Construct validity and reliability of the generalised anxiety disorder-7 scale in a sample of tuberculosis patients in the Free State Province, South Africa

Background: Generalised anxiety disorder (GAD) frequently occurs amongst patients with tuberculosis (TB) and contributes to poor quality of life and treatment outcomes. This study evaluated the construct validity and reliability of the GAD-7 scale in a sample of patients with TB in the Free State Province.

Methods: A pilot study was conducted amongst a convenience sample of 208 adult patients newly diagnosed with drug-susceptible TB attending primary healthcare (PHC) facilities in the Lejweleputswa District in the Free State. A structured interviewer-administered questionnaire comprising social demographic questions and the GAD-7 scale was used. Confirmatory factor analysis was used to investigate the construct validity of the GAD-7 scale. The reliability of the scale was assessed by calculating Cronbach’s alpha.

Results: The analysis showed that a modified two-factor (somatic symptoms and cognitive-emotional symptoms) model, in which the items ‘Not being able to stop or control worrying’ and ‘Worrying too much about different things’ were allowed to covary (Comparative Fit Index: 0.996, Tucker–Lewis Index: 0.993, Root Mean Square Error of Approximation: 0.070, 90% confidence interval: 0.032–0.089), fitted the data better than a unidimensional (generalised anxiety) or an unmodified two-factor model. The indicators all showed significant positive factor loadings, with standardised coefficients ranging from 0.719 to 0.873. The Cronbach’s alpha of the scale was 0.86.

Conclusion: The modified two-factor structure and high internal consistency respectively provide evidence for construct validity and reliability of the GAD-7 scale for assessing GAD amongst patients with TB. Studies are necessary to assess the performance of this brief scale under routine TB programme conditions in the Free State.

Keywords: tuberculosis; GAD-7; primary healthcare; anxiety; construct validity; confirmatory factor analysis.

Background: Mental health is increasingly being prioritised globally as well as in South Africa. In 2015, the World Health Organization (WHO) ranked anxiety disorders – with a global prevalence of more than 260 million – as the sixth largest contributor to disability. In 2009, a nationally representative adult survey in South Africa established that anxiety disorders were the most prevalent 12-month and lifetime disorders. By 2015, anxiety disorders were associated with 7.2 years lived with disability in South Africa. Generalised anxiety disorder (GAD) is a type of anxiety disorder characterised by overwhelming anxiety and worry about ordinary situations occurring frequently for at least 6 months. If left untreated, GAD can impair patients’ quality of life and disease treatment outcomes. Despite being treatable, there are concerns that GAD remains largely underdiagnosed and undertreated in primary healthcare (PHC) settings in South Africa.

Tuberculosis (TB) is a communicable disease caused by Mycobacterium tuberculosis. It is a major cause of ill health and a leading cause of death from a single infectious agent. In 2019, 10 million people were diagnosed with TB globally, and an estimated 1.2 million and 208 000 deaths were reported amongst human immunodeficiency virus (HIV)-negative and HIV-positive people respectively. South Africa is ranked amongst the 30 high TB burden countries, accounting for 3.6% (306 000 cases) of the global TB incidence in 2019. In the same year, the country recorded 22 000 deaths amongst HIV-negative people and 36 000 deaths amongst HIV-positive people.
Reviews indicate that anxiety is frequent in patients with TB. The prevalence of anxiety in patients with TB ranges between 12% and 70%. As was established in an Ethiopian study, the risk for GAD specifically is heightened amongst patients with TB and comorbid HIV. However, there is a dearth of evidence on the screening and treatment of GAD in patients with TB in South Africa. This could be attributed, in part, to the poor integration of mental healthcare within programmes at the PHC level. Consequently, there are hardly any routine screening tools or treatment care models for GAD amongst patients with TB within PHC programmes.

Valid, reliable and easy-to-administer tools are necessary within the TB programme to timeously detect individuals at risk of GAD to facilitate early intervention. The GAD-7 scale is used to identify GAD in individuals and to assess symptom severity. Based on the symptom criteria for GAD in the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition, scores range from 0 to 21. Scores between 5 and 9, 10 and 14, and 15 and higher represent mild, moderate and severe anxiety symptoms respectively. The GAD-7 scale has been validated in various populations in developed and developing countries including PHC users in Finland and Zimbabwe, college students in Portugal and Korea and an adolescent population in Ghana. In terms of construct validity, the majority of studies have established a unidimensional factor structure of the GAD-7 scale. However, other research found that a one-factor structure may not always fit the data well, suggesting a need for a context-specific analysis. Furthermore, studies have reported satisfactory internal consistency of both the English version and translated versions of the GAD-7 with a Cronbach’s alpha value of at least 0.8. However, there is a dearth of information on the performance of this scale amongst patients with TB. Besides, no study has assessed the performance of the GAD-7 scale in the Free State Province. This study sought to establish the construct validity and reliability of an interviewer-administered GAD-7 scale in a sample of patients with newly diagnosed drug-susceptible TB in the Free State.

Methods
Design and setting
A pilot study was conducted amongst patients with TB in the Lejweleputswa District in the Free State Province of South Africa. Eleven PHC facilities were purposefully selected from the district based on a high burden of TB.

Participant sampling and recruitment
The study population constituted adult patients newly diagnosed with susceptible TB. A convenience sampling strategy was used to select patients aged 18 years and older, who had initiated treatment between 01 May 2019 and 31 October 2019, and were proficient in either English or Sesotho. Patients younger than 18 years, those who were too ill to be interviewed, those on TB re-treatment and those with multidrug-resistant TB were excluded from the study.

Patients were recruited through their attending nurses. The nurses informed them about the study and referred them to trained fieldworkers located in private spaces within the facility premises. Eligible patients provided written informed consent for interviews as well as access to their clinical information.

Data collection
A structured interviewer-administered questionnaire was used for data gathering. The questionnaire comprised five questions to obtain the patients’ socio-demographic and clinical information including sex (male or female), age, marital status (married or unmarried), educational qualification (no formal education, primary, secondary or tertiary) and HIV status (negative, positive or not recorded). The seven-item GAD scale was used to assess GAD in the patients. The patients were asked to indicate how often they experienced anxiety symptoms over two weeks before assessment. These included the following: (1) feeling nervous, anxious or on edge; (2) not being able to stop or control worrying; (3) worrying too much about different things; (4) trouble relaxing; (5) being so restless that it is hard to sit still; (6) becoming easily annoyed or irritable; and (7) feeling afraid as if something awful might happen. Responses were recorded on a 4-point Likert scale as follows: 0 = ‘not at all’; 1 = ‘several days’; 2 = ‘more than half the days’; and 3 = ‘nearly every day’. As with other validation studies in Africa, adapting response sets to improve respondent comprehension, response sets in this study were adjusted such that ‘several days’ was depicted as 1–7 days; ‘half the days’ was depicted as 8–11 days; and ‘nearly every day’ was depicted as 12–14 days.

The research instruments including a consent form and the questionnaire were forward-translated into Sesotho and back-translated to English by two independent translators who discussed discrepancies between original and translated versions with the research team before consensus was reached on the final draft of the translated questionnaire. A team of experienced bilingual fieldworkers conducted face-to-face interviews with the patients in either Sesotho or English. The questionnaire took approximately 10 minutes to complete.

Analysis
Data from 208 patients with drug-susceptible TB were analysed. The International Business Machines (IBM) Statistical Package for the Social Sciences (SPSS) version was used to analyse the patients’ socio-demographic and clinical characteristics. Discrete variables were presented as frequency counts and percentages, and continuous variables as means and standard deviations (SDs). Construct validity of the GAD-7 scale was investigated by using confirmatory factor analysis (CFA). The CFA models were fitted by using lavaan version 0.5–23 in R version 3.6.0. The dataset was examined for the CFA requirements of multicollinearity, residual values, multivariate outliers and normality. Only the CFA assumptions of multicollinearity, residual values and multivariate outliers were satisfied. The assumption of normality was violated for
several variables probably because the variables were measured on a Likert scale and were thus ordinal rather than continuous in nature. To account for the violation of this assumption, the variables were specified as ‘ordered’ (ordinal variables) when fitting the CFA model, and the diagonally weighted least squares (DWLS) estimator was used. The Comparative Fit Index (CFI) and the Tucker–Lewis Index (TLI) were used to determine whether the model fitted the data better than a more restricted baseline model. The root mean square error of approximation (RMSEA) was used to measure how closely the model represented data patterns. The model’s performance was tested by examining the differences between the expected and actual correlation matrix. Internal consistency of the GAD-7 scale was evaluated by calculating the Cronbach’s alpha.

Ethical considerations

This study was approved by the Health Sciences Ethics Review Board (UFS-HSD2019/1574/2611) at the University of the Free State. Permission to conduct the study at PHC facilities was provided by the Free State Department of Health. Participation in the research was entirely voluntary. Eligible patients signed consent forms upon being informed about the purpose of the study. All information gathered during the study was handled confidentially, and data were secured in locked cabinets.

Results

Sample characteristics

Table 1 shows the sample’s socio-demographic and clinical characteristics. Two-thirds of the sample were male ($n = 137; 65.9\%$). Just over half ($n = 116; 55.8\%$) of the patients were aged between 18 and 40 years.

Seven in every 10 patients were unmarried ($n = 140; 67.3\%$). Slightly more than half had attained secondary school education ($n = 112; 53.8\%$). Almost six in every 10 patients were co-infected with HIV ($n = 118; 56.7\%$). Based on the criteria for GAD in the *Diagnostic and Statistical Manual of Mental Disorders Fourth Edition,* just under half of the sample ($n = 94; 45.2\%$) had symptoms of GAD. More specifically, 28.4\% ($n = 59$) of the patients had mild anxiety symptoms, 12.0\% ($n = 25$) had moderate anxiety symptoms and 4.8\% ($n = 10$) had severe anxiety symptoms.

Construct validity of the generalised anxiety disorder-7 scale

Table 2 depicts the Goodness-of-fit indices of models for the GAD-7 scale. The latent factors were standardised, allowing free estimation of all factor loadings. The first model, with only a single latent variable (generalised anxiety) specified, showed adequate CFI (0.966) and TLI (0.949) scores, but a RMSEA value of 0.188 (90\% confidence interval [CI]: 0.157–0.220) indicated a poor fit. The second model, with two latent factors specified, that is, somatic symptoms and cognitive-emotional symptoms, showed an improved fit when compared with the first model, with a CFI of 0.981 and a TLI of 0.969. The RMSEA also improved from 0.188 to 0.147 (90\% CI: 0.115–0.181), but still indicated a poor model fit. Although the second model was deemed to be an improvement on the first model, the RMSEA value was still not satisfactory. Modification indices suggested that allowing the items ‘Not being able to stop or control worrying’ and ‘Worrying too much about different things’ to covary might lead to an improved model fit. Thus, a third two-factor model was run in which these two variables were allowed to covary. A chi-square difference test showed a statistically significant improvement in model fit between the modified and unmodified two-factor models ($\chi^2[1] = 47.192, p < 0.001$). The fit indices also showed an improved fit, with a CFI of 0.996 and a TLI of 0.993. Furthermore, the RMSEAs indicated a good model fit, with a value of 0.070 (90\% CI: 0.027, 0.110). As expected, for this final model, the indicators all showed significant positive factor loadings, with standardised coefficients ranging from 0.719 to 0.873 (Table 3). The item means ranged from 0.45 (SD: 0.87) to 1.09 (SD: 1.02) (Table 4). Taken together, the results indicate that a modified two-factor model, with somatic symptoms and cognitive-emotional symptoms as latent factors, that allows the items ‘Not being able to stop or control worrying’ and ‘Worrying too much about different things’ to covary, resulted in the best fit for the data when compared with a single-factor model with only generalised anxiety as an underlying factor, and an unmodified two-factor model. The results also provide evidence for the construct validity of the GAD-7 scale in the sample studied.

---

**TABLE 1: Participants’ characteristics (N = 208).**

| Variable            | n   | %   |
|---------------------|-----|-----|
| Sex                 |     |     |
| Male                | 137 | 65.9|
| Female              | 71  | 34.1|
| Age† (years)        |     |     |
| 18–30               | 52  | 25.0|
| 31–40               | 64  | 30.8|
| 41–50               | 31  | 14.9|
| 51–60               | 27  | 13.0|
| 61 and older        | 34  | 16.3|
| Marital status      |     |     |
| Married             | 68  | 32.7|
| Unmarried           | 140 | 67.3|
| Educational qualification | |     |
| No formal education | 3   | 1.4 |
| Primary school      | 53  | 25.5|
| Secondary school    | 112 | 53.9|
| Matric or grade 12  | 34  | 16.3|
| Tertiary education  | 6   | 2.9 |
| HIV status          |     |     |
| Negative            | 80  | 38.5|
| Positive            | 118 | 56.7|
| Not recorded        | 10  | 4.8 |
| Symptoms of anxiety |     |     |
| No symptoms         | 114 | 54.8|
| Mild symptoms       | 59  | 28.4|
| Moderate symptoms   | 25  | 12.0|
| Severe symptoms     | 10  | 4.8 |

HIV, human immunodeficiency virus.

†, Mean age (SD): 42.4 (15.2); median age (inter-quartile range): 38.5 (30.3–54.0) years.

**TABLE 2: Goodness-of-fit indices of models for the generalised anxiety disorder-7 scale (N = 208).**

| Model    | $\chi^2$ | DF  | CFI  | TLI  | RMSEA  | 90\% CI     |
|----------|----------|-----|------|------|--------|-------------|
| One-factor | 116.023* | 14  | 0.966| 0.949| 0.188  | 0.157–0.220 |
| Two-factor | 71.202*  | 13  | 0.981| 0.969| 0.188  | 0.115–0.181 |
| Unmodified| 24.01**  | 12  | 0.996| 0.993| 0.070  | 0.027–0.110 |

$\chi^2$, model Chi square; DF, degrees of freedom; CFI, Comparative Fit Index; TLI, Tucker–Lewis Index; RMSEA, root mean square error of approximation; CI, confidence interval.

* $p < 0.001$; ** $p < 0.05$. 

http://www.sajid.co.za
### TABLE 3: Unstandardised and standardised factor loadings for the modified two-factor model of the generalised anxiety disorder-7 scale.

| Latent factor                  | Indicator                                         | B       | SE     | Z      | Beta   | Sig     |
|-------------------------------|---------------------------------------------------|---------|--------|--------|--------|---------|
| Somatic symptoms              | Trouble relaxing                                  | 0.840   | 0.049  | 17.214 | 0.840  | < 0.001 |
| Somatic symptoms              | Being so restless that it is hard to sit still    | 0.873   | 0.046  | 18.905 | 0.873  | < 0.001 |
| Somatic symptoms              | Becoming easily annoyed or irritable             | 0.719   | 0.054  | 13.251 | 0.719  | < 0.001 |
| Cognitive-emotional symptoms  | Feeling nervous, anxious or on edge              | 0.734   | 0.051  | 14.368 | 0.734  | < 0.001 |
| Cognitive-emotional symptoms  | Not being able to stop or control worrying       | 0.735   | 0.048  | 15.440 | 0.735  | < 0.001 |
| Cognitive-emotional symptoms  | Worrying too much about different things          | 0.747   | 0.047  | 16.059 | 0.747  | < 0.001 |
| Cognitive-emotional symptoms  | Feeling afraid as if something awful might happen | 0.819   | 0.044  | 18.728 | 0.819  | < 0.001 |

B, unstandardised beta coefficient; SE, standard error; Z, standard Z-score; Beta, standardised beta coefficient; Sig, statistical significance.

### TABLE 4: Descriptive characteristics for observed variables.

| Variable                                    | M     | SD   | Min | Max |
|---------------------------------------------|-------|------|-----|-----|
| Trouble relaxing                            | 0.51  | 0.87 | 0   | 3   |
| Being so restless that it is hard to sit still | 0.45  | 0.83 | 0   | 3   |
| Becoming easily annoyed or irritable        | 0.82  | 0.95 | 0   | 3   |
| Feeling nervous, anxious or on edge         | 0.60  | 0.75 | 0   | 3   |
| Not being able to stop or control worrying  | 0.97  | 1.01 | 0   | 3   |
| Worrying too much about different things    | 1.09  | 1.02 | 0   | 3   |
| Feeling afraid as if something awful might happen | 0.63  | 0.88 | 0   | 3   |

M, mean; SD, standard deviation; Min, minimum score; Max, maximum score.

### TABLE 5: Generalised anxiety disorder-7 scale item-level values and item–total correlations.

| Variable                                    | Correlated item–total correlation | Alpha if item is deleted |
|---------------------------------------------|-----------------------------------|--------------------------|
| Trouble relaxing                            | 0.57                              | 0.84                     |
| Becoming easily annoyed or irritable        | 0.57                              | 0.84                     |
| Feeling nervous, anxious or on edge         | 0.58                              | 0.84                     |
| Not being able to control worrying          | 0.70                              | 0.82                     |
| Worrying too much about different things    | 0.70                              | 0.84                     |
| Feeling afraid as if something awful might happen | 0.64                              | 0.83                     |

Overall Cronbach's alpha = 0.86.

### Reliability

The Cronbach’s alpha for the full GAD-7 scale was 0.86, indicating that the scale exhibited acceptable internal consistency in this sample. High correlations were observed between the seven items and the total scores, ranging from 0.57 to 0.70 (Table 5). The sub-scales ‘Somatic symptoms’ and ‘Cognitive-emotional symptoms’ also exhibited satisfactory internal consistency with Cronbach’s alpha of 0.73 and 0.83 respectively.

### Discussion

This study sought to assess the factor structure, constructive validity and reliability of the GAD-7 scale in a sample of patients newly diagnosed with drug-susceptible TB in the Free State Province. As far as can be ascertained, this is the first study to do so. In line with research in England and the United States of America, the CFA results established two latent factors underlying the GAD-7 scale. The first latent factor comprised three somatic items including ‘trouble relaxing’, ‘being so restless that it is hard to sit still’ and ‘becoming easily annoyed or irritable’. The second latent factor comprised four cognitive-emotional items including ‘feeling nervous, anxious or on edge’, ‘not being able to stop or control worrying’, ‘worrying too much about different things’ and ‘feeling afraid as if something awful might happen’. Analysis of the scale further established that a modified two-factor model fit the data better compared with a single-factor model or an unmodified two-factor model. These findings thus support the research suggesting that the originally proposed unidimensional factor structure of the GAD-7 scale may not always provide a good fit to data.

In this study, the GAD-7 scale was translated to Sesotho and was interviewer-administered. Assessment of reliability established that the GAD-7 scale exhibited a Cronbach’s alpha value of 0.86 implying a good internal consistency of the scale. Other studies in African countries involving PHC attendees have also found the GAD-7 scale to have good internal consistency. Accordingly, the GAD-7 scale is a potentially useful tool for the routine screening of GAD within PHC programmes such as TB and could be used to facilitate the timely identification of patients who might require additional psychosocial evaluation and support during treatment. However, this necessitates appropriate training of health workers and the development of guidelines for the routine screening of patients. Furthermore, given that the scale is brief, simple to score and freely available, future research should explore its suitability for routine administration by non-clinical or lay health workers within TB programmes. Indeed, there is growing evidence that the use of non-specialist health workers is a key strategy for closing the treatment gap within mental healthcare. Lay health workers would also have to play a key role in the development and validation of culturally relevant screening tools.

A strength of this study is that, in the light of the increasing attention being paid to mental health in South Africa, the results highlight the need to assess GAD in patients with TB and can be used to inform future validation research in the Free State and similar settings. However, this study had some limitations. Because of resource and time constraints, the performance of the GAD-7 scale against other tools measuring anxiety disorders could not be assessed in this study setting. Determination of severity of anxiety in this study was based on the symptom criteria for GAD in the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition. More research is needed to confirm the sensitivity and specificity of the GAD-7 scale in this setting, as well as its performance across demographic groups such as sex and age. In addition, there is potential for sampling bias as the patients in this study were conveniently sampled. The results are therefore not generalisable to all patients with TB.

http://www.sajid.co.za
Conclusion
The CAF results of this pilot study support a modified two-factor structure of the GAD-7 scale. The GAD-7 scale was also found to have construct validity and acceptable internal consistency, implying that it is reliable for use amongst patients with TB. The TB programme in the Free State could explore the feasibility of using the GAD-7 scale as a routine screening tool for GAD. Further validation studies should explore the performance of the GAD-7 compared with other anxiety screening tools under routine or programmatic conditions.

Acknowledgements
The author extends gratitude to the Free State Department of Health at the provincial and district levels for supporting this study. The author further appreciates Dr N. Fouche for assisting with data analysis and Prof. J.C. Heunis for language editing the manuscript.

Competing interests
The author declares that she has no financial or personal relationships that may have inappropriately influenced her in writing this article.

Authors’ contributions
G.K. is the sole author of this research article.

Funding information
This work is based on the research supported by the National Research Foundation of South Africa (Grant Number: 116355). The funder did not contribute to the study design, data collection and writing of the manuscript.

Data availability
The data analysed during this study are not publicly available as individual privacy would otherwise be compromised.

Disclaimer
The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of the affiliated agency of the author.

References
1. World Health Organization (WHO). Depression and other common mental disorders: Global health estimates. Geneva: WHO; 2017.
2. Williams D, Herman A, Stein D, et al. Twelve-month mental disorders in South Africa: Prevalence, service use and demographic correlates in the population based South African stress and health study. Psychol Med. 2008;38(2):211–220. https://doi.org/10.1017/S003329170700420
3. American Psychiatric Association (APA). Diagnostic and statistical manual of mental disorders. 4th ed. Text revision (DSM-IV-TR). Washington, DC: APA; 2000.
4. Vega P, Sweetland A, Acha J, et al. Psychiatric issues in the management of patients with multidrug-resistant tuberculosis. Int J Tuberc Lung Dis. 2004;8(6):749–759.
5. Oluagunju AT, Adeyemi JD, Ogbolu RE, Campbell EA. A study on epidemiological profile of anxiety disorders amongst people living with HIV/AIDS in a sub-Saharan Africa HIV clinic. AIDS Behav. 2012;16(8):2192–2197. https://doi.org/10.1007/s10461-012-0250-x
6. Aggarwal AN. Quality of life with tuberculosis. J Clin Tuberc Other Mycobact Dis. 2019;17:100121. https://doi.org/10.1016/j.jtub.2019.100121
7. Stein DJ. Generalised anxiety disorder. S Afr J Psychol. 2003;33(1):490. https://doi.org/10.4102/sajpsych.v33i1.19390
8. Petersen I, Lund C. Mental health service delivery in South Africa from 2000 to 2010: One step forward, one step back. S Afr Med J. 2011;101(10):751–757.
9. World Health Organization (WHO). Global tuberculosis report 2020. Geneva: WHO; 2020.
10. Pachi A, Bratsi D, Moussas G, Tselis A. Psychiatric morbidity and other factors affecting treatment adherence in pulmonary tuberculosis patients. Tuberc Res Treat. 2013;2013:489665. https://doi.org/10.1155/2013/489665
11. Janse Van Rensburg A, Dube A, Curran R, et al. Comorbidities between tuberculosis and common mental disorders: A scoping review of epidemiological patterns and person-centred care interventions from low-to-middle income and BRICS countries. Infect Dis Poverty. 2020;9(1):4. https://doi.org/10.1186/s13756-019-0261-9
12. Dube B, Gebebehuru A, Ayan G. Prevalence and correlates of depression and anxiety amongst patients with tuberculosis at WolaitaSodo University Hospital and Sodo Health Center, WolaitaSodo, South Ethiopia, cross sectional study. BMC Psychiatry. 2015;15:214. https://doi.org/10.1186/s12888-015-0598-3
13. Kumar K, Kumar A, Chandras P, Kansal HM. A study of prevalence of depression and anxiety in patients suffering from tuberculosis. J Family Med Prim Care. 2016;5(1):150–153. https://doi.org/10.4103/2319-4863.184641
14. Wang KB, Li XL, Zhang Q, et al. A survey of anxiety and depressive symptoms in pulmonary tuberculosis patients in Beijing. Am J Prev Med. 2004;27(4):195–200. https://doi.org/10.1016/j.amepre.2004.08.006
15. Tesfaw G, Ayano G, Awoke T, et al. Prevalence and correlates of depression and anxiety amongst patients with HIV on follow-up at Alert Hospital, Addis Ababa, Ethiopia. BMC Psychiatry. 2016;16(1):368. https://doi.org/10.1186/s12888-016-1037-9
16. Matiala M, Maponya ML, Chigome AK, Meyer HC. Overview of mental health: A public health priority. S Afr Fam Pract. 2018;8(5):46–53.
17. Dube FN, Uys LR. Integrating mental health care services in primary health care clinics: A survey of primary health care nurses’ knowledge, attitudes and beliefs. S Afr Fam Pract. 2016;58(3):119–125. https://doi.org/10.1080/02882509.2016.1197147
18. Sweetland AC, Galea J, Shin SS, et al. Integrating tuberculosis and mental health services: Global receptivity of national tuberculosis program directors. Int J Tuberc Lung Dis. 2019;23(5):600–605. https://doi.org/10.5888/ijtld.19.05030
19. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: The GAD-7. Arch Intern Med. 2006;166(10):1092–1097. https://doi.org/10.1001/archinte.166.10.1092
20. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: Prevalence, impairment, comorbidity, and detection. Ann Intern Med. 2007;146(5):317–325. https://doi.org/10.7326/0003-4819-146-5-200703060-00004
21. Kroenke K, Spitzer RL, Williams JB, Löwe B. The patient health questionnaire somatic, anxiety, and depressive symptom scales: A systematic review. Gen Hosp Psychiatry. 2010;32(4):345–359. https://doi.org/10.1016/j.genhosppsych.2010.03.006
22. Kujanpää T, Ylisaukko-Oja T, Jokelainen J, et al. Prevalence of anxiety disorders amongst Finnish primary care high utilizers and validation of Finnish translation of GAD-7 and GAD-2 screening tools. Scand J Prim Health Care. 2014;32(3):78–83. https://doi.org/10.1080/02813432.2014.920597
23. Chibanda D, Verhey R, Gibson LI, et al. Validation of screening tools for depression and anxiety disorders in a primary care population with high HIV prevalence in Zimbabwe. J Affect Disord. 2016;181:50–55. https://doi.org/10.1016/j.jad.2016.03.006
24. Bártolo A, Monteiro S, Pereira A. Factor structure and construct validity of the generalized anxiety disorder 7-item (GAD-7) amongst Portuguese college students. Cad Saúde Pública. 2017;33(9):e00212716. https://doi.org/10.1590/0021-212716
25. Kim YE, Lee B. The psychometric properties of the generalised anxiety disorder scale (GAD-7) amongst Korean university students. Psychiatr Clin Psychopharmacol. 2019;29(4):864–871. https://doi.org/10.1080/24750573.2019.1691320
26. Adjorlolo S. Generalised anxiety disorder in adolescents in Ghana: Examination of the psychometric properties of the generalised anxiety disorder-7 scale. Afr J Psychol Assess. 2019;1(1):10. https://doi.org/10.4102/ajopa.v1i1.10
27. Plummer F, Manea L, Trepel D, McMillan D. Screening for anxiety disorders with the GAD-7 and GAD-2: A systematic review and diagnostic metaanalysis. Gen Hosp Psychiatry. 2016;39:24–31. https://doi.org/10.1016/j.genhosppsych.2015.11.005
28. Beard C, Björnssonsson T. Beyond generalized anxiety disorder: Psychometric properties of the GAD-7 in a heterogeneous psychiatric sample. J Anxiety Disord. 2014;28(6):547–552. https://doi.org/10.1016/j.janxdis.2014.06.002
29. Nyongesa MK, Mwangi P, Koot HM, Cuijpers P, Newton CRJC, Abubakar A. The reliability, validity and factorial structure of the Swahili version of the 7-item generalized anxiety disorder scale (GAD-7) amongst adults living with HIV from Kilifi, Kenya. Ann Gen Psychiatry. 2020;19:62. https://doi.org/10.4102/ajopa.v19i0.62
30. Budikayanti A, Larasari A, Malik K, Syeban Z, Indrawati LA, Fitri O. Screening of generalized anxiety disorder using a valid and reliable Indonesian version of generalized anxiety disorder-7 (GAD-7). Neurol Res Int. 2019;2019:5902610. https://doi.org/10.1155/2019/5902610
31. Pence BW, Gaynes BN, Atashili J, et al. Validity of an interviewer-administered patient health questionnaire-9 to screen for depression in HIV-infected patients in Cameroon. J Affect Disord. 2022;18:3(3):208–213. https://doi.org/10.1016/j. jad.2022.05.056
32. Bhana A, Rathod SD, Selohilwe O, Kathree T, Petersen I. The validity of the patient health questionnaire for screening depression in chronic care patients in primary health care in South Africa. BMC Psychiatry. 2015;15:118. https://doi.org/10.1186/s12888-015-0503-0

33. Cholera R, Gaynes BN, Pence BW, et al. Validity of the patient health questionnaire-9 to screen for depression in a high HIV burden primary healthcare clinic in Johannesburg, South Africa. J Affect Disord. 2014;167:160–166. https://doi.org/10.1016/j.jad.2014.06.003

34. Kigozi G. Confirmatory factor analysis of the patient health questionnaire-9: A study amongst tuberculosis patients in the Free State province. S Afr J Infect Dis. 2020;35(1):a242. https://doi.org/10.4102/sajid.v35i1.242

35. IBM Corp. IBM SPSS statistics for Windows, version 27.0. Armonk, NY: IBM Corp, 2020.

36. Rosseel Y. Iavaan: An R package for structural equation modeling. J Stat Softw. 2012;48(2):1–36. https://doi.org/10.18637/jss.v048.i02

37. R Core Team. R: A language and environment for statistical computing [homepage on the Internet]. Vienna: R Foundation for Statistical Computing; 2016 [cited 2021 May 03]. Available from: https://www.R-project.org/

38. Boothroyd L, Dagnan D, Muncer S. Psychometric analysis of the generalized anxiety disorder scale and the patient health questionnaire using Mokken scaling and confirmatory factor analysis. Health Prim Care. 2018;24(4):1–4. https://doi.org/10.15761/HPC.1000145

39. Van Ginneken N, Tharyan P, Lewin S, et al. Non-specialist health worker interventions for the care of mental, neurological and substance-abuse disorders in low- and middle-income countries. Cochrane Database Syst Rev. 2013;(11):CD009149. https://doi.org/10.1002/14651858.CD009149.pub2

40. Akena D, Joska J, Obuku EA, Amos T, Musisi S, Stein DJ. Comparing the accuracy of brief versus long depression screening instruments which have been validated in low and middle income countries: A systematic review. BMC Psychiatry. 2012;12:187. https://doi.org/10.1186/1471-244X-12-187