

**LOCUS OF CONTROL AND DEPRESSION AS MECHANISMS IN THE
RELATIONSHIP BETWEEN RACIAL DISCRIMINATION AND
SUBSTANCE USE**

by

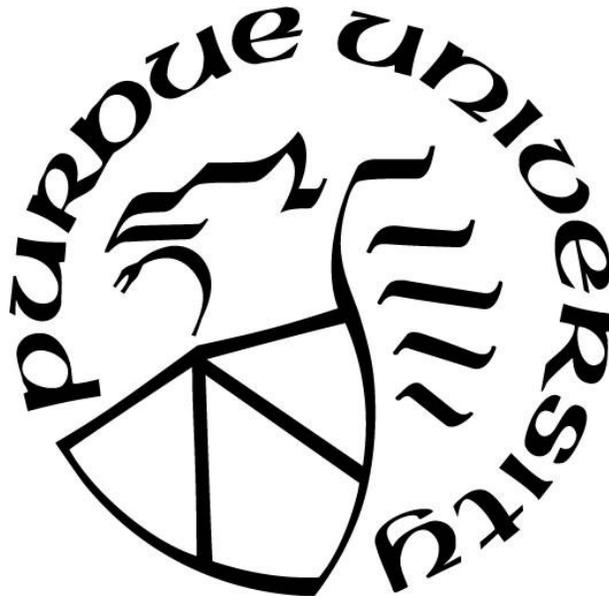
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ABSTRACT

Exposure to racial discrimination has been consistently linked with risk for substance use. However, outside of affect-based factors, few other mechanisms have been examined in the literature. One potential candidate is locus of control (LOC). LOC is a learning processes that involves the degree to which an individual attributes rewards as resulting from their own control (internal LOC) versus outside control (external LOC). There is evidence that exposure to stressors is associated with LOC, with a separate body of literature linking LOC with substance use. Thus, it is plausible that LOC may be a mechanism underlying the relationship between racial discrimination and substance use. Additionally, there is evidence that depression is related to LOC. Thus, the relationship between racial discrimination, locus of control, and substance use may also be serially mediated through depressive symptoms. The current study investigated these two pathways among 503 racial/ethnic minority adults aged 18-35 who completed an online questionnaire that included measures on racial discrimination related stress, locus of control, depressive symptoms, and substance use. Results indicated a significant indirect effect of racial discrimination related stress through external locus of control, specifically the chance orientation, on substance use. Moreover, for both domains of external locus of control (i.e., chance and powerful others) a significant serial indirect effect was found through depressive symptoms within the racial discrimination-substance use pathway among racial/ethnic minority adults. These findings expand our understanding on potential mechanisms that underlie the racial discrimination-substance use risk pathway among racial/ethnic minority adults, which may in turn provide important targets for substance use intervention programming for this population.

INTRODUCTION

Exposure to traumatic events, such as sexual assault, combat exposure, and natural disasters, have been associated with adverse health outcomes including decreased self-esteem (Maguire, Williams, Naughton, Cowley, Tempest, Mann, Teague, & Kemp, 2015) and self-efficacy (Luszczynska, Benight, & Cieslak, 2009), as well as increased risk for depressive symptoms (Place, Ling, & Patihis, 2018), posttraumatic stress disorder (PTSD; Luszczynska, Benight, & Cieslak, 2009), and substance use (Ullman, Relyea, Peter-Hagene, & Vasquez, 2013). In addition to these traditional forms of trauma, contemporary models of trauma have begun to include race-based stressors as a type of traumatic event (Bryant-Davis & Ocampo, 2006; Williams, Printz, & DeLapp, 2018). In line with evidence from traditional forms of trauma, racial discrimination has also been linked to similar negative health outcomes (Williams & Mohammed, 2009; Boynton, O'Hara, Covault, Scott, & Tennen, 2014; Haller & Chassin, 2014). Additionally, one behavioral health outcome that has garnered attention in the field as an outcome of racial discrimination is substance use (Pascoe & Smart Richman, 2009; Ouimette, Read, Wade, & Tirone, 2010; Rodriguez-Seijas, Stohl, Hasin, & Eaton, 2015).

With a direct effect of racial discrimination on substance use established, researchers have turned to examining underlying mechanisms that help explain this relationship, with evidence to suggest an indirect effect of racial discrimination through externalizing factors such as impulsivity, attention-deficit/hyperactivity disorder, and antisocial personality disorder (Rodriguez-Seijas et al., 2015), and internalizing factors, such as anger and hostility (Gibbons et al., 2010) and depressive symptoms (Sanders-Phillips et al., 2014; Zapolski, Fisher, Hsu, & Barnes, 2016). Of note, in regard to depressive symptoms, a recent meta-analysis examining the impact of racial discrimination on well-being during adolescence found that among the outcomes explored (e.g., self-esteem, positive well-being), the strongest correlation was found between racial discrimination and depressive symptoms ($r=.26$; Benner et al., 2018). Moreover, Clark (2014) found that depressive symptoms fully mediate the relationship between discrimination and recent substance use, while partially mediating the relationship between discrimination and lifetime substance use. This effect may be explained by the stress-coping model, which theorizes that perceived discrimination results in greater stress, and the elevation in psychological and physiological stress may result in avoidant coping strategies, such as substance use (Clark,

Anderson, Clark, & Williams, 1999; Clark, 2014). However, few studies have examined other potential mechanisms within the risk pathway between racial discrimination and substance use, with some researchers specifically highlighting the need to identify other mechanisms (Boynton, O'Hara, Covault, Scott, & Tennen, 2014; Tse & Wong, 2015).

Locus of Control

One potential candidate is locus of control. Locus of control was first conceptualized by Rotter (1966) as a learning processes that involves the degree to which an individual attributes rewards as resulting from their own control (internal locus of control) versus outside control, such as based on luck, fate, other people, or unknown factors (external locus of control). Lefcourt (1976) further noted that within this conceptualization, locus of control was thus thought to be a stable unidimensional trait, with an individual having either a relatively internal or external locus of control. However, over the years, research has suggested that locus of control is multidimensional, and that internal and external locus of control should be measured separately (Reid & Ware, 1974). In turn, Levenson (1973) created a measure for locus of control that consists of three domains, one internal domain for individuals who attribute control to themselves, and two external domains for individuals who attribute control to others perceived as more powerful (i.e., powerful others), and chance or fate (i.e., chance). Yet, it is important to note, that much of the research examining external locus of control has used a combined higher-order factor rather than examining associations based on the separate external locus of control domains (Trevino & Ernest, 2012; Ryon & Gleason, 2014; Omani Samani, Maroufizadeh, Navid, & Amini, 2017).

Moreover, in addition to the development of multidimensional measures, other measures have also been used to assess for factors thought to be synonymous or closely related to locus of control, such as perceived mastery, perceived control, personal control, and sense of control (Cheng, Cheung, Chio, & Chan, 2013). In line with this work, researchers have documented a relationship between locus of control as an outcome of stress exposure, such as racial discrimination (e.g., Moradi & Hasan, 2004; Moradi & Risco, 2006; Trevino & Ernest, 2012), and as predictor for various health outcomes, including substance use (e.g., Hunter, 1994; Soravia, Schläfli, Stutz, Rösner, & Moggi, 2015). Thus, locus of control is a potential novel

candidate as a mechanism underlying the relationship between racial discrimination and substance use. Each of these pathways will be discussed in detail below.

Racial Discrimination and Locus of Control

Although, locus of control was originally conceptualized as a stable trait that was related to various health and behavioral outcomes, more recent research also suggests that locus of control can exhibit state-like characteristics, being malleable depending on the context (Keeton, Perry-Jenkins, & Sayer, 2008). Several studies have in turn documented the effect of stress exposure on levels of locus of control. For example, Ryon & Gleason (2014) conducted a study examining the impact of stress on locus of control among 78 expecting couples. The researchers found that greater daily hassles and stressors (conflicts with partner, financial issues, and car maintenance, and all other hassles) were associated with changes in locus of control, suggesting that daily stressors can shift one's locus of control to becoming more external. In addition to general stress, there is a small body of work examining locus of control in relation to the discrimination. For example, Ruggiero and Taylor (1997) examined the effects of perceived discrimination, not specific to any characteristic such as race, among a sample of Asian and Black female participants, finding that less perceived discrimination was associated with a higher internal locus of control orientation.

Although limited, some research has also been conducted examining the relationship between locus of control and racial discrimination. Broman, Mavaddat, and Hsu (2000) found that African American participants who believed that they were victims of racial discrimination reported higher external locus of control compared to those who did not perceive themselves to be a victim of racial discrimination. A finding that has also been observed among other studies (Moradi & Hasan, 2004; Moradi & Risco, 2006; Trevino & Ernest, 2012). Additionally, some work has even found a link between race-related discrimination and external locus of control in more specific domains of life, such as academic (Brown, Rosnick, & Segrist, 2017) and health (Pieterse & Carter, 2010) among African American/Black adults. Researchers have theorized that perceiving racial discrimination could result in a person becoming more defensive in their social interactions, which can result in both perceiving that outside factors have more control and a decreased sense of personal control, which can in turn result in having a more external locus of control orientation. Thus, as these experiences become more chronic, individuals are more likely

to have a stable external locus of control orientation (Trevino & Ernest, 2012). However, this work is emerging, with much of the existing research on the relationship between racial discrimination and external locus of control. Thus, additional research is needed in this area, particularly in regard to the association between racial discrimination and internal locus of control, as well as examination of external locus of control based on the two domains (i.e., powerful others and chance) versus a global externalizing orientation.

Locus of Control and Health Outcomes

In addition to the effect of stressors on locus of control, locus of control has also been shown to have an independent and direct effect on health outcomes. Generally, studies have found that an internal locus of control has been associated with better health outcomes comparative to an external locus of control. Specifically, a strong and consistent relationship has been documented between locus of control and internalizing symptoms (i.e., psychological distress, depressive symptoms), such that high internal locus of control is associated with lower risk (Gale, Batty, & Deary, 2008; Omani Samani, Maroufizadeh, Navid, & Amini, 2017) and high external locus of control is associated with higher risk (Benassi, Sweeney, & Dufour, 1988; Bjørkløf et al., 2016; Yu & Fan, 2016). This effect has also been observed through prospective studies. For example, results of a longitudinal study indicated that an external locus of control at age 8 predicted a larger increase in risk of depression at age 12 and 16 (Sullivan, Thompson, Kounali, Lewis, & Zammit, 2017).

Outside of psychological health outcomes, locus of control is also associated with behavioral outcomes, such as substance use. This relationship may be explained by the role that control, specifically the perception of lacking control, plays in chronic substance use (American Psychiatric Association, 2013). Indeed, substance use issues and related problems have been shown to be more prevalent among those with an external locus of control (Haynes & Ayliffe, 1991; Soravia, Schläfli, Stutz, Rösner, & Moggi, 2015) and low internal locus of control (Sheffer et al., 2012). On the other hand, greater internal locus of control has been negatively associated with intent to use substances among adolescents (Coman et al., 2014) and has been positively associated with more time abstaining from alcohol use (Blagojević-Damašek, Frencl, Pereković, Čavajda, & Kovaček, 2012). Research has suggested that there may even be lasting effects of internal locus of control, in that adolescents with high internal locus of control are less likely to

engage in substance use as they progress through adolescence (Adalbjarnardottir & Rafnsson, 2001). The same positive effect can be seen when it comes to quitting substances. An internal locus of control has been associated with more success in smoking cessation, while individuals with high external locus of control may experience more difficulty quitting (Rosenbaum & Argon, 1979; McKenna & Higgins, 1997). Yet, it should be noted that although in general an internal locus of control has been suggested to be a protective factor against risk for substance use, there are some studies who have found contradictory evidence with internal locus of control associated with greater substance use risk (Goss & Morosko, 1970; Ersche, Turton, Croudace, & Stochl, 2012). It is postulated that this contradictory finding may be due to the belief among individuals with high internal locus of control that they have more control over their use, which keeps them from seeking help for their use (Conell-Price & Jamison, 2015).

Current Study

In summary, there is consistent evidence on the direct effect of racial discrimination on substance use outcomes among racial/ethnic minority populations (Gerrard et al., 2012; Boynton, O'Hara, Covault, Scott, & Tennen, 2014; Tse & Wong, 2015). Moreover, studies have provided evidence for the mediating role of externalizing factors such as impulsivity, attention-deficit/hyperactivity disorder, and antisocial personality disorder (Rodriguez-Seijas et al., 2015), and internalizing factors, such as anger, hostility, and depressive symptoms (Gibbons et al., 2010; Sanders-Phillips et al., 2014; Zapolski, Fisher, Hsu, & Barnes, 2016) within the risk pathway. However, less is known on other potential mechanisms, such as locus of control. Although this area of research is small, there is evidence of an association between discrimination and locus of control (e.g., Broman, Mavaddat, & Hsu, 2000; Moradi & Hasan, 2004; Moradi & Risco, 2006; Trevino & Ernest, 2012), as well as an effect of locus of control on substance use (Burnett, Sabato, Wagner, & Smith, 2014). Thus, it is plausible that locus of control may be an important mechanism within the relationship between racial discrimination and substance use. However, to date, no known study has examined this specific indirect pathway. Among a sample of racial/ethnic minority adults aged 18-35, the first aim of the current study is to examine the indirect effect of racial discrimination related stress through internal and external locus of control on substance use. Specifically, we hypothesize that stress related to racial discrimination will also be associated with lower levels of internal locus of control which

will be associated with more substance use. Additionally, we hypothesize that stress related to racial discrimination will be associated with higher levels of external locus of control which will be associated with more substance use.

Previous research has also established the indirect effect of depressive symptoms on the path between racial discrimination and substance use outcomes (Sanders-Phillips et al., 2014; Zapolski, Fisher, Hsu, & Barnes, 2016), as well as the association between locus of control and depressive symptoms (Gale, Batty, & Deary, 2008; Bjørkløf et al., 2016; Yu & Fan, 2016; Omani Samani, Maroufizadeh, Navid, & Amini, 2017). Yet, these factors have not been studied together. Thus, the second aim of the current study will expand upon this body of research by examining the potential indirect effect of racial discrimination related stress through locus of control on substance use serially mediated through depressive symptoms. Specifically, we hypothesize that stress related to racial discrimination will also be associated with lower levels of internal locus of control, which in turn will be associated with higher levels of depressive symptoms, which will be associated with more substance use. We also hypothesize that stress related to racial discrimination will be associated with higher levels of external locus of control, which in turn will be associated with higher levels of depressive symptoms and more substance use.

METHODS

Participants and Setting

Participants were recruited using two methods. Some participants were drawn from a parent study examining stress and health outcomes among adults 18-35, in which an online survey was administered to Introduction to Psychology students at Indiana University Purdue University in Indianapolis (IUPUI) during Fall 2018 through Spring 2020. Participants were eligible to participate in the study if they were between the ages 18-35 and were able to read in English. A total of 304 individuals who self-identified as belonging to one or more of the racial/ethnic minority categories (i.e., African American/Black, Asian American/Pacific Islander, American Indian/Native American/Eskimo/Alaskan Native, Bi-racial/Multi-racial, Hispanic/Latino) completed the survey as part of the IUPUI psychology course. Additional participants were recruited in two rounds using Amazon Mechanical Turk (MTurk), which is an online marketplace that is used to recruit participants for research that has been found to be comparable to other routes of online recruitment (Buhrmester, Kwang, & Gosling, 2016). Limiting the survey to only those residing in the United States, and removing 8 participants who did not have adequate ReCAPTCHA scores (an algorithm within Qualtrics to identify responses completed by a computer versus human) and 5 participants who did not correctly answer the comprehension question, an additional 373 participants between the ages of 18-35 who self-identified as belonging to one or more of the racial/ethnic minority categories (i.e., African American/Black, Asian American/Pacific Islander, American Indian/Native American/Eskimo/Alaskan Native, Bi-racial/Multi-racial, Hispanic/Latino) were included in the current study through the MTurk recruitment source.

Thus, a total of 677 individuals who self-identified as belonging to one or more racial/ethnic groups participated in the current study. Of this sample, 99 participants did not answer any study measures, and another 69 participants did not have complete data, so these participants were also excluded from analyses. Additionally, 6 participants were removed from analysis due to low numbers of individuals who selected non-binary gender categories (2 transgender male, and 4 selected other) bringing the final sample size to 503. Most participants were female ($n=298$; 59.2%) and the average age was 23.76 ($SD=5.78$). Participants were

included if they indicated membership with at least one racial/ethnic group but were able to select as many racial/ethnic categories as they identified with. Racial/ethnic membership of the sample included African American/Black (39%), Hispanic/Latino (30.8%), Asian American/Pacific Islander (26.8%), Caucasian/White (16.1%), Bi-racial/Multi-racial (13.5%), other (9.5%), and American Indian/Native American, Eskimo/Alaskan (3.4%). A majority of our sample consisted of currently enrolled college students (63.4%) and approximately half (51.7%) resided in Indiana. Of note, among participants recruited through MTurk, 29.4% (n=148) resided in 33 other states (California 5%, New York 3.8%, Texas 2.4%).

Procedures

After obtaining IRB approval, participants completed an online questionnaire that aimed to examine various health, behavioral, academic, and trauma-related variables among adults aged 18-35. The study took approximately 45 minutes to complete and participants recruited through the IUPUI Introduction to Psychology class received course credit for completing the study, while participants recruited through MTurk were compensated with \$2.50 through their MTurk account. To protect against repeat participants for our second round of recruitment through MTurk, all MTURK worker ID's from the first round were entered into MTurk which blocked repeat attempts to complete the survey. For the current study, only items pertaining to demographic information, racial discrimination, substance use, locus of control, and depressive symptoms were included from the parent study. Additionally, only those who completed all items within measures pertaining to the aforementioned variables were included in the analyses (N=503).

Measures

Demographics

Participants were asked to describe their age, gender, current enrollment status, and race/ethnicity. Additionally, participants recruited through MTurk were asked to describe the state they currently reside in. Participants that identified only as Caucasian/White were not included in the study.

Racial Discrimination

The Index of Race-Related Stress-Brief Version (IRRS-B; Utsey, 1999) was used to measure the multidimensional experience of racial discrimination, focusing on race-related stress experienced in daily life. The IRRS-B is a self-report measure that includes 22 items scored on a Likert scale ranging from 0 (*this has never happened to me*), 1 (*event happened but did not bother me*), 2 (*event happened and I was slightly upset*), 3 (*event happened and I was upset*), to 4 (*event happened and I was extremely upset*). The IRRS-B provides three subscale scores (i.e., Cultural Racism, Institutional Racism, and Individual Racism), and a total scale score. For the current study only the total scale score was used to measure racial discrimination. Higher scores indicate greater frequency of stress related to racial discrimination. The IRRS-B is a widely used measure (Reynolds, Sneva, & Beehler, 2010; Cruz & Palmer, 2015) that was originally created and validated among African American/Black samples, but has been applied to other racial/ethnic minorities with good internal consistency (total score Cronbach's $\alpha=0.91$; Utsey, Chae, Brown, & Kelley, 2002). For the current study, internal consistency was high for the global score, Cronbach's $\alpha=0.942$.

Locus of Control

Locus of control was measured using the Internality, Powerful Others, and Chance scale (IPC; Levenson, 1972) scale. The IPC is 24-item multidimensional instrument comprised of three subscales: Internal (I), and external measured by the Powerful Others (PO) and Chance (C) subscales. The internality subscale measures the extent to which an individual believes reinforcements are contingent on their own behaviors. Conversely, the powerful others subscale measures the extent to which a participant believes that reinforcements are attributed to those who they perceive as more powerful, while the chance subscale measures beliefs attributing reinforcements to other forces such as chance, luck, fate. Each subscale includes 8 items that are scored on a 6-point Likert scale from 1 (*strongly disagree*) to 6 (*strongly agree*). A high score on each subscale indicates beliefs of control by the source of each subscale and does not necessarily indicate a low score on another (Chaturvedi, 2015).

For the current study, the internality subscale was used to measure an internal locus of control, while only the powerful others subscale was used to measure an external locus of control

for the primary aim of the study, as it has been suggested to be better correlated with coping styles (Brosschot, Gebhardt, & Godaert, 1994). Moreover, when examining racial discrimination, racial and ethnic minorities may be more likely to attribute control to people identifying as belonging to other races and ethnicities who have more power in society (Garcia & Levenson, 1975). Thus, the powerful others subscale may better capture external locus of control for this population than the chance subscale. In turn, the powerful others subscale was used to assess the primary aims of the study, however supplemental analysis were run with the chance subscale to see if it also operates similarly to powerful others in the proposed risk model. The internal consistency for each locus of control subscale among college students with mean age of about 25 have moderate internal consistency (Cronbach's alpha = .67-.83; Roddenberry & Renk, 2010). The current study showed acceptable internal consistency in the internality subscale (Cronbach's alpha=0.757), and good internal consistency in the two external locus of control domain, powerful others (Cronbach's alpha=0.858) and chance (Cronbach's alpha=0.849) subscales.

Depression

Depressive symptoms were measured using the depression subscale from the Depression Anxiety and Stress Scale (DASS-21; Henry & Crawford, 2005). The DASS-21 measures the severity of a range of symptoms common to depression over the previous week, with responses scored on a scale from 0 (*did not apply to me at all over the last week*) to 3 (*applied to me very much or most of the time over the past week*). The depression scale has high reliability for African-American, Asian, and Hispanic/Latino/a samples (Cronbach's alpha=.83-.84; Norton, 2007). In the current study, internal consistency was strong (Cronbach's alpha=0.924).

Substance Use

Alcohol use was measured with The Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente & Grant, 1993). The AUDIT is a 10-item self-report measure used to determine if a person's alcohol consumption may be harmful and is assessed based on past year use. Items are rated on a Likert-type scale with 0 (*never*), 1 (*monthly or less*), 2 (*two to four times a month*), 3 (*two to three times a week*), and 4 (*four or more times a week*). More general non-alcohol related substance use was measured with the Drug Use Disorders

Identification Test (DUDIT; Berman, Bergman, Palmstierna, & Schlyter, 2002). The DUDIT measures drug use patterns and various drug-related problems in the past year. Drugs included in the measure are cannabis (e.g., marijuana, hash), solvents, tranquilizers (e.g., Valium, Xanax), barbiturates, cocaine, crack, stimulants (e.g., speed), hallucinogens (e.g., LSD) and narcotics (e.g., heroin, Percocet). The DUDIT consists of 11 items rated on a Likert-type scale with 0 (*never*), 1 (*monthly or less*), 2 (*two to four times a month*), 3 (*two to three times a week*), and 4 (*four or more times a week*). For the current study, the first item from the AUDIT (“How often do you have a drink containing alcohol?”) and DUDIT (“How often do you use drugs other than alcohol?”) was totaled to obtain a composite substance use score.

Attention Check

To ensure participants’ attentiveness while completing the survey through the first round of MTurk recruitment, the survey was restricted to MTurk users with a high approval rate of a 95 percent cutoff on previous Human Intelligence Tasks (HITs; Buchheit et al., 2018). We also used ReCAPTCHA scores, as previously mentioned, which estimate whether the activity on a computer screen was completed by a human or a computer, resulting in the removal of participants who’s scores were lower than 0.5 (Von Ahn, Maurer, McMillen, Abraham, & Blum, 2008). In our second round of recruitment through MTurk, to take further measures to protect against bots, through Qualtrics, any participant with a ReCAPTCHA score lower than 0.5 was automatically disqualified from taking the survey in the beginning. We also added a comprehension question, “What do you call a student in their third year of high school”, and only accepted “junior”. As previously mentioned, participants were removed due to incorrectly answering the comprehension question (i.e. “third grade”, “senior”, and “sophomore”). The use of the additional qualitative comprehension question with the previous measures, has been shown to help ensure a more reliable data set (Hauser, Paolacci, & Chandler, 2018).

Data Analysis & Considerations

Analysis

In order to create the final data set of 503 participants with complete data, as previously mentioned, 69 participants were removed. The demographics of the 69 participants that were

removed were somewhat comparable to our study sample, with a majority of the participants currently enrolled as college students (76.8% compared to 63.4% in the final sample), residing in Indiana (58% compared to 51.7% in final sample) and with an average age of 23.76 (SD=5.78; compared to $m=23.76$, $SD=5.78$ in final sample). However, this group did contain a higher percentage of male participants ($n=40$; 58% compared to 40.8% in final sample) and had high percentage of some racial/ethnic membership compared to the final sample (African American/Black: 59.4% compared to 39%, Hispanic/Latino: 36.2% compared to 30.8%, Asian American/Pacific Islander: 13% compared to 26.8%, Caucasian/White: 10.1% compared to 16.1%, Bi-racial/Multi-racial: 5.8% compared to 13.5%, other: 11.4% compared to 9.5%, and American Indian/Native American, Eskimo/Alaskan: 4.3% compared to 3.4%).

Prior to analyzing the study aims among the final sample, data were screened for outliers on the variables of interest (i.e., racial discrimination, substance use, internal locus of control, powerful others locus of control, and depressive symptoms). The skewness of the data was examined using the metric -1 to 1 (Hair Jr, Hult, Ringle, & Sarstedt, 2016). Internal locus of control and depressive symptoms were moderately skewed, and racial discrimination related stress and powerful others locus of control were fairly normal. Substance use was the only variable with significant skewness (1.196, std. error=1.09), therefore a logarithm transformation was conducted due to its positive skewness and the inclusion of zeros. Once substance use was transformed, it was fairly normally distributed as defined by Hair Jr et al., (2016). The kurtosis of the data were also examined and had acceptable kurtosis within the metrics of -2 to 2 (Field, 2009; George & Mallery, 2012; Gravetter & Wallnau, 2012).

All analyses were performed using SPSS 27.0. Bivariate correlations were used to examine the relationship between racial discrimination related stress, each locus of control domains, depressive symptoms, and substance use, as well as age, gender, and recruitment source. Although not the aim of this study, age (Newton-Howes, Cook, Martin, Foulds, & Boden, 2019) and gender (O'Malley & Johnston, 2002) were added as covariates to control for their unique and combined contribution to substance use. Additionally, there is evidence to suggest that both age (Coman et al., 2014) and gender may affect locus of control orientation (McPherson & Martin, 2017). Recruitment source (i.e., IUPUI Intro to Psychology students or MTurk), was also added as a covariate post hoc, as it was plausible that variability on study variables may have been impacted based on the recruitment source.

Analyses of indirect effects were completed using the PROCESS macro (Hayes, 2013) to explore the relationship between racial discrimination related stress and substance use through the internal and powerful others locus of control subscales (simple parallel mediation: Model 4 specified by Hayes, 2013). As a supplemental analysis, a second parallel mediation model was run between internal locus of control and chance subscales. Parallel mediation models were used to look at competing pathways between internal and external locus of control in order to examine this risk pathway in a more comprehensive way. Additionally, to examine the indirect effect between stress related to racial discrimination, locus of control, depressive symptoms, and substance use a serial mediation model was conducted (serial mediation with two mediators: Model 6 specified by Hayes, 2013). This model was run separately with internal locus of control and powerful others locus of control, with each model including the other locus of control subscale as a covariate. As a supplemental analysis, an additional serial mediation model was run with chance locus of control. Thus, there were a total of three mediation models for the primary aim of the study and two mediation models for the supplemental analyses. Although the term mediation is used for these analyses, given the cross-sectional nature of the data, temporal order could not be explicitly examined. However, Model 4 and 6 provide indirect effects, consistent with mediation analysis (Preacher & Hayes, 2004). The PROCESS macro estimates the total and direct effect of the independent variable on the dependent variable and the indirect effect of the independent variable through the mediator(s). To better ensure the parameters of the results, bootstrapping tests were administered. By using bootstrapping, a technique which does not carry a normality assumption, it generates bias-corrected confidence intervals for the indirect effect and various indices of effect size for the indirect effect (Hayes, 2013). For all analyses of indirect effects in the current study, we used 10,000 bootstrap samples.

Power Considerations

Using an a priori G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) analysis for the simple parallel mediation examining the indirect effect of 6 predictor variables (i.e., age, gender, recruitment source, racial discrimination related stress, internal locus of control, and external locus of control) on substance use at an $\alpha=.05$ and $\text{power}=.80$, the projected sample size needed for a medium effect ($f = .15$) with linear multiple regression was $N=98$, and for a small effect ($f=0.02$) the sample size needed was $N=688$. Another analysis was conducted for the serial

mediation examining the indirect effect of 7 predictor variables (i.e., age, gender, recruitment source, racial discrimination related stress, internal locus of control, external locus of control, and depressive symptoms) on substance use at an $\alpha=.05$ and power=.80, the projected sample size needed for a medium effect ($f = .15$) with linear multiple regressions was $N=103$, and for a small effect ($f=0.02$) the sample size needed was $N=725$.

RESULTS

Study Descriptives

Although a composite substance use variable was used in this study, we had some variability in terms of type of substance used. Of the 503 study participants, 228 (45.3%) reported that they have never consumed a drink containing alcohol within the past year, while 132 (26.2%) reported monthly or less use, 83 (16.5%) reported use 2-4 times a month, 49 (9.7%) reported use 2-3 times a week, and 11 (2.2%) reported use 4 or more times a week. For drug use other than alcohol, which included cannabis, of the 503 study participants, 378 (75.1%) reported that they have never used in the past year, while 67 (13.3%) reported use monthly or less, 34 (6.8%) reported use 2-4 times a month, 14 (2.8%) reported use 2-3 times a week, and 10 (2%) reported use 4 or more times a week.

Correlations

Bivariate correlations with listwise deletion were used to examine the relationship between racial discrimination related stress, locus of control (internal and powerful others), depressive symptoms, substance use, and covariates (i.e., age, gender, and recruitment source). Results of the correlations were as expected, and significant associations were found. Stress related to racial discrimination was positively associated with substance use, $r(503) = .157, p < .001$. Thus, higher scores on racial discrimination related stress was associated with greater substance use. As expected, stress reacted to racial discrimination was also positively associated with powerful others locus of control, $r(503) = .158, p < .001$, meaning higher scores on racial discrimination related stress was associated with higher perceptions that those who are perceived as more powerful are responsible for events that occur in one's life. However, racial discrimination related stress was not associated with internal locus of control ($r(503) = .01, ns$). Stress related to racial discrimination was also positively associated with depressive symptoms, $r(503) = .272, p < .01$, in that more racial discrimination related stress was associated with more depressive symptoms. As for substance use, it was positively associated with powerful others locus of control, $r(503) = .147, p < .01$, meaning that higher substance use was associated with the perception that there are others that are more powerful who are responsible for events that occur

in one's life. Substance use was also positively associated with depressive symptoms, $r(503) = .225, p < .001$. Additionally, the locus of control variables were correlated, $r(503) = .270, p < .001$, in that higher internal locus of control was associated with higher powerful others locus of control. Lastly, higher scores on the powerful others locus of control was positively associated with depressive symptoms, $r(503) = .417, p < .001$, in that attributing events that occur in one's life to those perceived to be more powerful is associated with endorsing depressive symptoms. (see Table 1).

Table 1: Correlation Coefficient Matrix

	Age	Gender	Recruit	RD	Internal	PO	Dep Sym	SU
Age	—	-0.32**	0.81**	0.08	0.17**	0.24**	0.12*	0.26**
Gender		—	-0.26**	0.04	-0.06	-0.21**	-0.12*	-0.12**
Recruitment Source			—	0.05	0.16**	0.28**	0.11*	0.27**
Racial Discrimination				—	0.01	0.16**	0.27**	0.16**
LOC-Internal					—	0.27**	-0.02	0.04
LOC-Powerful Others						—	0.42**	0.15**
Depressive Symptoms							—	0.23**
Substance Use								—

Note: N=503. Gender: male=0, female=1. Recruitment Source: SONA=0, MTurk=1

* $p < .05$; ** $p < .01$

Simple Parallel Mediations

To examine whether there was an indirect effect of stress related to racial discrimination on substance use through internal or powerful others locus of control, we ran a parallel mediation model utilizing Hayes (2018) PROCESS macro and 10,000 bootstrap samples. Age, gender, and recruitment source were also included as covariates in the model. No significant indirect effects (i.e., the 95% confidence interval crossed zero) were found for the pathway of racial discrimination related stress on substance use via internal locus of control (.0000; 95% CI:

[-.0001, .0001]) or racial discrimination related stress on substance use via powerful others locus of control (.0001; 95% CI: [-.0001, .0003]). (see Figure 1).

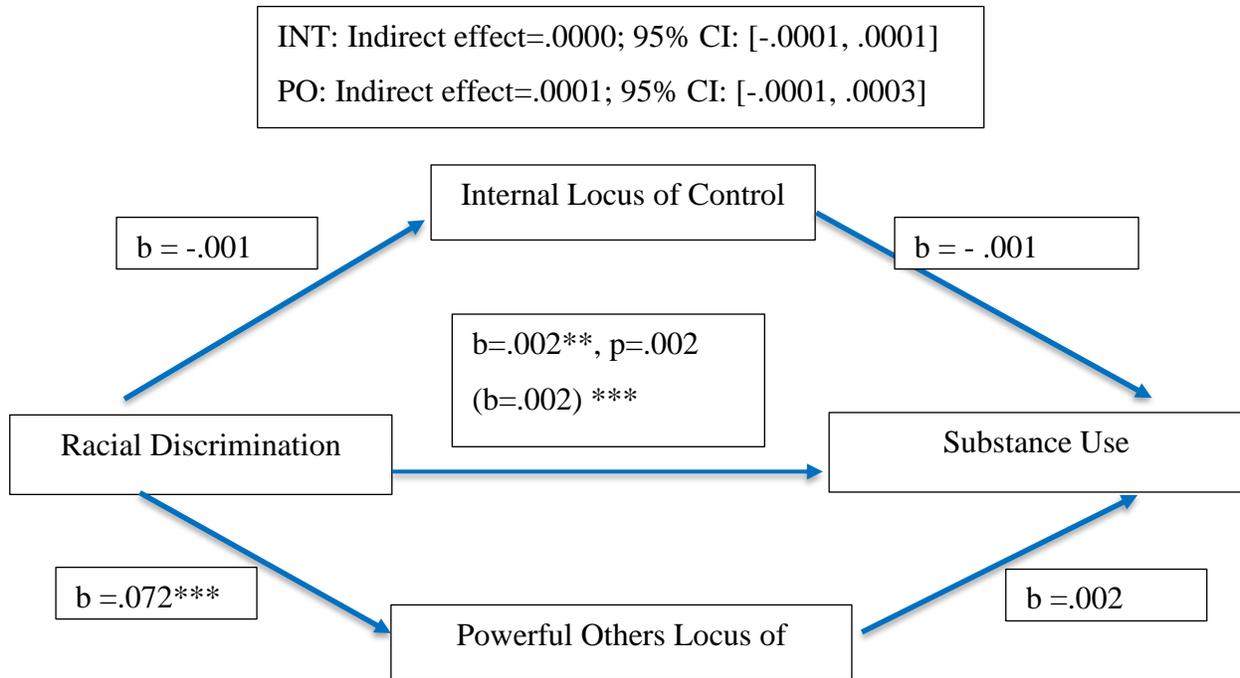


Figure 1: Simple Parallel Mediation Model

The figure above is a mediational model testing the indirect effect of stress related to racial discrimination on substance use through internal and powerful others locus of control controlling for age, gender, and recruitment source. The total effect of stress related to racial discrimination on substance use is shown in parenthesis, and the direct effect (i.e., the effect of racial discrimination related stress controlling for internal locus of control, powerful others, age, gender, and recruitment source) is shown without parenthesis. b = the unstandardized regression coefficient. + = $p < .1$, * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Serial Mediations

To examine the second aim of the current study, the potential indirect effect of locus of control on the relationship between stress related to racial discrimination and substance use serially mediated through depressive symptoms, serial mediation models utilizing Hayes (2018) PROCESS macro and 10,000 bootstrap samples were run. While controlling for age, gender, recruitment source, and powerful others locus of control, there was no significant indirect effect

of racial discrimination related stress on substance use via internal locus of control through depressive symptoms (.0000; 95% CI: [.0000, .0000]). (see Figure 2).

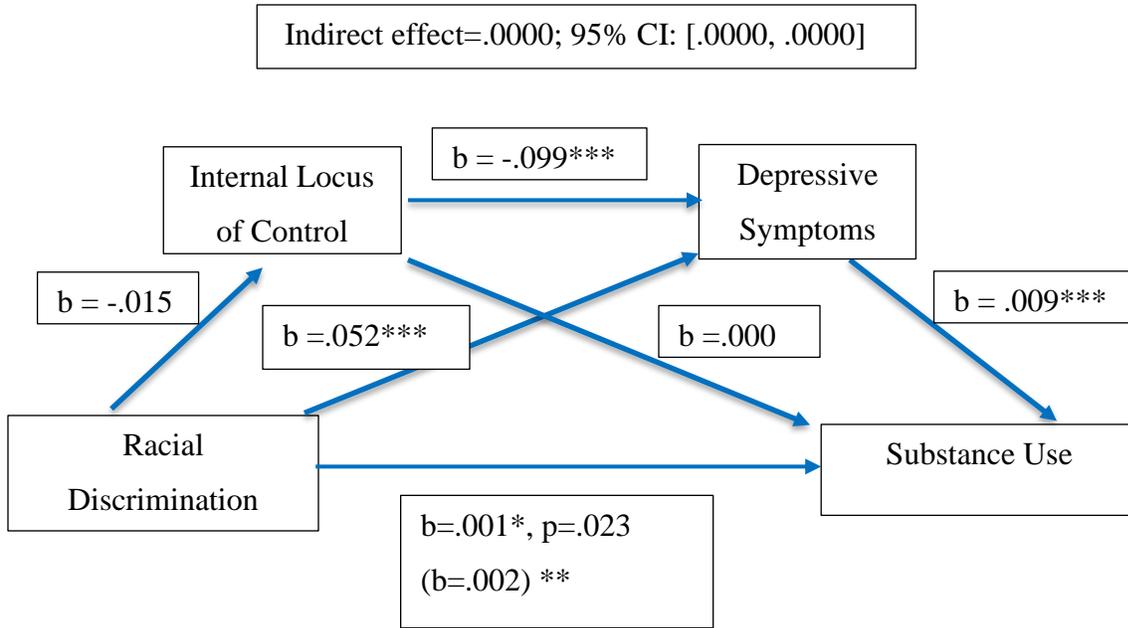


Figure 2: Serial Mediation Model: Internal Locus of Control

The figure above is a serial mediational model testing the indirect effect of stress related to racial discrimination on substance use through internal locus of control and depressive symptoms, controlling for age, gender, recruitment source, and powerful others. The total effect of stress related to racial discrimination on substance use is shown in parenthesis, and the direct effect (i.e., the effect of racial discrimination related stress controlling for powerful others locus of control, depressive symptoms, age, gender, and recruitment source) is shown without parenthesis. b= the unstandardized regression coefficient. + = $p < .1$ * = $p < .05$, ** = $p < .01$, *** = $p < .001$

However, for powerful others locus of control, a significant indirect effect (i.e., the 95% confidence interval did not cross zero) was found for stress related to racial discrimination on substance use via powerful others locus of control through depressive symptoms, controlling for age, gender, recruitment source, and internal locus of control (.0001; 95% CI: [.0000, .0003]). (see Figure 3).

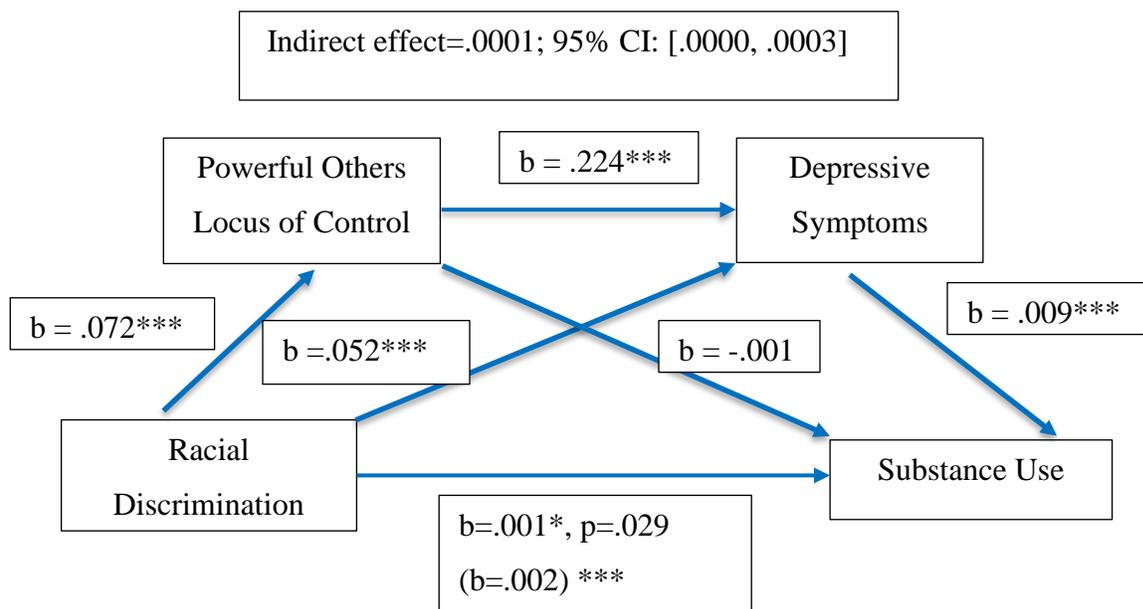


Figure 3: Serial Mediation Model: Powerful Others Locus of Control

The figure above is a serial mediational model testing the indirect effect of stress related to racial discrimination on substance use through powerful others locus of control and depressive symptoms, controlling for age, gender, recruitment source, and internal locus of control. The total effect of stress related to racial discrimination on substance use is shown in parenthesis, and the direct effect (i.e., the effect of racial discrimination related stress controlling for internal locus of control, depressive symptoms, age, gender, and recruitment source) is shown without parenthesis. b = the unstandardized regression coefficient. + = $p < .1$ * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Supplemental

For the purpose of this study, the powerful others domain of external locus of control was used in the analyses, however supplemental analyses were conducted to examine whether a similar effect was found for the other external locus of control domain, chance. Chance was a normally distributed variable, both in terms of kurtosis and skewness. The sample size in these additional analyses was 486 due to missing data within the chance variable. Additional bivariate correlations showed that similar to the powerful others orientation, higher orientation on chance was positively associated with racial discrimination related stress, $r(486) = .122, p < .01$ and substance use, $r(486) = .167, p < .001$. Thus, the belief that events in one's life are due to outside factors such as chance are associated with greater stress related to racial discrimination and more substance use. Powerful others locus of control was strongly positively associated with chance

locus of control, $r(486) = .822, p < .001$, such that when an individual endorsed higher scores on one external locus of control subscale, they also had higher scores on the other. Chance locus of control was also positively associated with depressive symptoms, $r(486) = .431, p < .001$, in that endorsing depressive symptoms was associated with having a higher chance locus of control orientation. These results are fairly similar when compared to the powerful others locus of control.

For the supplemental analyses, we examined the same mediation models with chance locus of control to determine whether similar effects were found between the two external locus of control domains, powerful others and chance. For the simple mediation model, controlling for age, gender, recruitment source, and internal locus of control, a significant indirect effect (i.e., the 95% confidence interval did not cross zero) was observed for the effect of stress related to racial discrimination on substance use via chance locus of control (.0002; 95% CI: [.0000, .0004]). However, similar to previous models, controlling for age, gender, recruitment source, and chance locus of control, a non-significant indirect effect was found (i.e., the 95% confidence interval crossed zero) for stress related to racial discrimination on substance use via internal locus of control (.0000; 95% CI: [-.0001, .0001]). (see Figure 4).

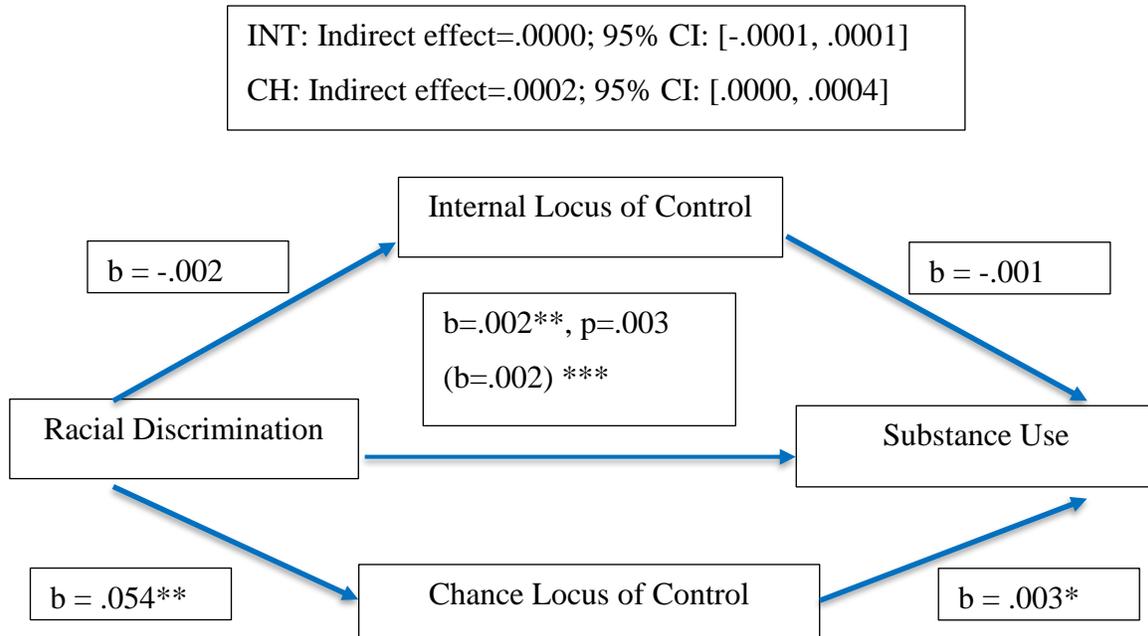


Figure 4: Supplemental Simple Parallel Mediation Model

The figure above is a mediational model testing the indirect effect of stress related to racial discrimination on substance use through internal and chance locus of control, controlling for age, gender, and recruitment source. The total effect of stress related to racial discrimination on substance use is shown in parenthesis, and the direct effect (i.e., the effect of racial discrimination related stress controlling for internal locus of control, chance locus of control, age, gender, and recruitment source) is shown without parenthesis. b = the unstandardized regression coefficient. + = $p < .1$, * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Additionally, we ran a serial mediation model to examine the indirect effect of stress related to racial discrimination on substance use through chance locus of control and depressive symptoms, controlling for age, gender, recruitment source, and internal locus of control. A significant indirect effect (i.e., the 95% confidence interval crossed zero) was found for the effect of stress related to racial discrimination on substance use via chance locus of control through depressive symptoms (.0001; 95% CI: [.0000, .0002]). (see Figure 5).

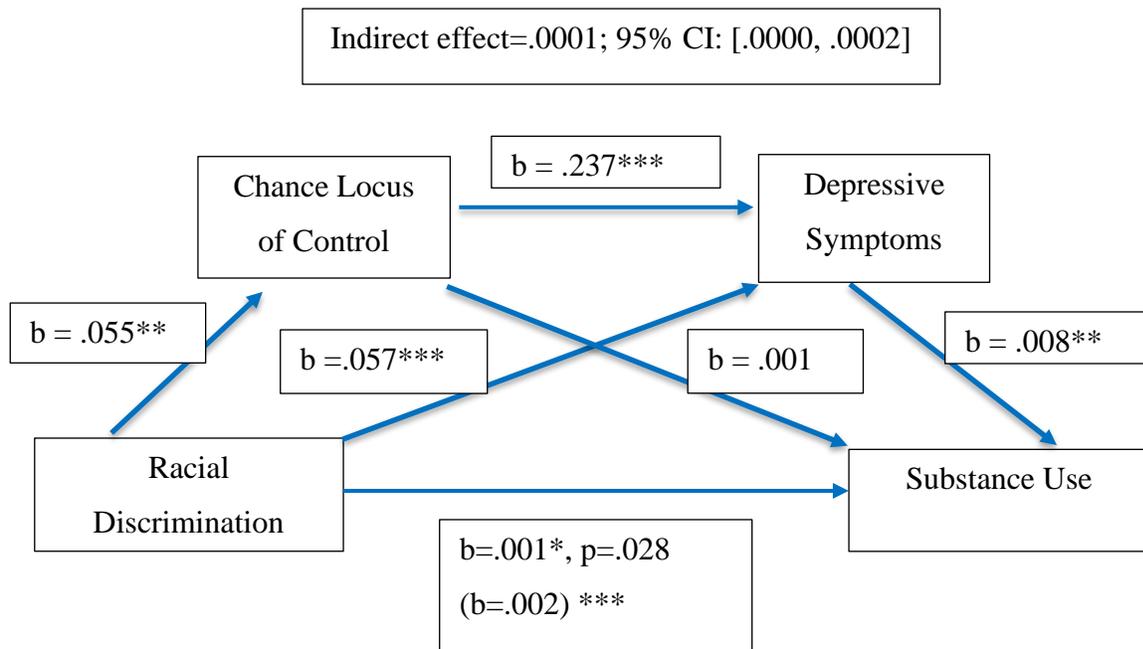


Figure 5: Supplemental Serial Mediation Model: Chance Locus of Control

The figure above is a serial mediational model testing the indirect effect of stress related to racial discrimination on substance use through chance locus of control and depressive symptoms, controlling for age, gender, recruitment source and internal locus of control. The total effect of stress related to racial discrimination on substance use is shown in parenthesis, and the direct effect (i.e., the effect of racial discrimination related stress controlling for chance locus of control, internal locus of control, depressive symptoms, age, gender, and recruitment source) is shown without parenthesis. b = the unstandardized regression coefficient. + = $p < .1$ * = $p < .05$, ** = $p < .01$, *** = $p < .001$

DISCUSSION

This current study aimed to examine whether locus of control may be an underlying mechanism to explain the relationship between stress related to racial discrimination and substance use (i.e., alcohol, cannabis, and illicit drug use) among racial and ethnic minority adults aged 18-35. Specifically, for our first aim, we examined the indirect effect of the internal and powerful others subscales of locus of control on the pathway between stress related to racial discrimination and substance use, while controlling for age, gender, and recruitment source. internal and powerful others locus of control were ran in the same model, which is an important contribution to the field, as a majority of previous literature examining locus of control have examined pathways individually by subscale and have not accounted for the possible contribution of other subscales within proposed models (Haynes & Ayliffe, 1991; Sheffer et al., 2012; Soravia, Schläfli, Stutz, Rösner, & Moggi, 2015). By doing so, we can examine the effect of each locus of control domain while accounting for the other to understand its unique influence and relationship with our variables. Furthermore, by examining these pathways based on the external orientation domains, we are able to add to existing literature by understanding the effect of the powerful others domain (and chance domain through supplemental analysis) instead of the general external measure utilized by previous literature (Trevino & Ernest, 2012; Yu & Fan, 2016; Sullivan, Thompson, Kounali, Lewis, & Zammit, 2017).

Contrary to our hypothesis and the limited literature (Ruggiero & Taylor, 1997; Blagojević-Damašek, Frencl, Pereković, Čavajda, & Kovaček, 2012; Sheffer et al., 2012; Coman et al., 2014), no relationship was found for internal locus of control, in that it was not significantly related to either stress related to racial discrimination or substance use. Thus, we did not find support for our hypothesis that the pathway between racial discrimination stress and substance use operated indirectly through internal locus of control. Thus, although there might be some relationship between internal locus of control and stress (Ryon & Gleason, 2014; Szabo, Chang, & Chancellor-Freeland, 2015; Moreland, Felton, Hanson, Jackson, & Dumas, 2016), it may be that the stress from race-related discrimination does not have a relationship with internal locus of control. This contradictory finding may be due to the type of stressor examined in this study, as previous literature has mainly focused on how internal locus of control relates to general stressors. Little work has examined discrimination as a stressor and found that those who

minimized perceptions of discrimination perceived greater control over their lives, thus having a more internal locus of control, among a sample of Black and Asian participants (Ruggiero & Taylor, 1997). It is clear that no significant relationship between internal and stress related to racial discrimination was found, despite previous research that has found association between internality and general discrimination. It is plausible that these mixed findings are due to differences in measurement of stressors (general discrimination vs race-related stress) and race/ethnic makeup of the samples, making the case that internal locus of control may have varied relationships with different types of stressors. It could be the case that general stress may leave one to evaluate their own level of control over those events (internality), and that specific race-related stress influences perceptions of external sources of control (externality), which has been observed among a small body of work (Broman, Mavaddat, & Hsu, 2000; Trevino & Ernest, 2012).

This brings us to our external locus of control variable, where we examined the effect of powerful others on the pathway between stress from race-related discrimination and substance use. We did find that stress related to racial discrimination was significantly associated with higher powerful others locus of control directly, making the case that stress related to racial discrimination relates to external rather than internal locus of control. However, contrary to our hypothesis, no significant indirect effect was found for powerful others locus of control, in explaining the relationship between stress related to racial discrimination and substance use. The lack of a significant indirect effect was due to the non-significant association of external locus of control on the substance use outcome, which is inconsistent with previous literature (Haynes & Ayliffe, 1991; Soravia, Schläfli, Stutz, Rösner, & Moggi, 2015). These differing results may be due to differences in measurement. Specifically, we examined substance use by measuring alcohol and drug consumption in the past year while previous literature measured consumption, frequency, and related problems of use (Haynes & Ayliffe, 1991; Soravia, Schläfli, Stutz, Rösner, & Moggi, 2015). Additionally, our study examined powerful others rather than a general locus of control domain, contrary to previous work, which may account for variation in the findings. Lastly, our study was conducted among people who identified as belonging to racial/ethnic minority groups, which is different from the previous studies that were conducted among predominantly White participants in some type of treatment for substance use. Thus, there may be other factors that contributed to the lack of finding a significant indirect effect of

powerful others on the pathway between stress related to racial discrimination and substance use for our sample. However, even though we did not find a significant indirect effect of powerful others, it is important to note that these findings add to the literature by examining specific domains of external locus of control. Therefore, we found that the perception of control being attributed to those perceived as more powerful specifically, rather than a general external locus of control belief, may not explain risk for substance use as a consequence of stress related to racial discrimination.

In order to examine our second set of hypotheses, we examined these models serially by adding depressive symptoms as a mediator. Contrary to our hypothesis, results indicated that higher internal locus of control through depressive symptoms did not serially mediate the pathway between stress related to racial discrimination and substance use while controlling for age, gender, recruitment source, and powerful others. However, consistent with previous literature (Gale, Batty, & Deary, 2008; Omani Samani, Maroufizadeh, Navid, & Amini, 2017), higher internal locus of control was significantly associated with lower depressive symptoms and lower depressive symptoms were significantly associated with lower substance use. Thus, the perception of not having control over the events in one's life can be distressing which explains its consistent association with increased depressive symptoms (Yu & Fan, 2016; Omani Samani, Maroufizadeh, Navid, & Amini, 2017; Sullivan, Thompson, Kounali, Lewis, & Zammit, 2017). Furthermore, this distress is associated with substance use among our sample of racial and ethnic minority adults. These findings highlight that although we did not find support on the effect of internal locus of control through depressive symptoms on substance use as a consequence of racial discrimination, controlling for levels of racial discrimination stress this pathway does appear to be found. Thus, future work may want to consider the association between control beliefs and depressive symptoms on negative health outcomes, particularly among racial and ethnic minorities.

When examining the indirect effect of powerful others through depressive symptoms within the racial discrimination related stress-substance use pathway, consistent with our hypothesis, a significant, though small, indirect effect was observed. This finding suggests that although powerful others was not directly related to substance use as a consequence of stress related to racial discrimination, this pathway does appear to operate through depressive symptoms. Additionally, these results are consistent with the stress coping model (Clark,

Anderson, Clark, & Williams, 1999), suggesting that belief in external sources having control over one's life may be distressing and contributes to experiencing depressive symptoms, which in turn may result in avoidant coping such as substance use (Clark, 2014). Future research can build off of this work to better tailor intervention efforts aimed at reducing substance use risk by focusing efforts on external locus of control and how that may impact depressive symptoms among racial/ethnic adults.

Given that there was a second subscale for external locus of control, chance, post-hoc analyses were conducted to examine whether this subscale operated similarly to the powerful others subscale. Upon running post hoc mediation analyses, we did find that after controlling for age, gender, recruitment source, and internal locus of control, a significant indirect effect of the chance subscale on the risk pathway between stress related to racial discrimination and substance use. In other words, stress related to racial discrimination is significantly associated with higher beliefs that events in one's life are attributed to chance and that is associated with higher substance use. Similarly, when running the serial mediation model with chance locus of control and depressive symptoms, we found a significant indirect effect of the variables after controlling for age, gender, recruitment source, and internal locus of control. Thus, higher stress related to racial discrimination was associated with a higher perception that events in one's life are due to chance, which was associated with higher depressive symptoms, and in turn associated with higher substance use.

Although some research has theorized that for racial/ethnic minority group members, it may be more salient to examine the powerful others orientation (Garcia & Levenson, 1975) as living in a racialized society can affect one's sense of agency and control (Broman, Mavaddat, & Hsu, 2000), the other external locus of control of chance may also need to be further examined and not discounted. It is plausible that chance locus of control beliefs may better explain the relationship between stress related to racial discrimination and substance use rather than powerful others beliefs. It is not clear why this may be, as previous research is limited, and has not examined the two specific external locus of control domains within this pathway. It may be that chance beliefs, such as events in life being complex and chaotic and out of one's hands, may be more distressing than powerful others beliefs, resulting in substance use to cope with the distress (Clark, Anderson, Clark, & Williams, 1999). Additionally, in line with previous literature linking external and depressive symptoms (Benassi, Sweeney, & Dufour, 1988;

Bjørkløf et al., 2016; Yu & Fan, 2016), we find that chance locus of control is associated with depressive symptoms, and together they may explain the relationship between racial discrimination related stress and substance use. Our study provides evidence of each external locus of control domain and how they relate to our risk pathway uniquely, adding to the idea that they influence variables in their own way (Levenson, 1973; Reid & Ware, 1974).

There are significant implications of this study. First, this is the first known study to examine the influence of locus of control as a mechanism in explaining risk for substance use as a consequence of stress related to racial discrimination. For the first aim, examining a simple mediation model between stress related to racial discrimination, locus of control, and substance use, although both the external locus of control domains were related to racial discrimination stress, only the chance locus of control domain had a significant indirect effect within the discrimination-substance use risk pathway. This finding, highlights the important effect racial discrimination stress can have on each external locus of control domain, and the role chance locus of control plays in understanding risk for stress related from racial discrimination exposure on substance use risk among racial/ethnic minority adults. Importantly, this risk pathway was also examined while controlling for the potential effect of internal locus of control, in order to extend the literature and better understand the unique effect that each locus of control orientation may have. For the second aim, we also provided novel information regarding the serial pathways between racial discrimination stress on substance use through locus of control and depressive symptoms, finding that this pathway was significant for both external locus of control orientations, powerful others and chance, but not internality. This finding signifies the impact that that stress related to racial discrimination has on substance use through impacting both an individual's perceptions of external control of their lives as well as their mood, and provides important targets for interventions to address substance use risk for racial and ethnic minority adults.

Although there are several novel and important implications from the study, there are some limitations. First, more than half of data for the current study was obtained from a college sample (63.4%), predominantly in the Midwest (51.7%), limiting the generalizability of its findings. Our sample is also primarily African American/Black and Hispanic/Latino which further limits the generalizability of our findings to other racial/ethnic groups. Future research should examine these models among different racial/ethnic minority categories as well across different states and

adults not enrolled in college. Third, our study removed six participants that identified with non-binary gender affiliation, thus our results represent findings among those who identify as having a binary gender affiliation (male or female), and future work can expand on this by examining locus of control among gender diverse samples. Fourth, we may have been underpowered to detect an effect based on the power-analysis conducted. Thus, future studies are needed to confirm the proposed pathways with a larger sample of participants. Additionally, it is important to note the variability in past year substance use in our sample compared to national surveys. According to SAMHA's 2017 report, among 18-25-year-olds, 65% of African American/Black and 70% of Hispanic/Latino populations reported past year alcohol use compared to our rate of 54.7% for our sample of racial/ethnic minority adults. For illicit drug use, national past year drug use rates were found to be 38% for African American/Black and 37% of Hispanic/Latino populations compared to our rate of 24.9%. These lower rates of use may have reduced our power to detect an effect, thus future work may want to recruit a larger sample that is also more commensurate to the national stats.

In spite of these limitations, future studies can build off of this work in important ways. The current study was notable in that it examined external locus of control at the domain level rather than examine more global levels of external locus of control. However, examining both domain within the same models is also important, as it can further our understanding of each domain's unique influence on variables of interest. Yet, doing this may be dependent on the sample characteristics, as although powerful others and chance as were only moderately correlated when it was originally created ($r = .54, p < .01$; Levenson, 1973) and in our study they were highly correlated ($r(486) = .822, p < .001$). These differences in correlations may be due to our sample being comprised of people identifying a belonging to racial/ethnic minorities rather than predominantly White samples, thus the two external domains may look different across cultures, warranting further research.

Future studies can also expand on the current study by using other scales measuring locus of control that may provide useful information. For example, there are measures for locus of control scales that assess perceived control in regard to specific domains of the person's life (e.g. health, academic achievement). For example, the Academic Locus of Control for College Students revised (ALC-R; Curtis & Trice, 2013) assesses one's perceived level of control within the area of academic achievement. Examining this specific domain of locus of control could be

particularly relevant for college students, given that more than half of our sample were currently enrolled in college, academic achievement may be a central component of their life during this developmental period. Moreover, for racial/ethnic minority college students, it is plausible that there may be cultural factors regarding inclusion (Griffin, Cunningham, & George Mwangi, 2016) and perceived discrimination (Levin, Van Laar, & Foote, 2006; Brown, Rosnick, & Segrist, 2017) within this setting that could also impact locus of control. Another example is the Multidimensional Health Locus of Control scale (MHLC; Wallston, Wallston, & DeVellis, 1978) which assesses one's perceived level of control over their health. Future studies can also examine this specific domain of locus of control, as it could be particularly relevant for the racial/ethnic minority adults given that beliefs about control over health and health behaviors, such as substance use, are related. Particularly, Pieterse and Carter (2010) found that among a sample of African American women, experiences of racial discrimination were associated with an external health locus of control, likely affecting health behaviors such as getting cancer screenings and other health related choices. Moreover, for racial/ethnic minority adults, it is plausible that there may be other factors such as racial identity attitudes (Pieterse & Carter, 2010) within this domain that could also impact locus of control. Utilizing other specific measures of locus of control may provide additional insight into the influence of locus of control on risk models of racial discrimination on health outcomes among racial/ethnic minority adults.

In addition to utilizing different measurements of locus of control, future research may want to expand upon the current study by examining the identified relationships through prospective research designs. Research has found that locus of control has elements that are enduring and malleable, being susceptible to outside factors (Keeton, Perry-Jenkins, & Sayer, 2008). Therefore, one-time measures of locus of control may not necessarily be measuring the person's general enduring locus of control (Keeton, Perry-Jenkins, & Sayer, 2008). Thus, future studies can build from the current work by obtaining multiple assessments of locus of control to examine the temporal ordering between stress related to racial discrimination, locus of control, depressive symptoms, and substance use.

Taken together, our findings suggest that although a significant indirect effect was not observed for internal locus of control within the relationship between stress related to racial discrimination and substance use, external locus of control, specifically the chance domain does appear to be a mechanism within this pathway. Furthermore, both domains of external locus of

control, powerful others and chance, appear to operate indirectly through depressive symptoms in understanding the stress related to racial discrimination-substance use pathway, suggesting that racial discrimination related stress relates to external locus of control beliefs that influences depressive symptoms which is associated with increased risk for substance use. Although we expected to see effects mainly for powerful others, as power structures and lack of power in society are related to racial discrimination, we unexpectedly found that chance may be a better indicator within this model, possibly due to belief in chance rather than powerful others may be more distressing which then better relates to using substances.

These results have important implications for future research and interventions. Specifically, our findings can inform future research by further examining these two domains of external locus of control and how they work together, perhaps through higher order factor to better understand risk. With more future research examining distinct locus of control domains, these findings can also be used to help inform and improve intervention programs targeted for substance use reduction among racial/ethnic minority individuals. Within the treatment literature, a majority of studies have focused on internal locus of control, finding it to be an important factor of prevention and intervention strategies targeted at reducing substance use by shifting people to have a more internal orientation (Figurelli, Hartman, & Kowalski, 1994; Gagnon et al., 2012; Lennings, 1980; Leung, Abdallah, Copeland, & Cotter, 2010). Yet, our findings are a first step that begs the question whether external locus of control could be an intervention target. It is too early to tell whether shifting intervention efforts to external locus of control domains rather than internal, particularly for racial and ethnic minorities, may be more effective. However, findings do highlight the need to further study external locus of control, specifically, powerful others and chance orientations, as well as looking at how they impact depressive symptoms, in ultimately reducing risk for substance use as a consequence of discrimination exposure among racial/ethnic minority adults.

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