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Psychosis-risk among Black American youth: The role of stressful experiences and cognitive schemas

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Abstract

Psychosis-risk among Black American youth: The role of stressful experiences and cognitive schemas

By Derek M. Novacek

Black Americans are diagnosed with psychotic disorders at a rate three times higher than their White American counterparts and endorse more severe psychotic symptoms. Elevated rates remain even when accounting for indices of socioeconomic status. These findings raise important questions about the determinants and treatment implications of racial disparities, both of which remain major public health issues. Early theories focused on diagnostic bias to explain these differences, but more recent research suggests that this bias does not likely fully account for higher rates of psychosis and differing symptom presentations. Contemporary theoretical conceptualizations postulate that greater exposure to discrimination, social disadvantage, social defeat, and other forms of adversity contribute to elevated rates of psychosis among racial/ethnic minorities. In addition, cognitive models of psychosis posit that early adversity can lead to enduring cognitive vulnerabilities characterized by negative cognitive schemas, which ultimately can increase susceptibility to the development of psychotic symptoms. No prior studies have sought to characterize the clinical presentation of Black American youth prior to the onset of psychosis or elucidate mechanisms of heightened risk. The clinical high-risk (CHR), or prodromal phase, is characterized by a period of functional decline and the emergence of attenuated psychotic symptoms that often precedes the first psychotic episode. Data from the North American Prodrome Longitudinal Study (NAPLS-2) were used to examine potential differences in attenuated psychotic symptoms, stress exposure, and cognitive schemas between Black and White American youth meeting CHR criteria. Controlling for group differences in age, analyses revealed that Black youth had more severe suspiciousness/persecutory ideas and grandiosity. Black youth also reported more perceived discrimination and daily stress. In addition, Black youth endorsed more negative schemas about others as well as more positive schemas about the self. Negative schemas mediated the effects of stress exposure on attenuated psychotic symptoms. However, race was not a significant moderator. Longitudinal studies are warranted to determine what sociocultural and clinical factors predict conversion among Black CHR youth and whether they have higher conversion rates compared to other racial/ethnic groups. Stress exposure, perceived discrimination, and negative schemas represent potential targets for culturally-adapted preventative interventions.

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Dedication

To people of color who were capable of this work, but due to systematic oppression and racism, did not have the opportunity to pursue their educational and occupational dreams.

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Introduction

Numerous studies demonstrate that Black Americans are diagnosed more often with psychotic disorders when compared to White American individuals (Bresnahan et al., 2007; Minsky et al., 2013; Nugent et al., 2012; Robins & Reiger, 1991; Schwartz & Blakenship, 2014). This disparity remains even after accounting for the influence of various indicators of socioeconomic status, such as income and educational level (Bresnhan et al., 2007). In addition, Black Americans endorse more severe positive psychotic symptoms including hallucinations and delusions (Adebimpe, 1981; Barrio et al., 2003; Mukherjee et al., 1983; Strakowski et al., 1996). Further, this racial difference is not restricted to the United States. Findings from the United Kingdom indicate that individuals of African descent also have higher rates of psychotic disorders than White Europeans (Kirkbride et al., 2012; Tortelli et al., 2015), even when controlling for socioeconomic disadvantage (Kirkbride et al., 2017). People of African descent in the UK also experience worse functional outcomes following psychosis onset when compared to their White counterparts (Morgan et al., 2017).

Although there is evidence suggesting that the disparity in rates of psychotic diagnoses may reflect racial bias in diagnostic practices (Gara et al., 2012; Veling et al., 2013), several lines of research demonstrate that diagnostic bias cannot fully explain the higher prevalence rates (Selten & Hoek, 2008). In a study in which clinicians were blind to the ethnicity of the participants, African Americans were still rated with more severe positive symptoms (Arnold et al., 2004). In addition, a recent meta-analysis found that Black Americans were 2.4 times more likely to receive a diagnosis of schizophrenia compared to White Americans, and rigorous structured diagnostic assessments did not eliminate this disparity (Olbert, Nagendra, & Buck, 2018).

Consistent with the findings on racial disparities in psychotic diagnoses, higher prevalence rates of subclinical psychotic symptoms have also been observed in general population samples of Black American youth compared to White American youth (DeVylder, Oh, Corcoran, & Lukens, 2014; Paksarian, Merikangas, Calkins, & Gur, 2016). These subclinical symptoms are attenuated manifestations of the positive symptoms (i e., hallucinations, delusions and thought disorder) that are the defining features of psychosis. Included among them are unusual thoughts and auditory perceptions, confusion of reality and fantasy, mind tricks, superstitions, persecutory and suspicious thoughts, and beliefs about predicting the future, mind reading, and thought control. Moreover, a nationally-representative study in the United States, based on the Collaborative Psychiatric Epidemiology Surveys, also found more subclinical psychotic symptoms among Black Americans when surveying the general population (Cohen & Marino, 2013). The aforementioned studies utilized self-report measures to assess psychotic-like experiences, demonstrating that racial differences were not a result of clinician/researcher bias.

In order to determine whether characteristics of the community are associated with racial disparities described above, researchers have examined the ethnic mix of the local population. The results indicate that among ethnic minority and immigrant populations in the United States, United Kingdom, and the Netherlands, the incidence of psychosis in ethnic minorities and immigrants is higher in areas where these groups make up a smaller proportion of the population, and lower in areas where they make up a larger proportion of the population, suggesting that factors associated with being a minority are associated with a greater risk of psychosis (Boydell et al., 2001; Faris & Dunham, 1939; Kirkbride et al., 2007; Veling et al., 2008). Based on these findings, factors other than diagnostic bias have begun to receive more attention in the literature

on ethnic disparities in psychosis. Central among these are social adversities unique to ethnic minorities (Veling, 2013).

Two primary theories that have been proposed to explain this ethnic disparity in psychosis and other serious mental disorders, namely the sociodevelopmental model (Morgan et al., 2010) and the social defeat model (Selten & Cantor Graae, 2005, 2007), focus on social adversity as a central factor contributing to elevated rates of psychosis among ethnic minorities, particularly individuals of African descent. The sociodevelopmental model posits that greater exposure to social adversity and trauma, particularly in childhood, interacts with underlying genetic vulnerability to disrupt neuromaturational processes, which in turn increases stress-sensitivity, and can result in an enduring vulnerability to psychosis (Morgan et al., 2010). This sociodevelopmental model also assumes that vulnerability is reflected in cognitive biases that become manifest in the event of further stress exposure. Similarly, the social defeat hypothesis proposes that the mesolimbic dopamine system is sensitized in individuals who experience chronic social defeat, defined as being in a subordinate position or of outsider status, thereby increasing risk for psychosis (Selten & Cantor-Graee, 2005; Selten, van der Ven, Rutten, & Cantor-Graae, 2013). Both of these theories emphasize role of stress response systems as primary mechanisms through which the experiences unique to ethnic minorities can yield higher rates of psychotic disorders compared to the majority population. While stress/adversity has figured prominently in theories of the etiology of psychosis, it is assumed to play a unique and greater role for ethnic minorities.

Psychosocial Trauma and Stress in the Development of Psychosis

Our current understanding of the etiology of psychosis includes trauma and stress as contributors to both vulnerability and illness progression. A recent meta-analysis demonstrated

that childhood trauma increased the likelihood of psychotic symptoms (Varese et al., 2012). In addition, retrospective studies included in the meta-analysis indicated that patients with psychosis were more likely to report a history of trauma compared to healthy controls. Childhood trauma has been shown to be associated with the severity of positive symptoms (e.g., hallucinations and delusions) among individuals with a psychotic disorder, whereas childhood neglect is associated with negative symptoms (Bailey et al., 2018). Although there is no consistent evidence to suggest that individuals diagnosed with psychotic disorders experience more stressful life events than healthy or psychiatric controls (Phillips et al., 2007; Walker et al., 2008), their perception of the events as stressful, undesirable, and/or uncontrollable has consequential effects on symptom severity (Horan et al., 2005; Renwick et al., 2009). In addition to stressful life events, a critical aspect of understanding the link between stress and psychopathology are what are referred to as "daily stressors or hassles" (Wright, Aslinger, Bellamy, Edershile, & Woods, 2019). Daily stressors have been defined as the "irritating, frustrating, and distressing demands … that plague us day in and day out" (Lazarus & DeLongis, 1983). Previous studies demonstrate that daily stressors are positively associated with the severity of both psychotic and mood symptoms in patients (see Phillips et al., 2007 for review).

In an effort to better understand the etiology of psychosis and identify targets for preventative interventions, a large focal point of research in the last decade has been on illness progression prior to the disorder's onset. The prodrome, also referred to as the clinical high-risk (CHR) period, is characterized by a functional decline and gradual emergence of attenuated positive symptoms. The Structured Interview for Prodromal Syndromes (SIPS; McGlashan, Miller, Woods, Hoffman, & Davidson, 2001), which assesses attenuated positive, negative, disorganized, and general symptomatology, is the most widely used assessment tool for

determining whether individuals meet CHR criteria. Around one-third of individuals who meet CHR criteria go on to develop a psychotic disorder within two years (Fusar-Poli et al., 2012). The CHR period has proven useful in elucidating the contributions of stress to the development of psychosis.

Among CHR youth, the prevalence rate of childhood trauma is estimated to be around 86%, which is significantly higher than in controls (Kraan, Velthorst, Smit, de Haan, van der Gaag, 2015). Several studies demonstrate childhood trauma to be predictive of conversion to psychosis among CHR youth (see Mayo et al, 2017 for review). However, in the NAPLS-2 sample, childhood trauma was not predictive of the transition to psychosis, which may be due to measurement limitations (Stowkowy et al., 2016). Similar to patient populations, findings have been mixed as to whether CHR individuals experience more stressful life events or daily stress (Holtzman et al., 2013). However, CHR individuals do report these life events and daily stressors to be more stressful and upsetting (Tessner et al., 2011; Phillips et al., 2012). Moreover, daily stressors have been shown to predict attenuated psychotic symptoms over time (Tessner et al., 2011). Using a large sample of CHR subjects and controls, initial findings from the North American Prodrome Longitudinal Study (NAPLS) revealed that CHR individuals reported a greater frequency of life events and also experienced the life events as more stressful compared to controls (Trotman et al., 2014). Moreover, greater frequency and degree of stressfulness of these life events differentiated between those who went on to develop psychosis and those who did not; youth who later met clinical criteria for psychosis manifested more frequent and distressing life events than those who did not. Interestingly, there was also some evidence of stress sensitization as individuals who experienced more stress from life events rated current daily stressors as more stressful (Trotman et al., 2014).

It is important to note that there is also evidence of sex differences in the experience of psychosocial stress, with females reporting exposure to more stress in nonclinical populations as well as among patients with psychosis. Related to this, it is hypothesized that females are more likely to experience an affective pathway to psychosis, characterized by greater stress-reactivity or sensitivity, whereas males are more likely to develop psychosis as a result of cognitive impairments (Myin-Germeys & van Os, 2007). Among individuals with psychosis, females reported more emotional reactivity to daily stressors compared to males, suggesting heightened stress-sensitivity (Myin-Germeys, Krabbendam, Delespaul, & van Os, 2004). Similarly, females reported experiencing more subjective stress from daily stressors compared to males in a sample of CHR youth (Trotman et al., 2014).

Biological Stress Response System and Psychosis

In understanding how stress influences risk for psychosis, a growing body of evidence suggests that the hypothalamic-pituitary-adrenal (HPA) axis is implicated in the development of psychotic disorders. In the neural diathesis-stress model of schizophrenia, it is posited that the HPA axis mediates the relation between stress exposure and psychosis through the augmenting effect of the HPA axis on dopamine (DA) synthesis and receptors (Walker & Diforio, 1997). Walker, Mittal, and Tessner (2008) review this body of literature which demonstrates compelling evidence for the involvement of the HPA axis in the development of psychosis. Research has shown that indices of HPA activity, namely cortisol and adrenocorticotropic hormone (ACTH), are elevated in patients with psychosis. Subsequent studies have provided further support for elevated cortisol levels (Garner et al., 2011). Consistent with these findings, glucocorticoid receptors appear to be downregulated in patients with psychosis suggesting reduced negative feedback on the HPA axis (Walker et al. 2008). Moreover, antipsychotic medications have been

shown to reduce cortisol and ACTH secretion (Venkatasubramanian et al., 2010; Walker et al., 2008). Reduced hippocampal volume, one the most consistently reported structural brain differences among individuals with psychotic disorders (Nelson, Saykin, Flashman, & Riordon, 1998), has been found to be associated with higher cortisol levels (Mondelli et al., 2010). Finally, hypercortisolemia induced by the administration of exogenous corticosteroids in high doses can trigger psychotic symptoms including hallucinations, delusions, and disorganized thought (Buchman, 2001; Warrington & Bostwick, 2006).

Only a handful of studies have examined HPA activity in CHR samples. Earlier studies were plagued by methodological limitations as well as small sample sizes, and thus yielded inconsistent results (Holtzman et al., 2013). However, recent findings with larger samples have begun to produce consistent results. In a longitudinal study examining salivary cortisol, CHR subjects who converted to psychosis had higher cortisol levels at the 7-10-month follow-up (Walker et al., 2010). However, this difference was not significant at the one-year follow-up after some were under treatment. In the largest sample of CHR youth to date, initial findings from NAPLS-2 revealed that CHR youth had higher levels of cortisol at baseline compared to controls (Walker et al., 2013). Moreover, among the participants who were followed for two years, CHR youth who converted to psychosis had higher levels of baseline cortisol compared to controls and CHR individuals whose symptoms remitted. Additional studies with sufficient numbers of CHR individuals are needed to replicate these findings.

Discrimination

Discrimination against African Americans has a long history in the United States and continues to be prominent in US society (Pettigrew, 1975). In a recent survey of 802 Black American adults conducted by the National Public Radio, Robert Wood Johnson Foundation, and

the Harvard T.H. Chan School of Public Health, 57% of Black adults reported being discriminated against in the workplace, 50% reported experiencing discrimination when interacting with police, 35% reported discrimination when trying to rent or buy housing, and notably, 32% reported experiencing racial discrimination when visiting a doctor's office or another health clinic (Harvard T.H. Chan School of Public Health, 2017). Discrimination may uniquely affect Black Americans due to the legacy of slavery and segregation, as well as ongoing systemic racism. When compared to Blacks in Brazil, for example, Black Americans report more experiences of ethno-racial exclusion and more racial discrimination. In contrast to racial discrimination, class and gender forms of discrimination are reported as less frequent among Black Americans (Lamont et al., 2016).

Discrimination is now conceptualized as a form of stress exposure with significant consequences (Clark, Anderson, Clark, & Williams, 1997). Discrimination has been associated with numerous adverse mental and physical health outcomes and is thought to partially explain many racial disparities in health including cardiovascular disease and hypertension (see Lewis, Cogburn, & Williams, 2015 for review). Discrimination provides a plausible socio-contextual framework for understanding elevated risk for physical and mental illness among African Americans, given the effects that discriminatory experiences have on HPA-axis function (Berger & Sarnyai, 2014; Busse, Yim, Campos, & Marsburn, 2017). In a recent meta-analysis, it was shown that the effect size for experimental studies that manipulated experiences with discrimination was larger than nonexperimental paradigms, and that there was a significant acute cortisol increase in response to perceived discrimination (Korous et al., 2017). This finding is consistent with previous reviews showing larger effect sizes for cortisol responses to evaluative and uncontrollable social threats.

Increasing evidence suggests that the experience of discrimination is implicated in the etiology of psychotic disorders. In a large Dutch sample, perceived, self-reported experiences of discrimination, were predictive of the onset of psychotic symptoms in a dose-response fashion (Janssen et al., 2003). Perceived discrimination has also been found to be associated with attenuated psychotic symptoms in a nonclinical sample of young adults (Anglin, Lighty, Greenspoon, & Ellman 2016) as well as youth experiencing psychosis-risk syndromes (Shaikh et al., 2016; Stowkowy, et al., 2016). Similarly, in a nationally-representative sample using the National Survey of American Life, major discriminatory events (e.g., victim of police abuse, denied a promotion, and discouraged from pursuing education) were associated with increased risk for psychotic-like experiences (Oh, Cogburn, Anglin, Lukens, & DeVylder, 2016). Findings from the NAPLS project suggest that, across sex and race, youth at clinical high-risk for psychosis experience more perceived discrimination than controls (Saleem et al., 2014). Moreover, perceived discrimination was also found to be predictive of later conversion to psychosis (Stowkowy et al., 2016). Perceived discrimination, however, was found not to be associated with ethnic minority status in prior NAPLS investigations, however, ethnic minority subgroups were not examined separately. Thus, effects may be obscured when ethnic minority groups are aggregated. Moreover, differences in the effects of various forms of discrimination would be expected, as would differences among various ethnic groups. For example, ethnic groups with higher average socioeconomic status, such as Asians in the US, and those characterized by family networks that immigrate together, such as Latinos, may be protected from the effects of discrimination in the US. Thus, research focused specifically on differences between African American and non-Hispanic White youth at risk for psychosis has greater potential for shedding light on relations between discrimination and psychosis.

There is evidence of sex differences in the effect of perceived discrimination on health outcomes. In a longitudinal study that followed African American youth through early adulthood, racial discrimination only predicted in an increase in depression and anxiety for males, but not females, suggesting that African American males are more susceptible to the psychological effects of discrimination (Assari, Moazen-Zadeh, Caldwell, & Zimmerman, 2017). Thus, sex differences need to be examined in the context of relation between discrimination and psychotic disorders as well.

Cognitive Schemas and Psychosis

Some cognitive models of psychosis posit that early social adversity and life events lead to disruptions in cognitive processes of attention, perception and judgement (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001). It is postulated that these enduring cognitive vulnerabilities, characterized by negative schemas about the self and others, can foster external attributions and ultimately increase susceptibility to the development of psychotic symptoms. This increased susceptibility is assumed to be a consequence of the sensitization of the mesolimbic dopamine system that assigns salience to these attributions and schemas. Both the sociodevelopmental and social defeat models include a cognitive interpretation or appraisal component.

Compared to healthy controls, individuals with psychosis report experiencing more negative schemas about the self and others (Fowler et., 2006; Taylor et al., 2014). Moreover, both negative schemas about the self and others were found to be predictive of paranoia, with the effect being strongest for negative schemas about others. Grandiose delusions on the other hand, were associated with positive views of the self (Fowler et al., 2006). In an interesting investigation across the psychosis continuum, first-episode psychosis patients and CHR youth

were found to endorse more negative self and other schemas when compared to a non-helping seeking group with only psychotic-like experiences (Taylor et al., 2014). Those with psychosis-risk syndromes also endorsed lower positive schemas about the self. Negative schemas about the self and others were also positively associated with unusual thoughts, perceptual abnormalities, and disorganized speech (Taylor et al., 2014). These findings are consistent with results from NAPLS, in which CHR youth reported experiencing more negative schemas about the self and others. Negative schemas were positively associated with positive symptoms severity, even after controlling for depressive symptoms (Stowkowy et al., 2015). Interestingly, negative schemas about others were associated with childhood psychological bullying, whereas negative schemas about the self were associated with childhood psychological and physical abuse. Although these findings are correlational and thus causality cannot be determined, they are consistent with cognitive models of psychosis which assert that adversity can alter one's schemas (Garety et al., 2001). In fact, in a smaller sample of CHR youth, negative schemas mediated the relation between social defeat and attenuated positive symptoms, suggesting that cognitive schemas partially explain the association between social adversity and attenuated psychotic symptoms (Stowkowy & Addington, 2012). In another sample of CHR youth, negative schemas about the self partially mediated the association between emotional neglect and being at clinical high-risk of psychosis (Appiah-Kusi et al., 2017). Given that African Americans experience higher rates of social adversity, cognitive schemas may be the mechanistic link between the experience of social adversity and increased risk of psychosis. No prior investigations, however, have specifically examined cognitive schemas among Black American CHR youth.

Theoretical Framework for Understanding Psychosis-Risk among Black American Youth

The role of stress exposure in the pathogenesis of psychosis is one of the most robust findings in the psychosis literature (see Pruessner, Cullen, Aas, & Walker, 2017 for a recent review). Although there is some evidence that misdiagnosis may partially explain the increased higher incidence of psychosis among individuals of African descent, including Black Americans, it is likely not the only explanation. Stress exposure is a compelling mechanism to explain heightened incidence rates among ethnic minorities and is the primary component of the sociodevelopmental and social defeat models (Morgan et al., 2010; Selten & Cantor Graae, 2005). Stressful experiences such as trauma, chronic discrimination, and negative life events may lead to sustained elevation of cortisol and subsequently sensitize the stress response and mesolimbic dopaminergic systems. Brain structures involved in the salience network (i.e., prefrontal cortex, amygdala, anterior cingulate, interior insula, and thalamus) may then undergo structural and functional changes which leads to changes in attributional processes and the development of sustained hypervigilance. This, in turn, could increase susceptibility to daily stressors and subsequent discriminatory experiences. It has been postulated that cumulative, chronic stressors can hard-wire erroneous attributions that become the basis for hallucinations and paranoid delusions (Berger & Sarnyai, 2014). Thus, investigation of the relations among stress indices, cognitive schemas, and psychosis-risk may shed light on the determinants of psychosis-risk in Black Americans.

Aims of the Present Study

The present study is focused on racial differences in the experiential (e.g., stress exposure) and cognitive schema determinants of attenuated positive symptom severity risk among youth who are at CHR of developing psychosis. Utilizing the NAPLS-2 dataset makes it possible to test hypotheses concerning the nature and mediators of the relation between ethnicity

and CHR symptom severity. The goal of the current project was two-fold. First, clinical, experiential and cognitive characteristics (attenuated positive symptoms, stressful experiences, and cognitive schemas) of Black American and White American youth, were compared. Second, relations among attenuated positive symptoms, stress indices, and negative schemas were examined, in order to test hypothesized mediation and moderation models. The hypotheses tested in the present study are:

(1) Consistent with previous findings in patient populations (Adebimpe, 1981; Barrio et al., 2003; Mukherjee et al., 1983; Strakowski et al., 1996)., it is hypothesized that Black CHR youth will endorse a greater severity of attenuated positive symptoms compared to White CHR youth.

(2) It is hypothesized that Black CHR youth will report more total life event stress, daily stress, perceived discrimination, and will have higher cortisol levels compared to White CHR youth due to experiencing greater social disadvantage as a marginalized group.

(3) It is also hypothesized that Black CHR youth will endorse more negative schemas about others, less positive schemas about others, more negative schemas about the self, and less positive schemas about the self.

(4) Consistent with the social developmental and social defeat models described earlier (Morgan et al., 2010; Selten & Cantor Graae, 2005), it is hypothesized that negative schemas about others will mediate the relation between perceived discrimination and suspiciousness/persecutory ideas (see Figure 1 in Appendix). It is expected that there will be positive associations between the variables.

(5) In the mediation model described above, it is hypothesized that race will moderate the relation between perceived discrimination and negative schemas about others in that the effect will be stronger for Black American youth due to the severity of discrimination being greater for racial/ethnic minorities (see Figure 2).

(6) It is hypothesized that indices of general stress exposure (e.g., life event stress and daily stress) will also have an effect on attenuated positive symptoms. Further, it is expected that negative schemas about the self will mediate these relations (see Figure 3).

Exploratory Aims:

(1) Although females with psychosis report experiencing more subjective stress and emotional reactivity compared to males (Myin-Germys et al., 2004; Trotman et al., 2014), racial discrimination predicted an increase in depression and anxiety for Black males, but not Black females (Assari, Moazen-Zadeh, Caldwell, & Zimmerman, 2017). Thus, it is hypothesized that race will moderate mediation models of the effect of stress exposure on attenuated positive symptoms through negative schemas, the direction of the moderating effect is unclear. Sex was examined as a moderator for the effects of both perceived discrimination and general stress exposure (e.g., life event and daily stress) on attenuated positive symptoms through negative schemas (see Figures 4 and 5).

(2) The HPA-axis is postulated to be one of the underlying neurobiological mechanisms for the effects of perceived discrimination on health. Cortisol was examined as a potential mediator of the effect of perceived discrimination on suspiciousness in the combined sample of Black and White CHR youth.

Method

Participants

Participants were recruited for the multi-site NAPLS-2 study, a 2-year longitudinal study of youth at CHR for psychosis (Addington et al., 2012). The total CHR sample consists of 764 participants (436 males, 328 females) ranging from 12 to 35 years of ages (*M*=18.5, *SD*=4.23). There were 111 participants who identified as Black/African American and 383 who identified as non-Hispanic White. Participants were recruited through referrals from clinical practitioners, mental health treatment centers, and media announcements. Inclusion criteria included being between the 12 and 35 years of age, meeting criteria for a prodromal syndrome per the Criteria of Prodromal Syndromes (COPS) or under the age of 19 and met criteria for schizotypal personality disorder. Exclusion criteria were 1) being outside the age of 12-35 years old, 2) meeting diagnostic criteria for an Axis I psychotic disorder, 3) having an IQ below 70, 4) a neurological disorder, or 5) a substance abuse disorder six months prior to baseline assessment. A written vignette was written up for each participant and presented on an all-site conference call where consensus was needed on symptom ratings and diagnoses for entry to the study.

Measures

Prodromal Symptomatology. The Structured Interview for Prodromal Syndromes (SIPS) was used to assess prodromal symptomatology (e.g., positive, negative, disorganized, and general symptoms) and the Scale of Prodromal Syndromes (SOPS) was used to designate clinical high-risk (CHR) criteria at baseline (Miller et al., 2003). Positive symptoms are used to determine whether or not an individual meets clinical high-risk criteria (CHR) for psychosis. Each symptom is rated from 0 to 6. Zero to two is characterized as normal/sub-syndromal, three to five indicates a prodromal level/CHR status, and six suggests conversion to psychosis. The

SIPS has shown to have good inter-rater reliability (ICC=0.75-0.95) and predictive validity in identifying those at risk for psychosis (Miller et al., 2003). Cronbach's alpha of the SOPS for the NAPLS sample was 0.76 indicating acceptable internal consistency. Trained interviewers who met reliability standards for NAPLS conducted the interviews (Addington et al., 2012). A prodromal syndrome was diagnosed if an individual met one of the following criteria: 1) manifested a rating of 6 on a positive symptom in the past 3 months, but did not meet criteria for a psychotic disorder (i.e., Brief Intermittent Psychotic Syndrome; BIPS); 2) received at least one rating of 3, 4, or 5 on a positive symptom (i.e., Attenuated Positive Symptom Syndrome; APSS), 3) had a first degree relative with a nonaffective psychotic disorder and has shown a functional decline over the past year (i.e., Genetic Risk and Deterioration Syndrome; GRDS), or 4) were >18 years of age at baseline and met criteria for Schizotypal Personality Disorder (SPD). CHR individuals could meet criteria for more than one prodromal syndrome.

Life Event Stress. Participants completed a modified version of the Psychiatric Epidemiology Research Interview Life Events Scale (LES; Dohrenwend et al., 1978). The LES was modified to exclude items that would be of unlikely relevance to the adolescent/young adult age range (e.g., getting a diverse, encountering serious financial loss). The modified version of the LES included 59-items pertaining to significant events or life changes that could be conceivably experience at any of the ages included in the study sample. The LES records the frequency and severity rating of each life event. Participants indicated whether specific life events occurred at any point in their lives. Interviewers then queried participants about their level of subjective stress for each LE endorsed on a 7-item Likert scale ranging from "occurred but was not very stressful" to "caused me to panic". Stress sensitivity to life events was computed by dividing the total subjective stress ratings by the number of life events endorsed.

Daily Stress. The Daily Stress Inventory (DSI) is a 58-item measure of stressors over the past 24 hours (Brantley et al., 1987). Items include "misplaced something", "encountered bad weather", "was interrupted during task/activity", and "had sleep disturbed". The DSI has been utilized with healthy and clinical adolescent samples with results supporting its validity and reliability with this age range (Gallaty & Zimmer-Gembeck, 2008; Tessner al.,2011; White & Shih, 2012). Participants indicated whether the event occurred and rated each on a 7-point scale ranging from "occurred but was not very stressful" to "caused me to panic". Stress sensitivity to daily stressors was computed by dividing the total subjective daily stress rating by the number of daily stressors endorsed.

Perceived Discrimination. Participants completed an adapted self-report measured in which they answered "yes" or "no" to whether or not they had experienced discrimination in the past year or in their lifetime because of the color of their skin, ethnicity, gender, age, appearance, disability, sexual orientation, religion, or another reason. Total perceived discrimination was calculated as the total number of "types of discrimination" items that were endorsed for lifetime. For Black youth, this was most often endorsed as discrimination based on skin color and/or ethnicity. Cronbach's alpha for the NAPLS sample was 0.84 indicating good internal consistency.

Cognitive Schemas. The Brief Core Schema Scale (BCSSS; Fowler et al., 2006), a 24-item self-report measure, assesses positive and negative schemas about the self (e.g., "I am successful") others (e.g., "Other people are nasty"). Each item is assessed on a 5-point Likert scale. Four scores are obtained: negative-self, positive-self, negative-others, and positive-others, each with a range of 0 to 24 (a higher score on the negative items indicates more maladaptive schemas, whereas a higher score on the positive items indicates more adaptive schemas). The

measure has been demonstrated to be valid in CHR populations (Addington & Tran, 2009) and has been shown to demonstrate good internal consistency with Cronbach's alpha ranging between 0.78 to 0.88 across the four schema scales (Fowler et al., 2006).

Saliva Collection and Cortisol Assay. Participants were given dietary instructions to refrain from consuming caffeine, alcohol, dairy products, and nonprescription medications the night prior and the morning of their study assessments. Saliva samples for cortisol assay were obtained three times during a three-hour period at the BL assessment. Multiple saliva samples were collected to derive a more accurate and reliable cortisol estimate. The saliva samples were stored in a -20°C freezer. Samples were rapidly thawed and centrifuged in preparation for assay. All samples were assayed for salivary cortisol (μg/dL) using a highly sensitive enzyme immunoassay (Salimetrics, State College, PA). The test uses around 25 μL of saliva for singlet determination, has a range of sensitivity from 0.007 to 1.8 mg/dL, and an average intra-assay and inter-assay coefficients of variation less than 10% and 15% respectively. All samples were assayed in duplicate. Initial analyses of the salivary assays revealed significant correlations among the three salivary cortisol samples indicating reliability of the assays (Walker et al., 2013). For the present study the mean value across the three salivary cortisol assays was be used as the index of cortisol.

Procedures

The study was approved by the Institutional Review Boards at all eight sites participating in NAPLS. Participants provided informed consent or assent (parental informed consent for minors). Participant were assigned a clinical rater who conducted semi-structured interviews and administered the self-report measures. Raters were experienced clinicians who demonstrated adequate reliability at routine reliability checks. Gold standard post-training agreement on the determining the prodromal diagnoses was excellent (kappa = .88). Once study inclusion

diagnosis and other criteria were established over a consensus clinical conference call, participants were enrolled for the baseline assessment. All data analyzed in the present study were collected during each participant's baseline assessment (i.e., first or second study visit).

Statistical Analyses

Statistical analyses were conducted using IBM SPSS Statistics version 25. Independent samples t-tests were used to test for group differences in age, years of education, and maternal education. A chi-square test was used to examine group differences in sex ratio. Age has been previously shown to be related to attenuated positive symptoms (Waford et al., 2015) and stress indices (Trotman et al., 2014) in CHR samples. Because of this association, and age differences between Black and White CHR youth, multivariate analyses of covariance (MANCOVA) with age as a covariate were performed to examine racial group differences in attenuated positive symptomatology, stress indices, and cognitive schemas. Pairwise comparisons with Bonferroni-adjusted p-values were used due to multiple comparisons. For the MANCOVA, a square root transformation was performed on perceived discrimination to increase normality and reduce skewness. Because transformation could not eliminate skew, conservative non-parametric Mann-Whitney U tests were also conducted to confirm results of the MANCOVAs. Spearman correlations were computed to examine relations among variables. Mediation and moderated mediation analyses were conducted using the PROCESS macro version 3 for SPSS (Hayes, 2018) to examine atemporal associations among variables. Total stress scores (e.g., total daily stress, total life event stress) were used as the stress indices for the mediation and moderation analyses.

Results

Sample Characteristics

Demographic and clinical characteristics of the sample are presented in Table 1 below. There were no significant differences in sex, $\chi^2(1) = 0.479$, p=0.489, or years of education, t(490) = 1.94, p=0.053, between Black and White CHR youth. However, Black CHR individuals were significantly older, $t(492)$=4.10, p<.001.

Group Comparisons of Prodromal Symptomatology

MANCOVA. Using Pillai's trace, there was a significant effect of age on the severity of attenuated positive symptoms, V = .041, $F(5,487)$= 4.614 p < .001. Also, using Pillai's trace, there was a significant effect of race on the severity of attenuated positive symptoms, V = .040, $F(5,487)$ = 4.07, p < .002. When controlling for age, separate univariate tests revealed that Black CHR youth had more severe suspiciousness/persecutory ideas, $F(1,491)$ = 4.10 p = .043, partial η^2 = .008 and grandiose ideas, $F(1,491)$ = 14.787, p < .001, partial η^2 = .029. There were no significant differences in unusual thought content, $F(1,491)$ = .060, p = .806, partial η^2 = .000, perceptual abnormalities, $F(1,491)$ = .161, p = .688, partial η^2 = .000, or disorganized communication, $F(1,497)$ = 3.01, p = .084, partial η^2 = .006.

Nonparametric Mann-Whitney U Test. Black CHR youth had more severe suspiciousness/persecutory ideas, U = 18,522.50, p = .004, grandiose ideations, U = 17,814, p < .001, and disorganized communication, U = 19,555, p = .032, compared to White CHR youth. There were no significant group differences in unusual thought content, U = 21,841.00, p = .669, or perceptual abnormalities, U = 23,726, p = .316. Thus, consistent with prediction, Black youth were rated as having more severe positive symptoms, though the group differences did not reach significance for two of the symptoms in the positive domain.

Group Comparisons of Stress Indices and Perceived Discrimination

MANCOVA. Using Pillai's trace, there was a significant effect of age on stress indices $V = .182$, $F(7,361) = 11.49$, $p < .001$. Using Pillai's trace, there was also a significant effect of race on stress indices, $V = .081$, $F(7,361) = 4.52$, $p < .001$. When controlling for age, separate univariate tests revealed no significant differences in the number of life events endorsed, $F(1,367) = 0.86$, $p = .355$, partial $\eta^2 = .002$, in total subjective stress from life events, $F(1,367) = 0.70$, $p = .402$, partial $\eta^2 = .002$, or in life event stress sensitivity, $F(1,367) = 0.70$, $p = .154$, partial $\eta^2 = .000$. In contrast, Black CHR youth endorsed a significantly greater number of daily stressors, $F(1,367) = 7.52$, $p = .006$, partial $\eta^2 = .020$, reported more total stress from daily stressors, $F(1,367) = 12.23$, $p < .001$, partial $\eta^2 = .032$, and had greater sensitivity to daily stressors, $F(1,367) = 4.78$, $p = .029$, partial $\eta^2 = .013$. Black CHR youth also endorsed more perceived discrimination, $F(1,367) = 13.05$, $p < .001$, partial $\eta^2 = .034$. This difference in perceived discrimination remained even when controlling for both age and suspiciousness/persecutory ideas in a separate ANCOVA, $F(1,451) = 11.91$, $p = .001$.

Nonparametric Mann-Whitney U Tests. There were no significant group differences in the number of life events endorsed, $U = 17{,}980.50$, $p = .795$, or in the subjective total stress experienced from life events, $U = 17{,}389.50$, $p = .906$. There was also no significant difference in the number of DSI events endorsed, $U = 12{,}495.50$, $p = .095$. However, Black CHR youth did report experiencing more subjective stress from the daily stressors, $U = 11{,}127.50$, $p = .028$, compared to White CHR youth. Thus, although there was no significant difference in stress sensitivity to life events, $U = 16{,}320.50$, $p = .310$, Black CHR youth were more sensitive to daily stress, $U = 10{,}896.50$, $p = .014$. Black CHR youth also reported more lifetime perceived discrimination, $U = 14{,}519.50$, $p < .001$, compared to White CHR youth.

Group Comparison of Cortisol Levels

The average salivary cortisol level across the three samples at the baseline assessment was regressed on the time at which the first sample was taken. The unstandardized residual was then used for analyses with cortisol in order to control for time of salivary sampling onset due to circadian changes. Univariate analysis of covariance controlling for age revealed no significant group difference in cortisol levels between Black and White CHR youth, $F(1,329) = 0.035$, $p = .852$.

Group Comparisons of Cognitive Schemas

MANCOVA. Using Pillai's trace, there was a significant effect of age on cognitive schemas, $V = .023$, $F(4,449) = 2.70$, $p = .030$. In addition, using Pillai's trace, there was a significant effect of race on cognitive schemas, $V = .084$, $F(4,449) = 10.32$, $p < .001$. When controlling for age, separate univariate tests revealed that Black CHR youth endorsed more negative schemas about others, $F(1,452) = 13.35$, $p < .001$, partial $\eta^2 = .029$, and more positive schemas about the self, $F(1,452) = 14.70$, $p < .001$, partial $\eta^2 = .031$. There were no significant group differences in negative schemas about the self, $F(1,452) = 2.61$, $p = .107$, partial $\eta^2 = .006$, or in positive schemas about others, $F(1,452) = 0.20$, $p = .654$, partial $\eta^2 = .000$.

Nonparametric Mann-Whitney U Test. There was no significant difference between groups in negative schemas about the self, $U = 20{,}538.00$, $p = .217$ or in positive schemas about others, $U = 20{,}401.00$, $p = .244$. Black CHR youth endorsed more positive schemas about the self, $U = 14{,}869.50$, $p = .001$, and negative schemas about others, $U = 14{,}622.50$, $p < .001$.

The Relations among Stress Indices, Symptom Severity, and Cognitive Schemas

Spearman correlations among attenuated positive symptoms, stress indices, and cognitive schemas for Black and White CHR youth are presented in Table 2. As shown in Table 2 below,

significant relations between stress measures and symptoms were generally positive, with the number of significant coefficients greater for the White subsample, partially due to the larger number of participants in this group. Also, consistent with previous reports (Kelleher et al., 2012; Laroi et al., 2019), positive symptoms are associated with age, with all but perceptual abnormalities increasing with age. This is to be expected given that psychotic symptoms are gradually emergent in adolescence/young adulthood. Using Fisher's r to z transformation, exploratory analyses revealed that the relation between grandiose ideas and life event stress was significantly stronger for Black CHR youth, $z = 2.10$, $p = .018$. In contrast, the relation between daily stress and perceptual abnormalities was stronger for White CHR youth, $z = -2.59$, $p = .005$ as well as the relation between sensitivity to daily stress and perceptual abnormalities, $z = -2.83$, $p = .004$.. Further, the relation of age with number of life events was significantly stronger for Black youth than White youth, $z = 3.3.8$, $p < .001$. Age was also more strongly related to total stress from life events for Black youth compared to White youth, $z = 2.77$, $p = .006$.Thus, with age, there is a greater accumulation of stressful life events for Black CHR youth.

Greater negative self- and other-schemas are generally positively associated with LE and DSI stress in both groups. In contrast, associations of positive self- and other-schemas with the stress measures tend to be inverse and less often significant.

Mediation Model

Mediation analysis was first conducted using a combined sample of Black and White CHR youth (see Figure 1). There was a significant total atemporal association between perceived discrimination on suspiciousness/persecutory ideas, $b = 0.11$, $p = .0005$ (path c). Perceived discrimination was atemporally associated of negative schemas about others, $b = 0.79$, $p < .001$ (path a). Negative schemas about others was associated with suspiciousness/persecutory ideas, *b*

= 0.06, p < .001 (path b). There was a significant indirect effect of perceived discrimination on suspiciousness through negative schemas about others, *b* = 0.04, BCa CI [0.024, 0.068]. The atemporal relation between perceived discrimination and suspiciousness remained significant when accounting for negative schemas about others, b = 0.07, p = .037 (path c). This represents a partial statistical mediation.

Moderated Mediation Models

Moderated mediation analysis was conducted using the combined sample of Black and White CHR youth (see Figure 2). To test the moderating effect of race, negative schemas about others were regressed in a model on perceived discrimination, race, and the interaction term. Within this model, there was no significant effect of perceived discrimination on negative schemas about others, b = 0.50, p = .519. There was also no significant effect of race on negative schemas about others, b = -0.72, p = .081. Therefore, there was no moderating effect of race on the atemporal relation between perceived discrimination and negative schemas, as the interaction term was not significant, b = 0.03, p = .771. However, there were significant conditional effects of the atemporal association between perceived discrimination and suspiciousness when accounting for their relations to persecutory ideas through negative schemas about others, for both Black CHR youth, b = 0.04, BCa CI [0.004, 0.074), and White CHR youth, b = 0.04, BCa CI [0.021, 0.065]. There remained a significant atemporal association between perceived discrimination and suspiciousness/persecutory ideas, b = 0.07, p = .037. There was also as significant atemporal relation between negative schemas about others and suspiciousness/persecutory ideas, b = 0.06, p < .001.

A second moderated mediation analysis was conducted using the combined sample of Black and White CHR to test whether sex moderated the atemporal association between

perceived discrimination and negative schemas. Sex was not found to be a significant moderator as the interaction term was not significant, $b = 0.21$, $p = .416$ (see Figure 13).

Exploratory Mediation and Moderated Mediation Models: Stress Exposure and Negative Schemas about the Self

Daily Stress. For the Black and White groups combined, there was a significant atemporal association between total daily stress and the total attenuated positive symptom score, $b = 0.01$, $p < .001$. There was a significant relation between subjective daily stress and negative schemas about the self, $b = 0.04$, $p < .001$. There was also a significant association between negative schemas about the self and attenuated positive symptoms, $b = 0.09$, $p = .010$, as well as a significant indirect effect of daily stress on attenuated positive symptoms through negative schemas about the self, $b = 0.003$, BCa CI [0.001, 0.006]. There remained a significant association between daily stress and attenuated positive symptoms, $b = 0.001$, p =.040. Thus, negative schemas about the self partially statistically mediated the association between daily stress on attenuated positive symptoms (see Figure 14). In the moderated mediation analysis, sex was not found to moderate the association between daily stress and negative schemas about the self, $b = -0.001$, $p = .888$.

Life Event Stress. There was a significant relation between life event stress and the total attenuated positive symptom score, $b = 0.007$, $p = .001$. Life event stress was also related to negative schemas about the self, $b = 0.02$, $p < .001$. There was a significant association between negative schemas about the self and attenuated positive symptoms, $b = 0.10$, $p = .002$. There was a significant relation between stress and attenuated positive symptoms when accounting for relations with schemas about the self, $b = 0.002$, BCa CI [0.001, 0.003]. The association between between life event stress and attenuated positive symptoms remained significant , $b = 0.01$, p

=.019 Thus, negative schemas about the self partially statistically mediated the effect of life event stress on overall attenuated positive symptoms (see Figure 15). In the moderated mediation analysis, sex was not found to moderate the association between life event stress and negative schemas about the self, $b = 0.01$, $p = .072$.

Exploratory Mediation Model: Cortisol

There was no significant an association between perceived discrimination and cortisol, $b = 0.002$, $p = .429$. There was also no significant relation between cortisol and suspiciousness, $b = 0.48$, $p = .539$. Moreover, there was not a significant association between perceived discrimination and suspiciousness when accounting for cortisol, $b = 0.001$, BCa CI [-0.004, 0.009]. Thus, cortisol does not statistically mediate the relation between perceived discrimination and suspiciousness (see Figure 16).

Discussion

The present study sought to characterize the differences between Black and White CHR youth in clinical presentation and to identify potential determinants of heightened risk for positive symptoms among Black CHR youth. Consistent with the hypotheses, when controlling for age, Black CHR youth were rated as having more severe positive symptoms overall, with suspiciousness/persecutory ideas and grandiose ideas showing significant group differences with univariate tests. Contrary to the hypotheses, using MANCOVA to control for age, there were no significant differences in unusual thought content, perceptual abnormalities, or disorganized communication.

These findings are partially consistent with studies of diagnosed patient populations which found that Black American patients with psychosis had more severe positive symptoms,

particularly delusions and hallucinations (Adebimpe, 1981; Barrio et al., 2003; Mukherjee et al., 1983; Strakowski et al., 1996). However, the present study findings regarding perceptual abnormalities suggest the heightened severity of hallucinations observed in Black patients with psychosis is not yet apparent in Black youth at CHR for psychosis. Consistent with the present findings, at least two previous reports have documented higher levels of grandiosity in ethnic minority youth compared to those from the majority group (Adriaanse et al., 2015; Eilbrecht et al., 2015). Increased grandiosity, as discussed below, may be a reflection of defensive or self-protective reaction to minority status.

The present finding that Black CHR youth are rated as having more severe suspiciousness/persecutory ideas carries significant implications, as it is one of the most highly predictive positive symptoms for later conversion to psychosis (Cannon et al., 2008, 2016). The present study did not examine conversion rates to determine whether Black CHR youth were more likely to develop psychosis. This is a logical next step, given that a recent study based on a CHR sample from New York showed that Black and Asian CHR participants were more likely to transition to psychosis than whites (Brucato et al., 2017). Thus, further investigation is needed to determine whether this finding on conversion will be replicated in the NAPLS-2 sample.

Hypotheses regarding stress exposure were partially confirmed, as Black CHR youth endorsed more perceived discrimination, number of daily stress, total daily stress, and had higher daily stress sensitivity scores. However, there were significant difference between Black and White CHR youth in in the number of life events endorsed, total life event stress, or in life event stress sensitivity. The group comparisons were relatively consistent using both parametric and nonparametric approaches. Moreover, there was no significant difference in baseline cortisol levels between Black and White CHR youth.

Black CHR youth endorsed more negative schemas about others. Surprisingly, they also endorsed more positive schemas about the self which is consistent with higher grandiosity scores as well. Consistent with prediction, negative schemas about others partially statistically mediated the atemporal association between perceived discrimination and suspiciousness. However, race was not a significant moderator of the relation between perceived discrimination and negative schemas about others. Thus, the strength of the association between perceived discrimination and negative schemas did not vary by race, but Black CHR subjects experienced more discrimination leading to more severe suspiciousness. Cortisol did not statistically mediate the atemporal association bewteeen perceived discrimination and suspiciousness.

It is noteworthy that the relations of age with the number of life events and total life event stress were significantly stronger for Black than White CHR youth. This could reflect contextual factors, such as socioeconomic deprivation that contribute to life event stress or greater changes in the perception of life event stress with increasing age in Black CHR youth. For both racial groups, however, there were significant increases in perceived discrimination and negative self-schemas with age, suggesting that experiences that result in perceptions of discrimination and negative self-schema increase to the same extent with age in both racial groups.

Evidence for the Sociodevelopmental and Social Defeat Models?

As discussed earlier, the sociodevelopmental model suggests that problematic social experiences and contexts create a pathway to psychosis that explains the higher rates of psychosis among ethnic minorities (Morgan et al., 2010). Specifically, the model proposes that early life adversity interacts with underlying genetic risk to disrupt brain development (e.g., dopaminergic system) and increase stress-sensitivity which, in turn, contributes to an enduring liability to psychosis that is characterized by social-cognitive biases, psychotic-like experiences,

and affective disturbances. This liability becomes manifest in the presence of further cumulative stressors and/or prolonged substance use (e.g., cannabis). The social-defeat hypothesis posits that social disadvantage and adversity, which results from experiencing chronic subordination and/or having an outsider status from the majority group, lead to defeatist beliefs and sensitization of the mesolimbic dopamine system (Selten and Cantor Graae, 2005).

The present study's findings, although correlational and cross-sectional, are consistent with both the sociodevelopmental and social defeat models, as Black CHR youth reported experiencing greater stress exposure in the form perceived discrimination and daily stress. Interestingly, Black CHR youth were more sensitive to daily stressors compared to White CHR youth. Within the sociodevelopmental framework, this could suggest that Black CHR youth are more sensitive or reactive to daily stressors, potentially due to negative sociocultural experiences that led to dysregulation of the HPA-axis and/or disruption in the dopaminergic system. However, the role of the HPA axis as the mediating neurobiological process was not confirmed in the present study as cortisol did not statistically mediate the association betweeen perceived discrimination and suspiciousness. Future studies may want to consider experimental designs as used by Korous and colleagues (2017), to assess real-time changes in cortisol responses to discriminatory stressors and effects on attenuated positive symptoms in CHR youth.

The sociodevelopmental and social defeat models also lead to the prediction that Black CHR youth experience more stressful life events, but this was not found. There are two potential explanations for this. The most plausible is based on sample differences; studies suggesting higher rates of stress exposure for Blacks than whites were based on sample of diagnosed psychotic patients, rather than CHR samples. As shown above, life event stress is cumulative, so that older subjects endorse more life event stressors, and this relation is more pronounced for

Blacks. Further, the mean ages of CHR samples, compared to diagnosed psychotic patients, tends to be younger, and many are minors who are dependent on their parents. Thus, some of the most stressful events resulting from ethnic minority status, such as failure to gain employment, loss of employment, and housing discrimination, would be underrepresented in the younger CHR samples. For example, in the United Kingdom, Mallett and colleagues (2002) found that unemployment at first contact with mental health services and separation from a parent during childhood differentiated African-Caribbean individuals with psychosis from White British patients, as well as controls. Another study in the United Kingdom examined relations between markers of social disadvantage in the areas of education, housing, employment, social networks, relationships, and living arrangements, and psychosis in Black Caribbean and White British individuals (Morgan et al., 2008). A linear relationship was found between cumulative social disadvantage, both current and long-term disadvantage, and odds ratio of having a psychotic disorder. Furthermore, markers of social disadvantage were higher among Black Caribbean and White British individuals.

Thus, while the sociodevelopmental model suggests that a wide range of problematic social experiences contribute to the development of psychosis, many of these (e g., social exclusion/isolation employment and housing discrimination, and socioeconomic disadvantage) would be expected to be more common among Black youth as they pass through young adulthood. As a result, the stressors linked with ethnic minority status may play a greater role in determining the transition to psychosis, than in determining the severity of attenuated positive symptoms in youth.

It is also possible that the stressors associated with ethnic minority status are not captured by the LE stress scale used in the present study. More comprehensive measures of LE stress that

include familial and neighborhood disadvantage may be needed to understand elevated rates of attenuated positive symptoms among Black youth. Further, markers of social disadvantage are likely not to be purely socioeconomic in nature, but also reflect systemic and institutional racism. It will also be of interest for future research to delineate the effects of independent versus potentially illness-dependent stressors when making inferences regarding the causality of stress exposure in the development of psychosis (Trotman, et al., 2014).

Problematic social experiences and contexts experienced more commonly by individuals from marginalized groups can be conceptualized as *minority stress*. Mirowsky and Ross (1989) described minority stress as related to the "juxtaposition of minority and dominant values and the resultant conflict with the social environment experienced by minority group members". Similarly, Meyer (2003) defined minority stress as the excess stress experienced by individuals from stigmatized social categories as a result of their minority social position. The experience of minority stress is not unique to racial/ethnic minorities, as increasing evidence demonstrates that sexual and gender minority individuals also experience more adverse health outcomes including higher rates of psychosis (Bolton and Sareen, 2011; Institute of Medicine, 2011; Meyer, 2003; Russell & Fish, 2016).

Although altered cognitive biases are included in the sociodevelopmental model, the social defeat model puts a greater emphasis on the interpretation of stressors as defeating. This interpretation of being socially defeated is the cognitive mechanism through which stress exposure and social disadvantage increase risk for psychosis. Accumulating evidence supports social defeat as a mediator between subjective stress and risk for psychotic disorders (see Selten, van der Ven Rutten, & Cantor-Graee for review). For example, a recent study in Korea

demonstrated that social defeat partially mediates the relation between childhood trauma and paranoid ideation in a psychiatric population (Seo & Choi, 2018).

The present study's findings were consistent with the social defeat model, in that Black CHR youth reported more negative schemas about others. However, they did not differ in terms of negative beliefs about the self when compared to White CHR youth, and actually had more positive beliefs about the self and showed more severe grandiose ideations. These latter findings appear to be incongruent with the social defeat hypothesis as one would expect defeated individuals to have negative beliefs about themselves as well. This could be explained by Black CHR youth endorsing more grandiose ideas. Positive self-schemas and grandiose ideas could be a self-protective psychological response against discrimination and other adverse social experiences. Future studies that also assess social defeat through measures such as Social Defeat Scale (Gilbert & Allen, 1998) are needed to tease apart differences between racial/ethnic groups in the nuanced relations among these constructs.

Nevertheless, the present study suggests that negative schemas represent a cognitive mechanism through which stress exposure confers risk for psychopathology, as negative schemas about others partially mediated the effect of perceived discrimination on suspiciousness. However, this mediational effect was not greater for Black Americans, which might be expected according to the sociodevelopmental and social defeat models. Instead, the present findings indicate that, while Black CHR youth experience more discrimination than white CHR youth, the adverse effects and mediators of perceived discrimination do not differ as a function of race. Because the measure of discrimination used in the present study was not limited to discrimination based on race, it captured a broader range of discrimination perceptions (e g., sex, disability, etc.). The advantage of this is that it afforded the opportunity to determine whether

discrimination adversely affects whites similar to Blacks. Alternatively, the absence of race differences in the direct and mediated effects of perceived discrimination could be due to the fact that the perceived discrimination measure did not specifically target racial discrimination, as discussed further in the limitations section.

Additional support for the role of cognitive schemas came from the exploratory analyses which revealed that negative schemas about the self partially mediated the effects of both life event stress and daily stress on attenuated positive symptoms. These effects, however, were not moderated by sex or race. These findings are consistent with a study by Jaya, Ascone, and Lincoln (2016) which found that negative schemas mediated the relation between social adversity and positive symptoms in a large multi-national community sample. Although evidence is growing to suggest that cognitive schemas are generally implicated in the development of psychosis, further work is needed to clarify whether these cognitive mechanisms differ by race.

Implications for Treatment

The present findings identify stress exposure and cognitive schemas as potential treatment targets, especially for Black Americans and more broadly, youth who report experiencing perceived discrimination. Despite research demonstrating that indices of stress including stressful life events, daily stress, and cortisol secretion contribute to the development of psychotic illness (Holtzman et al., 2013; Pruessner, et al., 2017), no targeted interventions have been specifically developed to reduce stress in individuals with psychotic or CHR syndromes. In addition, stress is rarely included as a measured outcome that is measured in intervention studies of psychosis. However, there are some promising interventions including mindfulness-based interventions whose demonstrated efficacy in improving symptoms and functioning may be a result of stress reduction. Mindfulness-based interventions encourage

individuals to accept symptoms as transient experiences that do not define them, rather than engaging in maladaptive processes such as rumination. In adolescents, mindfulness was shown to be buffer the effects of everyday stressors against symptoms of anxiety and depression (Marks, Sobanski, & Hine, 2010), demonstrating the potential effectiveness of these approaches in youth. To our knowledge, there have been no empirical studies evaluating whether mindfulness interventions are beneficial for CHR youth. Stress reduction should be included as a primary treatment target in the development of preventative interventions for CHR individuals. Indices of stress sensitivity and reactivity could provide useful benchmarks of treatment efficacy along with more traditional outcome measures for symptoms and functioning.

With accumulating evidence, including the present study, to suggest that cognitive schemas mediate the effects of stress exposure on attenuated positive symptoms, cognitive treatment approaches are also warranted. Cognitive-behavioral interventions have been shown to reduce the likelihood of conversion to psychosis among CHR youth (Stafford, Jackson, Mayo-Wilson, Morrison, & Kendall, 2013) and thus, represent the best current treatment approach for CHR youth. Helping individuals develop more balanced and realistic beliefs, even in the context of previous discrimination or trauma, could prove fruitful in decreasing stress reactivity and threat sensitivity during the CHR period. Intervention research is needed to determine whether they are alternative efficacious treatment approaches. Furthermore, additional research is warranted to investigate the acceptability and effectiveness for racial/ethnic minority youth.

Given the adverse effects of perceived discrimination on physical health and its contributions to the development of psychosis, interventions that specifically address perceived discrimination are especially needed. One possible treatment target to reduce the negative consequences of perceived discrimination is ethnic identity, the quality of affiliation and

commitment to one's ethnic group (Phinney & Ong, 2007). In a study of non-help-seeking racial and ethnic minorities, individuals who experienced discrimination with a high ethnic identity reported fewer attenuated positive symptoms compared to those with low ethnic identity (Anglin, Lui, Espinosa, Tikhonov, & Ellman, 2018). Moreover, among Dutch adolescents, weak ethnic identity was associated with a higher risk of reporting psychotic-like experiences (el Bouhaddani, van Domburgh, Schaefer, Doreleijers, & Veling, 2019). Thus, ethnic identity appears to be a protective factor against adverse effects of exposure to discriminatory experiences including psychotic symptoms. Interventions focused on strengthening ethnic identity could reduce the negative consequences that discrimination has on the development of attenuated positive symptoms.

Strengths & Limitations

There are several notable strengths to the study. First, the present study draws from the largest sample of CHR youth to date (i.e., NAPLS-2). As a result, there was sufficient statistical power to examine racial differences and detect small effects. No other reports have specifically characterized the clinical high-risk syndrome and examine potential mechanisms of psychosis-risk among Black American youth. In addition, few studies previously investigated relations between stress exposure and cognitive schemas in a CHR sample.

In addition to the strengths, there are some limitations that must be taken into account when interpreting the results of the study. The questionnaire used to assess perceived discrimination is not as comprehensive and detailed as measures often used in the racial health disparities literature. Thus, our findings regarding perceived discrimination may be an underestimate of discrimination specific to race. Future studies examining the role of discrimination in the development of psychosis would benefit from more comprehensive

measures such as the Everyday Discrimination Scale (Williams, Yu, Jackson, & Anderson, 1997), which has been shown to be appropriate for Black American youth (Clark, Coleman, and Novak, 2004). In addition, correlations of attenuated positive symptoms with other measures were moderate, which may reflect the restricted range of positive symptoms characterizing CHR samples. As discussed by Pruessner and colleagues (2017), CHR status is defined by the presence of subclinical psychotic signs that are severe enough to meet standardized criteria, but not so severe that they cross the clinical threshold into psychosis. In the NAPLS protocol, this means having an attenuated positive symptom rating from 3-5 on at least one of the five attenuated symptoms on the SIPS. This criterion limits the variability within CHR samples and the ability to detect effects that would be observed in random samples from the general population that represent the entire range from healthy to CHR to psychotic. Additionally, the sample consists of a wide age range (12-35) and thus, age could be moderating relations between various indices. Although age was a covariate, due to Black American youth being significantly older, age could be moderating relations between variables within racial/ethnic groups. The main challenge in testing for age moderation effects in CHR samples is that the numbers of subjects at the extremes of the age distribution are small because the onset of prodromal symptoms is uncommon in those under 14 and over 25 years of age. Nonetheless, the issue of age moderation warrants attention in future research given the consequences that age-at-onset of psychosis has for illness prognosis and functional outcomes (Immonen, Jääskeläinen, Korpela, & Miettunen, 2017). Finally, the present study is based on baseline, cross-sectional data, and thus cannot directly address causality. In addition, mediation and moderation analyses using cross-sectional data collected through self-report have interpretative limitations because the measurement of the constructs is not temporally ordered (Winer et al., 2016). Prospective longitudinal studies are

needed to further elucidate the mechanisms contributing to heightened psychosis-risk among Black Americans. In addition, ambulatory or experience sampling methodologies are likely to be beneficial in assessing the effects of stressful experiences and cognitive schemas on symptoms in real time.

Conclusions and Future Directions

The present study showed that, compared to White CHR youth, Black CHR youth report experiencing more daily stress, negative schemas about others, and perceived discrimination. They also endorse more severe suspiciousness/persecutory and grandiose ideas. Based on mediational analyses, it appears that the association between perceived discrimination and attenuated symptoms is partially accounted for by negative schemas for both White and Black CHR youth. Examining Black American youth at clinical high-risk for psychosis provides an opportunity to characterize the presentation of psychosis-risk syndromes and identify potential mechanisms of heightened-risk. Identification of these factors and mechanisms of risk is essential to the development of preventative interventions. In addition to examining whether or not Black American CHR youth have higher conversion rates to psychosis compared to other racial/ethnic groups, it will also be important to identify predictors of conversion to psychosis within samples of Black American youth. This will be the best way to identify what factors are contributing to conversion and inform the development of new or modification of existing preventative interventions for Black Americans specifically. The challenge of this, of course, will be recruiting enough Black CHR youth to have an adequate sample size to examine predictors of conversion. Moreover, it will be important for future research to include normative samples when examining racial/ethnic differences among CHR youth to better understand whether racial/ethnic differences are specific to those at risk of developing psychosis or are

evident in the general population as well. While attenuated positive or "psychotic-like" symptoms occur at a lower rate and more restricted range of severity in healthy youth, they are measurable in community samples of adolescents (Ronald, Sieradzka, Cardno, Haworth, McGuire, & Freeman, 2013). Thus, similar patterns of relations among stressful experiences, schemas, and psychotic-like experience may be observed in non-CHR samples.

It is hoped that this study reignites research examining sociocultural and environmental factors that contribute to the development of psychosis so that we can more adequately understand and address why marginalized groups such as racial/ethnic minorities and sexual and gender minorities experience elevated rates of psychosis in the United States and around the world. These health disparities deserve our attention and our resources.

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Appendix

Table 1. Demographic and clinical characteristics of the CHR groups. *Note:* Group means. [a] = significant group difference after controlling for age. Sens = Sensitivity.

Variable (mean ± SD)	Black Youth (*n* = 111)	Non-Hispanic White Youth (*n* = 383)
Age	20.23 ± 5.10	18.37 ± 3.93 [a]
(range)	(12-35)	(12-32)
Sex (n, %)		
Male	62 (55.9%)	228 (59.5%)
Female	49 (44.1%)	155 (40.5%)
Years of Education	11.95 ± 2.82	11.36 ± 2.77
Unusual Thought Content	3.35 ± 1.33	3.34 ± 1.29
Suspiciousness	3.09 ± 1.32	2.67 ± 1.50 [a]
Grandiose Ideas	1.50 ± 1.50	0.90 ± 1.24 [a]
Perceptual Abnormalities	3.03 ± 1.32	3.15 ± 1.43
Disorganized Communication	2.01 ± 1.40	1.68 ± 1.45
Number of Life Events	28.99 ± 25.33	26.58 ± 19.36
Life Event Stress	113.69 ± 119.21	97.31 ± 77.74
Life Event Sens.	3.78 ± 1.00	3.63 ± 1.10
Number of Daily Stressors	26.39 ± 16.23	21.71 ± 11.66 [a]
Daily Stress	102.15 ± 85.80	70.47 ± 53.12 [a]
Daily Stress Sens.	3.50 ± 1.35	3.03 ± 1.17 [a]
Perceived Discrimination	3.61 ± 2.14	2.43 ± 2.16 [a]
Positive Schemas – Self	13.04 ± 6.06	10.64 ± 5.58 [a]
Negative Schemas - Self	5.93 ± 5.39	6.57 ± 5.66
Positive Schemas - Others	9.24 ± 5.67	9.57 ± 5.07 [a]
Negative Schemas - Others	10.21 ± 6.70	7.41 ± 5.85[a]

Table 2. Spearman rho correlations among attenuated positive symptom scores, indices of stress exposure, and cognitive schemas in Black CHR youth and White CHR youth (in parentheses). *Note*. $p <$ *.05, **.01, ***.001 [a] indicates group difference in magnitude of coefficients. LE = Life Events. Sens = Sensitivity. Positive Self = Positive schemas about the self.

Variable	Number of Life Events	LE Stress	LE Stress Sens.	Number of DS	Daily Stress	Daily Stress Sens.	Perceived Discrimination	Positive Self	Negative Self	Positive Others	Negative Others	Age
Unusual Thoughts	-.01 (.05)	.04 (.10)	.03 (.08)	.11 (.11)	.05 **(.14*)**	-.05 **(.14*)**	.12 (.01)	.13 (-.04)	.02 **(.17**)**	.04 (-.07)	**.24*** **(.14**)**	.05 **(.11*)**
Suspiciousness	.17 **(.11*)**	.16 **(.20***)**	.03 **(.23***)**	.06 (.06)	.17 **(.16**)**	.22 **(.20***)**	.12 **(.15**)**	**-.26**** **(-.12*)**	.16 **(.19***)**	**-.22*** **(-.20***)**	**.22*** **(.26***)**	.14 **(.14**)**
Grandiose Ideas	**.29**** (-.04)[a]	**.22*** (-.02) [a]	-.09 (.04)	.12 (-.01)	.05 (-.06)	-.12 -.09	.17 (.03)	**.27**** **(.19***)**	-.18 (-.05)	.14 (-.01)	-.02 (.04)	**.20*** (.09)
Perceptual Abnormalities	-.05 (.01)	.04 (.07)	-.13 (.10)	-.07 **(.12*)**	-.15 **(.18**)**[a]	-.15 **(.21***)**[a]	.14 (.09)	.05 (-.11*)	-.02 (-.17**)	.09 **(-.16**)**	.02 **(.13*)**	-.11 **(-.12*)**
Disorganized Communication	.16 (.09)	.04 (.10)	-.13 (.06)	.01 (.05)	-.01 (.05)	-.03 .02	.15 **(.11*)**	.09 (.01)	.17 (.10)	.20 (.05)	.03 (.08)	.03 **(.15**)**
Number of Life Events	--	--	--	--	--	--	**.42***** **(.38***)**	-.06 **(.15**)**	.16 **(.30***)**	-.13 **(-.11*)**	.08 **(.15**)**	**.67***** **(.40***)**[a]
Life Event Stress	--	--	--	--	--	--	**.42***** **(.45***)**	-.15 **(.15**)**	**.27**** **(.42***)**	-.13 **(-.12*)**	.15 **(.28***)**	**.66**** **(.44***)**[a]
Life Event Stress Sens.	--	--	--	--	--	--	.16 **(.36***)**	**-.28**** **(-.11)**	**.43***** **(.39***)**	.02 (-.10)	**.27**** **(.35***)**	.17 **(.23***)**
Number of Daily Stressors	--	--	--	--	--	--	**.39***** **(.36***)**	-.08 (-.06)	**.35**** **(.23***)**	.12 **(-.12*)**	.21 **(.28***)**	.05 (.08)
Daily Stress	--	--	--	--	--	--	**.37**** **(.39***)**	-.20 **(-.14*)**	**.50***** **(.39***)**	.03 **(-.16**)**	**.29*** **(.42***)**	.08 **(.16**)**
Daily Stress Sens.			--			--	.12 **(.26***)**	**-.31**** **(-.15**)**	**.54***** **.47*****	-.10 **(-.13*)**	**.26*** **(.44***)**	.04 **(.20***)**
Perceived Discrimination	-	--	--	--	--	--	--	-.02 (-.09)	**.27**** **(.29***)**	-.002 **(-.15**)**	.18 **(.29***)**	**.29**** **(.20***)**
Positive Schemas - Self	--	--	--	--	--	--	--	--	--	--	--	-.07 (-.01)

Negative Schemas – Self	--	--	--	--	--	--	--	--	--	--	--	**.27** (.20***)**
Positive - Others	--	--	--	--	--	--	--	--	--	--	--	-.03 (-.003)
Negative - Others	--	--	--	--	--	--	--	--	--	--	--	.00 **(.14**)**

Figure 1. Hypothesized mediated effect of negative schemas about others on the atemporal association between perceived discrimination and suspiciousness for the combined CHR sample (i.e., both Black and White participants).

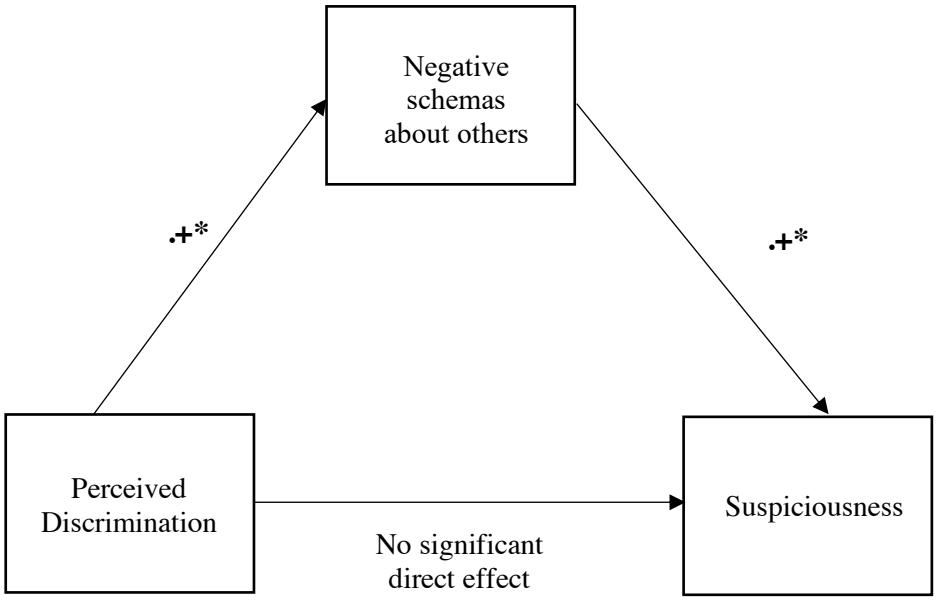

Figure 2. Hypothesized moderated mediational effect on the atemporal association between perceived discrimination and suspiciousness.

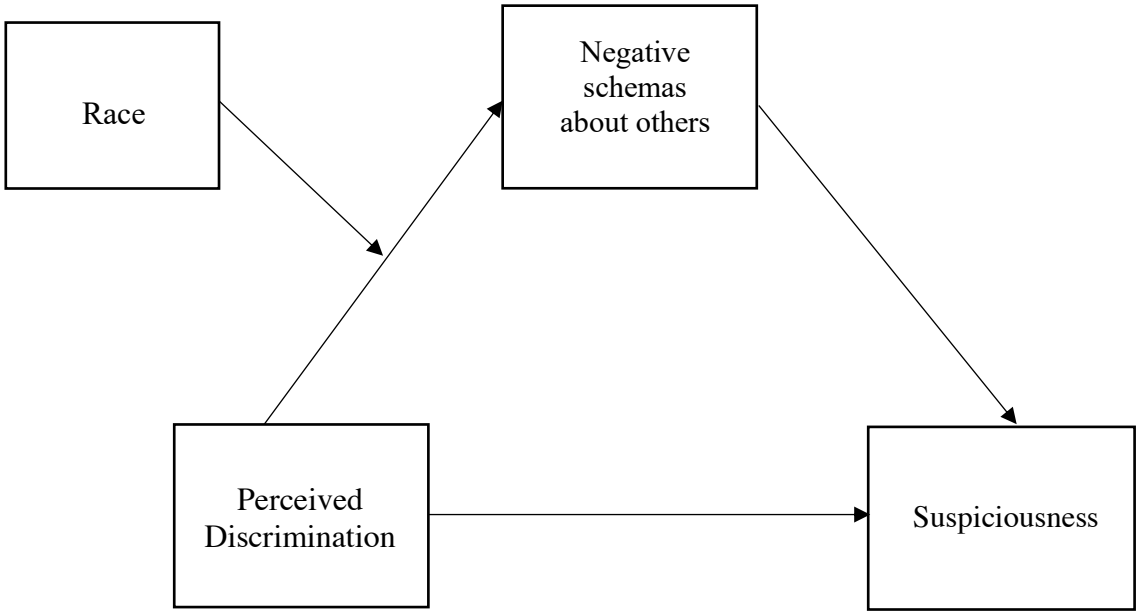

Figure 3. Hypothesized mediated effects of negative schemas about the self on the atemporal association between general stress exposure (e.g., life event stress and daily stress) and attenuated positive symptoms for combined CHR sample (i.e., both Black and White participants).

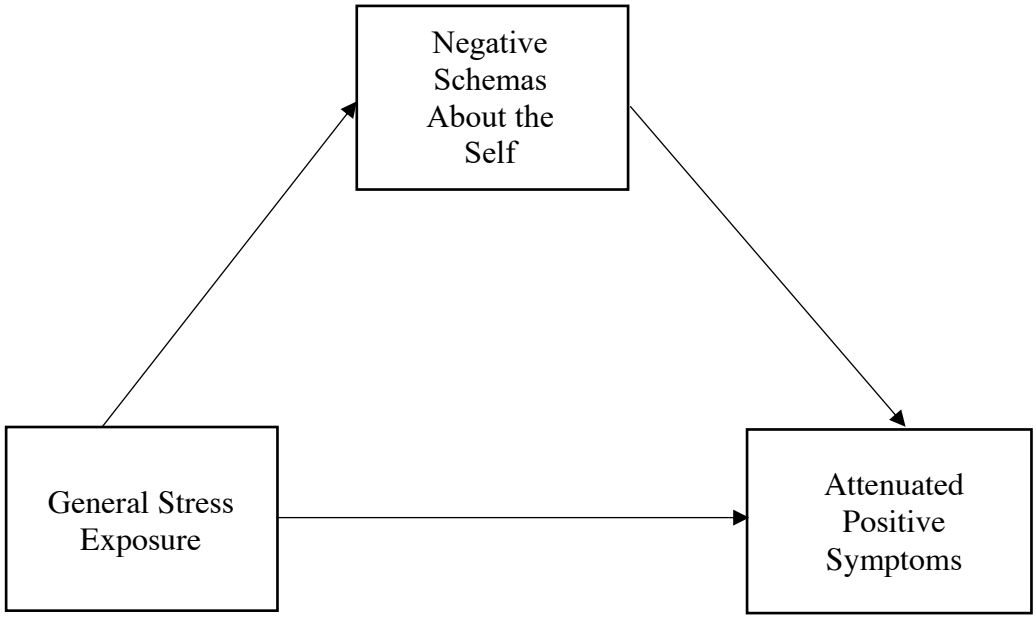

Figure 4. Proposed moderated mediation model of the atemporal association between perceived discrimination and suspciousness.

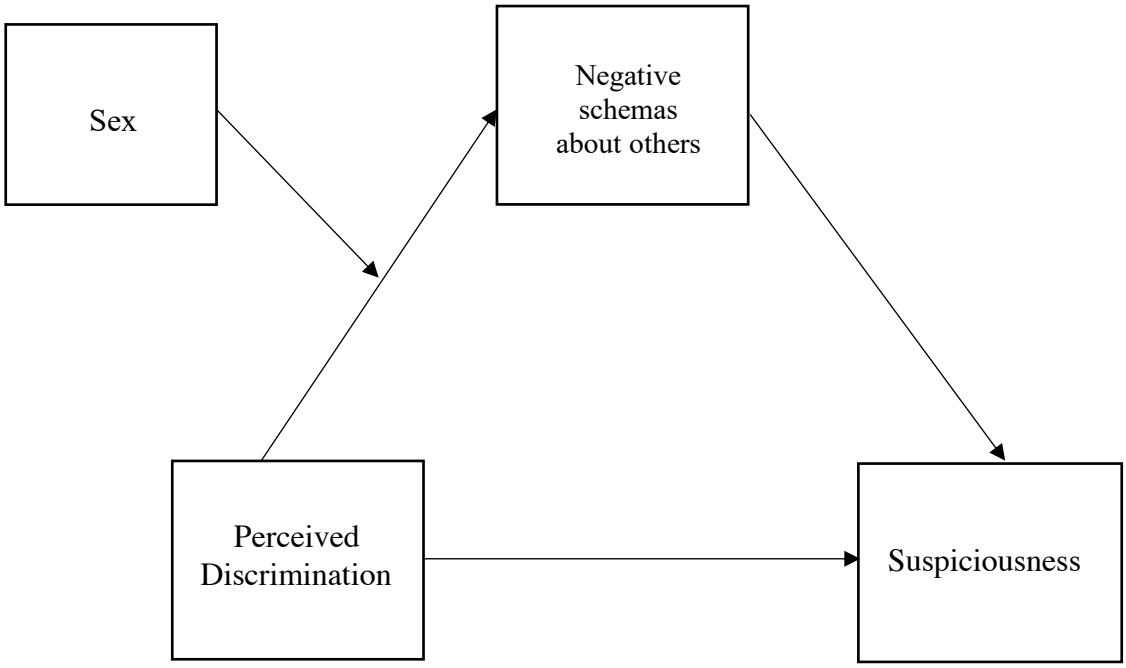

Figure 5. Proposed moderated mediation model of the atemporal association between general stress exposure and attenuated positive symptoms with negative schemas about the self as a mediator and sex as a moderator.

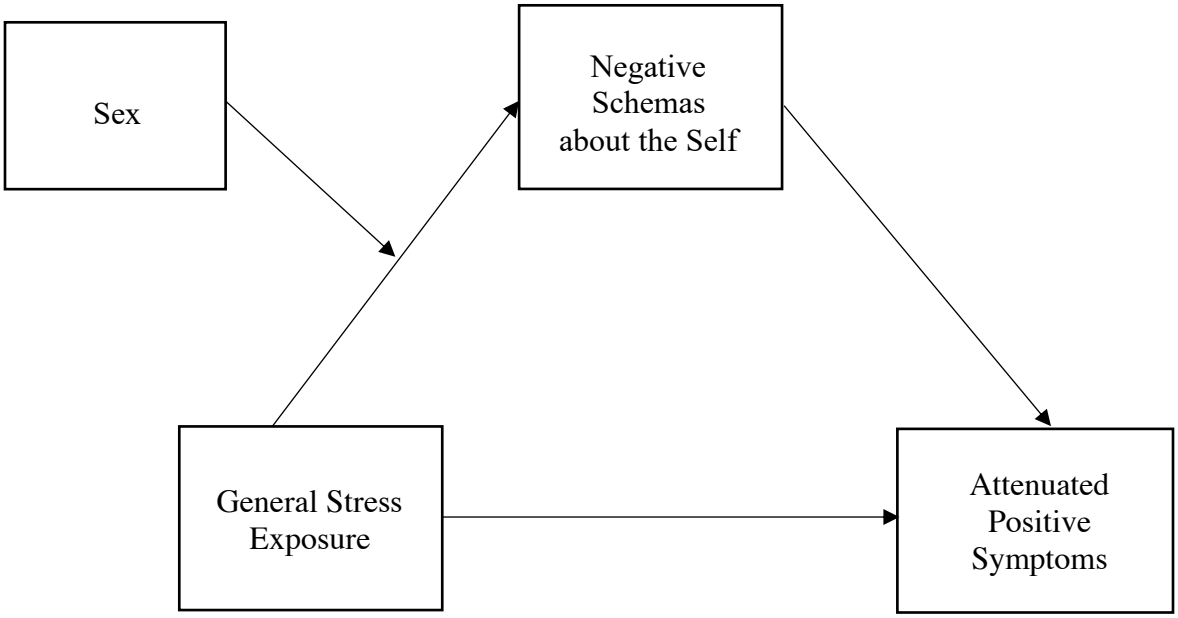

Figure 6. Group mean differences in attenuated positive symptoms between Black and White CHR youth (Error bars = SEM)

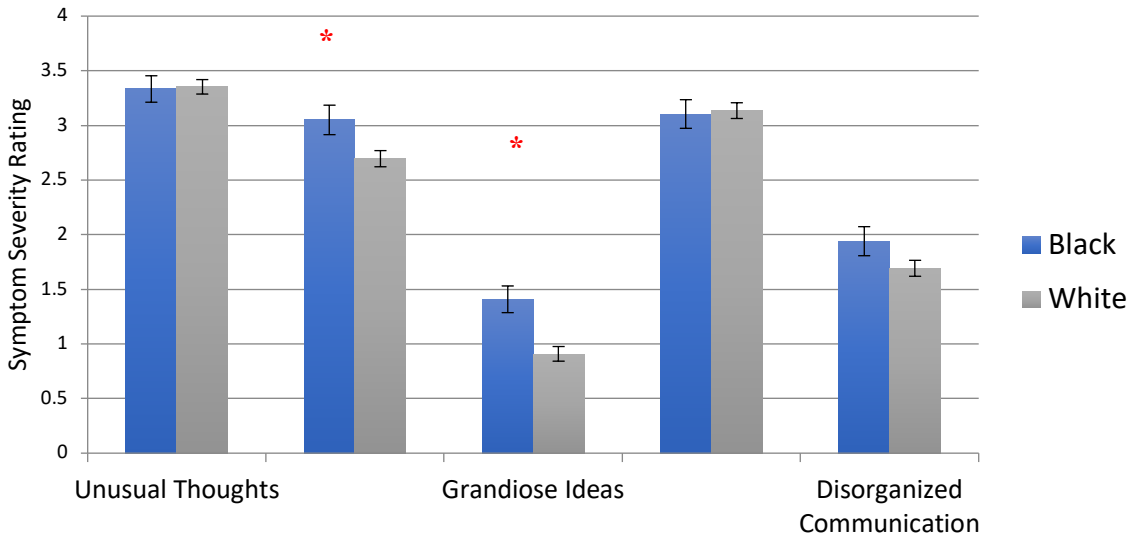

Figure 7. Group means in the number of life events and daily stressors endorsed by Black and White CHR youth (Error bars = SEM)

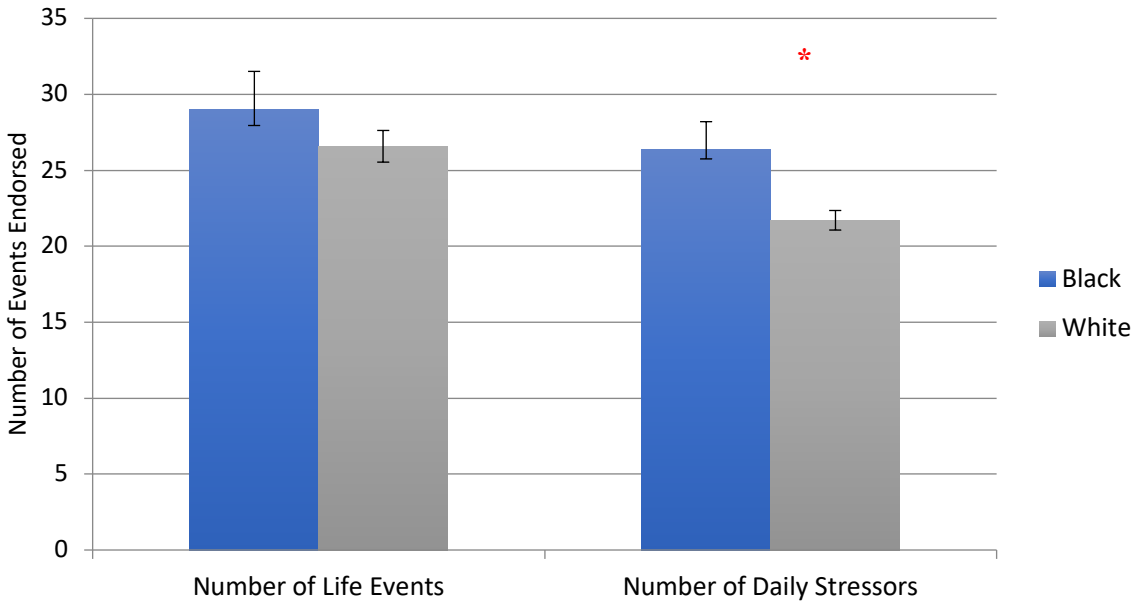

Figure 8. Group mean differences in the amount of life event and daily stress endorsed by Black and White CHR youth (Error bars = SEM)

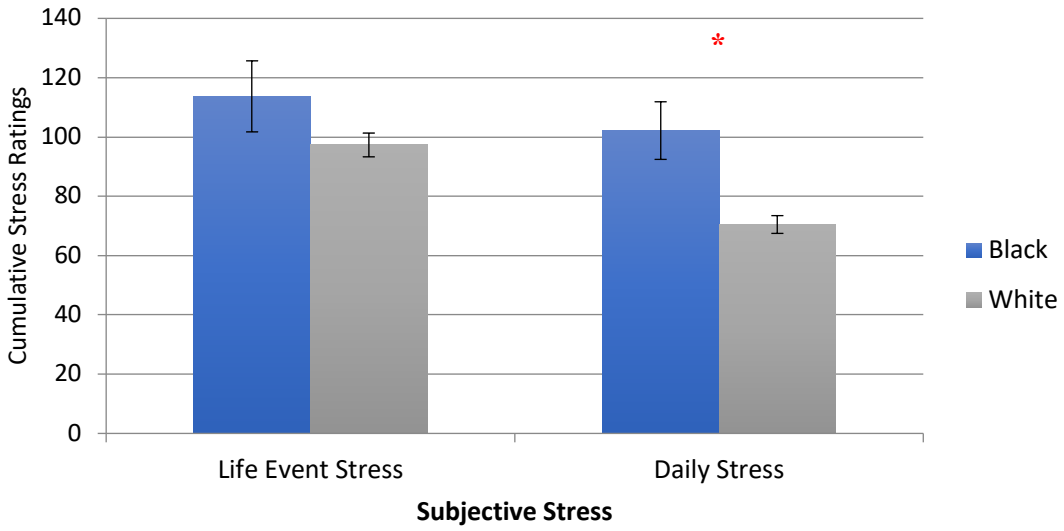

Figure 9. Group mean differences in perceived discrimination between Black and White CHR youth (Error bars = SEM)

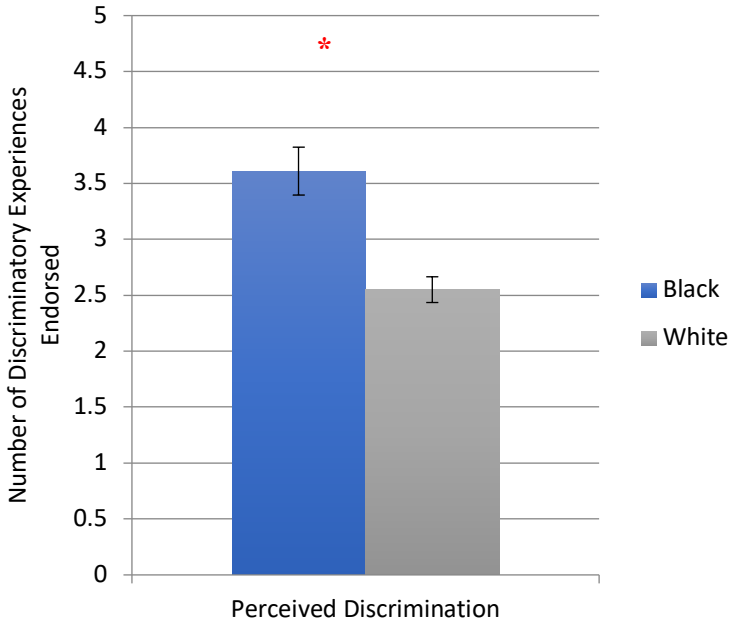

Figure 10. Group mean differences in cognitive schemas between Black and White CHR youth (Error bars = SEM)

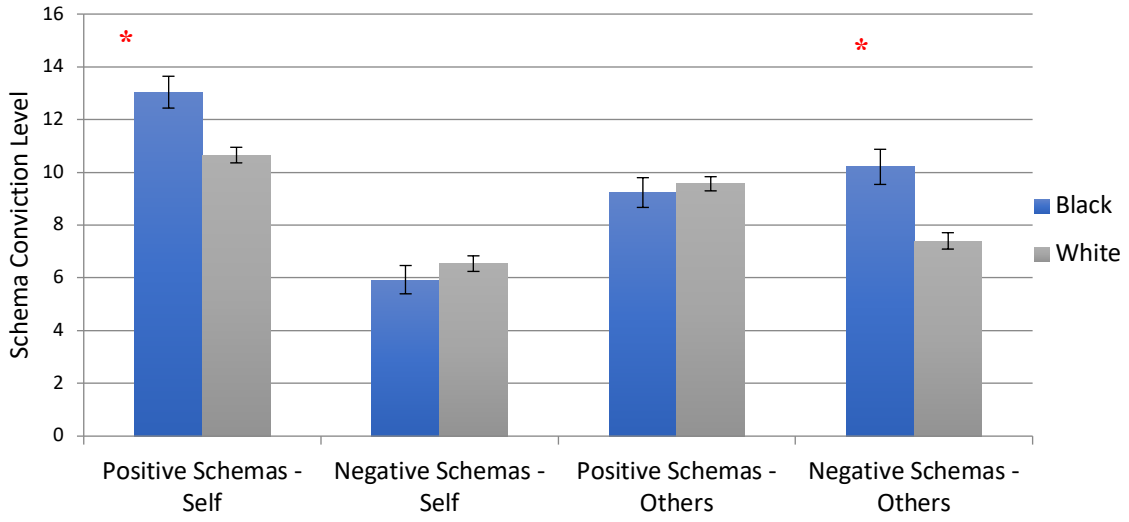

Figure 11. Mediation model of the atemporal association between perceived discrimination and suspiciousness through negative schemas about others (b=unstandardized coefficients)

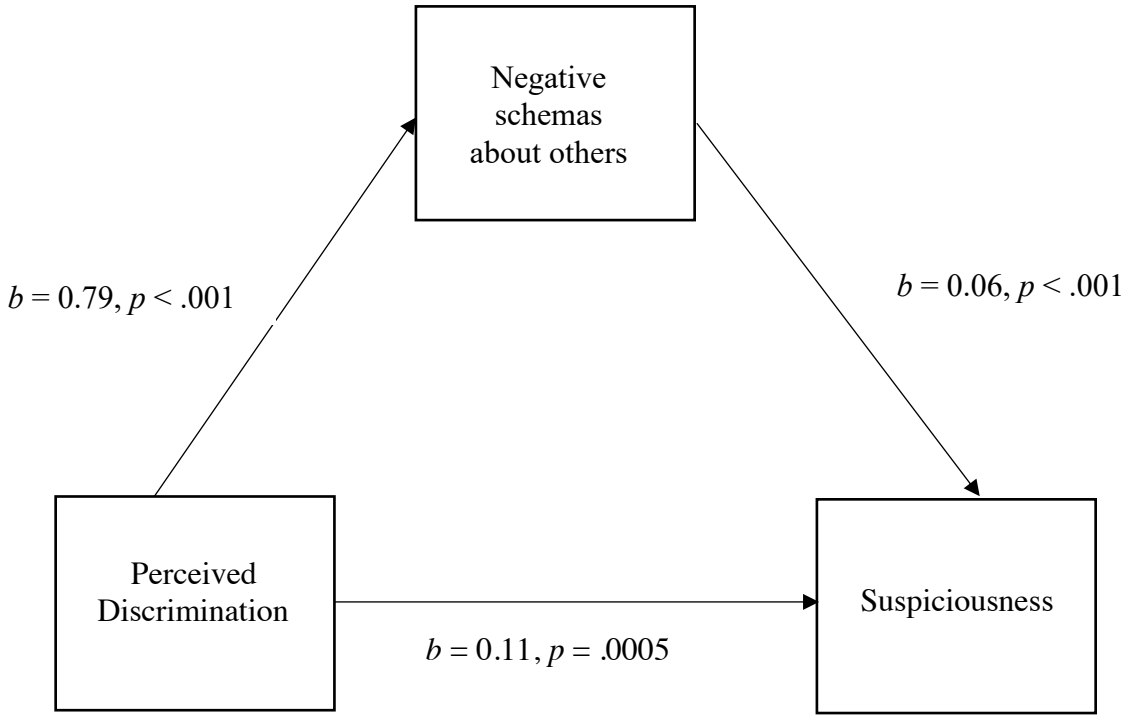

Figure 12. Moderated mediation model of the atemporal association between perceived discrimination and suspiciousness through negative schemas about others moderated by race (b=unstandardized coefficients)

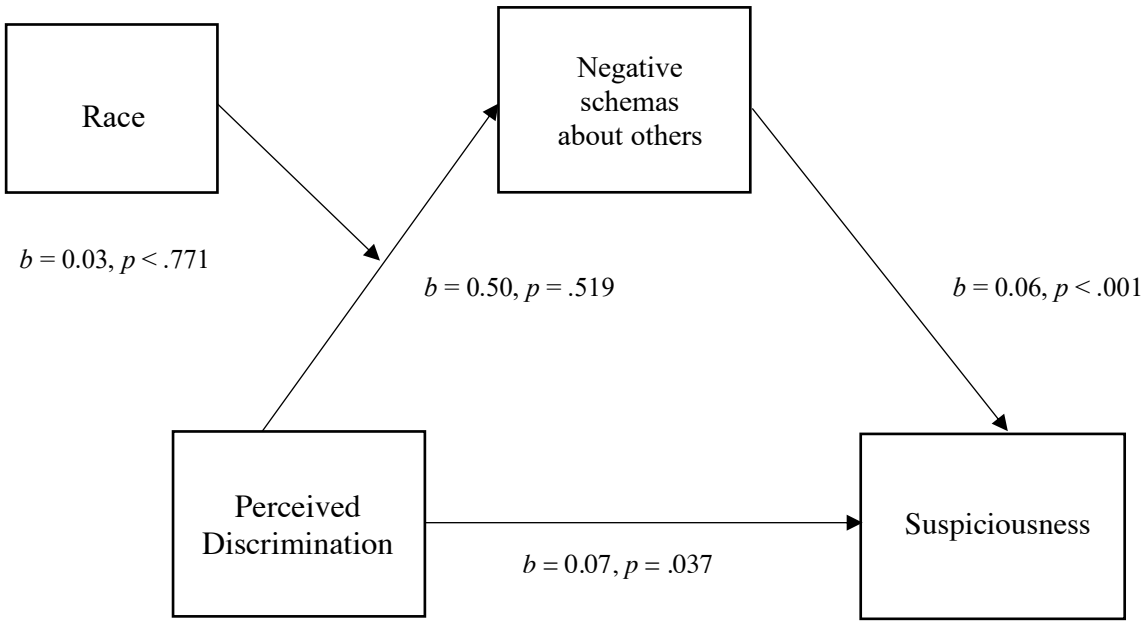

Figure 13. Moderated mediation model of the atemporal association between perceived discrimination and suspiciousness through negative schemas about others moderated by sex (b=unstandardized coefficients)

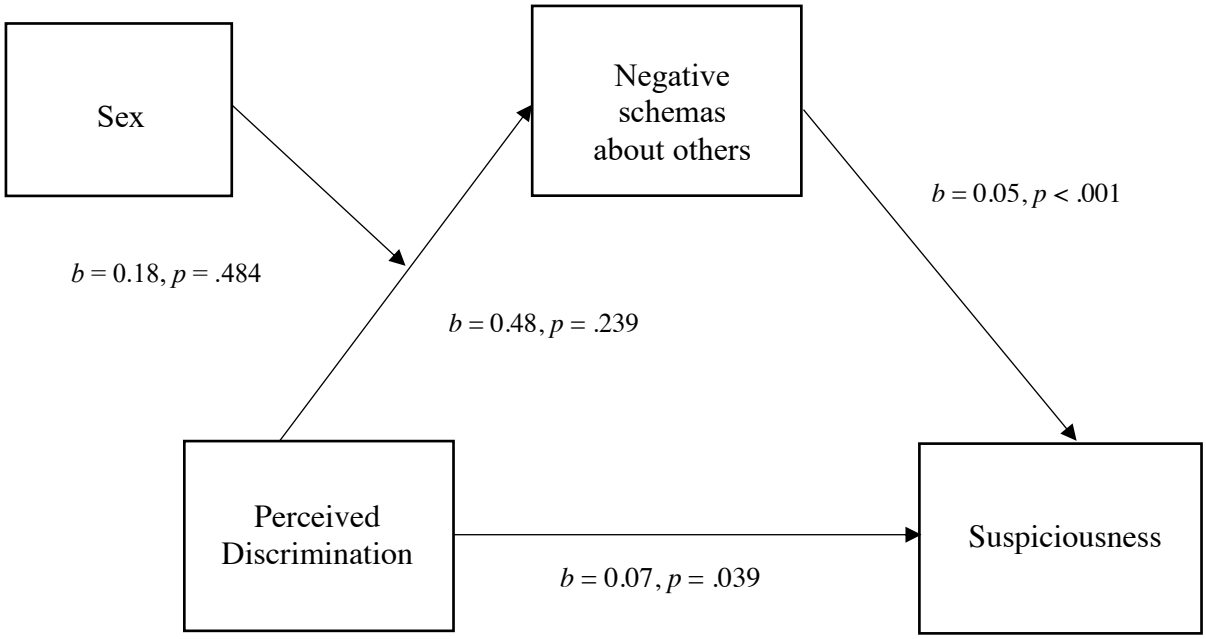

Figure 14. Mediation model of the atemporal association between daily stress and attenuated positive symptoms through negative schemas about the self (b=unstandardized coefficients)

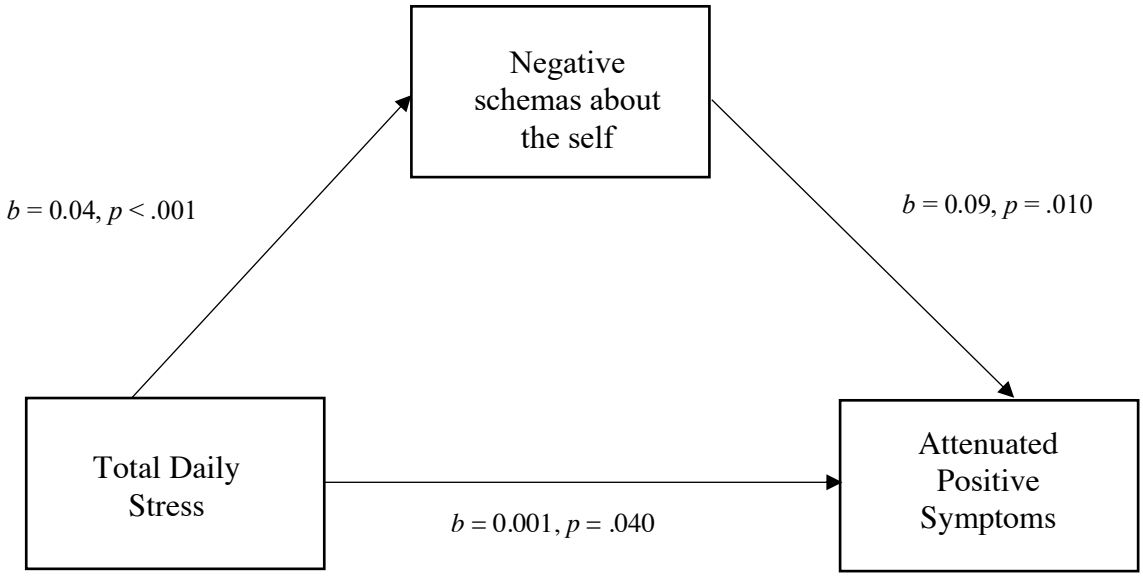

Figure 15. Mediation model of the atemporal association between life event stress and attenuated positive symptoms through negative schemas about the self (b=unstandardized coefficients)

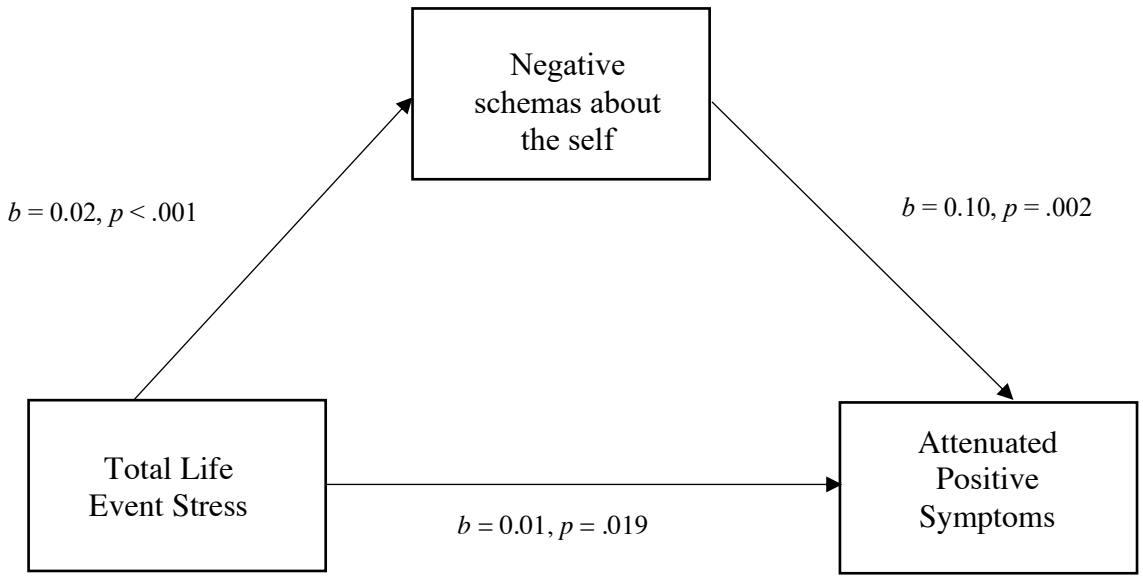

Figure 16. Mediation model of the atemporal association between perceived discrimination and suspiciousness through cortisol (b=unstandardized coefficients)