ABSTRACT

Title of Thesis:	PSYCHOSOCIAL STRESS AND INTERNALIZING SYMPTOMS IN BLACK EMERGING ADULTS: THE ROLE OF PHYSIOLOGICAL DYSREGULATION AND CULTURAL SOCIALIZATION
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Research suggests that ethnic-racial minority emerging adults disproportionately experience higher levels of internalizing problems due to exposure to higher levels of generalized stress (e.g., perceived stress) and unique, race-related stress (e.g., discrimination), which is especially relevant for Black emerging adults. However, few studies have examined the unique contributions of these types of stress and the mechanisms that facilitate their detrimental mental health effects. Informed by existing theoretical models, the current study evaluated the unique contribution of both generalized and discriminatory stress on internalizing symptoms (i.e., anxiety and depression) as well as the mediating role of physiological functioning (i.e., diurnal cortisol slope, C-reactive protein) on these associations. Further, the current study takes a

strength-based approach by examining the potential protective role of cultural socialization on the links among psychosocial stress, physiological functioning, and internalizing symptoms. Findings indicate that generalized stress and discriminatory stress both contribute to depressive symptoms and physiological functioning in Black emerging adults, although the links between psychosocial stress and internalizing symptoms were not mediated by physiological functioning. In addition, cultural socialization protected or exacerbated the effects of psychosocial stress on mental and physiological health outcomes depending on the type and severity of the stressor. These findings suggest that therapeutic treatment and intervention efforts for Black emerging adults should consider the impact of both types of stress on these youth's mental and physiological health as well as the nuanced role of cultural socialization on these links. Future research should examine how other types of psychosocial stress, mediating mechanisms, and resilience processes may impact the mental and physiological health outcomes of Black emerging adults.

PSYCHOSOCIAL STRESS AND INTERNALIZING SYMPTOMS IN BLACK EMERGING ADULTS: THE ROLE OF PHYSIOLOGICAL DYSREGULATION AND CULTURAL SOCIALIZATION

by

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Chapter 1: Introduction

Internalizing Symptoms in Black Emerging Adults

Emerging adults are vulnerable to developing internalizing problems, such as depression and anxiety, given frequent changes in their social environment, their exploration of new identities, and the increasing demand to succeed in their lives (Richards, 2021; Schwartz et al., 2013). Of importance, internalizing problems have been increasing rapidly in emerging adults over the past two decades, with major depressive episode in the past year increasing by 63% from 2009 to 2017 (Twenge et al., 2019) and anxiety symptoms increasing by 84% from 2008 to 2018 (Goodwin et al., 2020). Recent nationally representative data show that ~48% of emerging adults experience internalizing symptoms (Adams et al., 2022; Lipson et al., 2022). Compared to externalizing problems (e.g., hyperactivity, aggression), internalizing problems exist within the individual and are less likely to be identified and intervened upon. Despite being less observable, anxiety and depression diagnoses are the most prevalent among all other mental health conditions (Kessler et al., 2005; SAMHSA, 2022). Thus, it is not surprising that internalizing symptoms are the most common reasons for emerging adults to seek mental health care (Collegiate Mental Health, 2020).

Although emerging adulthood is a sensitive developmental period for mental health concerns (Schulenberg et al., 2004; Tyrell & Yates, 2018), ethnic-racial minority emerging adults disproportionately experience higher levels of internalizing problems (Anderson & Mayes, 2010; McLaughlin et al., 2007). This may, in part, be due to exposure to higher levels of generalized stress (e.g., stressful life events, perceived stress; López et al., 2017) and unique, race-related stress (e.g., discrimination, systemic racism; Williams, 2018), which is especially relevant for Black emerging adults (Bernard et al., 2022). Exposure to generalized and race-

related stress robustly predicts internalizing symptoms in Black emerging adults (Gaylord-Harden et al., 2011; Hurd et al., 2014; Sanchez et al., 2013; Sosoo et al., 2020). However, studies often examine these psychosocial stressors separately, which may limit our knowledge about the unique contribution or additive effects of both generalized and race-related stress on ethnic-racial minority youth's mental health.

Depression and anxiety predict severe negative life outcomes such as suicidal thoughts and behaviors (Bentley et al., 2016), impaired academic achievement (Hysenbegasi et al., 2005; Von Der Embse et al., 2018), and strained interpersonal relationships (Monica A Longmore, 2015; Negriff, 2019). Given the significant psychological distress and daily functional impairment involved in internalizing problems, it is important to understand the factors that contribute to internalizing symptoms in Black emerging adults so that researchers and clinicians can identify mechanisms that can be targeted to promote better mental health outcomes in this population. Thus, the present study will examine how perceptions of generalized and race-related psychosocial stress influence internalizing symptoms in Black emerging adults. In addition, this study will examine whether physiological dysregulation is a mechanism through which psychosocial stress influences internalizing symptoms and whether cultural socialization functions as a moderator of these associations.

Theoretical Frameworks on Stress, Physiological Dysregulation, and Adaptation

According to the allostatic load model, exposure to chronic stress leads to wear and tear of the body, which in turn, generates negative mental health outcomes (McEwen, 1998). Similarly, the biopsychosocial model of perceived racism purports that perceptions of racism and other stressors differentially impact mental health outcomes due to their influence on coping and physiological responses (Clark et al., 1999). The culturally-informed adverse childhood

experiences (C-ACE) model expanded on both of these theoretical frameworks to highlight the importance of considering the effects of both generalized and race-related stressors on the mental health outcomes of Black youth (Bernard et al., 2021). Although theory posits that race-related stress may be more relevant to the mental health outcomes of ethnic-racial minority populations than generalized stress (Clark et al., 1999; D. R. Williams & Mohammed, 2009), empirical research has produced mixed findings (Bernard et al., 2022; Estrada-Martínez et al., 2012; Gaylord-Harden et al., 2011; Sellers et al., 2003). Thus, further research comparing the effects of these types of stress is needed.

Stress and Internalizing Symptoms

There is an extensive literature on the effect of stress on mental health and much of this research focuses on internalizing problems (Harkness & Hayden, 2020). Early life stress (ELS), recent stressful life events (SLEs), and perceptions of stress that span across a variety of life domains (i.e., interpersonal, financial, familial, neighborhood and race-related) predict higher internalizing symptoms in children and adults (Jenness et al., 2019; Kendler et al., 1999; Lecarie et al., 2022; McLaughlin, 2020). For example, a meta-analysis with 13,340 adolescents found that SLEs have a medium effect on internalizing symptoms (March-Llanes et al., 2017) and several studies in young adults have shown than perceived stress and internalizing symptoms are significantly associated (Ewing & Hamza, 2023; Seo et al., 2018). Among African American adolescents and young adults, SLEs and perceived stress have also been associated with higher rates of internalizing problems (Estrada-Martínez et al., 2012; Gaylord-Harden et al., 2011; Sanchez et al., 2013; Sellers et al., 2003).

ELS and recent SLEs have been consistently found to predict higher rates of depressive symptoms in adolescents and adults (Vrshek-Schallhorn et al., 2020). However, childhood

adversity has been shown to be a stronger predictor of childhood depression than adulthood depression, while adversity in adulthood is most strongly associated to depression in adulthood (Shanahan et al., 2011). Similarly, although reports of stress exposure (i.e., number of stressful events) and perception of stress have both been shown to predict internalizing symptoms (Ewing & Hamza, 2023; Harkness & Hayden, 2020; March-Llanes et al., 2017), theories have suggested that the perception of stress may be more relevant to mental health (Clark et al., 1999; McEwen, 1998; Spencer et al., 1997). However, perceived stress has been less empirically examined than stressful events (Thorsén et al., 2022). Because recent and perceived stress may be more relevant to mental health outcomes, the current study will focus on the impact of concurrent perceived stress on internalizing symptoms in Black emerging adults. Moreover, given that most studies examining stress and internalizing symptoms have been conducted with European American samples (Vrshek-Schallhorn et al., 2020), the goal of the current study is to investigate this association in Black emerging adults while considering other unique stressors that may be relevant to their mental health (Sellers et al., 2003).

Race-Related Stress and Internalizing Symptoms

Research has established that race-related stress, such as racial discrimination, is associated with higher rates of internalizing symptoms in Black adults (Britt-Spells et al., 2018; Pieterse et al., 2012) as well as Black emerging adults specifically (Hurd et al., 2014; Sosoo et al., 2020). In a meta-analysis with 91,338 adolescents, the strongest correlation between discrimination and well-being outcomes was between perceived discrimination and internalizing symptoms (Benner et al., 2018).

Although there is literature on the independent effects of generalized stress and race-related stress on mental health outcomes, few studies have accounted for the influence of both

types of stress on internalizing symptoms in the same statistical models. However, it is important that researchers investigate the effect of multiple types of stressors on internalizing symptoms given that ethnic-racial minorities experience different kinds of generalized and race-based stress concurrently (Clark et al., 1999; Spencer et al., 1997). A previous study found that discrimination stress added unique variance to depressive (4%) and anxiety (1.5%) symptoms after controlling for peer stress, family stress, exposure to violence, school stress, and economic stress (Gaylord-Harden & Cunningham, 2009). In a recent study that utilized an ACEs framework, findings indicate that racial discrimination had commensurate effects on internalizing symptoms compared to the other ACEs which included parental psychopathology, domestic violence, and economic hardship (Bernard et al., 2021). However, both studies only accounted for exposure to specific stressful events and did not consider the perception of stress, which has been theorized and empirically shown to be a relevant component of stress that is directly link to mental health outcomes (Ewing & Hamza, 2023; Spencer et al., 1997; Thorsén et al., 2022).

In the few studies that have accounted for both perceived generalized stress and discrimination in Black youth, perceived stress had a larger effect on internalizing symptoms than discrimination (Estrada-Martínez et al., 2012; Sellers et al., 2003). The current study aims to replicate this work and extend it by examining the mechanisms of the associations between perceived psychosocial stress (i.e., perceived generalized stress, perceived discrimination) and internalizing symptoms and elucidate whether different types of stressors may act through the same mechanisms to influence mental health in Black emerging adults. Although generalized and race-related stress have both been shown to have indirect effects on internalizing symptoms (Benner et al., 2018), no known research to date has examined whether these race-related

stressors may operate through the same mechanisms as more well-studied, generalized stressors to influence internalizing symptoms.

Physiological Mechanisms of Stress and Internalizing Symptoms

Although there is an established association between psychosocial stress and internalizing symptoms (Zahniser & Conley, 2018), there is only a small, growing body of research focusing on *how* psychosocial stress can lead to internalizing symptoms. According to the allostatic load, biopsychosocial, and C-ACE models, psychosocial stress may affect internalizing symptoms through its disruption of basic physiological processes. Two relevant physiological systems that have been implicated in the link between stress exposure and mental health outcomes are the hypothalamic-pituitary-adrenal (HPA) axis and immune system.

The HPA axis is a neuroendocrine system that plays a major role in stress response by secreting a hormone called cortisol. The daily secretion of cortisol follows a diurnal pattern with high waking levels during the first 30 minutes followed by a decline in cortisol production throughout the rest of the day, reaching the lowest point around midnight (Adam & Kumari, 2009). Diurnal cortisol slope (DCS), in which the plot of one's cortisol level in the morning and evening creates a downward slope, is an indicator of HPA axis functioning. Dysregulation of the HPA axis, measured via cortisol, has been related to negative mental health consequences, including internalizing symptoms and disorders (Adam et al., 2017). Research has shown that steeper diurnal slopes indicate better health outcomes whereas flatter diurnal slopes have been associated with negative mental and physical health outcomes (Adam & Kumari, 2009).

Recent research has examined HPA axis functioning as a potential mechanism of the association between stress and internalizing symptoms in adolescent samples (Duprey et al., 2021; Lecarie et al., 2022; Stroud et al., 2019; Sun et al., 2022). However, the research findings

have been mixed among samples comprised of mostly White youth. For example, a study with 113 adolescents girls found that early life adversity predicted internalizing symptoms through lower levels of latent trait cortisol (Stroud et al., 2019). However, in another study, findings suggest that early life family stress predicts subsequent internalizing symptoms through interpersonal stress instead of cortisol AM slope (slope from morning to afternoon; Lecarie et al., 2022). Additionally, in a study with a sample of 75% African American youth, emotional abuse significantly predicted internalizing symptoms through cortisol reactivity to a lab stress task (difference between cortisol levels at resting and post-stressor task; Duprey et al., 2021).

Given mixed findings, more research is needed to determine if HPA axis functioning plays a mediating role in the link between stress and internalizing symptoms. Additionally, discrimination has been linked to HPA axis dysfunction in African American emerging adults (Lee et al., 2018) with one study showing that perceived discrimination is related to flatter diurnal cortisol slope (Adam et al., 2015). Some studies have examined psychological mediators of the link between racial discrimination and HPA axis functioning (Lee et al., 2018; Peterson et al., 2020) but far less have examined HPA axis functioning as a mediator in the association between discrimination and mental health outcomes. This is especially surprising because there are documented racial-ethnic disparities in HPA axis functioning among U.S. youth. Specifically, Black youth have been shown to have flatter diurnal cortisol slopes than their White peers (Cohen et al., 2006; Deer et al., 2018; DeSantis et al., 2007). These findings point towards the need to explore the role of the HPA axis in the association between psychosocial stress (including race-related stress) and internalizing symptoms in Black youth.

Alterations in the HPA axis affect the immune system, which also plays a major role in stress response by promoting inflammation in the face of acute and chronic stress. Although this

process is adaptive if the inflammatory response is short-term, elevated levels of inflammation (i.e., low-grade inflammation) can develop in the presence of chronic stress exposure (Furman et al., 2019). Low-grade inflammation as measured by the acute phase protein, C-reactive protein (CRP), has been repeatedly linked to psychosocial stress (Slopen et al., 2013) and mental health outcomes, including depression and anxiety (Furman et al., 2019; Kim et al., 2022; Osimo et al., 2019; Rohleder, 2014), and exist at elevated levels among Black individuals (Carroll et al., 2009). Although there is some theoretical and empirical evidence to support the associations between stress, inflammation, and depression (Jonker et al., 2017; Slavich & Irwin, 2014), research examining inflammation as a mediator in the link between perceived stress and internalizing symptoms is sparse. A recent study examined the psychological factors that mediate the link between adversity and inflammation outcomes (Reid et al., 2020), but, to our knowledge, no research has examined low-grade inflammation as a mediator in the association between psychosocial stress and mental health outcomes.

Despite the lack of studies examining mediation, empirical evidence suggests that perceived discrimination predicts inflammation and that inflammation is related to internalizing symptoms. In a recent meta-analysis of ethnic-racial minorities, perceived discrimination had the strongest association with CRP compared to other stress-related biomarkers (Lawrence et al., 2022). Perceived discrimination has also predicted higher concentrations of CRP in Black youth and adults (Chen et al., 2023; Goosby et al., 2015; Sims et al., 2020). Further, CRP has been linked to internalizing symptoms in a sample of comprised of 66% Black youth (Cicchetti et al., 2015). In a study of older Black adults testing depressive symptoms as a mediator, depressive symptoms did not mediate the link between discrimination and CRP (Lewis et al., 2010).

However, no known studies have tested CRP as a mediator in the association between stress and mental health outcomes in Black emerging adults.

Processes of Resilience: Cultural Socialization as a Protective Factor

Cultural processes play an important role in the mental health of ethnic-racial minority youth. Ethnic-racial socialization (ERS), or the process through which youth learn about the significance and meaning of their ethnic-racial background (Hughes et al., 2006), has been found to buffer the effects of discrimination on poor mental health outcomes in Black youth (Harris-Britt et al., 2007; Kwon et al., 2022; Neblett, 2008).

Cultural socialization is a type of ERS message that teaches youth about their racial-ethnic heritage and history to promote cultural and racial-ethnic pride (Neblett, 2023). Previous research in Black youth have found that cultural socialization mitigates the impact of racial discrimination on conduct problems (Kwon et al., 2022), expressions of anger (Gibbons et al., 2018) and self-esteem (Harris-Britt et al., 2007). Recent research has also suggested that cultural socialization protects against the effects of racial discrimination on depressive symptoms in other ethnic-racial minority youth (Park et al., 2021). However, very few studies have examined cultural socialization as a protective factor against the effects of generalized and race-related stress on internalizing symptoms in Black emerging adults.

Additionally, limited research has examined how culture-related protective factors influence the link between stress and physiological functioning or physiological functioning and internalizing symptoms. One of the few studies with Black emerging adults examined the moderating role of ethnic-racial identity (ERI) centrality in the association between racial discrimination and parasympathetic responses and found that the association between discrimination and greater parasympathetic reactivity was only significant for low centrality

participants (Volpe et al., 2019). More research is needed to understand how different cultural processes influence the link between discrimination and physiological functioning as well as if they can buffer the impact of physiological dysfunction on mental health outcomes. The current study will examine whether cultural socialization mitigates the impact of perceived generalized stress and perceived discrimination on physiological functioning and internalizing symptoms as well as the impact of physiological dysfunction on internalizing symptoms in Black emerging adults.

The Current Study

Drawing on a sample of Black emerging adults, the present study addresses an important gap in the literature by examining (1) the unique contribution of perceived stress and perceived discrimination on internalizing symptoms (i.e., anxiety and depressive symptoms), (2) whether biomarkers of HPA axis (i.e., diurnal cortisol slope) and immune (i.e., CRP) functioning function as mediators of the association between psychosocial stress and internalizing symptoms, and (3) whether cultural socialization moderates these associations. By incorporating perceived discrimination in addition to perceptions of generalized stress in the current study, we will evaluate the C-ACE model, which notes the significance of racism and social inequality as additional burdens that contribute to negative mental health outcomes in Black youth (Bernard et al., 2021). By examining cortisol and CRP as mechanisms, we will also evaluate the allostatic load and biopsychosocial models, which posit that stressful conditions can lead to the dysregulation of multiple physiological systems, which in turn, leads to negative mental health outcomes (Clark et al., 1999; Lupien et al., 2006; McEwen, 1998). In support of these theoretical models, we hypothesize that:

(1) Psychosocial stress (i.e., perceived stress, perceived discrimination) would be significantly and positively associated with anxiety and depressive symptoms (hypothesis1a), with perceived discrimination having a unique effect on both anxiety and depressive symptoms above and beyond perceived stress (hypothesis 1b).

(2) Flatter diurnal cortisol slopes (hypothesis 2a) and higher levels of C-reactive protein (hypothesis 2b) would mediate the effects of psychosocial stress on internalizing symptoms.

(3) Cultural socialization would serve as a protective factor against psychosocial stress and physiological dysfunction to moderate the direct associations between psychosocial stressors, physiological dysfunction, and internalizing symptoms.

Chapter 2: Methods

Participants

Data for the current study was drawn from the Stress and Health Study (SHS), a cross-sectional investigation examining the influence of sociocultural factors on Black emerging adults' health and adaptation. Data collection started in June 2022 and is ongoing. To be eligible for this study, potential participants had to (1) identify as a Black/African American attending an undergraduate institution in the Washington D.C. Metropolitan area, (2) be between the ages of 18-25 years old, (3) understand and speak English, and (4) express willingness to have their blood and saliva samples collected.

Participants (N = 187; M_{age} = 19.97 [*SD* = 1.55]) are 67% female. 83% were born in the United States, while 17% were born outside of the United States. However, 66% of participants come from an immigrant-origin background in which at least one of their parents were born outside of the United States. 28% report that their family income is unknown, while 14%, 16%, 20%, 15%, and 7% of the sample report having an annual household income less than $25,000, between $25,000 and $50,000, between $50,000 and $100,000, between $100,000 and $200,000, more than $200,000, respectively. For maternal education level, 4% had less than a high school diploma, 26% received a high school diploma, 9% went to vocational school or received an associate degree, 28% received a bachelor's degree, 22% received a master's degree, 10% received a professional degree (e.g., MD, JD, PhD), and 2% responded that this item was not applicable to them. Participants were split fairly equally between freshmen (26%), sophomore (23%), junior (27%) and senior year (24%) academic statuses at the time that they completed study procedures. 96% of the sample attend Predominantly White Institutions (PWIs) whereas 4% attend Historically Black Colleges and Universities (HBCUs).

Procedure

Participants completed an in-person lab visit. Before completing any study procedures, participants' informed consent was obtained. Following the signing of the informed consent, participants completed a battery of self-report questionnaires through the Qualtrics survey system on an iPad. After the participants completed the questionnaires, a certified phlebotomy technician (CPT) drew 30mL of blood from the antecubital vein on the participant's preferred arm while the participant laid on their back to prevent lightheadedness, dizziness, or fainting. A bandage was applied immediately after the needle was removed from the participant's vein. At the end of the in-person visit, participants were provided instructions on how to collect the saliva samples at home by a trained research assistant. All study procedures were approved by the Institutional Review Board (IRB protocol #: 1853726-17) at UMD.

Measures

Self-Report Questionnaires

Perceived Stress. The 10-item version of the Perceived Stress Scale (PSS-10; Cohen et al., 1983) is a valid (Lee, 2012) and reliable (Baik et al., 2019) self-report questionnaire that is widely used to measure the perception of stress. Using a 5-point Likert scale ranging from "never" to "very often", the PSS assessed how often participants felt a certain way during the last month. Items include "...felt difficulties were piling up so high that you could not overcome them" and "...felt nervous and stressed". Higher scores indicate higher perceived stress. Internal consistency for the PSS was good ($\omega = 0.88$).

Perceived Discrimination. The Everyday Discrimination Scale (EDS; Williams et al., 1997) is comprised of 9-items which assess how often experiences of discrimination occur in someone's life on a day-to-day basis. The EDS uses a 6-point Likert scale ranging from "never"

to “almost everyday”. Items include statements such as “You are treated with less respect than other people are” and “You are called names or insulted”. The EDS has demonstrated good convergent and predictive validity and adequate internal consistency in African American samples (Stucky et al., 2011). Higher scores indicate higher perceived discrimination. Internal consistency for the EDS was good (ω = 0.91).

Anxiety Symptoms. The General Anxiety Disorder-7 Scale (GAD-7; Spitzer et al., 2006) was utilized to assess how often participants had been feeling bothered by anxiety symptoms for the past two weeks. Items included issues such as “feeling nervous, anxious or on edge” and “trouble relaxing” that participants addressed using a 4-point Likert scale ranging from “not at all” to “nearly every day”. The GAD-7 has been shown to be reliable and valid in African American university students (Kirakosian, 2018). Higher scores indicate higher anxiety symptoms. Internal consistency for the GAD-7 scale was excellent (ω = 0.92).

Depressive Symptoms. The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) was utilized to assess depressive symptoms in the past week. Items included statements such as “I felt lonely” and ‘’I was bothered by things that usually don’t bother me” that participants rated using a 4-point Likert scale from “rarely” to “most”. The CES-D has demonstrated reliability and validity in Black samples (Conerly et al., 2002; Kilburn et al., 2018). Higher scores indicate higher depressive symptoms. Internal consistency for the CES-D was good (ω = 0.90).

Cultural Socialization. The Family Ethnic Socialization Measure (FESM; Umaña-Taylor, 2001) was used to assess the extent to which families discussed ethnicity, race, and its history as well as encouraged children to learn, practice, and have pride in cultural traditions and values. Using 12 items, participants were asked to indicate how true each statement was about

their family or how often their family engaged in each behavior or activity. Items include “My family teaches me about our family’s ethnic/cultural background” and “My family celebrates holidays that are specific to my ethnic/cultural background” that participants rate using a 5-point Likert scale from “not at all” to “very much”. Higher scores indicate higher experiences of cultural socialization in one’s family. Internal consistency for the FESM was good ($\omega = 0.91$).

Salivary Diurnal Cortisol Slope

Participants collected four 1.0 - 1.5 mL samples of their passive drool saliva at home. Research assistants communicated through text with participants during the time they were collecting saliva at home and scheduled an in-person drop-off appointment for the return of all four samples. Participants were told to store their completed saliva samples in the refrigerator until completion of the saliva drop-off. Each participant collected one sample immediately when they woke up in the morning and one sample right before they went to bed over two consecutive days.

Samples were assayed in two batches at the Salimetrics’ Saliva Lab (Carlsbad, CA) using the Salimetrics Salivary Cortisol Assay Kit (Cat. No. 1-3002). Samples were thawed to room temperature, vortexed, and then centrifuged for 15 minutes at approximately 3,000 RPM (1,500 x g) immediately before performing the assay. Then, samples were tested for salivary cortisol using a high sensitivity enzyme immunoassay.

Cortisol values were log-transformed. Mean diurnal cortisol slopes were calculated by averaging the morning and nighttime values between the two days and taking the difference between the morning and nighttime values. Larger negative values represent steeper slopes and smaller negative values represent flatter slopes. Steeper diurnal slopes indicate healthier HPA axis functioning whereas flatter diurnal slopes suggest less healthy HPA axis functioning (Adam

et al., 2017). There were no significant differences in diurnal cortisol slopes between the two batches, which were assayed at different times.

C-Reactive Protein

The Human C-reactive protein/CRP enzyme-linked immunosorbent assay (ELISA) kit from R&D Systems (Warren et al., 2023) was used to extract CRP (mg/dL) from two separate batches of blood samples drawn at study visits. Blood samples were collected from fasting participants before being immediately spun and frozen at −80 °C in the School of Public Health at UMD.

CRP values were log-transformed and no outliers were determined. There was a significant difference in CRP between the two batches. Thus, we included batch number as a covariate in statistical analyses that included CRP.

Analytic Approach

Analyses were conducted in SPSS version 27.0 (IBM Corp, 2020) and Mplus version 8.10 (Muthén & Muthén, 1998-2017). SPSS was used to conduct descriptive and correlational analyses for all study variables. Path analyses were conducted in Mplus with full information maximum likelihood and robust standard errors to account for missing data and issues with normality. For models that included DCS, an auxiliary variable that accounted for missingness on this variable was included in analyses. Path models were conducted to evaluate the direct and indirect effects of perceived generalized stress and perceived discrimination on anxiety and depressive symptoms through DCS and CRP as well as the moderating role of cultural socialization on these associations.

Age, sex, immigrant-origin status, and maternal education level were included as covariates in each model. Given that 1/3 of the participants did not know their family income,

maternal education level was used as a proxy covariate variable assessing socioeconomic status instead of family income. The CRP batch number covariate included in analyses with CRP was computed with 0 representing the first batch and 1 representing the second batch.

Model fit was evaluated using multiple indices, including a non-significant chi-square statistic (Satorra, 2000), the Tucker Lewis Index (TLI > 0.95; Tucker & Lewis, 1973), comparative fit index (CFI > 0.95; Bentler, 1990), root mean square error of approximation (RMSEA < 0.05; MacCallum et al., 1996), and standardized root mean square residual (SRMR < 0.08; Hu & Bentler, 1999). A bootstrapping procedure with 5,000 resamples (Preacher & Hayes, 2008) was used to test statistical significance using 95% confidence intervals for indirect effects.

Due to the cross-sectional nature of the data and our inability to test the temporal ordering of the variables, we also conducted alternative mediation models in which internalizing symptoms (i.e., anxiety and depressive symptoms) replaced DCS and CRP as mediators.

Chapter 3: Results

Descriptive Statistics

Demographic and descriptive statistics for the total sample are reported in Table 1. Bivariate correlations are reported in Table 2. CES-D scores indicate that 59% of the participants were at risk for clinical depression (i.e., T score ≥ 16; Lewinsohn et al., 1997). GAD-7 scores indicate that 23.5% of participants evidenced minimal anxiety (i.e., 0 ≤ T score ≤ 4), 31% evidence mild anxiety (i.e., 5 ≤ T score ≤ 9), 17% evidenced moderate anxiety (i.e., 10 ≤ T score ≤ 14), and 25.7% evidenced severe anxiety (i.e., T score ≥ 15; Spitzer et al., 2006). Perceived stress and perceived discrimination were associated positively with anxiety and depressive symptoms. Perceived stress was also associated positively with diurnal cortisol slope. Cultural socialization and depressive symptoms were associated positively. No other associations were significant among the variables of interest.

Hypothesis 1: Direct effects of psychosocial stress on internalizing symptoms

The first direct effects path model predicting depressive symptoms had good fit overall: χ^2 (11) = 12.45, p = 0.33; RMSEA = 0.03 [90% C.I. = 0.00 – 0.08]; CFI = 0.99; TFI = 0.99; SRMR = 0.05. Results indicate that after controlling for age, gender, immigrant-origin background and maternal education level, perceived stress and perceived discrimination were both significantly associated with depressive symptoms (β = .61, p < .001; β = 0.16, p < .01, respectively). However, the effect of perceived stress was stronger than the effect of perceived discrimination. Predictors in this model explained 46% of the variance in depressive symptoms, R^2 = .46, p < .001.

The second direct effects path model predicting anxiety symptoms also had good fit: χ^2 (11) = 12.17, p = .35; RMSEA = 0.02 [90% C.I. = 0.00 – 0.08]; CFI = 0.99; TFI = 0.99; SRMR = 0.05. After controlling for age, gender, immigrant-origin background and maternal education level, results of this model indicate that perceived stress was significantly associated with anxiety symptoms (β = .65, p < .001), but perceived discrimination was not (β = .06, p = .35). The total variance in anxiety symptoms that was explained by this model was 46%, R^2 = .46, p < .001.

Hypothesis 2: Indirect effects of psychosocial stress on internalizing symptoms through diurnal cortisol slope (DCS) and C-reactive protein (CRP)

DCS as a Mediator

A mediated path model evaluated the indirect effects of perceived stress on depressive symptoms via DCS (see Figure 1). The model fit was good: χ^2 (7) = 7.33, p = .40; RMSEA = 0.02 [90% C.I. = 0.00 – 0.09]; CFI = 0.99; TFI = 0.99; SRMR = 0.04. Results indicate that perceived stress was associated positively with DCS (β = .18, p < .05) and depressive symptoms (β = .66, p < .001), but DCS was not significantly associated with depressive symptoms (β = .00, p = 1.00). A test of the indirect effect of DCS via the pathway from perceived stress, β = 0.00, p = 1.00, 95%CI [−.03, .03], revealed no significant mediation.

A second mediated path model evaluated the indirect effects of perceived discrimination on depressive symptoms via DCS (see Figure 2). The model fit was good: χ^2 (8) = 8.02, p = 0.43; RMSEA = 0.00 [90% C.I. = 0.00 – 0.09]; CFI = 1.00; TFI = 1.00; SRMR = 0.04. Results indicate that perceived discrimination was associated positively with depressive symptoms (β = .35, p < .001), but was not significantly associated with DCS (β = .11, p = .25). DCS was not significantly associated with depressive symptoms (β = .09, p < .31). A test of the indirect effect

of DCS via the pathway from perceived discrimination, $\beta = 0.01$, $p = .51$, 95%CI [−.02, .05], revealed no significant mediation.

A third mediated path model evaluated the indirect effects of perceived stress on anxiety symptoms via DCS (see Figure 3). This model fit was good: χ^2 (7) = 7.05, $p = 0.42$; RMSEA = 0.01 [90% C.I. = 0.00 – 0.09]; CFI = 1.00; TFI = 1.00; SRMR = 0.04. Results indicate that perceived stress was associated positively with DCS ($\beta = .18$, $p < .05$) and anxiety symptoms ($\beta = .66$, $p < .001$), but DCS was not significantly associated with anxiety symptoms ($\beta = .02$, $p = .77$). A test of the indirect effect of DCS via the pathway from perceived stress, $\beta = 0.004$, $p = .80$, 95%CI [−.03, .04], revealed no significant mediation.

A fourth mediated path model evaluated the indirect effects of perceived discrimination on anxiety symptoms via DCS (see Figure 4). This model had good fit: χ^2 (8) = 8.15, $p = 0.42$; RMSEA = 0.01 [90% C.I. = 0.00 – 0.09]; CFI = 0.99; TFI = 0.99; SRMR = 0.04. Results indicate that perceived discrimination was associated positively with anxiety symptoms ($\beta = .25$, $p = .001$), but not significantly associated with DCS ($\beta = .10$, $p = .29$) and DCS was not significantly associated with anxiety symptoms ($\beta = .14$, $p = .15$). A test of the indirect effect of DCS via the pathway from perceived discrimination, $\beta = 0.01$, $p = .48$, 95%CI [−.02, .06], revealed no significant mediation.

CRP as a Mediator

In addition to including age, gender, immigrant-origin and maternal education level as covariates, a variable controlling for the effect of batches was added to all mediated path models with CRP as the mediator to account for differences attributed to the processing of CRP on different occasions. A fifth mediated path model evaluated the indirect effects of perceived stress on depressive symptoms via CRP (see Figure 5). The model fit with the data was good: χ^2 (11) =

12.08, $p = 0.36$; RMSEA = 0.02 [90% C.I. = 0.00 – 0.08]; CFI = 0.99; TFI = 0.99; SRMR = 0.04. Results indicate that perceived stress was associated positively with depressive symptoms ($\beta = .66$, $p < .001$), but was not significantly associated with CRP ($\beta = -.06$, $p = .49$). CRP was not significantly associated with depressive symptoms ($\beta = .01$, $p = .92$). A test of the indirect effect of CRP via the pathway from perceived stress, $\beta = 0.00$, $p = .95$, 95%CI [−.02, .02], revealed no significant mediation.

A sixth mediated path model evaluated the indirect effects of perceived discrimination on depressive symptoms via CRP (see Figure 6). The model fit with the data was good: χ^2 (12) = 9.65, $p = 0.65$; RMSEA = 0.00 [90% C.I. = 0.00 – 0.06]; CFI = 1.00; TFI = 1.00; SRMR = 0.04. Results indicate that perceived discrimination was associated positively with depressive symptoms ($\beta = .37$, $p < .001$), but was not significantly associated with CRP ($\beta = .13$, $p = .19$). CRP was not significantly associated with depressive symptoms ($\beta = -.11$, $p = .22$). A test of the indirect effect of CRP via the pathway from perceived discrimination, $\beta = -0.01$, $p = .45$, 95%CI [−.06, .01], revealed no significant mediation.

A seventh mediated path model evaluated the indirect effects of perceived stress on anxiety symptoms via CRP (see Figure 7). The model fit was good: χ^2 (11) = 10.71, $p = 0.47$; RMSEA = 0.00 [90% C.I. = 0.00 – 0.08]; CFI = 1.00; TFI = 1.00; SRMR = 0.04. Results indicate that perceived stress was associated positively with anxiety symptoms ($\beta = .67$, $p < .001$), but was not significantly associated with CRP ($\beta = -.07$, $p = .45$). CRP was not significantly associated with anxiety symptoms ($\beta = .06$, $p = .36$). A test of the indirect effect of CRP via the pathway from perceived stress, $\beta = -.004$, $p = .65$, 95%CI [−.03, .01], revealed no significant mediation.

An eighth mediated path model evaluated the indirect effects of perceived discrimination on anxiety symptoms via CRP (see Figure 8). The model fit was good: χ^2 (12) = 9.44, p = 0.67; RMSEA = 0.00 [90% C.I. = 0.00 – 0.06]; CFI = 1.00; TFI = 1.00; SRMR = 0.04. Results indicate that perceived discrimination had a significant positive association with anxiety symptoms (β = .27, p < .001), but was not significantly associated with CRP (β = .11, p = .24). CRP was not significantly associated with anxiety symptoms (β = -.05, p = .60). A test of the indirect effect of CRP via the pathway from perceived discrimination, β = -.005, p = .70, 95%CI [−.04, .02], revealed no significant mediation.

Alternative Mediated Path Models

For each hypothesized mediated path model, the competing model for which the outcome variable (anxiety or depressive symptoms) was replaced with the mediator variable was estimated. For example, for the first mediation model, the alternative model evaluated the indirect effects of perceived stress on DCS via depressive symptoms. No significant indirect effects were found for any of the alternative mediated path models (see supplemental materials).

Hypothesis 3: Moderating effects of cultural socialization on the direct and indirect effects of psychosocial stress on internalizing symptoms

Given that no significant indirect effects were found for the mediated path models, moderated mediation path models were not evaluated. Instead, we conducted path models evaluating the moderating effects of cultural socialization on the direct effects of psychosocial stress (i.e., perceived stress, perceived discrimination) on internalizing symptoms and physiological functioning.

A path model evaluated the moderating role of cultural socialization on the direct effects of perceived stress and perceived discrimination on depressive symptoms. The model fit was

good: χ^2 (24) = 24.21, p = 0.45; RMSEA = 0.01 [90% C.I. = 0.00 – 0.06]; CFI = 1.00; TFI = 1.00; SRMR = 0.05. Results indicate that perceived stress and cultural socialization were significantly associated with anxiety symptoms (β = .94, p < .001; β = -.18, p < .01, respectively), but perceived discrimination was not (β = .03, p = .90). There were no significant moderation effects for cultural socialization (see Table 3).

A second path model evaluated the moderating role of cultural socialization on the direct effects of perceived stress and perceived discrimination on anxiety symptoms. The model fit was good: χ^2 (24) = 23.54, p = 0.49; RMSEA = 0.00 [90% C.I. = 0.00 – 0.06]; CFI = 1.00; TFI = 1.00; SRMR = 0.04. Results indicate that perceived stress and perceived discrimination were significantly associated with anxiety symptoms (β = .77, p < .001; β = -.43, p < .05, respectively), but cultural socialization was not (β = -.05, p = .44). Cultural socialization did not moderate the association between perceived stress and anxiety symptoms (b = -.05, p = .56). However, there was a significant interaction between cultural socialization and perceived discrimination on anxiety symptoms. Specifically, perceived discrimination was not associated significantly with anxiety symptoms at low levels of cultural socialization, but perceived discrimination was associated positively with anxiety symptoms at high levels of cultural socialization (see Table 3 and Figure 9).

A third path model evaluated the moderating role of cultural socialization on the direct effects of perceived stress and perceived discrimination on DCS. The model fit was acceptable: χ^2 (24) = 24.15, p = 0.45; RMSEA = 0.01 [90% C.I. = 0.00 – 0.06]; CFI = 0.00; TFI = 1.00; SRMR = 0.04. Results indicate no significant direct or interactive effects predicting DCS (see Table 4).

A fourth path model evaluated the moderating role of cultural socialization on the direct effects of perceived stress and perceived discrimination on CRP. The model fit was good: χ^2 (24) = 24.13, p = 0.45; RMSEA = 0.01 [90% C.I. = 0.00 – 0.06]; CFI = 0.98; TFI = 0.99; SRMR = 0.04. Perceived stress was significantly associated with CRP (β = .62, p < .05), but perceived discrimination and cultural socialization were not (β = -.42, p = .17; β = -.02, p = .84, respectively). However, cultural socialization had significant interactions with perceived stress and perceived discrimination in predicting CRP (see Table 4). Specifically, perceived stress and CRP did not have a significant association at low levels of cultural socialization but perceived stress and CRP were negatively associated at high levels of cultural socialization (see Figure 10). In addition, perceived discrimination and CRP did not have a significant association at low levels of cultural socialization but perceived discrimination and CRP was associated positively at high levels of cultural socialization (see Figure 11).

Chapter 4: Discussion

Psychosocial stress, including perceived stress and perceived discrimination, negatively impacts mental health outcomes in Black emerging adults. However, little is known about the potential physiological mechanisms through which psychosocial stress impacts internalizing in this population as well as the sociocultural moderators of these associations. The current study examined the mediating and moderating role of physiological functioning and cultural socialization, respectively, on the relations between psychosocial stress (i.e., general and race-related) and internalizing symptoms (i.e., anxiety and depression). Cumulatively, findings indicate that the different types of psychosocial stress uniquely contributed to internalizing symptoms and physiological functioning, but physiological functioning did not mediate the association between psychosocial stress and internalizing symptoms. Moreover, cultural socialization moderated the effects of psychosocial stress on mental and physiological health outcomes.

Unique Contributions of Perceived Stress and Perceived Discrimination on Internalizing Symptoms

Hypothesis 1 was partially supported with results indicating that perceived stress and perceived discrimination had unique effects on depressive symptoms. However, the effect of perceived stress was stronger than the effect of perceived discrimination. These findings suggest that Black emerging adults who reported higher levels of stress or discrimination were more likely to endorse higher levels of depressive symptoms. These results replicate previous research findings indicating that perceived stress had a stronger influence on internalizing symptoms than perceived discrimination in Black youth (Gaylord-Harden & Cunningham, 2009; Sellers et al., 2003), which could be because perceived stress captures most of the variance in internalizing

that could be explained by perceived discrimination. They are also consistent with findings that discrimination is a unique and salient stressor that contributes to depressive symptoms in Black youth (Bernard et al., 2022; Estrada-Martínez et al., 2012).

Similar findings emerged for anxiety symptoms. However, whereas perceived stress had a unique effect on anxiety symptoms, the association between perceived discrimination and anxiety symptoms was not significant after controlling for the effect of perceived stress and study covariates. Overall, these findings suggest that Black emerging adults who reported higher levels of generalized stress were more likely to endorse higher levels of anxiety symptoms but that this was not true for discrimination. Although the effect of generalized stress is consistent with previous literature, the finding that perceived discrimination was not related to anxiety symptoms is inconsistent with literature on Black youth. Specifically, previous research has shown that perceived discrimination was uniquely related to anxiety symptoms even after controlling for the effects of generalized stress (Gaylord-Harden et al., 2009) and other ACEs (Bernard et al., 2022). This could be due to several reasons. First, it could be related to the characteristics of our sample (i.e., the majority of the sample was females who usually report relatively high levels of anxiety; Leach et al., 2008). Second, the assessment periods of the PSS (i.e., past month) and GAD-7 (i.e., past week) have overlap whereas the EDS did not assess for a specific time period. Third, anxiety symptoms that are more common in Black individuals, such as hypervigilance and somatic complaints (Lewis-Fernández et al., 2011), were not assessed by the GAD-7 scale.

Mediating Effects of Physiological Functioning

Hypothesis 2, which posited that flatter diurnal cortisol slopes and higher levels of C-reactive protein would mediate the effects of perceived stress and perceived discrimination on

anxiety and depressive symptoms, was not supported because no significant indirect effects were found. These findings add to the literature of mixed findings. For example, in samples comprising of mostly White youth, cortisol was a significant mediator in the link between stress and internalizing symptoms (Stroud et al., 2019; Duprey et al. 2021), but not in other studies (Lecarie et al., 2022). Additionally, a study examining inflammation as a mediator in the link between adversity and youth internalizing symptoms found a significant indirect effect through Interleukin-6, but not C-reactive protein (Flouri et al., 2019).

In general, the lack of significant indirect effects may be attributed to the non-significant associations between physiological functioning (DCS and CRP) and internalizing symptoms. These findings could also suggest that the link between physiological functioning and internalizing symptoms have not "come online" in our sample of relatively physically healthy young adults. Prior studies have found these effects in community samples and at-risk populations (Adam et al., 2017; Cicchetti et al., 2015; Furman et al., 2019; Kim et al., 2022; Osimo et al., 2019; Rohleder, 2014). However, the current sample was comprised of college students in which a majority were from educated families (i.e., mothers with post-high school degrees). Previous research has shown that socioeconomic status tends to be protective for both mental and physiological health outcomes in Black populations (Allen et al., 2019).

Additionally, lack of significant indirect effects may be due to insufficient power provided by the current sample size. Although Fritz & MacKinnon (2007) estimated that a sample size of 148 is required to detect effect sizes of 0.26 in mediation analyses, an estimated sample size of 462 is needed to detect small effects (e.g., 0.14). Thus, our current sample of 187 participants may not have provided enough power to detect small indirect effects.

Perceived Stress, Physiological Functioning, and Internalizing Symptoms

Although perceived stress did not have an indirect effect on internalizing symptoms through diurnal cortisol slope, perceived stress was positively associated with diurnal cortisol slope. Findings revealed that Black emerging adults who reported higher levels of perceived stress were more likely to have flatter diurnal slopes, an indicator of physiological dysregulation. These results are consistent with previous empirical findings (Koss et al., 2016). In contrast, perceived stress was not related to C-reactive protein, which is inconsistent with research linking psychosocial stress and C-reactive protein (Slopen et al., 2013). One explanation for the significant association with cortisol slope but not with C-reactive protein is that diurnal cortisol slope and C-reactive protein operate in different time scales. Cortisol reactivity and production is a primary mediator that reflects a more immediate neurobiological response to stress, whereas C-reactive protein is a secondary outcome that reflects more downstream neurobiological processes (Amasi-Hartoonian et al., 2022). Thus, diurnal slope may be a reflection of an immediate physiological response to perceived stress as measured by the PSS (i.e., past month perceived stress). In contrast, C-reactive protein is further removed and reflects physiological functioning that may be influenced by earlier periods of stress exposure which were not captured by the PSS.

Although perceived stress was not directly associated with C-reactive protein, we found that cultural socialization moderated the influence of perceived stress on C-reactive protein. Black emerging adults who experienced low perceived stress and endorsed high levels of cultural socialization had higher levels of C-reactive protein, whereas individuals who experienced high levels of stress and endorsed high levels of cultural socialization had lower levels of C-reactive protein. There were no differences found among individuals who endorsed low levels of cultural socialization. These findings partially supported hypothesis 3, which posited that cultural

socialization would buffer the negative effects of psychosocial stress. These findings are consistent with prior literature (Saleem et al., 2023; C. D. Williams et al., 2023), and indicate that cultural socialization can serve as a protective factor for Black emerging adults' immune functioning when they experience higher levels of perceived generalized stress. Cultural socialization did not moderate the effects of perceived stress on diurnal slope or internalizing symptoms.

Perceived Discrimination, Physiological Functioning, and Internalizing Symptoms

Perceived discrimination was not directly associated with diurnal cortisol slope nor C-reactive protein. These results are inconsistent with previous findings indicating that perceived discrimination was significantly associated with flatter diurnal slopes (Adam et al., 2015) and higher levels of C-reactive protein (Goosby et al., 2015; Sims et al., 2020) in Black youth and adults. However, we found that cultural socialization moderated the effects of perceived discrimination on C-reactive protein. Specifically, Black emerging adults who experienced low levels of perceived discrimination and endorsed high levels of cultural socialization had lower levels of C-reactive protein, whereas Black emerging adults who experienced high levels of perceived discrimination and endorsed high levels of cultural socialization, had higher levels of C-reactive protein. No differences were found among youth who endorsed lower levels of cultural socialization.

Similar patterns emerged for the effects of perceived discrimination on anxiety symptoms, but not depressive symptoms. Cultural socialization moderated the association between perceived discrimination and anxiety symptoms, such that Black emerging adults who experienced low levels of perceived discrimination and endorsed high levels of cultural socialization reported lower levels of anxiety symptoms, whereas Black emerging adults who

experienced high levels of perceived discrimination and endorsed high levels of cultural socialization reported higher levels of anxiety symptoms.

Although these findings contradict our initial hypothesis (hypothesis 3) that cultural socialization would be protective for youth mental and physiological health outcomes who are exposed to psychosocial stress, they are congruent with some evidence suggesting that resilience processes (e.g., educational attainment, communalistic coping, ethnic-racial identity) are protective against low levels of perceived discrimination, but not moderate or high levels of discrimination (Allen et al., 2019; Christophe et al., 2019; Gaylord-Harden & Cunningham, 2009). Nonetheless, there is also evidence of resilience processes that are protective against high levels of discrimination (e.g., nurturant-involved parenting, parental emotional support; prosocial peers; Brody et al., 2014; Wiggins et al., 2023).

Our findings are novel, in part, because they provide evidence that these moderation patterns are consistent across both mental and physiological health outcomes. These findings also revealed that cultural socialization might operate as a risk or protective process depending on the type and levels of stress that Black emerging adults are facing. For instance, it appears that cultural socialization may protect emerging adults against high levels of perceived stress but may not protect them if they surpass or experience a certain threshold of discriminatory stress. Future research with larger samples should replicate these findings to determine what could explain these incongruencies as well as investigate what resilience processes can protect youth from high levels of perceived discrimination.

Strengths and Limitations

The current study has several strengths. First, it examines risk and resilience processes at multiple levels of analysis (i.e., psychological, physiological, cultural) to gain a more holistic

understanding of how psychosocial stress impacts mental and physiological health outcomes in Black emerging adults. Second, this is one of the first study to evaluate physiological functioning (diurnal slope and C-reactive protein) as mediators in the links between psychosocial stress and internalizing symptoms, extending the literature on the potential physiological mechanisms of generalized stress and discriminatory stress in Black emerging adults. Third, our measures of stress accounted for generalized stress and identity-related stress given their relevance to Black youth, which allowed us to bolster and extend the literature by comparing their effects on mental and physiological health outcomes.

Despite these strengths, findings should be considered in the context of several limitations. First, we used cross-sectional data to evaluate associations among psychosocial stress, physiological functioning, internalizing symptoms, and cultural socialization. Temporal precedence cannot be established with cross-sectional data, which reduces confidence in the directionality of our results. To account for these issues, we evaluated alternative competing models for each mediated path analysis; however, longitudinal data is essential to evaluate mediation models (Maxwell et al., 2011).

Second, the self-report questionnaire measuring perceived discrimination (i.e., Everyday Discrimination Scale) assesses discrimination due to any form of identity. Thus, although racial discrimination is highly relevant to Black emerging adults, the EDS may not fully capture race-related stress. Future research should consider using a more valid measure of racial discrimination.

Third, the study sample is a convenience sample of college students that agreed to a blood draw. Given that college students are usually more affluent and do not reflect the heterogeneity evident in community samples, our findings may not be generalizable to other

Black emerging adults living in the U.S. Moreover, 96% of the study sample attended a PWI, which may explain our findings that cultural socialization exacerbated the effects of perceived stress. Thus, results of the current study may not generalize to students at HBCUs given differences in cultural and contextual experiences (Mitchell, 2018). Future research should evaluate whether similar findings exist among emerging adults attending HBCUs. Despite the sample limitation, the findings are relevant to college students, given that this population experiences higher rates of stress and internalizing symptoms than the general public (Richards et al., 2021).

Finally, the current study did not examine heterogeneity within our Black emerging adult sample. Within group differences in ethnicity, national origin, gender, religiosity, immigrant generational status, sexual orientation and more are important to consider as Black emerging adults are not a monolith and considering other identities that intersect with race is critical to our empirical understanding of socioemotional development in this population.

Future Directions

Further research and replication of this work is required to be confident in the study findings. Specifically, utilizing longitudinal data to examine mechanisms will allow researchers to examine the reciprocal transactions and directionality among psychosocial stress, physiological functioning, and mental health outcomes. Evaluating the mechanisms through which psychosocial stress affects physiological functioning, and internalizing symptoms may have novel treatment implications for the mental and physical health outcomes of Black youth.

To understand heterogeneity within Black youth and emerging adults, researchers should also consider other intersecting identities (e.g., Black immigrant-origin youth, queer Black youth) and identify the additional types of stress that may be unique to these specific groups. For

example, research on Black immigrant-origin youth can examine acculturative stress in addition to generalized stress and discriminatory stress given their exposure to anti-Blackness and xenophobia.

Future research should also consider other sociocultural protective factors and continue to incorporate a strengths-based approach to studying marginalized populations' mental and physical health. Although this study focused on one type of racial-ethnic socialization strategy, future studies can examine other dimensions, such as promotion of mistrust, preparation for bias and egalitarianism, or various dimensions of ethnic-racial identity (Umaña-Taylor & Hill, 2020).

Implications

One of the implications from this study is that generalized and discriminatory stress are both relevant to Black emerging adult's internalizing symptoms. Thus, intervention efforts and clinical practitioners should consider both types of stress in the treatment process for this population. Clinicians assessing clients for stress should incorporate brief measures of discrimination as this could improve treatment efficacy. Additionally, while it is important to provide Black youth with the tools and resources to cope with generalized and discriminatory stress, clinicians, researchers, and policy makers should engage in ongoing efforts to develop and support effective prevention programs that can be easily disseminated and implemented in communities that are known to perpetrate interpersonal discrimination. One example of this is The Identity Project, an intervention that promotes adolescents' ethnic-racial identity exploration and resolution, which has had promising results in promoting positive psychosocial functioning among youth (Umaña-Taylor, 2018; Umaña-Taylor et al., 2018). Further, chronic stress exposure such as discrimination is a byproduct of systemic and institutional inequalities; therefore, it is important that intervention efforts aimed at reducing sociocultural stress are sustainable and

disseminated in different socioecological contexts (e.g., schools, churches, neighborhoods, workplaces). Finally, our findings indicated that cultural socialization can be helpful or harmful depending on the context (i.e., the type of stress one is facing and the severity of that stress). Thus, it is important for clinicians and researchers to determine under what conditions, cultural socialization strategies should be facilitated to combat different types of environmental stressors.

Conclusion

Few studies have examined the direct and indirect effects of both generalized stress and discriminatory stress on internalizing symptoms or account for the moderating role of cultural socialization on these links in Black emerging adults. Findings from this study suggest that generalized stress and discriminatory stress both contribute to depressive symptoms and physiological functioning in Black emerging adults. Therefore, both types of stress should be considered in therapeutic treatment and intervention efforts for this population. Cultural socialization also appears to protect against or exacerbate the negative effects of stress on youth mental and physiological health outcomes depending on type and severity of the psychosocial stressor. Thus, although cultural socialization can be promotive and protective, our research findings suggest that Black emerging adults should not solely rely on cultural socialization practices to protect them from high levels of discrimination as this might be detrimental to both their mental and physiological well-being. Future research should examine how other types of psychosocial stress (e.g., acculturative stress), mediating mechanisms (e.g., coping, rumination, sleep) and resilience processes (e.g., social support, education level, ethnic-racial identity) may impact the mental and physiological health outcomes of Black emerging adults.

Tables and Figures

Table 1. *Demographic and Descriptive Statistics. N=187 (Unless otherwise specified)*

Variable		
Participant Demographics		**N (%)**
Age [a]	18	40 (21.4)
	19	38 (20.3)
	20	43 (23.0)
	21	34 (18.2)
	22	19 (10.2)
	23	9 (4.8)
	24	2 (1.1)
	25	1 (0.5)
Gender	Female	125 (66.8)
	Male	53 (28.3)
	Non-binary	8 (4.3)
	Prefer not to say	1 (0.5)
Immigrant-Origin Status	Yes	124 (66.3)
	No	63 (33.7)
Maternal Education Level	Less than high school	8 (4.3)
	High school diploma or GED	48 (25.7)
	Vocational or technical school graduate	8 (4.3)
	Associate degree	8 (4.3)
	Bachelor's degree	53 (28.3)
	Master's degree	41 (21.9)
	Professional degree: MD, JD, PhD (etc.)	18 (9.6)
	Not applicable	3 (1.6)
Family Income	Less than $25,000	26 (13.9)
	$25,000-$50,000	30 (16.0)
	$50,000-$100,000	38 (20.3)
	$100,000-$200,000	28 (15.0)
	More than $200,000	13 (7.0)

	I don't know	52 (27.8)
Variables of Interest		**M (SD); Range**
	Mean PSS (SD) [a]	2.16 (0.67); 0.4-3.7
	Mean EDS (SD) [b]	1.47 (0.93); 0.0-4.4
	Mean DCS (SD) [c]	-0.47 (0.37); -1.4-0.7
	Mean CRP (SD) [d]	0.20 (0.27); 0.002-1.5
	Mean ANX (SD) [e]	1.37 (0.88); 0-3
	Mean DEP (SD) [f]	1.01 (0.55); 0.05-2.45
	Mean FESM (SD)	2.89 (0.84); 0.16-3.99

Note. *p<.05, ** p<.01, *** p<.001.
[a] n = 186. [b] n = 185. [c] n = 125. [d] n = 143. [e] n = 183. [f] n = 180.

Table 2. *Bivariate Correlations. N=187 (Unless otherwise specified)*

Variable	1	2	3	4	5	6	7	8	9	10
1. Age	-									
2. Gender	-0.19**	-								
3. Immigrant Origin	0.16*	-0.03	-							
4. Maternal Education Level	-0.10	0.8	-0.10	-						
5. Perceived Stress	0.09	0.07	-0.16*	-0.01	-					
6. Perceived Discrimination	0.08	-0.12	0.02	-0.05	0.33**	-				
7. Diurnal Cortisol Slope	-0.03	0.08	0.04	0.12	0.18*	0.10	-			
8. C-reactive Protein	0.03	0.08	0.09	-0.07	0.02	0.16	-0.10	-		
9. Anxiety Symptoms	0.01	0.12	0.08	-0.12	0.66**	0.25**	0.16	0.08	-	
10. Depressive Symptoms	0.004	0.06	0.09	-0.01	0.66**	0.35**	0.15	-0.05	0.73**	-
11. Cultural Socialization	-0.16*	0.12	-.29**	0.02	-0.09	-.02	-0.03	0.06	-0.07	-0.21**

Note. Gender is coded as Female (1) and Male/Non-binary (0); Immigrant-Origin Status is coded as Yes (1) and No (0).
*p<.05, **p <.01

Table 3. Path Model with Perceived Stress, Perceived Discrimination and Cultural Socialization Predicting Internalizing Symptoms

	Depressive Symptoms		Anxiety Symptoms	
Variable	*β*	*SE*	*β*	*SE*
Intercept	3.07***	.79	1.81*	.79
Age	-.06	.06	-.02	.06
Gender	.05	.06	.09	.06
Immigrant-Origin Status	.05	.06	.04	.06
Maternal Education Level	-.002	.05	-.11*	.05
PSS	.94***	.20	.77***	.21
EDS	.03	.21	-.43*	.21
FESM	-.18**	.06	-.05	.06
PSS X FESM	-.24	.21	-.12	.21
EDS X FESM	.15	.21	.51*	.21

Note. SE = standard error; PSS = perceived stress; EDS = perceived discrimination; FESM = cultural socialization.

* p < .05. ** p < .01. *** p < .001

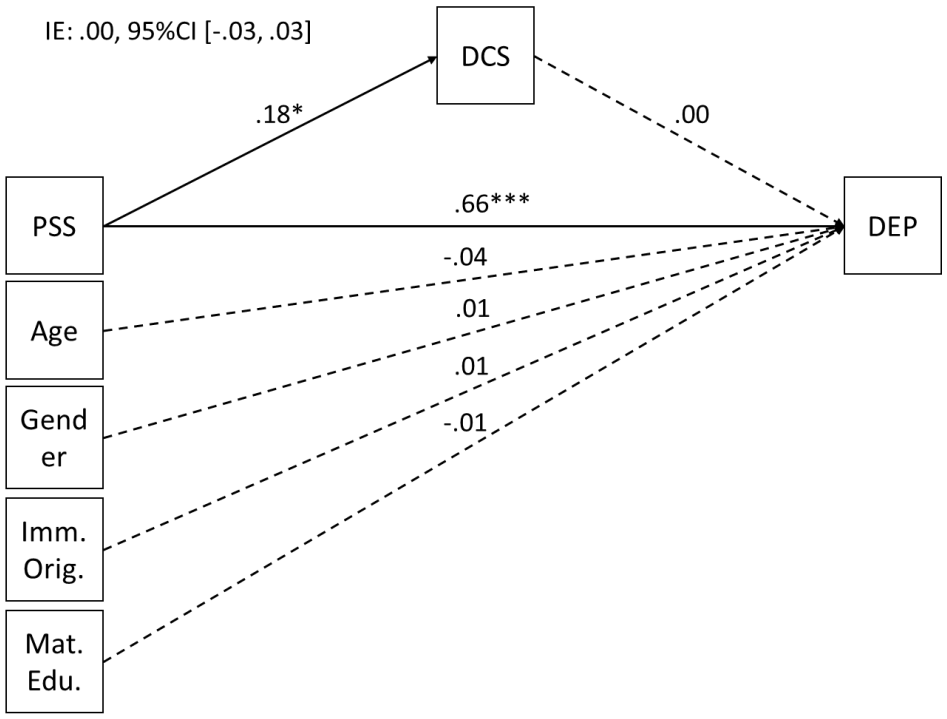
Table 4. Path Model with Perceived Stress, Perceived Discrimination and Cultural Socialization Predicting Physiological Functioning

	Diurnal Cortisol Slope		C-Reactive Protein	
Variable	*β*	*SE*	*β*	*SE*
Intercept	-1.16	1.35	-1.13	1.24
Age	-.02	.09	-.04	.09
Gender	.05	.10	.09	.08
Immigrant-Origin Status	.06	.10	-.14	.08
Maternal Education Level	.11	.09	-.01	.07
PSS	.31	.42	.62*	.30
EDS	-.28	.47	-.42	.30
FESM	-.04	.11	-.02	.08
PSS X FESM	-.16	.42	-.81**	.29
EDS X FESM	.33	.46	.65*	.31

Note. SE = standard error; PSS = perceived stress; EDS = perceived discrimination; FESM = cultural socialization.

* $p < .05$. ** $p < .01$. *** $p < .001$

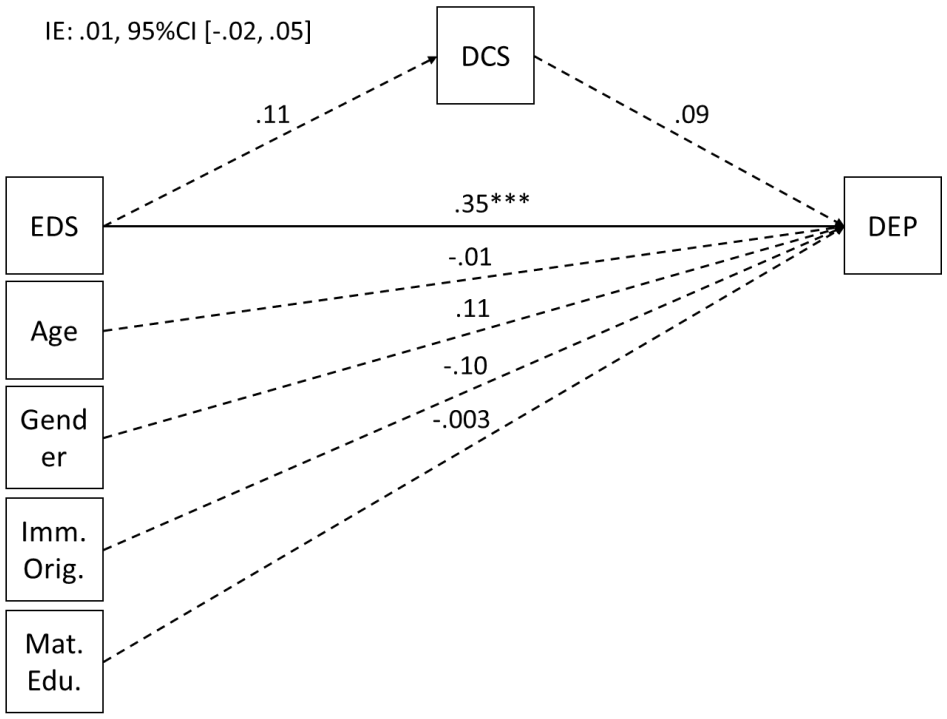
Figure 1. *Mediated Path Analysis Model of the Indirect Effect of Perceived Stress on Depressive Symptoms via DCS*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients. IE = Indirect Effect; PSS = Perceived Stress; DCS = Diurnal Cortisol Slope; DEP = Depressive Symptoms

*p<.05, **p <.01, ***p<.001

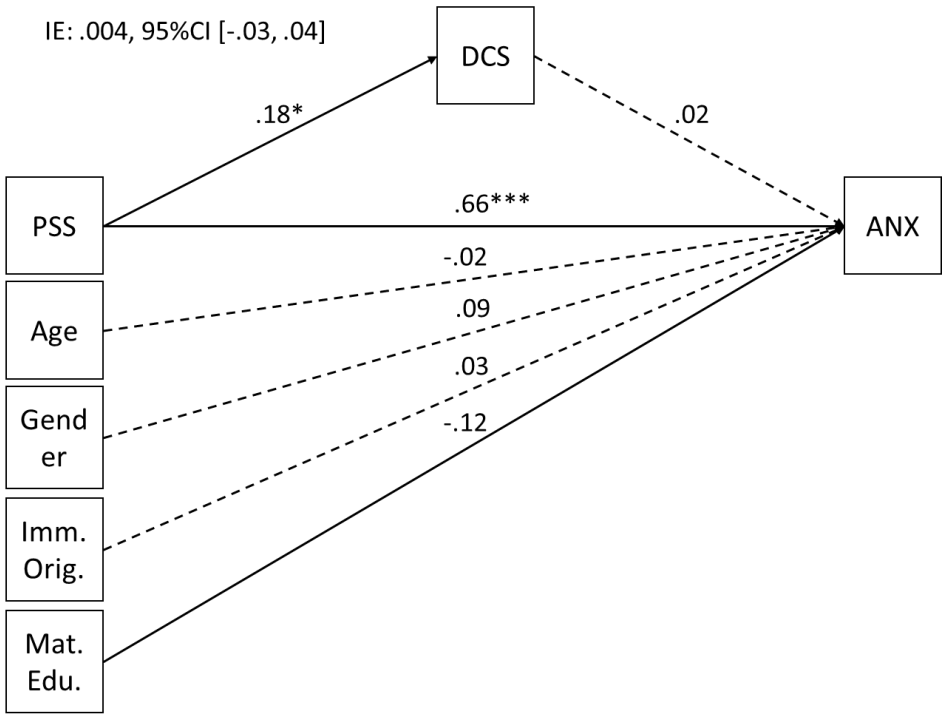
Figure 2. *Mediated Path Analysis Model of the Indirect Effect of Perceived Discrimination on Depressive Symptoms via DCS*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients. EDS = Perceived Discrimination

*p<.05, **p <.01, ***p<.001

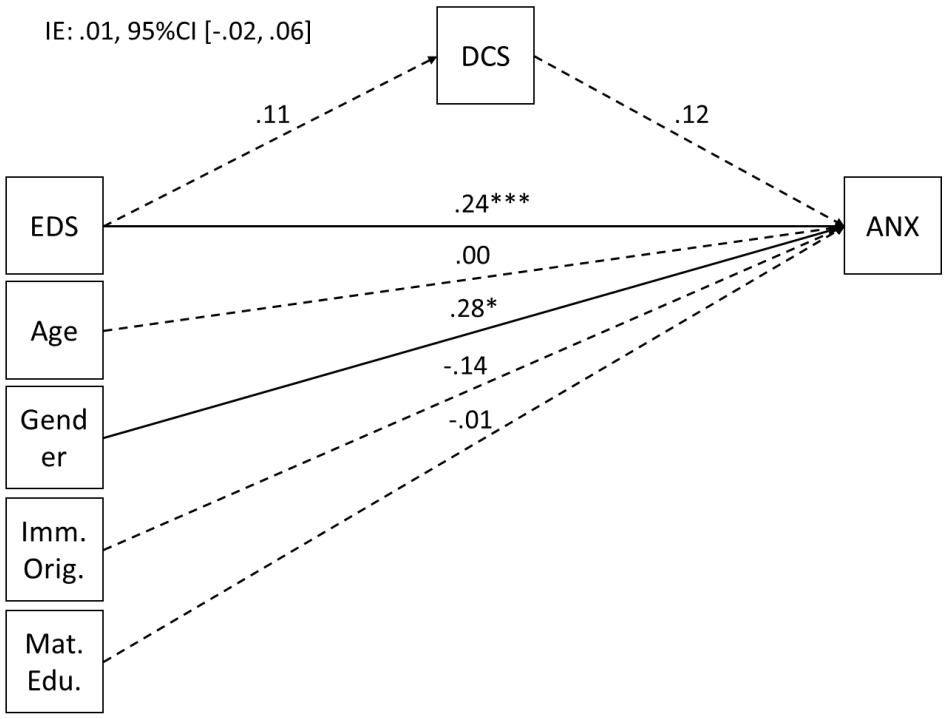
Figure 3. *Mediated Path Analysis Model of the Indirect Effect of Perceived Stress on Anxiety Symptoms via DCS*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients. ANX = Anxiety Symptoms

*p<.05, **p <.01, ***p<.001

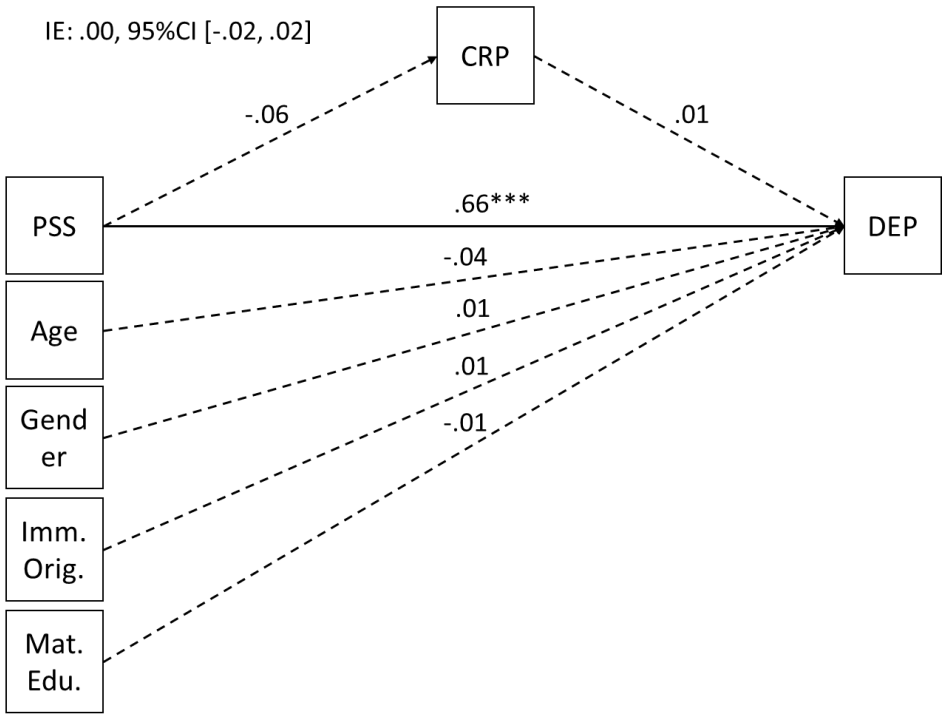
Figure 4. *Mediated Path Analysis Model of the Indirect Effect of Perceived Discrimination on Anxiety Symptoms via DCS*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

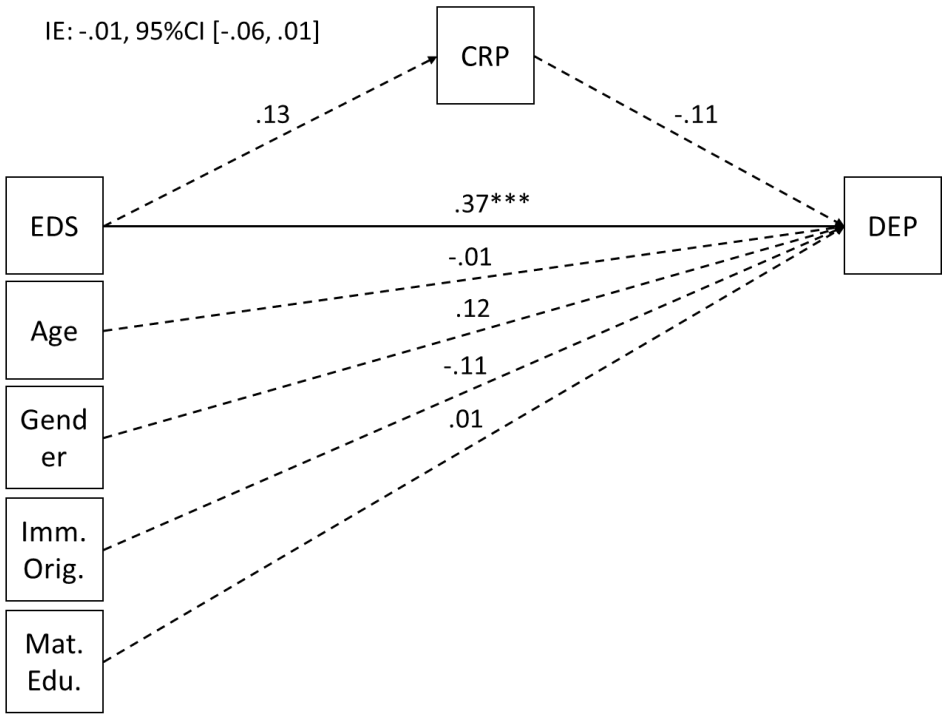
Figure 5. *Mediated Path Analysis Model of the Indirect Effect of Perceived Stress on Depressive Symptoms via CRP*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

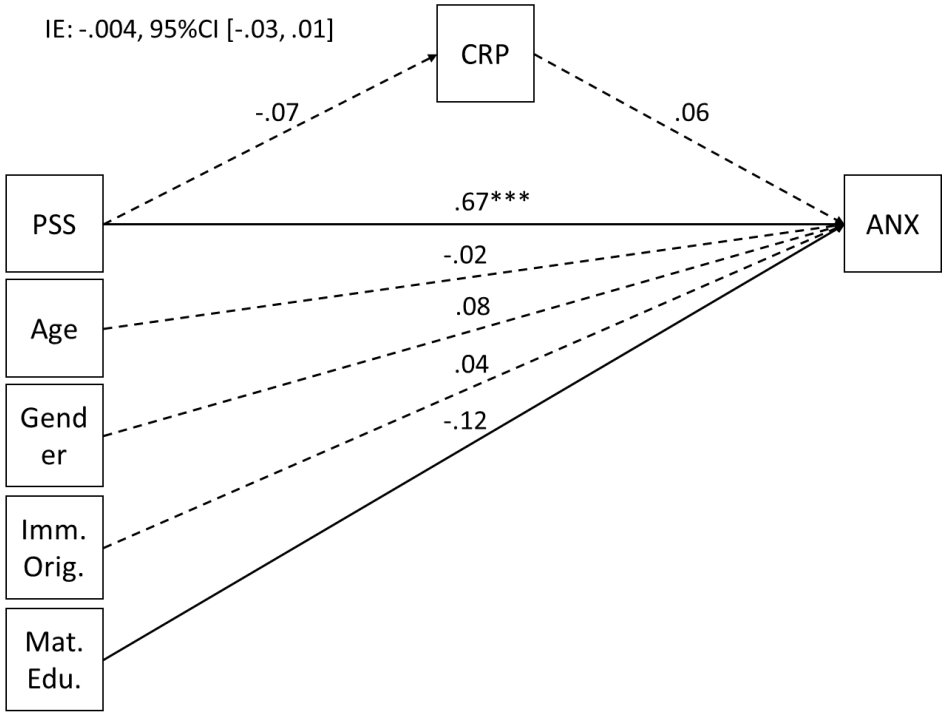
Figure 6. *Mediated Path Analysis Model of the Indirect Effect of Perceived Discrimination on Depressive Symptoms via CRP*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

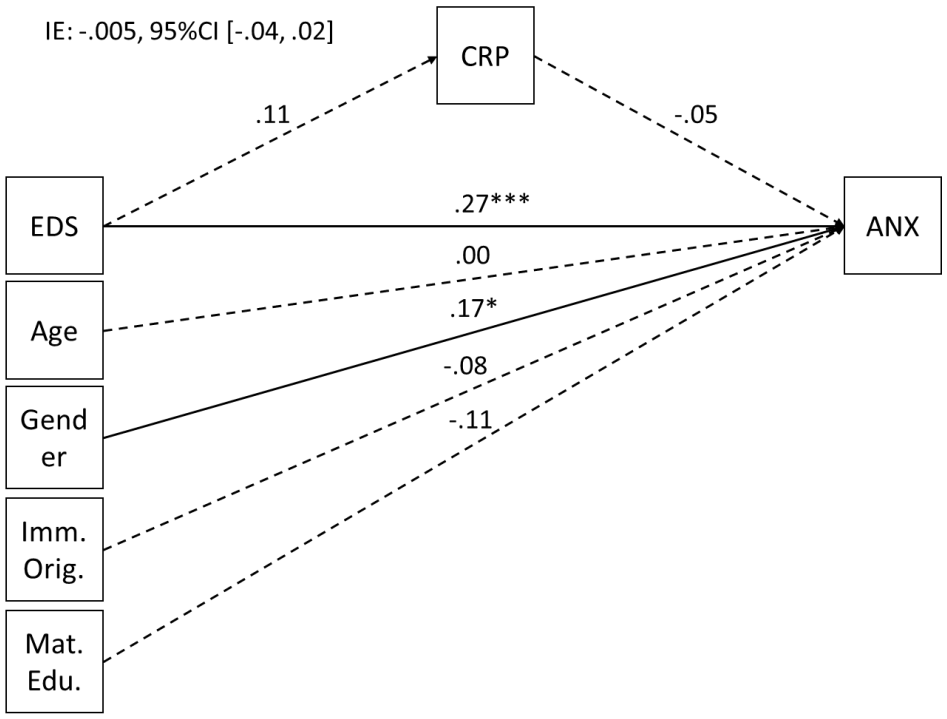
Figure 7. *Mediated Path Analysis Model of the Indirect Effect of Perceived Stress on Anxiety Symptoms via CRP*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

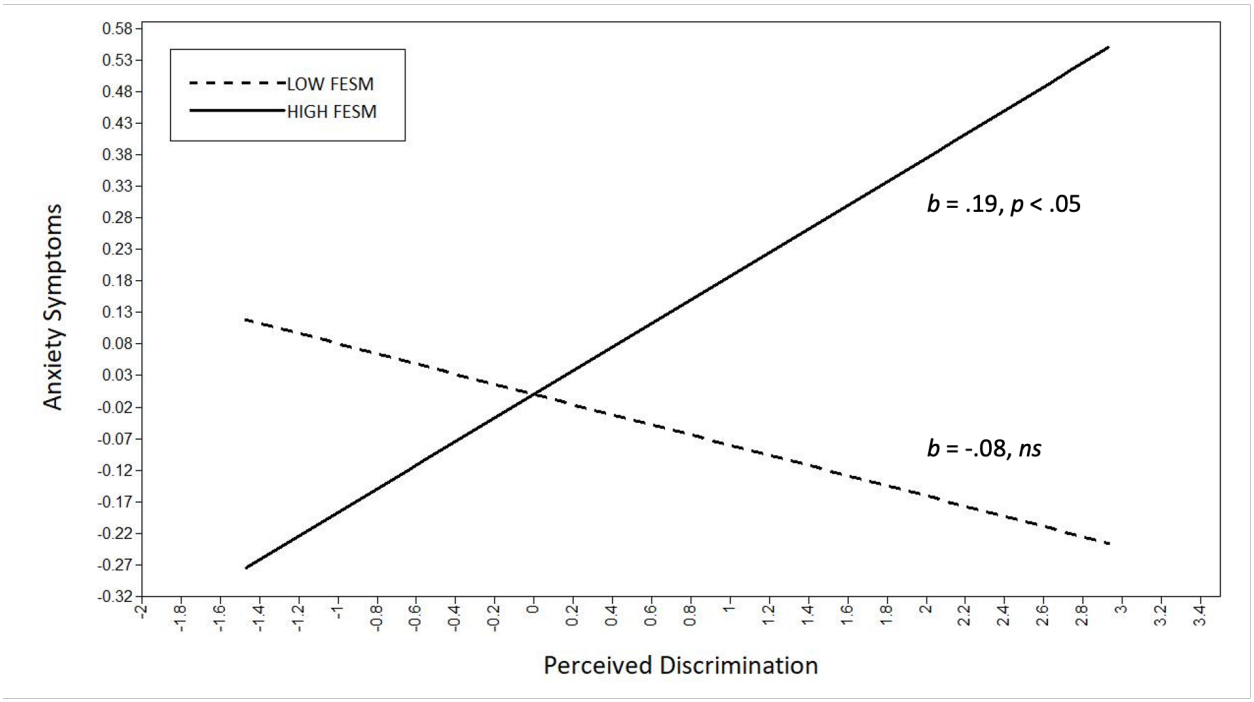
Figure 8. *Mediated Path Analysis Model of the Indirect Effect of Perceived Discrimination on Anxiety Symptoms via CRP*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

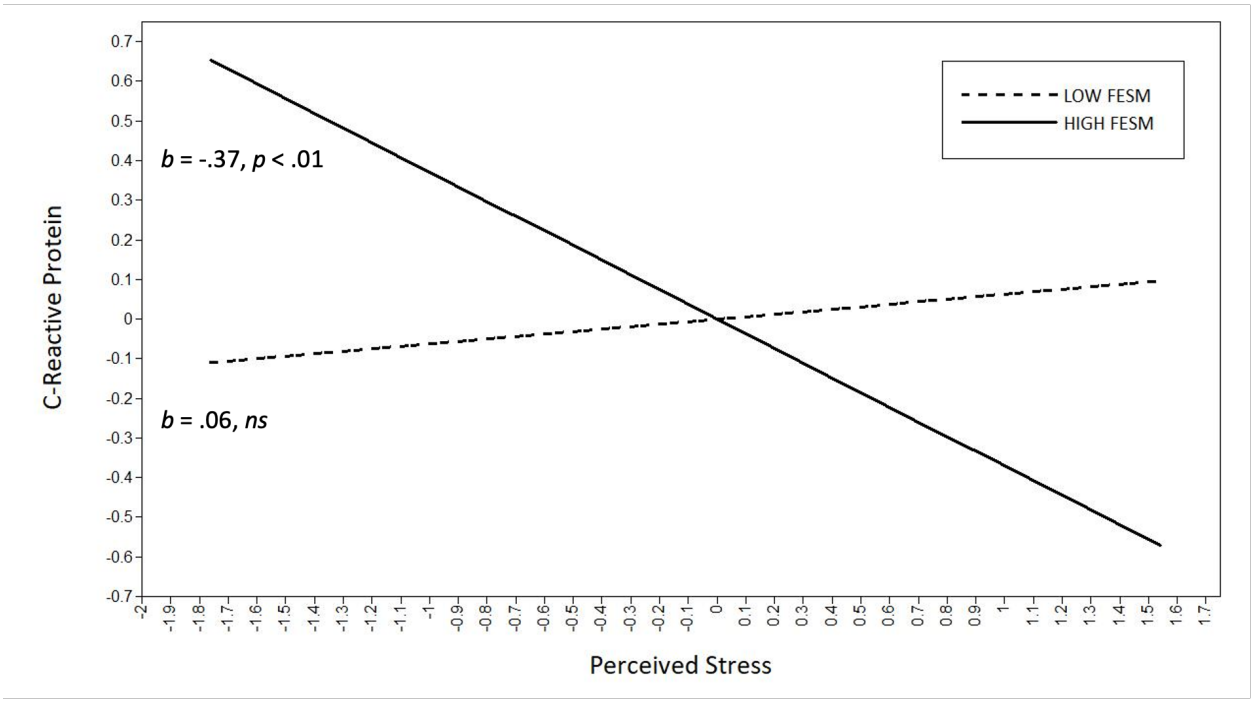
*p<.05, **p <.01, ***p<.001

Figure 9. *Interactive Effect of Perceived Discrimination and Cultural Socialization on Anxiety Symptoms*



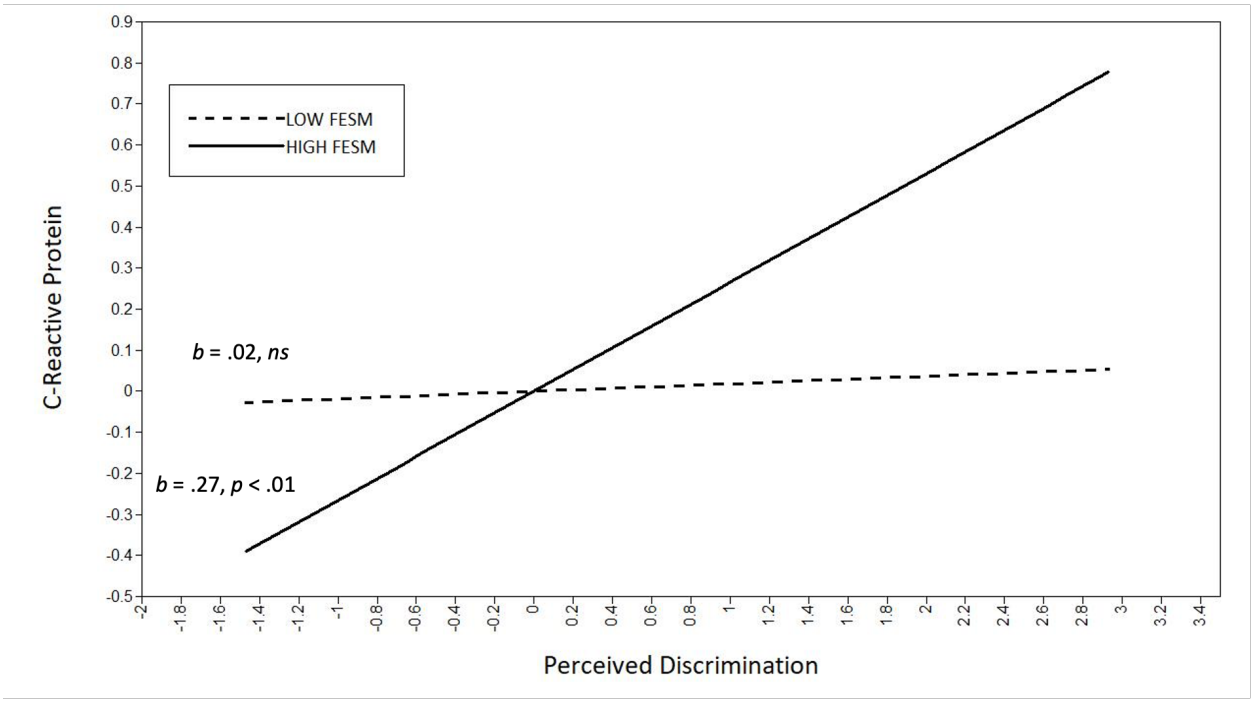
Note. FESM = cultural socialization.

Figure 10. *Interactive Effect of Perceived Stress and Cultural Socialization on C-Reactive Protein*



Note. FESM = cultural socialization.

Figure 11. *Interactive Effect of Perceived Discrimination and Cultural Socialization on C-Reactive Protein*

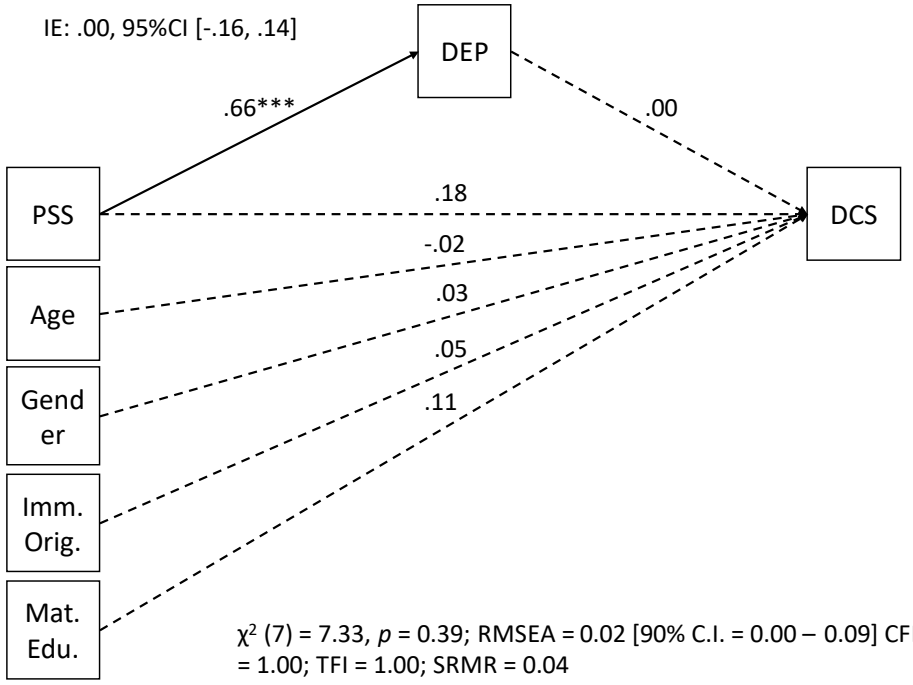


Note. FESM = cultural socialization.

Supplemental Materials

Alternative Mediation Model Results

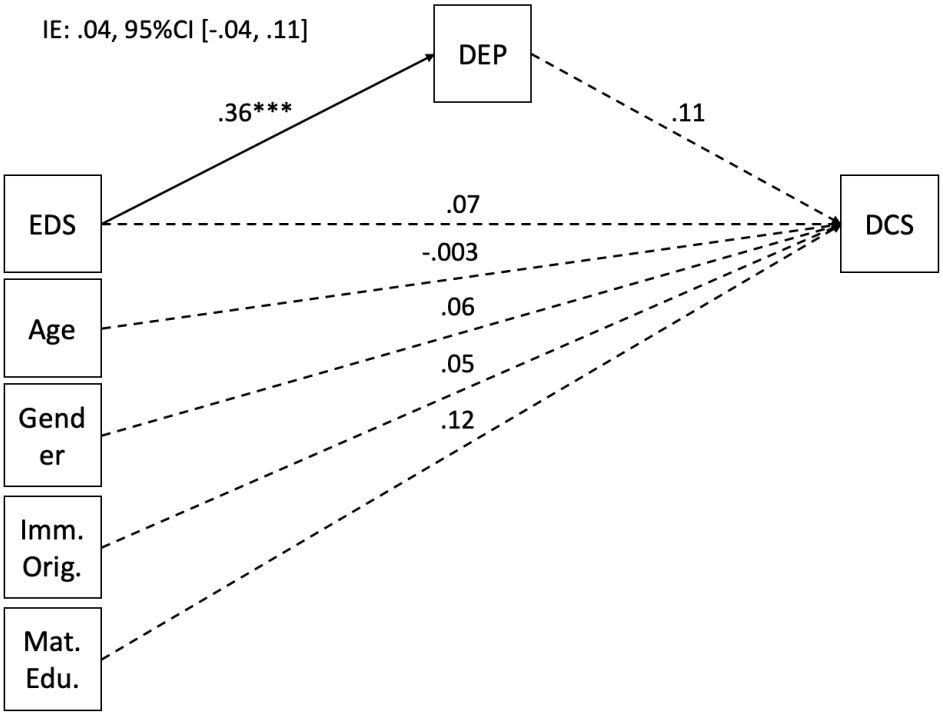
Figure 1. *Mediated Path Analysis Model of the Indirect Effect of Perceived Stress on DCS via Depressive Symptoms*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

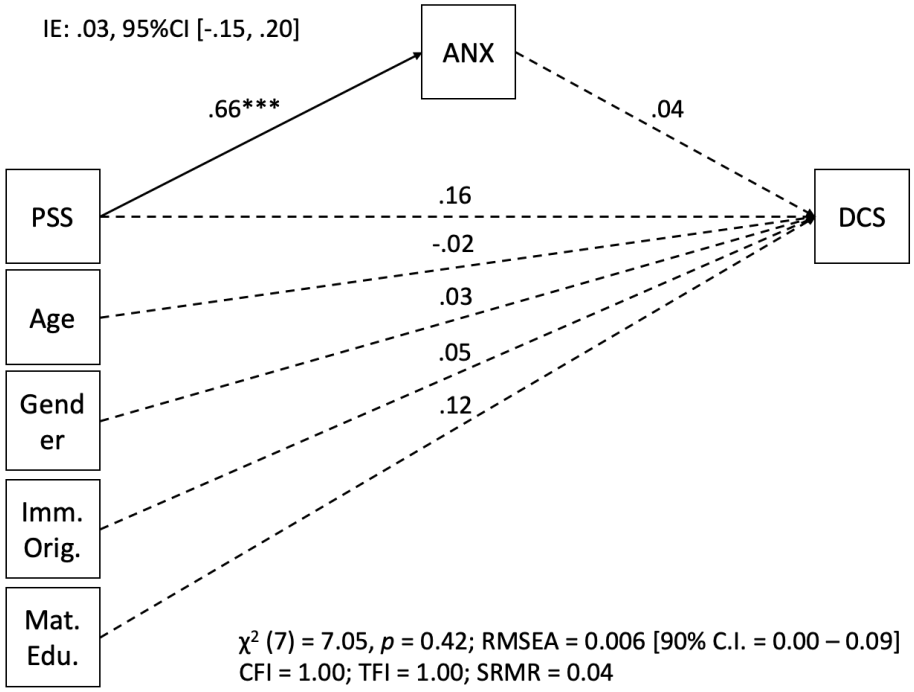
Figure 2. *Mediated Path Analysis Model of the Indirect Effect of Perceived Discrimination on DCS via Depressive Symptoms*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

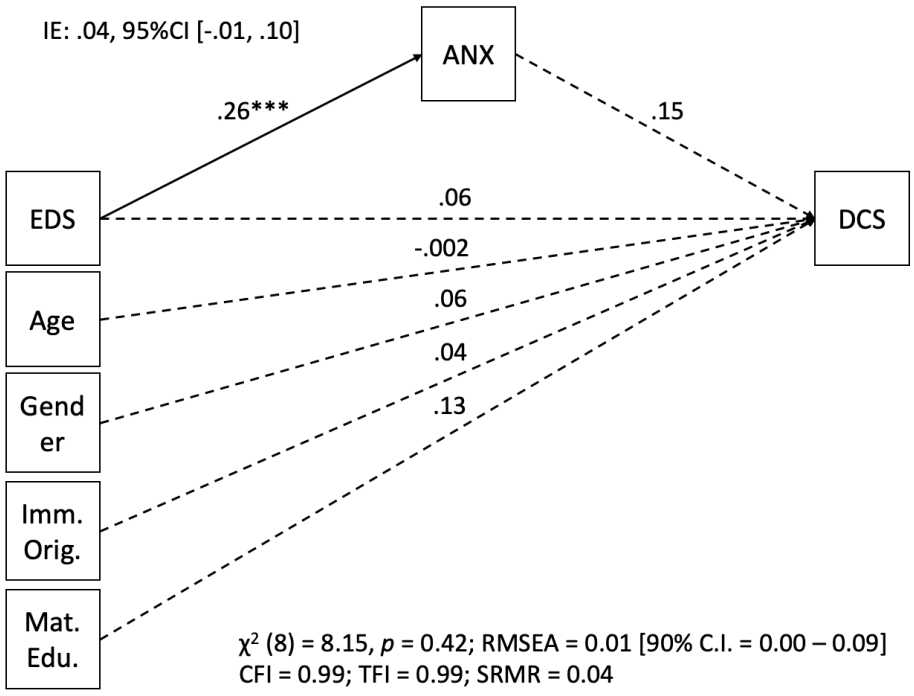
Figure 3. *Mediated Path Analysis Model of the Indirect Effect of Perceived Stress on DCS via Anxiety Symptoms*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

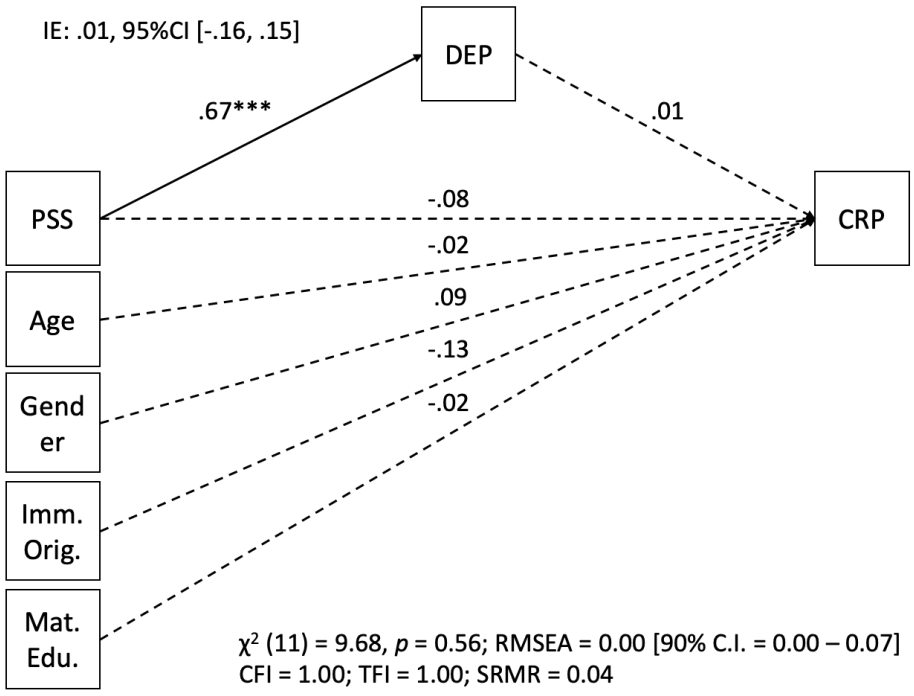
Figure 4. *Mediated Path Analysis Model of the Indirect Effect of Perceived Discrimination on DCS via Anxiety Symptoms*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

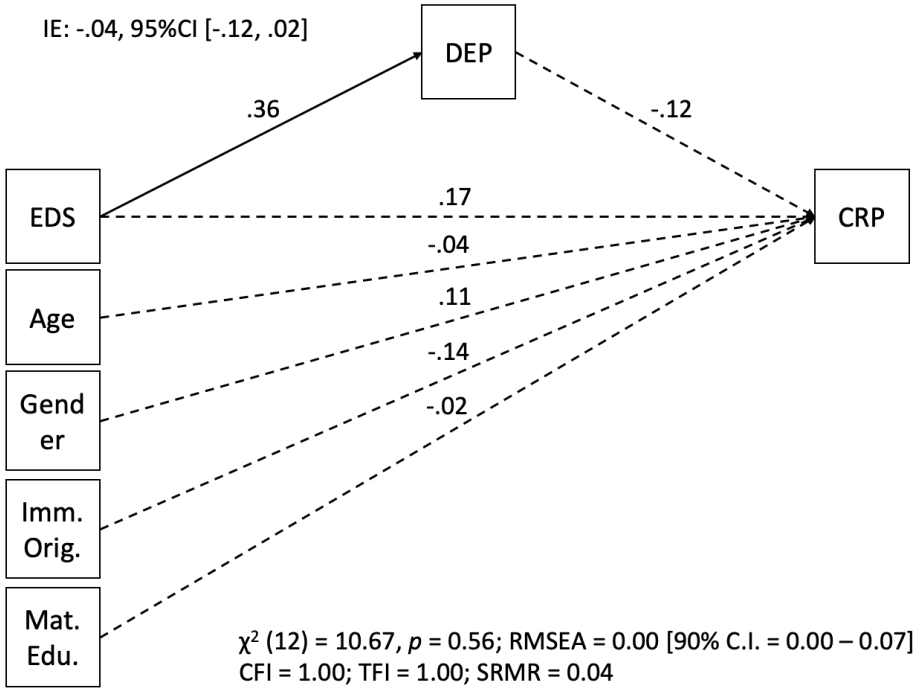
Figure 5. *Mediated Path Analysis Model of the Indirect Effect of Perceived Stress on CRP via Depressive Symptoms*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

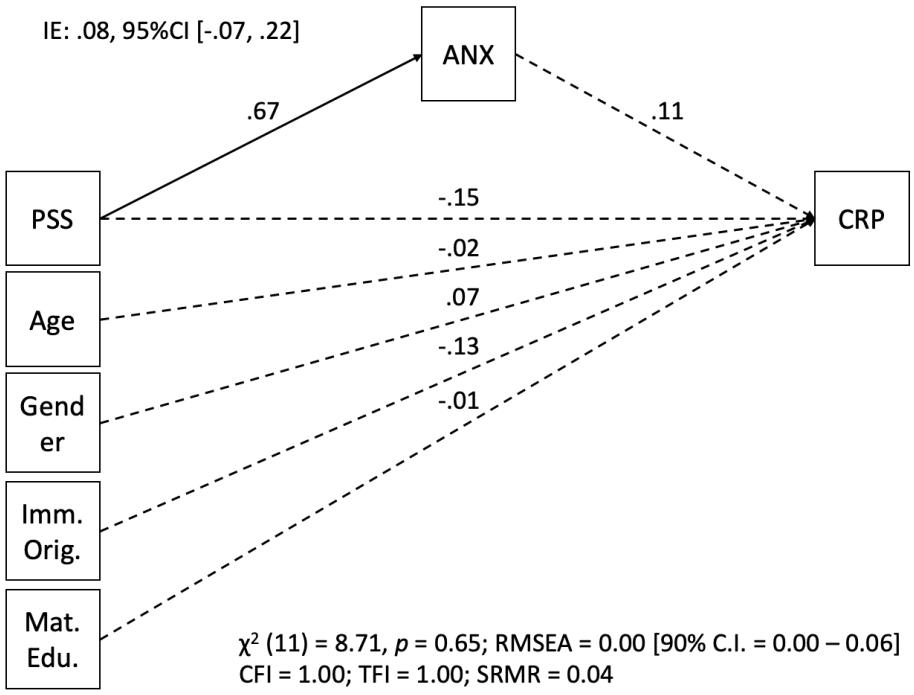
Figure 6. *Mediated Path Analysis Model of the Indirect Effect of Perceived Discrimination on CRP via Depressive Symptoms*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

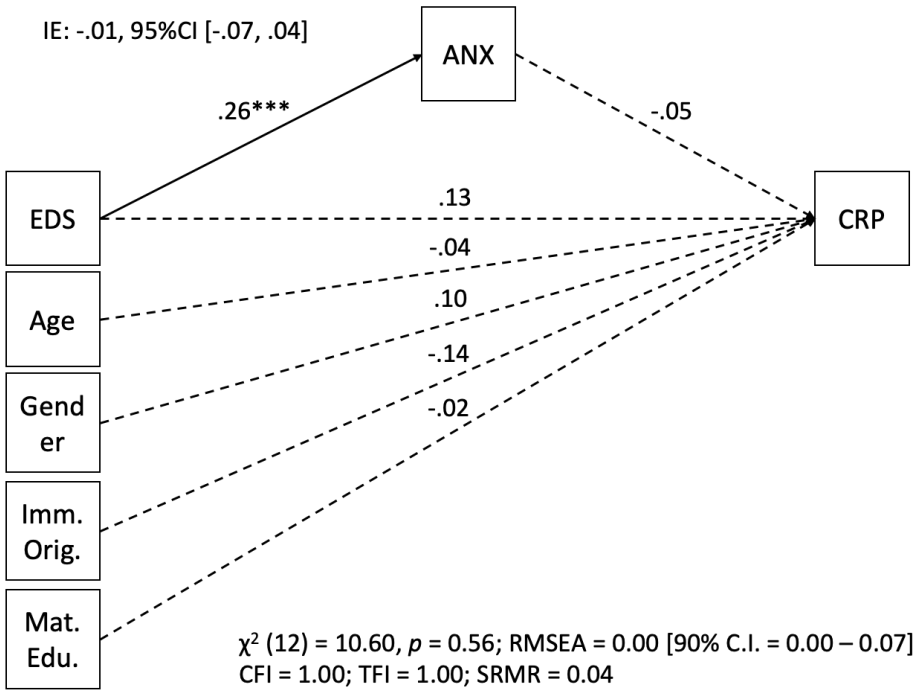
Figure 7. *Mediated Path Analysis Model of the Indirect Effect of Perceived Stress on CRP via Anxiety Symptoms*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

Figure 8. *Mediated Path Analysis Model of the Indirect Effect of Perceived Discrimination on CRP via Anxiety Symptoms*



Note. Covariates are age, gender, immigrant-origin background and maternal education level. Coefficients presented are standardized linear regression coefficients.

*p<.05, **p <.01, ***p<.001

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