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REGULAR ARTICLE

Cannabis and Other Substance Use, Experiences of Ethnoracial Discrimination, and Psychotic-Like Experiences

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Background and Hypothesis: **Cannabis use has been linked to increased positive psychotic-like experiences (PLEs) and found to act additively with stressful/traumatic events to increase risk for psychosis. Emerging evidence suggests that experiencing ethnoracial discrimination is a chronic stressor associated with increased substance use and positive PLEs. We hypothesized that ethnoracial discrimination would be associated with increased positive PLEs through the indirect effect of increased cannabis use.**

Study Design: **Community individuals ($n = 7{,}429$) aged 16-30 ascertained from the Multi-site Assessment of Psychosis-risk (MAP) study completed self-report assessments of ethnoracial discrimination, cannabis and substance use, and positive PLEs. Statistical analyses using an indirect effects framework examined direct effects from ethnoracial discrimination to specific positive PLEs (non-persecutory ideation, persecution ideation, and perceptual abnormalities), and indirect effects through cannabis use. To test the specificity of cannabis, supplementary analyses examined indirect effects through other substance.**

Study Results: **Across Asian, Black, Hispanic, and non-Hispanic White participants, significant direct effects were found from ethnoracial discrimination to each positive PLE (all $p < 0.01$). Significant indirect effects were found through cannabis use and through other substance use among Asian, Black, and Hispanic individuals, and via other substance use in non-Hispanic White individuals (all 95% CIs excluded zero).**

Conclusions: **Results suggest that any substance use, including but not limited to cannabis use, may be a common pathway by which exposure to stressful experiences of ethnoracial discrimination may contribute to increased positive PLEs. Findings have implications for targeting substance use in individuals who may be at increased risk for psychotic experiences and who have experienced ethnoracial discrimination.**

Key words: ethnoracial discrimination; cannabis; substance use; psychotic-like experiences; psychotic experiences; community sample.

Introduction

In recent decades, cannabis use has increased among adolescents and young adults in the United States and has become the most commonly used substance among this age group.[1-3] The developmental period from adolescence to young adulthood coincides with peak onset for many psychological conditions, including psychotic disorders.[4,5] Studies find that cannabis use is a risk factor for multiple psychosis-spectrum outcomes, including psychotic disorders like schizophrenia,[6] clinical high-risk for psychosis state,[7] and subthreshold positive psychotic-like experiences (PLEs) of non-persecutory ideation, persecutory ideation, and perceptual abnormalities among the general population[8,9]; with PLEs considered an independent risk factor for developing a psychotic disorder.[10] When examining associations with specific positive symptom domains, findings from prior research among psychosis-spectrum and community samples suggest that cannabis is positively associated with all types of psychotic symptoms and experiences.[7,11-13] However, much of the research conducted in community samples report associations between cannabis use and total positive symptoms, limiting our understanding of specificity with the various positive symptom domains among community individuals. Considering the increasing, widespread use of cannabis among adolescents and

young adults in the general population, further research using large, community samples to examine associations with different positive PLE types is important to increase our understanding of the specific effects of cannabis on psychosis outcomes, which may inform early identification and prevention efforts for individuals who might not otherwise present for treatment.

Stress and trauma have also been identified as putative risk factors for psychosis, consistently associated with increased positive psychotic symptoms and PLEs,[10,14] and which may act additively with cannabis use to further increase risk for psychosis.[15-18] While childhood trauma has been extensively studied in these relationships, research on other types of stressful/traumatic life events that may be chronically experienced, like ethnoracial discrimination, has been relatively underexamined in association with substance use and their additive effects on PLEs. Emerging evidence suggests that experiencing ethnoracial discrimination, which is the perception of being treated unfairly because of one's race, ethnicity, or skin color,[19] and which can be experienced interpersonally and at multiple levels of society through the effects of structural racism,[20] is a chronic stressor among Asian, Black, and Hispanic individuals in the United States,[21] and that is associated with a range of poor mental health outcomes.[22-24] Ethnoracial disparities have been noted in substance use outcomes, with the majority of the literature focusing on cannabis use.[25,26] Prior studies suggest that individuals exposed to ethnoracial discrimination, notably Black adolescents and young adults, may engage with substances to cope with chronic stress exposure from experiences of discrimination.[27-31] Additionally, ethnoracial discrimination has also been associated with multiple psychosis-spectrum outcomes, including PLEs.[20,32-35] While prior studies suggest that ethnoracial discrimination may be uniquely associated with persecutory ideation,[33] and this particular relationship is often studied, other studies have found ethnoracial disparities and ethnoracial discrimination to also be associated with other positive symptom domains like non-persecutory ideation and perceptual abnormalities.[35,36] However, many studies collapse the various positive symptom domains into one category, precluding examination of potential specificity. Ethnoracial differences in PLE types were previously found to be explained in part by different groups being exposed to qualitatively different experiences of discrimination (ie, major experiences of discrimination, microaggressions), though these findings were from a college student sample, potentially limiting generalizability to community individuals.[35] To our knowledge, one prior study has reported significant correlations between ethnoracial discrimination, perceived stress, substance use, and positive PLEs, though the study sample was limited to Black college students, and did not examine associations with specific PLEs.[37] Thus, further research using large, community samples is needed to clarify whether ethnoracial discrimination may be uniquely linked with particular positive PLE domains or if it may be associated with multiple domains, how cannabis use may play a role in these relationships, and whether these relationships may vary across different ethnoracial groups.

Given this rationale, as a primary aim, we examined the effects of ethnoracial discrimination and cannabis use on three types of positive PLEs—persecutory ideation, non-persecutory ideation, and perceptual abnormalities—to address how several risk factors may act additively to increase risk for psychosis among community adolescents and young adults. Furthermore, we aimed to understand these relationships across multiple ethnoracial groups, which expands prior literature that has largely focused on the effects of ethnoracial discrimination on substance use in fewer ethnoracial groups. To do this, we employed an indirect effects framework, which allows for examination of these associations based on theoretical longitudinal processes of experiences of discrimination increasing vulnerability to substance use, which in turn may increase risk for PLEs. This statistical approach does not require temporal precedence, as it may be difficult to disentangle the temporal effects of how ethnoracial discrimination and cannabis use may operate within the course of psychosis, with both potentially acting in concert over time. We hypothesized that experiences of ethnoracial discrimination among community Asian, Black, and Hispanic adolescents and young adults would be associated with increased non-persecutory ideation, persecutory ideation, and perceptual abnormalities through the indirect effect of increased cannabis use. Analyses were also conducted in non-Hispanic White individuals for exploratory purposes, which is a heterogenous group comprised of individuals who may differentially experience ethnoracial discrimination. To examine the specificity of cannabis use, we conducted supplementary analyses investigating indirect effects through other substance use.

Methods

Participants

Participants came from the community-based Multisite Assessment of Psychosis-risk (MAP) study, a study of psychosis-risk symptoms in adolescents and young adults aged 16-30.[38] Between July 2017 and December 2022, participants were recruited via flyers and online advertisements (e.g., Facebook, Craig's List, etc.) across four racially/ethnically and economically diverse catchment areas in the United States (the greater Philadelphia County, Pennsylvania; Baltimore County, Maryland; Cook County, Illinois; and Orange County, California areas; including the urban, suburban, and rural areas). No other exclusion criteria besides a maximum age of 30 was followed to recruit individuals at peak onset

for psychotic experiences. Written informed consent or assent (for minors who also had a parent provide informed consent) was obtained prior to study tasks. All participants completed an online battery of baseline self-report questionnaires and were compensated via cash or gift card. Ethical approval for study procedures was approved by the Institutional Review Boards at all institutions (Temple University; University of Maryland, Baltimore County; Northwestern University; University of California, Irvine).

Measures

Demographic variables including age, sex assigned at birth, race, and ethnicity were self-reported. Race and ethnicity were reported according to the National Institutes of Health racial and ethnic categories. All clinical variables were self-reported, and included:

Ethnoracial discrimination was assessed with the Experiences of Discrimination questionnaire.[19] This questionnaire assesses lifetime frequency of experiences of discrimination due to race, ethnicity, or skin color, across nine contexts (e.g., school, work, housing, public, legal) on a four-point scale from "never" to "4 or more times." The measure has been administered with Asian, Black, Hispanic, and non-Hispanic White adult samples, and validated in Black and Hispanic adult samples.[19] A sum score was calculated and treated as the predictor variable.

Cannabis and other substance use was assessed with the Drug Use Frequency scale.[39] This questionnaire assesses frequency of substance use in the past three months on a five-point scale from "never" to "daily," including amphetamines/stimulants; psychostimulants; cocaine; barbiturates/tranquilizers; marijuana; heroin, opium, morphine, opioids; hallucinogens; PCP; inhalants; other drugs (e.g., Robitussin AC, steroids, nonprescription sleep pills). A one-item score with a Likert-type scale for marijuana or cannabis use was treated as the indirect effect variable in main analyses. A 9-item sum score across the other substance categories was calculated and used in supplementary analyses as the indirect effect variable. Of note, while this "other substance use" category did include polysubstance users, it collapsed multiple substances together that had a low frequency of responding and use (i.e., most of the endorsements were for only one substance and used infrequently). Frequencies of the individual substance categories that comprised the other substance use variable are presented in Table S1.

Positive psychotic-like experiences (PLEs) were assessed with the Prodromal Questionnaire (PQ).[40] This questionnaire assesses endorsement (yes/no) of a range of PLEs in the past month when not using alcohol, drugs, and/or medications that could affect response accuracy. A 17-item subset assessed non-persecutory ideation, an 8-item subset assessed persecutory ideation, and a 14-item subset assessed perceptual abnormalities (see Table S2 for a list of these items).[41] Sum scores for each positive PLE domain were calculated by counting the number of endorsed items, and treated as the outcome variables. Measurement invariance on this measure among Asian, Black, Hispanic, and White college students has been demonstrated.[42]

Design and Statistical Analyses

Missing Data. Total sample sizes for each ethnoracial group included 1,797 non-Hispanic Asian participants, 865 non-Hispanic Black participants, 1,182 Hispanic participants, and 3,585 non-Hispanic White participants. Participants who failed attention checks during the online self-report battery were excluded from analyses. Missing data from self-report measures were handled by calculating the average item scores of available data scaled to the sum scores based on the number of measure items. The percentage of missing data for each variable, by ethnoracial group, are noted in Table 1.

Data Analysis Plan. Residuals of outcome variables (non-persecutory ideation, persecutory ideation, and perceptual abnormalities) regressed on the predictor variable (ethnoracial discrimination) were normally distributed in individual linear regression models. Descriptive statistics on demographic and clinical characteristics by ethnoracial group were conducted, as well as omnibus differences across groups. When omnibus tests were statistically significant, pairwise differences using Welch's t-tests with a Holm-Bonferroni p-value correction were explored. Bivariate Pearson's correlations among study variables by ethnoracial group were also tested. Age and sex assigned at birth were included as covariates in indirect effects analyses given significant bivariate associations with some of the variables, and prior literature demonstrating age and sex differences in subthreshold positive psychotic symptoms.[43]

Direct and indirect effects analyses were conducted using Mplus 8.11 and facilitated using the MplusAutomation package.[44,45] Indirect effects is the more general term for models that include effects of a predictor variable on an outcome variable via an intermediary or indirect effect variable. In the context of cross-sectional designs, indirect effects models allow for examination of these associations without a requirement for temporal precedence and ruling out alternative directions of effects. Thus, multiple group models, for Asian, Black, and Hispanic individuals, were estimated that specified direct effects from ethnoracial discrimination to each positive PLE, and indirect effects through cannabis use. Indirect effects through other substance use were specified in supplementary analyses. We compared a model that freely estimated path coefficients across Asian, Black, and Hispanic groups to a model that constrained like path coefficients to be equal across groups. A chi-square difference test evaluated whether there were significant differences in path coefficients across ethnoracial groups. Maximum

Table 1. Participant Demographics and Clinical Characteristics

	Asian ($n = 1,797$) mean (SD) [range]	**Black ($n = 865$) mean (SD) [range]**	**Hispanic ($n = 1,182$) mean (SD) [range]**	**non-Hispanic White ($n = 3,585$) mean (SD) [range]**	**Differences [F, p][a]**
Age (years)	20.67 (2.82) [16-30] {0.001%}	21.10 (3.29) [16-30] {0.005%}	21.18 (3.18) [16-30] {0.002%}	21.56 (3.28) [16-30] {0.001%}	(37,412) = 32.5, <0.001[a]
Female, *n* (%)	1,227, (68.51%) {0.003%}	589, (68.41%) {0.004%}	821, (69.87%) {0.01%}	2,472, (68.42%) {0.01%}	(37,384) = 0.33, .81
Race, *n* (%)					-
American Indian/Alaska Native	-	-	33, (2.79%)	-	
Asian	1,797, (100%)	-	47, (3.98%)	-	
Native Hawaiian or Other Pacific Islander	-	-	4, (0.34%)	-	
Black	-	865, (100%)	85, (7.19%)	-	
White	-	-	614, (51.95%)	3,585, (100%)	
More than One Race	-	-	79, (6.68%)	-	
Ethnoracial discrimination	4.47 (5.53) [0-45] {0.03%}	7.54 (8.27) [0-45] {0.03%}	4.19 (5.94) [0-40] {0.02%}	0.86 (2.66) [0-40] {0.004%}	(37,301) = 540.10, <0.001[a]
Non-persecutory ideation	2.81 (2.78) [0-16] {0.01%}	3.84 (3.58) [0-17] {0.01%}	3.40 (3.29) [0-17] {0.01%}	3.12 (3.18) [0-17] {0.01%}	(37,383) = 22.85, <0.001[a]
Persecutory ideation	1.45 (1.79) [0-8] {0.01%}	1.90 (2.16) [0-8] {0.01%}	1.55 (1.93) [0-8] {0.01%}	1.54 (1.98) [0-8] {0.01%}	(37,370) = 10.69, <0.001[a]
Perceptual abnormalities	1.45 (2.11) [0-13] {0.01%}	2.15 (2.72) [0-14] {0.01%}	2.01 (2.72) [0-14] {0.004%}	1.76 (2.59) [0-14] {0.003%}	(37,388) = 19.31, <0.001[a]
Cannabis use	0.30 (0.74) [0-4] {0.01%}	0.63 (1.09) [0-4] {0.01%}	0.75 (1.17) [0-4] {0.01%}	0.82 (1.23) [0-4] {0.01%}	(37,345) = 91.78, <0.001[a]
Other substance use	0.23 (0.84) [0-10] {0.002%}	0.43 (1.45) [0-18] {0.003%}	0.76 (2.76) [0-36] {0.003%}	0.60 (1.66) [0-25] {0.004%}	(37,402) = 28.82, <0.001[a]

n's listed are total sample sizes. % missing data is indicated in {} with statistics based on available data. [a]Pairwise differences are contained in Supplementary Table 3.

likelihood estimation was used in indirect effects analyses to account for missing data across variables. The indirect effect was tested using bootstrapping with 5,000 samples, with significant results indicated by the 95% confidence interval (CI) of the indirect effect not including zero. Indirect effects analyses were also conducted in non-Hispanic White individuals for exploratory purposes.

Results

Descriptive Statistics

Table 1 presents descriptive statistics on demographic and clinical characteristics by group. Significant omnibus differences among ethnoracial groups were found in age, experiences of ethnoracial discrimination, non-persecutory ideation, persecutory ideation, perceptual abnormalities, cannabis use, and other substance use. Pairwise differences between ethnoracial groups are presented in Table S3. Table 2 presents bivariate Pearson's correlations among all study variables by ethnoracial group. Ethnoracial discrimination was significantly correlated with both cannabis use and other substance use, and all PLE domains, among all ethnoracial groups. Both cannabis use and other substance use were significantly correlated with all PLE domains among all ethnoracial groups.

Model Comparisons

When examining cannabis use, chi-square difference tests found that the unconstrained model was a significantly better fit to the data across all models (non-persecutory ideation: $\chi^2(6) = 35.02$, p <0.001; persecutory ideation: $\chi^2(6) = 25.97$, $p < 0.001$; perceptual abnormalities: $\chi^2(6) = 29.59$, $p < 0.001$). This indicated that indirect effects differed across ethnoracial groups; thus, we focused on the model estimates in each group.

Direct and Indirect Effects Analyses

Results from the full indirect effects models examining non-persecutory ideation (Figure 1), persecutory ideation (Figure 2), and perceptual abnormalities (Figure 3) are presented. Across Asian, Black, and Hispanic individuals, significant direct effects were found from ethnoracial discrimination to increased non-persecutory ideation (Asian: c' = 0.034, SE = 0.003, $p < 0.001$; Black: c' = 0.024, SE = 0.004, $p < 0.001$; Hispanic: c' = 0.027, SE = 0.004, $p < 0.001$), persecutory ideation (Asian: c' = 0.041, SE = 0.004, $p < 0.001$; Black: c' = 0.028, SE = 0.004, $p < 0.001$; Hispanic: c' = 0.035, SE = 0.005, $p < 0.001$), and perceptual abnormalities (Asian: c' = 0.045, SE = 0.004, $p < 0.001$; Black: c' = 0.032, SE = 0.005, $p < 0.001$; Hispanic: c' = 0.034, SE = 0.006,

Table 2. Bivariate Relationships Among Study Variables (*r, p*)

	Ethnoracial discrimination	Cannabis use	Other substance use	Non-persecutory ideation	Persecutory ideation	Perceptual abnormalities	Age	Female
Ethnoracial discrimination	1							
Cannabis use	0.12**[a]	1						
	0.25**[b]							
	0.11**[c]							
	0.04*[d]							
Other substance use	0.09**[a]	0.22**[a]	1					
	0.17**[b]	0.24**[b]						
	0.09**[c]	0.30**[c]						
	0.19**[d]	0.24**[d]						
Non-persecutory ideation	0.21**[a]	0.08**[a]	0.13**[a]	1				
	0.24**[b]	0.16**[b]	0.18**[b]					
	0.20**[c]	0.21**[c]	0.15**[c]					
	0.15**[d]	0.21**[d]	0.22**[d]					
Persecutory ideation	0.21**[a]	0.07**[a]	0.12**[a]	0.70**[a]	1			
	0.22**[b]	0.15**[b]	0.14**[b]	0.77**[b]				
	0.20**[c]	0.17**[c]	0.11**[c]	0.76**[c]				
	0.14**[d]	0.16**[d]	0.18**[d]	0.76**[d]				
Perceptual abnormalities	0.21**[a]	0.07**[a]	0.13**[a]	0.70**[a]	0.59**[a]	1		
	0.24**[b]	0.15**[b]	0.17**[b]	0.76**[b]	0.71**[b]			
	0.20**[c]	0.17**[c]	0.21**[c]	0.75**[c]	0.67**[c]			
	0.14**[d]	0.13**[d]	0.23**[d]	0.75**[d]	0.66**[d]			
Age	0.17**[a]	0.01[a]	0.08**[a]	−0.08**[a]	−0.09**[a]	−0.04[a]	1	
	0.21**[b]	0.03[b]	0.12**[b]	−0.06[b]	−0.07*[b]	−0.05[b]		
	0.05**[c]	0.07*[c]	0.19**[c]	−0.02[c]	−0.05[c]	0.04[c]		
	0.09**[d]	−0.01[d]	0.12**[d]	−0.10**[d]	−0.10**[d]	−0.02[d]		
Female	0.09**[a]	−0.01[a]	0.02[a]	0.01[a]	−0.01[a]	0.04[a]	0.02[a]	1
	0.01[b]	0.00[b]	−0.05[b]	−0.03[b]	−0.04[b]	−0.01[b]	−0.09*[b]	
	0.01[c]	−0.11**[c]	−0.14**[c]	−0.04[c]	−0.02[c]	−0.01[c]	−0.01[c]	
	−0.07**[d]	−0.07**[d]	−0.06**[d]	−0.07**[d]	−0.04**[d]	−0.00[d]	0.04*[d]	

Total sample sizes: [a]Asian ($n = 1{,}797$). [b]Black ($n = 865$). [c]Hispanic ($n = 1{,}182$). [d]non-Hispanic White ($n = 3{,}585$). *indicates $p < 0.05$. **indicates $p < 0.01$.

$p < 0.001$). Among Asian, Black, and Hispanic participants, ethnoracial discrimination was associated with significantly greater cannabis use (Asian: a = 0.016, SE = 0.004, $p < 0.001$; Black: a = 0.032, SE = 0.006, $p < 0.001$; Hispanic: a = 0.022, SE = 0.006, $p < 0.001$), and cannabis use was associated with significantly increased non-persecutory ideation (Asian: b = 0.069, SE = 0.026, $p < 0.01$; Black: b = 0.082, SE = 0.027, $p < 0.01$; Hispanic: b = 0.142, SE = 0.024, $p < 0.001$), persecutory ideation (Asian: b = 0.067, SE = 0.031, $p < 0.05$; Black: b = 0.104, SE = 0.031, $p < 0.01$; Hispanic: b = 0.144, SE = 0.030, $p < 0.001$), and perceptual abnormalities (Asian: b = 0.073, SE = 0.036, $p < 0.05$; Black: b = 0.100, SE = 0.034, $p < 0.01$; Hispanic: b = 0.150, SE = 0.033, $p < 0.001$). Across Asian, Black, and Hispanic individuals, we found significant indirect effects from ethnoracial discrimination through increased cannabis use to increased non-persecutory ideation [Asian: (95% CI, 0.00031-0.00221); Black: (95% CI, 0.00097-0.00498); Hispanic: (95% CI, 0.00148-0.00535)], persecutory ideation [Asian: (95% CI, 0.00012-0.00232); Black: (95% CI, 0.00135-0.00593); Hispanic: (95% CI, 0.00141-0.00575)], and perceptual abnormalities [Asian: (95% CI, 0.00006-0.00264); Black: (95% CI, 0.00135-0.00593); Hispanic: (95% CI, 0.00148-0.00593)].

Among non-Hispanic White individuals, we again found significant direct effects from ethnoracial discrimination to increased non-persecutory ideation (Figure 1), persecutory ideation (Figure 2), and perceptual abnormalities (Figure 3) (all $p < 0.01$). Ethnoracial discrimination was not associated with significant changes in cannabis use (all $p > 0.05$), but cannabis use was associated with significantly increased non-persecutory ideation, persecutory ideation, and perceptual abnormalities (all $p < 0.001$). Among non-Hispanic White participants, we found no evidence for significant indirect effects through cannabis use to non-persecutory ideation (95% CI, −0.00012-0.00558), persecutory ideation (95% CI, −0.00012-0.00566), nor perceptual abnormalities (95% CI, −0.00006-0.00554).

When examining other substance use (see Table S4), we found significant indirect effects across Asian, Black, Hispanic, and non-Hispanic White participants from ethnoracial discrimination through increased other substance use to increased non-persecutory ideation [Asian: (95% CI, 0.00061-0.00258); Black: (95% CI, 0.00062-0.00338);

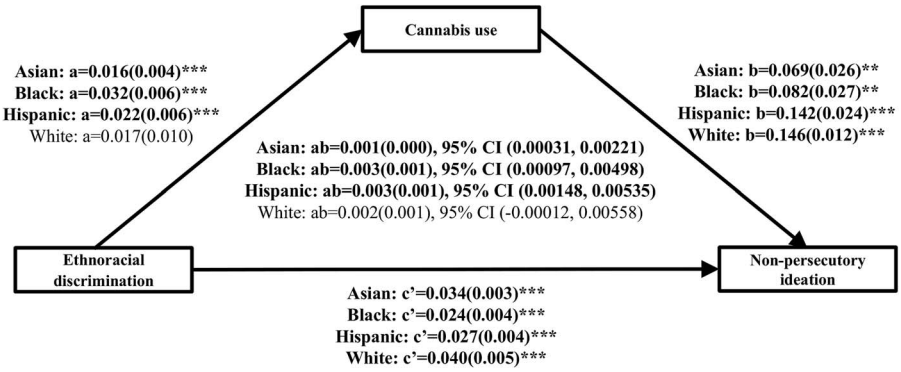

Figure 1. Indirect Effects from Ethnoracial Discrimination to Non-persecutory Ideation Through Cannabis Use. "a" indicates the effect of ethnoracial discrimination on cannabis use; "b" indicates the effect of cannabis use on non-persecutory ideation; "c" indicates the direct effect from ethnoracial discrimination to non-persecutory ideation; "ab" indicates the indirect effect from ethnoracial discrimination to non-persecutory ideation through cannabis use. Values are unstandardized coefficients and standard errors (in parentheses). Significant indirect effect indicated by the 95% CI not including zero. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

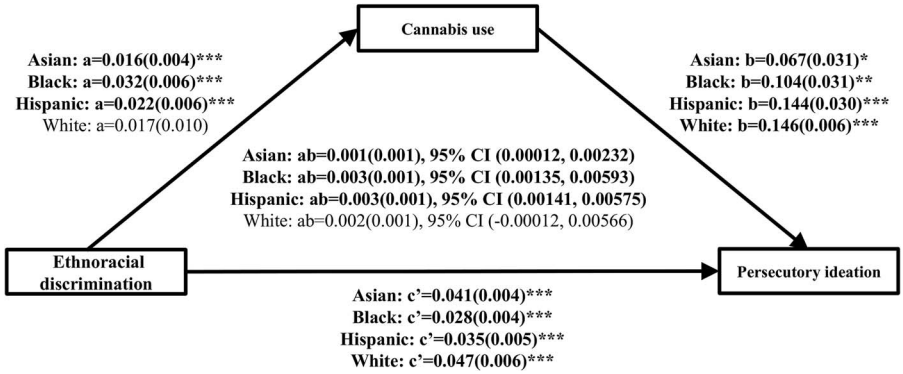

Figure 2. Indirect Effects from Ethnoracial Discrimination to Persecutory Ideation Through Cannabis Use. "a" indicates the effect of ethnoracial discrimination on cannabis use; "b" indicates the effect of cannabis use on persecutory ideation; "c" indicates the direct effect from ethnoracial discrimination to persecutory ideation; "ab" indicates the indirect effect from ethnoracial discrimination to persecutory ideation through cannabis use. Values are unstandardized coefficients and standard errors (in parentheses). Significant indirect effect indicated by the 95% CI not including zero. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

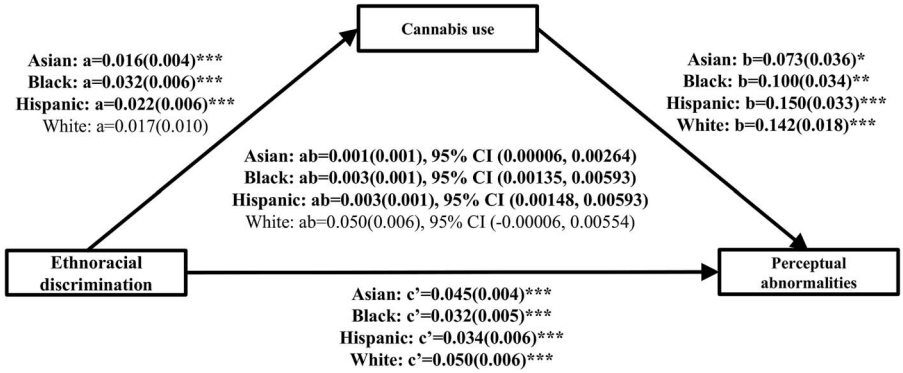

Figure 3. Indirect Effects from Ethnoracial Discrimination to Perceptual Abnormalities Through Cannabis Use. "a" indicates the effect of ethnoracial discrimination on cannabis use; "b" indicates the effect of cannabis use on perceptual abnormalities; "c" indicates the direct effect from ethnoracial discrimination to perceptual abnormalities; "ab" indicates the indirect effect from ethnoracial discrimination to perceptual abnormalities through cannabis use. Values are unstandardized coefficients and standard errors (in parentheses). Significant indirect effect indicated by the 95% CI not including zero. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Hispanic: (95% CI, 0.00053-0.00300); non-Hispanic White: (95% CI, 0.00549-0.01459)], persecutory ideation [Asian: (95% CI, 0.00061-0.00303); Black: (95% CI, 0.00056-0.00328); Hispanic: (95% CI, 0.00047-0.00301); non-Hispanic White: (95% CI, 0.00560-0.01468)], and perceptual abnormalities [Asian: (95% CI, 0.00087-0.00351); Black: (95% CI, 0.00069-0.00391); Hispanic: (95% CI, 0.00069-0.00421); non-Hispanic White: (95% CI, 0.00688-0.01852)].

Discussion

This study examined how several known risk factors for psychotic disorders, including experiences of ethnoracial discrimination, cannabis use, and other substance use, are associated with different types of positive PLEs in a community sample of adolescents and young adults. Consistent with our hypotheses, ethnoracial discrimination was associated with increased non-persecutory ideation, persecutory ideation, and perceptual abnormalities across Asian, Black, Hispanic, and non-Hispanic White individuals. Furthermore, greater frequency of cannabis use, as well as other substance use, significantly accounted for these associations among Asian, Black, and Hispanic participants. Among non-Hispanic White individuals, greater frequency of other substance use, but not cannabis use, significantly accounted for associations between ethnoracial discrimination and each positive PLE. While individuals in this non-Hispanic White group reported experiencing ethnoracial discrimination, this group is large and heterogenous, composed of individuals who may experience qualitatively different experiences of ethnoracial discrimination that make it difficult to interpret the specificity of results (e.g., individuals of Middle Eastern or North African backgrounds who may need to identify in this way per the current NIH racial/ethnic categories, or individuals with various ethnic backgrounds who immigrated to the United States, with discrimination experienced by these groups requiring further study). Nevertheless, these results are consistent with the suggestion that chronically stressful experiences of ethnoracial discrimination may increase vulnerability to substance use which, in turn, may contribute to increased positive PLEs.

Results suggest that substance use may be a common pathway to increased positive PLEs across races and ethnicities. These results are noteworthy given prior studies have largely found that the sequelae of ethnoracial discrimination varies by race and ethnicity, in part due to sociocultural factors which some ethnoracial groups may be more likely to experience.[20,46] Our findings are also consistent with prior research that indicates that Asian, Black, and Hispanic adolescents and young adults who have experienced discrimination may be more vulnerable to substance use,[27] and may use it to cope with additional stress associated with experiencing ethnoracial discrimination.[29,31,37] However, it is important to note that substance use among these groups may be associated with exposures to other social stressors and biopsychosocial factors,[27] which in many cases may act additively and/or interactively as well as dynamically, making it difficult to estimate the precise risk pathway among ethnoracial discrimination, substance use, and risk for PLEs. For example, individual-level factors like sex and gender identity may play a role and would be important to study further, with known sex and gender differences in both substance use and psychotic symptoms.[10,47] Gender identity may also interact with ethnoracial identity to contribute to intersectional experiences of discrimination that may further impact risk for psychosis.[48,49] Substance use may also be associated with a variety of contextual factors, such as exposure to substances by peers and family, neighborhood disadvantage, and urban environments.[27,50] While our community sample represented four racially/ethnically, economically, and geographically diverse catchment areas in the United States, further studies incorporating more granular geospatial methods (e.g., at the zip code or census block levels) are needed to determine whether our findings are fully related to substance use and/or other contextual/social risk factors. At the neurobiological level, prior studies show that experiences of ethnoracial discrimination are associated with changes in the hypothalamic–pituitary–adrenal (HPA) axis and other neural systems associated with psychosis,[51,52] which may result in increased vulnerability to psychosis onset following a second potent risk factor like substance use, which acts on the endocannabinoid system and has also been found to interact with the HPA axis.[53] Given these variables may entail complex interactions at the neurobiological level, an important future line of research will be to understand how ethnoracial discrimination and substance use may interact to contribute to increased risk for PLEs.

While many prior studies have focused on the relationship between cannabis use and psychosis, perhaps in part due to the prevalence of this substance type, our results are consistent with meta-analytic findings demonstrating that any substance use, including but not limited to cannabis use, is associated with experiencing PLEs.[54] Besides cannabis use, alcohol, tobacco, and amphetamine use have been found to be associated with PLEs,[54] and among individuals at clinical high-risk for psychosis, alcohol and tobacco are other frequently used substance types.[55] However, research on associations between other substance types and specific PLE types has been constrained by both of these variables often being studied broadly and collapsed across different substance and symptom types. Relatively lower endorsement of other substance types (e.g., amphetamines, cocaine, heroin, hallucinogens, inhalants) compared to the more commonly used substances may also pose a challenge to conducting specificity analyses, as was the case in the

current study, requiring future studies to target recruitment of individuals who report using less commonly used substances. Furthermore, evidence suggests that community individuals who report polysubstance use of cannabis and other substance types may be at increased risk for experiencing subclinical positive psychotic symptoms,[56] suggesting it may also be important to further understand the effects of using multiple different types of substances on risk for PLEs, including in the context of exposure to ethnoracial discrimination. Additionally, though we did not examine associations with grandiosity or disorganized communication given insufficient rationale implicating substance use with these PLE types, future studies should seek to understand the mechanisms by which ethnoracial discrimination may increase these experiences, with prior research suggesting different types of ethnoracial discrimination (major experiences, microaggressions) are variably associated with these PLE domains among different ethnoracial groups.[35]

Limitations

The results of this study should be considered in the context of some methodological limitations. First, cross-sectional data were analyzed, limiting our understanding of the directionality among variables. Future studies using longitudinal designs may help to clarify the temporal precedence among variables, though models permitting shared interpretations—like the indirect effects framework used in the current study—may represent more ecologically valid processes as chronic experiences of ethnoracial discrimination may operate in concert with substance use over time within the course of psychosis. Also, there may be other factors at play that were not assessed in the current study, but that may shed light on associations among these variables. Exposure to additional stressful/potentially traumatic life events may contribute further variability in the observed associations, with some evidence to suggest that a greater number of traumatic exposures may be associated with greater odds of cannabis use,[57] as well as increased psychosis-spectrum symptoms,[58] which will be important to examine further. Future studies may wish to control for exposures to other lifetime traumatic events and/or examine whether ethnoracial discrimination confers additional unique variability to associations with substance use and PLEs compared to other lifetime traumas. We were also unable to test associations with other substance types more specifically due to less frequent endorsement in our sample compared to cannabis use. In particular, alcohol and tobacco use are frequently reported among individuals experiencing PLEs or at clinical high-risk for psychosis,[54,55] and may be relevant to study further when exploring associations between experiences of ethnoracial discrimination and positive PLEs. Additionally, the scale we used to measure substance use assessed frequency only in the past three months, which limits our understanding of the effects of chronic compared to acute substance use. Prior studies have found that the magnitude of risk for psychotic disorders is larger with more chronic and earlier initiation of substance use,[59] which would be important to address in future studies. Finally, although all participants received a Certificate of Confidentiality in which they were informed that any endorsed substance use would not be reported to authorities or parents if they were under the age of 18, we were unable to study adolescents who did not get parental consent, and who may represent a vulnerable group in substance use research.

Implications

This study has important clinical and policy implications. Targeting any substance use among community individuals who have been exposed to stressful/traumatic experiences of ethnoracial discrimination may have implications on the treatment of PLEs, which should be further studied. Potential interventions should also incorporate anti-racist practices, including addressing in a culturally sensitive manner how a history of exposure to ethnoracial discrimination may increase vulnerability to substance use,[60] which in turn, may contribute to psychotic experiences. School and neighborhood-based substance prevention programs could also be important to reduce ethnoracial disparities in access to substance use education and increase utilization of substance use treatments,[61] which may potentially reduce the risk for onset of psychosis among adolescents and young adults in the community who have experienced discrimination.

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Author Contributions

Z.M.H.: Conceptualization, Formal analysis, Methodology, Writing—original draft, Writing—review & editing. T.M.O.: Conceptualization, Formal analysis, Methodology, Supervision, Writing—review & editing. J.S.: Conceptualization, Data curation, Funding acquisition, Investigation, Project administration, Resources, Writing—review & editing. V.A.M.: Conceptualization, Data curation, Funding acquisition, Investigation, Project administration, Resources, Writing—review & editing. L.M.E.: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing—review & editing

Supplementary Material

Supplementary material is available at https://academic.oup.com/schizophreniabulletin.

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Conflicts of Interest

The authors have declared that there are no conflicts of interest in relation to the subject of this study.

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