Introduction

Globally, about 0.25% of the population is diagnosed with schizophrenia (He et al, 2020). In sub-Saharan Africa (SSA), the lifetime prevalence of psychotic disorders was 1% among a community sample drawn from western Kenya (Kwobah, Epstein, Mwangi, Litzelman, & Atwoli, 2017) Despite such a low prevalence, psychotic disorders are associated with significant disability and mortality. In 2017, schizophrenia accounted for 12.66 million Disability-Adjusted Life Years (0.51% of all-cause DALYs) globally (He et al, 2020). A study conducted among adolescents and young adults with a first diagnosis of a psychotic disorder in the US, found the all-cause mortality to be 54.6 per 10,000 compared with 6.7 per 10,000 among health system out-patients (Simon et al., 2018). Additionally, psychotic disorders result in considerable economic costs emanating from increased utilization of health care, as well as productivity losses related to premature morbidity and mortality (Chong et al., 2016; De Oliveira, Cheng, Rehm, & Kurdyak, 2016).

Unfortunately, the proportion of persons with possible mental disorders (psychotic disorders included), who receive a diagnosis is very low in clinical settings in SSA. For example in Nigeria, only 12.6% of general out-patients with a mental disorder received a diagnosis, while a study in Kenya reported an accuracy of detection of mental disorders of 4.1% (Ndetei et al., 2009). One potential reason for poor detection of psychotic disorders in clinical settings in SSA is a lack of valid and reliable tools for detecting these disorders. The major psychotic disorder assessment and diagnostic tools were developed in the western world (Bech, Larsen & Andersen, 1988; Kay, Fiszbein & Opler 1987), and the validation of these scales using African populations is in the nascent stage. The existence of cross-cultural differences in the expression of psychotic disorders has been well documented (Katz et al. 1988, Vermeiden et al., 2019). The use of tools validated in western populations for African settings could therefore lead to under-estimation or mis-identification of psychotic disorders in these settings.

The Mini International Neuropsychiatric interview (MINI) (Sheehan et al., 2017) is a diagnostic tool whose utility has been demonstrated in primary care settings (De Azevedo Marques

& Zuardi, 2008). Its psychotic disorder module has a set of questions examining 10 psychotic symptoms. Several studies have examined and confirmed the reliability and criterion validity of the psychosis module of the MINI across different settings (Rossi et al., 2004; Mordal, Gundersen, & Bramness, 2010; Kadri et al., 2005; De Azevedo Marques & Zuardi, 2008; Sheehan, et al., 1997; Otsubo et al., 2005; Kittirattanapaiboon & Khamwongpin, 2005). However, the underlying construct validity of the MINI psychosis items has not been investigated globally. Studies investigating the factor structure of psychosis using other psychometric scales have yielded one to seven factor solutions (Emsley et al., 2001; Emsley, Rabinowitz, & Torreman, 2003; Seretti & Olgiati 2004; Stefani et., al 2002, Higuchi et al., 2014). Most of these studies have been conducted in high income settings, thereby limiting the generalizability of the findings to other resource-constrained settings. Few studies have investigated the factor structure of psychosis with an African sample, of which only one study examined the factor structure of psychosis among Xhosa patients with schizophrenia in South Africa. The study found that a five-factor solution best fit the data (Emsley et al., 2001). However, no studies have investigated the factor structure of psychosis in other SSA countries, including in Kenya. Further investigation on the latent structure of psychosis in African samples is needed to better understand the nature of psychosis outside of Western countries.

The aim of this study was twofold. First, we examined the factor structure of psychosis in a large Kenyan sample using the standard MINI version 7.0.2 (MINI-7). We examined the latent factor structure of psychosis in the full sample and assessed the factor structure by sex to determine whether the MINI-7 is invariant (i.e., measuring the same underlying construct) in males and females. Second, we evaluated the item difficulties through an item response theory framework. We explored the item difficulties of the MINI-7 psychosis items in the full sample and by sex to determine which items are the most and least difficult in the Kenyan sample. The study used data collected using this measure from subjects enrolled in an epidemiological case-control study seeking to investigate the genetics and accompanying phenotype symptoms of psychosis among African populations in Kenya (Stevenson et al., 2019).

Method

Participants

The current study utilized participant data from the Kenyan sites of the Neuropsychiatric Genetics of African Populations-Psychosis (NeuroGAP-Psychosis) study. The NeuroGAP-Psychosis study is an ongoing, multi-site, case-control and genome-wide association study (GWAS) aimed at exploring the genetic and environmental risk factors for psychotic disorders in Ethiopia, Kenya, South Africa, and Uganda. See Stevenson and colleagues (2019) for additional details of the study design.

Participants were comprised of 2,760 cases from the Kenyan sites enrolled between March 2018 and March 2020. However, only data from 2,738 cases were used in the current investigation due to missing data on MINI-7 for 22 participants. Cases were defined as participants with a primary psychotic or bipolar disorder (i.e., schizophrenia, schizoaffective disorder, psychotic disorder not otherwise specified, and bipolar disorder) in were recruited to participate. Control participants were not used in the analyses as they were not administered the MINI-7 as part of the NeuroGAP-Psychosis study. Participants were excluded if they were not fluent in Swahili, had an inability 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), had a substance use disorder based on a history of having been an in-patient for the same disorder, or were experiencing severe, acute, psychotic symptoms at the time of the study that interfered with the patient's ability to complete the study procedures. See Table 1 for a breakdown of participant characteristics.

Measures

Demographic Questionnaire. A researcher designed demographic questionnaire was used to gather information about the participants such as age, sex, marital status, level of education, general health information, language preference, and other demographic variables of interest for the multi-site NeuroGAP-Psychosis study.

Standard MINI 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 from the *Diagnostic and Statistical Manual* (*DSM*-5; American Psychiatric Association, 2013) and *International Classification of Disease* (ICD-10; World Health Organization, 1992) diagnostic manuals. The current study utilized data from the MINI-7 psychotic disorder section (items K1-K10) assessing for lifetime presence of psychotic symptoms. The MINI-7 psychosis section is comprised of 10-items assessing delusions, hallucinations, and the negative symptoms of psychosis (e.g., "Have you ever felt that people were spying on you, or that someone was plotting against you, or trying to hurt you?"). The items are rated using a categorical response scale with "no" indicating absence of a symptom and "yes" indicating endorsement of a symptom. The MINI-7 was administered in English or Swahili, depending on the participants' language of preference. The Swahili version of the MINI-7 was translated and back translated to Swahili and reviewed by native Swahili speakers for accuracy prior to participant enrollment. The MINI-7 was administered in English and Swahili by highly trained research assistants fluent in both languages. Study staffs underwent a two-day training by the developer of the MINI-7 to ensure they received an optimal level of training prior to administering the MINI-7.

San Diego Brief Assessment of Capacity to Consent (UBACC) (Jeste et al., 2007). The UBACC was administered to ensure participants had capacity to consent for the present study. Participants not reaching the required level of capacity (i.e., score of 14.5 out of total score of 20) after completing four trials of the UBACC as recommended in prior studies on the use of the UBACC in SSA (Campbell et al., 2017), were deemed to lack capacity for consent and were not eligible for the study.

Procedure

Kenyan participants were recruited from two main sites in Kenya: (1) Moi Teaching and Referral Hospital and affiliated health facilities in Webuye, Kapenguria, Kitale, Kapsabet, Iten and Kakamega; and the (2) Kenya Medical Research Institute (KEMRI) Wellcome Trust Research

Programme with recruiting sites in Kilifi County Referral Hospital, Malindi Sub-County Hospital, Port Reitz Sub-County Hospital, and Coast General Teaching & Referral Hospital. Potentially eligible participants were identified by providers working in outpatient clinical settings. Providers identified potentially eligible participants based on chart review of their diagnoses. Patients with psychotic disorder listed in their chart were the research staff on the NeuroGAP-Psychosis study team assess for study eligibility. 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 full recruitment procedure and study design).

Ethical approval to conduct this study was obtained from all participating sites, including Moi University School of Medicine Institutional Research and Ethics Committee (#IREC/2016/145, approval number: IREC 1727), 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) in Kenya; and the Harvard T.H. Chan School of Public Health (#IRB17-0822), in the United States.

Data Analytic Plan

The factor structure of the MINI-7 psychosis module K was explored using confirmatory factor analyses (CFA). First, we conducted CFA's with robust weighted least squares (WLSMV) in Mplus 8.4 (Muthen and Muthen, 1998-2017) of the full sample to evaluate the overall model fit of a one-factor structure of the MINI-7 psychotic symptoms items (K1-K10). CFA model fit was evaluated based on overall (chi-square), comparative fit indices (comparative fit index; CFI and Tucker Lewis Index; TLI) and parsimony (root standardized mean square of approximation, RMSEA). Cutoffs for model fit indices of an adequate or good fitting model were based on established cut-offs (Brown, 2006; Hu & Bentler, 1999; MacCallum, 1996). Significant chi-square values ($p < .05$) were deemed to be appropriate based on findings from prior investigations demonstrating that chi-square values

will be significant with large sample sizes as is the case in the present study (Hu & Bentler, 1999). Adequate and good fitting models were evaluated based on factor structure and item loadings for each factor. Non-salient items (factor loadings <.40; (Brown, 2006) were removed from the analysis and the models were re-run to assess for improvement in model fit after dropping non-salient items. Consistent with recommendations for performing multiple group analysis (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 sex (i.e., assessing metric invariance by sex).

After identifying adequate fit for the overall sample, we then performed single group CFA's to provide a comparison of the factor structure of the MINI-7 by sex. Finally, given that running CFA analysis with categorical variables provides results comparable to item-response theory (IRT), (De Ayala, 2009) analysis (Brown, 2006; Paek, Cui, Öztürk Gübeş, & Yang, 2018) we also evaluated the thresholds (e.g., item difficulties) of the MINI-7 psychosis items in the full sample and by sex. Interpretation 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 being measured (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: (1) comparisons of the item difficulties of the MINI items in the full sample and (2) comparisons of MINI item difficulties by sex.

Results

Lifetime endorsement of the MINI-7 psychotic items was high and all the psychotic symptoms were endorsed by more than a half of the participants (Table 2). The most common psychotic symptoms experienced were odd beliefs (92.2%) and disorganized speech (85.9%). The least prevalent psychotic symptoms were special messages (54.6%) and visual hallucinations (51.0%). The MINI revealed endorsement of bipolar disorder was high with 74.9% of participants meeting

criteria for lifetime bipolar disorder. Lifetime psychotic disorder was identified in 6.5% of the sample. Further, 16.2% endorsed a lifetime major depressive disorder.

Consistent with the assumptions of performing multiple group CFA's (Brown, 2006), analyses revealed that an unidimensional, 1-factor model provided adequate fit of the MINI-7 Psychosis items (K1-K10) based on absolute (x^2 = 397.92, df = 35, p <.0001, parsimony (RMSEA = .06) and comparative fit (CFI = .92 and TLI = .90) indices. 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 =2738) in the current investigation. All items were salient (factor loadings > .40; (Brown, 2006)) on the 1-factor latent construct with factor loadings ranging from 0.45 for MINI item K9 measuring catatonia/disorganized behavior to .68 on item K5 measuring odd beliefs.

Model fit for the comparisons for the female and males groups were supportive of measurement invariance by sex, reflecting a similar pattern as the results observed in the full sample. We found acceptable fit for the 1-factor models for the female group in regards to absolute (x^2 = 185.16.92, df = 35, p <.0001), parsimony (RMSEA = .06) and comparative fit (CFI = .93 and TLI = .91) indices, and an acceptable fit for the male group (x^2 = 242.09, df = 35, p <.0001; RMSEA = .06; CFI = .92) with slightly (albeit modestly) less acceptable fit for the male group on the TLI index (TLI = .89; See Table 3). Once again, all item loadings were salient for both the female and male groups. Item K5 (odd beliefs) had the highest factor loading for the male group (.72) and item K1 (persecutory delusions) had the highest loading (.65) for the female group. Item K9 measuring catatonia/disorganized behavior had the lowest factor loadings for both females (.48) and males (.45). See Table 4 for the factor loading for all MINI-7 psychosis item for the full sample and by group (males, females).

Due to the categorical nature of the MINI-7 items, item thresholds were evaluated and interpreted using an IRT approach (De Ayala, 2009) as the interpretation of threshold values in CFA with categorical variables is similar to the interpretation of item difficulties when performing an IRT

analysis (Brown, 2006; Paek et al., 2018). Item thresholds for the full sample ranged from -1.42 for item K5 (odd beliefs) to -0.03 for item K7 (visual hallucinations). A similar pattern emerged for the female and male groups. Item K5 (odd beliefs) had the highest thresholds in the female (-1.33) and the male (-1.51) groups and item K7 (visual hallucinations) had the lowest threshold values with -0.04 for females and -0.01 for the male group. Thus, those endorsing item K5 (odd beliefs) had the highest item difficulty i.e. the item was associated with a greatest likelihood of falling high on the latent factor of psychosis; whereas endorsement of item K7 (visual hallucinations) had the lowest item difficulty and was not predictive of falling high on the latent construct of psychosis in the full sample or in the male or female groups. The thresholds values for all of the MINI-7 psychosis items are reported in Table 5. The ICC for the 10 MINI-7 items can be found in Figure 1.

Discussion

The present study evaluated the factor structure of the MINI-7 psychosis items with a sample of individuals with psychotic disorder or bipolar disorder in Kenya. To the best of our knowledge, this is the first study to evaluate the factor structure and item difficulties of the psychosis module of the MINI-7 in Kenya. We also explored the measurement invariance of the MINI-7 psychosis items by sex. The results of the CFA analyses provided support for the prediction that the one-factor model would provide an adequate fit for the MINI-7 psychosis items. Further, we found that the factor structure for MINI-7 psychosis was comparable for both males and females. These findings provide support for measurement invariance by sex. Thus, the MINI-7 psychosis items appear to be measuring the same underlying construct of psychosis in Kenyan males and females.

The item difficulty results revealed that the MINI-7 item K5 measuring odd beliefs had the strongest item difficulty on the latent factor of psychosis. As such, it is possible that endorsement of odd beliefs and other items with higher item difficulties (e.g., item K8 measuring disorganized speech), are particularly important when measuring psychosis in Kenyan samples determining

whether one will fall high or low on psychosis. Interestingly, visual hallucinations had the lowest item difficulty, suggesting that it is an “easier” item to endorse in this population, and therefore, less predictive of whether one will fall high or low on the latent construct of psychosis.

Our findings add to the nascent literature of the latent factor structure of psychosis in non-Western samples. Consistent with prior research, our results showed an adequate fit for a one-factor structure of psychosis (Heuvelman, Nazroo, & Rai, 2018). However, it is important to note the equivocal findings in the literature. Prior investigations have reported psychosis to be comprised of two or more factors (Kay, Fiszbein, & Opler, 1987; Giesbrecht et al., 2016; Wu et al. 2015; Emsley, Rabinowitz, & Torreman, 2003; Overall & Gorham, 1962; Kopelowicz, Ventura, Liberman, & Mintz, 2008). The equivocal factor structure could be related to the use of different scales in measuring psychosis across studies, as well as differences in characteristics of study populations. For example, Giesbrecht et al. (2016) reported a three-factor solution for psychosis among homeless persons with multi-morbidity in Canada. Further, Wu et al. (2015) reported a five-factor solution among persons with schizophrenia in China, and Kay and colleagues (1987) reported a four factor solution among persons with schizophrenia in the US. In a cross-country trial, Emsley et al. (2003) obtained a seven-factor solution among patients with recent onset psychosis (schizophrenia, schizophreniform disorder, schizoaffective disorder). Finally one study conducted among the Xhosa in South Africa reported a five-factor solution for psychosis Emsley et al., (2001). Another potential reason for the variation in findings could be related to the use of different rating scales. Using the BPRS, four and five factor solutions have been reported (Kopelowicz et al., 2008; Shafer et al., 2005); whereas a three (Giesbrecht et al. (2016) and seven-factor structure (Emsley, 2003) has been identified using the PANSS. Our study (to the best of our knowledge) was the first to examine the factor structure of psychosis using the MINI-7.

Further, given that this is among the first studies to examine the factor structure of psychosis in Kenya, the differences in the findings observed could also reflect true variations in psychosis in Kenya compared to Western countries. Prior research has reported variations in the endorsement of

psychotic symptoms based on culture (McLean et al., 2014; Vega & Lewis-Fernández, 2008). Vermeiden et al. (2019) found that Nigerian participants tended to endorse “strange experiences” and “paranoia” more than those in the Dutch and Norwegian participants in their study. Given the nascent stage of this literature, it is unclear whether these variations reflect true differences in the experience of psychosis; or if it is more of a reflection of the cultural acceptability related to the endorsement of psychotic experiences. Further research is needed to obtain a clearer sense of how the nature of psychosis varies by culture.

The findings from the item difficulties revealed that endorsement of odd beliefs for both males and females were the most “difficult” items and thereby most predictive of having a high score on the latent construct of psychosis. Consistent with the finding that odd beliefs had the strongest factor loading in the CFA solution, the high item difficulty of this item emphasizes the role of odd beliefs as being predictive of someone rating high on psychosis among Kenyan adults. In addition, we found that endorsement of visual hallucinations for both males and females were the least difficult items, indicating that endorsement of these items was not predictive of having a high level of psychosis on the underlying latent construct. Interestingly, visual hallucinations have traditionally been considered to be less prevalent in primary psychotic disorders compared to other psychotic symptoms (McCarthy Jones 2017).This may suggest that visual hallucinations may not be the most informative when measuring psychosis and it may be beneficial to drop these scale items in the case that one wanted to create a shortened version of the MINI-7 in Kenya. Additional research is needed to replicate these findings to determine whether these changes would be warranted.

Overall, the findings add to the literature on the latent structure of psychosis using the MINI-7 in an ethnically diverse sample of patients with psychosis in Kenya. Further, results demonstrate that the underlying factor structure and item difficulties are invariant in males and females. That said, this study is not without limitations. First, we might have obtained a biased sample because we conducted a hospital-based survey among out-patients. For example, patients with milder psychotic symptoms and therefore not presenting to hospital, or those with very severe symptoms therefore

admitted, may have been excluded from the NeuroGAP-Psychosis study. Our findings may therefore not be generalizable to the general population in Kenya. Future research should evaluate the factor structure of psychosis in a community sample and in other SSA settings to enhance generalization of findings.

In conclusion, the MINI-7 psychosis module is a useful tool for diagnosing psychotic disorders in clinical settings in Kenya. Given the high prevalence of psychotic disorders in mental health services in SSA, having a simple to administer tool like the MINI-7 psychosis module, can help with the identification and hence treatment for those with a psychotic disorder.

References

American Psychological Association. (2013). *American Psychiatric Association: Diagnostic and statistical manual of mental disorders, fifth edition*. Arlington, VA: American Psychiatric Association.

Bech P, Larsen JK, Andersen J. (1988). The BPRS: psychometric developments. Psychopharmacol Bull. 24(1):118-21. PMID: 3387515.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York: Guilford Press.

Campbell, M. M., Susser, E., Mall, S., Mqulwana, S. G., Mndini, M. M., Ntola, O. A., . . . Stein, D. J. (2017). Using iterative learning to improve understanding during the informed consent process in a South African psychiatric genomics study. *PLOS ONE, 12*(11), 1-11.

Chong, H. Y., Teoh, S. L., Wu, D. B.-C., Kotirum, S., Chiou, C.-F., & Chaiyakunapruk, N. (2016). Global economic burden of schizophrenia: a systematic review. *Neuropsychiatric disease and treatment, 12*, 357-373. doi:10.2147/NDT.S96649

De Ayala, R. (2009). *The theory and practice of item response theory*. New York, New York: Guilford Press.

De Azevedo Marques, J. M., & Zuardi, A. W. (2008). Validity and applicability of the Mini International Neuropsychiatric Interview administered by family medicine residents in primary health care in Brazil. *General Hospital Psychiatry, 30*(4), 303-310. doi:https://doi.org/10.1016/j.genhosppsych.2008.02.001

De Oliveira, C., Cheng, J., Rehm, J., & Kurdyak, P. (2016). The Economic Burden of Chronic Psychotic Disorders in Ontario. *J Ment Health Policy Econ, 19*(4), 181-192.

Emsley, R., Rabinowitz, J., & Torreman, M. (2003). The factor structure for the Positive and Negative Syndrome Scale (PANSS) in recent-onset psychosis. *Schizophrenia Research, 61*(1), 47-57. doi:https://doi.org/10.1016/S0920-9964(02)00302-X

Emsley RA, Niehaus DJ, Mbanga NI, Oosthuizen PP, Stein DJ, Maritz JS, Pimstone SN, Hayden MR, Laurent C, Deleuze JF, Mallet J. The factor structure for positive and negative symptoms in South African Xhosa patients with schizophrenia. Schizophr Res. 2001 Mar 1;47(2-3):149-57. doi: 10.1016/s0920-9964(00)00010-4. PMID: 11278132.

Emsley R, Rabinowitz J, Torreman M; RIS-INT-35 Early Psychosis Global Working Group. The factor structure for the Positive and Negative Syndrome Scale (PANSS) in recent-onset psychosis. Schizophr Res. 2003 May 1;61(1):47-57. doi: 10.1016/s0920-9964(02)00302-x. PMID: 12648735.

Giesbrecht, C. J., O'Rourke, N., Leonova, O., Strehlau, V., Paquet, K., Vila-Rodriguez, F., . . . Honer, W. G. (2016). The Positive and Negative Syndrome Scale (PANSS): A Three-Factor Model of Psychopathology in Marginally Housed Persons with Substance Dependence and Psychiatric Illness. *PLOS ONE, 11*(3), e0151648. doi:10.1371/journal.pone.0151648

Heuvelman, H., Nazroo, J., & Rai, D. (2018). Investigating ethnic variations in reporting of psychotic symptoms: a multiple-group confirmatory factor analysis of the Psychosis Screening Questionnaire. *Psychol Med, 48*(16), 2757-2765. doi:10.1017/s0033291718000399

He H, Liu Q, Li N, Guo L, Gao F, Bai L, Gao F, Lyu J. Trends in the incidence and DALYs of s schizophrenia at the global, regional and national levels: results from the Global Burden of Disease Study 2017. Epidemiol Psychiatr Sci. 2020 Jan 13;29:e91. doi: 10.1017/S2045796019000891. PMID: 31928566; PMCID: PMC7214712.

Higuchi CH, Ortiz B, Berberian AA, Noto C, Cordeiro Q, Belangero SI, Pitta JC, Gadelha A, Bressan RA. Factor structure of the Positive and Negative Syndrome Scale (PANSS) in Brazil: convergent validation of the Brazilian version. Braz J Psychiatry. 2014 Oct-Dec;36(4):336-9. doi: 10.1590/1516-4446-2013-1330. Epub 2014 Jul 16. PMID: 25028780.

Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. doi:10.1080/10705519909540118

Jeste, D. V., Palmer, B. W., Appelbaum, P. S., Golshan, S., Glorioso, D., Dunn, L. B., . . . Kraemer, H. C. (2007). A New Brief Instrument for Assessing Decisional Capacity for Clinical Research. *Archives of General Psychiatry, 64*(8), 966-974. doi:10.1001/archpsyc.64.8.966

Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin, 13*(2), 261-276. doi:10.1093/schbul/13.2.261

Kittirattanapaiboon P, Khamwongpin M. The validity and reliability of the Mini International Neuropsychiatric Interview (MINI) - Thai version 126. Journal of Mental Health of Thailand. 2005;13(3):126–136.

Kopelowicz, A., Ventura, J., Liberman, R. P., & Mintz, J. (2008). Consistency of Brief Psychiatric Rating Scale Factor Structure across a Broad Spectrum of Schizophrenia Patients. *Psychopathology, 41*(2), 77-84. doi:10.1159/000111551

Kwobah, E., Epstein, S., Mwangi, A., Litzelman, D., & Atwoli, L. (2017). Prevalence of psychiatric morbidity in a community sample in Western Kenya. *BMC Psychiatry, 17*(1), 30. doi:10.1186/s12888-017-1202-9

Lamela, D., Soreira, C., Matos, P., & Morais, A. (2020). Systematic review of the factor structure and measurement invariance of the patient health questionnaire-9 (PHQ-9) and validation of the Portuguese version in community settings. *Journal of Affective Disorders, 276*, 220-233. doi:https://doi.org/10.1016/j.jad.2020.06.066

Lecrubier, Y., Sheehan, D. V., Weiller, E., Amorim, P., Bonora, I., Harnett Sheehan, K., . . . Dunbar, G. C. (1997). The Mini International Neuropsychiatric Interview (MINI). A short diagnostic

structured interview: reliability and validity according to the CIDI. *European Psychiatry, 12*(5), 224-231. doi:https://doi.org/10.1016/S0924-9338(97)83296-8

MacCallum, R. C., Browne, Michael W.,Sugawara, Hazuki M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 12*, 130-149.

McCarthy-Jones S, Smailes D, Corvin A, Gill M, Morris DW, Dinan TG, Murphy KC, Anthony O Neill F, Waddington JL, Australian Schizophrenia Research Bank, Donohoe G, Dudley R. Occurrence and co-occurrence of hallucinations by modality in schizophrenia-spectrum disorders. Psychiatry Res. 2017 Jun;252:154-160. doi: 10.1016/j.psychres.2017.01.102. Epub 2017 Feb 24. PMID: 28273630.

McLean, D., Thara, R., John, S., Barrett, R., Loa, P., McGrath, J., & Mowry, B. (2014). DSM-IV "Criterion A" Schizophrenia Symptoms Across Ethnically Different Populations: Evidence for Differing Psychotic Symptom Content or Structural Organization? *Culture, Medicine, and Psychiatry, 38*(3), 408-426. doi:10.1007/s11013-014-9385-8

Mordal, J., Gundersen, O., & Bramness, J. G. (2010). Norwegian version of the Mini-International Neuropsychiatric Interview: Feasibility, acceptability and test-retest reliability in an acute psychiatric ward. *European Psychiatry: The Journal of the Association of European Psychiatrists*, *25*(3), 172–177. https://doi.org/10.1016/j.eurpsy.2009.02.004

Moreno-Küstner, B., Martín, C., & Pastor, L. (2018). Prevalence of psychotic disorders and its association with methodological issues. A systematic review and meta-analyses. *PLOS ONE, 13*(4), e0195687-e0195687. doi:10.1371/journal.pone.0195687

Moreno-Küstner B, Martín C, Pastor L. Prevalence of psychotic disorders and its association with methodological issues. A systematic review and meta-analyses. PLoS One. 2018 Apr 12;13(4):e0195687. doi: 10.1371/journal.pone.0195687. PMID: 29649252; PMCID: PMC5896987.

Muthen, L. K., Muthen, BO. (1998-2017). *Mplus user's guide. Seventh*. Los Angeles, CA: Muthen & Muthen.

Mwesiga EK, Nakasujja N, Nakku J, et al. One year prevalence of psychotic disorders among first treatment contact patients at the National Psychiatric Referral and Teaching Hospital in Uganda. *PLoS One*. 2020;15(1):e0218843. Published 2020 Jan 29. doi:10.1371/journal.pone.0218843

Ndetei, D. M., Khasakhala, L. I., Kuria, M. W., Mutiso, V. N., Ongecha-Owuor, F. A., & Kokonya, D. A. (2009). The prevalence of mental disorders in adults in different level general medical facilities in Kenya: a cross-sectional study. *Annals of general psychiatry, 8*, 1-1. doi:10.1186/1744-859X-8-1

OTSUBO, T., TANAKA, K., KODA, R., SHINODA, J., SANO, N., TANAKA, S., . . . KAMIJIMA, K. (2005). Reliability and validity of Japanese version of the Mini-International Neuropsychiatric Interview. *Psychiatry and Clinical Neurosciences, 59*(5), 517-526. doi:https://doi.org/10.1111/j.1440-1819.2005.01408.x

Overall, J. E., & Gorham, D. R. (1962). The Brief Psychiatric Rating Scale. *Psychological Reports, 10*(3), 799-812. doi:10.2466/pr0.1962.10.3.799

Paek, I., Cui, M., Öztürk Gübeş, N., & Yang, Y. (2018). Estimation of an IRT Model by Mplus for Dichotomously Scored Responses Under Different Estimation Methods. *Educational and Psychological Measurement, 78*(4), 569-588. doi:10.1177/0013164417715738

Rossi, A., Alberio, R., Porta, A., Sandri, M., Tansella, M., & Amaddeo, F. (2004). The reliability of the Mini-International Neuropsychiatric Interview—Italian version. *Journal of Clinical Psycho pharmacology*, *24*(5), 561–563. https://doi.org/10.1097/01.jcp.0000139758.03834.ad

Serretti A, Olgiati P. Dimensions of major psychoses: a confirmatory factor analysis of six competing models. Psychiatry Res. 2004 Jun 30;127(1-2):101-9. doi: 10.1016/j.psychres.2003.07.005. PMID: 15261709.

Simon GE, Stewart C, Yarborough BJ, et al. Mortality Rates After the First Diagnosis of Psychotic

Disorder in Adolescents and Young Adults. *JAMA Psychiatry*. 2018;75(3):254-260. doi:10.1001/jamapsychiatry.2017.4437

Shafer, A. (2005). Meta-analysis of the Brief Psychiatric Rating Scale factor structure. *Psychological Assessment, 17*(3), 324–335.

Stefanis NC, Hanssen M, Smirnis NK, Avramopoulos DA, Evdokimidis IK, Stefanis CN, Verdoux H, Van Os J. Evidence that three dimensions of psychosis have a distribution in the general population. Psychol Med. 2002 Feb;32(2):347-58. doi: 10.1017/s0033291701005141. PMID: 11866327.

Stevenson, A., Akena, D., Stroud, R. E., Atwoli, L., Campbell, M. M., Chibnik, L. B., . . . Koenen, K. C. (2019). Neuropsychiatric Genetics of African Populations-Psychosis (NeuroGAP-Psychosis): a case-control study protocol and GWAS in Ethiopia, Kenya, South Africa and Uganda. *BMJ Open, 9*(2), e025469. doi:10.1136/bmjopen-2018-025469

Vega, W. A., & Lewis-Fernández, R. (2008). Ethnicity and variability of psychotic symptoms. *Current Psychiatry Reports, 10*(3), 223. doi:10.1007/s11920-008-0037-y

Vermeiden, M., Janssens, M., Thewissen, V., Akinsola, E., Peeters, S., Reijnders, J., . . . Lataster, J. (2019). Cultural differences in positive psychotic experiences assessed with the Community Assessment of Psychic Experiences-42 (CAPE-42): a comparison of student populations in the Netherlands, Nigeria and Norway. *BMC Psychiatry, 19*(1), 244. doi:10.1186/s12888-019-2210-8

Wu, B.-J., Lan, T.-H., Hu, T.-M., Lee, S.-M., & Liou, J.-Y. (2015). Validation of a five-factor model of a Chinese Mandarin version of the Positive and Negative Syndrome Scale (CMV-PANSS) in a sample of 813 schizophrenia patients. *Schizophrenia Research, 169*(1), 489-490. doi:https://doi.org/10.1016/j.schres.2015.09.011

Table 1. Participant Demographics

	Count	%	Mean	SD
Age			35.9	11.7
Sex				
Male	1497	54.2		
Female	1263	45.8		
Marital status				
Single	1145	41.5		
Married or cohabitating	1026	37.2		
Widowed	101	3.7		
Divorced or separated	488	17.1		
Level of education				
No formal education	51	1.8		
Some Primary	445	16.1		
Finished Primary	716	25.9		
Some Secondary	367	13.1		
Finished Secondary	609	22.1		

Some University	197	7.1
Finished University	347	13.6

Note. N = 2738; SD = standard deviation.

Table 2. Endorsement of MINI-7 Lifetime Psychotic Symptoms (Items K1-K10)

MINI-7 Psychotic Item	Number endorsing	**%**
K1. People spying on you	2110	77.1
K2. Read mind/others hear thoughts	1910	69.8
K3. Thought insertion / removed from head	2015	73.6
K4. Special messages (radio, TV)	1494	54.6
K5. Odd beliefs	2525	92.2
K6. Auditory hallucinations	1884	68.2
K7. Visual hallucinations	1397	51.0
K8. Disorganized speech	2738	85.9
K9. Catatonia/disorganized behavior	2022	73.8

K10. Negative symptoms	1744	63.0

Note: *N* = 2738. The text for the MINI-7 items was shortened in the table and are not verbatim.

Table 3. Model Fit Indices of the MINI-7 Psychotic Symptoms for the Full Sample and the Multi-group Models (male, females)

Model Fit Indices for the 1-Factor Model					
	X^2	*df*	RMSEA	CFI	TLI
Full Sample	397.92	35	.06	.92	.90
Female	185.16*	35	.06	.93	.91
Male	242.09*	35	.06	.91	.89

*Note. N = 2738; * p<.0001; X^2 =chi-square; df=degrees of freedom; RMSEA=root mean square error of approximation; CFI=comparative fit index; TLI=Tucker–Lewis index.*

Table 4. Factor Loadings for the 1-Factor CFA Model of the MINI-7 Psychosis Items for the for the Full Sample and the Multi-Group Models (male, females)

MINI-7 Psychosis Item	Factor Loadings		
	Full Sample	Male	Female
K1. People spying on you	.64	.63	.65
K2. Read mind/others hear thoughts	.62	.61	.63
K3.Thought insertion / removed from head	.65	.65	.65
K4. Special messages (radio, TV)	.59	.57	.61
K5. Odd beliefs	.68	.72	.64
K6. Auditory hallucinations	.58	.60	.56
K7. Visual hallucinations	.65	.67	.63
K8. Disorganized speech	.59	.60	.57

K9. Catatonia/disorganized behavior	.45	.42	.48
K10. Negative symptoms	.53	.54	.51

*Note. N = 2738; * p<.0001; X^2 = chi-square; df = degrees of freedom; RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker–Lewis index.*

Table 5. MINI Psychotic Symptoms: Thresholds (Item Difficulties) for the 1-Factor CFA for the Full Sample and the Male and Female Group.

MINI-7 Psychosis Item	Thresholds (intercepts)		
	Full Sample	Male	Female
K1. People spying on you	-0.74	-0.84	-0.64
K2. Read mind/others hear thoughts	-0.52	-0.58	-0.45
K3. Thought insertion / removed from head	-0.63	-0.70	-0.56
K4. Special messages (radio, TV)	-0.12	-0.18	-0.04
K5. Odd beliefs	-1.42.	-1.51	-1.33
K6. Auditory hallucinations	-0.49	-0.50	-0.48
K7. Visual hallucinations	-0.03	-0.01	-0.04

K8. Disorganized speech	-1.08	-1.11	-1.04
K9. Catatonia/disorganized behavior	-0.64	-0.70	-0.58
K10. Negative symptoms	-0.35	-0.36	-0.34

Note. *N* = 2738.

Katz MM, Marsella A, Dube KC, Olatawura M, Takahashi R, Nakane Y, Wynne LC, Gift T, Brennan J, Sartorius N, et al. On the expression of psychosis in different cultures: schizophrenia in an Indian and in a Nigerian community (1988). Cult Med Psychiatry. 12(3):331-55. doi: 10.1007/BF00051973.

Sheehan DV, Lecrubier Y, Sheehan KH, Amorim P, Janavs J, Weiller E, Hergueta T, Baker R, Dunbar GC (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. J Clin Psychiatry. 59 Suppl 20:22-33;quiz 34-57.

Kadri N, Agoub M, El Gnaoui S, Alami KhM, Hergueta T, Moussaoui D (2005). Moroccan colloquial Arabic version of the Mini International Neuropsychiatric Interview (MINI): qualitative and quantitative validation. Eur Psychiatry. 20(2):193-5. doi: 10.1016/j.eurpsy.2004.11.007.

World Health Organization. (1992). The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines. Geneva: World Health Organization.

Emsley R, Rabinowitz J, Torreman M; RIS-INT-35 Early Psychosis Global Working Group. (2003). The factor structure for the Positive and Negative Syndrome Scale (PANSS) in recent-onset psychosis. Schizophr Res. 1;61(1):47-57. doi: 10.1016/s0920-9964(02)00302-x.

McCarthy-Jones S, Smailes D, Corvin A, Gill M, Morris DW, Dinan TG, Murphy KC, Anthony O Neill F, Waddington JL, Australian Schizophrenia Research Bank, Donohoe G, Dudley R. (2017). Occurrence and co-occurrence of hallucinations by modality in schizophrenia-spectrum disorders. Psychiatry Res. 252:154-160. doi: 10.1016/j.psychres.2017.01.102.