# *Cambridge Cognitive Examination*: performance of healthy elderly Brazilians with low education levels

# *Cambridge Cognitive Examination*: desempenho de idosos brasileiros saudáveis com baixa escolaridade

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## Abstract

*This study aimed to estimate the quartile distribution on the cognitive assessment of normal elderly with low education as measured by the* Cambridge Cognitive Examination *(CAMCOG). A sample of 292 elderly (> 65 years of age), screened for dementia and depression, were assessed using the CAMCOG. The CAMCOG scores of normal subjects (n = 206) were stratified according to age (65-69, 70-74, 75-79, ≥ 80) and schooling (illiterate, 1-4, and ≥ 5 years of formal education). Mean age was 72.8 (± 3.5) and mean schooling was 3.5 years (± 3). The mean score on the CAMCOG was 71 (± 12.7). The scores at the first quartile for illiterate/1-4 years of schooling were 58/62 (65-69 years), 52/63 (70-74 years), 48/67 (75-79 years) and 46/64 (> 80 years), respectively. There was a significant difference in the CAMCOG quartiles according to education and age. This study provides normative data on the CAMCOG of elderly people with low educational levels which may be clinically useful.*

*Cognition; Mental Health; Aged*

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## Introduction

The increasing prevalence of age-associated chronic degenerative illnesses is a major outcome of the progressive aging of the world population. Among these diseases, dementia is one of the most important [1]. Epidemiological studies, both in developed and in developing countries, have shown that the prevalence of dementia doubles every five years after the age of 65, ranging from 3% among 70-year-old subjects to 20%-30% among the elderly older than 85 [2,3]. Brazil already has a total of 14 million people over 60, of which 37% are illiterate or have less than one year of formal education [4]. In this country, Herrera et al. [5] found a 7.1% prevalence of dementia which was higher among women, increased with age, and presented an inverse correlation with education. It should be noted that only 3.5% of the cases had 8 or more years of formal education, whereas 12.2% were illiterate.

Early detection of cognitive decline in the elderly is relevant, as this may precede progression to Alzheimer's disease. Sensitive neuropsychological tests could identify pre-clinical cognitive deficits and characterize the cognitive profile of a subgroup with poor memory [6]. Many factors seem to interfere with cognitive performance, such as age, personal income, gender, socio-cultural level, intelligence quotients, and jobs. However, educational background plays a key role in this assessment, its influence on the cognitive

scores being a matter of debate and constant research [7,8,9,10,11,12,13].

The *Cambridge Examination for Mental Disorders of the Elderly* (CAMDEX) [14,15] is a standardized structured interview and examination for diagnosing common mental disorders in later life, with special reference to the dementias. It has been validated for use in several languages [16,17,18,19,20,21,22,23]. There is also a validated version in Portuguese [22,23]. The *Cambridge Cognitive Examination* (CAMCOG – section B of the CAMDEX) evaluates a broad range of cognitive functions and it has been applied by many studies as a sensitive measure to detect early stages of dementia in elderly with more than nine years of education [24,25,26]. Two British studies have evaluated the CAMCOG normative values. In the first study, the variables "advanced age", female gender, low schooling, and low social class have been associated with low performance [24]. The other study examined 1,914 community-dwelling elderly. Given the fact that no subjects attained the maximum score, the authors suggested that the CAMCOG is not an easy test even for those without a diagnosed mental disease. This might be an indication that the test has "no ceiling effect" [26]. Research on the prevalence of dementia in India established 52 as the cutoff score on the CAMCOG for illiterates with an 88% specificity and a 98% sensitivity to identify cases. As for educated subjects, a cutoff score of 72 was able to achieve 90% specificity and 94% sensitivity [21]. Also, a Greek study described the performance on the CAMCOG of elderly aged over 70, who had less than 6 years of education, but were not illiterate. They found a 90% sensitivity with scores 56/57 and 90% specificity with scores 43/44 to detect dementia [27].

All cognitive tests show some problems when used to assess individuals with a low level of education. There are few validated instruments to evaluate the Brazilian elderly with less than nine years of education and this is a cause of complication for the assessment of cognitive profiles, from both a clinical and epidemiological perspective. Normative data for age ranges and schooling could help the clinician identify normal and cognitively-impaired individuals. In Brazil, only the *Mini Mental State Examination* (MMSE) [28] has been studied regarding normative scores according to age and education [11,12,29,30,31].

The aim of this study is to assess the distribution in quartiles of the CAMCOG scores in normal elderly subjects who are illiterate or have less than five years of formal education.

## Methods

### Sample

The subjects were consecutively included (n = 292) in this cross-sectional study. Subjects who declared, or were observed during examination to have a severe hearing or sight impairment, or motor alterations that could interfere with the performance in the tests, were not included in this study. Also, subjects with any mental or neurological illness (a neurological examination was performed besides a complete anamnesis) were excluded from the research, as were those elderly whose native language was not Portuguese. The present study aimed to analyze only data on normal subjects from the total sample. Patients with dementia or depression (86 subjects) were excluded. A group with more than five years of formal education was also included in order to compare their cognitive performance with that of the illiterate/low education group.

The procedures for this inclusion and exclusion in the study are detailed below.

### Instruments

The CAMCOG is a structured interview for the diagnosis of neuropsychiatric disorders in the elderly and takes about 30 minutes to be applied. It is designed to detect cognitive deficits which comply with the operational criteria *of the Diagnostic and Statistical Manual of Mental Disorders, Third Edition* (DSM-IIIR), consisting of 60 items in 11 subscales. The cutoff score which discriminates normal from dementia cases in subjects with more than 5 years of education is 79-80. A Brazilian version was used for the present study [22,23].

Two items from the original CAMCOG were omitted in the assessment of the sample (object tactile recognition and recognition of two people in the room). The ability to recognize two people (item 185) was taken from the *Blessed Dementia Scale* [32], an abbreviated version of which is included in the CAMCOG. The item was originally intended for use in a clinical setting where the ability of recognize doctors, nurses, etc. could be tested. Since this test was usually inappropriate for the study situation, the authors' suggestion was to remove the item [24,33]. Tactile recognition (item 175) has been removed from the newer version of the CAMDEX, CAMDEX-R, maintaining the cutoff points for recognition of cognitive impairment [15]. This has reduced the total CAMCOG score by three points, i.e., to a maximum score of 104.

### Procedure

This study was carried out at a public health outpatient unit in Rio de Janeiro, Brazil, from April to June, 2002. Elderly individuals aged 65 or more who came to the unit were invited to participate in the study, and those who agreed to take part signed the informed consent form prior to any research procedure. The study was approved by the Ethics Committee of the State University of Rio de Janeiro.

The subjects were evaluated in order to detect cognitive impairment and/or depression, in three steps. Firstly, a socio-demographic questionnaire, the *Activities of Daily Living Scale* (ADL) [34] and the *Instrumental Activities of Daily Living* (IADL) [35] were used to evaluate functional capacity. Then, two neuropsychologists applied the CAMCOG. Finally, two geriatricians trained to diagnose mental diseases interviewed the subjects to look for disorders according to the DSM-IV [36] criteria.

A Portuguese version of the *Structured Clinical Interview* for DSM-IV (SCID-I) [36] was used to diagnose mood disorders, whereas the diagnosis of dementia syndrome was performed by a consensus meeting which discussed the clinical symptoms, the results of the neuropsychological assessment, and the results of the ADL and IADL scales.

### Statistical analysis

The socio-demographic data were expressed as means and standard deviation (SD) and the CAMCOG scores were expressed both as a mean and standard deviation and as quartiles.

Quartiles on the CAMCOG were compared according to age ranges (65-69, 70-74, 75-79 and > 80), years of education (illiterate, 1-4 years and 5 or more years of formal education), and personal income expressed in the Brazilian currency (R$).

The chi-square test was used to assess the relation of the independent variables with the CAMCOG quartiles and the Kruskall-Wallis test was used to evaluate the relation of the CAMCOG quartiles with mean schooling, age, and personal income. Stratified analyses were performed to assess the inter-relation of the CAMCOG quartiles and the mean income controlled for education range. The accepted statistical significance was 0.05. The statistical package used for analysis was the SPSS 11.0 (SPSS Inc., Chicago, USA).

## Results

Among the 206 subjects without dementia and depression, the mean age was 72.8 (± 3.5), the mean duration of education was 3.5 (± 3), and the mean income was R$ 366.07 (± 335.46). The mean score on the CAMCOG was 71 (± 12.7). The variables which had a relation with the CAMCOG quartiles were age, income and schooling. Gender, however, did not present a significant relationship with the performance on the CAMCOG.

The other socio-demographic data are depicted in Table 1. Table 2 shows the CAMCOG quartiles distribution by the socio-demographic variables.

Table 3 shows the performance on the CAMCOG distributed in quartiles according to education and age ranges.

Table 4 depicts the direct relation among the CAMCOG quartiles, education, personal income, and the inverse relation with age.

## Discussion

The CAMCOG is a highly used test in clinical and epidemiological studies [22] being considered a sensitive measure to detect dementia at early stages [14,25,33,37,38]. However, few studies have attempted so far to identify cutoff scores which

Table 1

Socio-demographic characteristics of the normal elderly sample.

| | n | % |
|---|---|---|
| Gender | | |
| Male | 65 | 31.6 |
| Female | 141 | 68.4 |
| Age (years) | | |
| 65-69 | 60 | 29.1 |
| 70-74 | 83 | 40.3 |
| 75-79 | 35 | 17.0 |
| ≥ 80 | 28 | 13.6 |
| Schooling (years) | | |
| None | 40 | 19.4 |
| 1-4 | 118 | 57.3 |
| ≥ 5 | 48 | 23.3 |
| Marital status | | |
| Single | 18 | 8.7 |
| Married | 84 | 40.8 |
| Widowed | 82 | 39.8 |
| Separated | 22 | 10.7 |

Table 2

*Cambridge Cognitive Examination* quartiles distribution by socio-demographic variables.

| | 1st quartile 38-62 | 2nd quartile 63-71 | 3rd quartile 72-81 | 4th quartile 82-96 |
|---|---|---|---|---|
| Gender | | | | |
| Male | 11 | 16 | 18 | 20 |
| Female | 32 | 39 | 32 | 31 |
| Age (years) | | | | |
| 65-69 | 13 | 17 | 12 | 18 |
| 70-74 | 22 | 20 | 17 | 24 |
| 75-79 | 7 | 7 | 12 | 9 |
| ≥ 80 | | | | |
| Schooling (years) | | | | |
| Illiterate | 21 | 14 | 5 | - |
| 1-4 | 25 | 34 | 37 | 22 |
| ≥ 5 | 4 | 7 | 8 | 29 |

Table 3

*Cambridge Cognitive Examination* quartiles by age range and schooling.

| Schooling (years) | Quartiles | Age range (years) | | | |
|---|---|---|---|---|---|
| | | 65-69 (n = 60) | 70-74 (n = 83) | 75-79 (n = 35) | ≥ 80 (n = 28) |
| Illiterate (n = 40) | | | | | |
| | 25 | 58 | 52 | 48 | 46 |
| | 50 | 67 | 60 | 53 | 56 |
| | 75 | 71 | 69 | 59 | 69 |
| 1-4 (n = 118) | | | | | |
| | 25 | 62 | 63 | 67 | 64 |
| | 50 | 71 | 73 | 74 | 69 |
| | 75 | 79 | 83 | 78 | 75 |
| ≥ 5 (n = 48) | | | | | |
| | 25 | 74 | 76 | 77 | 58 |
| | 50 | 86 | 85 | 82 | 71 |
| | 75 | 89 | 89 | 86 | 75 |

could establish cognitive impairment in elderly samples with less than 4 years of education. Taking into consideration the cutoff score of 79/80 on the CAMCOG, as suggested by the original authors [14], approximately 50% in our sample would be classified as cognitively impaired. The first and last quartile scores were 38/62 and 82/96, with a mean education of 1.96 and 5.98 years, respectively. Age showed an inverse relationship with the CAMCOG scores. The sample with more than 5 years of education, on the other hand, showed a performance compatible with the ones depicted in the literature regarding samples with more than 9 years of education from developed countries. The first and last quartiles showed scores of 89 and 93 points, respectively [26].

The stratification of the CAMCOG quartiles by age and education may contribute to the follow-up of subjects with no cognitive and functional problems. Indeed, it has been shown that tests of cognitive abilities may predict the development of dementia in normal subjects a decade before the clinical outcome, better than and independently of genetic tests [39]. According to this line of reasoning, the observation of the migration to lower quartiles in the CAMCOG scores along a

Table 4

Relation among *Cambridge Cognitive Examination* (CAMCOG) (intra-quartile intervals) and mean (95%CI) age, schooling and personal income.

| | Age | Schooling | Income (R$) |
|---|---|---|---|
| CAMCOG intra-quartile intervals | | | |
| 38-62 | 73.12 (71.62-74.62) | 1.96 (1.15- 2.77) | 246.48 (197.62-295.34) |
| 63-71 | 73.31 (71.76-74.86) | 2.76 (2.11-3.41) | 311.75 (256.80-366.69) |
| 72-81 | 74.14 (72.33-75.95) | 3.50 (2.89-4.11) | 434.62 (328.36-540.88) |
| 82-96 | 70.84 (69.71-71.86) | 5.98 (5.16-6.80) | 474.71 (343.84-605.58) |
| Kruskal wallis | 8.96 | 62.75 | 9.92 |
| p-value | 0.030 | 0.000 | 0.019 |

given period of time might then provide valuable information, rather than just the ascertaining of a cutoff score in a cross-sectional cognitive screening. As shown in Table 3, educational level had a marked effect on the total score in all age ranges, a fact that must be taken into consideration whenever a patient is examined.

Some limitations of the present report must be acknowledged. The subjects were considered to be normal after a clinical examination, without complementary exams. However, other clinical problems could exert some influence on the cognitive performance. The lack of follow-up of the sample precludes the generalization of these findings to detect dementia longitudinally. Also, the small number of elderly above 80 renders our data as insufficient for comparing the clinical performance of subjects in this age range. Life expectancy in Brazil is currently around 72, a fact that may partially explain the scarcity of subjects aged over 80 in our sample.

To the best of our knowledge, this is the first attempt to study the cognitive performance of normal low educational elderly using the CAMCOG with a special focus on illiterate subjects. The data presented herein might aid the evaluation of patients in Portuguese speaking countries, and in Brazil in particular, and may also support the design of other trans-cultural studies.


## Resumo

*Este estudo objetivou estimar a distribuição em quartis do* Cambridge Cognitive Examination *(CAMCOG) de idosos normais com baixa escolaridade. Foram selecionados 292 idosos (≥ 65 anos) que fizeram avaliação para detectar demência ou depressão (DSM-IV). Os resultados do CAMCOG dos indivíduos normais (n = 206) foram estratificados por idade (65-69, 70-74, 75-79 e ≥ 80) e escolaridade (sem escolaridade, 1-4 anos e ≥ 5 anos de estudo formal). A média de idade foi 72,8 anos (± 3,5), a de escolaridade 3,5 (± 3) anos e a pontuação do CAMCOG foi 71 (± 12,7). Os escores do quartil inferior do CAMCOG de analfabetos/1-4 anos de estudo foram 58/62 (65-69 anos), 52/63 (70-74 anos), 48/67 (75-79 anos) e 46/64 (> 80 anos), respectivamente. Verificou-se diferença significativa no desempenho dos quartis do CAMCOG quanto à escolaridade e relação inversamente proporcional com a idade. Este estudo oferece dados normativos do CAMCOG para idosos brasileiros com baixa escolaridade que podem ser úteis no contexto clínico.*


*Cognição; Saúde Mental; Idosos*

## Contributors

I. F. H. Moreira organized the database and participated in the writing of the manuscript. R. A. Lourenço provided the initial database and participated in the writing of the manuscript. C. Soares performed the statistical analyses and participated in the writing of the method section of the manuscript. E. Engelhardt revised the text and added issues in the discussion section of the manuscript. J. Laks designed the study and participated in the writing of the manuscript.

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