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Reliability and Factor Structure of the 10-item Kessler Psychological Distress Scale (K10) among Portuguese adults

Confiabilidade e Estrutura Fatorial da Escala de Distress Psicológico de Kessler de 10 itens (K10) entre adultos Portugueses

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Abstract *The 10-item Kessler Psychological Distress Scale (K10) has been presented as a valid measure to assess psychological distress levels in population surveys but its dimensional structure was not consensual. Our main objective was to provide a Portuguese version of the K10 exploring the reliability and factor structure of this measure. This cross-sectional study included 694 adults collected from a web-based survey and in training entities. Results showed that 37.9% of the individuals reported significant distress symptoms. A good internal consistency of the K10 scale (α=.91) and strong inter-item correlation (ranges from .350 to .659) were found in our study but the original one-dimensional structure was not confirmed. A two-factor model considering anxiety and depression as two latent, independent but correlated factors shows a good fit with the data even across two data collection methods. The K10 tool was sensitive to sociodemographic variables. Participants aged 40 or over and belonging to the general working class presented higher distress levels. Our data indicates the Portuguese version of K10 as a reliable tool with a factor structure to assess psychological distress.*

Key words *K10, factor structure, reliability, adults, Portuguese.*

Resumo *A Escala de Distress Psicológico de Kessler de 10 itens (K10), é apresentada como uma medida válida para avaliar o distress psicológico em pesquisas populacionais, mas a sua estrutura dimensional não é consensual. O objetivo do presente estudo foi providenciar uma versão Portuguesa do K10 explorando a confiabilidade e a estrutura fatorial desta medida. Este estudo transversal incluiu 694 adultos, recrutados através de uma pesquisa via web e em entidades formadoras. Os resultados mostraram que 37,9% dos indivíduos reportaram sintomas de distress significativos. A escala K10 apresentou uma boa consistência interna (α= 0,91) e fortes correlações inter-item (entre 0,35 e 0,66). No entanto, a estrutura unidimensional original não foi confirmada. Um modelo dois fatores considerando a ansiedade e a depressão como dois fatores latentes independentes, mas correlacionados mostrou um bom ajuste mesmo entre os dois métodos de recolha. A ferramenta K10 foi ainda sensível para variáveis sociodemográficas. Participantes com 40 anos ou mais e que pertenciam à classe trabalhadora geral apresentaram maiores níveis de distress psicológico. Os dados obtidos indicaram que a versão Portuguesa do K10 é uma ferramenta confiável com uma estrutura fatorial para avaliar sintomas não específicos de distress.*

Palavras-chave *K10, Estrutura fatorial, Confiabilidade, Adultos, Portugueses*

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Introduction

Psychological distress is a serious public health problem that affects college students[1-3] and the general working population[4]. These symptoms are disabling and can harm students' school performance and workers' ability to perform their functions[4,5]. Kessler et al.[6] showed that developed countries were most affected by mental illness. Anxiety and mood disorders were reported as having greatest estimated lifetime prevalence, on average, 16% and 12% respectively. Therefore, within this setting, it is increasingly necessary to concentrate on the availability of measures to screen these symptoms.

The 10-item Kessler Psychological Distress Scale (K10) is a brief scale that assesses non-specific psychological distress. The original version was designed to assess the distress level in population surveys including the National Survey of Mental Health and Wellbeing (SMHWB) in Australia as a short module[7]. However, highlighted in relation to other measures such as the General Health Questionnaire (GHQ-12)[8] due to its sensitivity and specificity[9], it was quickly included in population surveys in other countries. In the last decade, this tool has shown good screening properties in detection, according to the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition (DSM-IV), of mood and anxiety disorders in Australian[9], Japanese[10] and New Zealand[11] epidemiological samples. In addition, empirical studies indicate that K10 presents high reliability even in a non-Western sample[12] and aboriginal people[13].

The factor structure of the K10 has been the least consensual psychometric characteristic within the scientific community. Kessler et al.[14] indicated a one-factor solution in their first studies. However, later this finding was criticized through application of a low threshold to test the assumption of unidimensionality[15]. According to Brooks et al.[15] a multifactorial structure integrating depression and anxiety as second order factors presented a good fit with adult samples. More recently, Sunderland et al.[16] once again explored this issue and confirmed an adequate fit of the original one-dimensional model for the general community but proposed a two-dimensional model for a clinical psychiatric sample.

Given the controversial conclusions of international studies in relation to the dimensionality of the measure and strong evidence of its reliability, our main purpose was to provide a comprehensive validation of the measure for Portugal. Our specific objectives were: (i) To examine the reliability of a Portuguese version of the K10 scale; (ii) To explore the factor structure of this tool considering the international discussion on this subject; and (iv) To test the sensitivity of the measure to sociodemographic variables.

Methods

Participants and Procedures

The sample included 694 individuals of Portuguese nationality (153 men and 541 women), aged between 18 and 71 (M = 36.16 years; SD = 12.49). Among respondents, 37.2% were college students, 50.5% were employed and 12.2% were unemployed. Most participants were single (51.7%). Considering the college student subsample, 59.1% were studying towards a degree, 34.6% a master degree and 2.3% a Ph.D. Within the group of employees and unemployed over 70% were teachers, educators or educational assistants. A web-based survey was performed to collect the sample of college students. Questionnaires were available on the online server of the University of Aveiro. A link was sent by e-mail to State and private universities and polytechnic institutes from the north to the south of Portugal. A detailed explanation of the research objectives and procedures was given to all students on the first page of the questionnaire, highlighting the voluntary nature of participation and the anonymity and confidentiality of the data. Consent was obtained through the use of "I agree" or "I do not agree" buttons instead of signatures. Employed and unemployed subjects were recruited through training entities and local authorities in the centre of the country. Participants attending training actions were invited to complete the questionnaire. The objectives of the research were also explained and informed consent was signed.

Measure

The *Kessler Psychological Distress Scale (K10)* (original version by Kessler et al.[14,17]) is a10-item scale that assesses the frequency of non-specific psychological distress symptoms during the last 30 days. This self-report measure is based on questions about anxiety and depression symptoms. Participants answer on a 5-point scale (1 = *none of the time* to 5 = *all of the time*) and total scores range from 10 to 50. Higher scores in K10

indicate higher levels of distress. The following cut-off scores were suggested by Andrews and Slade[18] to estimate the psychological distress level: 10 to 15 points "low distress", 16 to 21 points "moderate", 22 to 29 points "high" and 30 to 50 points "very high". Respondents with a total score higher than 22 risk having a mental disorder[18]. The K10 scale was translated into Portuguese by two researchers and back translated into English by two bilingual individuals who did not see the original version. A discussion group composed of the translators and a researcher compared the back-translated versions with the original measure. A lexical and cultural consensus was obtained. A cognitive debriefing was conducted using a sample of college students and employees with a lower level of education but no major changes were made.

Statistical analysis

Descriptive statistics were obtained using the Statistical Package for Social Sciences, version 24 (SPSS Inc., Chicago) software. Cronbach's alpha and item-total correlations allowed the reliability of the K10 scale to be analysed. Factor validity included exploratory and confirmatory factor analysis. Confirmatory factor analysis (CFA) was undertaken to confirm the dimensionality of the K10 scale. Data was examined using EQS version 6.1 and (i) the Satorra-Bentler chi-square statistic (c^2), (ii) the robust comparative fit index (CFI), and (iii) the root-mean-square error of approximation (RMSEA) were generated. Socio-demographic group differences in the mean scores of K10 were also determined through one-way analysis of variance (one-way ANOVA). Missing data were treated by the listwise method.

Results

Prevalence of significant distress symptoms

The K10 overall score ranged between 10 and 50 and the mean score was 20.55 (SD = 7.16). Considering the K10 cut-off criteria (≥ score 22), 37.9% of participants presented significant psychological distress symptoms. More specifically, 28.5% of respondents reported low distress symptoms, 33.1% presented moderate levels, 24.2% high and 13.7% very high. Within the subsamples included in the study, 31.2% of college students, 43.9% of employed subjects and 36.5% of the unemployed were psychologically distressed.

Reliability analysis

The Cronbach's alpha value obtained confirmed a good internal consistency of the Portuguese version of the K10 scale (.910) with item-to-total scale correlations between .597 and .760 for items 1 ("tired") and 7 ("depressed"), respectively. As shown in Table 1, even when we delete an item, the alpha value remains acceptable. Considering the mean scores for all the K10 items, participants indicated more nervousness (item 2) and restlessness or fidgetiness (item 5). All K10 items were significantly correlated. Inter-item correlations ranged from around .350 to .659 and most were above .40.

Factor validity

A Principal Axis Factoring (PAF) oblimin rotation method, used by Kessler et al.[14] to identify the factor structure of the original K10 version, was used in our study. A Kaiser-Meyer-Olkin (KMO) assumed the value of .917 (≥ .60) and the Bartlett's test of sphericity ($c^2_{(45)} = 3685.180$ $p < .001$) was significant[19]. PAF was carried out on the K10 items to extract the minimum number of factors that explained the maximum variance in the scale items, with this extraction resulting in one factor with an eigenvalue greater than one. A unidimensional structure explained 50.87% of the total variance. Most of the items showed a factorial weight on the factor above .60 (.627 to .801). The item 7 ("depressed") of K10 presented the highest factor load. CFA was undertaken to test the one-factor solution. Similarly to the study by Brooks et al.[15], considerable skewness and kurtosis in the response pattern were found, as was multivariate non-normality of the data (Mardia's coefficient = 65.20). Robust Maximum Likelihood estimation method was used and the Satorra-Bentler scaled chi-square was calculated[20]. The original one-factor model presented a poor fit: Satorra Bentler$\chi^2_{(35)} = 338.94$, $p < .0001$, RCFI = .881, RMSEA = .112 (90% CI .101-.123) and simple changes did not improve the fit indexes. As an alternative, based on the research of Sunderland et al.[16], we tested a two-factor model. The anxiety items (2, 3, 5 and 6) and depression items (1, 4, 7, 8, 9 and 10) were considered as independent factors. The two-factor solution presented an acceptable fit (Figure 1). The Satorra-Bentler chi-square was significant ($\chi^2_{(34)} = 187.57$, $p < .0001$) but RCFI was higher .92 (.94) than what was suggested by Marsh et al.[21] indicating a reasonable fit. RMSEA was not higher

Table 1. Descriptive statistics and inter-item correlations (n=694).

Item	M	SD	Corrected Item-Total Correlation	Alpha if Item Deleted	1	2	3	4	5	6	7	8	9	10
1.Tired	2.46	1.06	.597	.906	–									
2.Nervous	2.80	.91	.672	.901	.442	–								
3.Cannot calm down	1.64	.82	.702	.900	.469	.595	–							
4.Hopeless	1.92	1.03	.693	.900	.416	.470	.533	–						
5.Restless or fidgety	2.51	.99	.670	.901	.452	.627	.507	.442	–					
6.Not sit still	1.69	.90	.639	.903	.410	.519	.621	.434	.626	–				
7.Depressed	2.03	1.01	.760	.895	.527	.520	.573	.638	.518	.448	–			
8.Everything an effort	2.16	1.03	.729	.897	.560	.543	.500	.554	.568	.453	.611	–		
9.Nothing cheer up	1.69	.92	.694	.900	.427	.444	.527	.599	.421	.454	.659	.580	–	
10.Worthless	1.62	.92	.599	.905	.351	.377	.404	.575	.372	.387	.562	.489	.547	–

than .08 as recommended by Hu and Bentler[22]. Latent factors were positively correlated (Figure 1) presenting good internal consistency (Cronbach's alpha values of .847 and .875 for anxiety and depression, respectively). In addition, the established configural model was tested for each of the data collection methods (web or in person). The two-factor model presented a reasonable fit with the data for both collection methods [web: RCFI=.95, RMSEA= .08 (90% CI .060-.100); in person: RCFI = .94, RMSEA = .07 (90% CI .06-.09)]. Although the upper limit was not less than the .08 required for a well-fitting model, a value range of .05 to .10 indicates a fair fit[23]. According to the research by Cheung and Rensvold[24], we used the ΔRCFI differences to test the equivalence of the model, which seems not to be influenced by sample size. The difference did not reach significance (ΔRCFI = .001).

Descriptive data and relationships

Descriptive measures by gender, age group and employment status were reported showing the sensitivity of the K10 scale to socio-demographic variables (Table 2). One-way analysis of variance was used due to its resistance to discrepant samples[25]. The homogeneity of variances was analyzed with the *Levene* Test. The assumption the variance is homogeneous was accepted for the overall K10 score in all comparisons ($p = .095$, $p = .225$, $p = .197$ regarding employment status, gender and age group, respectively). The results showed statistically significant differences according to employment status. A post hoc test using Bonferroni correction indicated that employed subjects presented higher non-specific distress symptoms than college students 95% CI [-4.59; -1.83], $p < .0001$. Regarding gender, Table 2 reveals there are no significant differences in the K10 scores. Age was transformed in a dichotomic variable, namely respondents under 40 or 40 or older. The data presented significant differences for the recoded variable. The group aged 40 or over reported higher distress levels.

Discussion

The current study showed that the Portuguese version of K10 is a valid tool to assess psychological distress. This brief measure can be a solution to improve the assessment of these non-specific distress symptoms in the Portuguese population, which often go unnoticed, mainly among college

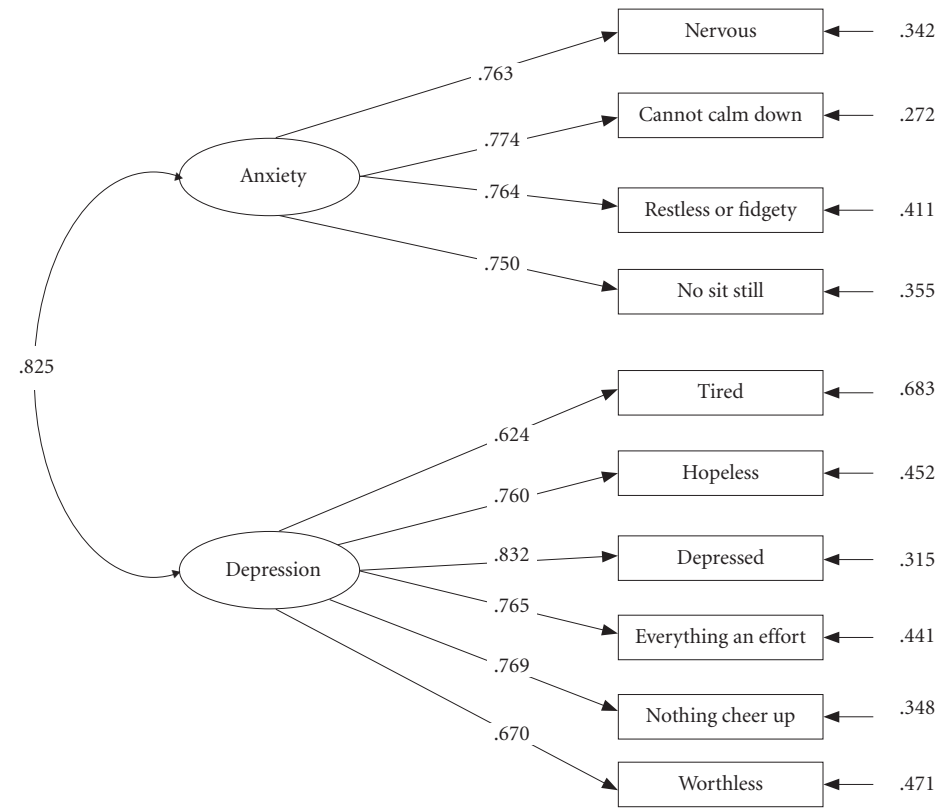

Figure 1. Two-factor model.

Note: Standardised estimates and residual variance are showed.

Table 2. Relationship between K10 means scores and sociodemographic characteristics.

Variable	Group	Mean	SD	F
Employment status	Employed	21.91	7.30	
	Non-employed	20.47	5.97	
	College Student	18.69	6.92	15.55***
Gender	Female	20.68	6.92	2.23
	Male	19.67	7.83	
Age	Less 40 years	19.45	6.73	20.37***
	40 or more	21.93	7.41	

***p<.001

students[26]. Considering the prevalence estimate of our representative sample, 37.9% of the adults were psychologically distressed and 43.9% of the employed subsample presented high or very high levels of distress. These results are not a complete surprise. Empirical studies have reported the risk of the general working population developing psychological distress due to emotional demands and role conflicts in the work setting[27].

Regarding specific psychometric properties, the K10 scale showed high internal consistency in the adult sample. More specifically, the Cron-

bach's alpha value of .91 and strong inter-item correlations were identical to the results found in non-Western communities[12]. In contrast, the single-factor structure indicated in the original validation study14did not fit our data. Nevertheless, two latent-factor models based on the proposal of Sunderland et al.[16] presented an acceptable fit. This model included anxiety and depression as latent, independent but correlated factors confirming the multidimensional nature of K10 but this time for non-clinical adult samples. Unlike previous studies, we indicated the configural invariance of this factor structure even using different data collection methods.

Differences between socio-demographic groups indicated some discriminant validity of the tool studied, but our findings are not in line with the literature available for other settings[11,28,29]. In our data, psychological distress levels were independent of gender but influenced by age. The older group (40 years or over) reported higher distress. Still in this field, we also found a significant effect of employment status on psychological distress. The general working population presented more non-specific distress symptoms than college students. Again, a controversial result since the conclusion of Stallman[5] suggested worse mental health outcomes in college student samples compared to the general population.

Our conclusions should be interpreted cautiously but the Portuguese version of K10 is introduced as a multifactorial solution for assessing distress in college and training settings. As the main limitation of this study, we identify the different sized subsamples of college students, employed and unemployed. Future studies should include more evenly balanced groups and consider convergent measures to provide a complete assessment of the construct validity of the scale. In addition, and similarly to what has been done in other developed countries[9-12,30] the sensitivity and specificity of this tool version to the screening of mood and anxiety disorders should be the focus of further research.

Collaborations

All authors listed have contributed sufficiently to the conception of the project, data analysis and critical review to being included as authors.

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