)	β	B (SE)	β	B (SE)	β
Constant	62.57 (8.18)**		62.66 (8.28)**		61.72 (8.54)**	
Sexual Identity	2.79 (1.11)*	.23	2.80 (1.12)*	.23	2.95 (1.15)*	.24
Depression	.38 (.15)*	.29	.39 (.15)*	.30	.39 (.15)*	.30
Self Esteem	-.44 (.24)	-.20	-.44 (.24)	-.20	-.42 (.25)	-.19
GD-Lifetime			-.01 (.06)	-.01	-.03 (.12)	.12
GD-Recent					.02 (.18)	.02
R^2	.30		.30		.31	
F	13.91**		10.33**		8.08**	
ΔR^2	.30		.000		.000	
ΔF	13.91**		.01		.02	

Note. Depression = Current Depressive Symptoms, GD-Recent = Experience(s) of Gender Discrimination Last 6 months, GD-Lifetime = Experience(s) of Gender Discrimination Lifetime
* p<.05 level
**p<.01 level

Supplemental Table 5. Hierarchical multiple regression predicting depressive symptoms from gender, sexual identity, self-esteem, lifetime and recent experiences of gender discrimination, lifetime and recent experiences of racial discrimination, and the interaction between recent experiences of racial discrimination and recent experiences of gender discrimination

Variable	Current Depressive Symptoms					
	Model 1		Model 2		Model 3	
	B (SE)	β	B (SE)	β	B (SE)	β
Constant	33.31 (2.58)**		34.71 (3.12)**		35.12 (3.14)**	
Gender	1.43(.92)	.07	1.44 (.92)	.07	1.31 (.93)	.07
Identity						
Sexual	1.46 (.39)**	.16	1.50 (.39)**	.17	1.48 (.39)**	.16
Identity						
Self	-.99 (.07)**	-.62	-.99 (.08)**	-.62	-.98 (.07)**	-.61
Esteem						
RD-	.04 (.03)	.08	.06 (.06)	.11	.05 (.05)	.09
Lifetime						
GD-	.02 (.02)	.04	-.03(.05)	-.07	-.03 (.05)	-.07
Lifetime						
RD-			-.03(.08)	-.04	.004 (.08)	.006
Recent						
GD-			.07(.07)	.12	.07(.07)	.13
Recent						
Int.					-.001 (.001)	-.06
R^2	.45		.45		.46	
F	54.80**		39.16**		34.43**	
ΔR^2	.45		.002		.002	
ΔF	54.80**		.62		.29	

Note. RD-Recent = Experience(s) of Racial Discrimination Last 6 months (mean centered), RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 months (mean centered), GD-Lifetime = Experience(s) of Gender Discrimination Lifetime; Int = Interaction Between Recent Experiences of Racial and Gender Discrimination

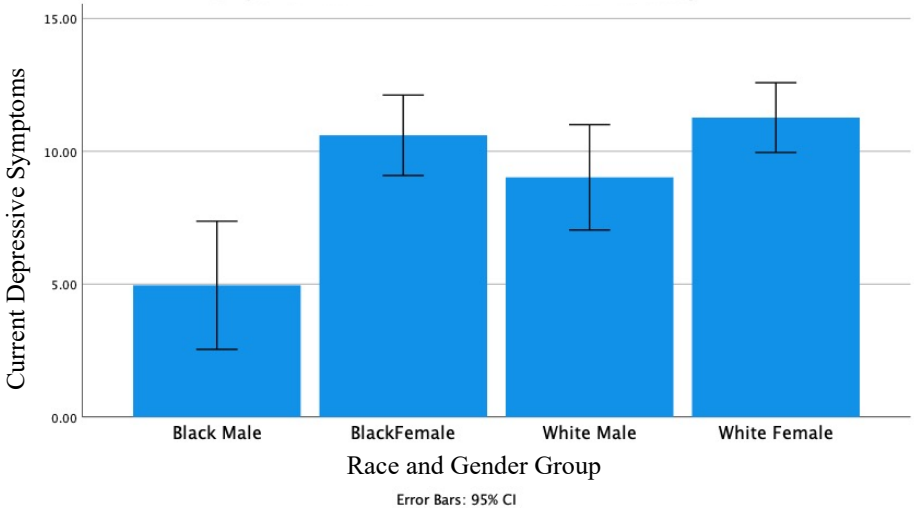
* $p < .05$ level
** $p < .01$ level

Supplemental Table 6. Hierarchical multiple regression predicting depressive symptoms from gender, sexual identity, self-esteem, lifetime experiences of gender discrimination, lifetime experiences of racial discrimination, and the interaction between lifetime experiences of racial discrimination and lifetime experiences of gender discrimination

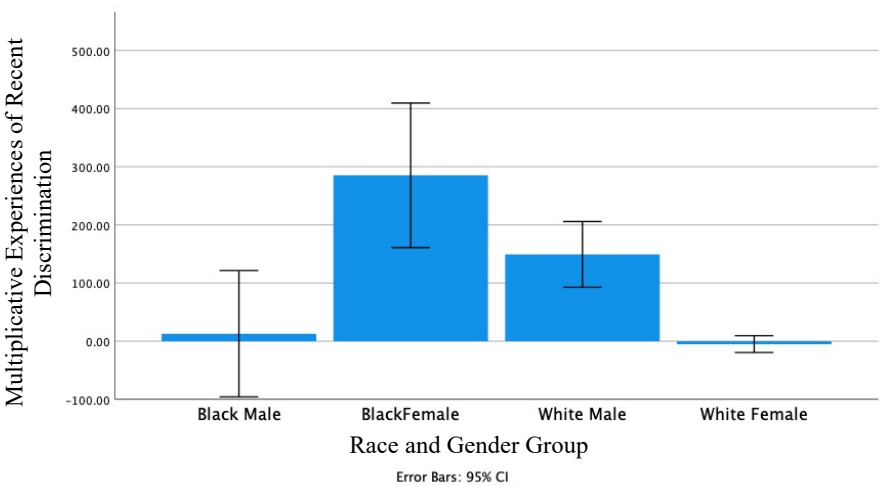
Variable	Current Depressive Symptoms					
	Model 1		Model 2		Model 3	
	B (SE)	β	B (SE)	β	B (SE)	β
Constant	33.78 (2.54)**		35.60 (2.68)**		36.08 (2.71)**	
Gender	1.86 (.81)*	.09	1.19 (.90)	.06	.96 (.91)	.05
Sexual Identity	1.39 (.37)**	.15	1.38 (.38)**	.15	1.35 (.38)**	.15
Self Esteem	-.97 (.07)**	-.61	-.99 (.07)**	-.62	-.98 (.07)**	-.62
RD- Lifetime			.02 (.02)	.05	.03 (.02)	.06
GD- Lifetime			.04(.03)	.08	.06 (.03)*	.11
Int.					-.001 (.001)	-.06
R^2	.44		.45		.45	
F	92.13**		57.23**		48.02**	
ΔR^2	.44		.01		.002	
ΔF	92.13**		.04		.22	

Note. RD-Lifetime = Experience(s) of Racial Discrimination Lifetime (mean centered), GD-Lifetime = Experience(s) of Gender Discrimination Lifetime (mean centered); Int = Interaction Between Lifetime Experiences of Racial and Gender Discrimination
* p<.05 level
**p<.01 level

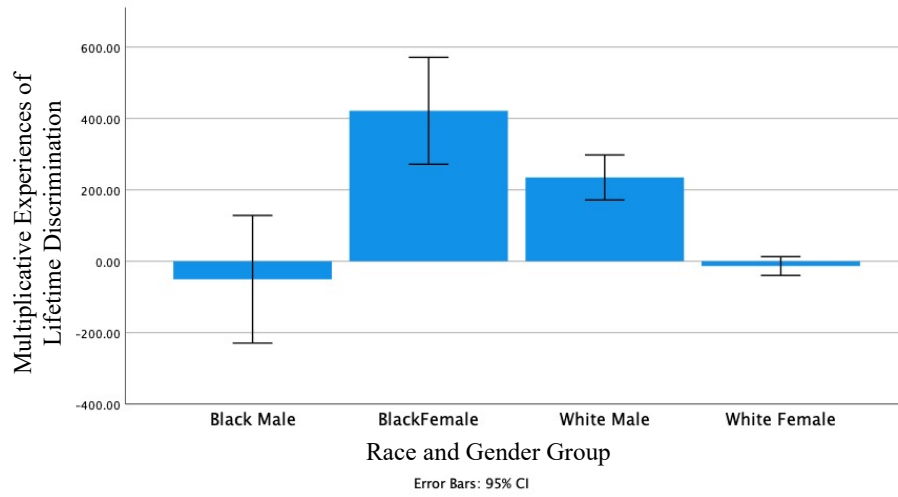
Supplemental Figure 1. Mean depressive symptoms by race and gender



Supplemental Figure 2. Multiplicative recent experiences of discrimination by race and gender (Sample 1)



Supplemental Figure 3. Multiplicative lifetime experiences of discrimination by race and gender (Sample 1)



Supplemental Table 7. Hierarchical multiple regression predicting executive functioning from gender, sexual identity, self-esteem, lifetime and recent experiences of gender discrimination, lifetime and recent experiences of racial discrimination, and the interaction between recent experiences of racial discrimination and recent experiences of gender discrimination

Variable	Current Depressive Symptoms					
	Model 1		Model 2		Model 3	
	B (SE)	β	B (SE)	β	B (SE)	β
Constant	60.69 (8.88)**		59.07 (10.29)**		57.20 (10.23)**	
Sexual Identity	2.74 (1.18)*	.23	2.42 (1.24)	.20	2.34 (1.22)	.19
Self Esteem	-.39 (.26)	-.18	-.35 (.26)	-.16	-.34 (.26)	-.16
Depression	.42 (.17)*	.32	.44 (.17)*	.34	.49 (.17)**	-.16
RD-Lifetime	.004 (.08)	.01	-.13 (.17)	-.16	.05 (.05)	.09
GD-Lifetime	-.02 (.06)	.03	.09 (.15)	.15	-.12 (.17)	-.15
RD-Recent			.20 (.24)	.18	.10 (.15)	.17
GD-Recent			-.17 (.22)	-.18	-.20 (.22)	-.21
Int.					.01 (.01)	.16
R^2	.31		.32		.34	
F	7.64**		5.52**		5.31**	
ΔR^2	.31		.01		.02	
ΔF	7.64**		.46		2.92	

Note. Depression = Current Depressive Symptoms, RD-Recent = Experience(s) of Racial Discrimination Last 6 months (mean centered), RD-Lifetime = Experience(s) of Racial Discrimination Lifetime, GD-Recent = Experience(s) of Gender Discrimination Last 6 months (mean centered), GD-Lifetime = Experience(s) of Gender Discrimination Lifetime; Int = Interaction Between Recent Experiences of Racial and Gender Discrimination

* p<.05 level
**p<.01 level

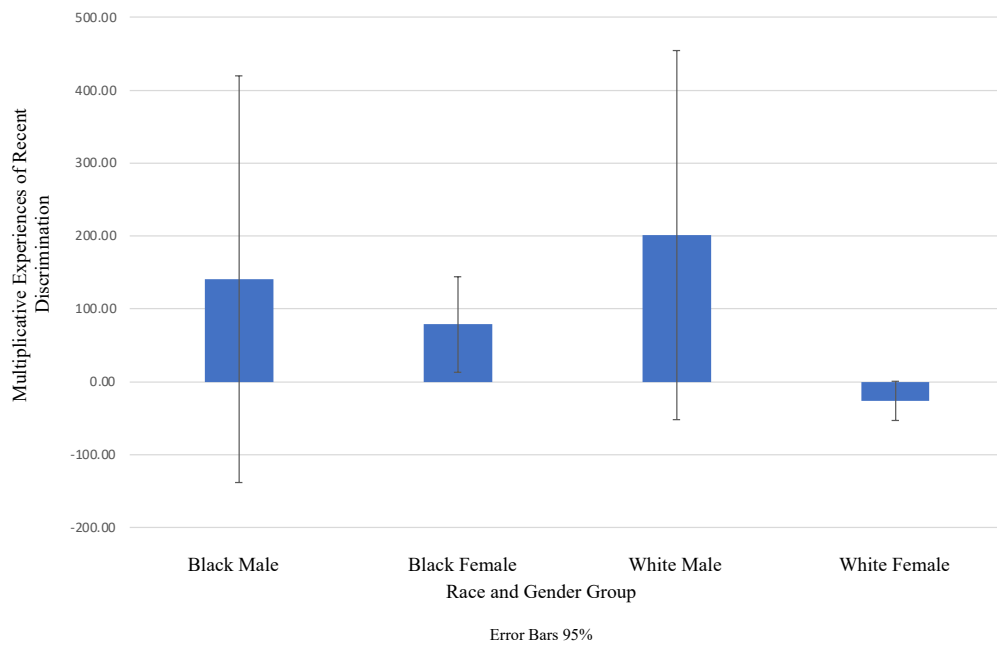
Supplemental Table 8. Hierarchical multiple regression predicting executive functioning from gender, sexual identity, self-esteem, lifetime experiences of gender discrimination, lifetime experiences of racial discrimination, and the interaction between lifetime experiences of racial discrimination and lifetime experiences of gender discrimination

Variable	Current Depressive Symptoms					
	Model 1		Model 2		Model 3	
	B (SE)	β	B (SE)	β	B (SE)	β
Constant	61.58 (8.54)**		61.31 (8.81)**		60.27 (8.88)**	
Sexual Identity	2.57 (1.15)*	.21	2.63 (1.17)*	.22	2.76 (1.18)*	.23
Self Esteem	-.42 (.25)	-.19	-.42 (.25)	-.19	-.41 (.25)	-.19
Depression	.41 (.16)*	.31	.41 (.16)*	.31	.43 (.17)*	.33
RD- Lifetime			.03 (.08)	.03	.01 (.08)	.01
GD- Lifetime			-.02(.06)	-.03	-.02 (.06)	-.02
Int.					-.004 (.004)	.09
R^2	.31		.31		.32	
F	13.14**		7.75**		48.02**	
ΔR^2	.31		.001		.01	
ΔF	13.14**		.01		.93	

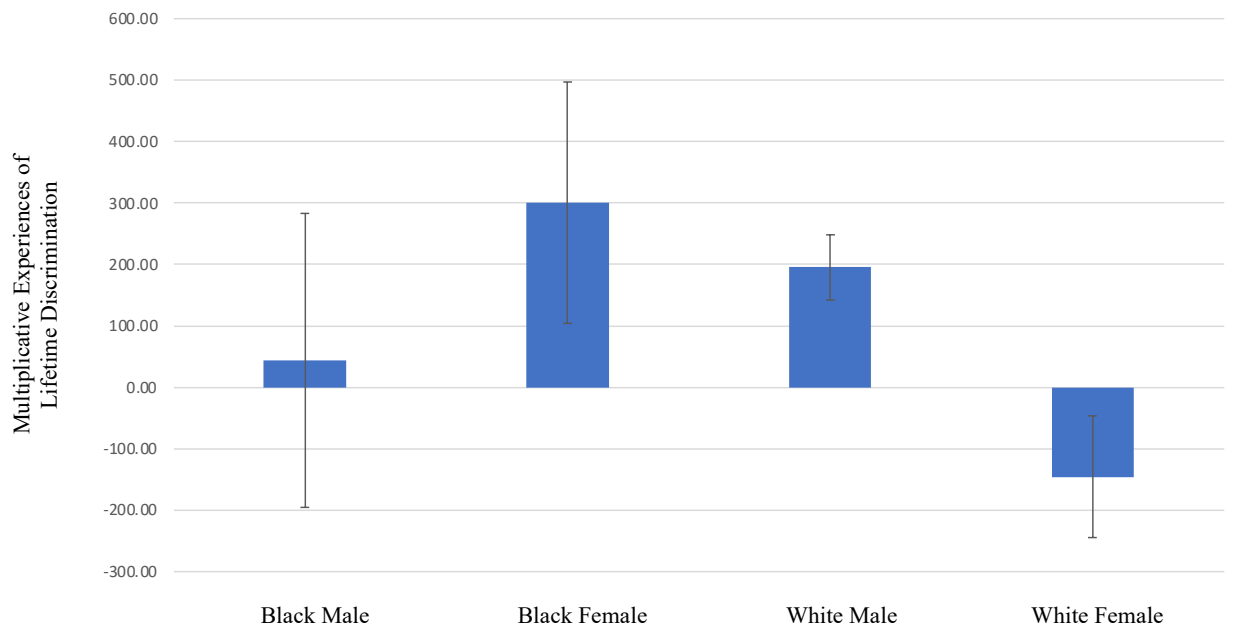
Note. Depression = Current Depressive Symptoms, RD-Lifetime = Experience(s) of Racial Discrimination Lifetime (mean centered), GD-Lifetime = Experience(s) of Gender Discrimination Lifetime (mean centered); Int = Interaction Between Lifetime Experiences of Racial and Gender Discrimination

* p<.05 level
**p<.01 level

Supplemental Figure 4. Multiplicative recent experiences of discrimination by race and gender (Sample 2)



Supplemental Figure 5. Multiplicative lifetime experiences of discrimination by race and gender (Sample 2)



Supplemental Table 9. Indirect effect of executive function on the association between recent experiences of racial discrimination and depressive symptoms

	<i>Bootstrap Estimate</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	95% CI	
					Lower	Upper
Total Effect	-.06	.11	-.52	.61	-.28	.16
Direct Effect	-.04	.11	-.39	.70	-.26	.17
Indirect Effect	-.02	.04			-.13	.05

Note. N=116. S.E. = Standard Error, CI = Confidence Interval.

* p<.05 level

**p<.01 level

Supplemental Table 10. Indirect effect of executive function on the association between lifetime experiences of racial discrimination and depressive symptoms

	<i>Bootstrap Estimate</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	95% CI	
					Lower	Upper
Total Effect	.04	.04	.90	.37	-.04	.12
Direct Effect	.03	.04	.74	.46	-.05	.11
Indirect Effect	.01	.02			-.02	.06

Note. N=116. S.E. = Standard Error, CI = Confidence Interval.

* p<.05 level

**p<.01 level

Supplemental Table 11. Indirect effect of executive function on the association between recent experiences of gender discrimination and depressive symptoms

	<i>Bootstrap Estimate</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	95% CI	
					Lower	Upper
Total Effect	.01	.12	.12	.91	-.22	.25
Direct Effect	.01	.11	.06	.95	-.22	.24
Indirect Effect	.01	.04			-.07	.10

Note. N=97. S.E. = Standard Error, CI = Confidence Interval.
 * p<.05 level
 **p<.01 level

Supplemental Table 12. Indirect effect of executive function on the association between lifetime experiences of gender discrimination and depressive symptoms

	<i>Bootstrap Estimate</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	95% CI	
					Lower	Upper
Total Effect	.05	.04	1.11	.27	-.04	.13
Direct Effect	.04	.04	.99	.32	-.04	.13
Indirect Effect	.01	.02			-.04	.07

Note. N=116. S.E. = Standard Error, CI = Confidence Interval.
 * p<.05 level
 **p<.01 level

CHAPTER 2

ASSOCIATED LITERATURE REVIEW

Introduction

As the minority population in the United States continues to grow, there has been considerable debate in the field of neuropsychology concerning how best to provide culturally informed care (Mindt et al., 2010; Brickman, Cabo & Manly, 2006). Of particular concern is the growing awareness that brain function, and by extension performance on neuropsychological assessments, is influenced by culture, which may explain, at least in part, the general trend of poorer performance among minority individuals on neuropsychological tests compared to their White peers (Brickman et al., 2006). Indeed, many sociocultural factors have been advanced as potential mechanisms underlying this disparity including age, gender, quality of education, level of acculturation, literacy, socioeconomic status, and racism (Birkman et al., 2006; Cotrena et al., 2015; Gasquoin, 1999; Hackman et al., 2015; Thames et al., 2013). Whereas any sociocultural stressor could play a role in cognitive functioning, culturally based, social stressors like stereotypes, prejudice, and discrimination may be particularly predictive of cognitive impairment in minority groups and warrant increased consideration in the literature.

Stereotypes, Prejudice, and Discrimination

Stereotypes, prejudice, and discrimination were described first by Gordon Allport (1954) in his seminal work, *The Nature of Prejudice*. Per Allport's conceptualization, prejudice is an overarching construct encapsulating both attitudes of (dis)favor and an overgeneralization of inaccurate beliefs that converge to influence behavior. Thus, prejudice captures stereotyped thoughts, biased attitudes, and acts of discrimination in a unitary entity.

Despite this original conceptualization, it is currently theorized that although stereotypes, prejudice, and discrimination could be operationalized as a single latent construct, they are more accurately conceptualized as three distinct, but related, factors (Fiske, 1998; Kite & Whitley Jr, 2016). Broadly speaking, *stereotypes* encapsulate beliefs and opinions about members of another socially derived group; *prejudice* pertains to attitudes directed towards members of a specific social group, including evaluations and emotional responses, and *discrimination* refers to the treatment of and behaviors toward members of out-groups (Fiske, 1998; Kite & Whitley Jr, 2016). Stereotypes, prejudice, and discrimination can affect members of any socially derived, categorically based, group, and have been shown to constitute commonly experienced forms of sociocultural stress among minority group members, and, in their negative forms, have adverse effects on physical and mental health, educational attainment, and cognitive functioning in stigmatized individuals (Kite & Whitley Jr, 2016).

Stereotypes

Stereotypes can be understood through three frameworks: the psychodynamic, sociocultural, and cognitive approaches (Hamilton & Sherman, 2014). According to the psychodynamic approach, stereotypes derive from defense mechanisms and the drive to place self-related sources of distress onto others. Per the sociocultural approach, stereotypes constitute intergroup beliefs that are socially learned and reinforced. Finally, following the cognitive approach, stereotypes are viewed as belief systems that influence information processing and shape both ideas about and behaviors toward out-group individuals. As Hamilton and Sherman (2014) point out, these approaches are not mutually exclusive, but rather can be viewed as complementary processes.

Interestingly, although stereotypes are culturally derived, studies have shown that some stereotypes are evidenced across cultures, whereas others are culturally specific (Fiske, 2017). In a review of this topic, Fiske (2017) argues that categorizations rooted in both biological and social underpinnings, like gender and age, and those based on underlying structures that have limited variability between different cultures, such as social class, result in the formation of cross-culturally evident stereotypes. Conversely, stereotypes that are rooted within social and historical contexts, such as those based on race, ethnicity, and religion, are culturally specific. Whether this distinction differently impacts cognitive functioning, however, largely is overlooked in the literature.

Prejudice

At its most basic level, prejudice can be understood as attitudes directed toward members of a specific social group (Fiske, 1998; Kite & Whitley Jr, 2016). As such, prejudice inherently is evaluative, communicating favor or disfavor toward a person or group (Greenwald & Krieger, 2006). Often studied through the lens of bias, prejudice can be *explicit*, a consciously endorsed belief, or *implicit*, an unconsciously endorsed belief (Greenwald & Krieger, 2006). Scholars have suggested that whereas both explicit and implicit biases have important contributions to behaviors, implicit biases may motivate actions that objectively are opposite to an individual's stated views about a specific group (Greenwald & Krieger, 2006).

It is important to remember, however, that biases do not inherently translate into behavior. Indeed, one of the most commonly utilized assessments of implicit bias, the Implicit Association Test (IAT; Greenwald et al., 1998), has been identified as a poor predictor of discrimination (Oswald et al., 2013), as have explicit assessments of bias, which overestimate attitudes of impartiality or neutrality (Greenwald & Krieger, 2006). One potential explanation for

the poor predictive power of bias for behavior may be the mediating role of cognitive functioning. Indeed, it is well established that intergroup interactions are a particularly useful experimental manipulation to evoke both explicit and implicit biases (Shelton et al., 2009). These types of interactions, however, have been shown to be particularly taxing on executive functions, as it is hypothesized that suppressing one's biases during intergroup interactions requires considerable cognitive effort (Richeson & Shelton, 2003; Richeson & Trawalter, 2005). Thus, cognitive functioning may play a key role in preventing the conversion of prejudiced attitudes into discriminatory behaviors.

Discrimination

As previously described, discrimination is defined as the unfair treatment of individuals on the basis of one or more identities, characteristics, or categories (Fiske, 1998; Kite & Whitley Jr, 2016). Experiences of discrimination are common, with 60.9% of Americans endorsing experiences of day-to-day discrimination, and 33.5% of Americans reporting at least one instance of a major discriminatory event in their lifetimes (Kessler et al., 1999). These prevalence rates may explain the nuanced categorization of discrimination as a stressor. Indeed, whereas discrete instances of discrimination are thought of as an acute form of negative life stress, it has been suggested that the repeated experience of discrimination may be best conceptualized as a chronic stressor (Pascoe & Richman, 2009). This distinction is particularly important when we seek to consider the association between discrimination and cognition, given that exposure to mild acute stress is thought to enhance cognitive function, whereas high or very high experiences of acute and chronic forms of stress are thought to impede explicit memory formation, and more complex reasoning skills (Sandi, 2013).

Like prejudice, discrimination can be broken down further into two categories, *objective* experiences of discrimination and *subjective or perceived* experiences of discrimination (Paradies, 2006; Schmitt et al., 2014). Although both types of discrimination are important when assessing outcomes, experiences of perceived discrimination are thought to be particularly predictive of both physical and mental health outcomes (Paradies, 2006; Schmitt et al., 2014), with meta-analyses demonstrating that experiences of perceived discrimination are associated with heightened stress responses, increased engagement in unhealthy behaviors, and decreased engagement in healthy ones (Paradies, 2006; Schmitt et al., 2014). The robustness of this association also may explain the almost exclusive focus on perceived discrimination in the literature examining the association between discrimination and cognitive functioning (Barnes et al., 2012; Crowe et al., 2010; Guardabassi & Tomasetto, 2020; Ozier et al., 2019; Shankar & Hinds, 2017; Sutin et al., 2014; Thames et al., 2013; Zahodne et al., 2017).

Executive Function

As described above, stereotypes, prejudice, and discrimination can influence cognitive functioning unfavorably across multiple domains. The impact of these sociocultural stressors on executive function is of particular interest given that executive functions play a crucial role in social behavior (Burgess, 2003), and are particularly vulnerable to experiences of stress (Shields et al., 2016).

Executive function refers to a collection of mental processes that are involved in inhibitory control, working memory, and cognitive flexibility (Diamond, 2013). As conceptualized by Miyake and colleagues (2000), executive functions are comprised of three core components: 1) *updating*, or the process of updating and monitoring information in working memory, 2) *shifting*, or the process of moving between tasks or mental sets, and 3) *inhibiting*, or

the process of automatic response inhibition. Executive functions also are involved in higher order processes including goal formation, planning, carrying out goal directed behaviors, effective performance, and metacognition (Diamond, 2013; Lezak et al., 2004).

Although some have argued that executive functions constitute a unitary construct, evidence from neuroimaging studies suggest this may not be the case. Indeed, whereas executive function is associated strongly with activation of the prefrontal cortex (PFC; Euston, Gruber & McNaughton, 2012; Stuss, 2011a; Snyder, 2013), specific regions of the PFC are involved with individual components of executive function (Stuss, 2011a). Dorsomedial PFC circuit activation is associated with motivation, left dorsolateral PFC activation is associated with task setting, right dorsolateral PFC activation is associated with task monitoring, activation of the lateral/medial Orbitofrontal circuit is associated with behavioral and emotion regulation, and activation of the rostral PFC is associated with higher order executive functions like metacognitions (Stuss, 2011a). Thus, from the neurobiological perspective, executive functions are a set of distinct, yet interrelated, cognitive processes.

The relationship between executive functions and the PFC also shapes the developmental course of executive function. As detailed in their review, Jurado and Rosselli (2007) explain that executive functions develop over three distinct growth periods spanning childhood (birth through age 2, ages 7-9) through late adolescence (ages 16-19), in conjunction with PFC development. These processes largely are stable in young and middle adulthood and then go on to decline in late adulthood. Given this developmental trajectory, children, adolescents, and older adults are thought to be particularly vulnerable to executive dysfunction (Jurado & Rosselli, 2007). Impairment in this area is of significant concern given that executive functions are associated with social, emotional, physical, cognitive, and mental health functioning (Diamond, 2013).

Moreover, executive function impairment is associated with a host of physical and mental health concerns including obesity (Yang et al., 2018), depression (Wagner et al., 2015), obsessive compulsive disorder (Abramovitch et al., 2013), schizophrenia (Ventura et al., 2009), attention - deficit/hyperactivity disorder in children, and autism spectrum disorder (Pennington & Ozonoff, 1996). Given these outcomes, understanding risk for executive impairment is paramount.

The Allostatic Load Model

One prominent model of stress regulation, which may be particularly relevant to understanding the cognitive effects associated with stereotypes, prejudice, and discrimination, is the allostatic load model developed by McEwen and Stellar (1993). At its core, allostatic load centers on the idea of allostasis, or the process through which an organism maintains equilibrium in the context of external stressors or changes (Sterling, 1988). Specifically, in response to actual or perceived stressors, the body undergoes a series of dynamic physiological changes, including changes to the neuroendocrine, immune, metabolic, and cardiovascular systems (D'Amico, Amestory & Fiocco, 2020). With repeated exposure to stress, these changes result in a “wear and tear” on the body that promotes future adaptation or, more commonly, maladaptation (McEwen & Stellar, 1993). Further, the effects of stress in this model are thought to be cumulative, with experiences of stress over the lifespan contributing to cascading and longstanding impacts on future disease susceptibility (McEwen & Stellar, 1993).

While allostasis incorporates whole-body adaptations in response to stress, cognitive processes play an important role. Indeed, activations of the sympathetic-adrenal-medullary and hypothalamic-pituitary-adrenal axes are essential to threat perception and response, and thereby the process of allostasis (Juster, McEwen & Lupien, 2010). Moreover, the continued activation of these systems in response to chronic stressors leads to irreversible changes in the brain

including synaptic and dendritic remodeling, suppressed neurogenesis, and structural atrophy that subsequently can impact cognitive processing (Juster, McEwen & Lupien, 2010).

Indeed, a recent systematic review and meta-analysis by D'Amico, Amestoy, and Fiocco (2020) found that among adults 18 years of age or older, allostatic load was associated with poorer overall cognitive functioning and poor executive functioning cross-sectionally. Further, there was some degree of specificity to these changes, such that memory functioning was unassociated with allostatic load. Although the literature is more limited, the impact of allostatic load also has been demonstrated in youth, with higher allostatic loads indicated among youth experiencing more risk factors of disadvantage including overcrowding, high noise levels, housing instability, family separation or discord, violence exposure, low income in relation to needs, single parent household status, maternal high school dropout, and low maternal responsiveness (Evans et al., 2007). A longer exposure to poverty during childhood also has been found to be associated with an increased allostatic load and working memory impairments in late adolescence (Evans & Schamberg, 2009). Thus, among children and adults, executive functioning may be particularly susceptible to increases in stress exposure and subsequent elevations in allostatic load.

In a study of early life adversity and cognitive functioning in middle and late adulthood, D'Amico, Amestoy, and Fiocco (2022) found that early childhood experiences of adversity were significantly associated with allostatic load later in life, and that allostatic load significantly mediated the relationship between early life adversity and overall cognition, and early life adversity and executive functioning. As with prior studies, memory was not impacted by allostatic load. Interestingly, when results were stratified by gender, allostatic load was a significant mediator of the association between early life adversity and executive functioning for

women but not men. Thus, the role of gender may be particularly important in explorations of stress, allostatic load, and executive functioning.

Given these findings, it stands to reason that sociocultural stressors like stereotypes, prejudice, and discrimination also would contribute to allostatic load, thereby setting the stage for executive function impairment. Indeed, there is a suggestion in the literature that stereotypes overburden the executive system because they activate cognitive control processes necessary to manage thoughts and emotions, thereby taxing the underlying neural systems implicated in the allostatic stress model (Ståhl et al., 2012). Similarly, it has been suggested that acting under conditions in which implicit biases are activated taxes executive functioning resources because the individual allocates extra cognitive resources to ensure that they do not appear to be biased in their behaviors, thereby activating response regulation systems (Richeson & Shelton, 2003; Richeson & Trawalter, 2005).

Yet, our understanding of the allostatic load model, as it pertains to culturally derived, social stressors may be limited due to the examination of stereotypes, prejudice, and discrimination as disparate processes in the literature. To the author's knowledge, no review to date has sought to examine the body of literature on stereotypes, prejudice, discrimination and executive function through an allostatic load lens, including an examination of findings both within and across these sociocultural stressors, and within and across different forms of oppression. Therefore, the aims of the current review were to 1) systematically review empirical studies regarding the impact of stereotypes, prejudice, and discrimination on executive function, 2) synthesize findings on the allostatic load model within and across these sociocultural stress categories, 3) synthesize findings across different domains of oppression, and 4) identify current methodological weaknesses in the literature that warrant further study.

Method

Search Strategy

This systematic review was conducted following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). A literature search was conducted using the following databases: Psych INFO, PubMed, and Medline. Empirical studies reporting on negative stereotypes, prejudice, or discrimination as related to executive functioning skills published between 1990 and 2020 were included.

The following key words were used in the search: executive function or executive functioning or executive dysfunction AND perceived discrimination or racial discrimination or racism or racial bias or gender discrimination or sex discrimination or sexism or gender bias, or homophobia or homonegativity or sexual prejudice or antigay prejudice or age discrimination or ageism or age bias or age stereotypes or stereotypes or prejudice or generalization. Broad search terms encapsulating sociocultural stressors were utilized to facilitate a comprehensive search of all sociocultural stressors related to any categorical identity that potentially could be implicated from an allostatic load model. Thus, studies that did not explicitly reference the model, but evidenced this effect were included in the review.

Inclusion / Exclusion Criteria

Inclusion Criteria. Studies that could be examined via the allostatic load model as it relates to executive functioning were included in the review. As sociocultural identity-based stressors were the focus of this review, study participants must have identified with one or more minority and/or stigmatized group identities (e.g., woman/girl, BIPOC, gay, older adult) for the study to be included. Additionally, studies must have included one or more accepted measures of executive functioning in the literature (e.g., Stroop task; Stroop, 1935), to be included (for a

review see Burgess, 2003, Chan et al., 2008, or Jurado & Rosselli, 2007). Finally, only original, empirical, peer-reviewed studies available in English were included.

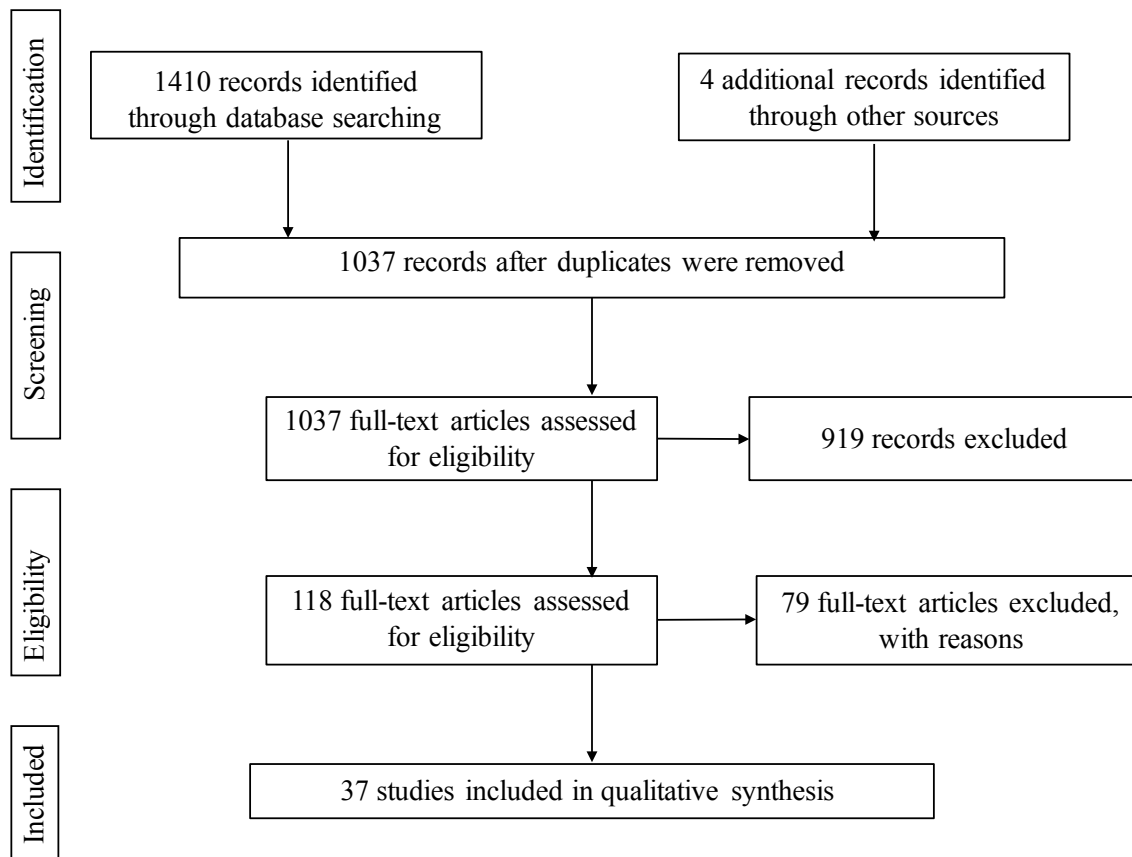
Exclusion Criteria. Studies were excluded from the current review if they did not examine main effects of discriminatory stress on executive functioning. Studies also were excluded if executive functions only were examined as a collapsed cognitive functioning composite involving measures outside the scope of executive functions. Studies that examined negative self-conceptions or stereotypes that are positive or neutral also were excluded. Finally, studies that examined executive functioning as an independent variable predicting to bias or prejudice also were excluded, as they were outside the scope of the current review.

Screening and Review Process

Figure 4 provides an illustration of the literature search and screening procedures utilized in the current review. Database searches yielded a total of 1410 records. An additional 4 records, identified through other sources, were included. Following the removal of duplicates, there were a total of 1037 articles. The first author independently screened all articles and excluded 919 articles that did not meet inclusion criteria due to the assessment of executive function utilized (e.g., examining executive functioning based on a handful of items on a clinical measure of PTSD symptomology), study focus (e.g., literature review or editorial), lack of peer review (e.g., dissertation studies), or that met at least one exclusion criterion (e.g., examined neutral or positive stereotypes without a threat context). Following initial screening, 118 articles underwent a full review. Of these studies, all examined some construct of discrimination and at least one facet of executive function. Upon closer review, 81 articles were removed due to study aims, methodology, and/or the operationalization of key constructs deemed to be incompatible with the

allostatic load model being examined. A total of 37 studies were included in the final qualitative review.

Fig. 4 PRISMA flow diagram illustrating the process of literature searches and screening



Results

Study Characteristics

The literature search yielded 37 original studies examining the impact of either stereotypes, prejudice, or discrimination on executive functioning across 51 individual experiments. Of these studies, 24 examined the association between stereotypes and executive functioning (Table 7), eight explored the association between prejudice and executive functioning (Table 8), and seven investigated the association between discrimination and executive functioning (Table 9). Two articles examined the association between multiple forms

of sociocultural identity-based stress and executive function within the same experiment or set of experiments (Guardabassi & Tomasetto, 2020; Thames et al., 2013). No article examined all three forms of sociocultural stress within the same study.

Articles will be synthesized in three ways. First, articles will be synthesized by domain of oppression within each domain of sociocultural stress. Articles then will be synthesized by domain of sociocultural stress. Finally, articles will be synthesized across all three domains of sociocultural stress.

Support for the allostatic load model will be classified into three levels: well-supported, preliminarily supported, and not supported at present. Consistent with prior studies (Scott et al., 2015), support for the executive function allostatic load model will be classified as *well supported* if more than half of the studies examined within a specific domain of oppression or form of sociocultural stress demonstrate support; *preliminary supported*, if only one of two or fewer studies within a specific domain of oppression or form of sociocultural stress demonstrate support; and *not supported at present* if either fewer than half of the studies within a specific domain or form of sociocultural stress demonstrate support for the allostatic load model.

Stereotypes and Executive Functioning

24 studies examined the association between stereotypes and executive functioning across 35 individual experiments (Table 7). All reviewed studies utilized a stereotype threat paradigm (see Steele & Aronson, 1995; Steele et al., 2002 for additional information). Consistent with prior findings, the majority of studies reviewed utilized the general stereotype threat procedure of situationally cuing the threat, actively framing the task as diagnostic in the stereotyped domain, manipulating the threat level across participants, then comparing

performance within or between individuals to determine the effect of the threat manipulation (Spencer et al., 2016).

Across studies, a diverse range of stereotypes were explored including stereotypes based on gender, physical or mental health diagnosis, race and ethnicity, age, substance use, academic major, obesity, and income (see Table 7). Only one study examined the effect of multiple stigmatized identities within the same experiment (Tine & Gotlieb, 2013). Participants ranged in age from young children (Guardabassi & Tomasetto, 2020) to older adults (Barber & Mather, 2013; Jordano & Touron, 2017b; et al., 2006; Popham & Hess, 2015), and the majority of studies utilized undergraduate samples (Allen & Gervais, 2017, Johns, et al., 2008; Jordano & Touron, 2017a; Rydell et al., 2014; Schmader & Johns, 2003; Schmader et al., 2009; Ståhl et al., 2012; Tine & Gotlieb, 2013; Wister et al., 2013). Studies will be discussed in accordance with the identity being examined, with the exception of the Tine and Gotlieb (2013) study, which will be discussed separately.

Gender Based Stereotypes

Eight studies examined the influence of gender-based stereotypes on executive functioning (Allen & Gervais, 2017; Fresson et al., 2019b; Johns, et al., 2008; Jordano & Touron, 2017a; Rydell et al., 2014; Schmader & Johns, 2003; Schmader et al., 2009; Wister et al., 2013). Of these, seven examined negative stereotypes about women (Allen & Gervais, 2017; Johns, et al., 2008; Jordano & Touron, 2017a; Rydell et al., 2014; Schmader & Johns, 2003; Schmader et al., 2009; Wister et al., 2013), and one examined negative stereotypes about boys (Fresson et al., 2019b).

Stereotypes About Women. Stereotypes About Women. Of the studies examining negative stereotypes about women, the majority examined negative stereotypes about women

Table 15. Summary of studies examining executive functioning impairment following stereotype activation

Study	Sample	Design	Type of ST	ST Manipulation	Measure of Executive Function	Findings	Support for Allostatic Load Model?
Allen & Gervais, 2017 (Experiment 2)	103 female undergraduate (mean age = 18.88 years, 93.2% European American)	C	Gender ST	Femininity Saliency Manipulation (Femininity vs. Masculinity) & Money Saliency Manipulation (Money vs. Paper)	Stroop Task	No significant main effects. Significant interaction emerged such that participants in the money x femininity condition had significantly slower reaction times (inhibition) on the Stroop task compared to participants in the money x masculinity condition. No significant differences were found in the paper condition. Accuracy was unaffected.	Yes
Allen & Gervais, 2017 (Experiment 3)	76 female undergraduates (mean age = 20.25 years, 85.6% European American)	C	Gender ST	Femininity Saliency Manipulation (Femininity vs. Gender Neutral) & Money Saliency Manipulation (Money vs. Paper)	Stroop Task	Main effect of femininity saliency such that participants in the femininity saliency condition had significant slower reaction times. No main effect for money saliency was observed. Significant effect for femininity x money saliency interaction with slower reaction times (inhibition) in the money x femininity condition compared to the money x gender neutral condition. No effects on accuracy.	Yes
Fresson et al., 2019b (Experiment 2)	103 French speaking children (Mean age = 9.27)	C	Gender ST	Instruction manipulation (threat vs. neutral)	Executive Functioning composite derived from Fruit Stroop KiTAP subtest and Skewed fruit task	Executive error scores were higher for male participants compared to female participants in the threat condition only if their level of stigma consciousness was low. There was no other significant effect of threat condition.	Partial
Johns, et al., 2008 (Experiment 1)	85 White female psychology undergraduates	C	Gender ST	Task Instruction manipulation (threat vs. non-threat)	Reading Span	Significant main effect of threat on number of words recalled, with lower recall in the threat condition compared to the control condition.	Yes
Johns, et al., 2008 (Experiment 2)	46 female undergraduates	C	Gender ST	Task Instruction manipulation (threat vs. threat and emotional suppression vs. threat and emotional reappraisal)	Stroop	Significant effect of condition with participants in the emotion reappraisal condition completing task faster and with fewer errors compared to participants in the suppression condition and threat-only condition. No differences between threat-only and emotional suppression conditions in either reaction time or accuracy.	Yes

Johns, et al., 2008 (Experiment 3)	61 female undergraduates	C	Gender ST	Task Instruction manipulation (non-threat vs. threat vs. threat and emotional reappraisal)	Reading Span	Participants in the threat condition recalled fewer words than participants in either the control condition or threat and anxiety reappraisal condition	Yes
Jordano & Touron, 2017a (Experiment 1)	60 female undergraduate (mean age =19.10 years)	C	Gender ST	Task Instruction manipulation (threat vs. non-threat)	OSPAN	No effect of stereotype threat on OSPAN performance.	No
Jordano & Touron, 2017a (Experiment 2)	60 female undergraduate (mean age =19.25 years)	C	Gender ST	Task Instruction manipulation (threat vs. non-threat)	OSPAN	Participants in the stereotype threat condition were less accurate than participants in the control condition on a more challenging version of the OSPAN task	Yes
Rydell et al., 2014 (Experiment 1)	168 undergraduates (55.34% male)	C	Gender ST	Study Description Manipulation (threat vs. control)	Stroop Letter-Memory task Number-letter task	Significant two-way interaction such that women showed poorer inhibition in the Stroop task in the ST condition compared to the control condition, and poorer updating in the Letter-Memory task in the threat condition compared to the control condition. There was no interaction for performance in the letter number task (shifting). Men's performance was not difference across conditions in any task. Both inhibition and updating were significant mediators of the association between the interaction of ST and gender and accuracy on the math problems.	Yes
Rydell et al., 2014 (Experiment 2)	90 female undergraduates	C	Gender ST	Study Description Manipulation (threat vs. control)	Stroop Keep Track Task Color-Shape Task	Significant effect of threat on measures on inhibition (Stroop) and updating (Keep Track Task), such that women in the threat condition performed worse on these tasks compared to women in the control condition. No effect of threat on shifting (Color-Shape Task) performance. Both inhibition and updating significantly mediated the association between ST and accuracy on math problems.	Yes
Rydell et al., 2014 (Experiment 3)	82 female undergraduates	C	Gender ST	Study Description Manipulation (threat vs. control)	Antisaccade Task Letter-Memory Task	Significant effect of threat on measures on inhibition (Antisaccade) and updating (Letter-Memory Task), such that women in the ST condition performed worse on these tasks compared to women in the control condition. No effect of threat on shifting (Color-Shape Task) performance. Both inhibition and updating significantly mediated the association	Yes

					Color-Shape Task	between threat and accuracy on math problems. Inhibition significantly mediated the association between threat and risk-taking behavior.	
Schmader & Johns, 2003 (Experiment 1)	75 psychology undergraduates (53.33% male)	C	Gender ST	Study Description Manipulation (threat vs. control)	Adapted Operation-Span Task	There was a significant main effect of gender and threat condition and their interaction on working memory span such that women in the ST condition recalled few words than men in the same condition and women in the control condition.	Yes
Schmader et al., 2009 (Experiment 2)	116 female undergraduates (68.10% White)	C	Gender ST	Study description manipulation (threat vs. control)	Reading Span Test	No significant main effects or two-way interactions. Significant three-way interaction such that working memory performance was lower only for participants who reported high anxiety and for whom the task was framed as a diagnostic test (ST condition).	Partial
Wister et al., 2013	92 female undergraduates (mean age = 20.76 years, 87% European American)	C	Gender ST	Menstruation History survey	Stroop	Main effect of threat on Stroop performance, such that participants in the ST condition were less accurate than participants in the no threat condition. Participants in the no threat, positive prime condition had the best performance. Participants in the ST, positive prime condition had the worst performance.	Yes
Barber & Mather, 2013 (Experiment 1)	56 older adults (mean age = 69.29 years, 61% male, 66% White)	C	Age ST	Article manipulation (ST vs. no threat)	Sentence Span Task pre and post manipulation	No significant difference between participants in the ST and no threat conditions.	No
Barber & Mather, 2013 (Experiment 2)	56 older adults (mean age = 65.61 years, 80% female, 48% White)	C	Age ST	Article manipulation (ST vs. no threat)	Sentence Span Task pre and post manipulation	No significant difference between participants in the ST and no threat conditions.	No
Fresson et al., 2017	72 French speaking adults (Mean age = 64.04 years)	P	Age ST	Manipulation (reading positive vs. negative articles about aging and cognition)	Executive Functioning Composite derived from Stroop; TAP Divided Attention Task; Trail Making Test	Significant effect of condition on executive function composite score seen approximately 1 week later with worse performance evidenced in the negative condition. Participants who reported higher levels of dementia worry had lower scores in the negative condition, there was no difference between conditions for participants with low levels of dementia worry. Exploratory analyses indicated a main effect of condition, dementia fear, and their interaction on Stroop errors only.	Yes

Jordano & Touron, 2017	120 participants divided into two age cohorts: young adults (Mean age = 19.20 years) and older adults (Mean age = 67.51 years)	C	Age ST	Task manipulation (ST threat articles vs. ST relief articles vs. control articles)	OSPAN	Significant main effect of condition such that older adults in the threat condition had lower letter accuracy than young adults, older adults in the relief condition, and older adults in the control condition. Main effect for math accuracy was also found with young adults obtaining higher accuracy than older adults in the stereotype threat condition only.	Yes
Kalenzaga et al., 2006	50 adult participants divided into two age cohorts: young adults (between 21-30 years) and older adults (66-80 years)	C	Age ST	Task instruction manipulation (all participants in threat and control condition)	Running-Span Test Trial Making Test	Significant effect of condition on executive functioning scores with poorer performance in the ST condition compared to control condition. Significant main effect of age with older participants performing worse than younger participants.	Yes
Popham & Hess, 2015	63 older adults (aged 65-83) and 64 undergraduates (aged 18-23)	C	Age ST (older adults) Academic ST (undergraduates)	Reading manipulation (threat vs. positive stereotypes)	OSPAN Letter-Number Sequencing	Young adults in the threat condition had reduced working memory performance compared to positive stereotype group. There was no effect of stereotype manipulation on working memory of older adults. Correlation between Letter-Number sequencing and OSPAN seen in older adults but not young adults.	Partial (young adults only)
Ståhl et al., 2012 (Experiment 1)	63 social science undergraduates (mean age = 22 years, 79.37% female)	C	Academic ST	Study description manipulation (threat vs. control) and identification of major before task	Simplified Stroop	Participants in the ST condition had significantly worse Stroop performance (more interference) than participants in the control condition.	Yes
Ståhl et al., 2012 (Experiment 2)	108 social science undergraduates (mean age = 19 years, 75.93% female)	C	Academic ST	Study Description Manipulation (threat vs. control) and identification of major before task	Simplified Stroop	Participants in the ST condition who utilized a promotion regulatory focus strategy had significant worse Stroop performance (more interference) than participants in the control condition, and participants in the ST condition who used either a prevention strategy or no control strategy	Yes
Carter-Allison et al., 2016	67 participants with a history of mild TBI	C	Diagnosis ST	Brief Illness Perception Questionnaire	Digit Span Letter-Number Sequencing	No significant differences between participants in the ST and control condition. Moderation analyses indicated that diagnosis ST was associated with poorer digit span performance among participants who reported higher levels of concern about their TBI and among participants who reported higher levels of suggestibility.	Partial
Fresson et al., 2019a (Experiment 1)	106 adult participants. 53 participants with	P	Diagnosis ST	Instruction manipulation (threat vs. neural)	Executive Functioning Composite	Significant effect of threat seen approximately 1 week later with participants with acquired brain injury scoring lower on the executive function	Yes

	acquired brain injury between 17 and 55 years old and 53 matched control participants				derived from an adapted sustained attention to response task; adapted Tone monitoring task; Shape-Color task	compared to control participants when in the threat condition, but no differences seen in the neutral condition. Mediation analyses indicated that negative emotions mediated the association between condition and executive functioning.	
Kit et al., 2014	84 participants divided into two groups: 42 individuals with mild-to-moderate TBI and 42 matched healthy controls	C	Diagnosis ST	Task instruction manipulation (threat vs. reduced threat)	Letter Number Sequencing Auditory Consonant Trigrams Test	No significant differences were noted across threat conditions.	No
Moritz et al., 2018	50 participants with verified or likely OCD	C	Diagnosis ST	Cue manipulation (threat vs. control)	Go/No-Go Task	Adjusting for age and gender, the odds of participants in the threat condition having fewer hits than participants in the control condition increased, and constituted a medium to large effect	Yes
Johns, et al., 2008 (Experiment 4)	81 undergraduates (42.00% Latinx, 61.73% female)	C	Racial/Ethnic ST	Task Instruction manipulation (threat vs. non-threat)	Reading Span	Latinx participants in the ST and no reappraisal condition recalled fewer words compared to participants Latinx participants in the anxiety appraisal condition, and White participants in either the reappraisal or no reappraisal condition.	Yes
Schmader & Johns, 2003 (Experiment 2)	73 psychology undergraduates (64.38% female, 45.21% Latinx)	C	Racial/Ethnic ST	Study description manipulation (threat vs. control) and identification of ethnicity before task	Adapted Operation-Span Task	There was a significant ethnicity x ST interaction such that Latinx students in the ST condition recalled fewer words than White participants in the ST condition or Latinx participants in the control condition. There was also a significant gender main effect with men recalling more words than women.	Yes
Schmader et al., 2009 (Experiment 1)	78 undergraduates (47.44% identified as an academically stigmatized minority)	C	Racial/Ethnic ST	Study description manipulation (threat vs. no threat based on identity)	Reading Span Test	Significant two-way interaction between prime and anxiety, such that working memory performance was worse for participants in the ST condition who also reported high levels of anxiety compared to participants who reported low levels of anxiety in the threat condition.	Partial

Thames et al., 2013	92 healthy adults (48.91% African American)	C	Racial/Ethnic ST	Task instruction manipulation (ST vs. non-threat) and examiner manipulation (same race vs. different race)	Trail Making Test – Part B Stroop	Significant two-way interaction between participant race and ST condition such that African American participants in the ST condition took longer on to perform the trail making task compared to African American participants in the control condition and White participants in both conditions. There were no significant differences in performance evidenced in the Stroop task. When executive function scores were examined as a composite in analyses, results indicated that African Americans in the ST condition performed worse than White participants in the ST condition.	Partial
Cole et al., 2006	68 volunteers aged 18-36 (50% self-reported Ecstasy users)	C	Substance Use ST	Informational Sheet manipulation (ST vs. no prime)	Digit Span	No significant differences were noted between users and non-users in Digit Span performance in either the ST or no-prime condition	No
Looby & Earleywine, 2010	57 adult heavy cannabis users (mean age 21.32 years, 52.63% male, 88% White)	C	Substance Use ST	Information Manipulation (threat vs. control)	Controlled Oral Word Association Task (COWA) Digit Span Digit Symbol Substitution Task	No main effect of threat condition on measures examined. Significant gender by condition interactions on verbal fluency task (COWA) and Digit Symbol task switches. Male participants in the threat condition performed more poorly than males in the control condition on the verbal fluency task as indicated by few words generated and fewer switches. Female participants in the threat condition performed better than females in the control condition as indicated by more symbol production on the digit symbol task.	Partial
Pennington et al., 2016	55 alcohol users (mean age = 24.20 years, 54.55% female, 92.9% White British)	C	Substance Use ST	Task Stimuli (alcohol related vs. control visual cues, and alcohol related vs. no sound cue)	Cued Go/No-Go Task	Main effect of condition on response latency with slower reaction time for participants in ST condition compared to controls. No effect on response accuracy or commissions following standard instructions. Following reverse scoring rules, there was a main effect of ST condition on accuracy with participants in threat condition less accurate following beer bottle presentation and letter K and significant 3-way interaction between condition, sound, and stimuli type. Participants in the ST condition were less accurate on alcohol related and neutral stimuli in both sound conditions. Threat	Yes

						participants were also more accurate to alcohol related stimuli compared to neutral stimuli in both sound conditions. Participants in the ST condition also made more commission errors compared to controls. Main effect of condition such that participants in the ST condition took longer to respond to the beer bottle and letter K compared to controls.	
Guardabassi & Tomasetto, 2020	176 Italian primary school students (M age = 116.07 months)	C	Weight ST	Perception of Teasing Scale Task Instruction manipulation (threat vs. non-threat)	N-back	No main effect of condition. Significant interaction between BMI and condition on N-back score, with lower scores evidence in the threat but not non-threat condition.	Partial
Tine & Gotlieb, 2013	71 undergraduates (mean age = 19.54 years, 64.79% female, 66.2% White, 53.52% High Income)	C	Gender ST Racial Minority ST Income ST	Gender, race, and income stereotype manipulation given to all participants	Automated Working Memory Assessment (Verbal Working Memory) given pre and post manipulation	Significant gender stereotype effect with male participants' improvement on task from pre to post assessment was significantly greater than female participant's improvement. Significant race x ST interaction with White participants showing greater improvement from pre to post than BIPOC students. Significant income x ST interaction at pre assessment only with low-income participants scoring significantly lower than both middle and high income participants, and no differences noted between middle and high income group. Participants with three stigmatized identities performed worse than participants with zero, one or two stigmatized identities.	Yes

NOTE: BIPOC = Black, Indigenous, and People of Color; C = Cross Sectional Design; KiTAP=*Test of attentional performance for children*; OSPAN = Operation Span Task; P = Prospective Design; ST = Stereotype Threat; TBI = Traumatic Brain Injury

and math ability (Johns et al., 2008, Jordano & Touron, 2017a; Rydell et al., 2014, Schmader & Johns, 2003; Schmader et al., 2009). All five of these studies found some support for the allostatic load model as evidenced by impairment of executive functioning following the elicitation of stereotypes. Specifically, poor performance was found on tasks of inhibition (Rydell et al., 2014), working memory (Rydell et al., 2014, Schmader & Johns, 2003, Schmader et al., 2009; Jordano & Touron, 2017a), and verbal fluency (Johns et al., 2008). Consistent with the stereotype threat model, among studies utilizing a mixed gender sample (Rydell et al., 2014, Schmader & Johns, 2003), only individuals from the stereotypes group, in this case female participants, exhibited executive functioning impairment.

In the context of these largely supportive findings, there is also a suggestion of specificity in this model. Indeed, multiple aspects of executive functioning were impaired, in the only study to examine a task of shifting (Rydell et al., 2014), no performance impairments were found in this domain. Complexity of the executive functioning task also played an important role, with studies demonstrating impairments when more complex tasks were utilized but found no differences on less complex executive tasks (Jordano & Touron, 2017a). Moreover, results suggested that executive functioning impairments may be evidenced in some individuals but not others. Specifically, participants who reported higher rates of anxiety exhibited executive functioning impairments following the activation of stereotypes, whereas individual with lower levels of anxiety did not display these impairments (Schmader et al., 2009). Emotional reappraisal was also found to be protective against executive functioning impairment (Johns et al., 2008). Thus, individual and task related factors play an important role in understanding when and for who executive functioning impairments may manifest following exposure to negative stereotypes.

In a study examining a related stereotype of women having poor money management skills, Allen and Gervais (2017) found mixed support for the allostatic load model. While one experiment demonstrated null findings following a gender priming and stereotype threat manipulation, a significant effect was found in the second experiment. Specifically, participants in the femininity condition demonstrated significantly slower reaction times compared to participants in the gender-neutral condition. In both studies, a significant gender condition x money condition interaction occurred such that participants in the femininity x money condition demonstrated significantly slower reaction times compared to participants in either the masculinity x money condition or gender-neutral x money condition on the Stroop task, an indicator of impaired inhibition. Given that poorer performance only was evidenced in the condition match to the stereotype being investigated (the femininity x money condition), results indicate support for the allostatic load model.

In a separate study examining the impact of menstruation stereotypes on inhibitory control, Wister and colleagues (2013) found a significant main effect of threat on inhibitory control, such that participants in the threat condition were less accurate than participants in the no threat condition. An interaction between threat and prime condition also was evidenced, such that participants in the no threat, positive prime condition demonstrated the best performance, and participants in the threat, positive prime condition demonstrated the worst performance compared to the other groups. Thus, we find support found the allostatic load model for a diverse range of gender-based stereotypes among female participants.

Stereotypes about Men/Boys. In the only study to examine a gender-based stereotype about boys, Fresson and colleagues (2019b) examined the cognitive impact of the stereotype that boys are more inattentive, impulsive, and underachieving than girls in a sample of French

speaking Belgian children. Results indicated partial support for the allostatic load model. Specifically, executive functioning error scores were higher for male participants compared to female participants in the threat condition, but only if their level of stigma consciousness was low. There was no other significant effect of threat condition. Thus, findings suggest that susceptibility to threat may be dependent on individual, as opposed to group wide, factors.

Summary of Gender Stereotypes. In sum, the allostatic load model is well supported across the eight studies examining the impact of gender-based stereotypes on executive functioning skills, with worse performance on measures of executive function evidenced in the stereotyped group compared to the non-stereotyped group. This impairment was also seen across a variety of inhibition and updating tasks, and in both mixed gender and same-gender samples. Moreover, medium effect sizes were reported across studies, suggesting that this association is robust.

However, these studies do raise important considerations for the allostatic load model. Indeed, only one study examined a negative stereotype about men/boys (Fresson et al., 2019b), and results from this study only yielded partial support for this model. Thus, future work is needed in this area to elucidate any gender differences in susceptibility to executive function impairment following the activation of male gender-based stereotypes. Relatedly, most studies explored this association in undergraduate samples; thus, more work is needed to determine how these associations may differ across different age cohorts.

Further, several individual characteristics demonstrated an effect on this relationship. Indeed, among children, stigma consciousness was found to moderate the association between stereotype threat and executive function impairment (Fresson et al., 2019b), and both individual level of anxiety and anxiety regulation skills differentially influenced executive function

impairment in the context of gender based stereotypes (Johns et al., 2008; Schmader et al., 2009), suggesting that mental health conditions may further tax executive resources, thereby increasing an individual's vulnerability to allostatic load following stereotype threat. Thus, more work is needed to fully elucidate the role of individual differences in the allostatic load model. Finally, as noted above, null finding in the Jordano and Touron (2017a) study highlights that executive functioning impairment may not be evident in less demanding cognitive tasks.

Diagnosis Stereotypes

Four studies examined stereotypes based on diagnosis history (Carter-Allison et al., 2016; Fresson et al., 2019a; Kit et al., 2014; Moritz et al., 2018). Of these, three examined stereotypes related to Traumatic Brain Injury (TBI) (Carter-Allison et al., 2016; Fresson et al., 2019a; Kit et al., 2014), and one examined mental health related stereotypes (Moritz et al., 2018).

Traumatic Brain Injury Stereotypes. Of the studies examining TBI related stereotypes, support for the allostatic load model was mixed. In adults with a history of acquired brain injury and a matched healthy control group, Fresson and colleagues (2019a) found evidence of executive function impairment based on a composite measure of this domain. following a stereotype threat cue. Among participants with acquired brain injury, those in the threat condition scored lower on the executive function composite compared to participants without a history of acquired brain injury in the threat condition. No differences in performance were seen in the neutral condition. Negative emotions also were found to significantly mediate the association between condition and executive functioning, suggesting that negative emotions are a potential mechanism through which the association between exposure to negative stereotypes and executive function impairment emerges.

Other studies, however, provide only partial or no support for the allostatic load model for stereotypes related to TBI. Indeed, in their study of participants with a history of mild TBI who participate in boxing or rugby clubs, Carter-Allison and colleagues (2016) found no significant difference between the threat vs. control conditions on executive function performance on tasks of working memory. Similarly, null findings also were evidenced in a separate study by Kit and colleagues (2014) examining diagnosis-based stereotypes in a sample of individuals with mild-to-moderate TBI and matched healthy controls on a sequencing task.

However, Carter-Allison and colleagues (2016) did find significant moderators of the association between stereotype threat activation and executive function impairment. More specifically, they found that level of suggestibility and concern about one's condition significantly moderated the association between condition and working performance, such that participants who reported higher levels of suggestibility and participants who reported higher levels of concern about their TBI demonstrated poorer performance on the task. Thus, we find additional support that those more sensitive to negative stereotypes due to individual characteristics like anxiety and suggestibility, are at increased risk for allostatic load.

Mental Health Stereotypes. One study examined the association between a mental health related stereotype and executive function impairment. In this study, Moritz and colleagues (2018) examined diagnosis-based stereotypes in a sample of participants with confirmed or likely diagnoses of obsessive-compulsive disorder. Consistent with the allostatic load model, when results were adjusting for age and gender, the odds of participants in the threat condition having fewer hits than participants in the control condition increased following threat activation. Further, this difference constituted a medium to large effect. However, given that obsessive compulsive disorder is associated with broad impairments in executive function (Snyder et al.,

2015), it is likely that underlying cognitive impairments associated with mental health concerns, and the experience of stress associated with those condition, may have an important impact on allostatic load, above and beyond the activation of diagnosis-based stereotypes.

Summary of Diagnosis Based Stereotypes. Given these findings, the allostatic load model was well-supported in the context of diagnosis-based stereotypes. It should be conceded, however, that findings were variable across studies and the sample sizes of these studies were small. Indeed, even among studies examining the same stereotypes in similar samples, the effect of stereotypes on executive function was variable. These findings are even more surprising when we consider the well documented association between TBI and executive dysfunction (Stuss, 2011b). Further research is needed to better understand whether executive function impairment stemming from activation of stereotypes may present differently in individuals whose cognitive resources already are being taxed by physical and/or mental health concerns.

Test selection is also an important consideration. Both studies of TBI based stereotypes that reported null findings for a main effect of condition assessed executive function via a measure of a single domain of executive functioning (working memory), whereas significant findings were evidenced in the only study to use a composite score. More work is needed to parse out which domains of executive function may be implicated in this association.

Age Stereotypes

Three studies examining age-based stereotypes in older adults found support for the model (Fresson and colleagues, 2017; Jordano & Touron, 2017b; Kalenzaga et al., 2006). In a sample of French speaking adults, Fresson and colleagues (2017) found a significant effect of condition on executive function with worse performance evidenced in the negative compared to the positive condition, as assessed via an executive functioning composite score with scores

derived from performance on tasks of inhibition, divided attention, and sequencing. Dementia worry also significantly moderated this relationship, such that participants who reported higher levels of dementia worry had lower scores in the negative condition, but no difference between conditions was evidenced for participants with low levels of dementia worry.

A similar pattern of results was seen in the study by Jordano and Touron (2017b). In a sample divided equally into two age cohorts: young adults and older adults, older adults in the threat condition were less accurate on the working memory task than young adults, older adults in the relief condition, and older adults in the control condition. Younger adults were also more accurate on a related math task than older adults in the stereotype threat condition only. Lastly, in the only study of old age stereotypes in which participants were assigned to both the threat and control conditions, Kalenzaga and colleagues (2006) found significant effect of threat condition on executive functioning scores, with older participants performing worse than younger participants when in the stereotype threat condition.

However, several studies reviewed also demonstrated null finding. Indeed, Barber and Mather (2013) did not find support for this model in their study examining the impact of stereotypes related to aging and cognitive decline on executive functioning, specifically a task of verbal working memory. Null findings also were evidenced which when the study was replicated in a slightly younger sample. Similarly, Popham and Hess (2015) found no effect of condition using a similar paradigm in a sample of older adults. were randomly assigned to the stereotype threat or positive control condition.

Summary of Aging Stereotypes. Taken together, the allostatic load model is well supported in the context of aged-based stereotypes. Like the diagnosis-based stereotypes, however, findings were mixed across studies, and the number of studies examining this

association were small. Indeed, just over half of the studies yielded support for the allostatic model (Fresson et al., 2017; Jordano & Touron, 2017b; Kalenzaga et al., 2006). Given this variability, it may be that more sensitive measures of individual change are needed to accurately assess executive function change in older adults. It also should give us pause that the only study to examine executive function before and after the study manipulation found no support for the model (Barber & Mather, 2013). Moreover, the use of young adults as a comparison group in several studies (Jordano & Touron, 2017b; Kalenzaga et al., 2006) may be inflating significant findings, and thereby, overestimating cognitive risk in older populations. Ultimately, additional work is needed to fully tease apart the discrepant findings in this domain.

Racial and Ethnic Minority Stereotypes

Four studies explored the impact of racial and ethnic minority-based stereotypes on executive functioning (Johns, et al., 2008; Schmader & Johns, 2003; Schmader et al., 2009; Thames et al., 2013). Three studies utilized undergraduate samples (Johns, et al., 2008; Schmader & Johns, 2003; Schmader et al., 2009) and one study utilized a sample of healthy adults (Thames et al., 2013). Stereotypes were related to ethnicity in two studies (Johns, et al., 2008; Schmader & Johns, 2003), race in one study (Thames et al., 2013), and racial and ethnic minority status more broadly in the fourth study (Schmader et al., 2009).

In three studies (Johns, et al., 2008; Schmader & Johns, 2003; Schmader et al., 2009), participants in the threat conditions were primed with negative stereotypes about race and/or ethnicity and intelligence. In a sample of diverse undergraduates, Schmader and Johns (2003) found a significant interaction between ethnicity and threat condition on working memory performance. Specifically, Latinx students in the threat condition recalled fewer words than

White participants in the threat condition or Latinx participants in the control condition. There also was a significant gender main effect with men recalling more words than women.

A similar pattern of results was seen in a study by Schmader and colleagues (2009) examining the stereotype that minority students are academically inferior to White students, in which measures of anxiety and executive functioning were given. Results indicated a significant interaction between prime and anxiety, such that working memory performance was worse for participants in the threat condition who also reported high levels of anxiety compared to participants who reported low levels of anxiety in the threat condition. Thus, individual characteristics, specifically anxiety, differentially influenced the level of executive function impairment following activation of a stereotype based on race and ethnicity.

Support for the allostatic load model also was seen in a study by Johns and colleagues (2008) examining the stereotype that Latinx individuals are less intelligent than White individuals. Measure of cognitive appraisal and executive functioning were examined. Consistent with this, Latinx participants in the threat only condition recalled fewer words compared to Latinx participants in the threat and anxiety reappraisal condition. They also recalled fewer words than White participants in either the reappraisal or no reappraisal condition. Given these results, we again find evidence for the allostatic load model and the importance of anxiety, in this case one's ability to regulate feelings of anxiety, as differentially conferring risk for executive function impairment.

Mixed results were found in a study by Thames and colleagues (2013) which used a less overt manipulation that did not explicitly mention racial differences. Specifically, participants in the threat condition were informed that the tests they would be completing were reflective of cognitive abilities and that "various personal factors" could contribute to poorer performance.

Results indicated partial support for the allostatic load model of executive function. There was a significant race by threat interaction such that Black participants in the threat condition performed worse on the trail making task (as assessed via completion time) compared to Black participants in the non-threat condition and White participants in either the threat or non-threat condition, findings consistent with the allostatic load model. This two-way interaction also was significant when examining executive function scores as a composite but was not significant when examined using a task of inhibition. Thus, the authors found only partial support for the allostatic load model, with support being task dependent.

Summary of Race and Ethnicity Stereotypes. In sum, the allostatic load model was well-supported in the context of race and ethnicity-based stereotypes; however, there were only four studies in this domain. Across studies, findings demonstrated consistent support for the allostatic load among racial and ethnic minority individuals when primed with both explicit and implicit racial and ethnic based stereotypes of inferior performance on tests of intelligence and cognitive ability compared to White individuals. These studies also highlight the moderating role of anxiety and anxiety regulation in executive functioning impairment, findings also evidenced in the studies examining gender-based stereotypes. Similarly, effect sizes across studies fell in the medium range for studies examining explicit stereotypes. Effect sizes were slightly smaller when a less overt prime was used.

Despite strong support, there remain important unanswered questions. Indeed, three of the studies that found support for this model used tasks of verbal working memory as the sole measure of executive function (Johns, et al., 2008; Schmader & Johns, 2003; Schmader et al., 2009). Moreover, the one study that examined this model using other components of executive function, specifically shifting and inhibition, found only partial support for this model, with

support emerging on a task of shifting, but not a task of inhibition (Thames et al., 2013). Thus, it remains unclear if impairment following stress in this domain is specific to some components of executive function as opposed to executive function more broadly. Additionally, all four studies examined these associations within adult samples, with three studies relying solely on undergraduate samples (Johns, et al., 2008; Schmader & Johns, 2003; Schmader et al., 2009). More research is needed in other demographic groups to determine if these effects are limited to this specific period of the lifespan. Finally, all four studies examined stereotypes related to intelligence / cognitive ability. Thus, it remains unclear whether similar findings would be evidenced if other race and ethnicity-based stereotypes were primed.

Substance Use Stereotypes

Three studies examined negative stereotypes related to substance users (Cole et al., 2006; Looby & Earleywine, 2010; Pennington et al., 2016). All participants reportedly were drug free on the day of the in-person evaluation.

In a study examining the impact of negative stereotypes of ecstasy users on working memory capacity among ecstasy users and sex-matched controls who used alcohol, Cole and colleagues (2006) found no significant differences in working memory or verbal fluency. In a similar study examining the impact of stereotypes related to cannabis use, Looby and Earleywine (2010) also found no significant main effect of threat condition on executive function performance. However, a significant gender by condition interaction was found such that male participants in the threat condition performed more poorly than males in the control condition on verbal fluency and switching tasks. Contrary to the allostatic load model and experimenter hypotheses, females in the threat condition performed better than females in the control condition on the sequencing task. Thus, there was some suggestion that executive functioning impairment

may be influenced by gender, even in contexts where the stereotype being activated is explicitly gender neutral.

In the context of these null findings, support for the allostatic load model was found in a study examining the impact of substance use stereotypes on inhibitory control. In this study, Pennington and colleagues (2016) examined the impact of alcohol related stereotypes in a sample of adult alcohol users. Results indicated a main effect of condition on response latency with slower reaction time evidenced for participants in the threat condition compared to controls. There was no effect on response accuracy or commissions. Following reverse scoring rules, a significant main effect of threat condition on accuracy emerged, such that participants in the threat condition were less accurate following presentation of alcohol related stimuli (beer bottle) and the letter K. A significant 3-way interaction also emerged between condition, bar sound presence, and stimulus type, such that participants in the threat condition were less accurate on alcohol related and neutral stimuli in both sound conditions. Participants in the threat condition also were less accurate when responding to alcohol related stimuli compared to neutral stimuli in both sound conditions. Participants in the stereotype threat condition also made more commission errors compared to controls. Thus, these results indicated a pronounced effect of alcohol user stereotypes on executive functioning.

Summary of Substance Use Stereotypes. Taken together, there is preliminary support for the allostatic load model in the context of substance use-based stereotypes. Indeed, whereas the Pennington et al. (2016) study found support for executive function impairment in a stereotype threat condition, results from Looby and Earleywine (2010) indicated only partial support for an association, such that only male participants demonstrated executive function impairment when stereotypes of substance use were activated. Moreover, there were no

significant associations evidenced among female participants in the Looby and Earleywine study (2010) or in the Cole and colleagues' study (2006). Thus, unexplored individual characteristics may be driving study findings. It is important to consider, however, that each study explored a stereotype related to a different substance. Thus, it may be that some stereotypes are more salient influences on executive functioning.

Study design also may have contributed to these discrepant findings. For instance, the reference group in the Cole et al. (2006) study was comprised of alcohol users. Given that the findings of Pennington and colleagues (20016) suggests that alcohol users are susceptible to executive function impairment following the activation of substance related stereotypes, both groups may have been influenced by the prime. Additionally, only the Looby and Earleywine (2010) study examined the influence of gender in their model. Thus, underlying gender differences in these associations may be obscured in the other studies. Finally, more robust evidence in support of the allostatic load model was found when executive function was examined using an inhibition task, as opposed to other components of executive skills. This may suggest that inhibition, as opposed to executive function broadly, is more susceptible to impairment following the activation of stereotypes in this domain. Further work in this area is needed to fully elucidate the role of substance use-based stereotypes on executive function.

Academic Stereotypes

Two studies examined the impact of academic stereotypes on executive function performance. In the first study, Popham and Hess (2015), examined stereotypes about academic major among a group of college undergraduates who identified their academic major as a discipline other than engineering. Results indicated a significant effect of threat condition on speed in a regulation task, such that participants in the threat condition were significantly slower

than participants in the positive stereotype condition. Participants in the threat condition also experienced greater reductions in working memory compared to participants in the positive stereotype condition.

Using a similar paradigm, Ståhl and colleagues (2012) found that participants in the stereotype threat condition performed significantly worse on a task of inhibition, as measured by reaction time, than participants in the control condition. In a partial replication experiment also examining the effect of cognitive regulation on this association, the authors found that participants in the threat condition demonstrated worse performance than participants in the control condition on a task of inhibition. A significant two-way interaction emerged such that participants in the threat by prevention focus condition displayed significantly worse performance compared to participants in the threat by promotion focus condition or the threat by no control strategy condition. Taken together, results suggest support for the allostatic load model across both experiments. Moreover, findings from the second experiment suggest that cognitive regulation strategies further delineate risk, with participants utilizing a prevention focus strategy significantly more at risk for executive function impairment following the activation of negative stereotypes.

Summary of Academic Stereotypes. The allostatic load model is preliminarily supported by findings in this domain. Indeed, academic major was found to be a significant predictor of executive function impairment when primed among undergraduates. It should be noted, however, that there were only two studies of this domain. Additionally, given that all samples were restricted to college students, it remains unclear if threats related to academic major would similarly impair executive resources if primed at a different point during the lifespan. There is also a suggestion that individual factors, namely cognitive regulation

strategies, play an important role in this association, which warrants greater consideration in the literature.

Weight Stereotypes

In the only known study examining weight-based stereotypes and executive functioning in children, Guardabassi and Tomasetto (2020) examined the stereotype that obese people are less intelligent in a sample of Italian primary school aged children. Participants were screened via a questionnaire on obesity and psychological functioning. Results indicated no main effect of condition on working memory performance. There was, however, a significant two-way interaction between body mass index (BMI) and condition, which indicated that for participants in the stereotype threat condition only, increased BMI was associated with worse performance on the task. Thus, the authors found preliminary support for the allostatic load model in the context of weight-based stereotypes.

Combined Stereotype Stress

Only one study examined the influence of multiple stereotyped identities on executive function. In this study by Tine and Gotlieb (2013), a sample of diverse undergraduate students were primed for gender, race, and income-based stereotypes. Unlike the prior studies, all participants were assessed in both a no-threat condition (pre-manipulation) and threat condition (post-manipulation).

Results indicated significant main effects of gender, race, and income on working memory performance, with worse performance evidenced for the stigmatized groups. Specifically, improvement in working memory scores from pre to post assessment was significantly higher for male participants compared to female participants, and for White participants compared to minority participants. There also were lower mean scores for low-

income participants compared to middle or high-income participants, who did not significantly differ from each other. Moreover, low-income students performed slightly worse at post-test compared to pre-test, whereas both middle and high-income participants demonstrated significant improvement from pre to post-test. Post-hoc analyses also indicated a significant effect on working memory performance as a function of the number of stigmatized identities participants endorsed, such that participants with three stigmatized identities (low-income minority women) performed significantly worse on the working memory post-test compared to participants with two, one, or no stigmatized identities. There were no significant differences found on post-test performance between participants in the two, one, or no stigmatized identity groups.

Taken together, this study finds preliminary support for allostatic load model, with stigmatized participants performing worse than their non-stigmatized counterparts and participants with all three stigmatized identities performing worse than participants with fewer stigmatized identities. Thus, those at increased risk for experiences of stress displayed worse executive functioning performance, which is consistent with the allostatic load model. The comparison of working memory performance both within and across individuals provides a more robust and arguably more valid assessment of the model. Finally, the examination of multiple identities within the same individual also may be more ecologically valid as opposed to examining the impact of identities in isolation.

Stereotypes and Executive Function Summary

When examined in aggregate, support for the allostatic load model following the activation of negative, identity-based stereotypes can be classified as well supported. Indeed, findings were relatively robust and largely consistent when examining the impact of stereotypes

about women (Allen & Gervais, 2017; Fresson et al., 2019b; Johns, et al., 2008; Jordano & Touron, 2017a; Rydell et al., 2014; Schmader & Johns, 2003; Schmader et al., 2009; Tine & Gotlieb, 2013; Wister et al., 2013) and racial and ethnic minority individuals (Johns, et al., 2008; Schmader & Johns, 2003; Schmader et al., 2009; Thames et al., 2013; Tine & Gotlieb, 2013) on executive function, such that activation of these stereotypes were associated with poor executive function performance across all or almost all of the studies examined. Moreover, consistent with the allostatic load model, increased risk for experiences of stress, as determined by the number of identities being stigmatized, was significantly associated with higher levels of executive function impairment. Executive function impairment also was evidenced following the activation of both universal (e.g. gender, age, SES) and culturally specific stereotypes (e.g. race, ethnicity, diagnosis status, academic major, substance use, weight), lending further support for this model.

Despite this classification, several studies found no effect of threat condition on executive functioning in one or more experiments (Barber & Mather, 2013; Carter-Allison et al., 2016; Cole et al., 2006; Fresson et al., 2019b; Guardabassi & Tomasetto, 2020; Jordano & Touron, 2017a; Kit et al., 2014; Looby & Earleywine, 2010; Popham & Hess, 2015; Schmader et al., 2009; Thames et al., 2013). Indeed, insignificant main effects of threat condition were found across multiple stereotyped identities including gender (Fresson et al., 2019b; Jordano & Touron, 2017a; Schmader et al., 2009), age (Barber & Mather, 2013; Popham & Hess, 2015), diagnosis (Carter-Allison et al., 2016; Kit et al., 2014), racial and ethnic minority status (Schmader et al., 2009; Thames et al., 2013), substance use status (Cole et al., 2006; Looby & Earleywine, 2010), and weight (Guardabassi & Tomasetto, 2020). There also is evidence to suggest that task complexity is an important consideration for executive function impairment to be detected (Jordano & Touron, 2017a).

Finally, it's important to consider that the reliance on a between-subjects rather than within-subject design across studies, may contribute to an overestimation of the robustness of this model. Support for the allostatic load model would be considerably more robust if effects of impairment was evident both within and between subjects. of the two reviewed studies that assessed executive function impairment within-subjects, one reported a significant effect of condition on executive function (Tine & Gotlieb, 2013), and the second reported no effect (Barber & Mather, 2013). Given the individual variability within studies of this model, more within-person research is needed in this area to elucidate the nuanced relationship more fully between stereotype activation and executive function impairment.

Prejudice and Executive Function

Eight studies explored the association between prejudice and executive functioning across 10 individual experiments (Table 8). All eight studies utilized a sample of college students and examined executive function using a task of inhibition (Apfelbaum et al., 2008; Babbitt & Sommers, 2011; Bair & Steele, 2010; Richeson et al., 2003; Richeson & Shelton, 2003; Richeson & Trawalter, 2005; Salvatore & Shelton, 2007; Trawalter & Richeson, 2006). Six studies examined implicit prejudice in the context of interracial interactions (Apfelbaum et al., 2008; Babbitt & Sommers, 2011; Richeson et al., 2003; Richeson & Shelton, 2003; Richeson & Trawalter, 2005; Trawalter & Richeson, 2006). Three studies examined the impact of explicit racial prejudice (Bair & Steele, 2010; Richeson & Shelton, 2003; Salvatore & Shelton, 2007).

Implicit Racial Prejudice and Executive Function

All six of the studies exploring the association between implicit racial prejudice and executive function examined prejudice through the lens of implicit bias in the context of interracial interactions (Apfelbaum et al., 2008; Babbitt & Sommers, 2011; Richeson et al., 2003;

Table 16. Summary of studies examining the executive functioning impairment in the context of prejudice attitudes

Study	Sample	Design	Context of Prejudice	Measure of Prejudice	Measure of Executive Function	Findings	Support for Allostatic Load Model?
Apfelbaum et al., 2008 (Experiment 2)	48 White undergraduates (mean age = 19.77 years, 45.83% female)	C	Interracial Interaction	Two study naive White female judges listen to tape and rated friendliness on a 5 item scale during interactions with a confederate	Stroop	Acknowledgement of race in task was associated with significantly with slower reaction times in Stroop task. Effect of confederate race was trending but not significant. Stroop performance significantly mediated the association between acknowledgment of race and nonverbal friendliness.	Partial
Babbitt & Sommers, 2011 (Experiment 1)	172 undergraduates (comprising same sex 86 dyads, 65.12% dyads female, 61.23% dyads interracial)	C	Interracial Interaction	IAT	Stroop	Black participants in the interracial dyads and task focus condition experienced faster reaction times than Black participants in the social task focus condition. Similar pattern of results was trending for White participants in the interracial dyads. No different in all-White dyads. On IAT task completed post interaction, no differences in implicit racial attitudes were seen for Black participants or White female participants across conditions.	Yes
Richeson & Shelton, 2003	50 White undergraduates (58% male)	C	Interracial Interaction	IAT	Stroop	Automatic prejudice predicted level of Stroop interference following interactions with a Black confederate, but not following interactions with a White confederate. Participants with implicit racial bias scores also had more interference in the Stroop task following interaction with a Black person compared to level of interference following interaction with a White person. Similar findings were evidence when explicit racial bias rating were examined.	Yes

Richeson & Trawalter, 2005 (Experiment 1)	60 White undergraduate (66.67% female)	C	Interracial Interaction	IAT	Stroop	Significant main effect of confederate race such that interacting with a Black confederate was significantly associated with more interference in Stroop task compared to participants who engaged with a White confederate. Participants who received prejudice feedback also demonstrated more Stroop interference.	Yes
Richeson & Trawalter, 2005 (Experiment 2)	64 White undergraduates (64.06% female)	C	Interracial Interaction	IAT	Stroop	Among participants with no script there was greater Stroop interference following interracial contact compared to same race contact. Among participants given a script there was no significant difference in Stroop performance based on confederate race. There was also less interference following interracial contact for participants in the script condition compared to the no script condition.	Yes
Richeson & Trawalter, 2005 (Experiment 3)	68 White undergraduates (69.12% female)	C	Interracial Interaction	IAT	Stroop	Significant main effect of confederate race on performance, with decrease performance when confederate was Black compared to performance when confederate was White. Significant two way interaction between confederate race and anxiety attribution, with worse performance seen when confederate was Black and participant was in the anxiety misattribution condition, but no difference was seen in the attribution condition.	Yes
Trawalter & Richeson, 2006	45 White female undergraduates	C	Interracial Interaction	Not explicated examined, Participants given OSPAN in place of IAT to prevent bias	Stroop	Controlling for working memory, participants in the promotion condition had the least amount of interference in the Stroop task. There was no difference between performance in the prevention and control groups.	Yes

Richeson et al., 2003	15 White right handed undergraduates (mean age 20.5 years, 53.33% female)	P	Interracial Interaction (visit 1) Virtual presentation of interracial faces (visit 2)	IAT	Stroop	Among participants with greater racial bias, participants had more impaired performance on the Stroop task following interracial contact compared to participants with lower racial bias. When exposed to Black faces in an fMRI approximately 2 weeks later, there were significant BOLD signal activation in several PFC regions. Activity in the right middle frontal gyrus and right ACC predicted Stroop interference after interracial contact. This neural activity association with inhibitory performance was not evidence when presented with White faces.	Yes
Bair & Steele, 2010	72 Black students (mean age = 21.36 years)	C	Interracial Interaction	Partner Conversation Manipulation (racist vs. neutral response)	Stroop	Significant three-way interaction between partner race, racism condition, and centrality was observed. Among participants in the racist condition, those with higher racial centrality demonstrated slower reaction times paired with a White confederate, and faster reaction times when centrality was high and the confederate partner was Black. No interaction between racial centrality and partner race was evidenced in neural condition.	Yes
Salvatore & Shelton, 2007	250 undergraduates (51.2% White)	C	Hiring recommendation and rationale cuing racial prejudice	Explicit Racial Prejudice manipulation (non-prejudice. ambiguously prejudiced vs. blatantly prejudiced hiring recommendations)	Stroop	Black participants experienced more interference than White participants in the ambiguous condition, and White participants experienced more interference in the blatant prejudice condition compared to Black participants in the same condition. No difference were found in the no prejudice condition. Interference for Black participants was highest in the	Partial

						<p>ambiguous condition and was highest in the blatant condition for White participants. There was also a significant interaction between subject and experimenter race, with less interference evidence when the participant, evaluator, and job candidate were of the same race. Interference was increased when participant and candidate were the same race and evaluator was of another race.</p>	
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NOTE: ACC = Anterior cingulate cortex, BIPOC = Black, Indigenous, and People of Color; C = Cross Sectional Design; IAT = Implicit Association Test; MIBI = Multidimensional Inventory of Black Identity; OSPAN = Operation Span Task; P = Prospective Design; PFC = Prefrontal cortex, ST = Stereotype Threat TBI = Traumatic Brain Injury

Richeson & Shelton, 2003; Richeson & Trawalter, 2005; Trawalter & Richeson, 2006). Four studies (Babbitt & Sommers, 2011; Richeson et al., 2003; Richeson & Shelton, 2003; Richeson & Trawalter, 2005) examined implicit racial bias using the Implicit Association Task (IAT; Greenwald et al., 1998), a commonly used measure of automatic associations that is purported to tap into unconscious biases. Interestingly, given concerns about potential bias in the IAT, one study gave a working memory task in place of an explicit measure of implicit bias (Trawalter & Richeson, 2006). The final study of this group utilized independent observation ratings of friendliness during interactions with a confederate as their measure of implicit bias (Apfelbaum et al., 2008).

Of the studies examining implicit bias using the IAT, all are largely replications and extensions of a 2003 study conducted by Richeson and Shelton. In this seminal study, White undergraduates were randomly assigned to either a same race or other race confederate interaction. Prior to the interaction, participant's implicit racial biases were assessed using the IAT, and participants completed an inhibition task following the interaction. Consistent with the allostatic load, results indicated a significant interaction between confederate race and implicit attitude such that participants with higher levels of prejudice demonstrated more interference on the task following an interaction with a Black confederate as compared to participants who interacted with White confederates. Moreover, this interaction was evidenced for both implicit and explicit biases.

These findings largely were replicated across several studies using a similar paradigm (Babbitt & Sommers, 2011; Richeson et al., 2003; Richeson & Trawalter, 2005; Trawalter & Richeson, 2006). These studies also expanded on the initial findings by Richeson and Shelton (2003) by incorporating neuroimaging (Richeson et al., 2003) or by including study specific

manipulations within a similar framework (Babbitt & Sommers, 2011; Richeson & Trawalter, 2005; Trawalter & Richeson, 2006). Indeed, Richeson and colleagues (2003) found significant BOLD signal activation among participants in several PFC regions, with activity in the right middle frontal gyrus and right ACC when presented with Black faces significantly predicting executive functioning impairment following the interracial contact. Moreover, this association between neural activity and inhibitory performance was not evidenced when participants were presented with White faces in the scanner.

Across a series of three experiments, Richeson and Trawalter (2005) found increased executive functioning impairment occurred among participants who received prejudiced feedback and when interracial interactions were unscripted, whereas better performance occurred when interracial interactions were scripted. Also, a significant two-way interaction emerged between confederate race and anxiety attribution, with worse performance demonstrated among participants in the anxiety misattribution condition following interaction with a Black confederate compared to participants with misattribution who interacted with a White confederate. Among participants in the anxiety attribution condition, there was no effect of confederate race found on executive functioning.

Relatedly, Trawalter and Richeson (2006) found an effect of task framing on performance such that, when controlling for working memory skills, participants in the task promotion condition had the least amount of interference in the inhibition task following an interracial interaction compared to participants in either a prevention focus or control condition, and that performance among participants in the prevention focus and control groups did not significantly differ from each other. Similarly, Babbitt and Sommers (2011) found a significant effect of task framing on executive function impairment, such that Black participants in an

interracial dyad in which the focus of the interaction was task focused experienced faster reaction times than Black participants in the social task focus condition. A similar pattern of results was trending for White participants in the interracial dyads. No differences were noted in all-White dyads.

In the context of these largely supportive findings, one study found more mixed support for the model. In this study by Apfelbaum and colleagues (2008) examining the impact of interracial interactions on executive functioning, the authors found that in interactions in which race was acknowledged, reaction times on an inhibition task significantly slower. They did not, however, find a significant effect of confederate race on performance, although this effect was trending. A significant indirect effect was evidenced such that task performance significantly mediated the association between acknowledgment of race and perception of non-verbal friendliness during the interaction.

Taken together, the allostatic load model is well-supported by studies examining the influence of implicit racial bias following interracial interactions on executive function performance. It is interesting to note, however, that the one study that was most divergent in study design from the others reviewed (Apfelbaum et al., 2008) had more mixed findings. Thus, findings should be interpreted with caution, as study design may be contributing to an overestimation of the robustness of these effects. Findings also suggested that the association between implicit forms of prejudice and executive function impairment may be influenced by personal characteristics including anxiety attribution (Richeson & Trawalter, 2005), and contextual factors like framing of interracial interactions (Babbitt & Sommers, 2011; Trawalter & Richeson, 2006), which differentially confer risk for impairment in the face of implicit racial prejudice.

Explicit Racial Prejudice and Executive Function

Three studies examined the association between explicit racial prejudice and executive functioning (Bair & Steele, 2010; Richeson & Shelton, 2003; Salvatore & Shelton, 2007). As previously described, Richeson and Shelton (2003) found support for the allostatic load model following interracial interaction among individuals who reported high levels of explicit racial bias. A similar pattern of findings was found in the two other studies of explicit racial prejudice (Bair & Steele, 2010; Salvatore & Shelton, 2007); however, these two other studies demonstrated more conditional support for the allostatic load model.

Indeed, in a sample of Black college students, Bair and Steele (2010), found a significant main effect of partner race on task performance, such that participants with a White partner demonstrated worse inhibitory control compared to participants with a Black partner. Interestingly, they also found a significant three-way interaction between partner race, topic condition, and racial centrality. Specifically, among participants in the racist conversation topic condition, in which a confederate blatantly communicated racist opinions, participants interacting with a White partner who reported higher levels of centrality demonstrated more interference on the task compared to participants with low centrality. Interestingly, participants in the racist condition also demonstrated less interference on the task when their partner was Black, and their level of racial centrality was high.

Similar findings were seen in a study by Salvatore and Shelton (2007) examining racial prejudice in the context of hiring recommendations. In this study, participants were randomly assigned to one of three manipulation conditions: the non-prejudiced condition, the ambiguously prejudiced condition, or the blatantly prejudiced condition, and received condition specific human-resource officer hiring recommendations and rationale. Results indicated that Black

participants in the ambiguous condition demonstrated better performance than White participants in the same condition, and that White participants experienced more better performance in the blatantly prejudiced condition compared to the Black participants in the same condition. They also found a significant subject by experimenter by job candidate interaction, such that when the participant, examiner, and candidate were all the same race, levels of interference on the executive functioning task were lower. Conversely, when the participant and candidate were of the same race and the examiner was of a different race, levels of interference on the task increased.

Taken together, the allostatic load model can be classified as well supported for studies examining explicit forms of prejudice. It should be noted, however, that the findings of Bair and Steele (2010) and Salvatore and Shelton (2007) provide only partial support for the model following experiences of explicit racial prejudice and suggest that both individual and contextual factors play an important role in this phenomenon. Indeed, whereas both studies found support for the model, these effects only were evidenced when racist comments were made in a context in which racial differences between the participant and examiner (Salvatore & Shelton, 2007) or study confederate (Bair & Steele, 2010) were highlighted. Additionally, the level of ambiguity in the interaction significantly impacted the level of executive function impairment (Salvatore & Shelton, 2007). Finally, racial identity emerged as a significant moderator of the association between explicit racial prejudice and executive function among Black participants, and differentially conferred risk or resilience for executive function impairment following the experience of racial prejudice (Bair & Steele, 2010). Further research is needed in this area to better understand these findings in the context of the allostatic load model.

Summary of Findings on Prejudice and Executive Function

Overall, the allostatic load model was well supported by the studies reviewed. These findings largely were consistent across studies and constituted a medium effect. Findings were particularly robust when examining executive function impairment associated with experiences of implicit bias. This is of note given that studies have suggested more covert, subtle forms of prejudice have become increasingly common in many societies over the past several decades, including the United States, as opposed to more explicit experiences of prejudice (Sritharan & Gawronski, 2010). Thus, the deleterious effects of implicit forms of prejudice on executive function may be commonly experienced among stigmatized and oppressed individuals.

Despite these promising findings, more work is needed in this area to truly elucidate support for the allostatic load model. As previously described, all the studies examining the association between prejudice and executive function utilized undergraduate samples, the majority of which were White. Further work is needed to determine if support for the model is found in other demographic groups. Additionally, all the studies reviewed assessed executive function using an inhibition task. Thus, findings are limited to the inhibition component of executive function. More research is needed to determine whether impairment is evidenced across other components of executive function. Findings also were limited to racial prejudice. Further investigation is needed to determine whether support for the allostatic load model extends to prejudice related to identities. Finally, all the studies examine utilized a between-person design. Support for the allostatic load model would be strengthened considerably if findings also were evidenced in within-person designs.

Discrimination and Executive Function

Seven studies examined the association between discrimination and executive function (Table 9; Barnes et al., 2012; Dardenne et al., 2013; Guardabassi & Tomasetto, 2020; Ozier et al., 2019; Shankar & Hinds, 2017; Thames et al., 2013; Zahodne et al., 2017). Of these studies, two examined experiences of perceived discrimination broadly (Shankar & Hinds, 2017; Zahodne et al., 2017), three examined racial discrimination or racism (Barnes et al., 2012; Ozier et al., 2019; Thames et al., 2013), one examined gender discrimination or sexism (Dardenne et al., 2013), and one study examined weight-based teasing (Guardabassi & Tomasetto, 2020). Participants ranged in age from children (Guardabassi & Tomasetto, 2020) to older adults (Barnes et al., 2012; Shankar & Hinds, 2017; Zahodne et al., 2017), and were diverse in their racial, ethnic, and gender identities across studies. Discrimination was assessed via questionnaires (Barnes et al., 2012; Guardabassi & Tomasetto, 2020; Shankar & Hinds, 2017; Thames et al., 2013; Zahodne et al., 2017) or task manipulation (Dardenne et al., 2013; Ozier et al., 2019).

Perceived Discrimination

Two studies examined the influence of experiences of perceived discrimination, as experienced across multiple domains of identity, on executive function (Shankar & Hinds, 2017; Zahodne et al., 2017). In a sample of community dwelling older adults, Shankar and Hinds (2017) found partial support for the allostatic load model. In this longitudinal study, results suggested that self-reported experiences of everyday perceived discrimination predicted lower verbal fluency scores four years later after adjusting for age, gender, and baseline verbal fluency. These findings, however, were no longer significant when additional covariates (education level, wealth gap, marital/cohabitation status, ethnicity, health status, and depressive symptoms) were

Table 17. Summary of studies examining executive functioning impairment following discrimination

Study	Sample	Design	Form of Discrimination	Measure or Manipulation of Discrimination	Measure of Executive Function	Findings	Support for Allostatic Load Model?
Shankar & Hinds, 2017	4886 older adults (mean age = 69.6 years, 55.6% female)	L	Perceived Discrimination	Everyday Discrimination Scale	Verbal Fluency	Perceived discrimination predicted lower verbal fluency scores 4 years later after adjusting for age, gender, and baseline verbal fluency. The result was no longer significant when additional covariates (education level, wealth gap, marital/cohabitation status, ethnicity, health status, and depressive symptoms)	Partial
Zahodne et al., 2017	5201 participants divided into 3 age cohorts, young adults (n=1210, aged 44 or younger), middle aged (n=2693, aged 45-64), and older adults (n=1298, aged 65 or older)	C	Perceived Discrimination	Sum of 9-items measuring perceived discrimination	Brief Test of Adult Cognition; (EF comprised of Category Fluency, Digit Span Backward, Number Series, the 30 Seconds and Counting Task and Stop&Go Switch Tasks)	The was no main effect of perceived discrimination on the composite estimate of executive functioning for any age cohort. Indirect effects of perceived discrimination were smaller in young adults as there was no significant racial differences in reported of discrimination in this age group.	No
Barnes et al., 2012	407 Black older adults (mean age = 72.9 years old, 72.8% female)	C	Perceived Racial Discrimination	9-item measure of perceived racial discrimination	Verbal Fluency Working memory composite of Digit Span Forward and Back and	Main effect of working memory performance was not significantly associated with rating of perceived racial discrimination. Interaction between perceived racial discrimination and neuroticism was also not associated with working memory performance. As verbal performance of verbal fluency and Stroop tasks were collapsed into	No

					Digit Ordering Task; Modified Stroop Task	composite scores with measures not specific to executive function, effects of perceived discrimination on these outcomes could not be determined in the current study.	
Thames et al., 2013	92 healthy adults (48.91% African American)	C	Perceived Racial Discrimination	Perceived Ethnic Discrimination Questionnaire	Trail Making Test – Part B Stroop	Among African American participants, no significant interaction emerged between perceived discrimination and examiner-examinee race match on performance in the Trail Making Task, Stroop, of EF composite.	No
Ozier et al., 2019	191 Black and Hispanic undergraduates (mean age = 19.24 years, 59.16% female)	C	Observed Racial Discrimination	Observed Racial Discrimination manipulation (subtle vs. blatant vs. no discrimination)	Study created visual working memory task	Participants in the subtle discrimination condition performed more poorly than participants in the no discrimination condition on the visual working memory task. Performance of participants in the blatant discrimination group was not significantly different for either the subtle or no discrimination group.	Partial
Dardenne et al., 2013	42 female participants (mean age = 23.4 years)	C	Sexism	Task instruction manipulation (benevolent sexism vs. hostile sexism vs. no sexism)	Reading Span Test	No difference in performance in terms of accuracy in grammatical decision across groups. Accuracy of recall cues as also not significant. Participation in the benevolent condition demonstrated changes in the cerebral activity of the left and right Dorsal Lateral Prefrontal Cortex and left and right Anterior Cingulate Cortex when compared to the other two conditions.	Partial
Guardabassi & Tomasetto, 2020	176 primary school children (M age = 116.07 months)	C	Teasing due to Weight	Perception of Teasing Scale	N-back	Experience of teasing was not a significant moderator of the BMI and N-back score association	No

NOTE: ACC = Anterior cingulate cortex, BIPOC = Black, Indigenous, and People of Color; C = Cross Sectional Design; OSPAN = Operation Span Task; L = Longitudinal Design; PFC = Prefrontal cortex, ST = Stereotype Threat TBI = Traumatic Brain Injury

included in the model, suggesting that allostatic load may be better account for by other covariates in the model.

Null findings were evidenced in a study by Zahodne and colleagues (2017) examining the impacts of perceived discrimination in adults across multiple age cohorts. While results indicated no main effects of perceived discrimination on a composite derived estimate of executive functioning for any age cohort, the indirect effect of perceived discrimination on executive functioning was smaller in young adults as there were no significant racial differences in reported experiences of discrimination in this age cohort.

Taken together, the allostatic load can be classified as not supported at present by the studies of perceived discrimination more broadly. More work is needed in this area before this model can be classified as well supported. Furthermore, additional work is needed to better elucidate the role of covariates.

Racial Discrimination or Racism

Three studies examined the influence of racial discrimination or racism on executive function (Barnes et al., 2012; Ozier et al., 2019). One examined this association in racial and ethnic minority college students (Ozier et al., 2019), one in Black adults (Thames et al., 2013), and one in a sample of Black older adults (Barnes et al., 2012). Forms of racial discrimination examined across studies include perceived discrimination (Barnes et al., 2012; Thames et al., 2013) and observed racial discrimination towards others (Ozier et al., 2019). In two studies executive function was examined through assessments of working memory (Barnes et al., 2012; Ozier et al., 2019), whereas one study used tasks of shifting and inhibition (Thames et al., 2013).

Findings indicated mixed support for the allostatic load model. In a sample of Black and Hispanic undergraduates, Ozier and colleagues (2019) found conditional support for the model.

Utilizing an adapted version of the hiring task used by Salvatore and Shelton (2007, discussed above), results suggested a main effect of condition, such that participants in the subtle discrimination condition performed more poorly on the working memory task compared to participants in the no discrimination condition, findings consistent with those seen in the original study. However, there were no significant differences in performance between participants in the blatant discrimination condition and participants in either the subtle discrimination or no discrimination condition, which is somewhat counter to model hypotheses, as blatant experiences of discrimination may be conceptualized as more stressful events.

Similarly, in a sample of Black older adults, Barnes and colleagues (2012) found no significant impact on experiences of perceived racial discrimination on executive function. Specifically, results indicated no significant association between self-reported levels of perceived discrimination and working memory performance. The interaction between perceived racial discrimination and neuroticism also was not significant. It should be noted that although measures of verbal fluency and inhibition also were administered as part of the study, these scores were collapsed in a separate composite score, assessing semantic memory and processing speed respectively. Thus, the effect of perceived discrimination on these outcomes could not be determined in the current study.

Null findings also were evidenced in a study by Thames and colleagues (2013). In this study examining self-reported experiences of ethnic discrimination and executive functioning, the authors found indicated no significant impact of level of perceived discrimination and examiner-examinee race match on performance in the study. It should be noted, however, that analyses only were conducted for the Black identifying participants in the sample.

Thus, the allostatic load model is not well supported at present in this domain. More research is needed to better understand this model in the context of racial discrimination, and how findings may vary based on the target of discrimination (self or others). Further, additional studies are needed to examine the allostatic load model in members of other racial and ethnic identities.

Gender Discrimination or Sexism

In the only study to examine the association between sexism and executive function, Dardenne and colleagues (2013) found partial support for the allostatic load model. While the authors found no differences in performance in terms of accuracy on the task, during task anticipation, participants in the benevolent condition demonstrated changes in the cerebral activity of the left and right Dorsal Lateral Prefrontal Cortex and left and right Anterior Cingulate Cortex when compared to the other two conditions, brain regions implicated in thought suppression and working memory performance. Thus, the authors argued that experiences of benevolent sexism contribute to executive function impairment as they modify brain activity in brain regions implicated in working memory tasks.

Weight Based Teasing

As part of their study examining the association between weight-based stereotypes and executive function previously described, Guardabassi and Tomasetto (2020) examined how experiences of weight-based discrimination, specifically teasing, influenced executive function. They found no evidence that teasing moderated the association between body mass index and executive function impairment. Thus, support for the allostatic load model in the context of weight discrimination is classified as not supported at this time.

Summary of Findings on Discrimination and Executive Function

Taken together, support for the allostatic load model is classified as not well supported at present. Indeed, over half of the studies examined reported null findings (Barnes et al., 2012; Guardabassi & Tomasetto, 2020; Thames et al., 2013; Zahodne et al., 2017). Moreover, of the studies that did find some evidence for impairment, these findings often were conditional on other factors, and were no longer significant when study covariates were included in the analyses (Shankar & Hinds, 2017), in the context of subtle experiences of discrimination (Dardenne et al., 2013; Ozier et al., 2019), or were implied through associated brain region activation (Dardenne et al., 2013).

This divergence of findings is particularly challenging to the allostatic load model, as the studies of discrimination reviewed implemented more diverse designs than the studies of stereotypes and prejudice in terms of participant selection, assessment of executive function, exploration of both concurrent and prospective associations, and assessment of multiple domains of oppression. The number of studies in each domain, however, was relatively small. Further work is needed in this area to further disentangle the nuanced relationship between executive function and discrimination suggested by these studies.

Discussion

The current review sought to examine support for allostatic load model in the context of sociocultural forms of stress. Specifically, the study examined the association between stereotypes, prejudice, and discrimination and executive function performance. When findings are synthesized across stressors, we found that the allostatic load model generally is well supported by the literature to date. Indeed, across the reviewed studies, 43 of 51 experiments found full or partial support for the allostatic load model (Allen & Gervais, 2017; Apfelbaum et

al., 2008; Babbit & Sommers, 2011; Bair & Steele, 2010; Carter-Allison et al., 2016; Dardenne et al., 2013; Fresson et al., 2017; Fresson et al., 2019a; Fresson et al., 2019b; Guardabassi & Tomasetto, 2020); Johns et al., 2008; Jordano & Touron, 2017a; Jordano & Touron, 2017b; Kalenzaga et al., 2006; Looby & Earleywine, 2010); Moritz et al., 2018; Ozier et al., 2019; Pennington et al., 2016; Popham & Hess 2015; Richeson et al., 2003; Richeson & Shelton 2003; Richeson & Trawalter, 2005; Rydell et al., 2014; Salvatore & Shelton, 2007; Schmader & Johns, 2003; Schmader et al., 2009; Shankar & Hinds, 2017; Ståhl et al., 2012; Thames et al., 2013; Tine & Gotlieb, 2013; Trawalter & Richeson, 2006; Wister et al., 2013). In the remainder of this review, we will examine findings across the different forms of stress to the extent possible.

The allostatic load model was particularly well supported by the literature on gender based stressors. Indeed, all studies examining either negative gender-based stereotypes (Allen & Gervais, 2017; Fresson et al., 2019b; Johns, et al., 2008; Jordano & Touron, 2017a; Rydell et al., 2014; Schmader & Johns, 2003; Schmader et al., 2009; Wister et al., 2013) or experiences of sexism (Dardenne et al., 2013) found full or partial support for this model. The allostatic load model also was well supported by studies exploring race and ethnicity-based stressors (Apfelbaum et al., 2008; Babbit & Sommers, 2011; Bair & Steele, 2010; Johns et al., 2008; Ozier et al., 2019; Richeson et al., 2003; Richeson & Shelton 2003; Richeson & Trawalter, 2005; Salvatore & Shelton, 2007; Schmader & Johns, 2003; Schmader et al., 2009; Thames et al., 2013; Trawalter & Richeson, 2006). Despite some variability across studies, the allostatic load model also was well supported in the context of age-based stressors (Fresson et al., 2017; Jordano & Touron, 2017b; Kalenzaga et al., 2006). Preliminary support for the model was found in the literature on substance use (Looby & Earleywine, 2010; Pennington et al., 2016), weight

(Guardabassi & Tomasetto, 2020), income (Tine & Gotlieb, 2013), and academic based stressors (Popham & Hess 2015; Ståhl et al., 2012).

Interestingly, there also was preliminary support for the allostatic load model when multiple forms of oppression were examined within the same study (Tine & Gotlieb, 2013, Shankar & Hinds, 2017). These findings are particularly important when we consider that individual identities do not exist in a vacuum. Indeed, following the principles of interactional theory (Crenshaw, 1989), to fully understand inequity, one must understand the full context of the individual. Yet, consistent with the literature on perceived discrimination more broadly (Lewis & Grzanka, 2016), we found an overreliance on a single axis approach in the studies reviewed. Further research is needed to evaluate the allostatic load model more comprehensively in the context of socially derived, culturally based stressors.

There were several unexpected findings in the literature that are largely overlooked by our current conceptualization of allostatic load. First, multiple studies demonstrated that experiences of subtle or covert forms of sociocultural stress resulted in greater executive function impairment compared to more overt manifestations of the same stressors (Ozier et al., 2019; Salvatore & Shelton, 2007). Further, benevolent sexism, a more covert form of sexism, was found to differentially activate neural pathways associated with executive function (Dardenne et al., 2013), suggesting greater activation of this system and, subsequently, increased risk of impairment. On the surface, these findings counter what would be expected by the allostatic load model. Yet, if we consider that studies of decision-making in ambiguous situations have suggested an association between ambiguity and executive function (Brand, Labudda & Markowitsch, 2006), then these findings may not be as surprising. Indeed, when in ambiguous situations, the individual must not only think about how to perform the task effectively, thereby

expending executive resources (Diamond, 2013), but also must discern the intentions of others to determine their level of risk in the situation. This reasoning about the thoughts and actions of others requires the utilization of Theory of Mind (TOM) skills, which have been demonstrated to be highly associated with executive function (Abouafia-Brakha, Christe, Martory & Annoni, 2011; Perner & Lang, 2000; Saltzman, Strauss, Hunter & Archibald, 2000). Thus, by activating both executive function and other intertwined higher level cognitive processes, more cognitive resources are utilized when performing tasks in ambiguous situations, thereby the load associated with these events and subsequent executive impairment. Further research is needed to further elucidate these nuanced findings.

Several studies also highlighted the role of individual differences in the allostatic load model. Anxiety was identified as a potentially important moderator of the association between race/ethnicity and gender based sociocultural stress and executive function (Schmader et al., 2009). Related processes like anxiety reappraisal (Johns, et al., 2008), anxiety attribution (Richeson & Trawalter, 2005), and level of illness concern (Carter-Allison et al., 2016; Fresson et al., 2017) also emerged as significant moderators of the association between sociocultural stress and executive function. An indirect effect of emotion regulation more broadly also was noted (Ståhl et al., 2012). Additionally, negative emotions were found to mediate the association between diagnosis-based stress and executive function (Fresson et al., 2019a). Taken together, this suggests that anxiety, depression, and emotion regulation may play important roles for allostatic load as it pertains to executive function. It's important to consider, however, that there is some suggestion in the literature that executive function impairment is associated with experiences of anxiety (Castaneda et al., 2008) and depression (Castaneda et al., 2008; Snyder, 2013). Thus, it is unclear whether executive function impairment is a cause or a consequence of

psychopathology. Further study is needed to determine this relationship particularly in the context of sociocultural based stressors.

Additional person level moderators also have been advanced as impacting the association between sociocultural stress and executive functioning including level of suggestibility (Carter-Allison et al., 2016), level of stigma consciousness (Fresson et al., 2019b), racial centrality (Bair & Steele, 2010), age (Kalenzaga et al., 2006), gender (Looby & Earleywine, 2010), and BMI (Guardabassi & Tomasetto, 2020). Context level moderators also were reported including threat salience (Bair & Steele, 2010; Ozier et al., 2019; Pennington et al., 2016; Salvatore & Shelton, 2007) and task complexity (Jordano & Touron, 2017a; Richeson & Trawalter, 2005). These findings have important implications for clinical intervention and for delineating for whom sociocultural stressors would be harmful in terms of their impact on executive functioning. Further research is needed to better elucidate the role of individual difference characteristics on executive function impairment, particularly as it pertains to identifying those most at risk for executive challenges.

Methodological Limitations and Recommendations

Despite support for the allostatic load model, the lack of methodological diversity across studies raises concerns. The literature to date has focused on a relatively limited number of domains of oppression. Indeed, not a single article to date has examined the impact of stereotypes, prejudice, and/or discrimination related to sexual orientation on executive functioning. Examinations of level of religiosity, socioeconomic status, and immigration status among other identities also were largely overlooked in the literature to date. Moreover, of the studies on gender identity, gender is examined solely in the context of cisgender individuals.

Additional work is needed to better understand how allostatic load may function among individuals of different stigmatized identities.

Lack of methodological diversity also was apparent when examining study design. Indeed, only one of the studies reviewed (Shankar & Hinds, 2017) utilized a longitudinal framework. This overreliance on cross-sectional research has hindered our understanding of allostatic load and its limitations. It also has prevented us from examining the dynamic aspects of allostasis. More longitudinal work also may help to clarify the potential indirect associations suggested in the literature to date, which are more appropriately examined using a longitudinal framework. The utilization of longitudinal designs will allow for more sophisticated analyses that are sensitive to change over time.

Further, the studies reviewed largely examined executive function through tasks of working memory or inhibition. Although these constitute important components of executive function, shifting and higher order executive functions largely have been overlooked in the literature. This overreliance on specific measures of executive function was most clearly illustrated in the studies on prejudice, in which every study reviewed examined executive function using the same inhibition task. More diverse assessment of executive function would help clarify the potential limitations of this theory.

Finally, the majority of studies examined in this review utilized between-subject methodologies. Although there are limitations to both between- and within-subject designs, it generally is accepted that use of both designs is important when attempting to rule out confounds related to study contexts such as cue salience or task specific effects (Schepanski et al., 1992). Moreover, of the two studies that assessed executive function impairment within-subjects, one study reported a significant effect of sociocultural stress on executive function (Tine & Gotlieb,

2013), whereas the second found no effect (Barber & Mather, 2013). Given these findings, more within-subjects investigations are needed to further our understanding of allostatic load.

Conclusion

The current review evaluated the allostatic load model as it pertains to executive functioning impairment in the context of sociocultural identity-based stressors. Findings were synthesized both within and between types of stress and forms of oppression to determine the robustness of associations between sociocultural stressors and executive function impairment. Although on the surface the allostatic load model appears to be well supported in the literature, considerable methodological weaknesses may be obscuring our understanding of this theory. Additional and more diverse research on this topic is needed to foster a more dynamic, nuanced, and ecologically valid understanding of whether, how, for whom, and under what conditions sociocultural stressors such as stereotypes, prejudice, and discrimination negatively impact executive function.

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