HHS Public Access

Author manuscript

Psychol Med. Author manuscript; available in PMC 2024 November 01.

Published in final edited form as:

Psychol Med. 2023 November ; 53(15): 7042–7052. doi:10.1017/S0033291723000296.

Psychometric Properties of the Mini International Neuropsychiatric Interview (MINI) Psychosis Module: A Sub-Saharan Africa Cross Country Comparison

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Abstract

Background.—The Mini International Neuropsychiatric Inventory 7.0.2 (MINI-7) is a widely used tool and known to have sound psychometric properties; but very little known about its use in low and middle-income countries (LMICs). This study aimed to examine the psychometric

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Conflict of Interest. None.

properties of the MINI-7 psychosis items in a sample of 8,609 participants across four countries in Sub-Saharan Africa.

Methods.—We examined the latent factor structure and the item difficulty of the MINI-7 psychosis items in the full sample and across four countries.

Results.—Multiple group confirmatory factor analyses (CFAs) revealed an adequate fitting unidimensional model for the full sample; however, single group CFAs at the country level revealed that the underlying latent structure of psychosis was not invariant. Specifically, although the unidimensional structure was adequate model fit for Ethiopia, Kenya, and South Africa, it was a poor fit for Uganda. Instead, a 2-factor latent structure of the MINI-7 psychosis items provided the optimal fit for Uganda. Examination of item difficulties revealed that MINI-7 item K7, measuring visual hallucinations, had the lowest difficulty across the four countries. In contrast, the items with the highest difficulty were different across the four countries, suggesting that MINI-7 items that are the most predictive of being high on the latent factor of psychosis are different for each country.

Conclusions.—The present study is the first to provide evidence that the factor structure and item functioning of the MINI-7 psychosis vary across different settings and populations in Africa.

Background

Psychotic disorders occur globally (Chong et al., 2016; De Oliveira, Cheng, Rehm, & Kurdyak, 2016); however, limited research has been conducted on the measurement of psychosis in low and middle-income countries (LMICs). There are many measures used to assess the spectrum of psychosis. These measures range from tools designed to assess for psychotic-like experiences in the general population (e.g., Community Assessment of Psychotic Experiences – 42; CAPE-42; van Os, Verdoux & Hanssen, 1999), tools used to screen for psychotic symptoms in a variety of settings (e.g., Psychosis Screening Questionnaire; Bebbington & Nayani, 1995), and measures aimed at diagnosing psychotic disorders, such as the Mini International Neuropsychiatric interview (MINI-7; Sheehan, 2017). Although these measures are used globally, little attention has been made to examine the psychometric properties of these measures in different settings and populations. Thus, there is a pressing need to examine the item response and underlying latent structure of psychotic disorders using these tools of measurement in LMICs, such as Sub-Saharan Africa, to better understand the expression of these disorders in different settings and populations.

Psychotic disorders are associated with substantial heterogeneity (Anderson, 2019) and it is the norm for those diagnosed with the same condition (e.g., schizophrenia) to present with different clinical presentations of the same disorder. Practically speaking, this complicates the nomological boundaries of these disorders, making the measurement and diagnosis of these conditions complex (Peralta, Moreno-Izco, Calvo-Barrena, & Cuesta, 2013). Research in HICs has shown that findings related to the measurement of psychotic disorders can vary widely (Peralta et al., 2013). For example, studies examining the latent structure of psychotic disorders have been plagued by equivocal findings with studies reporting the latent structure of psychosis to range from a one-factor structure up to an 18-factor structure

(Higuchi, 2014; Smith et al., 2016; Seretti & Olgiatti, 2004; Stefani 2002; Peralta & Cuesta., 2001) making it difficult to discern the true underlying latent construct of psychosis. This is further complicated in LMICs where the assessment of psychosis is limited to the symptoms that are representative of the expression of psychosis in HICs; thereby potentially missing variation in the expression of psychosis that may be unique to these regions. The equivocal findings on the underlying structure of psychosis may be due to several reasons, including, but not limited to: (1) measurement issues related to the failure to measure the full symptom domains of psychosis (e.g., some scales only measure positive symptoms (e.g., Scale for the Assessment of Positive Symptoms; SAPS; Andreasen, 1984), while others measure both positive and negative symptoms (e.g., Positive and Negative Syndrome Scale; PANSS; Kay, Fiszbein, & Opler, 1987), (2) different methods are used in studies leading to varying results, or (3) variations related to heterogeneity in the symptom expression of psychosis in different populations and cultural contexts (Anderson, 2019).

When considering the evidence from the existing literature, there is a notable gap of research examining the measurement of psychotic disorders in Sub-Saharan Africa. Of the existing literature in Sub-Saharan Africa, Emsley and colleagues (2001; 2003), identified a five-factor structure of psychosis in a sample of patients with schizophrenia in South Africa using the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983) and the SAPS (Andreasen, 1984). More recent literature identified a minimally acceptable model fit for a five-factor structure of positive psychotic symptoms using the CAPE-42 (van Os, Verdoux & Hanssen, 1999) in a sample of participants in Nigeria (Vermeiden et al., 2019) and a unidimensional fit was identified using the Psychotic Screening Questionnaire (PSQ; Bebbington & Nayani (1996) in a large sample of individuals from Ethiopia, Kenya, South Africa, and Uganda (Bitta et al., 2022). However, these recent articles are limited in that they focused on the experience of psychotic-like symptoms in populations without psychotic disorders. Thus, there is a need to examine factor structure of psychosis in a clinical sample of individuals with psychotic disorders from Sub-Saharan Africa.

Numerous assessment measures assessing psychosis have been developed over the years. One of the most commonly used measures is the MINI-7 (Sheehan, 2017). The MINI-7 has been shown to have sound psychometric properties in a variety of settings in HICs (Rossi et al., 2004; Mordal, Gundersen, & Bramness, Kadri et al., 2005; (De Azevedo Marques & Zuardi, 2008; Sheehan, et al., 1997; Otsubo et al., 2005) Kittirattanapaiboon & Khamwongpin, 2005). A strength of the MINI-7 is that it is a clinician administered measure and designed to enhance the validity and reliability of diagnosing psychiatric disorders over self-report measures. However, very little research has examined the use of the MINI-7 in LMICs. Given the variations in the cultural expression of mental health disorders across the globe (Kleinman, 1988); we cannot assume that the latent structure and expression of psychotic disorders would be the same across the globe. By examining the latent structure of psychotic symptoms in different populations, we can better understand which symptoms tend to be present across varying populations and settings and which symptoms may be function differently in varying contexts. To date, the use of the MINI-7 in Sub-Saharan Africa has not been examined; thus, there is a need to examine the measurement properties of this tool in this region.

The psychometric evaluation of measurement tools tends to fall into two theoretical backgrounds: (1) classical testing theory (CTT; Brennan, 2011) or (2) item response theory (IRT; De Ayala, 2009; Yen & Fitzpatrick, 2006). CTT focuses on test level information (e.g., reliability coefficients, factor structure); whereas IRT-based approaches focus on how individual scale items function across groups (e.g., countries). A particular strength of IRT based approaches is the ability to evaluate whether items of a given tool of measurement, such as the MINI-7, are differentially able to predict whether one will be high or low on a given construct (e.g., item difficulties). IRT approaches are especially useful when evaluating differences across groups and assessing whether certain items on a scale are more or less difficult (i.e., predictive of being high or low on a latent construct) across different settings (i.e. various Sub-Saharan countries). For example, if an item measuring auditory hallucinations is found to have low difficulty across all countries, this would suggest that: (1) auditory hallucinations are highly endorsed across the countries regardless of whether one falls high or low on the latent construct of psychosis, and (2) there are no meaningful differences in the endorsement of auditory hallucinations across the four countries. In contrast, if auditory hallucinations were found to have the highest difficulty in South Africa, but low difficulty in the other countries, this would suggest that endorsement of auditory hallucinations in South Africa would be predictive of being high in the latent construct of psychosis. Thus, an item measuring auditory hallucinations would be more meaningful to identifying cases with psychosis in South Africa than other items on the scale. However, this would not necessarily be the case for the other countries since the item difficulty was low, meaning that endorsement of auditory hallucinations would not distinguish between whether one is high or low in psychosis in those countries.

To provide a thorough evaluation of the functioning of the items of a scale, such as the MINI-7, it would be ideal to combine approaches of CTT and IRT to assess the latent structure and the item difficulty in the same investigation. A benefit of analyzing categorical items (i.e., MINI-7 items) using confirmatory factor analysis (CFA; Brown, 2006), is that it allows for the examination of both the latent factor structure and item difficulty in a single analysis. Unlike traditional CFA, conducting multiple group CFA analysis with categorical items, results in threshold parameters that are the comparable as item difficulty parameters in IRT analysis (Brown, 2006; Kim & Yoon, 2011; Muthen & Muthen, 2017). For this reason, the threshold parameters obtained through the CFA analyses in this study can be interpreted in the same manner as item difficulties in IRT. This study aimed to provide an item-level analysis of the MINI-7 psychosis items in a large sample of participants across four countries in Sub-Saharan Africa (Ethiopia, Kenya, South Africa, and Uganda). The specific aims of the study were twofold. First, we explored whether the underlying latent factor structure of psychosis identified using the MINI-7 is invariant by country using multiple group CFA. Second, we examined the item difficulty of the MINI-7 items. The item difficulties of the MINI-7 psychosis items were examined to determine which items are the most and least difficult, both in the full sample and by country.

Methods

Participants

The study used data collected using the MINI-7 from participants enrolled in an ongoing study, the Neuropsychiatric Genetics of African Populations – Psychosis (NeuroGAP-Psychosis) study, examining the neuropsychiatric genetics and phenotypes of psychosis in Sub-Saharan Africa. The primary study utilizes a case-control design and collects data from two groups: (1) cases – participants with a psychotic or bipolar spectrum disorder and (2) controls – participants without a psychotic or bipolar spectrum disorder. The current analysis used data from the cases only as the control participants were not administered the MINI-7. See Stevenson and colleagues (2019) for additional details on the study design.

Participants were comprised of 8,609 individuals from four countries in Sub-Saharan Africa including Ethiopia (n = 2,375), Kenya (n = 2,760), South Africa (n = 1,219), and Uganda (n = 2,255). A majority of the participants were males (56.5%) with a mean age of 36.65 (*SD* = 11.31). To be eligible for the study, participants must have a clinical diagnosis of psychosis (i.e., a primary psychotic disorder or a bipolar spectrum disorder) as assessed by a chart review. Participants were excluded if they were acutely psychotic, had severe alcohol or substance misuse as defined by being inpatient or under medical care for an alcohol of substance use disorder, under the age of 18 years old, not fluent in one of the study languages, or did not have the capacity to consent to study participation as assessed by the University of California, San Diego Brief Assessment of Capacity to Consent (UBACC; Jeste et al., 2007). See Table 1 for a breakdown of participant characteristics for the overall sample and by country.

Measures

Demographic Questionnaire.—A demographic questionnaire, created by research staff of the study, was used to gather information demographic variables that were of interest for the ongoing NeuroGAP-Psychosis study (e.g., age, language preference).

Mini International Neuropsychiatric Interview Version 7.0.2 (*MINI-7*).—The MINI-7 (Sheehan et al., 1998; Lecrubier et al., 1997) is a structured, diagnostic interview designed to assess the presence of current and past mental health disorders as assessed by the *International Classification of Disease*s (ICD-10; World Health Organization, 1992) and the *Diagnostic and Statistical Manual* (*DSM*-5; American Psychiatric Association, 2013) diagnostic manuals. The current investigation used data from the MINI-7 psychotic disorder section (Module K, items K1-K10) assessing for current or lifetime psychotic symptoms. The MINI-7 psychosis section is comprised of 10-items assessing delusions, hallucinations, and negative symptoms of psychosis. MINI-7 items 1-7 are scored based on participant's responses, while items 8, 9 and 10 are assessed based on clinician judgement. The items are rated using a dichotomous, forced choice, response scale with "yes" indicating endorsement of a symptom and "no" indicating absence of a symptom. The MINI-7 was administered in English or one of the native languages in each country (Kiswahili in Kenya, isi-Xhosa or Afrikaans in South Africa, Amharic in Ethiopia, and Luganda, Acholi, Lugbara, or Runyankole in Uganda) depending on the participants' language preference. The non-

English versions of the MINI-7 was translated and back translated in each language and reviewed by native speakers of each language for accuracy prior to participant enrollment. The MINI-7 was administered by highly trained research staff fluent in English and the languages of the non-English versions (e.g., Amharic in Ethiopia). Before administering the MINI-7, the research staff underwent a two-day training with the developer of the MINI-7 to ensure they received an optimal level of training prior to administering the MINI-7.

Procedure

Potentially eligible participants were recruited from inpatient (Ethiopia and South Africa only) and outpatient clinical sites (all countries). Participants with a clinical diagnosis of a psychotic disorder (i.e., schizophrenia, schizoaffective disorder, psychotic disorder not otherwise specified, and bipolar disorder; see Table 2 for diagnostic breakdown) were recruited to participate. Providers working in inpatient and outpatient clinical settings referred potentially eligible patients (via chart review) to the research staff on the NeuroGAP-Psychosis study team. Eligible participants completed a study visit comprised of the consenting process, collection of a saliva sample, completion of phenotype measures including the MINI-7, and physiological measures (see Stevenson et al., 2019 for more information of the recruitment procedure and study design).

The NeuroGAP-Psychosis study was approved by the Institutional Review Board at Harvard T.H Chan School of Public Health (#IRB17-0822) in the USA and the following ethics committees: Addis Ababa University College of Health Sciences (#014/17/Psy) and the Ministry of Science and Technology Ethics Committee (#3.10/14/2018), Moi Teaching and Referral Hospital Ethics Committee (#IREC/2016/145), Kenya National Council of Science and Technology (#NACOSTI/P/17/56302/19576) KEMRI Centre Scientific Committee (CSC# KEMRI/CGMRC/CSC/070/2016), KEMRI Scientific and Ethics Review Unit (SERU#KEMRI/SERU/CGMR-C/070/3575); The University of Cape Town (#466/2016) and Walter Sisulu University (#051/2016) Ethics Committees; The Makerere University School of Medicine (SOMREC #REC REF 2016-057), and the Uganda National Council for Science and Technology Ethics Committee (UNCST #HS14ES).

Data Analytic Plan

Multiple group CFAs (Brown, 2006) were used to confirm the factor structure and item difficulties of the MINI-7 psychosis items (items K1 – K10). Items included in this analysis assessed lifetime symptoms only. Multiple group CFA's with robust weighted least squares (WLSMV) in Mplus 8.4 (Muthen and Muthen, 1998-2017) were computed on the full sample to examine the model fit of a unidimensional, one-factor, latent structure of the MINI-7 psychotic symptoms items (i.e., items K1-K10). The model fit of the CFA was evaluated based on overall, (chi-square), parsimony (root standardized mean square of approximation, RMSEA), and comparative fit indices (comparative fit index; CFI). Model fit indices cutoffs to assess for an adequate or good fitting model were based on established cut-offs (Brown, 2006; Hu & Bentler, 1999; MacCallum, 1996). Although findings from prior research has established that chi-square values will be significant with large sample sizes (Hu and Bentler, 1999, the values are still relevant to report and significant chi-square values ($p < .05$) were deemed to be appropriate, given the large sample size in the present

study. Adequate and good fitting models were evaluated based on factor structure and item loadings for each factor. Item level factor loading were reviewed to identify potentially problematic items. Non-salient items (items with factor loadings <.40; (Brown, 2006) were dropped from the analysis and rerun to assess for improvement in model fit after dropping non-salient items. Consistent with recommendations for performing multiple group CFA (Brown, 2006), an adequate fitting unidimensional model was identified in the full sample to meet the criteria of *configural invariance* (i.e., equal factor structure), prior to moving on to single group analysis by country (i.e., assessing metric invariance by country).

After identifying adequate fit for the overall sample using multiple group CFAs, we then performed single group CFAs to provide a comparison of the factor structure of the MINI-7 by country. As noted, running CFAs with categorical variables yields results comparable to IRT (De Ayala, 2009) analysis (Brown, 2006; Paek, Cui, Öztürk Gübeş, & Yang, 2018; Raykov & Marcoulides, 2016). For the present study, the results from the CFAs with the categorical MINI-7 items are the comparable to conducting 2 parameter logistic (2PL) IRT models. We evaluated the thresholds (e.g., item difficulties) of the MINI-7 psychosis items in the full sample and by country. Interpretation of these analyses followed interpretation for 2PL IRT models and focused on the item difficulties and the item-characteristic curves (ICC). Item difficulties with categorical items refer to the degree to which endorsement of an item is predictive of a higher score on an overall latent construct. Larger item difficulties reflect greater probability of being high (or receiving a high score) on the underlying latent construct of interest (e.g., psychosis); whereas lower difficulty values are less predictive of whether one will score high or low on the latent construct. Item difficulties were evaluated based on comparisons of the item difficulties of the MINI-7 items in the full sample and comparisons of MINI-7 item difficulties by country.

Results

First, we examined endorsement of psychotic symptoms on the MINI-7. Lifetime endorsement of the MINI-7 psychotic items was high ranging from 74.8% endorsing K5 (odd beliefs) to the lowest endorsement at 44.6% for K7 (visual hallucinations). See Table 2 for a breakdown of the endorsement of the MINI-7 items by country. Diagnoses for the full sample as assessed by the MINI-7 were 60.8% for bipolar disorder, 18.4% for a psychotic disorder, and 26.4% for a mood disorder with psychotic features. The diagnostic breakdown by country showed that 30.2% met criteria for bipolar disorder in Ethiopia, 74.9% in Kenya, 73.5 % in Uganda, 60.5% in South Africa. Those meeting criteria for a psychotic disorder was 22.1% in Ethiopia, 6.5% in Kenya, 20.3% in Uganda, and 34.4% in South Africa. Mood disorder with psychotic features was diagnosed in 18.5% of participants in Ethiopia, 16.1% in Kenya, 10.8% in Uganda, and 10.8% in South Africa.

Second, we examined the model of the unidimensional latent structure of psychosis in the full sample to ensure the underlying assumption of meeting configural invariance for the full sample is met prior to conducting group level analysis. Consistent with the assumption of unidimensionality (Brown, 2006), the preliminary analyses revealed that an unidimensional, 1-factor model provided adequate fit of the MINI-7 psychosis items (items K1-K10) based on the absolute fit(χ^2 = 1929.30, df = 35, p <.0001, parsimony (RMSEA = .08) and

comparative fit (CFI = .90, TLI = .85) indices. Although a non-significant chi-square value is typically indicative of good model fit, it is notable that when interpreting the absolute model fit in large samples, the chi-square value will always be significant (Hu & Bentler, 1999) and, thus, a significant chi-square value is appropriate when interpreting model fit given the large sample size (i.e., $N = 8,609$) in the current investigation. The factor loadings for all items (K1-K10) were salient (i.e., factor loadings > .40; Brown, 2006) on the unidimensional structure. Factor loadings ranged from 0.40 for MINI-7 item K9 measuring catatonia/disorganized behavior to .70 on item K2 measuring the delusion of the ability of others read one's mind. The adequate unidimensional structure indicates that is appropriate to proceed with multi-group analyses. See Table 3 for overall model fit indices and Table 4 for MINI-7 item level factor loadings.

Single group CFAs were conducted to assess whether the latent structure of psychosis using the MINI-7 was invariant by country (Ethiopia, Kenya, South Africa, and Uganda). A comparison of the model fit indices at the country level revealed the factor structure at the country level was not invariant. Whereas there was an acceptable unidimensional structure for Kenya ($\chi^2 = 397.92$, df = 35, $p < .0001$, RMSEA = .12, CFI = .92, TLI = .89) and marginally acceptable for Ethiopia ($\chi^2 = 374.10$, df = 35, $p < .0001$, RMSEA = .06, CFI = .89, TLI =.86) and South Africa ($\chi^2 = 475.04$, df = 35, $p < .0001$, RMSEA = .10, CFI = .88, TLI = .85), the model fit was poor for Uganda ($\chi^2 = 1237.83$, df = 35, $p < .0001$, RMSEA = .12, CFI = .75, TLI = .68). Examination of the factor loading of the single group CFAs revealed salient factor loadings on all MINI-7 items for Kenya; however, there were non-salient loadings on MINI-7 item 10 (negative symptoms) for South Africa (0.38) and item 9 (catatonia/ disorganized behavior) for Ethiopia, and items 8 (disorganized speech), item 9 (catatonia/ disorganized behavior) and item 10 (negative symptoms) for Uganda. Dropping the non-salient items for South Africa (item 10) and Ethiopia (item 9) resulted in a negligible change in model fit for South Africa ($\chi^2 = 397.54$, df = 35, $p < .0001$, RMSEA = .10, CFI = .89) and Ethiopia ($\chi^2 = 324.88$, df = 35, $p < .0001$, RMSEA = .07, CFI = .90).

Given the notably poor model fit for Uganda, we performed additional analyses. to further examine the factor structure of psychotic symptoms in Uganda. We first used exploratory factor analysis (EFA) to assess the factor structure and then used CFAs to further evaluate the factor structure in the confirmatory framework. These analyses revealed that a 2-factor solution was the best fitting model ($\chi^2 = 208.72$, df = 35, $p < .0001$, RMSEA = .04, CFI = .96, TLI = .95), with MINI-7 items K1, K2, K3, K4, K5, K6, and K7 measuring delusions and hallucinations loading on one factor and items K8 (disorganized speech), K9 (catatonia/ disorganized behavior), and K10 (negative symptoms) loading on a second factor. Factor loadings for the 2-factor structure in Uganda ranged from 0.54 for MINI-7 item K7 for visual hallucinations to 0.77 for the MINI-7 item K1 delusion of reference of people spying on you for the first factor and 0.48 for MINI-7 item K9 assessing catatonia/disorganized behavior to 0.83 for MINI-7 item K8 assessing disorganized speech on the second factor. See Table 4 for the factor loadings for all of the MINI-7 psychosis items for the full sample and by group (Ethiopia, Kenya, South Africa, and Uganda).

Given the use of a dichotomous, "yes"/"no" forced choice scoring of the MINI-7 items, item thresholds (i.e., item difficulties) were evaluated and interpreted using an IRT approach (De

Ayala, 2009) for 2PL IRT models. As noted elsewhere (see Brown, 2006; Kim & Yoon, 2011; Paek et al., 2018), the interpretation of threshold values in CFA with dichotomous variables is similar to the interpretation of item difficulties when performing IRT analyses. Results revealed the item thresholds (difficulties) for the full sample ranged from −0.02 for MINI-7 item K4 assessing the delusion of reference of receiving special messages to −0.70 for MINI −7 item K5 assessing odd beliefs. Item thresholds (difficulties) at the country level revealed a different pattern. In South Africa, MINI-7 item K6 measuring auditory hallucinations had the highest threshold value (−0.60) and MINI-7 item K7 measuring visual hallucinations had the lowest threshold (−0.05). In contrast, MINI-7 item K5 measuring odd beliefs had the highest threshold value (−1.49), with MINI-7 item K7 assessing visual hallucinations had the lowest threshold (−0.11) in Kenya. In Ethiopia, MINI-7 item K1 measuring delusion of people spying of you had the highest threshold value (−1.86) and item K7assessing visual hallucinations had the lowest threshold (−0.09). This is similar to the item difficulty pattern observed in Uganda with MINI-7 item K1 measuring delusion of people spying on you having the highest threshold value (−0.54) and item K7 assessing visual hallucinations having the lowest threshold (−0.03). The item difficulties for the full sample and by country can be found in Table 5. Finally, we examined the item characteristic curves (ICCs) of the MINI-7 items by country. Items with steeper ICCs (i.e., curves to the right) reflect items that have higher discrimination, whereas items with less steep ICCs (i.e., curves to the left) reflect items with less discrimination. Figure 1 shows the ICCs of the 10 MINI-7 psychotic items plotted separately for each country.

Discussion

The current study examined the factor structure and item response of the MINI-7 psychosis items (items K1-K10) in four African countries. Results revealed an unidimensional latent structure of the MINI-7 psychosis items for the overall sample; however, the unidimensional factor structure was not invariant at the country level. Evaluation of the item response revealed that MINI-7 item K7 (visual hallucinations) to have the lowest difficulty across the four countries, but the pattern was not the same when assessing which item had the highest difficulty across the countries. The present study has important implications on the nature and measurement of psychosis in different populations and settings.

When considering the findings on the latent structure of psychosis, it is notable that the literature is burdened by equivocal findings. The present study provides novel evidence for variations in the expression of psychosis across different cultural settings as measured by the MINI-7. Although the unidimensional structure was adequate for the full sample and for Ethiopia, Kenya, and South Africa at the country level analyses, the fit was poor for Uganda. This provides preliminary evidence that the expression of psychosis as observed by the latent factor structure of psychosis differs across countries in Sub-Saharan Africa when using the MINI-7. Future research would benefit from a more nuanced examination of the factor structure of psychosis by expanding to other countries and exploring the latent structure when using measures other than the MINI-7. Given the equivocal findings in this area, it would also be beneficial to examine whether the latent factor structure of psychosis is better represented by a hierarchical structure as previously suggested (Peralta et al., 2013).

Interestingly, MINI-7 items K8 (disorganized speech), K9 (disorganized behavior) and K10 (negative symptoms) loaded on a second factor in Uganda. This could suggest that in Uganda negative and disorganized symptoms tend to load together on one factor and positive symptoms load on a separate factor (i.e., positive symptoms are more associated with other positive symptoms than negative symptoms and vice versa). Further, from a test development perspective, it is also interesting that MINI-7 items K1-K7 are designed to be asked directly to the patient by an interviewer, whereas MINI-7 items K8 (disorganized speech), K9 (disorganized behavior) and K10 (negative symptoms) are scored based on clinician judgment. Similar to the findings in the method effect literature that reverse-scored items tend to load on one factor while straight-worded items load on a second factor (DiStefano & Motl, 2006); it is possible that we may also be observing a method effect where the items asked directly to the participants are loading on one factor and those assessed by clinician judgment are loading on a second factor. Because this pattern was not observed in the other countries, the concern of a method effect is somewhat mitigated; however, it will be important to further explore this in future studies.

The primary focus, and key strength, of the current investigation was the exploration of the item difficulties of the MINI-7 items using an IRT framework. The item difficulties of the MINI-7 psychosis items were examined to determine which items are the most and least difficult in the full sample and by country. Results revealed differing patterns based on country with the same item having the lowest threshold across the four countries and different items having the highest difficulties across the four countries. Specifically, MINI-7 item K7 (visual hallucinations) had the lowest difficulty across all four countries, indicating that endorsement of visual hallucinations was the least predictive of being high on the latent construct of psychosis. Culturally, this may mean that the experience of having visual hallucinations is not a rare experience or sufficient to differentiate between those in the general population reporting psychotic-like experiences and those with a psychotic disorder. This is consistent with prior research demonstrating that the endorsement of visual hallucinations is relatively common in nonclinical samples endorsing psychotic-like experiences (Linzen et al., 2022; Johns & van Os, 2001; Poulton et al., 2000; van Os et al., 2000) and that endorsement of these experiences is not invariably associated with having a psychotic disorder.

In contrast, the items with the highest difficulties were different across the four countries with MINI-7 item K6 (auditory hallucinations) having the highest difficulty in South Africa, MINI-7 item K5 (odd beliefs) highest in Kenya, and MINI-7 item K1 (delusion of reference of people spying on you) having the highest threshold in both Uganda and Ethiopia. This suggests that the MINI-7 items that are the most predictive of being high on the latent structure of psychosis is different for each country. For example, whereas endorsement of auditory hallucinations predicts being high on the latent construct of psychosis in South Africa, this would not be the case for the other countries, where having odd beliefs in Kenya and the delusion of reference of people spying on you in Ethiopia and Uganda, would be the best predictors of rating high on psychosis in those countries. This finding demonstrates that there are: (1) country level differences in the endorsements of psychotic symptoms and (2) that the symptoms (i.e., items) that are the best at discriminating whether an individual is high in the latent structure of psychosis is different for each country. From a psychometric

perspective, these results suggest that items shown to have low difficulty may benefit from being weighted differently than high difficulty items to reflect the relative impact of each item in certain populations in assessing psychosis.

Interestingly, the range of difficulties (e.g., thresholds) across the countries vary as well. Item difficulties have a smaller range in threshold for values in South Africa (−0.05 to −0.60) and Uganda (−0.03 to −0.54), whereas the threshold range for Kenya (−0.11 to −1.49) and Ethiopia (−0.09 to −1.89) had the largest range in threshold values. This indicates the relative degree to which individual MINI-7 items predicts psychosis appears to be less in South Africa and Uganda than in Ethiopia and Kenya where the range from the lowest to highest difficulty items are much larger. This could mean that endorsement of any of the specific psychosis items in South Africa and Uganda will have less impact on whether one is high the latent construct of psychosis; whereas individual items Ethiopia and Kenya will have more impact on whether one rates high or low on the psychotic latent construct since the range in the difficulties (from high to lowest difficulties) is larger. Said another way, items with the highest difficulty in Ethiopia and Kenya will be better at discriminating of whether one is high in psychosis than items with the highest difficulty in South Africa and Uganda.

The present study also has clinical implications. Rates of misdiagnosis tend to be high in clinical settings and this is especially true Sub-Saharan Africa. To illustrate, Ayano and colleagues (2021) found that over a third of patients with a severe mental health disorder were found to be misdiagnosed in specialty mental health clinics in Ethiopia. Although the use of structured and semi-structured interviews can improve diagnostic validity, it is also important to consider whether the existing measures of psychosis, such as the MINI-7 are able assess the full symptom expression of these disorders in LMICs. The present study showed that there was some variation in the latent structure and the item response of the MINI-7 in four African countries. Given the MINI-7 was developed in a HICs, it is possible that this measure, and other existing measures, are missing additional culturally relevant features of psychosis that are observed (but not measured) in Africa. As such, it is important to evaluate whether existing measures need to be adapted to include cultural considerations in the diagnosis of psychosis in each country.

Further, although clinician administered tools aid in improving diagnostic accuracy in clinical settings, the use of these measures can be burdensome in low resource settings due to (in part) by the time it takes to administer them. One way to decrease the burden of administration is to reduce the length of a diagnostic tool. The findings from the present study provide preliminary results indicating potential ways to alter the MINI-7 for various settings. For example, if one were interested in adapting the MINI-7 for different populations based on the findings of the present study, items providing the most information for the group could be selected to enhance the measurement precision for that group. Items found to provide the least value predicting psychosis in each population could be removed from the scale to enhance ease of administration. Based on the results from the present study, removing item K7 (visual hallucinations) with a low difficulty across all countries may not have a significant impact on the diagnosis of psychosis in clinical settings in these countries, but would be beneficial by reducing the length of the scale. In contrast, items

with the highest difficulty in each country [e.g., MINI-7 item K6 (auditory hallucinations) in South Africa; MINI-7 item K5) odd beliefs) in Kenya], would be retained as they have the greatest predictive value of whether a patient would be diagnosed with a psychotic disorder in a clinical setting. While the findings from the present study are preliminary, overtime this line of work may point to specific ways in which our assessment measures can be adapted to increase precision of measurement in various settings and populations.

Limitations and Future Directions

The present study had a few limitations that should be noted. First, given the cross-sectional nature of the study, we are unable to comment on the longitudinal predictive patterns of the MINI-7 items. Second, given the unequal samples sizes for males and females we were unable to assess for differences based on sex. Similarly, we were unable to evaluate differences based on language as well given the number of languages used for administration of the MINI-7 (9 languages across the full sample) and the uneven group numbers for each language, due to recommendations that multi-group analyses should be conducted on relatively equal samples to avoid bias and artificially inflating the error in the measurement models. Further, given that the MINI-7 only allows for a general catchall diagnosis of psychotic disorder, we were unable to perform more nuanced analysis based on specific diagnoses (e.g., schizophrenia). It will be important for future investigations to examine potential differences based on sex, language and diagnosis. Finally, given that the MINI-7 was not created in Africa, our study is limited in that we can only assess the cultural variation of psychosis as measured by the MINI-7. As noted above, it is possible that that are other culturally relevant symptoms of psychosis in Africa that are not assessed in this measure. Future research would benefit from examining whether there are psychotic symptoms observed in Sub-Saharan Africa that are either missed or not being measured in a culturally relevant manner in the MINI-7 and other existing psychosis measures. Despite these limitations, the present study adds significantly to the current literature by examining the latent structure and item response characteristics of the MINI-7 in a large sample of over 8,000 individuals from four countries in Sub-Saharan Africa. Additional investigations are greatly needed to continue to expand on what is known about the measurement and expression of the latent construct of psychosis as it functions in a variety of cultural contexts.

Acknowledgments.

The authors wish to thank all the dedicated members of the NeuroGAP-Psychosis team across all sites for their technical assistance as well as the participants who made this work possible.

Funding.

This research was supported by the Stanley Center for Psychiatric Research at Broad Institute of MIT and Harvard and, in part, by the National Institute of Mental Health (R01MH120642 (Koenen, Dickens, Teferra, Stein); U01MH125047 (Neal/Koenen) and U01MH125045) (Koenen) and the National Institute of Health, Fogarty International Center K01TW012180 (Korte) and the Fulbright U.S. Scholar Program in collaboration with the Institute of International Education (Korte).

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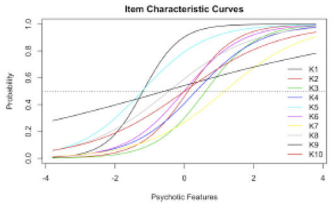
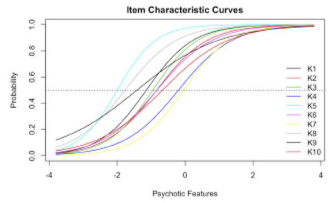
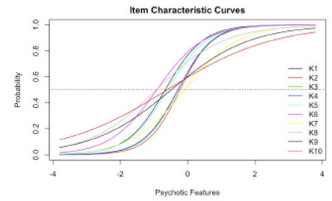


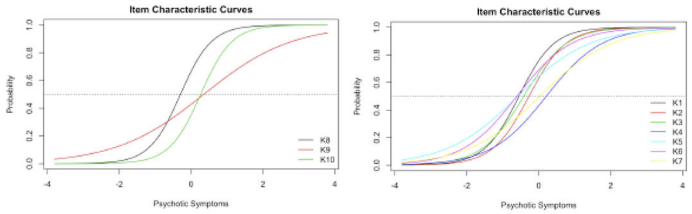
a. ICC for Ethiopia



b. ICC for Kenya.



c. ICC for South Africa



d. ICC for Uganda – 2-factor model

Figure 1.

Item characteristic curves (ICCs) by country (Ethiopia, Kenya, South Africa, and Uganda)

Table 1.

Sample Demographics by Country

	Mean	SD	Count	%
Ethiopia (*n* = 2255)				
Age	37.1	10.2		
Sex				
Male			1429	63.4
Female			826	36.6
Marital status				
Single			1277	56.6
Married/cohabiting			648	28.7
Widowed			52	2.3
Divorced or separated			277	12.3
Education				
No formal			103	4.6
Primary			666	29.5
Secondary			867	38.5
University			619	27.4
Kenya (*n* = 2760)				
Age	35.9	11.7		
Sex				
Male			1497	54.2
Female			1263	45.8
Marital status				
Single			1145	41.5
Married/cohabiting			1026	37.2
Widowed			101	3.7
Divorced or separated			488	17.1
Education				
No formal			51	1.8
Primary			1161	42.0
Secondary			976	35.2
University			544	20.7
Uganda (*n* =2375)				
Age	36.0	11.6		
Sex				
Male			1136	47.8
Female			1239	52.2
Marital status				
Single			993	41.8
Married/cohabiting			796	33.5
Widowed			101	3.7

	Mean	SD	Count	%
Divorced or separated			474	20.0
Education				
No formal			72	3.0
Primary			764	32.2
Secondary			1018	42.9
University			530	21.9
South Africa (n =1219)				
Age	38.7	11.5		
Male			801	65.7
Female			418	34.3
Marital status				
Single			932	76.5
Married/cohabiting			152	12.4
Widowed			35	2.9
Divorced or separated			100	8.2
Education				
No formal			11	0.9
Primary			195	16.0
Secondary			787	64.6
University			229	18.6
Total sample (n = 8609)				

Table 2.

Endorsement of the MINI-7 Psychosis Items for the Full Sample and by Country

	Full (%)	Ethiopia	Kenya	Uganda	South Africa
MINI-7 item					
1. People spying on you	73.2	80.1	76.4	65.5	67.9
2. Others read mind	58.3	47.0	69.2	57.3	56.4
3. Thought insertion	57.4	34.6	73.0	60.7	57.8
4. Special messages	48.8	42.3	54.1	44.2	56.4
5. Odd beliefs	74.8	74.0	91.5	60.8	65.7
6. Auditory hallucinations	62.7	49.8	68.3	63.7	71.9
7. Visual hallucinations	44.6	29.3	50.6	48.6	51.6
8. Disorganized speech	68.1	57.4	85.3	58.4	67.8
9. Disorganized behavior	57.6	53.4	73.3	42.9	58.4
10. Negative symptoms	52.7	58.3	63.2	40.8	58.3

Note. $N = 8,609$

Table 3.

MINI-7 Psychotic Symptoms: Model Fit Indices for CFA's: Full Sample and by Country

	χ^2	*(df, p)*	RMSEA (CI)	CFI	TLI
1-factor					
Full sample	1929.30	(35, p <. 000)	.08 (.09-.11)	.90	.85
South Africa	475.04	(35, p < .000)	.10 (.09-.11)	.88	.85
Kenya	397.92	(35, p < .000)	.06 (.05-.06)	.92	.89
Ethiopia	374.10	(35, p < .000)	.06 (.06-.07)	.89	.86
Uganda	1237.83	(35, p < .000)	.12 (.11-.12)	.75	.68
2-factor					
Uganda	208.72	(36, p< .000)	.04 (.04-.05)	.96	.96

Note. *N* = 8,609. RMSEA, root standardized mean square of approximation; CFI, comparative fit index, TLI = Tucker Lewis index, CI = 90% confidence interval.

Table 4.

MINI-7 Psychotic Symptoms – Factor Loadings by Country (slope)

Item	Overall	South Africa	Kenya	Uganda	Ethiopia
1. People spying on you	0.65	0.65	0.48	0.69	0.81
2. Others read mind	0.70	0.72	0.57	0.70	0.65
3. Though insertion	0.69	0.75	0.71	0.72	0.64
4. Special messages	0.60	0.74	0.56	0.60	0.46
5. Odd beliefs	0.60	0.70	0.70	0.49	0.55
6. Auditory hallucinations	0.62	0.64	0.56	0.69	0.59
7. Visual hallucinations	0.55	0.60	0.66	0.53	0.46
8. Disorganized speech	0.54	0.59	0.65	0.36	0.45
9. Catatonia/disorganized behavior	0.40	0.54	0.48	0.20	0.19
10. Negative symptoms	0.46	0.38	0.52	0.29	0.42

Note. $N = 8,609$.

Table 5.

MINI Psychotic Symptoms – Threshold Loadings by Country (item difficulty)

Item	Overall	South Africa	Kenya	Uganda	Ethiopia
1. People spying on you	−0.65	−0.48	−0.92	−0.54	−1.86
2. Others read mind	−0.23	−0.17	−0.59	−0.29	−0.80
3. Thought insertion	−0.20	−0.21	−0.60	−0.25	−0.65
4. Special messages	−0.02	−0.21	−0.27	−0.11	−0.25
5. Odd beliefs	−0.70	−0.42	−1.49	−0.42	−1.38
6. Auditory hallucinations	−0.34	−0.60	−0.62	−0.32	−0.78
7. Visual hallucinations	−0.12	−0.05	−0.11	−0.03	−0.09
8. Disorganized speech	−0.49	−0.47	−1.08	−0.24	−0.89
9. Catatonia/disorganized behavior	−0.21	−0.22	−0.67	−0.12	−0.33
10. Negative symptoms	−0.08	−0.22	−0.47	−0.10	−0.43

Note. $N = 8,609$.