The Association of Multidimensional Schizotypy with Symptoms and Impairment Across Racial Groups

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Abstract:

The assessment of schizotypy and schizophrenia-spectrum psychopathology has historically been adversely impacted by multiple forms of measurement bias, including racial bias. The Multidimensional Schizotypy Scale (MSS) was developed using modern scale construction methods to minimize measurement bias in the assessment of schizotypic traits. However, studies have not examined the validity of the measurement across different racial groups. The present study examined whether the associations of MSS positive, negative, and disorganized schizotypy subscales with interview-assessed ratings of functioning, schizophrenia-spectrum personality traits, and depressive disorders were generally comparable across nonclinically ascertained samples of Black ($n = 46$), Asian ($n = 87$), and White ($n = 116$) young adults. Consistent with previous findings, all three schizotypy subscales were associated with impairment and schizotypal and paranoid traits. Negative schizotypy was associated with schizoid traits, and disorganized schizotypy was associated with depressive disorders. These associations were comparable across the racial groups, supporting the use of the MSS in these groups. Culturally and empirically valid assessments are essential for providing accurate assessments across racial/ethnic groups and reducing the risk of overpathologizing people of color. The present findings support the cross-cultural validity of the MSS; however, future studies should expand upon these findings by including more diverse samples and longitudinal designs.

Keywords: Psychometrics | Psychopathology | Racial Groups | Schizophrenia | Schizotypal Personality Disorder diagnosis | Young Adult | Index Medicus

Article:

INTRODUCTION

Schizophrenia and schizotypy

Schizophrenia is a severe mental illness that affects approximately 1% of the population worldwide (American Psychiatric Association, 2013). The disorder often first emerges in adolescence or early adulthood and frequently has a chronic and episodic course (American Psychiatric Association, 2013). Schizophrenia is a multidimensional disorder that includes positive, negative, and disorganized symptoms. Positive symptoms include hallucinations and delusions, negative symptoms involve diminished functioning, such as alogia, anhedonia, flattened affect, avolition, and social disinterest, and disorganized symptoms include disruptions in the organization and expression of thought, speech, behavior, and emotion (Tandon et al., 2009). Schizophrenia represents the most severe manifestation of a continuum of clinical and subclinical psychopathology referred to as schizotypy (Kwapil & Barrantes-Vidal, 2015; Lenzenweger, 2010). Patients with schizophrenia often exhibit subclinical prodromal signs and symptoms prior to transitioning into psychosis. Relatives of patients with schizophrenia-spectrum disorders also often exhibit subclinical schizotypic experiences. Furthermore, young adults who experience subclinical schizotypy are at a heightened risk for developing schizophrenia-spectrum disorders (Kwapil et al., 2013). Similar to schizophrenia, schizotypy is characterized by a multidimensional structure that includes positive, negative, and disorganized dimensions (Kwapil & Barrantes-Vidal, 2015). Schizotypy is often assessed using questionnaire measures such as the Wisconsin Schizotypy Scales (WSS; Chapman et al., 1976, 1978; Eckblad et al., 1982; Eckblad & Chapman, 1983), Schizotypal Personality Questionnaire (Raine, 1991), Oxford-Liverpool Inventory of Feelings and Experiences Scales (Mason et al., 1995), and more recently the Multidimensional Schizotypy Scale (MSS) (Kwapil, Gross, Silvia, et al., 2018).

The assessment of schizophrenia and schizotypy has been hampered by racial bias. For example, psychotic disorders such as schizophrenia are more frequently diagnosed in people of color compared with their White peers. A review by Schwartz and Blankenship (2014) indicated that in the United States, Black patients are overdiagnosed with psychotic disorders at rates three to four higher times than White patients, and the rate was three times higher in Latino/a patients. Likewise, biases occur in the assessment of schizotypy (Adams, 2008; Cicero, 2016; Goulding et al., 2009; Linscott et al., 2006; Sharpley et al., 2001; Winterstein et al., 2011). Many extant schizotypy measures were developed on relatively small and predominately White college student samples. Furthermore, item and scale development typically did not examine differential performance across racial groups. Subsequent studies have demonstrated that racial and ethnic groups differ significantly on schizotypy scales and subscales, despite no evidence that rates or severity of schizotypy differ across such groups, thus raising the risk of overpathologizing people of color. For example, Chmielewski et al. (1995) reported that African American students had significantly higher scores on all four of the WSS scales. Furthermore, Winterstein et al. (2011) reported that between one fourth to one half of the items on the WSS measures exhibited differential item functioning in Black and White participants (in addition to items with differential item functioning for sex).

These measurement issues raise concerns about the extent to which questionnaire measures of schizotypy are assessing the same constructs in respondents of different races and ethnicities. Although some studies have examined the psychometric properties of schizotypy scales and items in different racial groups, they typically have not examined the extent to which the associations of

questionnaire-assessed schizotypy with ratings of impairment and symptoms are comparable across racial and ethnic groups. For example, Chapman et al.'s (1994) landmark 10-year longitudinal study of schizotypy was limited to White college students. Kwapil et al. (2002) examined the association of four of the WSS that tap positive and negative schizotypy traits with interview ratings of impairment, psychotic-like and negative symptoms, and schizophrenia-spectrum personality disorder traits in Black and White young adults drawn from three universities. They recommended the use of different race-based norms for the WSS, but reported comparable associations of the schizotypy scales with interview measures of impairment and psychopathology in Black and White young adults. However, this study failed to include measures assessing disorganized schizotypy.

Multidimensional Schizotypy Scale

The MSS is a 77-item, true–false questionnaire that includes subscales assessing positive, negative, and disorganized schizotypy based on current conceptual models of schizotypy (Kwapil & Barrantes-Vidal, 2015). It was developed to account for the limitations of previous scales, which include language that has become biased or outdated, lack of use of modern measurement models, and development with relatively small, nondiverse samples often drawn from singular testing sites (Kwapil, Gross, Silvia, et al., 2018). In order to address conceptual and empirical limitations of previous scales, the MSS was developed following detailed trait specifications using large, diverse derivation and cross-validation samples. Items were selected on the basis of content validity, classical test theory, item response theory, and differential item functioning metrics. Only one of the 77 items exhibited differential item functioning for race or ethnicity, and there were no significant differences among racial and ethnic groups on mean scores on the three subscales (see also Li et al., 2020). The MSS positive, negative, and disorganized schizotypy subscales have good internal consistency reliability (Kwapil, Gross, Silvia, et al., 2018) and test–retest reliability (Kemp et al., 2020). Furthermore, questionnaire (Kwapil, Gross, Burgin, et al., 2018), interview (Kemp et al., 2021; Kwapil et al., 2021), and ambulatory assessment (Kwapil et al., 2020) studies support the construct validity of the MSS subscales. All three schizotypy dimensions are associated with interview ratings of impaired functioning in nonclinically ascertained young adults. Positive schizotypy is robustly associated with psychotic-like, schizotypal, and paranoid symptoms, whereas negative schizotypy has its strongest associations with interview-assessed negative, schizoid, and schizotypal symptoms. Disorganized schizotypy is associated with cognitive and emotional disruptions. Although the psychometric properties of the MSS appear comparable across racial and ethnic groups that have been assessed, studies have not examined whether the associations of the MSS subscales with interview-rated symptoms and impairment are comparable across such groups.

Goals of the present study

Previous studies demonstrated that the schizotypy dimensions are associated with unique patterns of interview-assessed symptoms and impairment (Barrantes-Vidal et al., 2013; Kemp et al., 2021; Kwapil et al., 2008, 2021). The present study sought to extend these findings by examining whether the associations between psychometrically assessed schizotypy and interview measures of symptoms and impairment are comparable across young adults in Asian, Black, and White racial groups. Specifically, the study examined the associations of the MSS positive, negative, and

disorganized schizotypy subscales with interview-rated impairment, schizophrenia-spectrum personality disorder traits, and depression diagnoses. The samples were drawn from two recently published cross-sectional studies of multidimensional schizotypy (Kemp et al., 2021; Kwapil et al., 2021) to examine racial differences in the validity of the MSS. Furthermore, the study builds on the interview findings reported in Kwapil et al. (2002) that only examined positive and negative schizotypy dimensions in Black and White participants. Note that the derivation methods for the MSS minimized racial bias in the items and subscales. However, this is the first study to our knowledge to examine the extent to which the associations of the MSS subscales with symptoms and impairment is comparable across racial groups. Specifically, we hypothesize that racial group × MSS subscale interactions predicting symptoms and impairment will be nonsignificant, supporting that the validity of the MSS is comparable across racial groups. Given the hypothesis of a null effect for the interactions, we will evaluate the results employing Bayesian analyses. The psychometric properties and validity of all measures should be demonstrated across people from diverse backgrounds to determine the applicability of the assessment tool. It is essential to determine whether assessments work comparably for people of disparate backgrounds. The finding that subscales perform differently in different racial groups (i.e., differentially predicted symptoms and impairment in different groups) would greatly limit the utility of the MSS, whereas comparable associations would further the support for the measure. Thus, such demonstrations are essential for the MSS, and by extension the construct of multidimensional schizotypy, to have broad applicability.

METHODS

Participant

Participants were drawn from two cross-sectional interview studies conducted in 2017–2018 (Kemp et al., 2021) and 2019–2020 (Kwapil et al., 2021). Note that all data collection was completed prior to the lockdown and quarantine imposed by the global COVID-19 pandemic. The 249 participants included college students who self-identified their race as Black (n = 46), Asian/Pacific Islander (n = 87), or White (n = 116) who were recruited from an undergraduate subject pool at the University of Illinois at Urbana–Champaign. Sixty-eight percent of the sample identified as women, and mean age of the sample was 19.0 years (standard deviation [SD] = 1.1, range 18 to 22 years), consistent with the participant pool demographics. The racial groups did not differ on age or sex composition. Participants were recruited using two sampling methods. First, we allowed any eligible participant in the pool to enroll. Second, we oversampled participants who scored at least 1.5 SD above the mean on the Multidimensional Schizotypy Scale—Brief (Gross et al., 2018) positive, negative, or disorganized schizotypy subscales taken during a pre-screening. This allowed us to recruit participants with a broad range of scores on the three schizotypy subscales, as well as ensure that there was adequate representation of participants with elevated scores. Participants received course credit for taking part in the studies.

Materials

At the start of the study, participants completed a brief demographic questionnaire, followed by the full version of the MSS. Participants were then administered a semistructured interview. In order to assess demographic symptoms and impairment, we used a modified version of the

overview section of the Structured Clinical Interview for DSM-5 Disorders (SCID-5) (First et al., 2015). A general overview of psychosocial functioning was rated using the Global Assessment of Functioning Scale (GAF) (American Psychiatric Association, 2000), which is rated on a scale from 0 to 100, with lower scores indicating poorer functioning. The mood disorder module of the SCID-5 was administered. Schizoid, schizotypal, and paranoid personality traits and disorders were assessed using modules of the International Personality Disorder Examination (IPDE) (World Health Organization, 1995). The IPDE is a semistructured interview measure designed to assess DSM-5 personality disorder traits and diagnoses. Each personality criterion is rated as 0 (not present), 1 (subthreshold), or 2 (meets diagnostic threshold). The sum of each criteria score was computed for each personality disorder, producing dimensional ratings for each of the personality disorders.

Procedures

Each participant was assessed individually. Once the participants provided informed consent, they completed the questionnaires (20 min) and then underwent the semistructured interviews (1–2 h). The interviews were conducted by trained graduate and undergraduate student assessors supervised by a licensed psychologist. As noted in Kemp et al. (2021) and Kwapil et al. (2021), interrater reliability was good to excellent for the interview measures used in the present study. The interviewers and raters were aware of the oversampling methods but were not aware of which participants were oversampled or of participants' scores on the MSS.

RESULTS

MSS descriptive statistics

Scores on the MSS positive, negative, and disorganized schizotypy subscales were converted to standardized scores based upon norms from 9366 adults (Kemp et al., 2021). The mean, SD, range, and coefficient alpha values of each MSS subscale in the present study are listed in Table 1. Regarding our oversampling procedures, 13% of the sample scored at least 1.5 SD above the mean on the MSS positive schizotypy subscale, 14% did so on the MSS negative schizotypy subscale, and 16% did so on the MSS disorganized schizotypy subscale. As demonstrated by the means, range of scores, and proportion of high scorers, we successfully recruited participants that scored across the full range of the MSS subscales. Furthermore, the three MSS subscales had comparable means, SDs, and proportions of high scorers—suggesting that none of the subscales were advantaged or disadvantaged in comparison with the others in terms of the distribution of scores. The coefficient alpha reliabilities of each of the subscales were consistent with previous studies and indicated good to excellent internal consistency reliability. The intercorrelations of the three MSS subscales are shown in Table 1 and were lower than reported in unselected samples (Kwapil, Gross, Silvia, et al., 2018), suggesting that multicollinearity was a minimal issue in the regression analyses (which was further indicated by minimal variance inflation factors in the regression analyses). In addition, Table S1 presents the descriptive statistics for the MSS subscales and the interview outcome measures separately for the three racial groups.

TABLE 1.

Descriptive statistics and intercorrelations of the Multidimensional Schizotypy Scale subscales ($n = 249$)

Descriptive statistics					Correlations	
MSS subscale	Mean	SD	Range	Coefficient alpha	Negative schizotypy	Disorganized schizotypy
Positive schizotypy	0.23	1.06	-0.82 to 4.43	0.87	0.08	0.26
Negative schizotypy	0.21	1.17	-0.81 to 4.60	0.90		0.14
Disorganized schizotypy	0.17	1.07	-0.70 to3.48	0.94		

Note: Standardized scores for the MSS subscales based upon 9366 adults.
Abbreviations: MSS, Multidimensional Schizotypy Scale; SD, standard deviation.82RBEIZET AL.

Quantitative interview measures of psychopathology

Table 2 presents the results of the linear regression analyses predicting the association of the MSS positive, negative, and disorganized schizotypy subscales with interview-based ratings of overall functioning and schizotypal, schizoid, and paranoid personality disorder traits, as well as whether these associations varied by racial group. Each row in Table 2 indicates a separate regression analysis in which the three MSS subscales were entered simultaneously at Step 1, the dummy codes for racial groups were entered at Step 2, and the schizotypy × dummy code interactions were entered simultaneously at Step 3 as predictors of the quantitative interview measures. At Step 2, the D1 code indicated the comparison of White and Black participants, and the D2 code indicated the comparison of White and Asian participants. At Step 3, the D1 interaction indicated whether the association of the specific schizotypy dimension and outcome measures differed for Black and White participants, and the D2 interaction assessed this for Asian and White participants. Note that dummy coding did not allow us to compare all three groups in the same analysis, so separate regressions were run to examine the comparison of Black and Asian participants.

Consistent with previous findings from which the present sample was drawn, the positive, negative, and disorganized schizotypy subscales predicted the outcome measures (Kemp et al., 2021; Kwapil et al., 2021) in expected fashion. All three schizotypy dimensions independently (over and above the other dimensions) predicted impaired functioning and elevated schizotypal and paranoid traits. Negative schizotypy was associated with elevated schizoid traits. There were no significant differences on interview ratings of schizotypal symptoms between White and Black or White and Asian participants on any of the measures over and above the main effects for the MSS subscales. In general, the associations of the schizotypy dimensions with the interview measures did not differ across groups, as only two of the 24 interactions were significant. Overall, the association of positive schizotypy with schizoid symptoms was not significant; however, there was a significant negative association for Black ($p < 0.01$), but not White participants. Consistent with previous findings, negative schizotypy was robustly associated with schizoid traits overall and in all of the groups. However, the effect was stronger for White ($p < 0.001$) than for Black ($p < 0.01$) participants.

In order to compare the Asian and Black participant groups, we reran each of the linear regression analyses including a dummy code comparing these groups. In terms of prediction of GAF scores, the Asian (coded 1) and Black (coded 0) groups did not

TABLE 2

Linear regressions examining prediction of impairment and personality disorder traits by the Multidimensional Schizotypy Scale and race (n = 249)

	Step 1			Step 2		Step 3					
	MSS positive schizotypy	MSS negative schizotypy	MSS disorganized schizotypy	D1	D2	PosSz × D1	PosSz × D2	NegSz × D1	NegSz × D2	DisSz × D1	DisSz × D2
Criteria	β	β	β	β	β	β	β	β	β	β	β
Global functioning	-0.169**	-0.442***	- 0.278***	- 0.068	- 0.017	0.010	0.093	0.096	0.008	0.120	0.091
Schizotypal traits	0.461***	0.375***	0.120*	- 0.015	- 0.064	- 0.011	- 0.055	0.015	0.061	- 0.069	- 0.034
Schizoid traits	-0.096	0.667***	- 0.016	0.049	0.085	-0.151**	- 0.067	- 0.133**	0.000	0.102	0.031
Paranoid traits	0.169**	0.248***	0.173**	0.089	- 0.098	0.043	0.033	- 0.052	- 0.077	0.071	0.035

Note: Each row indicates a separate regression analysis in which the three MSS subscales were entered simultaneously at Step 1, the dummy codes for racial groups were entered at Step 2, and the schizotypy × dummy code interactions were entered simultaneously at Step 3 as predictors of the quantitative interview measures. At Step 2, the D1 code indicates the comparison of White and Black participants and the D2 the comparison of White and Asian participants. At Step 3, the D1 interaction indicates whether the association of the specific schizotypy dimension and outcome measures differed for Black and White participants, and the D2 interaction assessed this for Asian and White participants.

Abbreviation: MSS, Multidimensional Schizotypy Scale.

*p < 0.05. **p < 0.01. ***p < 0.001.

differ, β = 0.129. Likewise, the interactions of the dummy codes for group with positive, negative, and disorganized schizotypy were not significant, βs = -0.083, -0.116, and -0.046, respectively. Similarly, in the prediction of schizotypal traits, the groups did not differ, β = 0.046, and none of the interaction terms were significant, βs = 0.044, 0.041, and 0.045, respectively. In the prediction of schizoid traits, the groups did not differ, β = 0.025. The interactions of groups with positive and disorganized schizotypy were nonsignificant, βs = 0.085 and -0.085, respectively. However, the interaction of group ☐ negative schizotypy was significant, β = 0.171, p < 0.05. Simple slopes indicated that the association of MSS negative schizotypy with interview-rated schizoid traits was significant for both groups albeit stronger for Asian participants, p < 0.001, compared with Black participants, p < 0.01. Paranoid traits were significantly higher for Black than Asian participants, β = -0.207, p < 0.05; however, the interactions of the dummy codes for group with positive, negative, and disorganized schizotypy were not significant, βs = -0.010, -0.081, and -0.045, respectively.

Given our hypotheses that the MSS subscales would predict symptoms and impairment comparably across racial groups are based on null findings for the interaction terms, we subsequently computed Bayesian statistics to determine the likelihood that the results indicated a null effect (Tables S2–S5). Specifically, we computed Bayes factor 01 (BF01) for all of our predictors in the hierarchical linear regressions. BF01 quantifies evidence for the null hypothesis relative to the alternative hypothesis, with smaller values providing increasing evidence for the alternative hypothesis and larger values providing evidence for the null hypothesis. In addition to BF01 values, we provided descriptors for each value following Wagenmakers et al. (2018). As seen in the tables, there was anecdotal to moderate evidence for the null hypothesis in 31 of the 33 statistically nonsignificant interactions. Among the three interactions that were statistically significant, one had moderate evidence for the alternative hypothesis, whereas two had anecdotal support.

Categorical interview measure of psychopathology and functioning

Table 3 presents the results of a binary logistic regression analysis predicting the association of the MSS positive, negative, and disorganized schizotypy subscales with interview-based ratings of depressive episodes and whether these associations varied by racial group. The predictors were entered in the same order at three steps as in the linear regression analyses above. Consistent with previous findings (Kemp et al., 2021; Kwapil et al., 2021), disorganized schizotypy predicted depressive episodes. However, none of the racial group comparisons or the racial group interactions were significant, indicating comparable rates of depressive disorders across racial groups. The associations of the schizotypy dimensions with depressive episodes were likewise comparable across the groups.

In order to compare the Asian and Black participant groups, we reran the logistic regression analysis including a dummy code comparing these groups. The groups did not differ on depressive disorders, odds ratio = 1.17 (95% confidence interval [CI] = 0.81 to 1.69). Likewise, none of the interactions of the dummy codes for group with positive, odds ratio = 0.65 (95% CI = 0.62 to 1.35), negative, odds ratio = 1.35 (95% CI = 0.90 to 2.04), and disorganized, odds ratio = 1.14 (95% CI = 0.76 to 1.71) schizotypy were significant.

Table 3

Binary logistic regressions examining predictions by the Multidimensional Schizotypy Scale subscales and race ($n = 249$)

| | Step 1 | | | | | | Step 2 | | | |
| | MSS positive schizotypy | | MSS negative schizotypy | | MSS disorganized schizotypy | | D1 | | D2 | |
Criteria	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Major Depressive Episode	1.06	0.79–1.40	0.93	0.70–1.22	1.87***	1.37–2.55	0.97	0.44–2.14	1.40	0.77–2.55

Note: Binary logistic regression analysis in which the three MSS subscales were entered simultaneously at Step 1, the dummy codes for racial groups were entered at Step 2, and the schizotypy × dummy code interactions were entered simultaneously at Step 3 as predictors of depressive episodes. At Step 2, the D1 code indicates the comparison of White and Black participants and the D2 the comparison of White and Asian participants. At Step 3, the D1 interaction indicated whether the association of the specific schizotypy dimension and outcome measure differed for Black and White participants, and the D2 interaction assessed this for Asian and White participants. Odds ratios and 95% CIs are indicated.

Abbreviations: CI, confidence interval; MSS, Multidimensional Schizotypy Scale.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 3 (continued)

| | Step 3 | | | | | | | | | | | |
| | PosSz × D1 | | PosSz × D2 | | NegSz × D1 | | NegSz × D2 | | DisSz × D1 | | DisSz × D2 | |
Criteria	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Major Depressive Episode	1.34	0.98–1.83	1.31	0.95–1.80	0.76	0.55–1.06	0.97	0.73–1.28	0.93	0.67–1.30	1.05	0.75–1.46

Note: Binary logistic regression analysis in which the three MSS subscales were entered simultaneously at Step 1, the dummy codes for racial groups were entered at Step 2, and the schizotypy × dummy code interactions were entered simultaneously at Step 3 as predictors of depressive episodes. At Step 2, the D1 code indicates the comparison of White and Black participants and the D2 the comparison of White and Asian participants. At Step 3, the D1 interaction indicated whether the association of the specific schizotypy dimension and outcome measure differed for Black and White participants, and the D2 interaction assessed this for Asian and White participants. Odds ratios and 95% CIs are indicated.

Abbreviations: CI, confidence interval; MSS, Multidimensional Schizotypy Scale.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

DISCUSSION

Extensive evidence indicates that schizophrenia-spectrum psychopathology can be better understood as a continuum of subclinical and clinical symptoms and impairment than as narrow categorical disorders (van Os et al., 2009). Furthermore, the heterogeneity of schizophrenia-spectrum psychopathology can be effectively addressed by employing a multidimensional framework that includes positive, negative, and disorganized dimensions (Tandon et al., 2009). Schizotypy provides a useful and unifying construct for conceptualizing and assessing this broad, multidimensional expression of schizophrenia-spectrum psychopathology (Kwapil & Barrantes-Vidal, 2015; Lenzenweger, 2010), and numerous measures have been developed to assess subclinical and clinical expressions of schizotypy (Kwapil & Chun, 2015; Mason, 2015). However, the assessment and classification of schizotypy and schizophrenia-spectrum disorders in non-White populations have suffered from well-documented measurement biases that impact our understanding of the epidemiology, development, expression, and treatment of these conditions.

The MSS was developed to provide dimensional assessments of positive, negative, and disorganized schizotypy. Preliminary evidence primarily from the derivation and cross-validation samples indicates that the subscales have comparable means across racial groups and that the items exhibit minimal differential item functioning (although continued study is needed in more diverse samples). However, studies have not examined the extent to which the validity of the subscales is comparable across racial groups. The goal of the present study was to provide a preliminary examination of the extent to which the three MSS subscales exhibited comparable associations with interview-assessed psychopathology and impairment in Black, White, and Asian young adults.

As hypothesized, the MSS positive, negative, and disorganized schizotypy subscales predicted the interview-based outcome measures, consistent with the results from the source studies examining the three schizotypy dimensions (Kemp et al., 2021; Kwapil et al., 2021). The present study found that the three schizotypy measures uniquely accounted for impaired functioning and elevated schizotypal and paranoid traits, with negative schizotypy predicting elevated schizoid personality traits. Although these findings are not surprising given our sampling procedures, they are important to note as they provide further evidence of the multidimensional model of schizotypy. They also support the fact that the schizotypy dimensions are uniquely associated with schizophrenia-spectrum symptoms and impairment (which are conceptualized as subclinical and clinical expressions of the schizotypy continuum). Notably, these associations are found even in high-functioning nonpatient samples such as students enrolled at a major university, further supporting the continuum model of schizotypy and the practicality of psychometric assessments, particularly the MSS, as useful and valid methods for assessing multidimensional schizotypy.

The focus of the present study was to examine whether the hypothesized associations of MSS schizotypy subscales with interview ratings of symptoms and impairment were comparable across racial groups (i.e., did race moderate the association of the MSS subscales and interview measures). The findings indicate that, in general, the associations of the MSS positive, negative, and disorganized schizotypy subscales with interview-based ratings of overall functioning, depressive episodes, and schizotypal, schizoid, and paranoid personality disorder traits were largely comparable among Asian, Black, and White participants. This was supported by moderate and anecdotal evidence for the null hypothesis for the racial group × MSS subscale interactions.

Note that three of the 36 racial group × MSS subscale interactions were statistically significant (one indicating moderate evidence for the alternative hypothesis, and two with anecdotal evidence). All three of these involved schizoid personality disorder traits as the dependent measure. The first interaction involved the association of MSS positive schizotypy with schizoid traits across Black and White participants. Overall, the association of positive schizotypy with schizoid traits was nonsignificant. This is not surprising, as schizoid traits are closely related to negative schizotypy and tend to be unassociated with positive schizotypy (Kwapil et al., 2008) or even have modest inverse associations (Kemp et al., 2021). In keeping with these previous findings, the association of positive schizotypy and schizoid traits in the present sample was nonsignificant for White participants and had a significant inverse association for Black participants. The second significant interaction involved the association of negative schizotypy and schizoid traits across Black and White participants. Consistent with previous findings, negative schizotypy was significantly associated with schizoid traits overall and in all of the groups. However, the effect is stronger for White ($p < 0.001$) than in Black ($p < 0.01$) participants. The third case involved the association of negative schizotypy and schizoid traits across Black and Asian participants. As in the previous case, negative schizotypy is associated with schizoid traits in both groups, although the effects were stronger in the Asian participants. Note that the associations of negative schizotypy with schizoid traits are one of the strongest findings across multiple interview studies (e.g., Kemp et al., 2021; Kwapil et al., 2008, 2013, 2021), with effects on the order of medium to large effects across multiple studies. Thus, it is unclear whether the statistically smaller effect noted in the Black participants represents meaningful differences in measurement or experience of schizoid traits.

The present study reported significant hypothesized associations between the schizotypy dimensions and the personality disorder ratings. However, this could raise concerns that these findings simply represent item overlap between the questionnaire and interview measures. As discussed in Kwapil et al. (2021), schizophrenia spectrum personality disorders (and their individual traits) are part of the schizotypy-spectrum, but they should not be considered synonymous. Clearly, there is overlap between the domains assessed by the MSS self-report questions and the interview-based IPDE questions. However, the MSS assesses a broad range of schizotypic experiences and there is little correspondence among the specific MSS and IPDE questions. Thus, the associations of the MSS questionnaire of multidimensional schizotypy and the IPDE interview of personality disorders do not appear to result from administration of similar questions in different assessment formats.

The present study was the first to our knowledge to explore the validity of the MSS across racial groups, as well as being one of only a few studies to examine such associations using any schizotypy measures. Nevertheless, it is important to note limitations of the study and specifically the constraints on generality. First, only three racial groups were examined and ethnicity was not considered in the study. Subsequent studies should recruit participants from more diverse racial, ethnic, and cultural groups that better capture the diversity of potential users of the scale. The study also employed relatively small and homogenous groups (college students from one university). We recognize that racial groups are by no means monolithic and that our study is limited in terms of the extent to which it can broadly generalize to Black, Asian, and White populations. In fact, numerous studies have shown that environmental factors such as racial discrimination, ethnic identity, and race-based rejection sensitivity moderate the relationship between race and experiences of psychosis (Anglin et al., 2016, 2018; Oh et al., 2016). Future research must look beyond race to understand how social and environmental factors impact experiences of psychosis.

However, before we can take this critical step, we must have culturally valid assessments. This study suggests that the MSS may be one such measure.

It is important to note that among the groups we assessed, the MSS subscales showed comparable patterns of associations with symptoms and impairment. Note that examining and establishing validity across racial, ethnic, cultural, and other categories and dimensions (like the establishment of construct validity) is an ongoing process. Therefore, we view this as a valuable first step, especially because scales such as the MSS are often used with young adults such as college students. Furthermore, we believe that this study provides a template for subsequent investigations. However, we recognize the limits of its generalizability.

One final concern is that the present study employed a nonclinically ascertained, college student sample. Although college students attending a major university may be considered generally high functioning, they fall within the age of greatest risk for developing schizophrenia-spectrum symptoms and disorders. Furthermore, note that previous studies have demonstrated that nonclinically ascertained young adults, including college student samples, who have elevated scores on schizotypy questionnaires exhibit higher rates of schizophrenia-spectrum symptoms (Barrantes-Vidal et al., 2013; Kwapil et al., 2008) and heightened risk for developing schizophrenia-spectrum disorders (Kwapil et al., 2013).

CONCLUSIONS

Schizotypy offers a promising multidimensional framework for understanding the etiology, development, and expression of schizophrenia-spectrum psychopathology. Furthermore, psychometrically sound questionnaires such as the MSS offer rapid, inexpensive, and minimally invasive methods for assessing multidimensional schizotypy. However, it is essential to demonstrate the validity of these measures and to demonstrate the extent to which such measures are valid across a diverse range of respondents. Measuring the same constructs across racial groups must be sewn into the fabric of assessment tools. Otherwise, they are rendered impractical and even dangerous to the populations that are misconstrued.

ETHICS STATEMENT

The study was conducted following APA ethical guidelines, and the study was approved and overseen by the University of Illinois at Urbana–Champaign Institutional Review Board. All participants provided written informed consent before participating.

CONFLICT OF INTEREST
None of the authors had conflicts of interest.

AUTHOR CONTRIBUTIONS
All authors approved the submission of the manuscript.

DATA AVAILABILITY STATEMENT
Data is available on Open Science Framework at https://osf.io/yq5et/

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