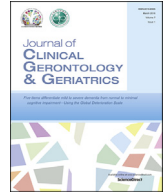




Contents lists available at ScienceDirect

## Journal of Clinical Gerontology &amp; Geriatrics

journal homepage: [www.e-jcgg.com](http://www.e-jcgg.com)

## Original article

## Five items differentiate mild to severe dementia from normal to minimal cognitive impairment—Using the Global Deterioration Scale



Yoon Jung Choi, MD <sup>a</sup>, Chang Won Won, MD, PhD <sup>a,\*</sup>, Sunyoung Kim, MD <sup>a</sup>,  
Hyun Rim Choi, MD, PhD <sup>a</sup>, Byung Sung Kim, MD, PhD <sup>a</sup>, Seung Youn Jeon, MD <sup>a</sup>,  
Sang Yun Kim, MD, PhD <sup>b</sup>, Kun Woo Park, MD <sup>c</sup>

<sup>a</sup> Department of Family Medicine, College Medicine, Kyung Hee University, Seoul, South Korea

<sup>b</sup> Department of Neurology, Seoul National University College of Medicine and Seoul National University Bundang Hospital, Gyeonggi-do, South Korea

<sup>c</sup> Department of Neurology, College of Medicine, Korea University, Seoul, South Korea

## ARTICLE INFO

## Article history:

Received 27 April 2015

Received in revised form

23 May 2015

Accepted 24 May 2015

Available online 5 September 2015

## Keywords:

Alzheimer disease  
dementia  
diagnosis  
mild cognitive impairment  
screening

## ABSTRACT

**Background/Purpose:** The aim of our study is to develop a concise and effective dementia screening tool for use in primary care, wherein we selected five items from the Global Deterioration Scale (GDS) that were most predictive of dementia diagnosis.

**Methods:** Our study population comprised 191 patients older than 60 years who visited four university hospitals between 2008 and 2011 for impaired memory or medical care. Our 5-item screening tool is an abbreviated version of the GDS. We compared the assessment results obtained through our model with those obtained through the GDS in order to evaluate the accuracy of our tool in detecting dementia.

**Results:** The screening tool had a sensitivity of 91.2%, specificity of 75.0%, a cutoff value of 12.495, and an area under the curve of 0.911 (95% confidence interval, 0.862–0.948;  $p < 0.05$ ).

**Conclusion:** We anticipate that our abridged GDS, composed of five items, will facilitate a rapid, yet effective assessment of patients in primary care centers. Its use will benefit both patients and medical professionals by minimizing the length of time required to conduct the assessment, and by allowing early diagnosis and care of patients. However, further research with a larger population is required to verify its efficacy.

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## 1. Introduction

The prevalence of dementia differs among regions: in Western countries, 3.6–10.3% of people  $\geq 65$  years of age have dementia<sup>1,2</sup>; in Japan, 5.8–6.7% of people  $\geq 65$  years of age<sup>3,4</sup> suffer from dementia; and in Korea, 6.8–9.0% of people  $\geq 65$  years of age suffer from dementia. The prevalence of dementia is expected to increase to 15.1% by 2050 and to double every 20 years.<sup>5–8</sup> The most well-known rating scales that measure dementia severity are the Global Deterioration Scale (GDS), the Clinical Dementia Rating (CDR), the Mini Mental Status Examination (MMSE), and the Minimum Data Set.<sup>9–13</sup> These tools are widely used as criteria for measuring dementia severity in clinical research and evaluating the

efficacy of dementia drugs in clinical testing.<sup>14</sup> The GDS and CDR evaluate various areas such as cognition, function, and behavioral symptoms. The GDS and CDR are covered under the National Health Insurance for prescription drugs for dementia.<sup>15</sup> The GDS has the advantage of being easy to use. The CDR has the disadvantage of taking at least 30 minutes for clinicians to administer.<sup>16</sup> The GDS classifies dementia into seven stages, whereas the CDR classifies dementia into five stages. The GDS also has advantages over the CDR because it is more detailed and can be used to evaluate subjective cognitive impairment.<sup>17,18</sup> Therefore, the GDS is a more important tool for evaluating cognitive function, and it has the advantage of easy administration. However, its scoring is not systematic and may be inaccurate; thus, it is not appropriate for use in primary medical care.<sup>14</sup> The GDS is believed to be useful in making a quick and accurate diagnosis of dementia if used as a screening test in the form of an abridged version consisting of specific items for a systematic diagnosis. For an early diagnosis of dementia, checking

\* Corresponding author. Department of Family Medicine, Kyung Hee University Medical Center, 23 Kyunghedae-ro, Dongdaemun-gu, Seoul 130-872, South Korea.  
E-mail address: [chunwon62@naver.com](mailto:chunwon62@naver.com) (C.W. Won).

for symptoms in primary care clinics is important before patients and caregivers voluntarily report symptoms of a decline in cognitive function.<sup>15</sup>

In a previous study, Won et al<sup>19</sup> selected 182 patients  $\geq 50$  years of age who had memory impairment and completed a cognitive test from the neurology or neuropsychiatry department in four university hospitals. An algorithm of the GDS stage was made and reported in that study. However, the study was limited in that only seven (3.8%) participants had normal cognitive function, which corresponded to 1 point on the GDS. In the study, the accurate prediction of GDS stage ranging from 1 to 7 points was reported as difficult.<sup>19</sup>

This study aims to present an abridged version of the GDS, which easily and quickly distinguishes the dementia groups from the normal groups.

## 2. Methods

### 2.1. Materials

Compared with Won et al's<sup>19</sup> study, in this study, 30 elderly people who visited the department of family medicine in one university hospital and 60 elderly people who took a cognitive test at the neurology departments in two university hospitals were added to the existing participants. A total of 272 people met the criteria mentioned above. However, those with hearing, vision, or speech impairments, who visited without a caregiver, or who had important missing values, were excluded from the study. The study for final analysis included a total of 191 participants. The past study<sup>19</sup> included people older than 50 years and with some cases that had missing variables, but in this study, the study population included participants who were older than 60 years and those cases with missing variables by systematic principle were excluded. As a result, the selection bias due to the exclusion of 81 patients, which is about one-third of the total study samples, was low. The survey was conducted with the company of the patients' caregivers, defined as spouses, relatives, or acquaintances, who spent time with the patient at least once a week.

### 2.2. Methods

After consultation and a consensus meeting with five dementia specialists, 31 sample items were extracted from all stages of the GDS (GDS 1–GDS 31), and with the 31 items, the questionnaire was formed (Appendix 1). Each item on the questionnaire was based on GDS, which was shown to be valid and reliable.<sup>9,14,17,20</sup> The questionnaire included 20 survey questions for the caregivers and 11 items that were evaluated by a tester and addressed accordingly. The psychometrician rated the participants with a GDS stage not by a newly published method, which was described by Won et al,<sup>19</sup> but by the original staging method. The GDS has seven stages (1–7), which follows the suggestion of Reisberg et al<sup>9</sup>: those who were classified as stage 1 (normal) to stage 3 [mild cognitive impairment (MCI)] comprised the normal group, whereas those who were classified as stage 4 (mild dementia) to stage 7 (severe dementia) comprised the dementia group. The authors named the operational dementia as GDS-based dementia.

### 2.3. Statistical analysis

The odds ratio was obtained using logistic regression analysis, and the weight was found by multiplying each odds ratio by each variable. The Dementia Screening Score was obtained by summing up the total scores from these items.

The relationship between each question of GDS items and GDS-based dementia (GDS stage  $\geq 4$ ) was analyzed by chi-square test. Receiver operating characteristic curve was used to choose a single cut-point at the point of maximized sensitivity and specificity. All statistical analyses were carried out with PASW version 18.0 for Windows (SPSS Inc., Chicago, IL, USA).

### 2.4. Ethics statement

This study was approved by the Institutional Review Board of Kyung Hee University Hospital, in Seoul, South Korea (approval ID: KMCIRB 1436-03). Informed consent was confirmed by the board.

## 3. Results

The total study population was 191, comprising 65 men and 126 women, with an average age of 74.4 years. Approximately 60% of patients were married or living with cohabitants, of whom 17% were undereducated (Table 1). The distribution of GDS were represented, including 17 (8.9%) patients with GDS Stage 1 (no cognitive decline), 19 (10.0%) patients with GDS Stage 2 (age-associated memory impairment), 64 (33.5%) patients with GDS Stage 3 (MCI), 49 (25.7%) patients with GDS Stage 4 (mild dementia), 27 (14.1%) patients with GDS Stage 5 (moderate dementia), and 15 (7.9%) patients with GDS Stage 6 (moderately severe dementia). There were no patients with GDS Stage 7 (severe dementia; Table 2).

The multivariate logistic regression analysis with forward stepwise method was used to predict GDS-based dementia: GDS Stage 20 (got lost traveling to an unfamiliar location) was most significant, followed by GDS Stage 30 (orientation to time), GDS Stage 8 (decreased performance in employment), and GDS Stage 25 (counting back from 100 in 7's). Finally, adding GDS 31 (orientation to place) resulted in  $p = 0.027$ . When more items were included in the model, the  $p$  value increased to  $>0.05$ . As a result, only five items, which are highly predictive of dementia, were selected (Table 3). The response options of these five questions were

**Table 1**  
General characteristics of the study participants.

Characteristics	N (%)
Sex	
Male	65 (34.03)
Female	126 (65.97)
Residential area	
Large city	111 (58.12)
Small city	52 (27.23)
Town	28 (14.66)
Marital status	
Married	116 (60.73)
Widowed	1 (0.52)
Bereaved	74 (38.74)
Education	
Uneducated	33 (17.28)
Primary school–high school	125 (65.4)
University	33 (17.28)
Cohabit	
Yes	117 (61.26)
No	74 (38.74)
Religion	
Buddhism	46 (24.08)
Catholicism	20 (10.47)
Christianity	68 (35.6)
None/rest	57 (29.85)
Caregiver(informant)	
Spouse	62 (32.46)
Children	97 (50.79)
Sibling/friend/employed nurse	32 (16.75)

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