Depression and Anxiety Symptoms Amongst Kenyan Adolescents: Psychometric Properties, Prevalence, Sociodemographic Factors, and Psychological Wellbeing

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Abstract

We assessed the psychometric properties of standard Western-derived instruments, the prevalence of depression and anxiety symptoms, and their associations with sociodemographic and wellbeing variables in a large sample of Kenyan adolescents. We administered self-report measures of depression (PHQ-8) and anxiety (GAD-7) symptoms, social support, gratitude, happiness, optimism, and perceived control to 2,192 Kenyan youths (57.57% female) aged 12-19. Both the PHQ-8 ($\alpha = 0.78$) and GAD-7 ($\alpha = 0.82$) showed adequate internal consistency. EFA with a sub-sample ($N = 1096$) yielded a 1-factor structure for both the PHQ-8 and GAD-7, a subsequent CFA conducted on the basis of the 1-factor model on another sub-sample ($N = 1096$) yielded good and moderate goodness of fit, respectively, for the PHQ-8 ($\chi^2=76.73$; $p<0.001$; RMSEA=0.05; CFI=0.96; TLI=0.95) and the GAD-7 ($\chi^2=88.19$; $p<0.001$; RMSEA=0.07; CFI=0.97; TLI=0.95). Some 28.06% and 30.38% of participants met the clinical cut-off for depressive and anxiety symptoms, respectively. Social support, gratitude, happiness, optimism, and perceived control were negatively associated with both depression and anxiety symptoms. Older adolescents reported higher symptoms while adolescents with more siblings reported lower symptoms. The western-derived PHQ and GAD met conventional psychometric standards with adolescents in Kenya; depression and anxiety symptoms showed relatively high prevalence and significant associations with important psychosocial and sociodemographic factors.

Keywords: Adolescents, depression, anxiety, Sub Saharan Africa, psychosocial correlates, sociodemographic factors, Kenya

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Adolescents in low-resource regions, like Sub-Saharan Africa (SSA), are at a greater risk of depression and anxiety due to risk factors such as poverty, socio-economic stress, and exposure to violence (Kilburn et al., 2016; Patel et al., 2007; Vigo et al., 2016). For already vulnerable SSA adolescents, help is often not available because of a paucity of mental health providers (World Health Organization, 2019), government under-investment in mental healthcare (Caddick et al., 2016; Patel et al., 2007), and a societal stigma around mental health issues that limit access to treatment (Ndetei et al., 2016).

The status quo is unfortunate because youth depressive and anxiety symptoms—even when subclinical—are associated with many negative life outcomes including impaired social and academic functioning (King & Bernstein, 2001), inferior quality of life, poor financial prospects, and an increased risk of suicide (Balázs et al., 2013; Bertha & Balázs, 2013). As. SSA countries have especially youthful populations—the median age, for example, is 19 (Awiti & Scott, 2016; United Nations Children's Fund, 2016)—the clear and urgent need for research dedicated to understanding adolescent mental health problems in SSA has become an urgent global public health priority (Collins et al., 2011).

One area that may benefit from such a dedicated focus is research on the psychometric properties of the standard instruments used to assess depression and anxiety symptoms. Due to the limited mental health experts in SSA, such standard instruments – especially brief and freely available ones – are particularly important for screening and clinical monitoring of youths with mental health problems. Epidemiological studies and clinical trials with SSA youths have used standard measures to screen for and clinically monitor adolescent depression and anxiety symptoms instead of structured interviews that

require experts (e.g., (Abbo et al., 2013; Magai et al., 2018; Osborn, Venturo-Conerly, et al., 2021).

As most of these now standard instruments were developed and validated for use with Western adolescents (Haroz et al., 2017), they fail to capture the salient features of mental health problems across cultures (Bass et al., 2007; Kleinman, 2004; Lewis-Fernández & Krishan Aggarwal, 2013). As such, research dependent on these tools may miss culture-specific features of distress or emphasize (or underestimate) some features over others. It has been suggested that the significant variance in the rates of depression and anxiety problems in SSA samples may be a function of the variability of these instruments and the general lack of research on their psychometric validity within these populations (Khasakhala et al., 2012; Magai et al., 2018; Osborn, Venturo-Conerly, et al., 2020).

Rather than abandon these instruments, they should be subjected to a rigorous psychometric evaluation (Lewis-Fernández et al., 2014; Lewis-Fernández & Díaz, 2002; Lewis-Fernández & Krishan Aggarwal, 2013) or complemented by locally co-developed instruments ((Manson et al., 1985; Osborn, Kleinman, et al., 2021)). These approaches facilitate cross-cultural comparisons in clinical research and practice while honoring the socio-cultural nuance of mental health problems (Kleinman & Good, 1985; Osborn, Kleinman, et al., 2021).

Investigating the psychometric properties of standard Western-developed instruments is an important step in facilitating research on adolescent mental health problems in SSA. Such research, for example, makes it possible to investigate the prevalence rates of mental health problems in this population and the association between these problems and important socio-demographic and psychosocial wellbeing variables in SSA. Such research has important clinical and public policy utility. For example, government allocation of resources towards mental health may be informed by an understanding of the prevalence rates of these

problems. Similarly, understanding the associations between mental health problems and sociodemographic and psychological wellbeing variables can help identify important risk and/or protective factors and influence clinical and public policy efforts on the prevention and treatment of youth depression and anxiety in SSA countries (Campbell & Osborn, 2021).

Here, we respond to the need for dedicated research on adolescent mental health problems in SSA. First, we investigate the psychometric properties of two Western-developed instruments for assessing depression and anxiety. Second, we use these instruments to explore the relationship between depression and anxiety symptoms as well as their prevalence rates in a large community sample of adolescents in Kenya, an SSA country. Finally, we investigate the associations between depression and anxiety symptoms and sociodemographic factors, like age and sex, and psychological wellbeing factors, like happiness and gratitude.

We decided to evaluate the psychometric properties of two brief and public domain instruments—the Patient Health Questionnaire (PHQ-9, used to assess for depressive symptoms, Kroenke & Spitzer, 2002) and the Generalized Anxiety Disorder Screener (GAD-7; used to assess for anxiety symptoms, Spitzer et al., 2006)—precisely because as they are short and freely available instruments, they can be used widely across SSA. We predicted that both the PHQ-9 and the GAD-7 would demonstrate adequate psychometric properties because one recent study (N=658) with these instruments showed that they demonstrated adequate internal consistency with Kenyan youths as evidenced by a Cronbach's alpha score of >.70 (Osborn, Venturo-Conerly, et al., 2020). In addition, a recent study – albeit with Kenyan adults – which investigated the degree of overlap between depression as measured by the Western PHQ-9 and a locally developed instrument found significant overlap between both measures even though the PHQ-9 missed salient features of depressive distress that the local tool identified (Osborn, Kleinman, et al., 2021). The study, taken together with other

cross-cultural studies (Haroz et al., 2017; Kleinman, 2004), suggests that there may be a significant portion of mental health distress that is universal and some portions that are culture-specific.

We also used these two brief instruments to assess the association between depression and anxiety symptoms in a large community sample of SSA youths. Around the world, studies have shown that depression and anxiety are strongly and positively correlated with each other and especially comorbid (Cummings et al., 2014; Essau, 2003). For youths with depression, anxiety comorbidity estimates range from 15% to 75% while for youths with anxiety, depression comorbidity range from 10% to 15% (Angold et al., 1999; Avenevoli et al., 2001; Axelson & Birmaher, 2001; Cummings et al., 2014; Yorbik et al., 2004). This has led to very interesting discussions in clinical research and practice on what this correlation and comorbidity means. Some observers have suggested that although youth anxiety and depression are meaningfully linked, there are important distinctions between the two (Brady & Kendall, 1992; Cummings et al., 2014). Other observers have suggested that this distinction is minimal and these syndromes may be manifestations of a similar underlying syndrome or collection of symptoms that reinforce each other (McElroy et al., 2018). Unfortunately, this very important discussion has not been influenced by research with SSA samples leading to a dialogue that heavily relies on the assumption of the generalizability of Western-derived research across the otherwise diverse populations (Haroz et al., 2017; Kirmayer et al., 2017). Here, in including SSA samples in the dialogue, we predicted that we would find similar associations between depression and anxiety symptoms.

With regards to the prevalence rates of depression and anxiety symptoms, we predicted that we would find a rather high prevalence rate of these symptoms amongst Kenyan youths. This is because Kenya is a low-income country with many youths living in poverty: poverty contributes to the development and maintenance of these symptoms

(Kilburn et al., 2016). In addition, the limited studies with Kenyan youths have painted a picture of rather higher endorsements of depression and anxiety symptoms that range from 25.70% to as high as 49.30% (Khasakhala et al., 2012; Magai et al., 2018; Ndetei et al., 2008; Osborn, Venturo-Conerly, et al., 2020).

When considering the association between depression and anxiety symptoms and sociodemographic factors, we hypothesized that these symptoms would be significantly associated with age and sex. Because of the nature of the Kenyan education system— where students take an important end-of-secondary school examination that determines future life prospects (Ndetei et al., 2008)—older adolescents face increased psychosocial stress and pressure from their families to succeed in these examinations. This psychosocial stress leads older adolescents to endorse higher depression and anxiety symptoms than their younger counterparts (Osborn, Venturo-Conerly, et al., 2020; Yara & Wanjohi, 2011). With regards to sex, studies around the world have shown that depression and anxiety symptoms are strongly linked with sex: female adolescents report higher symptoms than their male counterparts (Adewuya et al., 2018; Grant et al., 2004; McGuinness Teena M. et al., 2012; Mitchell & Abbott, 1987; Osborn, Venturo-Conerly, et al., 2020).

Finally, we investigated the association between depression and anxiety symptoms and psychological wellbeing indices because psychological wellbeing may play a preventive – and sometimes even therapeutic – role in the development and maintenance of depression and anxiety (Bartels et al., 2013; Greenspoon & Saklofske, 2001). Psychological wellbeing, which when broadly defined refers to a person's ability to experience their lives positively, can include positive feelings of accomplishment and satisfaction as well as the lack of negative aspects like loneliness and mental health problems (Antaramian et al., 2010; Zeng et al., 2019). Around the world, many models and indices are used to measure psychological wellbeing (see Diener, 1984 and Seligman, 2018 for examples). Here, we assessed

psychological being through self-report happiness, optimism, gratitude, perceived social support, and perceived academic control. As studies with Western samples have shown that these psychological wellbeing indices and mental health problems are strongly and negatively associated (Bartels et al., 2013; Joseph & Wood, 2010; Winefield et al., 2012), we predicted that we would find similar negative associations with Kenyan youths.

Methods

Study Setting

Our study took place in four secondary schools in Nairobi and Kiambu counties, Kenya. In Kenya, all students take a national-administered secondary school entrance examination at the end of eighth grade (Class 8). The best-performing students are admitted to top-ranked secondary schools known as *national schools.* Through a government-enforced quota system, national schools admit students from all geographical regions in Kenya. The next-tier of best-performers are admitted to *extra-county* schools which admit students from four –to five proximate students. The rest of the students are admitted to *county* schools and then *sub-county* schools based on their performance (Ndetei et al., 2008). It is important to note that most secondary schools are public single-sex boarding schools (~70%) and that the few day-attendance schools are majority mixed-gender (Ministry of Education & Technology, 2014). Because the Kenyan government recently implemented a 100% transition policy—in which all students who complete the national examination are admitted to secondary school—it is estimated that almost 80% of Kenyan youths attend secondary schools (Ministry of Education, Science, and Technology, 2015). Because there are more than 42 tribes in Kenya, we used a minority/majority tribe classification from a recent study with Kenyan youths (Osborn, Venturo-Conerly, et al., 2020) where tribes aligned to the ruling Jubilee Alliance—mainly the Kikuyu tribe and affiliated Bantu-speaking tribes the Kalenjin tribes—were classified as “majority” while tribes associated with the National Super Alliance

coalition— the Luo and Luhya and Akamba and Swahili-speaking tribes along the Kenyan coast—were classified as "minority" tribes.

We selected the four participating secondary schools to reflect the academic and resource diversity in Kenyan secondary schools as classified by the Ministry of Education (Ministry of Education & Technology, 2014). As such, our sample included two secondary schools – School A (all-boys) and School B (all-girls) – ranked as *national* schools (allowing us to sample students from all geographical regions in Kenya). School C (all-girls) and School D (mixed gender) were low-income *county* and *sub-county* schools respectively. Our sample, though convenient, was larger, and to the best of our knowledge, more diverse than samples from previous studies in Kenya (e.g., Khasakhala et al., 2012; Magai et al., 2018; Osborn et al., 2020). This strengthens our ability to address study hypotheses and consider results that are at least more generalizable than previous attempts. See Appendix A (Supplementary Materials) for more information on the characteristics and socio-demographics of participating schools.

Participants

Eligible participants were adolescents (ages 12–19) attending the four participating secondary schools. We recruited 2,192 adolescents (57.57% female; *M* age = 15.21, *SD* = 1.14). See Appendix A (Supplementary Materials) for participant demographics.

Procedures

All procedures were approved by a local ethics review board – the Maseno University Ethics Review Committee (MUERC). A research permit was granted by the National Commission for Science, Technology, and Innovation (NACOSTI). All students in forms one, two and three (equivalent to 9^{th} – 11^{th} grades) were notified about the study at a gathering in their school halls. Here, the study team explained study procedures and offered students an opportunity to ask questions. Parental consent for underage adolescents was obtained through

school administration per MUERC guidelines. All students who wished to participate in the study provided informed consent (or assent for minors) before completing study activities.

Consenting students completed a questionnaire battery, which was administered in English. English is an official language in Kenya and the primary language of instruction at all levels of education in Kenya. All students in secondary schools are required to demonstrate proficiency in written and oral English before admission. As a result, there was no need to translate the questionnaires into any other language. Many studies with Kenyan youths have also conducted study activities in English (Khasakhala et al., 2012; Ndetei et al., 2008; Osborn, Venturo-Conerly, et al., 2021).

Measures

Depression and anxiety symptoms

We assessed depressive symptoms using the **Patient Health Questionnaire-8 (PHQ-8)**, a brief diagnostic measure for depression (Kroenke & Spitzer, 2002). The PHQ-8 is the eight-item version of the PHQ-9, which excludes the suicidal ideation item (Kroenke et al., 2009). We excluded the suicidal ideation item because previous research with Kenyan youths has suggested that that item might be stigmatizing (Osborn, Venturo-Conerly, et al., 2020). PHQ-8 scores range from 0 to 24 with higher scores indicating more severe depressive symptoms. The cutoffs for mild, moderate, moderately severe, and severe depression are 5, 10, 15, and 20, respectively; scores of 10 and above on the PHQ-8 are considered clinically elevated (Kroenke et al., 2001; Kroenke & Spitzer, 2002; Manea et al., 2012). The PHQ-8 has documented adequate internal consistency with1 Kenyan youths (Osborn, Venturo-Conerly, et al., 2020).

Anxiety symptoms were assessed using the **Generalized Anxiety Disorder Screener-7** (GAD-7), which is a brief, cost-effective measure of generalized anxiety (Spitzer et al., 2006). Scores on the GAD-7 range from 0 to 21 with higher scores indicating more severe

anxiety symptoms. The cutoffs for the GAD-7 are 5, 10, and 15, indicating mild, moderate, and severe anxiety, respectively; scores of 10 and above are considered clinically elevated (Spitzer et al., 2006). GAD -7 has documented adequate internal consistency with Kenyan youths (Osborn, Venturo-Conerly, et al., 2020).

Psychosocial wellbeing indices

Self-reported social support was assessed using the **Multidimensional Scale of Perceived Social Support** (MSPSS) (Zimet et al., 1988). The MSPSS has three subscales, which each address a different source of social support: family, friends, and significant other. The scale has previously been used with Kenyan adolescents where it demonstrated adequate internal consistency (Osborn, Venturo-Conerly, et al., 2020).

Happiness and optimism were assessed using the **EPOCH Measure of Adolescent of Well-Being** (EPOCH) (Kern et al., 2016). The EPOCH measures five positive psychological characteristics, including engagement, perseverance, optimism, connectedness, and happiness (Kern et al., 2016). For the purposes of this study, we only administered the Happiness and Optimism subscales. The EPOCH scale has been used in a recent clinical trial with Kenyan adolescents (Osborn, Rodriguez, et al., 2020).

Perceived academic control was measured using the academic subscale of the **Perceived Control Scale** (PCS) (Weisz et al., 2001). The PCS measures the degree to which individuals believe they are in control of outcomes in their lives (e.g., academic achievement and performance outcomes). The PCS has also been used in a recent study with Kenyan adolescents (Osborn, Wasil, et al., 2020).

Gratitude was measured using the brief **Gratitude Questionnaire-6** (GQ-6) (McCullough et al., 2002). The GQ-6 assesses subjective feelings of gratitude via six self-report questions (McCullough et al., 2002).

Socio-demographic information

Socio-demographic information was collected through a **sociodemographic questionnaire**. Students provided their age, gender, tribe, financial status, financial status (upper-class vs. upper-middle-class vs. lower-middle-class vs. low-income), home (rural area vs. small town vs. big town vs. city), number of siblings, number of parents' dead (none vs. one vs. both), mother's education, father's education, involvement in co-curricular activities, and involvement in sports. We collected these socio-demographic variables because prior research suggests that they may be potentially important in the development and maintenance of adolescent depression and anxiety symptoms (Khasakhala et al., 2012; Ndetei et al., 2008; Osborn, Venturo-Conerly, et al., 2020; Othieno et al., 2014).

Data Analyses

All analyses were conducted on R Studio (Version 1.2.5019); data and accompanying R code files can be found in the Open Science Framework repository (masked for review).

Psychometric properties of the PHQ-8 and the GAD-7

Internal consistency and convergent validity

To investigate the psychometric properties of the PHQ-8 and the GAD-7 with Kenyan adolescents, we, first, calculated Cronbach's alpha to determine the internal consistency. We did this for all the measures used in the study (see Measures section). Only measures with an alpha of 0.70 and above were included in further analyses (Nunnally, 1978). All measures, except the Optimism sub-scale of the EPOCH Measure of Adolescent of Well-Being, met this requirement. As a result, we removed the Optimism sub-scale from further analyses.

We also investigated the convergent validity of these instruments by calculating whether they were negatively correlated with the psychological wellbeing indices: happiness, optimism, gratitude, social support, and perceived academic literature. Existing literature to

suggests that these variables should be negatively correlated with depression and anxiety (Bartels et al., 2013; Winefield et al., 2012).

Construct validity of the PHQ-8 and the GAD-7

Exploratory Factor Analysis. We assessed the construct validity of the PHQ-8 and GAD-7 measures by examining their factor structures. To do this, we split the total sample into 2 randomly selected subsamples, each with 1,096 participants. With the first subsample, we conducted an exploratory factor analysis (EFA) with maximum likelihood estimation with items of the PHQ-8 and the GAD-7, separately. Promax oblique rotation was performed because the items of each of the individual items in the scales may be correlated with each other. The number of factors to be extracted was determined using the criterion of eigenvalue greater than 1 and via examination of the scree plot.

When conducting the EFA analyses, we conducted the Kaiser-Meyer-Olkin (KMO) test to assess if our data were suitable for factor analysis. The KMO measure of sampling adequacy assesses the extent to which the proportion of variance among variables is a result of shared variance: the lower the proportion, the better-suited data is for factor analysis. KMO scores of between 0.8 to 1 indicate that data sampling is adequate (Hill, 2011; Kaiser, 1970). We also performed Bartlett's Test of Sphericity to verify whether factor analysis could compress the data in a meaningful way: significant values below the $p < .05$ threshold indicate that data is suitable for factor analysis (Gleser, 1966; Williams et al., 2010).

Confirmatory Factor Analysis. With the second subsample, we conducted a confirmatory factor analysis (CFA) for the PHQ-8 and the GAD-7. We used the *lavaan* package in R for model fitting using maximum likelihood estimation (Rosseel, 2012). We standardized latent factors to allow for free estimation of all factor loadings; goodness of fit was assessed using the root mean square error of approximation (RMSEA), Tucker – Lewis Fit Index (TFI), and the comparative fit index (CFI). TFI scores of >=.9 indicate acceptable

fit, scores of >=.95 indicate a very good fit; CFI score of >=.9 indicate acceptable fit and scores >=.95 indicate a good fit; RMSEA values of no greater than .05 indicate good fit, values between .05 and .08 indicate moderate fit, values of greater than .08 indicate a poor fit (Bentler & Bonett, 1980; Hu & Bentler, 1999).

Finally, after establishing the models for single groups, we conducted multiple-group analyses to assess for both sex and age invariance using a model with equality constraints (same factor loadings across groups) and without equality constraints (different factor loadings). Maximum likelihood χ^2 values were used to assess model fit; a non-significant difference in χ^2 values would indicate that factor loadings are equal between the groups.

Does one factor underly the PHQ-8 and the GAD-7?

Besides investigating the construct validity for the PHQ-8 and the GAD-7, we also conducted—at the suggestion of a reviewer—an EFA with 1 of the subsamples from prior analyses. Here, we included all the items of the PHQ-8 and the GAD-7. Our procedures were like earlier EFA procedures. We also conducted a CFA with the second sub-sample.

Association between depression and anxiety symptoms and psychosocial wellbeing and sociodemographic factors

We used linear mixed-effect modeling to assess the relationship between depression and the psychological wellbeing indices (social support, happiness, gratitude, and perceived control). Linear mixed-effect modeling allowed us to reflect the hierarchical nature of our data in the model (Knafl et al., 2009) and have been used in similar studies (Osborn, Venturo-Conerly, et al., 2020). The variables of social support, happiness, gratitude, and perceived control were all included as covariates in the model. We included a random intercept that allowed for participant variation in symptoms by school. We used the same approach to assess the relationships between anxiety and the above-mentioned psychological wellbeing variables.

Similarly, we used a linear mixed effect model to assess the relationship between depression and various sociodemographic factors: age, gender, tribal status, financial status, home, number of siblings, number of parents' dead, mother's education, father's education, involvement in co-curricular activities, involvement in sports, and perceived academic abilities. These sociodemographic factors were all included as covariates in the model. A similar approach was used to assess the association between anxiety symptoms and socio-demographic factors.

Data nesting and missingness

Our data had two levels of nesting (participants nested within schools) thus our use of linear mixed effect model. Missing data were imputed five times using the Fully Conditional Specification (FCS) methodology implemented using the multivariate imputation by chained equations (mice) algorithm in R (Buuren & Groothuis-Oudshoorn, 2011).

Results

PHQ-8 and GAD-7 Psychometrics

Internal consistency and convergent validity

In our sample, Cronbach's alpha was 0.78 for the PHQ-8 and 0.82 for the GAD-7; both were above the 0.70 cutoff for acceptable internal consistency. For the other variables, the Cronbach's alpha scores were 0.88 for the MSPSS ($\alpha = 0.81$, Family; $\alpha = 0.82$, Friends; $\alpha = 0.80$, Significant Other subscale), 0.79 for EPOCH Happiness, 0.68 for EPOCH Optimism, 0.80 for the PCS academic sub-scale, and 0.79 for GQ-6.

Convergent validity was assessed using Pearson's correlations. Table 1 shows the correlations between depressive and anxiety symptoms and a series of psychological wellbeing variables. As expected, depression and anxiety symptoms were moderately and negatively associated with social support (including social support from family, friends, and significant others), happiness, gratitude, and perceived control.

Factor Structure PHQ-8 and GAD-7

Using data from subsample 1 ($N = 1096$), an EFA yielded a 1-factor structure for the PHQ-8 that explained 32.00% of the variance. The KMO measure of sampling adequacy was 0.85; Bartlett's test of sphericity was 1864.67 ($p < 0.001$); the eigenvalue of the factor was 3.20. For the GAD-7, an EFA also yielded a 1-factor structure that explained 39.20% of the variance. The KMO measure of sampling adequacy was 0.87; Bartlett's test of sphericity was 2341.06 ($p < 0.001$); the eigenvalue of the factor was 3.46. Using data from subsample 2 ($N = 1096$), a CFA was conducted based on the 1-factor yielded by the above EFA for both PHQ-8 and GAD-7. The 1-factor model yielded a good goodness of fit ($\chi^2 = 76.73$; $p < 0.001$; RMSEA = 0.05; CFI = 0.96; TLI = 0.95) for the PHQ-8 and a moderate goodness of fit ($\chi^2 = 88.19$; $p < 0.001$; RMSEA = 0.07; CFI = 0.97; TLI = 0.95). See Table 2.

We also applied CFA separately for boys and girls to see whether the items in the PHQ-8 and GAD-7 represented a unidimensional structure within the sex subgroup. For the PHQ-8, the 1-factor model yielded a moderate goodness of fit for boys ($N = 930$; $\chi^2 = 116.77$; $p < 0.001$; RMSEA = 0.07; CFI = 0.93; TLI = 0.90) and a good goodness of fit for girls ($N = 1,262$; $\chi^2 = 87.85$; $p < 0.001$; RMSEA = 0.05; CFI = 0.97; TLI = 0.95). The 1-factor model for the GAD-7 also yielded a moderate goodness of fit for both boys ($N = 930$; $\chi^2 = 90.21$; $p < 0.001$; RMSEA = 0.08; CFI = 0.96; TLI = 0.94) and girls ($N = 1,262$; $\chi^2 = 121.50$; $p < 0.001$; RMSEA = 0.08; CFI = 0.96; TLI = 0.94).

Finally, we conducted a multiple-group CFA to test for invariance between boys and girls. When the models with and without equality constraints were contrasted, with the full sample, the model showed that the factor loadings of the items in the PHQ-8 were invariant across boys and girls ($\Delta\chi^2 = 3.73$; $p = 0.811$); the same was observed for the GAD-7 ($\Delta\chi^2 = 4.52$; $p = 0.606$). See Table 2 for more information and Appendix B (supplementary materials) for factor loadings.

Does an underlying factor underly the PHQ-8 and the GAD-7?

Using data from subsample 1 (N = 1096), an EFA yielded a 1-factor structure for the PHQ-8 and GAD-7 combined that explained 33.00% of the variance. The KMO measure of sampling adequacy was 0.93; Bartlett's test of sphericity was 4880.35 ($p < 0.001$); the eigenvalue of the factor was 3.20. Using data from subsample 2 (N = 1096), a CFA was conducted based on the 1-factor yielded above for the PHQ-8 and GAD-7 combined. The 1-factor model yielded a moderate goodness of fit ($\chi^2 = 436.63$; $p < 0.001$; RMSEA = 0.06; CFI = 0.93; TLI = 0.91) for the PHQ-8 and GAD-7 combined. See Table 2.

Prevalence Rates of Depression & Anxiety Symptoms

We calculated prevalence rates for depression and anxiety symptoms using cut-off norms from primary care studies with North American samples (Kroenke & Spitzer, 2002; Spitzer et al., 2006) that have also been used with Kenyan youths (Osborn, Venturo-Conerly, et al., 2020). Some 35.86% of participants endorsed mild depressive symptoms (i.e., 5-9 on the PHQ-8), 19.21% endorsed moderate depressive symptoms (i.e., 10-14 on the PHQ-8), and 8.85% endorsed severe depressive symptoms (i.e., 15 or above on the PHQ-8). Thus, 28.06% endorsed clinically elevated depression symptoms. Similarly, 32.89% endorsed mild anxiety symptoms (i.e., 5-9 on the GAD-7), 19.80% endorsed moderate anxiety symptoms (i.e., 10-14 on the GAD-7), and 10.58% (i.e., 15 or above on the GAD-7) endorsed severe anxiety symptoms. Thus, 30.38% endorsed clinically elevated anxiety symptoms.

Depression, Anxiety, and Psychosocial and Sociodemographic Variables

Table 3 shows the results of a linear mixed effect model showing the associations between depression and psychological wellbeing indices. For psychosocial variables, we found significant effects for social support (B = -0.13, 95%CI [-0.17, -0.09], p<0.001), gratitude (B = -0.13, 95%CI [-0.17, -0.08], p<0.001), happiness (B = -0.21, 95%CI [-0.26, -0.17], p<0.001), and perceived academic control (B = -0.19, 95%CI [-0.23, -0.15], p<0.001).

Table 3 also shows the results of a linear mixed effect model showing the associations between anxiety symptom and psychological wellbeing indices. Like with depression above, we found significant effects for social support (B = -0.14, 95%CI [-0.14, 0.16], p<0.001), gratitude (B = -0.8, 95%CI [-0.18, -0.10], p<0.001), happiness (B = -0.24, 95%CI [-0.13, -0.03], p<0.001), and perceived academic control (B = -0.14, 95%CI [-0.18, -0.10], p<0.001).

Finally, Table 4 shows the results of a linear mixed effect model showing the associations between depression and anxiety symptoms and sociodemographic variables. For depression, significant effects emerged for age (B = 0.12, 95%CI [0.07, -0.16], p<0.001), number of siblings (B = -0.06, 95%CI [-0.10, -0.02], *p=.007*), not being well-off financially (B = -0.13, 95%CI [-0.24, -0.02], *p=.017*), and some co-curricular involvement (B = 0.27, 95%CI [0.13, 0.42], p=0.01). For anxiety, significant effects emerged for age (B = 0.10, 95%CI [0.06, -0.15], p<0.001), number of siblings (B = -0.04, 95%CI [-0.08, -0.00], p=.049), being quite well-off financially (B = 0.31, 95%CI [0.09, 0.53], *p=.006*), and some co-curricular involvement (B = 0.26, 95%CI [0.12, 0.40], p<0.001).

Discussion

In this study, we administered standard Western-developed measures of depression, anxiety, and psychosocial wellbeing to a large community sample of Kenyan adolescents. We assessed the psychometric properties of these measures to ascertain whether they exhibited adequate internal consistency as well as construct and convergent validity. We then used these instruments to assess the prevalence rates of depression and anxiety symptoms as well as the associations between these symptoms and important sociodemographic and psychosocial wellbeing indices. By investigating the psychometric integrity of brief public-domain measures, our study facilitates future clinical research and practice in a region that currently relies heavily on such measures. Our study paints–with a large sample–a clearer picture of the prevalence rates of depression and anxiety symptoms, it identifies associations

between these symptoms, socio-demographic, and psychosocial wellbeing factors, and it is suggestive of possible risk/protective factors for further investigation.

Our findings indicate that the PHQ-8 and the GAD-7, two brief and free instrument tools, demonstrated adequate psychometric properties with Kenya youths: these tools showed adequate internal consistency, exploratory factor analyses revealed a 1-factor model to be a good fit for our data, and confirmatory factor analyses revealed that the 1-factor model was a good fit for the PHQ-8 and a moderate fit for the GAD-7. Pearson's correlations supported the convergent validity of these measures. Our findings are important because mental health research and practice, in low–resource areas with a paucity of experts, will benefit from the use of these psychometrically validated tools. Still, our work challenges the status quo in where research and practice are handicapped by the use of Western-derived measures absent robust psychometrical evaluation.

When we used these tools to investigate the prevalence rates of depressive and anxiety symptoms amongst Kenyan adolescents, we found rather high prevalence rates of these symptoms. Using PHQ-8 and GAD-7 guidelines from Western settings (Kroenke & Spitzer, 2002; Spitzer et al., 2006), we found that 28.06% and 30.38% of the participants reported clinically elevated depressive and anxiety symptoms respectively. This is consistent with recent findings from Kenya (Khasakhala et al., 2012; Ndetei et al., 2008) including a recent one that found that nearly 1 in 3 Kenyan adolescents reported clinically elevated symptoms of depression and/or anxiety (Osborn, Venturo-Conerly, et al., 2020).

How do these rates compare with those from other regions? In Ghana, a recent study that used the PHQ-8 and GAD-7 found the prevalence rates of depression and anxiety symptoms were 20.43% and 15.55% respectively (Anum et al., 2019). In Nigeria, the prevalence rates for depression and anxiety symptoms were 21.20% (Fatiregun & Kumapayi, 2014). Elsewhere, in Japan, the prevalence rates were 10.49% for depression and 4.61% for

anxiety (Masuyama et al., 2020) while in the USA the rates for depression and anxiety were 4.80% and 6.30% respectively (Dumont & Olson, 2012). It seems that the prevalence rates of adolescent depression and anxiety symptoms – at least when measures by the Western PHQ-8 and GAD-7 – are rather high in Kenya compared to other contexts. Future studies investigating the prevalence rates of adolescent depression and anxiety are needed. These studies should complement Western-derived measures with locally developed instruments to paint a clearer and fuller picture of these syndromes in SSA youths. Should these studies reveal similar high prevalence rates, then additional research on possible explanations for these rates is needed.

We found that depression and anxiety symptoms were strongly and positively correlated (r = .68). This finding is similar to another finding with Kenyan youths (r = .69; (Osborn, Venturo-Conerly, et al., 2020). Around the world, depression and anxiety have been shown to moderately to strongly correlated (r = .67 in Ghana, r = *.68* in Japan, and r = .78 in China for example; Anum et al., 2019; Liu et al., 2020; Masuyama et al., 2020). Besides showing the similar correlations exist in our sample, our study design does not allow us to speculate on the meaning of this correlation for clinical research and practice. When we investigated whether one factor underlies both depression and anxiety scales, factor analyses revealed a moderate goodness of fit for a 1-factor model of the PHQ-8 and GAD-7. (Interestingly, these scores were lower than those of the individual PHQ-8 and GAD-7).

When we investigated the association between depression and anxiety symptoms and psychological wellbeing, we found–as expected–that a reduction in symptoms was associated with an increase in happiness, gratitude, perceived social support, and perceived academic control. While causal directions cannot be established from our study design, these negative relationships echo the preventative role these psychological well-being play in the development and maintenance of mental health problems (Joseph & Wood, 2010; Winefield

et al., 2012). This finding may benefit future intervention development efforts in SSA by highlighting potentially non-stigmatizing avenues for assessing, preventing, and treating depression and anxiety. Perhaps targeting and improving positive psychosocial constructs, may prevent or reduce depression and anxiety symptoms (Campbell & Osborn, 2021).

Our results revealed that age was significantly and positively associated with depressive and anxiety symptoms. This converges with recent evidence implicating age as a significant correlate of depression and anxiety in both Kenyan adolescents (Osborn, Venturo-Conerly, et al., 2020) and university students (Othieno et al., 2014). Age has also emerged as significantly associated with increased adolescent depression and anxiety symptoms in the West (Saluja et al., 2004). In Kenya, various explanations for this association have been proposed. Some researchers have suggested that the increased academic pressure that older Kenyan students face when they approach the end-of-secondary-school examinations leads to increased psychosocial stress that exacerbates the symptoms of depression and anxiety (Yara & Wanjohi, 2011). Moreover, older adolescents might be more conscious of the difficulties of life and the limited future prospects in low-income countries like Kenya (Osborn, Venturo-Conerly, et al., 2020). However, further research is necessary to unravel the association between age and mental health problems among Kenyan adolescents.

Interestingly, the number of siblings was significantly associated with reduced adolescent depression and anxiety symptoms. This finding diverges from previous evidence in other contexts. In Malaysia, a study with 2,048 school-going adolescents found that an increase in the number of siblings was associated with increased depressive and anxiety symptoms (Adlina et al., 2007). We suggest that as culture undoubtedly affects the experience of mental health problems (Bass et al., 2007; Kleinman, 2004; Osborn, Kleinman, et al., 2021), it is possible that within the Kenyan socio-cultural context, an increase in the number of siblings may play a preventive/buffer role against internalizing problems. One reason for

this may lie in the social nature of Kenyan societies in which family ties and relationships are valued and emphasized. It has also been suggested that adolescents find it easier to share their feelings with their siblings and peers than they do with their parents (Makworo et al., 2014). Maybe having more siblings opens more opportunities for psychosocial support which strengthens copying and buffers against depression and anxiety symptoms. While our study design does not allow us to extensively explore this very interesting hypothesis, we conducted an exploratory cross-sectional mediation model in which we found that the relationship between social support and depression and anxiety symptoms was mediated by the number of siblings (see Supplementary Materials, Appendix C).

Other factors that emerged were involvement in co-curricular activities (associated with increased depression and anxiety symptoms) and financial status (associated with reduced depression but increased anxiety symptoms). Perhaps participating in co-curricular activities puts Kenyan youths, who are already balancing intense academic pressure, at increased risk of internalizing problems. We offer no suggestions for the findings on financial status because we assessed financial status through self-report measures – which have been shown to be susceptible to youths reporting *relative* rather than *objective* measures.

Finally, and surprisingly, sex did not emerge as a significant factor in our model. While this finding mirrors a recent one with Kenyan adolescents which found a significant association between sex and anxiety but not with depression (Osborn, Venturo-Conerly, et al., 2020), it differs from findings that have been reported in previous Kenyan studies (Khasakhala et al., 2012; Mitchell & Abbott, 1987; Ndetei et al., 2016) and adolescents around the world (Adewuya et al., 2018; Grant et al., 2004; McGuinness Teena M. et al., 2012). One possible explanation may be that most Kenyan adolescents attend single-sex boarding schools whereas in a global settings, boys and girls tend to attend mixed-gender schools (it's possible that mixed-gender settings put girls at more risk of depression and

anxiety symptoms). Future studies, which will most likely reveal an association between sex and these symptoms, are required.

Limitations

This study is not without limitations. Our cross-sectional design does not allow us to investigate the extent to which sociodemographic and psychological wellbeing factors play a role in the onset, maintenance, or time course of depression and anxiety. Although our sample is large and representative of different geographies in Kenya, we did not randomly select the schools in our study. Further, our participants were mostly from high-achieving schools. In addition, the measures that we have used are susceptible to acquiescence bias. Our self-report methodology may also inflate correlations due to method variance. Finally, as cross-cultural studies suggest that Western-derived measures may miss salient features of depression and anxiety symptoms (Osborn, Kleinman, et al., 2021; Weisz et al., 1988, 1993), future studies should complement our findings with locally-developed instruments.

Conclusions

Our study investigated the psychometric properties of two simple standard measures of depression and anxiety and used these instruments to assess the prevalence of depressive and anxiety symptoms and their associations with psychological wellbeing and sociodemographic factors, among Kenyan youths, a largely understudied yet vulnerable population. We found a rather high prevalence of depression and anxiety symptoms and identified important psychological wellbeing and sociodemographic factors that are associated with these for these symptoms. These findings provide a framework for future research that investigates similar questions of prevalence rates, psychological wellbeing, and sociodemographic associations with culturally apt measures. Ultimately, our findings contribute to global mental health research and may inform intervention and prevention efforts.

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