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RESEARCH PAPER (ORIGINAL)
ARTIGO DE INVESTIGAÇÃO (ORIGINAL)

# Screening capacity of Geriatric Depression Scale with 10 and 5 items

## Capacidade de rastreio da Escala de Depressão Geriátrica com 10 e 5 itens
## Capacidad de seguimiento de la Escala de Depresión Geriátrica con 10 y 5 ítems

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## Abstract

**Background:** The use of the brief versions of the Geriatric Depression Scale (GDS) for depression screening in different health care settings requires the identification of a cutoff.
**Objectives:** To assess the screening ability of the GDS-10 and GDS-5 for depression using DSM-5 diagnostic criteria for major depressive episode as reference test.
**Methodology:** The sample consisted of 139 older people. Sensitivity and specificity for different cutoff values were obtained using the Receiver Operating Characteristic curve. The cutoff was selected based on the Youden Index.
**Results:** The optimal cutoff was 1/2 for both versions of the GDS. The GDS-10 showed a sensitivity of 100% and a specificity of 45.7%, and the GDS-5 showed a sensitivity of 78.3% and a specificity of 85.3%.
**Conclusion:** The GDS-10 proved to be a good screening instrument for depression and its use in routine care is justifiable. The use of GDS-5 for screening depression is not recommended due to its limited screening ability.

**Keywords:** depression; aged; geriatrics; sensitivity and specificity; Geriatric Depression Scale

## Resumo

**Enquadramento:** O uso das versões abreviadas da Escala de Depressão Geriátrica (GDS) no contexto de cuidados de saúde requer a determinação do ponto de corte para o rastreio de depressão.
**Objetivos:** Avaliar a capacidade de rastreio de depressão da GDS-10 e GDS-5, usando como padrão-ouro os critérios diagnósticos do episódio depressivo *major*.
**Metodologia:** Participaram no estudo 139 idosos. A sensibilidade e especificidade para diferentes pontos de corte foram obtidas através da curva *Receiver Operating Characteristic*. A escolha do ponto de corte baseou-se no índice de Youden.
**Resultados:** A relação de sensibilidade e especificidade para ambas as versões revelou ser melhor no ponto de corte de 1/2, resultante em sensibilidade de 100% e especificidade de 45,7% para GDS-10, e sensibilidade de 78,3% e especificidade de 85,3% para GDS-5.
**Conclusão:** A GDS-10 mostrou ter uma boa capacidade de rastreio de depressão, sendo justificável o seu uso no contexto de cuidados de rotina. Quanto à GDS-5, devido à capacidade de rastreio limitada, o seu uso para detetar as pessoas com depressão não é recomendável.

**Palavras-chave:** depressão; idoso; geriatria; sensibilidade e especificidade; Escala de Depressão Geriátrica

## Resumen

**Marco contextual:** El uso de las versiones abreviadas de la Escala de Depresión Geriátrica (GDS) en el contexto de la atención de la salud requiere determinar el punto de corte para el seguimiento de la depresión.
**Objetivos:** Evaluar la capacidad de seguimiento de la depresión de la GDS-10 y GDS-5 utilizando como patrón de oro los criterios diagnósticos del episodio depresivo mayor.
**Metodología:** Participaron en el estudio 139 ancianos. La sensibilidad y especificidad para diferentes puntos de corte se obtuvieron a través de la curva *Receiver Operating Characteristic*. La elección del punto de corte se basó en el índice de Youden.
**Resultados:** La relación de sensibilidad y especificidad para ambas versiones reveló ser mejor en el punto de corte del 1/2, que resulta en sensibilidad del 100% y especificidad del 45,7% para GDS-10, y sensibilidad del 78,3% y especificidad del 85,3% para GDS-5.
**Conclusión:** La GDS-10 demostró que tiene una buena capacidad de seguimiento de la depresión, por lo que queda justificado su uso en el contexto de los cuidados de la rutina. En cuanto a la GDS-5, debido a la capacidad de seguimiento limitado, su uso para detectar a las personas con depresión no se recomienda.

**Palabras clave:** depresión; anciano; geriatría; sensibilidad y especificidad; la Escala de Depresión Geriátrica

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## Introduction

According to the World Health Organization (WHO; 2017), the number of people living with depression was estimated to exceed 320 million in 2015, affecting approximately 4.4% of the world population. When compared to the estimates for 2005, these estimates suggest an 18.4% increase in the number of people living with depression, while also indicating that the prevalence rates of this clinical condition reach their peak after the age of 50, affecting 7-8% of women and 5-6% of men, both aged 60-79 years (WHO, 2017). The high prevalence of depression among older adults demands an appropriate and timely response from national health systems. Equal emphasis should be placed on reducing depressive symptoms and managing the serious consequences of depression, including decreased functioning, increased physical comorbidities, and higher risk of suicide (Fiske, Wetherell, & Gatz, 2009). However, due to its atypical profile and multiple symptoms, depression is often underdiagnosed in older adults (Park & Unützer, 2011; Sözeri-Varma, 2012). Consequently, depressed older adults do not receive proper or early treatment, leading to a poor prognosis (Park & Unützer, 2011; Sözeri-Varma, 2012). Therefore, it is essential to create conditions in which geriatric depression can be screened in a regular and less intrusive way.

The Geriatric Depression Scale (GDS; Yesavage et al., 1983) is one of the instruments used to assess depressive symptoms in older adults. The original version of this scale consists of 30 items focusing on topics such as motivation, energy, past/future orientation, mood, and cognitive complaints (Yesavage et al., 1983), as well as typical aspects of geriatric depression such as anxiety and irritability (Park & Unützer, 2011). Simultaneously, the scale does not include somatic complaints, such as sleep disorders, weight loss, and sexual dysfunction because they may be associated with the aging process itself or, alternatively, point to common age-related medical conditions (Fiske et al., 2009), thus interfering with the screening process. There are also brief versions of this scale which are composed of one, four, five, 10, 12 or 15 items (Jongenelis et al., 2005).

In Portugal, the 30-item GDS was adapted and validated by Pocinho, Farate, Dias, Lee, and Yesavage (2009) and Simões and Firmino (2013). The versions of the GDS with 15 (GDS-15), 10 (GDS-10), and five (GDS-5) items were adapted and validated by Apóstolo et al. (2014). The objective of this study was to assess the screening ability of the GDS-10 and GDS-5, using as reference test the diagnostic criteria for major depressive episode from the Diagnostic and Statistical Manual of Mental Disorders - 5th edition (DSM-5; American Psychiatric Association [APA], 2013). In addition, the study also included the assessment of the screening ability of GDS-15, which is discussed in Apóstolo, Bobrowicz-Campos, Reis, Henriques, and Correia (in press).

## Background

In a recent systematic review, Pocklington, Gilbody, Manea, and McMillan (2016) sought to establish the diagnostic accuracy of the brief versions of the GDS. The authors published these results between 1982 and April 2014. The International Classification of Diseases – Version 10 (ICD-10) or DSM (3rd, 3rd revised and 4th editions) diagnostic criteria for major depressive episode were used for the purposes of comparison. As regards the GDS-10, Pocklington et al. (2016) reported the sensitivity and specificity scores for cutoff point(s) that ranged between 2 and 4 in five primary studies. Thus, the cutoff of 2 had a sensitivity of 67% and a specificity of 66%; the cutoff of 3 had a sensitivity of 52%-100% and a specificity of 63%-83%; and the cutoff of 4 showed a sensitivity of 65%-85% and a specificity of 79%-89%. It should be noted that three of the five studies took place in primary health care settings, one in secondary health care settings, and another in mixed settings, involving people from the community and a day hospital. In addition, only six of the 10 items included in the scale comprised all GDS versions under analysis. According to Pocklington et al. (2016), the lack of standardized versions of the scale may explain the differences observed in the scale's diagnostic accuracy.

In another study which was not included in the above-mentioned review, Shah, Phongsathorn, Bielawska, and Katona (1996) assessed the performance of the GDS-10 in a sample of continuing care geriatric inpatients, using one of the subscales of the Comprehensive Assessment and Referral Evaluation (CARE) as reference test. According to these authors, depression screening is more effective when using a cutoff of 3/4 with a sensitivity of 75% and a specificity of 77%. In another study conducted in nursing homes (Li et al., 2015), the authors analyzed the performance of the GDS-10 in samples of older adults with and without dementia and found a cutoff > 5, with a sensitivity of 62.5% and a specificity of 68.42%, for the subsample with dementia, and a cutoff > 2, with a sensitivity of 100% and a specificity of 52.78%, for the subsample without dementia.

In relation to the GDS-5, the systematic review by Pocklington et al. (2016) reported the results of a single study conducted in the community and day hospitals. The authors of this study suggested a cutoff of 2, resulting in a sensitivity of 67% and a specificity of 78%. Other authors have also suggested this cutoff (Rinaldi et al., 2003; Song, Meade, Akobundu, & Sahyoun, 2014). Rinaldi et al. (2003) examined the performance of the scale in three different contexts (community-dwelling subjects, hospitalized patients, and nursing home residents) and observed that the sensitivity of the GDS-5 remained relatively stable with a cutoff of 2, regardless of the study setting (with values ranging from 93% to 97%). With regard to specificity, it was quite high in the sample of community-dwelling subjects (94%), but not in the sample of hospitalized patients (74%) and nursing home residents (73%). Song et al. (2014) reported a high sensitivity (98%) and acceptable specificity (73%), with a cutoff of 2. These authors applied the GDS-5 in a sample of community-dwelling older adults and concluded that the five-item scale can be used as a screening tool for depression in primary health care settings. However, the authors suggested that the performance of the scale could be improved if the screening process were reorganized and that people who scored ≥ 2 in the GDS-5 should be referred to further evaluation.

The results of the above-mentioned studies suggest that both the GDS-10 and GDS-5 are adequate screening tools and that their diagnostic ability depends on the setting in which the screening is performed. It is important to analyze if the European Portuguese versions of the scale can be used as effective screening tools that allow for the identification of older adults at risk for major depressive episode and their referral to a more comprehensive and thorough evaluation. To our knowledge, no study has yet been conducted with the purpose of calculating the sensitivity and specificity of different cutoff point(s) of the European Portuguese version of the GDS-10 and GDS-5.

## Research questions

What is the screening ability of the European Portuguese version of the GDS with 10 and 5 items?

## Methodology

This validation study aimed to assess the screening ability of the brief versions of the GDS (with 5 and 10 items), using the DSM-5 diagnostic criteria for major depressive episode (APA, 2013) as reference test. In addition, the internal consistency of both scales and the influence of sociodemographic variables, namely age, education level, and gender, on these scales were also analyzed.

### Sample

The sample was selected from health care centers, day-care centers, and nursing homes in different urban, rural, and transition areas of the Central region of Portugal, using a non-probability convenience sampling technique. Two inclusion criteria were applied: age ≥ 65 years and score ≤ 21 on the Six-Item Cognitive Impairment Test (6CIT) to confirm at least one of the following functions: space-time orientation, attention, and short-term memory.

### Data collection tools

The 6CIT (Brooke & Bullock, 1999; Portuguese version by Paiva & Apóstolo, 2015)

is a cognitive screening test composed of six simple questions that assess time-space orientation, attention, short-term memory. The test can be applied in less than 5 minutes, and items are scored from 0 (no errors) to 28 points (maximum number of errors).

Both brief versions of the GDS-30 – the GDS-10 and the GDS-5 (Yesavage et al. 1983; Portuguese version by Apóstolo et al., 2014) – are used to assess the presence of typical depressive symptoms in older adults. Each scale item is scored 0 or 1. Items 2, 3, 6, 8, and 10 of the GDS-10 and item 5 of the GDS-5 are scored 0 in the absence of the symptom (answer *no*) and 1 in its presence (answer *yes*). The remaining items are reverse-coded.

The information which allowed assessing the presence/absence of DSM-5 diagnostic criteria for major depressive episode (APA, 2013) was obtained through semi-structured interviews focusing on the 2 week period before screening. The diagnosis of depression was confirmed by the presence of five or more of the nine symptoms in the diagnostic criteria list, among which depressed mood or loss of interest or pleasure is a mandatory symptom. These symptoms must be considered the cause of clinically significant distress or impairment in several areas of functioning. In addition, their presence cannot be attributable to the physiological effects of a substance or to another medical condition and cannot be better explained by another psychotic or affective disorder. Symptoms are classified according to their severity, based on three levels of depression: mild, moderate, and severe (APA, 2013).

**Methodological procedures**

Data were collected between January 2016 and February 2017. The study was presented to potential participants, who gave their consent. Afterwards, the participants' cognitive ability was assessed. Older adults who met the inclusion criteria were invited to participate in two screening sessions that were conducted on the same day. A team of nurses conducted the first session with the purpose of collecting sociodemographic data and completing the brief versions of GDS. A trained medical team (including a general medical practitioner and a clinical psychologist) conducted the second session to assess the presence of DSM-5 diagnostic criteria for major depressive episode. The medical team was not informed about the results obtained in the GDS.

**Ethical-legal considerations**

The research study received a favorable opinion from the Ethics Commitee of the Health Sciences Research Unit: Nursing (UICISA: E; Opinion 11-11/2010). All participants volunteered to participate in the study and signed the informed consent form.

**Statistical analysis**

The internal consistency was assessed using the Cronbach's alpha coefficient and the corrected item-total correlation.

Due to the non-normal distribution of the results, non-parametric statistical tests were used in the comparative analysis, considering the probability of Type I error ($\alpha$) of 0.05. Thus, the variance of ordinal variables for both groups was analyzed using the Mann-Whitney-Wilcoxon test. The effect size was calculated based on the following formula: $r = Z / \sqrt{N}$. The Kruskal-Wallis test was used to compare more than two groups. If differences were statistically significant, a multiple comparison of mean ranks was performed, and the effect size was calculated using the partial-eta squared measure ($\eta^2_p$).

The two-factor interaction effect on the dependent variables was analyzed using a non-parametric two-way ANOVA. The *H*-test was calculated based on the formula in which the sum of the squared ranks of a given factor is divided by the total mean square for those ranks. The effect size was indicated by the $\eta^2_p$ coefficient.

The statistical treatment of data also included an analysis of covariance. For this purpose, a non-parametric ANCOVA was used, and the effect of covariate on the dependent variable was determined based on statistic *F*. The *F* statistic was calculated using the univariate ANOVA of non-standardized residuals obtained through linear regression of the rank of the dependent variable on the rank of the covariate.

The Receiver Operating Characteristic (ROC) curve was used to determine the sensitivity and specificity of different cutoff point(s) for depression screening. The GDS-10 and GDS-5

scores were used as test variables and the presence or absence of the diagnosis of depression according to DSM-5 as state variable. The cutoff was selected taking into account the maximum Youden index, which was calculated based on the following formula: sensitivity + specificity - 1 (Fluss, Faraggi, & Reiser, 2005). The positive predictive values (PPV) and negative predictive values (NPV) were also calculated for each cutoff.
Data were statistically analyzed using IBM SPSS Statistics, version 24.0.

## Results

### Sociodemographic characteristics of the sample

The study sample was composed of 139 older adults (60% women), with a mean age of 77.68 years (± 7.11, ranging from 65 to 96 years). The mean education level was 5.59 years (± 4.79, ranging from 0 to 21): 17 participants had no formal education, 79 had completed 1 to 4 years of education, 20 had completed 5 to 9 years, 6 had completed 10 to 12 years, and 17 had completed 14 to 21 years. During the study, most of the participants were married or cohabiting (57.6%) and more than one-third (36%) were widowed. The remaining participants were single (2.9%) or divorced/separated (3.6%).

### Internal consistency

The GDS-10 showed a strong internal consistency ($\alpha$ = 0.818), with corrected item-total correlations ranging from 0.308 to 0.643, while the GDS-5 showed a weaker internal consistency ($\alpha$ = 0.711), with corrected item-total correlations ranging from 0.250 to 0.630.

### The GDS-10 and GDS-5 in older adults with and without depression

Of the 139 older adults included in the study, 23 of them met the DSM-5 criteria for the diagnosis of major depressive episode (the corresponding descriptive statistics are shown in Table 1). Three participants were diagnosed with mild depression, four with moderate depression, and six with severe depression. Symptom severity was not assessed in 10 participants. During the study, 13 people with depression and 22 people without depression took antidepressants, while nine depressed subjects and 81 non-depressed subjects did not take antidepressants. There was no data available for the remaining participants.
The mean scores obtained in the total sample were 3.21 (± 2.74, range: 0-10) for GDS-10 and 1.04 (± 1.34, range: 0-5) for GDS-5. The descriptive statistics related to the performance of older adults with and without depression are shown in Table 1. The comparison between the GDS-10 and GDS-5 scores obtained by both groups of depressed and non-depressed older adults revealed statistically significant differences (GDS-10: $U(116, 23) = 515.5$; $W = 7301{,}5$; $p < 0.001$; $r = 0.40$; GDS-5: $U(116, 23) = 392.5$; $W = 7178{,}5$; $p < 0.001$; $r = 0.48$). This statistically significant difference was also observed when comparing the scores obtained by non-depressed older adults to the scores obtained by older adults with different levels of symptom severity (GDS-10: $H(3) = 35.913$; $p < 0.001$; GDS-5: $H(3) = 40.596$; $p < 0.001$). The analysis based on the multiple comparison of rank means in both scales revealed significant differences between the scores obtained by non-depressed older adults and older adults with mild (GDS-10: $p = 0.002$; GDS-5: $p = 0.001$), moderate (GDS-10: $p < 0.001$; GDS-5: $p < 0.001$), and severe depression (GDS-10: $p < 0.001$; GDS-5: $p < 0.001$). The effect size, indicated by the $\eta^2_p$ coefficient, was 0.225 for GDS-10 and 0.257 for GDS-5. In addition, no statistically significant differences were found between the scores obtained by older adults with mild and moderate depression (GDS-10: $p = 0.960$; GDS-5: $p = 0.977$), between the scores obtained by people with mild and severe depression (GDS-10: $p = 0.885$; GDS-5: $p = 0.911$), and finally, between the scores obtained by people with moderate and severe depression (GDS-10: $p = 0.922$; GDS-5: $p = 0.929$).

Table 1
*GDS-10 and GDS-5 scores and DSM-5 diagnostic criteria for major depressive episode*

| | | Non-depressed older adults (*n* = 116) | Depressed older adults | | | |
|---|---|---|---|---|---|---|
| | | | Total (*n* = 23) | With mild depression (*n* = 3) | With moderate depression (*n* = 4) | With severe depression (*n* = 6) |
| GDS-10 | *M* (±*SD*)<br>Range | 2.66 (± 2.44)<br>0-9 | 5.96 (± 2.57)<br>2-10 | 4.67 (± 1.53)<br>3-6 | 6.75 (± 2.22)<br>4-9 | 8.83 (± 0.75)<br>8-10 |
| GDS-5 | *M* (±*SD*)<br>Range | 0.72 (± 1.02)<br>0-4 | 2.70 (± 1.55)<br>0-5 | 1.67 (± 0.58)<br>1-2 | 3.25 (± 0.96)<br>2-4 | 4.5 (± 0.55)<br>4-5 |
| DSM-5 | *M* (±*SD*)<br>Range | 1.11 (± 1.31)<br>0-4 | 6.26 (± 1.10)<br>5-8 | 5.33 (± 0.58)<br>5-6 | 6.25 (± 1.26)<br>5-8 | 7.17 (± 0.41)<br>7-8 |

*Note.* DSM-5 = Diagnostic and Statistical Manual of Mental Disorders; *SD* = standard deviation; GDS-10 = 10-Item Geriatric Depression Scale; GDS-5 = 5-Item Geriatric Depression Scale; *M* = mean.

**The GDS-10 and GDS-5 and sociodemographic variables**

The non-parametric ANCOVA was used to analyze the potential effect of the covariates of age and education level on the performance of the GDS-10 and GDS-5. The *F*-test showed that the different scores obtained by depressed and non-depressed older adults in both scales cannot be explained by the differences in age (GDS-10: $F_{NON\text{-}PARAMETRIC\ ANCOVA}$ (1, 137) = 62.622; $p < 0.001$; GDS-5: $F_{NON\text{-}PARAMETRIC\ ANCOVA}$ (1, 137) = 70,685; $p < 0.001$) or education level (GDS-10: $F_{NON\text{-}PARAMETRIC\ ANCOVA}$ (1, 137) = 65.649; $p < 0.001$; GDS-5: $F_{NON\text{-}PARAMETRIC\ ANCOVA}$ (1, 137) = 77.076, $p < 0.001$).

Subsequently, a two-factor non-parametric ANOVA test was used to analyze the effect of the gender variable on the scores obtained by depressed and non-depressed older adults in GDS-10 and GDS-5 (group: depressed/non-depressed x gender: male/female). As regards the GDS-10, the interaction between the group and gender factors was not statistically significant ($H(3) = 0.07$; $p = 0.79$; $\eta^2_p = 0.001$). In terms of main effect, the gender factor did not contribute to the distribution of the GDS-10 scores ($H(3) = 0.29$; $p = 0.59$; $\eta^2_p = 0.003$). On the contrary, the group factor proved to have a significant influence on the distribution of the GDS-10 scores ($H(3) = 39.20$; $p < 0.001$; $\eta^2_p = 0.295$), which explained 29.5% of the variance.

With regard to the GDS-5, the interaction between the group and gender factors ($H(3) = 0.03$; $p = 0.87$; $\eta^2_p = 0.000$) and the gender factor alone ($H(3) = 0.19$; $p = 0.67$; $\eta^2_p = 0.002$) had no influence in the scale scores. On the other hand, the group factor alone influenced the distribution of the GDS-5 scores ($H(3) = 44.36$; $p < 0.001$; $\eta^2_p = 0.333$), which explained 33.3% of the variance.

**Sensitivity and specificity of the GDS-10 and GDS-5**

Figure 1 and Figure 2 show the ROC curves for GDS-10 and GDS-5, respectively. The area under the ROC curve plotted for the GDS-10 scores and the presence/absence of a diagnosis of major depressive episode according to the DSM-5 was 0.807 (95% CI [0.718; 0.896], $p < 0.001$).

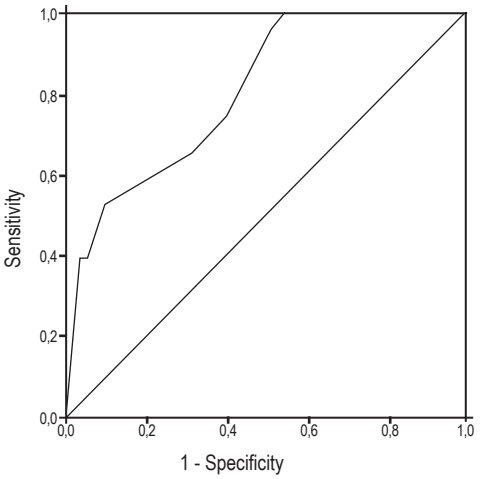


*Figure 1.* ROC curve for GDS-10, using DSM-5 diagnostic criteria as gold standart

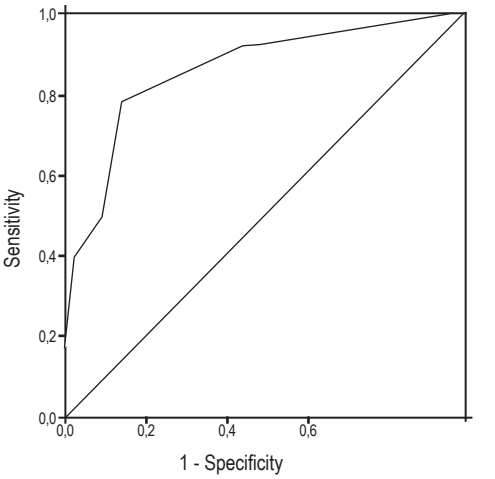


*Figure 2.* ROC curve for GDS-5, using DSM-5 diagnostic criteria as gold standart

The analysis of the sensitivity and specificity (shown in Table 2) and corresponding Youden index values showed an optimal cutoff in the GDS-10 for depression screening of 1/2 (absent/present), which resulted in a sensitivity of 100% and a specificity of 45.7%. The PPV and PNV values for this cut-off point were 0.267, 95% CI [0.236; 0.301] and 1.0, respectively.

In relation to the GDS-5 scores *versus* the presence/absence of a diagnosis of major depressive episode according to the DSM-5, the area under the ROC curve was 0.853, 95% CI [0.761; 0.944]; $p < 0.001$. As Table 3 shows, the optimal cutoff in the GDS-5 for depression screening, which is indicated by the maximum Youden index, was also of 1/2. In this case, the sensitivity and specificity were 78.3% and 85.3%, respectively. This cutoff had a PPV of 0.514, 95% CI [0.394; 0.633] and a PNV of 0.952, 95% CI [0.901; 0.977].

Table 2

*Sensitivity, specificity, and Youden Index of the GDS-10*

| Cutoff | Sensitivity | Specificity | Youden Index |
|---|---|---|---|
| 0/1 | 100% | 29.3% | 0.293 |
| 1/2* | 100% | 45.7% | 0.457 |
| 2/3 | 95.7% | 49.1% | 0.448 |
| 3/4 | 73.9% | 60.3% | 0.343 |
| 4/5 | 65.2% | 69.0% | 0.342 |
| 5/6 | 52.2% | 90.5% | 0.427 |
| 6/7 | 39.1% | 94.8% | 0.340 |
| 7/8 | 39.1% | 96.6% | 0.357 |
| 8/9 | 26.1% | 98.3% | 0.244 |
| 9/10 | 4.3% | 100% | 0.043 |

*Cutoff, sensitivity, and specificity for the maximum Youden index.

Table 3
*Sensitivity, specificity, and Youden Index of the GDS-5*

| Cutoff | Sensitivity | Specificity | Youden Index |
|---|---|---|---|
| 0/1 | 91.3% | 55.2% | 0.465 |
| 1/2* | 78.3% | 85.3% | 0.636 |
| 2/3 | 47.8% | 90.5% | 0.383 |
| 3/4 | 39.1% | 97.4% | 0.365 |
| 4/5 | 13.0% | 100% | 0.130 |

*Cutoff, sensitivity, and specificity for the maximum Youden index.

## Discussion

The objective of this study was to assess the ability of the European Portuguese versions of the GDS-10 and GDS-5 for screening depression, using the DSM-5 diagnostic criteria of major depressive episode as reference test. This article describes the results obtained through the application of the 5- and 10-item versions in a sample of older adults selected from healthcare centers, day-care centers, and nursing homes in the central region of Portugal.

The GDS-10 and GDS-5 showed a good and acceptable internal consistency, respectively. Apóstolo et al. (2014) obtained similar results. Both the 5- and 10-item versions proved to be able to identify depressed and non-depressed older adults, regardless of the severity of depressive symptoms. On the other hand, none of the versions obtained positive results in the identification of older adults with mild, moderate, and severe depression, which may be explained, at least partially, by the fact that symptom severity was only assessed in a small number of participants. However, further studies are necessary to clarify this issue.

The performance in GDS-10 and GDS-5 was not influenced by sociodemographic variables, namely age, education level, and gender, thus supporting the idea that the GDS is an appropriate tool to be used in the elderly population in general. Similar results were reported by Apóstolo et al. (in press) regarding the 15-item version. According to these authors, the GDS can be effectively applied to older adults without any formal education and in older adults with mild and moderate cognitive impairment. The properties of the brief versions of the GDS are even more relevant when associated with their ability to identify people with clinically significant depressive symptoms. As regards the GDS-10, this study showed that the use of two cutoff point(s) allows identifying depressed individuals with a sensitivity of 100%, thus demonstrating the importance of regularly applying this version of the scale in several health care settings for screening purposes. However, the reduced specificity of the suggested cutoff (47.5%) and its low PPV suggest that the GDS-10 is not a recommended diagnostic tool. As previously mentioned, other authors (Pocklington et al., 2016) have suggested the use of two cutoff point(s), although reporting diagnostic accuracy indicators that are significantly different from the indicators found in this study. Curiously, the cutoff point(s) suggested for the Brazilian Portuguese version of the GDS-10 were 3/4 for screening and 4/5 for diagnosis (Almeida & Almeida, 1999), which emphasizes the need to use the European and Brazilian Portuguese versions of the scale solely in the cultural context in which they were validated.

In addition, the use of 2 cutoff point(s) proved to be more appropriate to GDS-5, which is in line with results reported by other authors (Pocklington et al., 2016; Rinaldi et al., 2003; Song et al., 2014). However, the 5- item version showed a sensitivity of 78.3% associated with the cutoff, which significantly increases the risk of not identifying people with depression. For this reason, the 10-item version should be used for screening purposes. It should also be noted that the positive identification of cases of depression using the GDS-10 must necessarily be confirmed through a more comprehensive assessment. This solution is based on data relating to the

specificity of the scale, according to which the use of an optimal cutoff leads to an increase in the number of false positives. The two-stage approach allows avoiding the referral for intervention of people misdiagnosed with depression.

**Study limitations**

One of the limitations of this study was the low representativeness of the findings due to the use of a nonprobability sampling technique. To mitigate the impact of this limitation, older adults were selected from different institutions in the central region of Portugal. Another limitation was the small sample size, namely in the number of older adults who met diagnostic criteria for a major depressive episode according to the DSM-5. It should also be noted that symptom severity was assessed in only 13 of the 23 older adults with depression, thus reducing the capacity of inference about the performance of the scales in people with mild, moderate, and severe depression. However, according to Almeida and Almeida (1999), the brief versions of GDS (with 10 items and less) may not be very useful in the assessment of symptom severity, which may be explained by the fact that the small number of items does not provide a clear idea about the person's clinical status.

## Conclusion

This study demonstrates that the GDS-10 (but not the GDS-5) can be used as a tool for screening depression in older adults. However, due to the high number of false positives, its use for diagnostic purposes is not recommended. Therefore, all cases of depression that are identified using the scale should be referred to a more comprehensive and thorough evaluation. This two-step approach appears to be highly promising in primary health care settings for several reasons. First, the use of this scale allows saving time and resources required for screening depression, without being overly demanding to the older person. As a result, its application in routine care becomes easier. In addition, the early detection of depression contributes to a timely planning of interventions, thus improving the disease prognosis. Future studies should be conducted to improve the generalization of the findings and to confirm if the GDS-10 and GDS-5 are reliable tools to be used in settings other than those that were analyzed in this study.

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