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Personality Traits as Markers of Psychosis Risk in Kenya: Assessment of Temperament and Character

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Specific personality traits have been proposed as a schizophrenia-related endophenotype and confirmed in siblings at risk for psychosis. The relationship of temperament and character with psychosis has not been previously investigated in Africa. The study was conducted in Kenya, and involved participants at clinical high-risk (CHR) for psychosis (n = 268) and controls (n = 251), aged 15–25 years. CHR status was estimated using the Structured Interview of Psychosis-Risk Syndromes (SIPS) and the Washington Early Psychosis Center Affectivity and Psychosis (WERCAP) Screen. Student's t-tests were used to assess group differences on the Temperament and Character Inventory (TCI). Neurocognitive functioning, stress severity, and substance use were correlated with the TCI, correcting for psychosis severity. CHR participants were more impulsive (ie, higher novelty seeking [NS]) and asocial (ie, lower reward dependence) than controls. They were also more schizotypal (ie, high self-transcendence [ST] and lower self-directedness [SD] and cooperativeness [CO] than controls). CO was related to logical reasoning, abstraction, and verbal memory. Stress severity correlated with high HA and schizotypal character traits. Lifetime tobacco use was related to NS, and lifetime marijuana use to high NS, low SD and high ST. Temperament and character of Kenyan CHR youth is similar to that observed in schizophrenia. Psychosis risk in Kenya is associated with impulsive, asocial, and schizotypal traits. CHR adolescents and young adults with schizophrenia-specific personality traits may be most at risk for developing a psychotic disorder and to require early intervention to improve outcomes.

Key words: personality/temperament/character/psychosis/risk/TCI

Introduction

The psychobiological model of temperament and character indicates that specific heritable personality traits influence the risk of developing schizophrenia. This hypothesis has been supported by multiple studies showing that schizophrenia patients and their first-degree relatives tend to have personality traits distinct from the general population.[1–8] The Temperament and Character Inventory (TCI)[9] identifies 4 dimensions of temperament (ie, novelty seeking [NS], harm avoidance [HA], reward dependence [RD], and persistence [PS]) and 3 dimensions of character (ie, self-directedness [SD], cooperativeness [CO] and self-transcendence [ST]). In regard to temperament, individuals with schizophrenia generally have high average HA, while having levels of NS similar to contr ols.[1,2,5–8,10–12] Findings on other temperament dimensions remain mixed.[10,12] With respect to character, schizophrenia patients have lower average values of SD and CO, and higher ST compared to healthy controls,[1,2,5–8,12] in line with the constituent character traits of schizotypy.[9]

The TCI has also been used to investigate individuals at risk for schizophrenia. First-degree relatives represent a heterogenous group that share some genetic features with schizophrenia patients and have over a 6-fold higher risk of developing the illness than the general population.[13,14] Findings in first-degree relatives of patients have been mixed.[3,4,15] Relatives are more often found to be intermediate between schizophrenia and controls across one or more temperament traits[16]; however, negative findings have also been reported.[3] Asocial traits (ie, high HA and low RD) are increased in the first-degree relatives of patients with schizophrenia, and have been associated

with more prominent negative symptoms in particular.[1,4] First-degree relatives have also been reported to have schizotypal character traits (ie, they had higher ST and lower CO and SD than controls).[4,16] Others found high SD and CO[3] or low NS and ST[7] in nonpsychotic first-degree relatives, suggesting these traits may confer a protective influence. Smith et al[1] found that the non-psychotic sibs of people with schizophrenia were higher in HA and ST than the sibs of controls, and were also higher in SD and CO than were patients with schizophrenia. They posited that vulnerability to schizophrenia was increased by a schizotypal character profile (ie, low SD, low CO, and high ST), whereas high SD and CO were associated with neurocognitive strengths that protected against schizophrenia.

Two studies have explored temperament and character in those at clinical high-risk (CHR) for developing schizophrenia.[6,17] The CHR population has an increased risk for developing a psychotic disorder based on clinical criteria the most common of which are attenuated psychotic experiences.[18–20] The conversion risk in CHR is much higher than in first-degree relatives, with 20%–35% developing a psychotic disorder over 2 years.[21–25] Fresan et al[17] evaluated a small number of CHR and schizophrenia patients, and found both groups had higher HA and lower CO than healthy controls. In a South Korean study, Song et al[6] found high HA, low RD, and low PS as well as low SD and CO in the CHR and first-episode-psychosis patients. Longitudinal analysis over 2 years showed that low baseline CO predicted conversion to overt psychotic disorder,[6] suggesting that low CO may impart vulnerability to schizophrenia. In CHR individuals, identification of unique subclasses of personality traits could therefore have a role in personalized treatment approaches to improve clinical and functional outcomes.

There have been no prior studies investigating the relationship of personality and psychosis in Africa. Considering that both personality[9,26,27] and psychotic disorders[13,28] are heritable, there is a need for studies investigating their relationship across ethnicities and cultures. Studies have shown a common genetic liability to schizophrenia is largely shared across those of European and African ancestry.[29] However, such genetic studies do not account for the effects of rare causal variants, which are likely to be population specific. The symptoms, course, and outcomes of schizophrenia have been observed to differ across cultures.[30–32] For example, the distinction between reality and fantasy has been described as being more rigid in Euro-American culture in comparison to non-Western societies, and symptoms are therefore more likely to be labeled as pathological in Western settings.[33] Delusional content also reflects the prevalent cultural beliefs, with themes of witchcraft or ancestral worship more commonly experienced in Africa.[34] Others have explored cross-cultural differences in personality traits, and have reported higher mean extraversion and openness to experience and lower mean agreeableness compared to Asians and Africans.[35] Despite evidence of cross-cultural heterogeneity, studies exploring the relationship between personality and psychiatric disorders in Africa, in particular, are lacking.[36,37]

The current study builds on our longstanding history of investigating the CHR and related psychotic populations in Kenyan adolescents and young adults.[38–44] We explore the relationship of temperament and character in a large population (n = 519) of Kenyan youth, who are either controls or at CHR for psychosis. We investigate mean trait scores across groups, as well as personality configurations. Relationships of temperament and character with known psychosis risk factors, including neurocognition, stress, and substance use are also explored.

Methods

Recruitment

Participants were recruited from Nairobi county (largely urban) and Machakos, Kitui and Makueni counties (largely rural) in Kenya. Eighty-seven percent were recruited from tertiary academic institutions (ie, 8 colleges and 1 public university) and 13% were recruited directly through community outreach. Five-hundred forty participants were selected from among 9,564 youths using the WERCAP Screen.[45] Selection was done with goal of having comparable numbers of high (ie, ≥30) and low (ie, <10) psychosis scorers on the WERCAP Screen.[45] Among these, 519 completed the TCI[9] and were included in the study. Participants were aged 15–25 years (mean age 21.2 years).

Written consent was provided by a parent or guardian or by the student if aged 18 or older. The study was approved by the ethical review board of Maseno University, Kenya, and the Institutional Review Board of Washington University in St. Louis.

Temperament and Character Inventory

The TCI[9] used in this study is a self-report measure with 140 items rated on a 5-point Likert response format. It assesses 4 dimensions of temperament (ie, NS, HA, RD, and PS) and 3 domains of character (ie, SD, CO, and ST). Novelty seeking (NS) is the tendency to explore novel stimuli or pursue potential rewards. Harm avoidance (HA) is the inclination to avoid punishment. Reward dependence (RD) is social attachment based on approval and warmth. Persistence (PS) is perseverance in the face of adversity. Self-directedness (SD) is the will power to adapt changes to one's environment. Cooperativeness (CO) is the degree to which a person

is agreeable. Self-transcendence (ST) is the extent that you identify yourself as an essential part of the universe. Detailed reviews of the TCI, including an analysis of its reliability and validity, are available elsewhere.[9,46]

Psychosis Assessment

Assessment of psychosis was done using the psychotic section of the Washington Early Psychosis Center Affectivity and Psychosis Screen (*p*WERCAP),[45] which provides a quantitative rating of psychosis severity in the past year, using item frequency of occurrence and effects on functioning.[44,47,48] CHR status was established as psychosis scores ≥30, based on a previous validation study.[47] Psychosis-risk ascertainment was also determined using the Structured Interview of Psychosis-Risk Syndromes (SIPS),[49] administered by 12 trained interviewers. Previous studies in Kenya have shown high interrater reliability with the SIPS after training.[39] The SIPS assigns CHR status based on either attenuated psychotic symptoms, brief limited intermittent psychotic episodes, and/or a genetic risk and deterioration syndrome.

Other Clinical Assessments

Lifetime substance use and use frequency was measured with the WHO Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST),[50] an interviewer-assisted assessment tool. The WERC Stress Screen, a self-report questionnaire, was used to assess psychosocial stress severity.[47,48]

The Penn Computerized Neurocognitive Battery (PennCNB)[51,52] was administered using a portable laptop computer. Test modules on the PennCNB included the: (1) Continuous Performance Test (CPT; attention), (2) Letter N-Back (LNB; working memory), (3) Word Memory Test (WMT; verbal memory), (4) Visual Object Learning Test (VOLT; visual memory), (5) Verbal Reasoning Test (VRT; logical reasoning), (6) Motor Praxis Test (MPRACT; sensorimotor processing), (7) Penn Matrix Reasoning Test (PMAT; abstraction), and (8) Emotion Recognition Test (ERT; emotion recognition). Performance on cognitive tests were determined using measures of accuracy based on the formula of: (True Positive (TP) + True Negative (TN)) / (TP + TN + False Positive + False Negative), when constituent constructs were available (ie, for CPT, WMT, and VOLT). For other tests, accuracy was estimated using either the percent of correct responses (ie, for PMAT, VRT, and ERT) or the true positive rate (ie, for LNB). Performance on the MPRACT was estimated using the response time, controlled for the number of correct responses. Z-scores were calculated using a database of 1,107 individual tests from 645 subjects aged 14 to 28 years (mean: 19 y), including those in the current study. Total cognition scores were derived by averaging cognitive domain z-scores.

Statistical Analyses

Statistical analyses were carried out using SAS 9.4 (SAS Institute Inc.). Most analyses were done with CHR status determined using the *p*WERCAP, which identified a larger number of CHR subjects (n = 268) than the SIPS (n = 70). The WERCAP Screen was developed as a cross-culturally applicable tool, with particular attention paid to phrasing of questions to be understood in the Kenyan population. The validity of the SIPS in determining CHR status in Kenya is unclear, and may underestimate rates due to misunderstanding the questions, stigma, or rater experience. Group domains of temperament and character were assessed using 2-way analyses of variance and corrected for multiple comparisons (significance threshold: $P < .007$). Age and gender were not included as covariates, as they were highly similar across groups (table 1). Education was significantly different across groups but not included as a covariate as it may be influenced by factors related to psychosis development.

In order to examine the configurations of temperament and character, each TCI domain was dichotomized using the overall sample median, with high levels defined as scores at or above the median. Based on prior research,[53] persistence was not used in TCI configurations. Persistence acts as a general moderator of self-control and influences character development, so it also has an important role in emotional regulation and personality self-organization. Capital letters from the first word of the domain reflect scores at/above the median while lower-case letters reflect scores below the median (eg, scT = low self-directedness, low cooperativeness, high self-transcendence; "t" indicates low self-transcendence). Dichotomous variables were created to indicate the presence/absence of each configuration in the study subjects.

To examine the relationship between the TCI and psychosis scores, Spearman correlations were computed. For relationships between TCI and either neurocognition, stress or lifetime substance use, Spearman correlations were computed, partialling out psychosis scores. Significance was determined after controlling for multiple comparisons ($P < .007$).

Results

Demographic Characteristics and Psychotic Features

Table 1 shows the demographic characteristics of the study sample. There were no significant group effects of age or gender. Psychosis-risk subjects were more likely to have lower educational attainment than control subjects.

Quantitative information from the WERCAP screen and the SIPS showed significantly increased positive, negative, and affective symptoms in the CHR group compared to controls (table 1).

Table 1. Baseline Demographic and Clinical Characteristics Across Participant Groups ($N = 519$)

Characteristic	Control ($n = 251$)	Psychosis Risk ($n = 268$)	t or χ^2	P
Age (SD)	21.2 (1.9)	21.1 (2.0)	0.97	.3
Gender (%)			0.41	.5
Female	126 (50.2)	127 (47.4)		
Male	125 (49.8)	141 (52.6)		
Highest education (%)			13.7	.008*
Primary School	5 (2.0)	18 (6.8)		
Secondary School	7 (2.8)	17 (6.4)		
College, Tech. or Prof. Sch.	50 (19.9)	59 (21.2)		
Undergraduate University	70 (27.9)	73 (27.4)		
Graduate University	119 (47.4)	99 (37.2)		
Employment status (%)			8.7	.12
Employed				
Self-employed	6 (2.4)	18 (6.7)		
Part-time/casual	1 (0.4)	1 (0.4)		
Full-time	1 (0.4)	5 (1.9)		
Unemployed	25 (10.0)	30 (11.2)		
Student	214 (85.3)	211 (78.7)		
Marital status (%)			1.25	.5
Single	237 (94.4)	254 (95.1)		
Married	14 (5.6)	12 (4.5)		
Divorced	0	1 (0.4)		
Religion (%)			2.47	.5
Protestant Christian	154 (61.6)	148 (56.3)		
Catholic Christian	75 (30.0)	96 (36.5)		
Muslim	9 (3.6)	8 (3.0)		
Other	12 (4.8)	11 (4.2)		
WERCAP screen				
Psychosis	1.3 (2.9)	36.0 (6.5)	6011.5	<.0001*
Affectivity	5.4 (5.8)	24.2 (7.9)	951.5	<.0001*
SIPS positive symptoms				
Unusual thought	0.28 (0.6)	0.91 (1.1)	60.4	<.0001*
Persecutory	0.49 (0.8)	1.02 (1.2)	37.4	<.0001*
Grandiosity	0.32 (0.6)	1.71 (1.2)	28.9	<.0001*
Hallucinations	0.20 (0.5)	1.97 (1.6)	42.7	<.0001*
Disorg. Communication	0.17 (0.5)	0.71 (1.1)	20.1	<.0001*
SIPS negative symptoms				
Social anhedonia	0.38 (0.8)	1.57 (1.8)	16.9	<.0001*
Avolition	0.08 (0.4)	0.76 (1.3)	11.4	.0008*
Emotion expression	0.13 (0.5)	0.86 (1.3)	17.5	<.0001*
Emotion/self-experience	0.08 (0.4)	0.47 (0.9)	15.8	<.0001*
Difficulty understanding	0.35 (0.8)	0.68 (1.2)	9.3	.002*
Occupational functioning	0.10 (0.4)	0.47 (0.7)	16.9	<.0001*

Note: Values are given as means (SD) or number per group (%). Results derived from results of Student t-tests or Chi-Square analyses.
*$P < .05$.

Temperament

After correcting for multiple comparisons, we found a significant main effect of group status on novelty seeking ($P < .0001$) and reward dependence ($P = .0017$), as well as most of their respective subscales (table 2). Specifically, psychosis-risk subjects had increased NS and decreased RD compared to controls. There was also a trend towards increased harm avoidance ($P = .04$) and increased persistence ($P = .04$) in psychosis-risk subjects. The pattern of temperament was similar when CHR status was determined using self-report (figure 1A) or structured interview (figure 1B). The number of CHR subjects identified were higher when using self-report ($n = 268$) than when using structured interview ($n = 70$).

Excluding persistence, there were 8 potential configurations of temperament (table 3). The configuration of high NS, high HA, and low RD was more often present in psychosis-risk subjects than in controls ($\chi^2 = 8.6$; $P = .003$). The "NHr" configuration typically describes someone as impulsive, socially anxious, and isolated; the profile is labeled "explosive" because the combination of being both impulsive-aggressive (N) and anxious (H) leads to inhibition of anger with intermittent eruptions in individuals with low social warmth (r).

Table 2. Mean Scores on Temperament and Character Dimensions and Subscales Across Groups (N = 519)

Personality Traits	Control (N = 251)	Psychosis Risk (N = 268)	Cohen's d	t	P
Temperament					
Novelty seeking	2.71 (0.41)	2.93 (0.45)	0.51	−5.84	<.0001
Exploratory excitability	3.15 (0.57)	3.25 (0.54)	0.17	−1.99	.047
Impulsivity	2.51 (0.69)	2.82 (0.67)	0.45	−5.12	<.0001
Extravagance	2.46 (0.71)	2.66 (0.87)	0.24	−2.78	.0057
Disorderliness	2.72 (0.69)	3.00 (0.78)	0.38	−4.30	<.0001
Harm avoidance	2.70 (0.49)	2.81 (0.63)	0.18	−2.05	.041
Anticipatory worry	2.56 (0.67)	2.69 (0.72)	0.18	−2.02	.044
Fear of uncertainty	2.95 (0.71)	3.12 (0.81)	0.23	−2.56	.011
Shyness	2.73 (0.83)	2.82 (0.96)	0.10	−1.19	.23 (NS)
Fatigability	2.59 (0.64)	2.59 (0.82)	0.02	−0.26	.79 (NS)
Reward dependence	3.00 (0.41)	2.88 (0.44)	0.28	3.16	.0017
Sentimentality	2.66 (2.57)	3.03 (0.81)	0.49	−5.56	<.0001
Openness to warm communication	3.26 (0.71)	3.15 (0.79)	0.15	1.68	.093 (NS)
Attachment	3.21 (0.84)	2.84 (0.89)	0.43	4.84	<.0001
Dependence	2.86 (0.78)	2.50 (0.78)	0.47	5.34	<.0001
Persistence	3.62 (0.54)	3.72 (0.59)	0.18	−2.07	.039
Eagerness of effort	3.59 (0.72)	3.65 (0.77)	0.08	−1.04	.30 (NS)
Work Hardened	3.60 (0.68)	3.68 (0.79)	0.11	−1.19	.23 (NS)
Ambitiousness	3.90 (0.66)	4.04 (0.69)	0.22	−2.45	.015
Perfectionism	3.41 (0.71)	3.53 (0.75)	0.16	−1.84	.066 (NS)
Character					
Self-directedness	3.81 (0.58)	3.26 (0.72)	0.86	9.59	<.0001
Responsibility	3.69 (0.76)	3.16 (0.90)	0.63	7.19	<.0001
Purposefulness	4.26 (0.57)	3.96 (0.69)	0.47	5.39	<.0001
Resourcefulness	4.00 (0.77)	3.45 (1.00)	0.57	6.43	<.0001
Self-acceptance	3.30 (1.27)	2.54 (1.31)	0.59	6.72	<.0001
Enlightened second nature	3.81 (0.80)	3.14 (1.01)	0.73	8.28	<.0001
Cooperativeness	3.66 (0.45)	3.39 (0.52)	0.55	6.25	<.0001
Social acceptance	3.58 (0.75)	3.25 (0.83)	0.42	4.74	<.0001
Empathy	3.75 (0.75)	3.69 (0.74)	0.08	0.96	.34 (NS)
Helpfulness	3.44 (0.64)	3.30 (0.62)	0.22	2.55	.011
Compassion	3.92 (0.82)	3.41 (1.05)	0.55	6.18	<.0001
Pure-hearted conscience	3.59 (0.75)	3.30 (0.90)	0.35	3.96	<.0001
Self-transcendence	2.75 (0.64)	3.25 (0.67)	0.76	−8.69	<.0001
Self-forgetful	2.51 (0.81)	3.11 (0.91)	0.70	−7.93	<.0001
Transpersonal identification	3.02 (0.84)	3.47 (0.86)	0.53	−6.03	<.0001
Spiritual acceptance	2.73 (0.79)	3.18 (0.78)	0.57	−6.54	<.0001

Note: Values are given as means (SD). Results derived from results of Student t tests. NS = not statistically significant.

Character

There was a significant group effect of all 3 character traits. Psychosis-risk subjects had lower *self-directedness*, lower *cooperativeness* and higher *self-transcendence* compared to control subjects, and similar differences across most character subscales (table 2). Character patterns were similar when psychosis-risk was determined using self-report figure 1A) or structured interview (figure 1B).

As seen in table 3, there were 2 configurations more often present in psychosis-risk subjects: (1) low SD, low CO, and high ST (P < .0001); and (2) low SD, high CO, and high ST (P = .0008). Both configurations typically describe someone who is disorganized and highly imaginative. The more prevalent of these 2 configurations also describes someone who is socially distant.

Cognitive Correlations With Temperament and Character

Table 4 show the cognitive domain z-scores across the 2 primary character configurations observed in psychosis-risk (ie, "schizotypal" and "moody") and to their respective controls (ie, "organized" and "bossy"). Across groups, the "bossy" configuration (ie, Sct) tended to have to lowest cognitive performance, and significantly in logical reasoning (P = .003). The "schizotypal" configuration (ie, scT) tended to have the next lowest cognitive performance, though not in all domains. Notably, both the "bossy" and "schizotypal" participants have low CO scores.

We also analyzed cognitive relationships with individual personality traits. A significant relationship was only found between total cognition and cooperativeness (r_s = .21; P = .0006). There were no significant effects

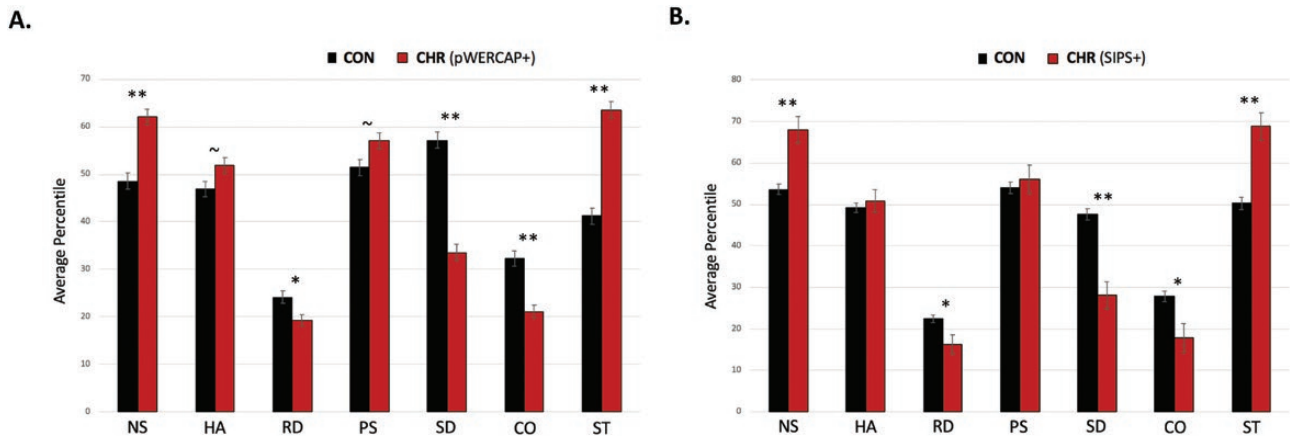

Fig. 1. TCI dimensions in psychosis-risk and control participants. Figures depicts mean percentile scores of participants at clinical high risk (CHR) for developing a psychotic disorder and healthy controls (n = 519). CHR status was assessed using either the psychotic section of the WERCAP Screen (pWERCAP) (A) or the Structured Interview of Psychosis-Risk Syndromes (SIPS) (B). With pWERCAP grouping, there were 251 control and 268 CHR participants. With SIPS grouping, there were 449 control and 70 CHR participants. NS = novelty seeking, HA = harm avoidance, RD = reward dependence, PS = persistence, SD = self-directedness, CO = cooperativeness, ST = self-transcendence. ~P < .05, *P < .007 (corrected for multiple comparisons). **P < .0001.

Table 3. Analysis of Temperament and Character Configurations (N = 519)

Characteristic	Control (n = 251)	Psychosis Risk (n = 268)	χ^2	P
Temperament				
NHR(sensitive)	30 (12.0)	48 (17.9)	3.6	.06
NHr (explosive)	**33 (13.2)**	**62 (23.1)**	**8.6**	**.003**
NhR (passionate)	28 (11.2)	31 (11.6)	0.0	.88
nHR (cautious)	37 (14.7)	21 (7.8)	6.2	.01
Nhr (adventurous)	17 (6.8)	34 (12.7)	5.1	.02
nHr (methodical)	24 (9.6)	20 (7.5)	0.7	.39
nhR (reliable)	**54 (21.5)**	**27 (10.1)**	**12.9**	**.0003**
nhr (independent)	28 (11.2)	25 (9.3)	0.5	.49
Character				
SCT (creative)	33 (13.2)	24 (9.0)	2.3	.13
SCt (organized)	**98 (39.0)**	**42 (15.7)**	**35.9**	**<.0001**
ScT (fanatical)	10 (4.0)	10 (3.7)	0.0	.88
sCT (moody)	**16 (6.4)**	**42 (15.7)**	**11.3**	**.0008**
Sct (bossy)	**31 (12.4)**	**14 (5.2)**	**8.3**	**.004**
sCt (dependent)	13 (5.2)	12 (4.5)	0.1	.71
scT (schizotypal)	**28 (11.2)**	**98 (36.6)**	**45.5**	**<.0001**
sct (apathetic)	22 (8.8)	26 (9.7)	0.1	.71

Note: Values are given in N (%). Chi-square calculated as specified trait configuration vs others. Bolded values are statistically significant after controlling for multiple comparisons (P < .00625).

between other TCI traits and total cognition (P > .05). Post hoc analysis of cognitive domain relationships with cooperativeness, showed significant effects for logical reasoning (r_s = .26; P < .0001), abstraction (r_s = .13; P = .03), and verbal memory (r_s = .12; P = .05).

Correlations of Stress Variables

A significant relationship was only found between stress scores and: (1) high harm avoidance (r_s = .14; P = .0014), (2) low self-directedness (r_s = −0.12; P = .007), (3) low cooperativeness (r_s = −0.11; P = .013), and (4) high self-transcendence (r_s = .09; P = .04). In other words, stress scores were higher in anxiety-prone (H) schizotypal (scT) participants.

Figure 2 shows mean severity of individual stressors across anxiety-prone participants (figure 2A) and in schizotypal participants (figure 2B), compared to their respective controls. Anxiety-prone (ie, high HA) individuals were analyzed separately, as this is the only personality trait relating to stress, which is not included among the schizotypal constituent personality traits. Almost all stressors tended towards higher severities in anxiety-proneness, most notably those involving their health and relationship with a partner. Schizotypal participants tended to have higher severities for most

Table 4. Mean Neurocognitive *z*-Scores Across Character Configurations

Cognitive Domains	SCt "Organized" (*n* = 140)	scT "Schizotypal" (*n* = 126)	sCT "Moody" (*n* = 58)	Sct "Bossy" (*n* = 45)	*F*	*P*
Total cognition	0.21	0.15	0.29	**0.02**	1.4	.24
Attention	−0.23	0.12	−0.26	**−0.30**	0.7	.55
Working memory	0.18	0.04	**−0.09**	0.09	0.9	.43
Verbal memory	0.09	−0.02	0.24	**−0.04**	1.0	.40
Visual memory	0.04	−0.03	−0.19	**−0.20**	0.8	.51
Logical reasoning	0.61	0.40	0.90	**0.04**	4.8	.003*
Sensorimotor processing	0.29	**0.03**	0.35	0.07	1.7	.17
Abstraction	0.29	0.21	0.54	**0.19**	0.9	.43
Emotion recognition	0.35	0.59	0.71	**0.35**	0.8	.48

Note: Values are given as means (SD). Results derived from results of analysis of covariance, controlling for psychosis scores. Bolded scores highlight the configuration with the lowest cognitive score, without considering statistical significance.
*Statistical significance ($P < .05$).

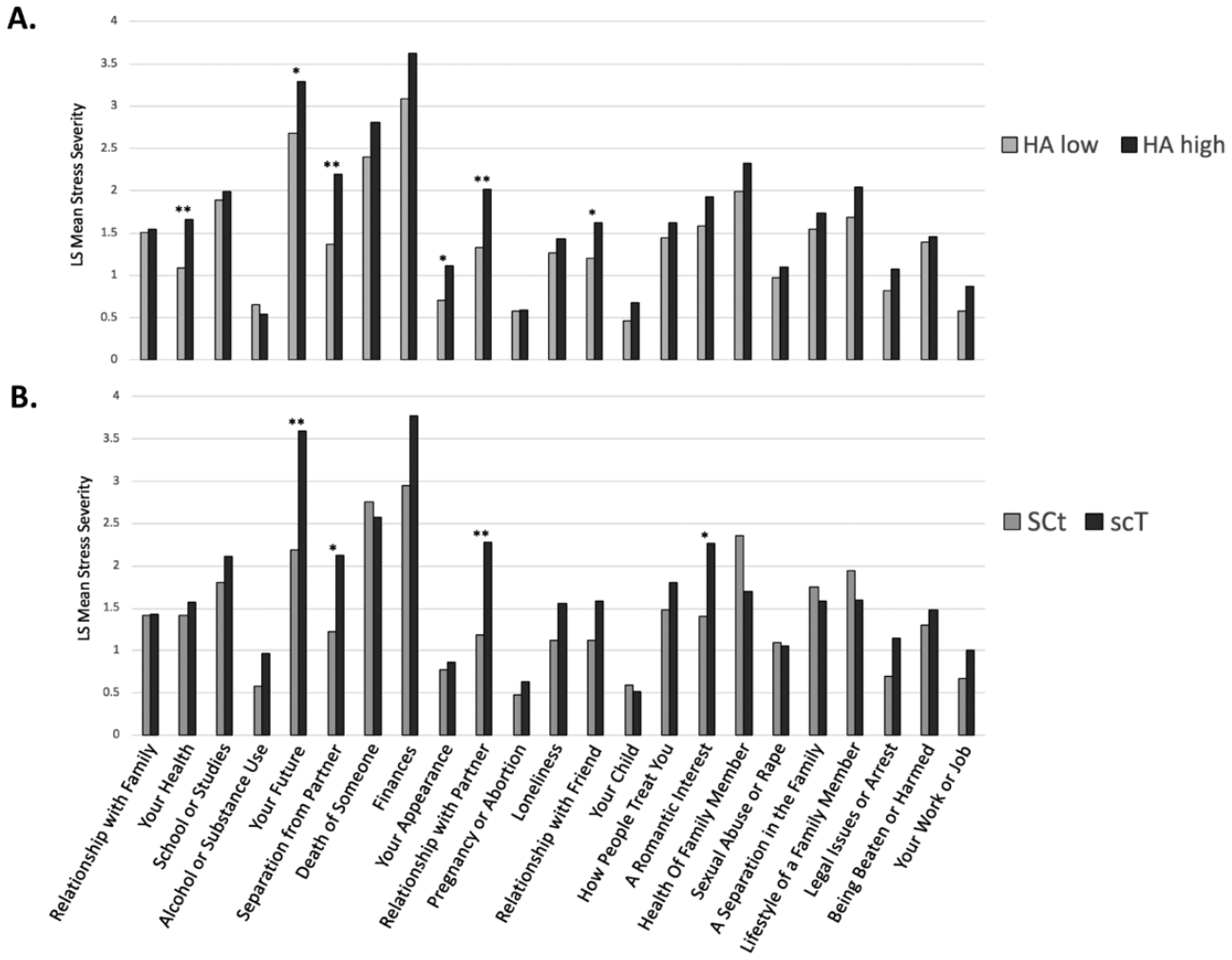

Fig. 2. Psychosocial stressors and TCI configurations. Figures show least square mean stress severity of individual items on the WERC Stress Screen, controlled for psychosis severity across all participants (*n* = 519). (A) Comparison of participants with harm avoidance (HA) scores on the TCI higher or lower than the cohort mean. (B) Comparison of participants with character configurations of high self-directedness, high cooperativeness and low self-transcendence (ie, SCt) with those with low self-directedness, low cooperativness and high self-transcendence (ie, scT). *$P < .05$. **$P < .005$.

stressors, but not those involving other people's well-being (ie, others' death, health, lifestyle, or separation). The most notable stressors in schizotypal participants involved concern over their future and relationship with a partner.

Substance Use Relationships

Spearman's correlations were conducted between the 7 TCI personality trait and lifetime use of the 4 most prevalent substances in the population (ie, tobacco, alcohol, marijuana and khat), partialling out psychosis scores. Novelty seeking was significantly related to lifetime use of marijuana (r_s = .12; P = .006) and tobacco (r_s = .10; P = .02), with alcohol showing trend level effects (r_s = .08; P = .06). Marijuana use also correlated with self-directedness (r_s = −0.10; P = .03) and self-transcendence (r_s = −0.09; P = .04).

Discussion

Our study found that Kenyan adolescents and young adults at CHR for developing schizophrenia have distinct personality traits, regardless of whether CHR status is determined using a structured interview or by self-report. Their temperament was most notable for high novelty seeking and low reward dependence, and character traits comprised of low self-directedness, low cooperativeness, and high self-transcendence. These personality traits are similar to those commonly seen in schizophrenia patients.[1,2,5–8] High harm avoidance is often reported in schizophrenia, which we also found in our study, albeit to a lesser degree than other traits. High novelty seeking observed in our study is uncommon in schizophrenia; however, a meta-analysis found novelty seeking as the only heterogenous trait across studies of personality in schizophrenia.[2]

Similar patterns of temperament and character have also been seen in unaffected siblings of schizophrenia patients.[1,3,15] Gonzalez-Torres et al[7]; however, found low novelty seeking and self-transcendence in first-degree relatives, suggesting that these traits may confer a protective influence. Additionally, psychotic experiences in healthy children and adolescents have been related to higher harm avoidance and lower self-directedness,[54] and in healthy adults to higher self-transcendence and persistence, and lower self-directedness.[55] High harm avoidance, and low reward dependence, persistence, self-directedness and cooperativeness have also been observed in CHR youths.[6,17] In a longitudinal study conducted over 24 months, baseline cooperativeness predicted conversion to overt psychosis in those at CHR.[6] Thus, assessment of dimensions of personality could be an essential component in early psychosis clinics to help identify individuals who may require more aggressive treatment to reduce illness progression.

Only a modest increase in harm avoidance in our CHR participants over controls may indicate a distinct psychosis phenotype prevalent in Kenya. High harm avoidance has been associated with prominent negative symptoms in work with non-African samples.[4,6]. Our prior work in Kenyan adolescents has shown relatively more severe positive symptoms compared to negative symptoms in both CHR and schizophrenia.[39] Thus, it is possible that low negative symptoms may underlie the modest increases in harm avoidance in the current study. We found that risk of schizophrenia in Kenya is increased by the explosive temperament profile that combines high harm avoidance (anxiety-prone) with high novelty seeking (anger-prone, impulsive) and low reward dependence (detached). We suggest that risk assessment for psychoses needs to consider the profiles of temperament and character along with consideration of different positive and negative syndromes of schizophrenia that can be distinguished clinically, genetically, and neurocognitively.[56,57] Harm avoidance has also been associated with suicidality[58] and homicidal violence[59] in schizophrenia patients, along with other personality traits.[58,60,61] Such associations may underlie the improved course and outcomes of schizophrenia patients observed in many developing countries.[30–32]

The personality trait configurations of our participants were found to be heterogenous. The most common temperament configuration was the "explosive" temperament, consisting of high novelty seeking and harm avoidance, and low reward dependence. The "explosive" temperament is generally seen in mood-labile individuals, who have immature regulation of their intense emotions and social relationships, such as those with borderline personality disorder.[62] Considering that the majority of those with psychotic experiences do not convert to a schizophrenia, it is conceivable that the 23% of the CHR cohort with explosive temperament represents a subgroup at one extreme of, or possibly outside, the schizophrenia-spectrum. For example. individuals with borderline or related personality disorder often report stress-related psychotic experiences,[63] which does not usually progress to overt psychotic disorder. In a meta-analysis of CHR individuals, 39% were comorbid for a personality disorder, and 12% for borderline personality disorder.[64] Thus, the explosive (ie, NHr) temperament may be useful as a marker for predicting non-conversion to chronic schizophrenia in CHR patients, or more specifically, it may indicate a vulnerability to transient stress-related psychotic episodes, as is often seen in patients with mixed features of borderline and schizotypal personalities. It should be remembered that more relatives of schizophrenia have such borderline and schizotypal features than schizophrenia.[65] Treatment for this subgroup may require more cognitive behavioral approaches, with a lesser emphasis on antipsychotic medication use.[62]

The predominant personality configuration in the psychosis-risk group involved character, with the "schizotypal configuration (consisting of low self-directedness, low cooperativeness, and high self-transcendence) being the most common (37%). The next was the "moody" configuration, with 16% prevalence among the CHR group. The moody character profile is similar to schizotypal but for high cooperativeness. A schizotypal character profile is generally been described in schizophrenia patients,[1,2,5–8] and thus may be a marker of illness progression in those at high risk. Such a profile may then require earlier introduction of antipsychotic medications. A previous study has reported low cooperativeness has been associated with psychosis conversion in CHR individuals,[6] suggesting cooperativeness may be the most important character trait in predicting schizophrenia. Understanding the relationship of personality on psychosis progression, however, will require more longitudinal studies in CHR individuals.[6]

We found that cognitive performance only correlated with cooperativeness. The relationship was most notable for logical reasoning. Agreeableness, the 5-factor personality model equivalent of cooperativeness, has also shown to be correlated with multiple domains of cognition.[66] However, it should be noted that the highly cooperative individuals in our sample who had high neurocognitive functioning had the "organized profile" in which both self-directedness and cooperativeness are high (see table 4); such individuals are distinguished by their excellent executive functions and logical reasoning.[67] Bergvall and Hansen[68] previously reported an association of low cooperativeness and low self-directedness with attentional set-shifting. In violent offenders, intellectual ability was also related to low cooperativeness and self-transcendence, but also to harm avoidance, novelty seeking and self-transcendence.[69] Smith et al[1] did not find an association between neurocognition and character profiles in schizophrenia, but did so in non-psychotic siblings. Specifically, both self-directedness and cooperativeness were related to working memory and crystallized IQ. Low self-directedness has also been associated with cognitive dysfunction in other populations,[70,71] but was not seen in our study. The mechanism linking cooperativeness and cognition is unclear. Compassion and social helpfulness may impart cognitive benefits, as evidenced by volunteerism being beneficial in maintaining cognitive functioning in older individuals[66] and in those with dementia risk.[72] Also, since individuals with high cooperativeness tend to be principled and emphatic to the assessment staff, they may put increased effort into the cognitive task than those with low cooperativeness.

Our study found a correlation of perceived stress with high harm avoidance and traits constituting the schizotypal character profile. High harm avoidance was expected to correlate with stress, considering it is characterized by excessive worrying, shyness and/or fearfulness.[9,53] An association with a schizotypal profile, which is characteristic of those with psychotic disorders, is consistent with findings of heightened sensitivity to environmental social stress in schizophrenia.[73] Our study is the first to our knowledge identifying an association of the constituent low cooperativeness, low self-directedness, and low self-transcendence independently to perceived stress. Underlying increased stress sensitivity with a schizotypal profile may be a hypothalamic-pituitary-axis (HPA) dysfunction, as elevated resting cortisol levels are often found in psychotic subjects.[74,75]

High novelty seeking had the strongest relationship to lifetime substance use in our study, correlating with tobacco and marijuana use, and to a lesser degree with alcohol use. This finding is consistent with the characteristics of novelty seeking, which include impulsive decision making and exploratory activity.[9,53] Novelty seeking is highly heritable and has been linked to substance use disorders and addictive behaviors.[76–80] Our study also found that marijuana use was related to low self-directedness and self-transcendence, which has not been previously reported to our knowledge. A negative association of self-directedness with marijuana is consistent with a responsible character deciding against trying this drug. High scorers on self-transcendence are more likely to be very religious or spiritual or to have magical thinking. This is in line with the observation that some individuals feel more spiritual when under the influence of cannabis.[81] Cannabis is also considered a risk factor for developing psychosis.[82]

Some limitations to our study should be considered. The CHR personality profile we found cannot be extrapolated to all schizophrenia populations. The majority of those designated CHR do not convert to a psychotic disorder, instead experience symptom persistence and remittance.[19,23,39,83] Nevertheless, findings in CHR which highly similar to that seen in schizophrenia suggest that the majority likely exist on the schizophrenia spectrum. The applicability of the TCI in Kenya has also not been previously established. It is conceivable that certain phrases may be misunderstood in the local culture, affecting the validity of some of the findings. We believe this is a minor concern, considering that English is a national language in Kenya, and English proficiency was a requirement for study inclusion. Future studies, for example, may require translation of the instrument to the local Swahili, and compare results. Our study also reports some findings that were unexpected. For example, increased novelty seeking being more substantial than increased harm avoidance in CHR participants. Such findings are not necessarily generalizable to other populations, and may in fact represent culture-specific presentations.

In summary, we found that those at CHR for psychosis have a temperament involving high NS and low RD, and a schizotypal character profile (ie, low SD, low CO, and high ST). Stress was most related to high HA and the constituent schizotypal character traits. Low CO was related to impaired cognition, and high NS was more related to lifetime substance use. Longitudinal studies will be required to understand the association of temperament and character with symptom change in psychotic individuals.

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