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World Health Organization 5-item well-being index: validation of the Brazilian Portuguese version

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Abstract The psychological well-being dimension and depressive symptoms are both important variables in an individual's health. In this study, we evaluated the World Health Organization 5-item well-being index (WHO-Five) internal and external validities, and accuracy in detecting depression. A total of 1,128 individuals between 18 and 65 years old from a rural Brazilian population were included. Cronbach's alpha and factor analysis were performed for internal validation. Demographic variables means were compared, receiver operating characteristic (ROC) curve was constructed, and sensitivity, specificity and positive and negative predictive values for different cutoff points were calculated for external validation and accuracy in detecting depression. Cronbach's alpha was 0.83, and only one factor was responsible for 59% of common variances, with an eigenvalue of 2.96. Higher WHO-Five scores were associated with being man, from oldest age category and retired. It was also related to better general health self-perception and negative screening in the Beck Depression Inventory (BDI). Based on BDI, the area under the curve was 67.37. A sensitivity of 66/75% and a negative predictive value of 91/92% for cutoffs <19/20 were detected. WHO-Five showed internal and external validities when used to measure the well-being dimension and to be a useful tool for depression screening.

Keywords Quality of life · WHO · Depression · Scale · Validation studies

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Introduction

The World Health Organization (WHO) defines quality of life (QOL) as the individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns. It is a broad concept affected in a complex way by sociocultural, health and psychological well-being dimensions [1]. QOL has emerged as an important attribute of clinical investigation and patient care, being devised to taken into account anything beyond mortality and symptom levels [2].

The WHO-Five well-being index aims to evaluate the dimension of psychological well-being. It originates from a larger scale developed by the WHO Regional Office for Europe for a project on quality of care in patients with insulin-dependent diabetes. An initial 28-item scale was developed using items from the Psychological General Well-being Scale and the Zung Scales for Anxiety and Depression. Following psychometric analysis of this first study data, the scale was reduced to 22 items. More recently, after additional psychometric analysis, shortened versions consisting of 10 (WHO-Ten Well-being Index) and 5 (WHO-Five Well-being Index) items were proposed. Finally, a revised version of the WHO-Five was proposed (Version 1998), with positively worded questions only [3, 4].

The measurement of positive well-being rather than depressive symptomatology has been shown to be effective at detecting depression and, in addition, is considered to be better accepted by patients. Lack of positive well-being is an indication of possible depression [5]. Depression is a treatable, common, chronic and recurrent medical condition associated with high individual and social burden. Unfortunately, it is still commonly underdiagnosed, with around 50–60% of cases not being detected by general practitioners [6]. Thus, finding a reliable instrument that meets both primary care and research requirements remains an important task.

The aim of the present study was to evaluate the internal and external validities of the 5-item World Health Organization well-being index in measuring the well-being dimension and its accuracy in screening depression in a larger epidemiological investigation.

Materials and methods

Population

The data from 1,128 subjects reported in this study are part of an investigation on the chronobiological profile of German immigrant descendants who live in rural towns in the Taquari Valley, southern Brazil. For the present study, subjects aged between 18 and 65 years who were investigated regarding demographic characteristics, daily working activities, the presence of any disease, self-perception of their health status, depressive symptoms and well-being were included in the analysis.

Study design and measurements

This was a cross-sectional study. Subjects were assessed at their homes, by trained interviewers. A protocol for demographics characteristics was performed. It included questions on age, gender, years of education ("Which was the highest grade you completed?"), main occupation ("Which is your working activity?"), the presence of any disease ("Do you have any disease?") and general health self-perception ("How do you evaluate your current health status?" Very good/Good/Bad/Very bad). Later, continuous variables were categorized as follows: age (18–25, 26–35, 36–45, 46–55, 56–65), years of education ($\leq$8 years—elementary school or lower, 9–11 years—high school, $\geq$12 years—college or higher), main occupation (unemployment, studies, primary sector or agriculture, secondary sector or industry, tertiary sector or specialized and non-specialized services, retirement) and any diseases (presence/absence).

The Beck Depression Inventory (BDI) was chosen to screen for depressive symptoms. This consists of 21 items, rated from 0 to 3, producing a score range from 0 to 63. The proposed cutoff scores within patients diagnosed as having an affective disorder are <10 for none or minimal depression, 10–18 for mild to moderate depression, 19–29 for moderate to severe depression and >29 for severe depression [7]. The Brazilian Portuguese version of the BDI has proved to have comparable psychometric properties to the original version, being useful for both clinical practice and research. In a Brazilian sample, when a cutoff $\geq$10 was used, an internal consistency of 0.81 in the general population and 0.88 in a depressed sample was obtained [8]. Thus, in our study, a cutoff $\geq$10 was defined as a positive screening for depression.

Each of the five items in the WHO-Five is rated on a 6-point Likert scale from 0 (not present) to 5 (constantly present). The raw score ranges from 0 to 25, and the author suggests the use of a percentage final score (0–100%), transforming the scale by simply multiplying the result by 4. A cutoff <13 (or <50%) indicates poor well-being and suggests that further clinical investigation for depression should be undertaken [9].

Statistical analysis

All data were included in the Statistical Package for the Social Sciences (SPSS) 18. The internal consistency was measured through Cronbach's alpha. A value between 0.7 and 0.9 was regarded as satisfactory.

The validity of the construct was evaluated through exploratory factor analysis. Principal component analysis was used as the factors extraction method, and the varimax rotation method was chosen for matrix interpretation. The Kaiser–Meyer–Olkin measure of sample adequacy (0.821) and Bartlett's test of sphericity (*Chi-square*: 1,973.217, $P = 0.000$) were calculated. The eigenvalues are the amount of total variance explained by the dimension. Only eigenvalues greater than 1 were retained. Factor loadings $\geq$0.4 were considered significant contributors to the dimension.

The relationship of age, gender, social aspects (years of education, main occupation), health aspects (having any diseases) and psychological aspects (general health self-perception and depressive symptoms) to the WHO-Five scores was assessed by comparison of means. Since variables were considered to be normally distributed, parametric tests were used. For dichotomous variables, *T* tests were performed, and for those with more than two groups, one-way ANOVA with Scheffe's post hoc analysis. Next, to assess possible confounding effects and colinearity of variables, a linear regression analysis was performed. The variable on main occupation was transformed into a

dummy variable (being/not being retired) so that it could be included in the multivariate analysis. All factors were entered simultaneously in the calculations.

The percentages of true-positive (sensitivity) and false-positive (1-specificity) values for each cutoff of WHO-Five taking the BDI scores as comparison were calculated. Then, this was graphically represented by a receiver operating characteristic (ROC) curve. Optimal cutoff points should present the highest percentage of true-positive values and the lowest percentage of false-positive values. In the curve, this is represented by the point that is furthest left and above. The area under the curve (AUC) was calculated to evaluate the accuracy of the scale in detecting depressive symptoms. For this purpose, an AUC > 0.5 is needed to say that the scale is able to discriminate different conditions. Sensitivity, specificity, positive and negative predictive values (PPV and NPV) of different cutoffs were also calculated so that in addition an optimal cutoff could be suggested.

Results refer to subjects who completed all questionnaires properly. This gives rise to the observed variations in the total number of subjects evaluated for the different tests. For all analyses, a two-tailed P-value <0.05 was considered statistically significant.

Ethical aspects

The research ethics committee approved the study protocol (Project 08-087 GPPG/HCPA, CONEP 15155), and written informed consent was obtained from all participants.

Results

Internal validity

The Cronbach's alpha was 0.83, which indicates that the answer for each question is consistent with the others, yet they do not overlap. The Cronbach's alpha was the same for total sample and depressive subjects (BDI $\geq$ 10) analysis.

In the factor analysis, only one underlying common dimension was found. This dimension accounted for 59% of total variance with an eigenvalue of 2.96. In other words, the reason for each of the questions correlating with the others is that there is an underlying dimension, which we would name "psychological well-being", being observed by these questions [10]. Table 1 depicts each question's factor loadings.

External validity

Table 2 shows the distribution of demographic variables, social, health and psychological aspects in relation to WHO-Five scores.

The sample consisted of 67% women and 33% men and had a mean age of 44.29 years (SD = 12.64). Men were significantly older than women ($t = 3.728$; $P < 0.001$) and sex contributed differently in each age category. Women comprised the majority of subjects in every age category, except the oldest, where both men and women contributed similarly.

The mean WHO-Five score for the sample was 18.34 $\pm$ 4.68 (73.37%). Men ($t = 4.94$; $P < 0.001$) and the oldest category ($F_{(4,1,123)} = 5.04$; $P < 0.001$) presented significantly higher WHO-Five scores. The group aged between 46 and 55 years did not differ from the others. Among men, WHO-Five scores showed a U-shaped progression, while for women they increased with increasing age.

Regarding social aspects, educational level was not associated with WHO-Five scores ($F_{(2,1,127)} = 1.06$; $P = 0.35$). The retired subjects showed higher scores, which was different from workers in industry and the services sector, but not from unemployed or agricultural workers ($F_{(5,1,122)} = 4.79$; $P < 0.001$).

In relation to health aspects, the WHO-Five score was lower for those with any disease. Nevertheless, this was not statistically significant ($t = -1.26$; $P = 0.21$).

For both psychological variables, there was an association with WHO-Five scores. Most (75.9%) participants evaluated their health as "Good". The better the self-perception of their general health, the higher the WHO-Five scores. The post hoc ANOVA showed that subjects who rated their health status as "Very Good" or "Good" differed from those who answered "Bad" or "Very Bad" ($F_{(3,1,123)} = 25.58$; $P < 0.001$). Similarly, 14% of subjects, who screened positive for depression, scored significantly lower than the ones who screened negative ($t = -6.97$; $P < 0.001$).

In the multivariate analysis, the proposed model explained 11.9% of the variation in WHO-Five scores ($F_{(7,1,126)} = 22.73$; $P < 0.001$). Just as in the univariate analysis, the variables gender ($\beta = -2.69$; $t = -2.36$; $P < 0.05$), age ($\beta = 2.23$; $t = 4.34$; $P < 0.001$), retirement ($\beta = 4.38$; $t = 2.45$; $P < 0.05$), general health self-perception ($\beta = -7.85$; $t = -7.16$; $P < 0.001$) and the BDI ($\beta = 9.68$; $t = 6.211$; $P < 0.001$) were associated with WHO-Five scores. Level of education ($\beta = -0.65$; $t = -0.69$; $P = 0.49$) and presence of any disease ($\beta = 1.53$; $t = 1.23$; $P = 0.21$) remained non-significant. There were no confounding or colinearity effects among variables.

Figure 1 shows different cutoff points along the ROC curve. The AUC was 67.37. Table 3 shows the performance of different WHO-Five cutoffs.

Discussion

The Brazilian Portuguese version of the Who-Five Index showed good internal validity. A Cronbach's alpha value of

Table 1 WHO-Five questions factor loadings for the "psychological well-being" dimension

WHO-Five questions	Factor loading
N.3 I have felt active and vigorous	0.811
N.4 I woke up feeling fresh and relaxed	0.806
N.2 I have felt calm and relaxed	0.762
N.1 I have felt cheerful and in good spirits	0.761
N.5 My daily life has been filled with things that interest me	0.705

Table 2 Sample means and distributions for study variables and % WHO-Five scores

Variable	*N* (%) or Mean ± SD	% WHO-five mean scores (SD)	95% CI
WHO-Five	18.34 ± 4.68	73.37 (18.72)	
Age*,+	44.29 ± 12.64		
18–25	119 (10.6)	70.79 (18.01)	67.52–74.06
26–35	176 (15.6)	71.00 (19.16)	68.15–73.85
36–45	252 (22.2)	71.49 (18.95)	69.14–73.84
46–55	345 (30.6)	73.96 (19.32)	71.91–76.01
56–65	236 (20.9)	77.58 (16.90)	75.41–79.74
Gender*,+			
Male	372 (33)	76.68 (17.48)	74.89–78.46
Female	756 (67)	71.74 (19.11)	70.38–73.10
Years of education	7.06 ± 3.39		
≤8	815 (72.2)	73.54 (19.31)	72.21–74.86
9–11	232 (20.6)	73.79 (17.11)	71.58–76.01
≥12	81 (7.2)	70.47 (17.08)	66.69–74.25
Occupation*,+			
Unemployment	17 (1.5)	66.82 (25.01)	53.96–79.68
Studies	14 (1.2)	63.71 (20.60)	51.82–75.61
Industry	63 (5.6)	68.63 (18.86)	63.88–73.38
Services	435 (38.6)	72.52 (18.01)	70.83–74.22
Agriculture	476 (42.2)	73.73 (19.30)	71.99–75.47
Retirement	123 (10.9)	79.38 (16.13)	76.50–82.26
Any diseases			
Yes	413 (36.6)	72.45 (17.72)	70.73–74.16
No	715 (63.4)	73.90 (19.27)	72.49–75.32
Health self-perception*,+			
Very good	182 (16.1)	77.63 (16.39)	75.23–80.02
Good	855 (75.9)	74.06 (18.27)	72.83–75.28
Bad	82 (7.3)	59.22 (19.73)	54.88–63.55
Very bad	8 (0.7)	48.00 (26.19)	26.11–68.89
BDI*,+	5.03 ± 5.03		
≥10	158 (14)	62.73 (21.13)	59.41–66.05
<10	970 (86)	75.10 (17.72)	73.98–76.22

* Univariate analysis $P < 0.05$, + multivariate analysis $P < 0.05$

0.83 for both general and depressed samples means that all of the five questions are related to each other, yet they are not identical, and thus, none of them can be dismissed. Similar internal consistency, ranging from 0.82 to 0.89, was found in previous studies with different populations [11–15].

This result was corroborated by the factor analysis, which, as in Dutch [12] and Thai [13] studies, suggested a unidimensional structure of the construct. All of the questions showed high factor loads (>0.6), with the two questions related to "energy" presenting the highest factor loads, followed by those related to "depression", "anxiety" and "positive well-being".

The mean WHO-Five score was high when compared to other studies. This might be due to the fact that most previous studies were performed on individuals affected by some diagnosed disease (diabetes and Parkinson's) or from specific age categories (adolescents and elderly), or it may be related to cultural differences when answering a scale [11–15]. In a study that included data from European, Asian and American countries, including Brazil, evidence was obtained for the existence of a U-shape distribution of psychological well-being through the life course [16]. In our study, the differences observed between the sexes may be simply an effect of men and women reporting internal affective states differently, or they may indicate real differences in gender role expectations [17]. Similarly, in a Swiss cohort, women rated their quality of life consistently lower than men in most domains. Interestingly, quality of life related to childhood or adolescence received especially low ratings, particularly from women [18]. In our essentially rural population, working opportunities may be more available to young men than to women, and men are better suited to working in agriculture with its requirement for a certain degree of physical strength. Thus, it is plausible that population-specific factors may be interfering in the well-being of our sample of young women.

Our sample showed rather a homogenous distribution of socioeconomic characteristics. Therefore, differences between groups may be more difficult to pinpoint. The unemployed and students showed the lowest mean WHO-Five scores, but, due to the small size of the groups and greater variability, they did not differ significantly from others. Being retired was associated with higher well-being scores, which, in this population, can be explained. Retirement means an extra and reliable gain and might not represent a complete interruption in daily activities, but rather substantially less work pressure.

Despite the fact that individuals affected by any health condition presented decreased WHO-Five scores, these were not significantly different from those of healthy subjects. This may be due to the fact that disease associated morbidity was not discriminated. Besides, our population

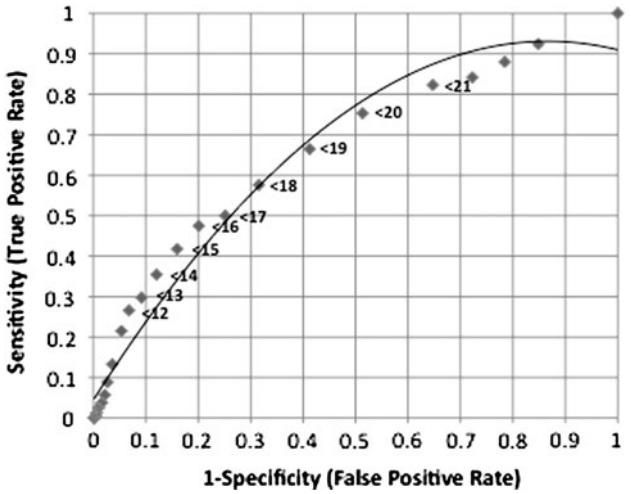

Fig. 1 ROC curve

Table 3 WHO-Five cutoffs performance in detecting depression based on BDI

Cutoff	Sensitivity	Specificity	PPV	NPV
<12	0.27	0.93	0.38	0.89
<13	0.30	0.91	0.35	0.89
<14	0.35	0.88	0.32	0.89
<15	0.42	0.84	0.30	0.90
<16	0.47	0.80	0.28	0.90
<17	0.50	0.75	0.24	0.90
<18	0.58	0.68	0.23	0.91
<19	0.66	0.59	0.21	0.91
<20	0.75	0.49	0.19	0.92
<21	0.82	0.35	0.17	0.92

has access to both public and private health services and having any disease was associated with undergoing treatment (Pearson *Chi-square* = 482.469, $P < 0.001$). We would expect a greater impact of disease when left untreated. Moreover, although the psychological well-being may reflect the presence of a disease, it is not, in essence, its direct measure.

Both psychological factors, the general health self-perception and screening for depressive symptoms, were well associated with WHO-Five scores. The finding that the subjective general health evaluation was related to the well-being scores instead of the mere presence or absence of disease strengthens the validity of the scale, confirming that it serves the purposes for which it was designed. Moreover, this is consistent with previous studies, which found an association between subjective self-reported health and psychological well-being [19] but not objective health-related variables [20].

Screening positive on BDI was highly correlated with lower well-being scores. Similar findings have been described in various studies from different populations [3, 11–15, 21]. ROC analysis confirmed a moderate ability of the scale to discriminate depressive and non-depressive subjects. Therefore, as suggested by the author of the original scale, the Brazilian Portuguese version of WHO-Five can also be used as a screening tool for depression. Fava and Mangelli reviewed the importance of prodromal or subclinical symptoms in recognition and follow-up of depressive patients. He found evidence suggesting that quality of life measurements, and not symptomatic ratings, could predict the recurrence of depression [22]. As mentioned before, depression is a severe disease, but fortunately, potentially treatable. The early detection and treatment can prevent an unfavorable progression. With this objective, the test should have good sensitivity, i.e., results positive indicating the affected people, as well as a good NPV, i.e., among negative tests, we find the healthy individuals. In this sample, the original proposed cutoff <13 (<52%), with low sensitivity and NPV, might not be the most appropriate. Thus, cutoffs of <19 (<72%) or <20 (<76%) appear to be more useful for this purpose, with higher sensitivities and NPVs. Also, for the main purpose of the scale, i.e., measuring psychological well-being, it is better to have a rather sensitive even at the expense of specificity, but able to detect an impairment even before an established disease.

According to what has been presented here, the scale showed good external validity since scores were associated with factors related to the concept of psychological well-being, such as social and health status, and mostly to other subjective measures of psychological status. The WHO-Five presented both internal and external validities when used to measure the well-being dimension in a rural Brazilian sample, and it may also be a tool to screen for depression. As it can be quickly filled out, it should be considered as a useful instrument for both primary care and research.

Finally, this is a growing field of research. Recently, Layard published a paper highlighting the importance of measuring subjective well-being in decision making and follow-up of new public policies rather than just evaluating the presence of depression or economic burden. This could be useful to study different populations and the possibility to compare specific trends and factors associated with greater or lesser degree of happiness and life satisfaction [23].

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Conflict of interest The authors declare that they have no conflict of interest.

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