



## Propiedades psicométricas de la escala de depresión geriátrica: revisión sistemática

### Psychometric properties of the geriatric depression scale: systematic review

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**Abstract:** Depression is the most common mental disorder among older adults and one of the most disabling conditions worldwide. To review the scientific evidence on the psychometric properties of the geriatric depression scale. A documentary study of systematic literature review was carried out. Regarding the search strategies, we worked with the library of the Catholic University of Cuenca, the Scopus, Pubmed and Web of Science databases were used, from 2017 to 2021 in English and Spanish language. This allowed obtaining a total of 14 articles that were thoroughly analyzed. The Geriatric Depression Scale (GDS) has adequate, reliable, and valid psychometric properties to assess knowledge about geriatric depression, thus contributing for students, health profession, because it is a brief and easy to apply screening instrument, widely used in clinical and research to detect depressive symptoms in older adults that can provide a reliability of an adequate diagnosis. Conclusion: It is concluded that the GDS is a reliable instrument to apply in the older adult population.

**Keywords:** psychometric properties, scale, geriatric depression.

**Resumen:** La depresión es el trastorno mental más común entre los adultos mayores y una de las afecciones más incapacitantes en todo el mundo. Revisar en la evidencia científica sobre las propiedades psicométricas de la escala de depresión geriátrica. Se realizó un estudio documental de revisión sistemática de bibliografía. Con respecto a las estrategias de búsqueda, se trabajó con la biblioteca de la Universidad Católica de Cuenca, se utilizaron las bases de datos Scopus, Pubmed y Web of Science, desde el año 2017 al 2021 en idioma inglés y español. Lo cual permitió obtener un total de 14 artículos que fueron analizados minuciosamente. La escala Geriatric Depression Scale (GDS) tiene propiedades psicométricas adecuadas, fiables y válidas para evaluar los conocimientos sobre la depresión geriátrica, aportando así para los estudiantes, profesión de la salud, debido a que es un instrumento de tamizaje breve y de fácil aplicación, ampliamente utilizado en la clínica y la investigación para detectar síntomas depresivos en los adultos mayores que puede brindar una confiabilidad de un diagnóstico adecuado. Se concluye que la GDS es un

instrumento fiable para aplicar en la población de adultos mayores.

**Palabras clave:** propiedades psicométricas, escala, depresión geriátrica.

## INTRODUCTION

Older adults are a part of the population more vulnerable to depression, because at this stage of human development they begin to experience new changes such as the death of their spouses or friends, decrease in their physical capacity, development of comorbidities, neurological disorders and the effect of life stressors, being this disease common in geriatric patients (1). This causes changes in mood and over time they show signs of irritability, feelings of sadness, crying, exaggerated worries, fears of abandonment and thoughts of death (2). Such is the case that in the year 2021, according to reports from the World Health Organization (WHO), it is estimated that 5.7% of older adults worldwide will suffer from depression (3).

Based on this problem, effective treatments for depression are available, but identification is often haphazard. Physicians may not recognize up to half of all patients with depression, and most patients with depression do not receive minimally adequate care (4). In this regard, the Geriatric Depression Scale (GDS) is very useful for detecting depression among older adults with greater sensitivity and specificity (5).

With respect to sustainable development, this research focuses on objective number three, which consists of guaranteeing a healthy life and promoting well-being at all ages (5). Together, it is based on sources that support the theoretical reference of the study, through a compilation of documents, articles, and publications of different authors. Being a topic that contributes to the nursing profession, because the Geriatric Depression Scale (GDS) is a brief and easy to apply screening instrument, where the direct beneficiaries are older adults and nursing professionals.

Under this context, by recruiting a total of 125 older adults with a prevalence of depression of 36.8% according to the psychiatrist's assessment. It is observed that the sensitivity, specificity, and Cohen's Kappa value of GDS-30 and 15 were better than the other scales used to assess depression. When sensitivity and specificity are evaluated using newer cut-off points, the specificity and sensitivity of GDS-30 are more than those of other scales (6).

While analyzing, the diagnostic performance of the 4-item geriatric depression scale for the detection of depression in older cancer patients: the ELCAPA cohort study. The sensitivity and specificity of the GDS-4 for detecting physician-diagnosed depression is, respectively, 90% and 89%. Concluding that the GDS-4 appears to be a clinically relevant and easy-to-use tool for the systematic detection of depression in older patients (7). Within this order of ideas, a study conducted on the diagnostic accuracy of various forms of geriatric depression scale for screening depression in older adults, it was found that all forms of Geriatric Depression Scale (GDS) very useful for detecting depression among the elderly with higher sensitivity and specificity. Diagnostic performance was much better for shorter forms of GDS such as GDS 15 and GDS 10 compared to GDS-30 (8). Therefore, the main objective was to review the scientific evidence on the psychometric properties of the geriatric depression scale.

## METHODOLOGY

### *Type of research*

A documentary study of systematic review of the literature was carried out. The process was carried out following the recommendations established in the PRISMA statement (9).

### *Search strategies*

Regarding the search strategies, we worked with the library of the Catholic University of Cuenca, the databases Scopus, Pubmed and Web of Science were used, the period of the publications was from 2017 to 2021 in the English and Spanish languages. Some statistical or informative data were taken from web pages and documents published by state agencies at the national level and international organizations linked to the social and health area such as the WHO.

Studies related to the psychometric properties of the geriatric depression scale were selected, taking into consideration the title, abstract and full text, which allowed the selection of those documents that were of greater contribution to the systemic review. In conjunction, descriptors in health sciences DeCS were used, such as: "Depression", "Geriatric Depression", "Psychometric properties". We also worked with the combination of keywords and Boolean operators AND y OR. The key words were: "Geriatric depression scale", "Psychometric properties of the geriatric depression scale", "Depression in older adults scale", "Depression in older adults", "Geriatric depression scale", "Psychometric properties of the geriatric depression scale", "Depression scale in older adults", "Depression AND older adults", "Scale of depression in older adults OR geriatric patients".

For the data extraction process, a matrix was designed to collect the information. The information organization matrix was an outline of documents to analyze the consistency and correspondence of each of the articles according to their relevance.

### *Inclusion criteria*

- Articles in English and Spanish language were included.
- Years of publication 2017 to 2021.
- Primary studies, qualitative, quantitative, systematic reviews, and research reports.

### *Exclusion criteria*

- We excluded articles that do not pertain to the topic of study.
- Do not belong to the English and Spanish language.
- We did not work with publications younger than 2017.
- Studies with unexplained methodologies.
- Article repeated from a previous search.

### *Assessment of study quality*

The Consolidated Standards for Reporting Trials (CONSORT-2010) guidelines (10) were used to assess study quality. This checklist was used worldwide to improve reported randomized controlled clinical trials using a list of 25 items to assess the title (including the type of design), the preparation of the abstract (structured and complete), the background and explanation of rationale, the definition of objectives and hypotheses, description of the trial design (including major changes in methods after trial initiation and reasons), the eligibility criteria for participants, the setting and location where data were collected, description of the intervention (with sufficient detail to allow for replication), fully defined outcome measures, sample size calculation (or power analysis), the method used to generate the sample data, the method used to generate the sample data. The method used to generate the randomization sequence (including type of randomization), use of blinding methods, statistical

procedures used for analyses, description of results (including comparison at baseline), discussion of results (including limitations and generalization), and other information (registry, protocol, and funding).

## PROCEDURE

In the first stage, the topic and the formulation of the research question were identified through the PO population and observation scale strategy. Having as a question What are the psychometric properties of the geriatric depression scale, in the second stage, we proceeded to apply the inclusion criteria in which the articles in English and Spanish language the years of publication 2017 to 2021. Primary studies, qualitative, quantitative, systematic reviews, and research reports. Applying the exclusion criterion to articles different from English and Spanish languages, publications less than 2017, studies with unexplained methodologies and article repeated from a previous search. In the third stage, the relevant articles were selected through a previous analysis of their content. In the fourth stage, the studies were classified in a matrix in which the most important characteristics and results of each of them were recorded. Finally, each result was analyzed by comparing similarities, complementarities, and discrepancies between authors of the different publications.

## RESULTS

Once the necessary information on the psychometric properties of the geriatric depression scale had been searched, 84 publications were identified, of which 25 were from the PubMed, 41 from Web of Science and 18 from Scopus databases. Subsequently, articles that did not address the topic were excluded, leaving a total of 71. Then, articles that did not correspond to the study were excluded by reading abstracts, obtaining 59 publications. Subsequently, when applying the eligibility criteria for complete reading, 46 documents were obtained. On analyzing them, 23 were excluded, of which 4 were literature reviews, 9 were duplicates and 10 had another objective. After that, the complete studies evaluated for eligibility were 21 excluding 7 studies, to obtain a total of 14 articles for the final sample of the corresponding analysis.

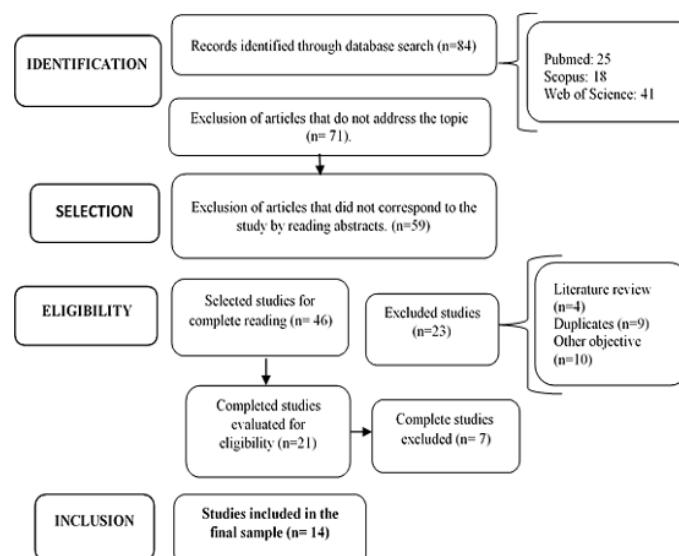


Figure 1. Flow diagram

Tabla 1. Artículos seleccionados

Base	Magazine	Author	Year	Title	Country	Sample	Age range	X2/gl	Rmse	Srmr	Cfi	Tli
Scopus	Archivos de Gerontología y Geriatria	Krishnamoorthy, et al. (8).	2020	Diagnostic Accuracy of Various forms of Geriatric Depression Scale for Screening of Depression among Older Adults: Systematic Review and Meta-Analysis	India	17.018	65 a 98 años	2,428	0,056	0,071	0,96	0,95
Pubmed	India de Medicina Psicológica	Mehra, et al. (6).	2021	Evaluation of Psychometric Properties of Hindi Versions of Geriatric Depression Scale and Patient Health Questionnaire in Older Adults	Estados Unidos	125	≥ 60 años	2,478	0,042	0,031	--	0,97
Web of Science	Oncóloga	Lafont, C, et al. (7)	2021	Diagnostic Performance of the 4-Item Geriatric Depression Scale for Depression Screening in Older Patients with Cancer: The ELCAPA Cohort Study	Francia	2,293	≥ 70	3,521	--	0,058	0,95	--
Pubmed	Psicopatología	Hallit, S, et al. (11)	2018	An Arabic Version of the Geriatric Depression Scale (30 Items): Psychometric Properties and Some Findings in a Lebanese Elderly Sample	Líbano	500	≥ 60 años	4,572	0,021	0,073	0,98	0,95
Pubmed	Clínicas del Norte de Estambul	Durmaz, et al. (12)	2018	Validity and Reliability of Geriatric Depression Scale - 15 (Short Form) in Turkish older adults	Turquía	329	≥ 65 años	2,563	0,038	--	0,95	0,97
Web of Science	Envejecimiento y salud mental	Gatti, et al. (13)	2018	An investigation of the psychometric properties of the Geriatric Anxiety Scale (GAS) in an Italian sample of community-dwelling older adults	Italia	231	≥ 65 años	2,479	0,067	0,034	0,93	0,91
Pubmed	Australas J Envejecimiento	Yueh et al. (14)	2021	Versiones cortas de la Escala de Depresión Geriátrica (GDS) entre personas mayores viudas en Taiwán: Comparación de sus propiedades psicométricas	Taiwán	330	≥ 65 años	4,265	0,043	0,049	0,9	0,94
Web of Science	Medical Sciences	Nikmat, et al. (15)	2021	Psychometric Properties of Geriatric Depression Scale (Malay Version) in Elderly with Cognitive Impairment	Malasia	219	72 - 79 años	3,551	0,021	0,037	0,98	0,96
Web of Science	Psicología: Reflexao e Crítica	Gallardo, et al. (16)	2020	Multi-ethnic validation of 15-item Geriatric Depression Scale in Chile	Chile	800	≥ 60 años	2,641	0,053	0,046	0,95	0,92
Web of Science	Indian journal of public health	Lahiri, et al. (17)	2020	Psychometric Validation of Geriatric Depression Scale - Short Form among Bengali-Speaking Elderly from a Rural Area of West Bengal: Application of Item Response Theory	Bengala	206	≥ 68 años	3,258	0,038	0,054	--	--

Base	Magazine	Author	Year	Title	Country	Sample	Age range	X2/gl	Rmse	Srmr	Cfi	Tli
Pubmed	Scandinavian journal of primary health care	Jokelainen, et al. (18)	2019	Validation of the Zung self-rating depression scale (SDS) in older adults	Finlandia	520	72 -73 años	2,429	0,041	0,063	0,94	0,91
Pubmed	Depression research and treatment	Galeoto, et al. (19)	2018	A Psychometric Properties Evaluation of the Italian Version of the Geriatric Depression Scale	Italia	119	≥ 79 años	4,157	0,016	0,071	0,97	0,93
Web of Science	Journal of Affective Disorders	Merkin, et al. (20)	2020	New avenue for the geriatric depression scale: Rasch transformation enhances reliability of assessment	Oceanía	212	≥ 70 años	3,642	0,049	0,078	0,95	0,94
Pubmed	Envejecimiento Mental Salud	Johansson et al. (21)		Una versión corta clínicamente factible de la escala de depresión geriátrica de 15 ítems extraída usando la teoría de respuesta al ítem en una muestra de adultos de 85 años o más	Suecia	651	≥ 85	4,597	0,061	0,075	0,98	--

## DISCUSSION

Fourteen empirical articles on scientific evidence on the psychometric properties of the geriatric depression scale were selected. This is followed by a description of the validations or adaptations and fit indices of the scale.

In this context, Krishnamoorthy, et al in their study conducted in India revealed that by including 17 018 participants, the pooled sensitivity and specificity of GDS 30 was found to be 82% and 76% with almost higher diagnostic accuracy (AUC = 0.85). GDS 15 had a pooled sensitivity and specificity of 86 % and 79 % with a higher diagnostic accuracy (AUC = 0.90). GDS 10 had a combined sensitivity and specificity of 87% and 75% with AUC = 0.83. The study found GDS 4 to have a sensitivity of 74 % with a specificity of 71 %. All four forms of GDS belonged to the lower right quadrant of the LR scatter plot, indicating neither confirmation nor exclusion. The diagnostic performance was much better for shorter forms of GDS such as GDS 15 and GDS 10 compared to GDS 30. Compared to Mehra, et al in their research conducted in the United States emphasizes that when recruiting 125 older adults from a rural community. The prevalence of depression was 36.8% according to the psychiatrist's evaluation. When the concordance of the different scales with the clinicians' diagnosis was evaluated, it was observed that the sensitivity, specificity and Cohen Kappa value of GDS-30 and 15 were better than the other scales used to evaluate depression. When sensitivity and specificity were evaluated using newer cut-off points, the specificity and sensitivity of GDS-30 were higher than those of other scales. The Hindi version of GDS-30 with a cut-off point of 13 has excellent psychometric properties (6).

In turn Lafont, et al (7) ratifies that in a sample of 2293 patients in France the sensitivity and specificity of the GDS-4 for detecting physician-diagnosed depression were, respectively, 90 % and 89 %. The positive and negative likelihood ratios were 8.2 and 0.11, and the AUROC was 92%. When considering the subset of patients with data on all measures of depression, the sensitivity and specificity values were, respectively,  $\geq 90$  % and  $\geq 72$  %, the positive and negative likelihood ratios were, respectively,  $\geq 3.4$  and  $\leq 0.11$ , and the AUROC was  $\geq 91$ %.

While Hallit, et al (11) mentions that in their case-control study in Lebanon by including 500 patients over 60 years of age (250 living inside and 250 living outside a nursing home). Strongly positive correlations ( $p < 0.001$  for all scale items) between each scale item and the total scale. The mean inter-item correlation of our scale was 0.51, higher than that of the original scale (0.36), with excellent internal consistency (Cronbach's  $\alpha = 0.901$ ). Living in a nursing home, stress, anxiety, being married, age and primary educational level would significantly increase depression ( $\beta = 2.211$ ,  $\beta = 0.223$ ,  $\beta = 0.041$ ,  $\beta = 0.902$ ,  $\beta = 0.118$  and  $\beta = 3.533$ , respectively). Normal nutritional status and college education level would significantly decrease depression ( $\beta = -0.732$ ,  $\beta = -1.961$ ).

On the contrary, Durmaz, et al states that in Turkey by recruiting a total of 329 older adult outpatients. The correlation of GDS-30 with GDS-15 was  $r=0.966$  ( $p<0.001$ ). Analysis performed considering DSM-5 criteria revealed that the sensitivity, specificity, positive predictive value and negative predictive value of GDS-15 for determining depression were 92 %, 91 %, 76 % and 97 %, respectively, when the cutoff value was taken as  $\geq 5$ . The area under the receiver operating characteristic curve [95 % confidence interval (CI)] was 0.97 (95 % CI=0.947-0.996) for GDS-15 ( $p<0.001$ ). Cronbach's alpha coefficient for the total scale was 0.920. The GDS-15, like GDS-30, is a beneficial scale in the determination of depression in older adults (12).

However, Gatti et al. note that in Italy, when the GAS-I was administered to 231 community-dwelling older adults, the results confirmed good psychometric qualities of the questionnaire. Confirmatory factor analyses showed a unidimensional structure of the GAS-I, in agreement with other validated versions. Convergent and discriminant validity were highly satisfactory. The three-factor model also provided an acceptable fit to the data. Receiver operating characteristic curve analyses revealed good discriminant power of the GAS-I (13). Although, Yueh et al in their publication conducted in Taiwan on 330 older adults posits that all short versions of the GDS had satisfactory internal consistency ( $\alpha = 0.83-0.90$ ), with a strong item loading embedded in the same construct of depression (0.43-0.72).

Activities of daily living (ADL) scores had strong associations with the 4-item version of van Marwijk et al (standardized absolute coefficient  $[|\beta|] = 0.15-0.59$ ), the 5-item version of Hoyl et al ( $|\beta| = 0.16-0.45$ ), and the 4-item version of Molloy et al ( $|\beta| = 0.09-0.40$ ) (14). Adding to the above Nikmat, et al demonstrates that by conducting a cross-sectional validation study with 219 elderlies with cognitive impairment, in Malaysia the construct validity showed a significant Bartlett's test of sphericity (Chi-square = 1,340.058,  $P < 0.001$ ) and Kaiser-Meyer-Olkin test (KMO) of 0.90. The factor loadings for each item in the depression domain were satisfactory and ranged between 0.42 and 0.83. The factor loadings for each item in the psychosocial activity's domain were satisfactory and ranged between 0.53 and 0.76. For the reliability analysis of the questionnaire, the total Cronbach's alpha for the final model was satisfactory, with an overall Cronbach's alpha of 0.89. The Cronbach's alpha value for the domain depression and psychosocial activities was 0.861 and 0.80, respectively (15).

In the same framework, Gallardo, et al. argue that when working with a sample of 800 older adults in Chile, 71% of whom declared themselves to be indigenous (Aymara/Mapuche). The non-indigenous group had higher total scores on GDS-15 and lower scores on quality of life and well-being than the indigenous groups ( $p < 0.001$ ). The GDS-15 had a KR-20 coefficient of 0.90 for the non-indigenous group, 0.80 for the Aymara and 0.85 for the Mapuche. The homogeneity index was 0.38 for non-indigenous, 0.24 for Aymara and 0.29 for Mapuche. Discussion: The GDS-15 showed satisfactory psychometric characteristics for the samples studied. However, the better results observed for the non-indigenous group suggest that some characteristics and the content of the rating scale are not entirely appropriate for the older indigenous population (16).

At the same time Lahiri, et al states that in their study conducted in Bengaluru when applying the 15-item GDS-SF translated into Bengali language was administered to 206 geriatrics. The highest discrimination was observed with item 8 (coefficient 3.682,  $P < 0.001$ ) followed by item 14 (coefficient 3.020,  $P < 0.001$ ). Question 2 had the lowest difficulty coefficient (-1.344,  $P = 0.013$ ), while item 15 had the highest (0.775,  $P = 0.001$ ). The questionnaire provided the maximum information (discrimination) around the mean value of the latent trait. The total cutoff score of 5 was almost related to the mean latent trait (-0.111). Items 10 and 13 showed consistent DIF across different demographic groups (17).

On the other, Jokelainen, et al emphasizes that in their research that included 520 older adults living in the city of Oulu, Finland. The screening parameters of the SDS and BDI-21 questions to detect the severity of depression. The Mini Neuropsychiatric Interview for the diagnosis of major depression. The optimal cut-off point for the SDS was 39. The sensitivity and specificity parameters for this cut-off point were 79.2% (95% CI 57.8-92.9) and 72.2% (95% CI 67.9-76.1), respectively. The positive and negative predictive values were 12.5% (95% CI 7.7-18.8) and 98.6% (95% CI 96.7-99.5), respectively. In addition, there was no statistically significant difference in the diagnostic accuracy rates at cut points 39 and 40. In an analysis of receiver operating characteristics, the area



under the curve was 0.85 (95% CI 0.77-0.92) for the SDS total score and 0.89 (95% CI 0.83-0.96) for the BDI-21 ( $p = 0.137$ ).

In addition, another study by Galeoto, et al described that by administering the Italian version of the Geriatric Depression Scale to 119 people (79 people with a diagnosis of depression and 40 healthy). Cronbach's alpha for the GDS-IT administered to the depressed sample was 0.84. The test-retest reliability was 0.91 and the concurrent validity was 0.83. The factor analysis showed a 5-factor structure, and the scale cutoff is between 10 and 11. In the study, the GDS-IT showed good psychometric properties (19).

In contrast, Merkin, et al. reported that in Oceania, when investigating non-demented older adults aged 70 years and older, the GDS-IT showed good psychometric properties. The GDS-15 item scores of 212 participants (47.2% male) were analyzed using the dichotomous Rasch model. The initially poor reliability of the GDS-15, Person Separation Index (PSI) = 0.68, was improved by combining locally dependent items into seven super-items. These modifications improved the reliability of the GDS-15 (PSI = 0.78) and resulted in the best fit of the Rasch model ( $\chi^2(28) = 37.72$ ,  $p = 0.104$ ), strict unidimensionality, and scale invariance across personal factors such as gender, diagnosis, and language background (20).

In the same context, Johansson et al express that in their population-based cross-sectional study in Sweden included 651 people aged  $\geq 85$  years. Where items 3, 8, 12 and 13 of the GDS-15 best differentiated respondents' depressive symptom levels corresponding to the GDS-15 cut-off value of  $\geq 5$ , regardless of age or gender, and thus comprise the proposed short version of the scale (GDS-4 GERDA). For the identification of persons with depression (GDS-15 total score  $\geq 5$ ), the GDS-4 GERDA with a cutoff score of  $\geq 2$  had a sensitivity of 92.9 % and a specificity of 85.0 % (21).

## CONCLUSIONS

The scale has adequate, reliable, and valid psychometric properties to evaluate the knowledge about geriatric depression, therefore it would be important to have it as an evaluation instrument at the level of the different countries, because it will help to know the knowledge of students and health professionals, to be able to intervene in the case that they do not comply with this knowledge.

The Geriatric Depression Scale (GDS) has promising psychometric properties and can be used to estimate the general severity of depression in the elderly population. Because it is short and easy to administer, it is recommended for use as a routine screening test to identify depression among older adults in all populations. The use of the GDS is of value to the nursing profession because it is a brief, easy-to-use screening instrument widely used in clinical and research settings to detect depressive symptoms in older adults that can provide adequate diagnostic confidence.

On the other hand, it would be interesting to conduct empirical studies with the geriatric depression scale in the face of the health emergency due to the COVID-19 pandemic in both confinement, estrangement, and vaccination stage in various populations (22,23,24) related to emotional (25) and educational aspects (26,27,28).

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Conflict of interest

There are no personal, professional, or other conflicts of interest.

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