



SAPIENZA
UNIVERSITÀ EDITRICE

Work published in open access form
and licensed under Creative Commons
Attribution – NonCommercial
ShareAlike 4.0 International (CC BY-NC-SA 4.0)

© Author(s)
E-ISSN 2724-2943
ISSN 2723-973X

Psychology Hub (2026)
XLIII, 2, 77-84

Article info

Submitted: 18 March 2026
Accepted: 08 June 2026
DOI: 10.13133/2724-2943/19303

Preliminary Psychometric Evaluation of the Kessler Psychological Distress Scale (K10) in a Mozambican Sample: Evidence on Internal Structure and Reliability

Filippo Cellucci^{1*}, Maria Ossumane³, Fernando Siteo⁴, Yolanda Marcelino⁵, José Chacatoma³, Cesar Palha de Sousa⁴, Jahit Sacarlal⁴, Valeria Carola^{1, 2 #} & Giampaolo Nicolais^{1 #}

¹ Department of Dynamic and Clinical Psychology, and Health Studies, Sapienza University of Rome, Rome, Italy

² IRCCS Santa Lucia Foundation, Rome, Italy

³ Hospital Central de Maputo, Maputo, Mozambique

⁴ Faculty of Medicine, Eduardo Mondlane University, Maputo, Mozambique

⁵ University Clinic, Eduardo Mondlane University, Maputo, Mozambique

These authors contributed equally to this work

Abstract

The Kessler Psychological Distress Scale (K10) is a widely used self-report instrument for assessing psychological distress, particularly symptoms of anxiety and depression. Although the scale has been extensively validated in Western populations, evidence from sub-Saharan African contexts remains limited. The present study aimed to provide a preliminary psychometric evaluation of the K10 in a Mozambican sample, focusing on its factor structure and score reliability. A total of 224 participants, including medical students, trainees, and residents, completed the K10. Confirmatory factor analyses were conducted using the WLSMV estimator for ordinal data to test different measurement models, including a unidimensional model, a correlated two-factor model, a second-order hierarchical model, and a bifactor model. Internal consistency was assessed using Cronbach's alpha and McDonald's omega. The unidimensional model showed poor fit, whereas the correlated two-factor model provided the most interpretable representation of the data. The second-order model showed comparable fit but presented estimation problems, and the bifactor model did not converge. Reliability analyses indicated good internal consistency for the total score and adequate-to-good reliability for the subscales. These findings provide preliminary evidence that the K10 is a reliable instrument with a meaningful internal structure in this Mozambican sample. Further research is needed to examine external validity and to confirm these results in more diverse populations.

Keywords: Kessler Psychological Distress Scale; psychological distress; confirmatory factor analysis; reliability; Mozambican Portuguese

*Corresponding author.

Filippo Cellucci
Department of Dynamic and Clinical
Psychology, and Health Studies,
Sapienza University of Rome,
Rome, Italy
E-mail: filippo.cellucci@uniroma1.it
(F. Cellucci)

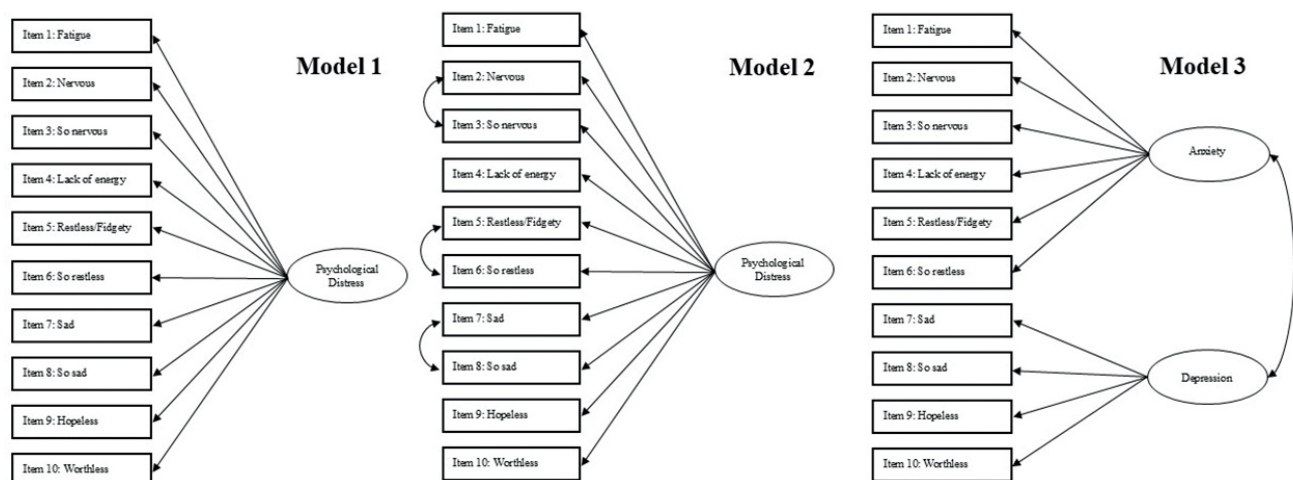
Introduction

The Kessler Psychological Distress Scale (K10), developed in the United States (Kessler et al., 2002), is a self-report instrument designed to measure nonspecific psychological distress, focusing on anxious and depressive symptoms experienced over the past 30 days. The scale assesses subjective experiences of sadness, nervousness, restlessness, feelings of worthlessness, and perceived excessive effort in daily activities, without distinguishing between specific diagnoses (Kessler et al., 2002). As the K10 assesses the level of distress without linking symptoms to specific diagnoses, it has been widely adopted for screening purposes and in population-based research. Studies conducted in various languages and cultural contexts have also shown good reliability (Wojujutari & Idemudia, 2024). However, a review highlights that the evidence regarding the validity and cultural equivalence of the K10 (or its 6-item version) in culturally diverse populations is limited (Stolk et al., 2014). Although initially considered unidimensional (Kessler et al., 2002), international studies have highlighted variable factorial structures, with unidimensional models in the general population and multifactorial models in clinical samples (Brooks et al., 2006; Kessler et al., 2002; Sunderland et al., 2012; Thelin et al., 2017). Notably, a study reported that a clearer bidimensional pattern emerges in clinical samples (Sunderland et al., 2012). In contrast, the apparent unidimensionality observed in the community samples may partly reflect methodological factors that artificially increase the interdependence between items (Sunderland et al., 2012). From a content standpoint, the K10 includes symptom expressions that can be meaningfully partitioned into anxious and depressive components. Depressive manifestations typically reflect fatigue, sadness, worthlessness, and difficulty carrying out daily activities, while anxiety manifestations reflect persistent nervousness, restlessness, and tension that is difficult to relieve (Kessler et al., 2002; Onger et al., 2022). In line with this conceptual distinction, international investigations have documented heterogeneous factorial models. For example, in South Africa, alternative structures including a four-factor solution have been explored, although the final model retained by the authors was a unidimensional solution with

correlated errors (Hoffman et al., 2022). In other contexts, studies conducted on Portuguese-speaking populations have highlighted the presence of a strong component of general distress, accompanied by related symptomatic dimensions. For example, research carried out on Brazilian university students provided evidence of a robust factor of general distress underlying responses to the K10 (Perrelli et al., 2024), whereas studies validating the lusophone version have confirmed the reliability of multidimensional structures, including related factors of anxiety and depression (Pereira et al., 2019). In general, recent large-scale psychometric studies continue to emphasise that K10 structure should not be assumed to remain unchanged across different contexts (Ametaj et al., 2024; Wang et al., 2025). In particular, recent research conducted on African samples, such as those from Ethiopia (Milkias et al., 2022), Kenya (Onger et al., 2022), Uganda (Naisanga et al., 2022) and South Africa (Hoffman et al., 2022), suggests that the structure of K10 varies depending on the context, making formal comparisons between alternative models necessary (Ametaj et al., 2024). The conceptual representations of the factor structures most frequently analysed in the literature are shown in *Figure 1*. In many low- and middle-income countries, including Mozambique, access to mental health services remains limited (Benoni et al., 2025), and screening tools that enable the rapid identification of psychological distress can play an important role. In particular, brief screening tools, such as the K10, are valuable in high-demand environments such as healthcare and training environments. Despite this need, psychometric data on widely used screening tools for psychological distress remains limited in the Mozambican population (Lovero et al., 2022).

Taken together, these findings suggest that, in cultural contexts that have been poorly studied, the latent structure of K10 should be tested empirically, rather than being regarded as unidimensional. In the present study, we evaluated the latent structure of the K10 in a Mozambican sample by comparing competing confirmatory factor analytic models that have been most frequently discussed in the literature: a unidimensional distress model, a two-factor model reflecting correlated anxiety and depression dimensions, and a hierarchical (second-order) model in which the two first-order factors load on a

Fig. 01. Conceptual representations of the K-10 factor structures most frequently analysed in the literature



general distress factor. In addition, given the previous findings suggesting the presence of both general and multidimensional structures in Portuguese-speaking contexts (Pereira et al., 2019; Perrelli et al., 2024), we also explored a bifactor specification to evaluate whether a general distress factor and orthogonal group factors could be simultaneously supported in this sample. On the basis of the retained measurement solution, we further examined score reliability for the K10 total score and for the anxiety and depression subscales using internal consistency indices (Cronbach's α and McDonald's ω). This approach allows the structural validity and score reliability of the K10 to be evaluated within a cultural context where psychometric evidence remains limited.

Methods

Participants

The study sample consisted of 224 participants, of whom 184 were women (82.14%) and 40 were men (17.86%). The mean age of female participants was 22.78 years ($SD = 4.50$; range = 18–45), while the mean age of male participants was 21.95 years ($SD = 4.51$; range = 18–35). No missing data were reported regarding gender, age or survey completion. Participants were recruited through convenience sampling from three groups in Mozambique: (a) university students from the Faculty of Medicine at Faculdade de Medicina – Universidade Eduardo Mondlane, (b) intermediate-level students engaged in practical internships at the Central Hospital of Maputo, and (c) medical residents at the UEM University Clinic. Inclusion criteria were being aged 18 years or older and providing complete responses to the K10 questionnaire.

Instruments

To assess non-specific psychological distress, focusing on symptoms of anxiety and depression experienced over the past 30 days, the Mozambican Portuguese (MP) translated version of the Kessler Psychological Distress Scale (K10) was used (Kessler et al., 2002), as shown in Table 1. The scale consists of 10 items rated on a 5-point Likert scale ranging from 0 ('never') to 4 ('always'). In the present study, responses to the items are summed to obtain a total score, where higher scores indicate greater levels of psychological distress (Kessler et al., 2002; Ongeri et al., 2022). Furthermore, the distinction between anxiety and depression related symptoms was examined at a latent level through confirmatory factor analysis, rather than through separate assessment procedures.

Procedure

The data were collected via an online survey conducted using Google Forms. Participation was voluntary and no incentives were offered. The questionnaire was designed to ensure complete anonymity, and no identifying information was collected. Before accessing the survey, participants were

informed about the study's objectives and procedures, and informed consent was obtained in electronic format. The study was approved by the Institutional Bioethics Committee for Health of the Faculty of Medicine / Maputo Central Hospital (CIBS FM&HCM). The research protocol was reviewed and approved (protocol number: CIBSFM&HCM/32/2025), in accordance with institutional ethical guidelines for research involving human participants. The K10 was administered in MP. The translation used in this study was based on the existing English version (Kessler et al., 2002) and was reviewed by bilingual individuals with a good understanding of the local context to ensure linguistic clarity and cultural appropriateness. The final version was considered suitable for use in the target population. The translated items are shown in Table 1.

Tab. 1. MP Kessler Psychological Distress Scale items translation

Item	Original version (English)	Mozambican Portuguese translation
1	...tired out for no reason?	...cansado/a sem um motivo válido?
2	...nervous?	...nervoso/a?
3	...so nervous that nothing calms you down?	...tão nervoso/a que nada conseguia acalmá-lo/a?
4	...hopeless?	...sem esperança?
5	...restless or fidgety?	...inquieta/o ou com dificuldade em manter braços e pernas parados?
6	...so restless you could not sit still?	...tão inquieto/a que não conseguia ficar sentado/a?
7	...depressed?	...deprimido/a?
8	...so depressed that nothing could cheer you up?	...tão deprimido/a que nada conseguia animá-lo/a?
9	...that everything was an effort?	...como se tudo fosse um esforço?
10	...worthless?	...inútil?

Note. English items are adapted from the original version (Kessler et al., 2002)

Data analysis

All analyses were conducted using the lavaan package in R (0.6-19; Rosseel, 2012) for confirmatory factor analysis (CFA) and the psych package for reliability estimation. The dataset included responses from 224 participants on the MP version of the K10 items (IT1–IT10), each rated on a 5-point Likert-type scale. Given the ordinal nature of the items, K10 responses were treated as ordered categorical variables in CFA.

CFA was used to test alternative factorial solutions of the K10 in the MP version. Model estimation relied on a weighted least squares approach for ordinal data, implemented in lavaan as DWLS with a mean- and variance-adjusted test statistic (WLSMV). This estimator is recommended for Likert-type ordinal indicators because it does not assume multivariate normality and is based on polychoric correlations and threshold estimation (Brown, 2015; Flora & Curran, 2004).

Four theoretically informed models were evaluated: a) *unidimensional model*, specifying a single latent factor (distress) loading on all 10 items (IT1–IT10); b) a *two-factor correlated model*, specifying two first-order correlated factors representing anxiety (IT2, IT3, IT5, IT6) and depression (IT1, IT4, IT7, IT8, IT9, IT10); c) a *second-order (hierarchical) model*, in which the same two first-order factors (anxiety and depression) were specified as indicators of a higher-order distress factor; and d) a *bifactor model*, including a general factor (distress) loading

on all 10 items, plus two orthogonal specific factors (anxiety and depression) loading on their respective subsets of items. Orthogonality constraints were imposed between the general and specific factors and between the two specific factors. Model fit was assessed using multiple complementary indices: the Comparative Fit Index (*CFI*), the Tucker–Lewis Index (*TLI*), the Root Mean Square Error of Approximation (*RMSEA*) with its 90% confidence interval, and the Standardized Root Mean Square Residual (*SRMR*). Consistent with common recommendations, values of $CFI/TLI \geq .90$ –.95, $RMSEA \leq .08$, and $SRMR \leq .08$ were considered indicative of acceptable-to-good fit. These thresholds, however, should be interpreted as guidelines rather than strict limits (Hu & Bentler, 1999). Standardized factor loadings (*Std.all*) were inspected to evaluate the strength and interpretability of item–factor relations.

Given the complexity of higher-order and bifactor specifications under ordinal estimation, model identification and convergence were also explicitly monitored. For the *hierarchical model*, lavaan indicated that the information matrix could not be inverted and therefore standard errors could not be computed, suggesting potential identification instability. For the *bifactor model*, the optimizer did not reach a stable solution and the model failed to converge, leading to unreliable parameter estimates. Therefore, this model was not interpreted.

Internal consistency was evaluated for the total K10 score and for the anxiety and depression subscales. Two complementary indices were reported: Cronbach’s alpha (α), computed on the observed item responses for comparability with previous studies, and McDonald’s omega total (ω), estimated using the psych package with polychoric correlations to better account for ordinal measurement and to provide a more robust estimate of scale reliability (Dunn et al., 2014). Omega was estimated separately for the total K10 (10 items), the anxiety subscale (4 items), and the depression subscale (6 items). Because the bifactor solution did not converge, hierarchical omega indices were not interpreted. Therefore, reliability reporting focused on α and ω total only for the total score and the two subscales.

Results

Descriptive statistics

Table 2 summarizes descriptive statistics for all items and latent dimensions of the MP version of the Kessler Psychological Distress Scale (K-10).

Tab. 2. Means, standard deviations, skewness, and kurtosis for the items of the MP version of the Kessler Psychological Distress Scale (K-10), for the anxiety and depression subscale scores, and for the total score.

Variable	M	SD	Skewness	Kurtosis
Item 1	1.75	1.12	0.140	-0.786
Item 2	1.66	0.980	0.407	-0.165
Item 3	0.705	0.929	1.260	0.975
Item 4	1.21	1.27	0.721	-0.622
Item 5	1.22	1.16	0.763	-0.222
Item 6	0.589	0.938	1.630	1.890
Item 7	1.19	1.17	0.782	-0.244

Variable	M	SD	Skewness	Kurtosis
Item 8	0.714	1.05	1.420	1.120
Item 9	1.67	1.28	0.334	-0.904
Item 10	0.938	1.24	1.150	0.129
Anxiety	4.17	3.13	1.170	0.968
Depression	7.48	5.16	0.752	-0.151
Total score	11.70	7.35	0.863	0.268

Note. M = mean; SD = standard deviation; Skewness = skewness coefficient; Kurtosis = kurtosis coefficient.

Factor Structure

Confirmatory factor analyses (CFA) were conducted on the MP translated version of the K10 items using the WLSMV estimator, appropriate for ordered categorical data. Three theoretically grounded measurement models were tested: a *unidimensional model* reflecting general psychological distress; a *two-factor correlated model* comprising anxiety (IT2, IT3, IT5, IT6) and depression (IT1, IT4, IT7, IT8, IT9, IT10); and a *hierarchical model* in which anxiety and depression loaded onto a higher-order Distress factor. A *bifactor model* was also examined but did not converge and was therefore not considered further. Model fit indices for all estimable models are reported in Table 3. The *unidimensional model* demonstrated poor fit to the data, $\chi^2(35) = 237.99$, $CFI = .949$, $TLI = .934$, $RMSEA = .161$ (90% CI [.142; .181]), $SRMR = .108$, indicating that a single latent factor did not adequately account for item covariation. The *two-factor correlated model* showed a substantial improvement in fit, $\chi^2(34) = 106.03$, $CFI = .982$, $TLI = .976$, $RMSEA = .097$ (90% CI [.077; .119]), $SRMR = .074$, supporting a multidimensional structure of psychological distress, although $RMSEA$ remained above conventional thresholds. The *hierarchical model* yielded a comparable overall fit, $\chi^2(33) = 106.03$, $CFI = .982$, $TLI = .975$, $RMSEA = .100$ (90% CI [.079; .121]), $SRMR = .074$; however, standard errors for this model could not be estimated due to identification issues, limiting its interpretability. Given the absence of estimation problems and its conceptual clarity, the *two-factor correlated model* was retained as the most appropriate representation of the K10 factor structure in the present sample. In this model, all items loaded significantly on their respective latent factors, with standardized loadings ranging from .63 to .91 for Anxiety and from .58 to .91 for Depression (see Table 4). The two latent factors were strongly and positively correlated ($r = .67$, $p < .001$), indicating substantial shared variance while supporting their distinction as related dimensions of psychological distress.

Tab. 3. Model fit indices for the MP version of the K10 models

Model	χ^2	df	CFI	TLI	RMSEA	RMSEA 90% CI			SRMR
						Lower	Upper		
Unidimensional	237.99	35	.949	.934	.161	.142	.181		.108
Correlated two-factor	106.03	34	.982	.976	.097	.077	.119		.074
Second-order	106.03	33	.982	.975	.100	.079	.121		.074
Bifactor	—	—	—	—	—	—	—		—

Note. WLSMV = weighted least squares mean and variance adjusted estimator, used for ordered categorical items (five response options). χ^2

= chi-square test statistic; df = degrees of freedom; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; CI = confidence interval; SRMR = standardized root mean square residual. The 90% confidence interval for RMSEA is reported as lower and upper limits.

Tab. 4. Standardized factor loadings for the correlated two-factor model of the MP version of the K10

Factor	Item	Standardized loading	SE	z	p
Anxiety	IT2	.748	—	—	—
Anxiety	IT3	.913	.078	15.724	< .001
Anxiety	IT5	.631	.076	11.143	< .001
Anxiety	IT6	.807	.071	15.137	< .001
Depression	IT1	.595	—	—	—
Depression	IT4	.668	.108	10.430	< .001
Depression	IT7	.857	.123	11.725	< .001
Depression	IT8	.911	.125	12.243	< .001
Depression	IT9	.584	.106	9.308	< .001
Depression	IT10	.687	.113	10.256	< .001

Note. Factor correlation (anxiety–depression): $r = .665$, $SE = .036$, $z = 8.234$, $p < .001$.

Score Reliability

Internal consistency of the MP translated version of the Kessler Psychological Distress Scale was evaluated for both the total score and the two dimensions identified by the correlated two-factor model. Reliability estimates were computed using Cronbach's alpha (α) and McDonald's omega total (ω_t), with omega coefficients based on polychoric correlations to account for the ordinal nature of the items. The MP version of the K10 total score demonstrated good internal consistency, with Cronbach's $\alpha = .852$ and $\omega_t = .886$, indicating that the scale provides a reliable overall index of psychological distress in the present sample. These values exceed commonly accepted thresholds for acceptable (.70) and good (.80) reliability, potentially supporting the use of the total score for research and screening purposes. Reliability estimates for the two subscales were also satisfactory. The anxiety subscale showed adequate-to-good internal consistency ($\alpha = .782$, $\omega_t = .835$), whereas the depression subscale exhibited good reliability ($\alpha = .814$, $\omega_t = .858$). Across both subscales, omega coefficients were slightly higher than the corresponding alpha values, suggesting that reliability estimates based on a latent variable framework may provide a more accurate representation of true-score variance.

Taken together, these findings indicate that the K10 yields reliable scores at both the total and subscale levels. In line with the results of the confirmatory factor analyses, which supported a correlated two-factor structure, the reliability results further justify the interpretation of anxiety and depression subscale scores alongside the overall psychological distress score. A summary of internal consistency coefficients for the total scale and subscales is reported in Table 5.

Tab. 5. Internal consistency estimates for the MP version of the K10 total score and subscales

Scale	Cronbach's α	McDonald's ω_t
K10 total	.852	.886
Anxiety	.782	.835
Depression	.814	.858

Note. α = Cronbach's alpha; ω_t = McDonald's omega total.

Discussion

This study examined the latent structure and reliability of the MP version of the Kessler Psychological Distress Scale scores in a Mozambican sample, in response to previous evidence suggesting that the factor structure of the K10 may vary across populations and cultural contexts and should therefore be assessed empirically rather than taken for granted a priori (Brooks et al., 2006; Kessler et al., 2002; Sunderland et al., 2012; Thelin et al., 2017; Wang et al., 2025). In line with this reasoning, the present results suggest that a single factor of general distress did not adequately capture the covariance structure among the items, whereas a multidimensional representation, specifically the two-factor correlated model, provided the most appropriate and interpretable solution among the estimable models. The unidimensional CFA model showed poor fit, indicating that the MP items of the K10 did not function as indicators of a single homogeneous latent construct in this sample. In contrast, the correlated two-factor model, representing anxiety and depression, showed a substantial improvement in fit and produced strong, interpretable standardised loadings in both domains. At the same time, it should be noted that the RMSEA remained above conventional thresholds, suggesting that the model should be considered the most interpretable solution in relative rather than absolute terms. Importantly, RMSEA values may be influenced by specific model characteristics, including the number of degrees of freedom, and previous evidence suggests that RMSEA may overestimate model misfit in models with relatively small degrees of freedom (Kenny et al., 2015). Therefore, RMSEA values should be interpreted alongside other fit indices and the theoretical interpretability of the measurement model. This pattern is consistent with the conceptual content of the K10, which includes symptomatic expressions that can be meaningfully differentiated into anxious and depressive manifestations (Ongeri et al., 2022). It is also in line with previous studies indicating that correlated two-factor solutions may emerge depending on the characteristics of the sample and the study context, particularly when psychological distress is expressed through partially distinguishable affective and arousal-related components (Sunderland et al., 2012). It is important to emphasise that the anxiety and depression factors were strongly correlated ($r = 0.67$), indicating substantial shared variance while remaining empirically distinguishable. This finding is theoretically consistent with the concept of non-specific psychological distress as a broader domain in which anxiety and depressive symptoms often co-occur. From a practical perspective, the strength of this association suggests that the K10 may still function effectively as a comprehensive screening measure, but the distinction between the two correlated dimensions may offer additional interpretative value when the aim is to characterise the pattern of symptoms rather than just overall severity. The second-order hierarchical model provided fit indices comparable to those of the two-factor correlated model, which is not surprising given that such models can reproduce similar covariance structures when first-order factors are highly correlated. However, the inability to estimate standard errors for the hierarchical model indicated an identification instability in the present dataset, substantially

limiting its interpretability. Under these conditions, retaining the two-factor correlated model represents the most defensible option, as it combines conceptual clarity and statistical estimability and supports interpretation at the level of two psychologically meaningful latent dimensions. A bifactor model was also examined, in light of previous findings suggesting the presence of both general and multidimensional structures in Portuguese-speaking contexts (Pereira et al., 2019; Perrelli et al., 2024). In the present study, however, the bifactor model failed to converge, indicating that the simultaneous estimation of a general factor and orthogonal cluster factors was not empirically supported under the current conditions. From a practical perspective, this failure to converge cautions against drawing conclusions regarding essential unidimensionality in this sample. Instead, it reinforces the importance of focusing on estimable CFA solutions, amongst which the two-factor correlated model provided the most stable and interpretable representation of the data. Reliability estimates confirmed the utility of the K10 both as a total score and as scores for the two subscales (anxiety and depression). The total score showed good internal consistency ($\alpha = 0.852$; $\omega_{\text{total}} = 0.886$), in line with previous literature documenting adequate reliability of the K10 in various contexts (Wojujutari & Idemudia, 2024). Reliability at the subscale level was also found to be adequate to good (anxiety: $\alpha = 0.782$, $\omega_{\text{total}} = 0.835$; Depression: $\alpha = 0.814$, $\omega_{\text{total}} = 0.858$). The fact that the omega coefficients were consistently higher than the alpha coefficients is not unexpected, as omega is based on less restrictive assumptions than alpha and can provide a more appropriate estimate of the reliability of the score when item loadings are not equivalent across indicators, as appears plausible in the present measurement solution. Taken together, these findings provide a preliminary guidance for the practical use of the K10 in the Mozambican context. Firstly, the total K10 score of the MP version appears suitable for general screening for psychological distress and for research purposes in Mozambican samples similar to that of the present study. Secondly, when the aim is to describe the pattern of symptoms in greater detail, interpreting the scores on the anxiety and depression subscales may be justified, provided that their strong intercorrelation is taken into account and that small differences between subscale scores are not overinterpreted. Overall, the present results provide preliminary evidence that the MP translation of the K10 yields structurally interpretable and internally consistent scores in this specific Mozambican sample, whilst highlighting the importance of empirically assessing its measurement structure in under-researched cultural contexts.

Limitations

These findings should be interpreted in light of several limitations. First, this study was designed as a preliminary psychometric investigation and was based on a single, relatively small Mozambican sample. Although the results provide initial evidence supporting the internal structure and reliability of the K10 in this context, replication using independent and more heterogeneous samples is required before definitive conclusions regarding its generalisability can

be drawn. In addition, the sample was not designed to be fully representative of the general Mozambican population, which may limit the external validity of the findings. Moreover, data collection was conducted through an online survey, which may have introduced an additional sampling bias. Specifically, individuals without internet access or with limited digital literacy may have been less likely to participate, potentially reducing the representativeness of the sample. Future studies should aim to include samples that are more heterogeneous in terms of sociodemographic characteristics and clinical status, to assess the robustness of the observed factor structure across different subgroups. Furthermore, although the two-factor correlated model emerged as the most interpretable solution among the estimable models, the model fit was not optimal across all indices, with RMSEA values exceeding conventional thresholds. This suggests that the proposed structure should be interpreted with caution and may not fully capture the complexity of the underlying construct in this sample. The bifactor model also failed to achieve convergence, preventing the assessment of a general factor alongside the specific dimensions. Whilst this may reflect the characteristics of the current dataset, it also limits conclusions regarding the potential intrinsic unidimensionality of the K10 in this context. We also emphasise that the scope of the analyses was limited to internal structure and internal consistency. Other important aspects of validity were not assessed, including measurement invariance across key demographic groups (gender and age), convergent and discriminant validity with related constructs, and criterion validity against clinical indicators or functional impairment. Despite these limitations, the present study provides an important initial quantitative contribution to the assessment of psychological distress in Mozambique. By offering a preliminary measurement framework based on CFA, these findings may inform future research and support the development of culturally appropriate screening and assessment practices in both clinical and community settings.

Conclusion

The present study provides preliminary psychometric evidence for the use of the MP version of the Kessler Psychological Distress Scale (K10) in a Mozambican sample. These findings suggest that, in this specific sample, psychological distress is more adequately represented by two correlated dimensions, anxiety and depression, than by a strictly unidimensional structure. At the same time, the good reliability of the total score supports its use as a global indicator of psychological distress severity. Overall, these results offer an initial measurement framework for the K10 in an under-studied cultural context and may inform future validation studies, as well as research and screening applications in Mozambique and similar settings.

Ethical Approval

The study was approved by the Institutional Bioethics Committee for Health of the Faculty of Medicine / Maputo Central Hospital (CIBS FM&HCM). The research

protocol was reviewed and approved (protocol number: CIBSFM&HCM/32/2025), which oversaw compliance with international research ethics standards.

Data Availability Statement

The datasets generated and analysed during the current study are available from the corresponding author (Dr. Filippo Cellucci) on reasonable request. The data are de-identified to preserve participant anonymity and are stored on secure institutional servers.

Funding

This work was supported by the international collaboration project “Development of a clinical psychological intervention protocol at the University Hospital of Maputo (Mozambique)” (D.R. No. 1110/2024, May 15, 2024).

Conflict of Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author Contributions

F.C.: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing.

M.O.: Data curation, Investigation, Writing – review & editing.

F.S.: Data curation, Investigation, Writing – review & editing.

Y.M.: Data curation, Investigation, Writing – review & editing.

J.C.: Data curation, Investigation, Writing – review & editing.

C.S.: Data curation, Investigation, Writing – review & editing.

J.S.: Data curation, Investigation, Writing – review & editing.

V.C.: Conceptualization, Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing.

G.N.: Conceptualization, Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Supplementary material

Not applicable.

Declaration about the use of generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, AI-assisted tools were used exclusively for language editing and improvement of the clarity and readability of the English text. No AI tools were used for scientific content generation, data analysis, or interpretation of results. All AI-assisted revisions were critically reviewed and approved by the authors, who take full responsibility for the final manuscript.

Acknowledgments

The authors gratefully acknowledge Prof. Marco Lauriola, Dr. Gaia Ciccia, and Dr. Giorgia Faiella for their valuable scientific support and insightful contributions during the development of this research. The authors also thank all participants for their time and valuable contribution to the study.

References

- Ametaj, A. A., Denckla, C. A., Stevenson, A., Stroud, R. E., Hall, J., Onger, L., Milkias, B., Hoffman, J., Naisanga, M., Akena, D., Kyebuzibwa, J., Kwobah, E. K., Atwoli, L., Gichuru, S., Teferri, S., Alemayehu, M., Zingela, Z., Stein, D. J., Pretorius, A., ... Gelaye, B. (2024). Cross-cultural equivalence of the Kessler Psychological Distress Scale (K10) across four African countries in a multi-national study of adults. *SSM - Mental Health*, 5, 100300. <https://doi.org/10.1016/j.ssmmh.2024.100300>
- Benoni, R., Sartorello, A., Malesani, C., Giannini, D., Cardoso, H., Ngozo, D., Atzori, A., Censi, V., Alamo, C., Namarime, E., Tognon, F., Putoto, G., & Gatta, M. (2025). Barriers and facilitators to accessing mental health services among young people living with HIV and healthcare professionals in Mozambique: A content and sentiment analysis using the capability, opportunity, motivation and behaviour (COM-B) framework. *BMC Public Health*, 25(1), 1736. <https://doi.org/10.1186/s12889-025-22695-3>
- Brooks, R. T., Beard, J., & Steel, Z. (2006). Factor structure and interpretation of the K10. *Psychological Assessment*, 18(1), 62–70. <https://doi.org/10.1037/1040-3590.18.1.62>
- Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). The Guilford Press.
- Dunn, T. J., Baguley, T., & Brunsden, V. (2014). From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. *British Journal of Psychology*, 105(3), 399–412. <https://doi.org/10.1111/bjop.12046>
- Flora, D. B., & Curran, P. J. (2004). An Empirical Evaluation of Alternative Methods of Estimation for Confirmatory Factor Analysis With Ordinal Data. *Psychological Methods*, 9(4), 466–491. <https://doi.org/10.1037/1082-989X.9.4.466>
- Hoffman, J., Cossie, Q., Ametaj, A. A., Kim, H. H., James, R., Stroud, R. E., Stevenson, A., Zingela, Z., Stein, D. J., & Gelaye, B. (2022). Construct validity and factor structure of the Kessler-10 in South Africa. *BMC Psychology*, 10(1), 177. <https://doi.org/10.1186/s40359-022-00883-9>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Kenny, D. A., Kaniskan, B., & McCoach, D. B. (2015). The performance of RMSEA in models with small degrees of freedom. *Sociological methods & research*, 44(3), 486–507. <https://doi.org/10.1177/0049124114543236>
- Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S.-L. T., Walters, E. E., & Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine*, 32(6), 959–976. <https://doi.org/10.1017/S0033291702006074>
- Lovero, K. L., Adam, S. E., Bila, C. E., Canda, E. D., Fernandes, M. E., Rodrigues, T. I. B., Sander, M. C. T., Mellins, C. A., Duarte, C. S., Dos Santos, P. F., & Wainberg, M. L. (2022). Validation of brief screening instruments for internalizing and externalizing disorders in Mozambican adolescents. *BMC*

- Psychiatry*, 22(1), 549. <https://doi.org/10.1186/s12888-022-04189-3>
- Milkias, B., Ametaj, A., Alemayehu, M., Girma, E., Yared, M., Kim, H. H., Stroud, R., Stevenson, A., Gelaye, B., & Teferra, S. (2022). Psychometric properties and factor structure of the Kessler-10 among Ethiopian adults. *Journal of Affective Disorders*, 303, 180–186. <https://doi.org/10.1016/j.jad.2022.02.013>
- Naisanga, M., Ametaj, A., Kim, H. H., Newman, C., Stroud, R., Gelaye, B., & Akena, D. (2022). Construct validity and factor structure of the K-10 among Ugandan adults. *Journal of Affective Disorders*, 311, 143–147. <https://doi.org/10.1016/j.jad.2022.05.022>
- Ongeri, L., Ametaj, A., Kim, H., Stroud, R. E., Newton, C. R., Kariuki, S. M., Atwoli, L., Kwobah, E., & Gelaye, B. (2022). Measuring psychological distress using the K10 in Kenya. *Journal of Affective Disorders*, 303, 155–160. <https://doi.org/10.1016/j.jad.2022.02.012>
- Pereira, A., Oliveira, C. A., Bártolo, A., Monteiro, S., Vagos, P., & Jardim, J. (2019). Reliability and Factor Structure of the 10-item Kessler Psychological Distress Scale (K10) among Portuguese adults. *Ciência & Saúde Coletiva*, 24(3), 729–736. <https://doi.org/10.1590/1413-81232018243.06322017>
- Perrelli, J. G. A., Vasconcelos, G. V. S. D., Correia E Sá, J. R., Medeiros, P. F. P. D., Uchôa, R., & Sanchez, Z. (2024). Validity of the Kessler Psychological Distress scale in Brazilian higher education students. *Revista Latino-Americana de Enfermagem*, 32, e4254. <https://doi.org/10.1590/1518-8345.7073.4254>
- Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modeling. *Journal of Statistical Software*, 48(2), 1–36. <https://doi.org/10.18637/jss.v048.i02>
- Stolk, Y., Kaplan, I., & Szwarc, J. (2014). Clinical use of the Kessler psychological distress scales with culturally diverse groups. *International Journal of Methods in Psychiatric Research*, 23(2), 161–183. <https://doi.org/10.1002/mpr.1426>
- Sunderland, M., Mahoney, A., & Andrews, G. (2012). Investigating the Factor Structure of the Kessler Psychological Distress Scale in Community and Clinical Samples of the Australian Population. *Journal of Psychopathology and Behavioral Assessment*, 34(2), 253–259. <https://doi.org/10.1007/s10862-012-9276-7>
- Thelin, C., Mikkelsen, B., Laier, G., Turgut, L., Henriksen, B., Olsen, L. R., Larsen, J. K., & Arnfred, S. (2017). Danish translation and validation of Kessler's 10-item psychological distress scale – K10. *Nordic Journal of Psychiatry*, 71(6), 411–416. <https://doi.org/10.1080/08039488.2017.1312517>
- Wang, Y., Zeng, Z., Huang, C., Ma, J., Ye, J., Li, J., Deng, X., & Zhang, L. (2025). Large-scale validation of the Kessler-10 Scale's psychometric properties among healthcare professionals in China. *General Hospital Psychiatry*, 94, 112–117. <https://doi.org/10.1016/j.genhosppsych.2025.02.017>
- Wojujutari, A. K., & Idemudia, E. S. (2024). Consistency as the Currency in Psychological Measures: A Reliability Generalization Meta-Analysis of Kessler Psychological Distress Scale (K-10 and K-6). *Depression and Anxiety*, 2024(1), 3801950. <https://doi.org/10.1155/2024/3801950>