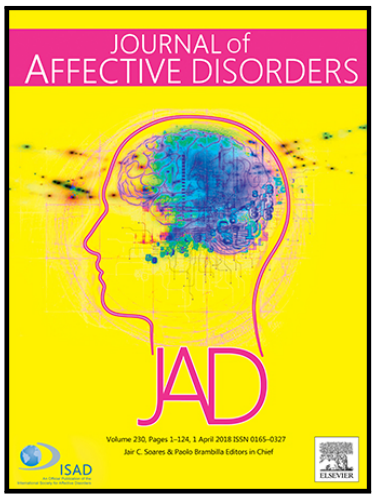

Cross-country variations in the reporting of psychotic symptoms among sub-Saharan African adults: A psychometric evaluation of the Psychosis Screening Questionnaire

Mary Bitta , Yanga Thungana , Hannah H. Kim , Christy A. Denckla , Amantia Ametaj , Mahlet Yared , Claire Kwagala , Linnet Ongeri , Rocky E. Stroud , Edith Kwobah , Karestan C. Koenen , Symon Kariuki , Zukiswa Zingela , Dickens Akena , Charles Newton , Lukoye Atwoli , Solomon Teferra , Dan J. Stein , Bizu Gelaye

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Highlights

- The prevalence of psychotic symptoms varied considerably between the individual countries and was unlikely due to a measurement artifact.
- The PSQ is unidimensional, but the hypomania item was the least associated with the construct of psychosis.
- The PSQ is more reliable at distinguishing psychosis in those with higher degrees of psychotic experiences.

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Cross-country variations in the reporting of psychotic symptoms among sub-Saharan African adults: A psychometric evaluation of the Psychosis Screening Questionnaire

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ABSTRACT

Background: Self-reporting of psychotic symptoms varies significantly between cultures and ethnic groups. Yet, limited validated screening instruments are available to capture such differences in the African continent.

Methodology: Among 9,059 individuals participating as controls in a multi-country case–control study of the genetic causes of psychosis, we evaluated the psychometric properties of the Psychosis Screening Questionnaire (PSQ). We applied multi-group confirmatory factor analysis and item response theory to assess item parameters.

Results: The overall positive endorsement of at least one item assessing psychotic symptoms on the PSQ was 9.7%, with variability among countries (Uganda 13.7%, South Africa 11%, Kenya 10.2%, and Ethiopia 2.8%). A unidimensional model demonstrated good fit for the PSQ (root mean square error of approximation = 0.009; comparative fit index = 0.997; and Tucker-Lewis Index = 0.995). Hypomania had the weakest association with single latent factor (standardized factor loading 0.62). Sequential multi-group confirmatory factor analysis demonstrated that PSQ items were measured in equivalent ways across the four countries. PSQ items gave more information at higher levels of psychosis, with hypomania giving the least discriminating information.

Limitations: Participants were recruited from general medical facilities, so findings may not be generalizable to the general population.

Conclusion: The PSQ demonstrated a unidimensional factor structure in these samples. Items were measured equivalently across all study settings, suggesting that differences in prevalence of psychotic symptoms between countries were less likely to represent measurement artifact. The PSQ is more reliable in screening for psychosis in individuals with

higher degrees of psychotic experiences—hypomania excluded—and might decrease the false-positive rate from mild nonspecific psychotic experiences.

Keywords: psychosis; sub-Saharan Africa; assessment; screening

1. INTRODUCTION

Psychotic symptoms are common among the general population and may be predictive of future psychotic disorder (Kaymaz et al., 2012; Van Os et al., 2009). Psychotic disorders are clinically characterized by the presence of hallucination, delusion, disorganized speech, grossly disorganized behaviour, and negative symptoms (American Psychiatric Association, 2013). However, only a small proportion of people with psychotic experiences develop psychotic disorders, which have a relatively low prevalence of about 1–3% (Cloutier et al., 2016; Saha et al., 2007). Further, while psychotic symptoms are a core feature of primary psychotic disorders such as schizophrenia, they are also common in affective disorders and primary neurological disorders.

Schizophrenia and related psychotic disorders are among the world's leading causes of disability, reduced productivity, and premature mortality (Chang et al., 2011; Hjorthøj et al., 2017; Morgan et al., 2014; Rabinowitz et al., 2013; Vos et al., 2015). In under-resourced settings, this burden is aggravated by inadequate access to healthcare (McBain et al., 2012), ongoing poverty, and material deprivation (Burns, 2012). In addition, untreated psychosis can have deleterious effects: longer duration of untreated psychosis is associated with unfavorable outcomes in schizophrenia, such as frequent hospitalization, inadequate response to treatment, and limited functional recovery (Chiliza et al., 2012; De Haan et al., 2003; Marshall et al., 2005; Perkins et al., 2005; Tang et al., 2014). This may be especially salient in sub-Saharan Africa because psychosis may go untreated longer in developing countries compared to developed countries (Farooq et al., 2009). Because early detection and intervention to reduce the duration of untreated psychosis may improve outcomes in patients with psychotic illness (De Haan et al., 2003; Marshall et al., 2005), validated screening tools that are practical and easy to administer without significant training could provide crucial support to improve diagnosis rates and reduce morbidity from psychotic disorders (Kline and Schiffman, 2014; Marshall et al., 2005).

In low- and middle- income countries, screening tools administered by laypersons may be beneficial given the limited mental health workforce (Aderibigbe and Perlman, 2019; Ali et al., 2016; Breuer et al., 2012; Vythilingum et al., 2013). A significant barrier to early detection and treatment of psychosis disorders in sub-Saharan Africa is the lack of primary

validation studies on common screening instrument psychometric properties. The Psychosis Screening Questionnaire (PSQ) is widely used to screen for psychotic disorders in sub-Saharan Africa. However, this instrument was formally validated in other settings [e.g., the United Kingdom (UK)] (Heuvelman et al., 2018), but not in sub-Saharan African countries. Further, although prior studies demonstrated the feasibility of using the PSQ in African settings (Ayano et al., 2017; Jenkins et al., 2012, 2010; Lasebikan and Ayinde, 2013; Lasebikan and Ige, 2015), formal psychometric properties have not yet been reported. It is therefore difficult to estimate this scale's generalizability within sub-Saharan Africa.

Determining the validity of the PSQ in sub-Saharan Africa is crucial because scales commonly used to screen for psychotic disorders demonstrate heterogeneity in prevalence rates across cultures and ethnic groups (Heuvelman et al., 2018; Ojagbemi et al., 2018). Indeed, the prevalence of self-reported psychotic symptoms varies notably between settings (Jenkins et al., 2012, 2010), and there is significant variation in the acknowledgment of psychotic symptoms between ethnic groups. For instance, in a study in the UK, an ethnic minority group had significantly higher self-reported psychotic symptoms compared to white British participants (Heuvelman et al., 2018). Similarly, other studies suggested a higher prevalence of psychotic symptoms among Latino and Black ethnic groups (Cohen Dr. and Marino Dr., 2013). . Together, these studies suggest that participants' cultural backgrounds influence the self-reporting of psychotic-like experiences (Lewis-Fernández et al., 2009; Maslowski et al., 1998; Weisman et al., 2000). Yet, differences in prevalence estimates may also

reflect differences in data collection methods, population, or other unmeasured variables. Only one study directly assessed measurement invariance across ethnic groups, concluding that paranoid symptoms are less reliably measured across ethnic minorities compared to white British individuals, such that a higher prevalence of paranoia among Caribbean individuals is likely not an artifact of measurement (Heuvelman et al., 2018). This raises the possibility that cultural expression of psychopathology symptoms may vary by setting.

Given the paucity of psychosis screening tools validated for use on the African continent, we conducted a study in culturally, racially, and linguistically diverse settings across four sub-Saharan African countries to: (1) evaluate the psychometric properties of the PSQ and compare measurement properties across countries; (2) examine cross-country differences in the prevalence of self-reported psychotic symptoms; and (3) explore measurement properties of the PSQ across countries.

2. METHODS AND MATERIALS

2.1 Study Participants

Data were obtained from the ongoing Neuropsychiatric Genetics of African Populations-Psychosis (NeuroGAP-Psychosis) study. NeuroGAP-Psychosis is a multi-country case–control study of psychosis conducted in Uganda, South Africa, Kenya, and Ethiopia. The overarching aims of the NeuroGAP-Psychosis study is to expand understanding of the causes of schizophrenia and bipolar disorder through large-scale sample collection and analyses in understudied African populations. Study methodology is detailed elsewhere (Stevenson et al., 2019). The current study included only control participants, who were recruited from general medical facilities. In Uganda, control participants were recruited from Butabika National Referral Hospital, Naguru Referral Hospital, Mbarara Regional Referral Hospital, Arua Regional Referral Hospital, and Gulu Referral Hospital. In South Africa, control participants were recruited from community health clinics in Western Cape (Crossroads, DuNoon, District 6, Dr. Adburahman, Grassy Park, Gugulethu, Lady Michaeis, Maitland, Mitchells Plan, Mitchells Plan Satellite Clinics, and Parrow). In Eastern Cape, controls were recruited from Nelson Mandela Academic Hospital, Fort England satellite clinics, and Dora Nginza Hospital and affiliated health clinics. In Kenya, control participants were recruited from Kilifi County Hospital, Coast General Provincial Hospital, Port Reitz sub-County Hospital, Malindi sub-County Hospital, and Moi Teaching and Referral Hospital and its affiliated clinics in Webuye, Kapenguria, Kitale, Kapsabet, Iten, and Kakamega. In Ethiopia, control participants were recruited from Black Lion Hospital (Tikur Anbessa).

2.2 Data Collection and Variables

Data were collected via structured interviews by research staff. NeuroGAP-Psychosis research staff included nurses, clinicians, and bachelor-level accredited research assistants (RAs). Before data collection, all research staff received extensive, structured training on study-related assessments and procedures, including the administration of the PSQ. Trainings included an item-by-item description of questionnaires and role-plays. RAs and their supervisors provided signed acknowledgement of training completion. To ensure high-quality data collection, interviewers were provided on-site supervision and support. Refresher trainings were conducted periodically to ensure adherence to study procedures and ongoing role-plays were conducted to ensure inter-rater reliability. All RAs also completed human subjects training. PSQ self-report items were read aloud to participants verbatim to avoid challenges with literacy and unfamiliarity with the format of the questionnaire. In each country, the PSQ was translated from English into local languages, following WHO translation guidelines for assessment instruments. Languages included: Acholi, Afrikaans, Amharic, English, Kiswahili, Luganda, Lugbara, Runyankole, and isXhosa. This iterative process included a forward translation, a targeted back-translation, and review by a bilingual expert group.

Participants were included if they were at least 18 years old and had a score of 14.5 or higher (out of a possible 20) on the University of California, San Diego Brief Assessment of Capacity to Consent (UBACC) form. Exclusion criteria encompassed a clinical diagnosis of psychosis (schizophrenia or bipolar disorder), known history of psychosis, currently

taking medication for psychosis, being an inpatient for alcohol or substance use, lack of fluency in one of the offered languages, and scoring 14.5 or lower on the UBACC. Due to low levels of missingness [120 (1.3%)], a complete case analysis was conducted. The final study population comprised 9,059 participants (Uganda n=2,087; South Africa n=2,557; Kenya n=2,489; and Ethiopia n=1,926).

2.3 Psychosis Screening Questionnaire

Psychosis was assessed using the PSQ (Bebbington and Nayani, 1996), a brief, self-report screening instrument designed to identify psychotic disorders. The PSQ assesses for five self-reported psychotic symptoms: mania, thought-interference, paranoia, strange experiences, and hallucinations. For each psychotic symptoms, a root questions is asked to assess for the presence of psychotic-like experience which is followed by one or two questions to corroborate the experiences as symptomatic of psychosis. Like prior studies, a binary measure (present vs. absent) was created for each of the five psychotic symptoms. For an item to be considered positive, both the root and the additional corroborating questions had to be endorsed either in the last 12 months or lifetime. In addition to these five binary measures, a composite screening measure was created using responses across all five psychotic symptoms (0 = negative on all; 1 = positive on any) and was further categorized into past-year and lifetime occurrence (Heuvelman et al., 2018).

2.4 Statistical Analyses

We first examined the descriptive statistics for sociodemographic characteristics of study participants. Continuous variables were summarized using means ± standard deviation (SD). Categorical variables are presented as counts and percentages (%). Next, we conducted confirmatory factor analysis (CFA) for each country and for the overall population to examine the latent structure of the PSQ and evaluate model fit. The fit of these models was assessed using the chi-square test of overall goodness of fit, the root mean square error of approximation (RMSEA), the comparative fit index, the Tucker-Lewis index (TLI), and the standardized root mean square residual.

2.4.1 Measurement Invariance

Cultural equivalence of the PSQ across the four countries was evaluated with measurement invariance, which tests if the same constructs and equivalent relationship to these constructs are present across settings, such that individuals interpret and respond to the measure equivalently. We evaluated measurement invariance as a series of multiple-group CFAs, adding increasingly strict equality constraints across groups at each step (Jöreskog, 1971). In the first model, we assessed the fit of a baseline model assuming configural invariance, which imposes the same factor structure across all countries, but factor loadings, intercepts, and other parameters vary. Next, we compared a model assuming strong invariance, in

which the factor structures, factor loadings, and intercepts are constrained to be equal across all countries. Then, we examined strict factorial invariance where residual errors are set to equivalence in addition to factor structures, factor loadings, and intercepts. Each increasingly constrained model was compared to the previous one to see if fit has degraded and was no longer supported, indicating non-invariance. Due to the large sample sizes, chi-square testing (a traditional method of testing fit) was not meaningful in determining invariance given its sensitivity to sample size (Bentler and Bonett, 1980). Examining decreases in fit indices, such as RMSEA, CFI, and TLI between models is recommended for determining non-invariance. These include decreases of less than 0.01 in CFI and less than 0.015 in RMSEA (Chen, 2007; Cheung and Rensvold, 2002).

2.4.2 Item-response Theory

The item response theory (IRT) is an important complement to classical test theory for scale development and evaluation. To examine the item properties of the PSQ, we conducted IRT analyses making two basic assumptions. Firstly, the unidimensionality of the measure is assumed meaning that only one latent construct is measured by the PSQ items. Secondly, the shape of the item characteristics curves (ICC) is assumed to reflect relationship between the latent trait and item responses. With binary scores (Yes/No) as with the PSQ, the ICC tend to be S-shaped curves and in our case, it

measured the probability of a positive answer on a test item as a function of the degree of psychosis. Also, items that are easy to positively endorse are shifted to left on the scale while difficult items are shifted to the right on the scale.

Specifically, we fit a two-parameter logistic item response model (2PLM) to the items which allowed for estimating the ability of each item to discriminate different levels of psychotic experiences (discrimination parameter, a) and estimated the probability of answering yes to the test items as a measure of the intensity of psychosis (difficulty parameter, b). All analyses were conducted in the R statistical program, version 3.6.2 and Mplus version 8 (K Muthén and O Muthén, 2017; R Core Team, 2019).

3. RESULTS

3.1 Descriptive Statistics

Our study sample comprised 9,059 participants (**Table 1**). Both sexes were evenly represented in the overall sample though there were differences in some countries, such as more males (60.2%) in Ethiopia and more females (56.3%) in Uganda. Across all countries, most participants were aged between 18–29 and 30–44 years, with more prominent differences between these age groups in Kenya (31.7% and 43.1%) and Ethiopia (25.3% and 51.9%), respectively. Most

study participants in South Africa (72.4%) had educational attainment of at least secondary education in contrast to Uganda (42.3%), Kenya (29.5%), and Ethiopia (29.4%).

3.2 Prevalence of Psychotic Symptoms

A total of 875 (9.7%) study participants reported at least one lifetime psychotic symptom (**Table 2**). The prevalence of lifetime psychotic symptoms varied between countries with Uganda (13.7%) having the highest number of participants with a positive PSQ score and Ethiopia (2.8%) having the least participants with a positive PSQ score. The most common psychotic symptom reported was strange experiences, with the exception of Ethiopia, where hallucination was the most frequently reported symptom. Hypomania was the least reported symptom in all four countries.

3.3 Factor Structure of PSQ

We conducted one-factor CFA to evaluate the fit and parameter statistics of the PSQ across the four countries (**Tables 3 and 4**). The unidimensional model provided a good fit [chi-square (df, p) = 8.371 (5, 0.137), RMSEA = 0.009, CFI = 0.997, TLI = 0.995, SRMR = 0.028), but hypomania had the weakest association with the latent factor (standardized factor

loading 0.62). CFA was repeated while excluding hypomania, but model fit did not improve [chi-square (df, p) = 5.853 (2, 0.054), RMSEA= 0.015, CFI = 0.997, TLI = 0.991, SRMR = 0.020]. Additionally, only a small number of participants reported hypomania (one in Kenya, three in Ethiopia, eight in South Africa, and 28 in Uganda). We therefore excluded hypomania from the multi-group measurement invariance analysis.

3.4 Psychometric Comparison

We conducted sequential multi-group CFAs using the remaining four PSQ items (thought interference, paranoia, strange experiences, and hallucination) across the four countries. The configural invariance model provided good fit (RMSEA 0.021 and CFI 0.997) (**Table 5**). Applying additional restrictions to the model with strong factorial invariance did not result in a worse fit (change in RMSEA <0.015 and CFI <0.01), suggesting that factor structure, factor loadings, and response thresholds were invariant across the four groups. Putting further constraints to the strong factorial invariance model by restricting residual errors did not result in model degradation (change in RMSEA <0.015 and CFI <0.01). The factor structure, factor loadings, response thresholds, and residuals were invariant across the four countries given that the strict factorial invariance model provided an acceptable fit to the data. We did not continue with measurement of partial strict factorial invariance.

3.5 Item Response Analysis

We conducted IRT analysis using a unidimensional latent structure to examine the item properties of the PSQ (**Figure 1, a-c**). The item characteristic curve (ICC) showed that strange experiences was the easiest to endorse at the same levels of the trait (psychosis) while the hypomania item was the hardest to endorse. The item information curves (IIC) showed that all items were to the right-hand side (above mean of trait) of the scale. Thus, all the items provided more information at higher levels of the trait, with hypomania giving the least information compared to the other PSQ items (**Figure 1b**). As a result, the PSQ scale gives a high level of information for discrimination among individuals with a high level of psychosis than individuals with low level psychosis (**Figure 1c**).

4. DISCUSSION

We investigated differences in the prevalence of psychotic symptoms in control participants across four sub-Saharan countries and evaluated the psychometric properties of the PSQ across these countries. Among our control sample derived from a population attending general medical facilities, we found an overall lifetime prevalence of 9.7% of psychotic symptoms. This overall estimate is comparable to that of one study that calculated overall prevalence across 52 countries

that also included low- and middle-income settings (Nuevo et al., 2012). However, there were variabilities between our country-specific estimates and other studies that have used the PSQ in general populations. For instance, whereas our study found a prevalence of 10.2% in Kenya, two other Kenyan studies found an overall prevalence of 8% and 16.8% (Jenkins et al., 2012; Ongeri et al., 2019). Additionally, studies using other psychosis screening tools have found an even higher prevalence of psychotic experiences (Mamah et al., 2021, 2013; Ndetei et al., 2012). Our multi-group CFA results showed that factor structure, factor loadings, response thresholds, and residuals were equivalent across the four countries with the strict factorial invariance model providing an acceptable fit to the data. Finally, the results of the IRT analyses indicated that the PSQ item assessing strange experiences was the easiest to endorse at the same levels of psychosis while hypomania was the hardest to endorse across all countries.

We found variability in the overall prevalence of psychotic symptoms among countries, with the highest prevalence in Uganda (13.7%) and the lowest in Ethiopia (2.8%). One possible explanation for this heterogeneity is the variability in the severity of the physical illnesses for which participants sought general health care in each country since general health status is associated with psychotic symptoms (Nuevo et al., 2012). Additionally, cultural differences in each country and sampling site may influence psychotic experiences, health-seeking behavior, and composition of our study sample (Abubakar et al., 2013; Birhanu et al., 2012). For instance, Ethiopia had predominantly male participants, whereas Uganda

had more female participants. Females may be more likely to report psychotic symptoms than males, which could increase the likelihood of positive psychotic screening scale scores in women and explain the higher prevalence in Uganda (Preti et al., 2007; Scott et al., 2008). However, the varied prevalence of psychotic symptoms between the countries in our study is not totally surprising considering that in some studies, African communities have a higher prevalence of psychotic experiences than Western societies (Fonseca-Pedrero et al., 2018; Wüsten et al., 2018). But, other studies have not found a trend of higher psychotic experiences in African countries (McGrath et al., 2015; Nuevo et al., 2012). However, significant variation in the prevalence of psychotic experiences in individuals from different parts of the world has not been shown to have affected the overall prevalence of psychotic disorders (Katz et al., 1988; Nuevo et al., 2012; Sartorius et al., 1986).

CFA and IRT analysis showed that in all countries, strange experiences measured the latent trait (psychosis) most precisely across the latent trait continuum, while hypomania was the least-precise item. Although our findings were similar to a study that examined the cross-cultural validity of the PSQ in five ethnically distinct groups in the UK (Heuvelman et al., 2018)**,** the perception of strangeness of experiences may differ between settings, especially between Western and non-Western societies. For instance, individuals from non-Western countries may be more likely to notice or easily report experiences such as feeling the presence of supernatural forces or communicating with the deceased because such

experiences may have a higher value and cultural meaning in these communities (Al-Issa, 1995; Bentall et al., 2017). Further, one study using a different psychosis screening instrument demonstrated that strange experiences and paranoia were significantly higher in Nigerian individuals compared to two Western countries (Vermeiden et al., 2019). As described by Heuvelman and colleagues in the UK study, the low predictive value of hypomania may be explained by the characteristic elevated mood in hypomania, compared to paranoia and persecution, in psychosis. Additionally, most participants fell within the 1.5–2.5 range in the latent trait continuum, congruent with the range at which all items, except hypomania, are informative suggesting that these items are useful and should be retained.

Lastly, sequential assessment of invariance indicated that thought interference, paranoia, strange experiences, and hallucinations were measured in equivalent ways across the four countries. Despite variations in underlying social, geographic, and cultural differences among populations included in this study, evidence suggests that the PSQ has cross-cultural equivalence and good construct validity.

4.1 Strengths and Limitations

Several African large scales studies to assess the prevalence of psychotic experiences have been done (Mamah et al., 2021, 2013; Ndetei et al., 2012). However, this was the first large-scale study to assess psychotic symptoms across four sub-Saharan African countries using standardized methods of data collection, cross-cultural comparisons of prevalence

estimates, and measurement of invariance. Nevertheless, some important study limitations must be considered when interpreting the results of our study. First, our study was restricted to participants attending outpatient general health care settings. Hence, the findings may not be generalized to the general population. Second, recall bias could lead to under-reporting of symptoms. Third, criterion validity utilizing diagnostic gold standard and test-retest reliability using repeated measures were not assessed.

4.2 Conclusions

Psychometric analyses suggested that the PSQ can accurately screen for psychotic symptoms in several sub-Saharan African nations. The PSQ items were measured in equivalent ways across all four countries, so the differences in overall prevalence of psychotic symptoms between countries are less likely to be a measurement artifact. PSQ items demonstrated unidimensionality represented by a single latent factor. Hypomania's weak association with the latent factor and its poor performance on IRT analysis suggests future research should evaluate the item's utility. The PSQ is more reliable at higher levels of the latent trait and might decrease the false-positive rate from mild nonspecific psychotic experiences.

Ethics Statement

Ethical approvals were obtained from the institutional review boards of each country before the commencement of data collection. Details of the Institutional Review Boards and the country-specific registration details of the study protocol can be obtained elsewhere (Stevenson et al., 2019). Research was conducted in accordance with the Declaration of Helsinki.

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Contributors

This work has not been published previously and is not under consideration for publication elsewhere. The manuscript has been reviewed and approved by all named authors.

We understand and accept that the Corresponding Author is the sole contact for the Editorial process. Therefore, she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs. Also, we verify that we have provided the current and correct email address of the Corresponding Author.

Author statement

This work has not been published previously and is not under consideration for publication elsewhere. MB, YT, HHK, AA analyzed the data. MB, YT, AA and BG drafted the manuscript. MB, YT, HHK, CAD, AA, MY, CK, LO, RES, EK, KCK, SK, ZZ, DA, CN, LA, ST, DJS, and BG interpreted the data, critically revised the draft for important intellectual content, and gave final approval of the manuscript to be published.

We understand and accept that the Corresponding Author is the sole contact for the Editorial process. Therefore, she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs. Also, we verify that we have provided the current and correct email address of the Corresponding Author.

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Declaration of Competing Interest

The authors declare no conflicts of interest.

REFERENCES

Abubakar, A., Van Baar, A., Fischer, R., Bomu, G., Gona, J.K., Newton, C.R., 2013. Socio-cultural determinants of health-seeking behaviour on the Kenyan Coast: A qualitative study. PLoS ONE 8. https://doi.org/10.1371/journal.pone.0071998

Aderibigbe, O. olanike, Perlman, C.M., 2019. Title : Review of layperson screening tools and model for a holistic mental health screener in lower and middle income countries. bioRxiv: The preprint server for biology. 38.

Ali, G.C., Ryan, G., De Silva, M.J., 2016. Validated screening tools for common mental disorders in low and middle income countries: A systematic review. PLoS ONE 11, 15. https://doi.org/10.1371/journal.pone.0156939

Al-Issa, I., 1995. The illusion of reality or the reality of illusion. Hallucinations and culture. British Journal of Psychiatry 166. https://doi.org/10.1192/bjp.166.3.368

American Psychiatric Association, 2013. Diagnositc and Statistical manual of Mental disorders, Fifth Edition. DSM-5.

Ayano, G., Assefa, D., Haile, Kibrom, Chaka, A., Solomon, H., Hagos, P., Yohannis, Z., Haile, Kelemua, Bekana, L., Agidew, M., Demise, S., Tsegaye, B., Solomon, M., 2017. Mental, neurologic, and substance use (MNS) disorders among street homeless people in Ethiopia. Annals of General Psychiatry 16. https://doi.org/10.1186/s12991-017-0163-1

Bebbington, P., Nayani, T., 1996. The psychosis screening questionnaire. International Journal of Methods in Psychiatric Research 5, 11–19.

Bentall, R., Boyle, M., Chadwick, P., Cooke, A., Garety, P., Gelsthorpe, P., 2017. Understanding Psychosis and Schizophrenia, Leicester: The British Psychological Society. Leicester.

Bentler, P.M., Bonett, D.G., 1980. Significance tests and goodness of fit in the analysis of covariance structures. Psychological Bulletin 88. https://doi.org/10.1037/0033-2909.88.3.588

Birhanu, Z., Abdissa, A., Belachew, T., Deribew, A., Segni, H., Tsu, V., Mulholland, K., Russell, F.M., 2012. Health seeking behavior for cervical cancer in Ethiopia: A qualitative study. International Journal for Equity in Health 11. https://doi.org/10.1186/1475-9276-11-83

Breuer, E., Stoloff, K., Myer, L., Seedat, S., Stein, D.J., Joska, J., 2012. Reliability of the lay adherence counsellor administered substance abuse and mental illness symptoms screener (SAMISS) and the international HIV dementia scale (IHDS) in a primary care HIV clinic in cape town, South Africa. AIDS and Behavior 16. https://doi.org/10.1007/s10461-011-0067-z

Burns, J.K., 2012. The Social Determinants of Schizophrenia: An African Journey in Social Epidemiology. Public Health Reviews 34. https://doi.org/10.1007/bf03391676

Chang, C.K., Hayes, R.D., Perera, G., Broadbent, M.T.M., Fernandes, A.C., Lee, W.E., Hotopf, M., Stewart, R., 2011. Life expectancy at birth for people with serious mental illness and other major disorders from a secondary mental health care case register in London. PLoS ONE. https://doi.org/10.1371/journal.pone.0019590

Chen, F.F., 2007. Sensitivity of goodness of fit indexes to lack of measurement invariance. Structural Equation Modeling 14. https://doi.org/10.1080/10705510701301834

Cheung, G.W., Rensvold, R.B., 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. Structural Equation Modeling 9. https://doi.org/10.1207/S15328007SEM0902_5

Chiliza, B., Asmal, L., Emsley, R., 2012. Early intervention in schizophrenia in developing countries: Focus on duration of untreated psychosis and remission as a treatment goal. International Review of Psychiatry. https://doi.org/10.3109/09540261.2012.704373

Cloutier, M., Aigbogun, M.S., Guerin, A., Nitulescu, R., Ramanakumar, A. V., Kamat, S.A., DeLucia, M., Duffy, R., Legacy, S.N., Henderson, C., Francois, C., Wu, E., 2016. The economic burden of schizophrenia in the United States in 2013. Journal of Clinical Psychiatry. https://doi.org/10.4088/JCP.15m10278

Cohen Dr., C.I., Marino Dr., L., 2013. Racial and ethnic differences in the prevalence of psychotic symptoms in the general population. Psychiatric Services 64. https://doi.org/10.1176/appi.ps.201200348

De Haan, L., Linszen, D.H., Lenior, M.E., De Win, E.D., Gorsira, R., 2003. Duration of untreated psychosis and outcome of schizophrenia: Delay in intensive psychosocial treatment versus delay in treatment with antipsychotic medication. Schizophrenia Bulletin. https://doi.org/10.1093/oxfordjournals.schbul.a007009

Farooq, S., Large, M., Nielssen, O., Waheed, W., 2009. The relationship between the duration of untreated psychosis and outcome in low-and-middle income countries: A systematic review and meta analysis. Schizophrenia Research 109. https://doi.org/10.1016/j.schres.2009.01.008

Fonseca-Pedrero, E., Chan, R.C.K., Debbané, M., Cicero, D., Zhang, L.C., Brenner, C., Barkus, E., Linscott, R.J., Kwapil, T., Barrantes-Vidal, N., Cohen, A., Raine, A., Compton, M.T., Tone, E.B., Suhr, J., Muñiz, J., de Albéniz, A.P., Fumero, A., Giakoumaki, S., Tsaousis, I., Preti, A., Chmielewski, M., Laloyaux, J., Mechri, A., Lahmar, M.A., Wuthrich, V., Larøi, F., Badcock, J.C., Jablensky, A., Ortuño-Sierra, J., 2018. Comparisons of schizotypal traits across 12 countries: Results from the International Consortium for Schizotypy Research. Schizophrenia Research 199. https://doi.org/10.1016/j.schres.2018.03.021

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. Psychological Medicine. https://doi.org/10.1017/S0033291718000399

Hjorthøj, C., Stürup, A.E., McGrath, J.J., Nordentoft, M., 2017. Years of potential life lost and life expectancy in schizophrenia: a systematic review and meta-analysis. The Lancet Psychiatry. https://doi.org/10.1016/S2215-0366(17)30078-0

Jenkins, R., Mbatia, J., Singleton, N., White, B., 2010. Prevalence of psychotic symptoms and their risk factors in Urban Tanzania. International Journal of Environmental Research and Public Health 7. https://doi.org/10.3390/ijerph7062514

Jenkins, R., Njenga, F., Okonji, M., Kigamwa, P., Baraza, M., Ayuyo, J., Singleton, N., Mcmanus, S., Kiima, D., 2012. Psychotic symptoms in Kenya - prevalence, risk factors, and relationship with common mental disorders. International Journal of Environmental Research and Public Health 9. https://doi.org/10.3390/ijerph9051748

Jöreskog, K.G., 1971. Statistical analysis of sets of congeneric tests. Psychometrika 36. https://doi.org/10.1007/BF02291393

K Muthén, L., O Muthén, B., 2017. Mplus User's Guide., Eight Ed. ed, Muthén & Muthén. Los Angeles, CA.

Katz, M.M., Marsella, A., Dube, K.C., Olatawura, M., Takahashi, R., Nakane, Y., Wynne, L.C., Gift, T., Brennan, J., Sartorius, N., Jablensky, A., 1988. On the expression of psychosis in different cultures: Schizophrenia in an indian and in a Nigerian community. Culture, Medicine and Psychiatry 12. https://doi.org/10.1007/bf00051973

Kaymaz, N., Drukker, M., Lieb, R., Wittchen, H.U., Werbeloff, N., Weiser, M., Lataster, T., Van Os, J., 2012. Do subthreshold psychotic experiences predict clinical outcomes in unselected non-help-seeking population-based samples? A systematic review and meta-analysis, enriched with new results. Psychological Medicine. https://doi.org/10.1017/S0033291711002911

Kline, E., Schiffman, J., 2014. Psychosis risk screening: A systematic review. Schizophrenia Research. https://doi.org/10.1016/j.schres.2014.06.036

Lasebikan, V.O., Ayinde, O.O., 2013. Effects of psychopathology, functioning and anti-psychotic medication adherence on caregivers' burden in schizophrenia. Indian Journal of Psychological Medicine 35. https://doi.org/10.4103/0253-7176.116237

Lasebikan, V.O., Ige, O.M., 2015. Prevalence of psychosis in tuberculosis patients and their nontuberculosis family contacts in a multidrug treatment-resistant treatment center in Nigeria. General Hospital Psychiatry 37. https://doi.org/10.1016/j.genhosppsych.2015.05.012

Lewis-Fernández, R., Horvitz-Lennon, M., Blanco, C., Guarnaccia, P.J., Cao, Z., Alegría, M., 2009. Significance of endorsement of psychotic symptoms by US latinos. Journal of Nervous and Mental Disease 197. https://doi.org/10.1097/NMD.0b013e3181a2087e

Mamah, D., Mutiso, V.N., Ndetei, D.M., 2021. Psychotic-like experiences among 9,564 Kenyan adolescents and young adults. Psychiatry Research 302. https://doi.org/10.1016/j.psychres.2021.113994

Mamah, D., Owoso, A., Mbwayo, A.W., Mutiso, V.N., Muriungi, S.K., Khasakhala, L.I., Barch, D.M., Ndetei, D.M., 2013. Classes of psychotic experiences in kenyan children and adolescents. Child Psychiatry and Human Development 44. https://doi.org/10.1007/s10578-012-0339-5

Marshall, M., Lewis, S., Lockwood, A., Drake, R., Jones, P., Croudace, T., 2005. Association between duration of untreated psychosis and outcome in cohorts of first-episode patients: A systematic review. Archives of General Psychiatry. https://doi.org/10.1001/archpsyc.62.9.975

Maslowski, J., Jansen Van Rensburg, D., Mthoko, N., 1998. A polydiagnostic approach to the differences in the symptoms of schizophrenia in different cultural and ethnic populations. Acta Psychiatrica Scandinavica. https://doi.org/10.1111/j.1600-0447.1998.tb10040.x

McBain, R., Salhi, C., Morris, J.E., Salomon, J.A., Betancourt, T.S., 2012. Disease burden and mental health system capacity: WHO Atlas study of 117 low- and middle-income countries. British Journal of Psychiatry 201. https://doi.org/10.1192/bjp.bp.112.112318

McGrath, J.J., Saha, S., Al-Hamzawi, A., Alonso, J., Bromet, E.J., Bruffaerts, R., Caldas-De-Almeida, J.M., Chiu, W.T., de Jonge, P., Fayyad, J., Florescu, S., Gureje, O., Haro, J.M., Hu, C., Kovess-Masfety, V., Lepine, J.P., Lim, C.C.W., Mora, M.E.M., Navarro-Mateu, F., Ochoa, S., Sampson, N., Scott, K., Viana, M.C., Kessler, R.C., 2015. Psychotic experiences in the general population: A cross-national analysis based on 31 261 respondents from 18 countries. JAMA Psychiatry 72. https://doi.org/10.1001/jamapsychiatry.2015.0575

Morgan, C., Lappin, J., Heslin, M., Donoghue, K., Lomas, B., Reininghaus, U., Onyejiaka, A., Croudace, T., Jones, P.B., Murray, R.M., Fearon, P., Doody, G.A., Dazzan, P., 2014. Reappraising the long-term course and outcome of psychotic disorders: The AESOP-10 study. Psychological Medicine. https://doi.org/10.1017/S0033291714000282

Ndetei, D.M., Muriungi, S.K., Owoso, A., Mutiso, V.N., Mbwayo, A.W., Khasakhala, L.I., Barch, D.M., Mamah, D., 2012. Prevalence and characteristics of psychotic-like experiences in Kenyan youth. Psychiatry Research 196. https://doi.org/10.1016/j.psychres.2011.12.053

Nuevo, R., Chatterji, S., Verdes, E., Naidoo, N., Arango, C., Ayuso-Mateos, J.L., 2012. The continuum of psychotic symptoms in the general population: A cross-national study. Schizophrenia Bulletin 38. https://doi.org/10.1093/schbul/sbq099

Ojagbemi, A., Chiliza, B., Bello, T., Asmal, L., Esan, O., Emsley, R., Gureje, O., 2018. The expression of neurological soft signs in two African populations with first-episode schizophrenia. Transcultural Psychiatry 55. https://doi.org/10.1177/1363461518786167

Ongeri, L., Kirui, F., Muniu, E., Manduku, V., Kirumbi, L., Atwoli, L., Agure, S., Wanzala, P., Kaduka, L., Karimi, M., Mutisya, R., Echoka, E., Mutai, J., Mathu, D., Mbakaya, C., 2019. Khat use and psychotic symptoms in a rural khat growing population in Kenya: A household survey. BMC Psychiatry 19. https://doi.org/10.1186/s12888-019-2118-3

Perkins, D.O., Gu, H., Boteva, K., Lieberman, J.A., 2005. Relationship between duration of untreated psychosis and outcome in first-episode schizophrenia: A critical review and meta-analysis. American Journal of Psychiatry. https://doi.org/10.1176/appi.ajp.162.10.1785

Preti, A., Bonventre, E., Ledda, V., Petretto, D.R., Masala, C., 2007. Hallucinatory experiences, delusional thought proneness, and psychological distress in a nonclinical population. Journal of Nervous and Mental Disease 195. https://doi.org/10.1097/NMD.0b013e31802f205e

R Core Team, 2019. R: A language and environment for statistical computing. R Foundation for Statistical Computing.

Rabinowitz, J., Berardo, C.G., Bugarski-Kirola, D., Marder, S., 2013. Association of prominent positive and prominent negative symptoms and functional health, well-being, healthcare-related quality of life and family burden: A CATIE analysis. Schizophrenia Research. https://doi.org/10.1016/j.schres.2013.07.014

Saha, S., Chant, D., McGrath, J., 2007. A systematic review of mortality in schizophrenia: Is the differential mortality gap worsening over time? Archives of General Psychiatry. https://doi.org/10.1001/archpsyc.64.10.1123

Sartorius, N., Jablensky, A., Korten, A., Ernberg, G., Anker, M., Cooper, J.E., Day, R., 1986. Early manifestations and first-contact incidence of schizophrenia in different cultures: A preliminary report on the initial evaluation phase of the WHO Collaborative Study on Determinants of Outcome of Severe Mental Disorders. Psychological Medicine 16. https://doi.org/10.1017/S0033291700011910

Scott, J., Welham, J., Martin, G., Bor, W., Najman, J., O'Callaghan, M., Williams, G., Aird, R., McGrath, J., 2008. Demographic correlates of psychotic-like experiences in young Australian adults. Acta Psychiatrica Scandinavica 118. https://doi.org/10.1111/j.1600-0447.2008.01214.x

Stevenson, A., Akena, D., Stroud, R.E., Atwoli, L., Campbell, M.M., Chibnik, L.B., Kwobah, E., Kariuki, S.M., Martin, A.R., De Menil, V., Newton, C.R.J.C., Sibeko, G., Stein, D.J., Teferra, S., Zingela, Z., 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. https://doi.org/10.1136/bmjopen-2018-025469

Tang, J.Y.M., Chang, W.C., Hui, C.L.M., Wong, G.H.Y., Chan, S.K.W., Lee, E.H.M., Yeung, W.S., Wong, C.K., Tang, W.N., Chan, W.F., Pang, E.P.F., Tso, S., Ng, R.M.K., Hung, S.F., Dunn, E.L.W., Sham, P.C., Chen, E.Y.H., 2014. Prospective relationship between duration of untreated psychosis and 13-year clinical outcome: A first-episode psychosis study. Schizophrenia Research 153, 1–8. https://doi.org/10.1016/j.schres.2014.01.022

Van Os, J., Linscott, R.J., Myin-Germeys, I., Delespaul, P., Krabbendam, L., 2009. A systematic review and meta-analysis of the psychosis continuum: Evidence for a psychosis proneness-persistence-impairment model of psychotic disorder. Psychological Medicine 39. https://doi.org/10.1017/S0033291708003814

Vermeiden, M., Janssens, M., Thewissen, V., Akinsola, E., Peeters, S., Reijnders, J., Jacobs, N., Van Os, 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. https://doi.org/10.1186/s12888-019-2210-8

Vos, T., Barber, R.M., Bell, B., Bertozzi-Villa, A., Biryukov, S., Bolliger, I., Charlson, F., Davis, A., Degenhardt, L., Dicker, D., Duan, L., Erskine, H., Feigin, V.L., Ferrari, A.J., Fitzmaurice, C., Fleming, T., Graetz, N., Guinovart, C., Haagsma, J., Hansen, G.M., Hanson, S.W., Heuton, K.R., Higashi, H., Kassebaum, N., Kyu, H., Laurie, E., Liang, X., Lofgren, K., Lozano, R., MacIntyre, M.F., Moradi-Lakeh, M., Naghavi, M., Nguyen, G., Odell, S., Ortblad, K., Roberts, D.A., Roth, G.A., Sandar, L., Serina, P.T., Stanaway, J.D., Steiner, C., Thomas, B., Vollset, S.E., Whiteford, H., Wolock, T.M., Ye, P., Zhou, M., Ãvila, M.A., Aasvang, G.M., Abbafati, C., Ozgoren, A.A., Abd-Allah, F., Aziz, M.I.A., Abera, S.F., Aboyans, V., Abraham, J.P., Abraham, B., Abubakar, I., Abu-Raddad, L.J., Abu-Rmeileh, N.M.E., Aburto, T.C., Achoki, T., Ackerman, I.N., Adelekan, A., Ademi, Z., Adou, A.K., Adsuar, J.C., Arnlov, J., Agardh, E.E., Al Khabouri, M.J., Alam, S.S., Alasfoor, D., Albittar, M.I., Alegretti, M.A., Aleman, A. V., Alemu, Z.A., Alfonso-Cristancho, R., Alhabib, S., Ali, R., Alla, F., Allebeck, P., Allen, P.J., AlMazroa, M.A., Alsharif, U., Alvarez, E., Alvis-Guzman, N., Ameli, O., Amini, H., Ammar, W., Anderson, B.O., Anderson, H.R., Antonio, C.A.T., Anwari, P., Apfel, H., Arsenijevic, V.S.A., Artaman, A., Asghar, R.J., Assadi, R., Atkins, L.S., Atkinson, C., Badawi, A., Bahit, M.C., Bakfalouni, T., Balakrishnan, K., Balalla, S., Banerjee, A., Barker-Collo, S.L., Barquera, S., Barregard, L., Barrero, L.H., Basu, S., Basu, A., Baxter, A., Beardsley, J., Bedi, N., Beghi, E., Bekele, T., Bell, M.L., Benjet, C., Bennett, D.A., Bensenor, I.M., Benzian, H., Bernabe, E., Beyene, T.J., Bhala, N., Bhalla, A., Bhutta, Z., Bienhoff, K., Bikbov, B., Abdulhak, A. Bin, Blore, J.D., Blyth, F.M., Bohensky, M.A., Basara, B.B., Borges, G., Bornstein, N.M., Bose, D., Boufous, S., Bourne, R.R., Boyers, L.N., Brainin, M., Brauer, M., Brayne, C.E.G., Brazinova, A., Breitborde, N.J.K., Brenner, H., Briggs, A.D.M., Brooks, P.M., Brown, J., Brugha, T.S., Buchbinder, R., Buckle, G.C., Bukhman, G., Bulloch, A.G., Burch, M., Burnett, R., Cardenas, R., Cabral, N.L., Campos-Nonato, I.R., Campuzano, J.C., Carapetis, J.R., Carpenter, D.O., Caso, V., Castaneda-Orjuela, C.A., Catala-Lopez, F., Chadha, V.K., Chang, J.C., Chen, H., Chen, W., Chiang, P.P., Chimed-Ochir, O., Chowdhury, R., Christensen, H., Christophi, C.A., Chugh, S.S., Cirillo, M., Coggeshall, M., Cohen, A., Colistro, V., Colquhoun, S.M., Contreras, A.G., Cooper, L.T., Cooper, C., Cooperrider, K., Coresh, J., Cortinovis, M., Criqui, M.H., Crump,

J.A., Cuevas-Nasu, L., Dandona, R., Dandona, L., Dansereau, E., Dantes, H.G., Dargan, P.I., Davey, G., Davitoiu, D. V., Dayama, A., De La Cruz-Gongora, V., De La Vega, S.F., De Leo, D., Del Pozo-Cruz, B., Dellavalle, R.P., Deribe, K., Derrett, S., Des Jarlais, D.C., Dessalegn, M., DeVeber, G.A., Dharmaratne, S.D., Diaz-Torne, C., Ding, E.L., Dokova, K., Dorsey, E.R., Driscoll, T.R., Duber, H., Durrani, A.M., Edmond, K.M., Ellenbogen, R.G., Endres, M., Ermakov, S.P., Eshrati, B., Esteghamati, A., Estep, K., Fahimi, S., Farzadfar, F., Fay, D.F.J., Felson, D.T., Fereshtehnejad, S.M., Fernandes, J.G., Ferri, C.P., Flaxman, A., Foigt, N., Foreman, K.J., Fowkes, F.G.R., Franklin, R.C., Furst, T., Futran, N.D., Gabbe, B.J., Gankpe, F.G., Garcia-Guerra, F.A., Geleijnse, J.M., Gessner, B.D., Gibney, K.B., Gillum, R.F., Ginawi, I.A., Giroud, M., Giussani, G., Goenka, S., Goginashvili, K., Gona, P., De Cosio, T.G., Gosselin, R.A., Gotay, C.C., Goto, A., Gouda, H.N., Guerrant, R.L., Gugnani, H.C., Gunnell, D., Gupta, Rajeev, Gupta, Rahul, Gutierrez, R.A., Hafezi-Nejad, N., Hagan, H., Halasa, Y., Hamadeh, R.R., Hamavid, H., Hammami, M., Hankey, G.J., Hao, Y., Harb, H.L., Haro, J.M., Havmoeller, R., Hay, R.J., Hay, S., Hedayati, M.T., Pi, I.B.H., Heydarpour, P., Hijar, M., Hoek, H.W., Hoffman, H.J., Hornberger, J.C., Hosgood, H.D., Hossain, M., Hotez, P.J., Hoy, D.G., Hsairi, M., Hu, H., Hu, G., Huang, J.J., Huang, C., Huiart, L., Husseini, A., Iannarone, M., Iburg, K.M., Innos, K., Inoue, M., Jacobsen, K.H., Jassal, S.K., Jeemon, P., Jensen, P.N., Jha, V., Jiang, G., Jiang, Y., Jonas, J.B., Joseph, J., Juel, K., Kan, H., Karch, A., Karimkhani, C., Karthikeyan, G., Katz, R., Kaul, A., Kawakami, N., Kazi, D.S., Kemp, A.H., Kengne, A.P., Khader, Y.S., Khalifa, S.E.A.H., Khan, E.A., Khan, G., Khang, Y.H., Khonelidze, I., Kieling, C., Kim, D., Kim, S., Kimokoti, R.W., Kinfu, Y., Kinge, J.M., Kissela, B.M., Kivipelto, M., Knibbs, L., Knudsen, A.K., Kokubo, Y., Kosen, S., Kramer, A., Kravchenko, M., Krishnamurthi, R. V., Krishnaswami, S., Defo, B.K., Bicer, B.K., Kuipers, E.J., Kulkarni, V.S., Kumar, K., Kumar, G.A., Kwan, G.F., Lai, T., Lalloo, R., Lam, H., Lan, Q., Lansingh, V.C., Larson, H., Larsson, A., Lawrynowicz, A.E.B., Leasher, J.L., Lee, J.T., Leigh, J., Leung, R., Levi, M., Li, B., Li, Yichong, Li, Yongmei, Liang, J., Lim, S., Lin, H.H., Lind, M., Lindsay, M.P., Lipshultz, S.E., Liu, S., Lloyd, B.K., Ohno, S.L., Logroscino, G., Looker, K.J., Lopez, A.D., Lopez-Olmedo, N., Lortet-Tieulent, J., Lotufo, P.A., Low, N., Lucas, R.M., Lunevicius, R., Lyons, R.A., Ma, J., Ma, S., MacKay, M.T., Majdan, M., Malekzadeh, R., Mapoma, C.C., Marcenes, W., March, L.M., Margono, C., Marks, G.B., Marzan, M.B., Masci, J.R., Mason-Jones, A.J., Matzopoulos, R.G., Mayosi, B.M., Mazorodze, T.T., McGill, N.W., McGrath, J.J., McKee, M., McLain, A., McMahon, B.J., Meaney, P.A., Mehndiratta, M.M., Mejia-Rodriguez, F., Mekonnen, W., Melaku, Y.A., Meltzer, M., Memish, Z.A., Mensah, G., Meretoja, A., Mhimbira, F.A., Micha, R., Miller, T.R., Mills, E.J., Mitchell, P.B., Mock, C.N., Moffitt, T.E., Ibrahim, N.M., Mohammad, K.A., Mokdad, A.H., Mola, G.L., Monasta, L., Montico, M., Montine, T.J., Moore, A.R., Moran, A.E., Morawska, L., Mori, R., Moschandreas, J., Moturi, W.N., Moyer, M., Mozaffarian, D., Mueller, U.O., Mukaigawara, M., Murdoch, M.E., Murray, J., Murthy, K.S., Naghavi, P., Nahas, Z., Naheed, A., Naidoo, K.S., Naldi, L., Nand, D., Nangia, V., Narayan, K.M.V., Nash, D., Nejjari, C., Neupane, S.P., Newman, L.M., Newton, C.R., Ng, M., Ngalesoni, F.N., Nhung, N.T., Nisar, M.I., Nolte, S., Norheim, O.F., Norman, R.E., Norrving, B., Nyakarahuka, L., Oh, I.H., Ohkubo, T., Omer, S.B., Opio, J.N., Ortiz, A., Pandian, J.D., Panelo, C.I.A., Papachristou, C., Park, E.K., Parry, C.D., Caicedo, A.J.P., Patten, S.B., Paul, V.K., Pavlin, B.I., Pearce, N., Pedraza, L.S., Pellegrini, C.A., Pereira, D.M., Perez-Ruiz, F.P., Perico, N., Pervaiz, A., Pesudovs, K., Peterson, C.B., Petzold, M., Phillips, M.R., Phillips, D.,

Phillips, B., Piel, F.B., Plass, D., Poenaru, D., Polanczyk, G. V., Polinder, S., Pope, C.A., Popova, S., Poulton, R.G., Pourmalek, F., Prabhakaran, D., Prasad, N.M., Qato, D., Quistberg, D.A., Rafay, A., Rahimi, K., Rahimi-Movaghar, V., Rahman, S.U., Raju, M., Rakovac, I., Rana, S.M., Razavi, H., Refaat, A., Rehm, J., Remuzzi, G., Resnikoff, S., Ribeiro, A.L., Riccio, P.M., Richardson, L., Richardus, J.H., Riederer, A.M., Robinson, M., Roca, A., Rodriguez, A., Rojas-Rueda, D., Ronfani, L., Rothenbacher, D., Roy, N., Ruhago, G.M., Sabin, N., Sacco, R.L., Ksoreide, K., Saha, S., Sahathevan, R., Sahraian, M.A., Sampson, U., Sanabria, J.R., Sanchez-Riera, L., Santos, I.S., Satpathy, M., Saunders, J.E., Sawhney, M., Saylan, M.I., Scarborough, P., Schoettker, B., Schneider, I.J.C., Schwebel, D.C., Scott, J.G., Seedat, S., Sepanlou, S.G., Serdar, B., Servan-Mori, E.E., Shackelford, K., Shaheen, A., Shahraz, S., Levy, T.S., Shangguan, S., She, J., Sheikhbahaei, S., Shepard, D.S., Shi, P., Shibuya, K., Shinohara, Y., Shiri, R., Shishani, K., Shiue, I., Shrime, M.G., Sigfusdottir, I.D., Silberberg, D.H., Simard, E.P., Sindi, S., Singh, J.A., Singh, L., Skirbekk, V., Sliwa, K., Soljak, M., Soneji, S., Soshnikov, S.S., Speyer, P., Sposato, L.A., Sreeramareddy, C.T., Stoecki, H., Stathopoulou, V.K., Steckling, N., Stein, M.B., Stein, D.J., Steiner, T.J., Stewart, A., Stork, E., Stovner, L.J., Stroumpoulis, K., Sturua, L., Sunguya, B.F., Swaroop, M., Sykes, B.L., Tabb, K.M., Takahashi, K., Tan, F., Tandon, N., Tanne, D., Tanner, M., Tavakkoli, M., Taylor, H.R., Te Ao, B.J., Temesgen, A.M., Have, M. Ten, Tenkorang, E.Y., Terkawi, A.S., Theadom, A.M., Thomas, E., Thorne-Lyman, A.L., Thrift, A.G., Tleyjeh, I.M., Tonelli, M., Topouzis, F., Towbin, J.A., Toyoshima, H., Traebert, J., Tran, B.X., Trasande, L., Trillini, M., Truelsen, T., Trujillo, U., Tsilimbaris, M., Tuzcu, E.M., Ukwaja, K.N., Undurraga, E.A., Uzun, S.B., Van Brakel, W.H., Van De Vijver, S., Dingenen, R. Van, Van Gool, C.H., Varakin, Y.Y., Vasankari, T.J., Vavilala, M.S., Veerman, L.J., Velasquez-Melendez, G., Venketasubramanian, N., Vijayakumar, L., Villalpando, S., Violante, F.S., Vlassov, V. V., Waller, S., Wallin, M.T., Wan, X., Wang, L., Wang, J., Wang, Y., Warouw, T.S., Weichenthal, S., Weiderpass, E., Weintraub, R.G., Werdecker, A., Wessells, K.R., Westerman, R., Wilkinson, J.D., Williams, H.C., Williams, T.N., Woldeyohannes, S.M., Wolfe, C.D.A., Wong, J.Q., Wong, H., Woolf, A.D., Wright, J.L., Wurtz, B., Xu, G., Yang, G., Yano, Y., Yenesew, M.A., Yentur, G.K., Yip, P., Yonemoto, N., Yoon, S.J., Younis, M., Yu, C., Kim, K.Y., Zaki, M.E.S., Zhang, Y., Zhao, Z., Zhao, Y., Zhu, J., Zonies, D., Zunt, J.R., Salomon, J.A., Murray, C.J.L., 2015. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: A systematic analysis for the Global Burden of Disease Study 2013. The Lancet. https://doi.org/10.1016/S0140-6736(15)60692-4

Vythilingum, B., Field, S., Kafaar, Z., Baron, E., Stein, D.J., Sanders, L., Honikman, S., 2013. Screening and pathways to maternal mental health care in a South African antenatal setting. Archives of Women's Mental Health 16. https://doi.org/10.1007/s00737-013-0343-1

Weisman, A.G., López, S.R., Ventura, J., Nuechterlein, K.H., Goldstein, M.J., Hwang, S., 2000. A comparison of psychiatric symptoms between Anglo-Americans and Mexican-Americans with Schizophrenia. Schizophrenia Bulletin. https://doi.org/10.1093/oxfordjournals.schbul.a033496

Wüsten, C., Schlier, B., Jaya, E.S., Fonseca-Pedrero, E., Peters, E., Verdoux, H., Woodward, T.S., Ziermans, T.B., Lincoln, T.M., 2018. Psychotic experiences and related distress: A cross-national comparison and network analysis based on 7141 participants from 13 countries. Schizophrenia Bulletin 44. https://doi.org/10.1093/schbul/sby087

Table 1. Characteristics of study participants (N=9,059)

	South Africa (n=2557)	Kenya (n=2489)	Uganda (n=2087)	Ethiopia (n=1926)	Overall (n=9059)
Sex					
Female	1317 (51.5%)	1216 (48.9%)	1175 (56.3%)	766 (39.8%)	4474 (49.4%)
Male	1240 (48.5%)	1273 (51.1%)	912 (43.7%)	1160 (60.2%)	4585 (50.6%)
Age					
Mean (SD)	35.4 (11.7)	36.8 (12.2)	36.0 (12.8)	36.2 (10.9)	36.1 (12.0)
18–29	951 (37.2%)	785 (31.5%)	739 (35.4%)	487 (25.3%)	2962 (32.7%)
30–44	1033 (40.4%)	1069 (42.9%)	834 (40.0%)	1000 (51.9%)	3936 (43.4%)
45–59	486 (19.0%)	508 (20.4%)	387 (18.5%)	387 (20.1%)	1768 (19.5%)
60+	87 (3.4%)	127 (5.1%)	127 (6.1%)	52 (2.7%)	393 (4.3%)
Marital status					
Single	1418 (55.5%)	821 (33.0%)	592 (28.4%)	750 (38.9%)	3581 (39.5%)
Married or cohabitating	868 (33.9%)	1330 (53.4%)	1102 (52.8%)	900 (46.7%)	4200 (46.4%)
Widowed	64 (2.5%)	110 (4.4%)	135 (6.5%)	79 (4.1%)	388 (4.3%)
Divorced or separated	200 (7.8%)	227 (9.1%)	257 (12.3%)	197 (10.2%)	881 (9.7%)
Other	6 (0.2%)	1 (0.0%)	1 (0.0%)	0 (0%)	8 (0.1%)
Level of education					
No formal	8 (0.3%)	44 (1.8%)	114 (5.5%)	52 (2.7%)	218 (2.4%)
Primary	218 (8.5%)	577 (23.2%)	654 (31.3%)	449 (23.3%)	1898 (21.0%)
Secondary	1853 (72.5%)	738 (29.7%)	887 (42.5%)	565 (29.3%)	4043 (44.6%)
University	476 (18.6%)	1129 (45.4%)	430 (20.6%)	860 (44.7%)	2895 (32.0%)
Living arrangements					

	South Africa (n=2557)	Kenya (n=2489)	Uganda (n=2087)	Ethiopia (n=1926)	Overall (n=9059)
Alone	600 (23.5%)	517 (20.8%)	319 (15.3%)	278 (14.4%)	1714 (18.9%)
Parental family	622 (24.3%)	425 (17.1%)	354 (17.0%)	655 (34.0%)	2056 (22.7%)
Spouse or partner	863 (33.8%)	1174 (47.2%)	987 (47.3%)	872 (45.3%)	3896 (43.0%)
Friends or other relatives	449 (17.6%)	371 (14.9%)	421 (20.2%)	113 (5.9%)	1354 (14.9%)
Other	22 (0.9%)	1 (0.0%)	5 (0.2%)	8 (0.4%)	36 (0.4%)

Numbers may not sum due to missing data.

Table 2. Differences in prevalence of psychotic symptoms by country

	South Africa	Kenya	Uganda	Ethiopia
N	**2,557**	**2,489**	**2,087**	**1,926**
Item	n (%)	n (%)	n (%)	n (%)
Hallucination	103 (4.0)	74 (3.0)	102 (4.9)	27 (1.4)
Thought interference	55 (2.2)	106 (4.3)	85 (4.1)	7 (0.4)
Paranoia	87 (3.4)	89 (3.6)	105 (5.0)	18 (0.9)
Strange experiences	125 (4.9)	118 (4.7)	137 (6.6)	23 (1.2)
Mania	8 (0.3)	1 (0.0)	28 (1.3)	3 (0.2)
Composite screening measure[a]	**282 (11.0)**	**255 (10.2)**	**285 (13.7)**	**53 (2.8)**

[a]Positive screen on any PSQ symptom.

Table 2. Results from confirmatory factor analyses for overall study population and by country[b]

	χ^2	df	p-value	RMSEA	CFI	TLI	SRMR
Overall	5.853	2	0.054	0.015	0.997	0.991	0.020
South Africa	4.770	2	0.092	0.023	0.988	0.963	0.053
Kenya	3.693	2	0.158	0.018	0.997	0.991	0.029
Uganda	0.207	2	0.901	0.000	1.000	1.014	0.006
Ethiopia	7.580	2	0.023	0.038	0.992	0.977	0.114

Abbreviations: df, degrees of freedom; RMSEA, Root Mean Square Error of Approximation; CFI, Comparative Fit Index; TLI, Tucker-Lewis Index; SRMR, Standardized Root Mean Square Residual

[b]*Without hypomania item.*

Table 3. Standardized factor loadings with and without hypomania

Standardized factor loadings with hypomania		Standardized factor loadings without hypomania
Item		
Hallucination	0.77	0.67
Thought interference	0.81	0.81
Paranoia	0.76	0.76
Strange experiences	0.83	0.82
Hypomania	0.62	-

Weighted least squares estimator, theta parameterization

Table 4. Fit statistics and model results from multiple-group confirmatory analyses[c]

		Overall fit					Difference test	Fit statistic		
Model	**Invariance Assumption**	χ^2	**df**	**p-value**	**RMSEA**	**CFI**	**Comparison**	χ^2	**df**	**p-value**
1.1	Configural invariance	15.688	8	0.047	0.021	0.997				
1.2	Strong factorial invariance	35.474	14	0.001	0.026	0.991	1.2 with 1.1	18.854	6	0.004
1.3	Strict factorial invariance	61.302	26	0.000	0.024	0.985	1.3 with 1.2	26.395	12	0.009

Abbreviations: df, degrees of freedom; RMSEA, Root Mean Square Error of Approximation; CFI, Comparative Fit Index
[c]The hypomania item was not included in the analysis.

Figure 1. (a) Item characteristics curves (ICC), (b) item information curves (IIC), and (c) test information function (TIF) for the PSQ