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Performance of Brazilian long and short IQCODE on the screening of dementia in elderly people with low education

Tíbor Rilho Perroco, Sonia E. Zevallos Bustamante, María del Pilar Q. Moreno, Sérgio R. Hototian, Marcos A. Lopes, Dionísio Azevedo, Júlio Litvoc, Wilson Jacob Filho and Cássio M. C. Bottino

Old Age Research Group (PROTER), Institute and Department of Psychiatry, Faculty of Medicine, University of São Paulo, Brazil

ABSTRACT

Background: Dementia screening in elderly people with low education can be difficult to implement. For these subjects, informant reports using the long (L) (26 items) and short (C) (16 items) versions of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) can be useful. The objective of the present study was to investigate the performance of Brazilian versions of the IQCODE L, S and a new short version (SBr) (15 items) in comparison with the Mini-mental State Examination (MMSE) for dementia screening in elderly people with low education.

Methods: Thirty-four patients with mild to moderate dementia, diagnosed according to ICD-10 criteria, and 57 controls were evaluated and divided into three groups based on their socioeconomic status and level of education. Patients were evaluated using the MMSE and the informants were interviewed using the IQCODE by interviewers blind to the clinical diagnosis.

Results: Education was correlated with MMSE results ($r = 0.280$, $p = 0.031$), but not with the versions of the IQCODE. The performance of the instruments, evaluated by the ROC curves, was very similar, with good internal consistency (Cronbach's $\alpha = 0.97$). MMSE correctly classified 85.7% of the subjects while the three IQCODE versions (L, S and SBr) correctly classified 91.2% of the subjects.

Conclusions: The long, short and the new short Brazilian IQCODE versions can be useful as a screening tool for mild and moderate patients with dementia in Brazil. The IQCODE is not biased by schooling, and it seems to be an adequate instrument for samples with low levels of education.

Key words: dementia, screening tests, informant report, diagnosis

Introduction

Screening tests are essential in the investigation of patients suspected of having dementia. As the population ages and dementia incidence rates increase, such tests have become even more important. Among screening tests are cognitive assessments performed directly on the patient while others are based on information provided by the carer (or family member). Studies have shown that the association of both is an effective method of performing screening tests (Mackinnon and Mulligan, 1998; Bustamante *et al.*, 2003), increasing sensitivity and specificity of the instruments when used independently. However, in some cases the patient is not able to provide information properly, due to severe disease, refusal to cooperate, or because the patient has a very low level of education (Jorm, 2004). In such cases, indirect assessments, applied only to the caregiver, play a major role in clinical practice, especially in developing countries, in which mean educational level is often lower than that seen in developed countries.

Ideally, screening tests have to be brief, easily adapted, with a high reproducibility level between different raters and in different cultures, and without any educational bias. Unfortunately, many of the current tests do not meet these requirements, and those that do are often long and require training prior to their application (Galvin *et al.*, 2006). In this context, a brief screening test applied to the

Correspondence should be addressed to: Dr. Tíbor R. Perroco, Old Age Research Group (PROTER), Institute of Psychiatry, Faculty of Medicine, University of São Paulo, R. Dr. Ovídio Pires de Campos, 785, 3° andar, CEAPESQ, sala 14, São Paulo / SP. CEP: 05403–010, Brazil. Phone: +55 11 306 969 73; Fax: +55 11 306 980 18. Email: perroco@ajato.com.br and perroco@bairral.com.br.
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caregiver, the IQCODE (Jorm and Jacomb, 1989), was evaluated to verify the efficacy of its long and short versions adapted for use in Brazil.

The IQCODE was originally developed as an interview with the informant by Jorm and Korten (1988). A total of 39 initial items were reduced to 26, making the test easier to apply. There are now versions available in several languages including Chinese, German, Finnish, French, Canadian French, Dutch, Italian, Japanese, Korean, Norwegian, Polish, Spanish, and Thai. Many short versions have been evaluated; for example, 16-item versions in English (Jorm, 1994) and German (de Jonghe *et al.*, 1997), and a 17-item version in Spanish (Morales *et al.*, 1995).

This study aims to evaluate the performance of long (L) and 16-item short (S) Brazilian versions of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) and compare them with the Mini-mental State Examination (MMSE) in the screening of dementia among elderly people with low education. Evaluating the results retrospectively, we also added a comparison with a new version, the IQCODE 15-item short Brazialian version (SBr). We hypothesized that instruments based on the informant report can be as useful as a brief cognitive test for the screening of dementia in elderly people with low education.

Method

A cross-sectional, case-control study was performed on patients diagnosed with dementia at the Old Age Research Group (PROTER) Clinic of the Institute of Psychiatry, Hospital das Clínicas, Faculty of Medicine, University of São Paulo (IPq-HCFMUSP). The control population comprised patients in the Geriatrics Service of HCFMUSP, and elderly relatives of patients in the PROTER Clinic.

Inclusion criteria were (i) older than 60 years and (ii) definitive diagnosis of mild to moderate dementia, performed by psychiatrists at PROTER Clinic of IPq-HCFMUSP, in accordance with the ICD-10 criteria (World Health Organization, 1993) and DSM-III-R (American Psychiatric Association, 1987). Exclusion criteria were (i) presence of other psychiatric disorders; (ii) severe stage of dementia according to DSM IIIR criteria; and (iii) lack of any relatives who could provide reliable information on the patients' current and previous health status. For the controls, the exclusion criteria were (i) having a psychiatric disorder and (ii) absence of relatives who could provide reliable information on the controls' current and previous health status.

Both the patients and controls were classified into three groups, according to their socioeconomic and educational level, in accordance with the criteria set down by the Brazilian Association of Market Research Institutes (ABIPEME) (Associação Brasileira de Anunciantes, 1989).

The instruments used were the Mini-mental State Evaluation (MMSE) (Brucki *et al.*, 2003); Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE), long (L) (26 items), short (S) (16 items) (Jorm *et al.*, 2004), and a new short version containing 15 items (IQCODE-SBr), developed based on the results obtained with the present sample; a scale to assess psychiatric symptoms, Psychiatry Screening Questionnaire (SRQ-20) (Mari and Williams, 1986); a brief cognitive test, Abbreviated Mental Test Score (AMTS) (Qureshi and Hodkinson, 1974); and the Criteria for Socioeconomic Classification by ABIPEME (Associação Brasileira de Anunciantes, 1989). All the instruments were used in their Brazilian Portuguese versions. The IQCODE versions used in this study were translated from their original version in English by a geriatric psychiatrist (M.A. Lopes) and by a psychologist and English teacher (P. Zukauskas).

The study was performed in two stages. The first stage was the selection of controls, which used the scales AMTS and SRQ-20 to assess psychiatric symptoms and cognitive performance. Most of the controls had been carefully assessed at the geriatric clinic in our hospital, and all of them (including the informants selected from within our service) were interviewed to rule out significant cognitive complaints and impairment in daily living activities, before being evaluated with the AMTS and SRQ20. The second study stage was the application of screening instruments for dementia in cases and in controls, which was performed at the Clinic of the Psychiatry Institute at HCFMUSP by examiners blinded to the individuals' clinical status.

Thirty-four patients diagnosed with mild to moderate dementia according to ICD-10 criteria were assessed, as well as 58 elderly controls, who underwent the SRQ-20 and AMTS. Individuals were divided into three groups, according to their socioeconomic status and educational level (high, middle and low). The patients were assessed using the MMSE, and the informants were interviewed using the 26 items of the IQCODE by examiners blinded to the individuals' previous clinical diagnosis. The scoring of the IQCODE in the present study involved summing the items and dividing them by the number of completed items, because there were some missing items (Fuh *et al.*, 1995; Lim *et al.*, 2003; Jorm, 2004).

This study was approved by the Ethics Committee of the Faculty of Medicine, University of São Paulo, and all the patients and informants agreed to participate in the study after signing a consent form.

Data analysis was performed using the statistical package SPSS for Windows version 14.0 and the MedCalc version 9.5, with descriptive analysis, analysis of receiver operating characteristics (ROC) curves and logistic regression. Diagnosis of dementia was the dependent variable, and the MMSE and IQCODE versions were the independent variables.

Results

Table 1 shows the sociodemographic characteristics of both groups. Note that the patient group had a higher mean age, and the control group had a higher proportion of women.

There was no difference in mean IQCODE L, S and SBr (15 or 16 items) according to gender as shown in Table 2. There was a significant correlation between educational level and the MMSE in the control group ($r = 0.272$; $p = 0.039$), but not in the patient group ($r = 0.303$; $p = 0.082$). As the correlation coeficients in patients and controls were comparable, the observed significance was probably due to low statiscal power in the patient group. On the other hand, the IQCODE versions were not significantly correlated with age and educational level (Table 2).

The performance of all four instruments evaluated by the areas under the ROC curves was very similar (see Figure 1): MMSE = 0.94 (95% CI: 0.90–0.98), IQCODE-L = 0.94 (95% CI: 0.88–1.00), IQCODE-S = 0.96 (95% CI: 0.90–1.01), IQCODE-SBr = 0.96 (95% CI: 0.90–1.01)

Table 1. Sociodemographic characteristics of the sample

VARIABLES		DIAGNOSIS: DEMENTIA	DIAGNOSIS: CONTROLS	STATISTICAL TEST AND P-VALUE
Gender	Male	16 (47.1%)	12 (20.7%)	$\chi^2 = 7.04$, $p = 0.008$
	Female	18 (52.9%)	46 (79.3%)	
Age		73.70 (5.8)	69.26 (5.4)	$t = 3.72$, $p < 0.001$
Years of education		5.44 (4.0)	4.81 (3.7)	$t = 0.76$, $p = 0.45$
Social class	Upper	11 (32.4%)	19 (32.8%)	
	Middle	13 (38.2%)	19 (32.8%)	$\chi^2 = 0.355$, $p = 0.837$
	Lower	10 (29.4%)	20 (34.5%)	

χ^2 = Pearson χ^2; t = Student t test; p = p-value.

Table 2. Instruments' characteristics by gender and correlation with age and education

		GENDER				AGE		EDUCATION	
		MALE (n = 12)	FEMALE (n = 46)	t	p	r	p	r	p
Controls	MMSE	28.08 ± 2.11	27.89 ± 1.97	0.297	0.768	–0.127	0.341	0.272*	0.039
	IQCODE-L	3.01 ± 0.62	3.01 ± 0.47	0.001	0.999	0.060	0.653	0.173	0.194
	IQCODE-S	2.86 ± 0.59	2.85 ± 0.47	0.074	0.941	0.052	0.700	0.173	0.193
	IQCODE-SBr	3.10 ± 0.65	3.05 ± 0.52	0.309	0.758	0.051	0.706	0.158	0.236
		Male (n = 16)	Female (n = 18)	t	p	r	p	r	p
Patients	MMSE	19.94 ± 6.81	19.72 ± 5.38	0.103	0.919	–0.100	0.572	0.303	0.082
	IQCODE-L	4.01 ± 0.56	4.13 ± 0.57	–0.623	0.537	0.181	0.305	–0.136	0.443
	IQCODE-S	3.93 ± 0.50	4.07 ± 0.60	0.714	0.493	0.171	0.334	–0.087	0.626
	IQCODE-SBr	4.28 ± 0.53	4.34 ± 0.59	0.824	0.744	0.160	0.367	–0.010	0.954

t = Student t test; p = p-value; r = Pearson correlation coefficient; * = significant ($p < 0.05$).

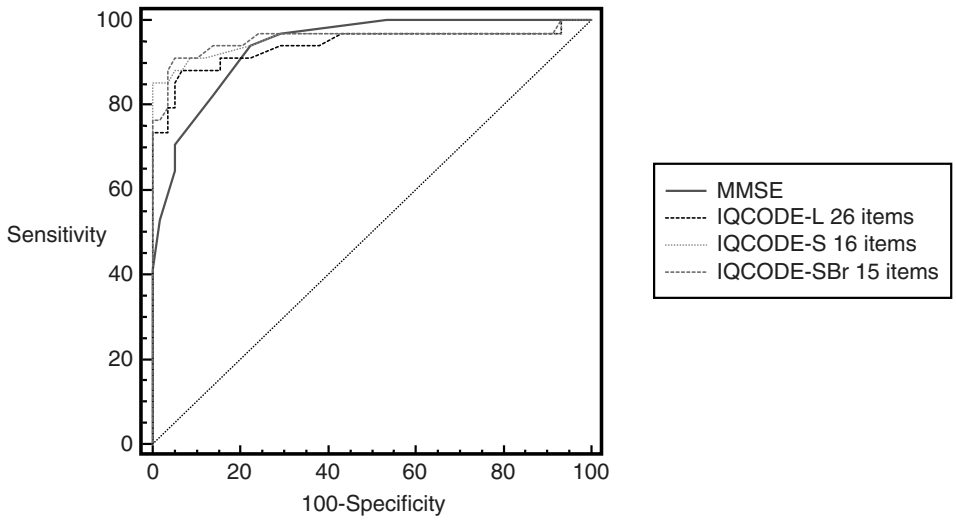

Figure 1. ROC curves comparison.

Table 3. ROC curve areas for each individual IQCODE item

QUESTION NUMBER	IQCODE VERSION	ANSWERS FREQUENCY (N)	AREA UNDER THE ROC CURVES	P-VALUE	95% CI	
14	a,b	90	0.916	<0.001	0.83	1.002
10	a,b	91	0.908	<0.001	0.826	0.991
5	a,b	92	0.889	<0.001	0.798	0.981
13	a,b	91	0.880	<0.001	0.771	0.99
23	a,b	91	0.877	<0.001	0.758	0.995
8	a,b	92	0.871	<0.001	0.76	0.981
2	b	91	0.862	<0.001	0.75	0.973
4	a,b	92	0.856	<0.001	0.739	0.973
22	a,b	90	0.856	<0.001	0.748	0.964
25	a,b	92	0.853	<0.001	0.727	0.979
6	b	92	0.838	<0.001	0.722	0.953
9	a,b	91	0.835	<0.001	0.716	0.953
24	a,b	90	0.824	<0.001	0.693	0.955
26	a,b	91	0.818	<0.001	0.677	0.959
3	a,b	92	0.817	<0.001	0.686	0.949
20	–	74	0.811	<0.001	0.674	0.947
12	a	91	0.800	<0.001	0.671	0.929
19	a	90	0.797	<0.001	0.65	0.944
18	–	86	0.792	<0.001	0.653	0.932
11	–	92	0.788	<0.001	0.655	0.92
1	–	91	0.786	<0.001	0.653	0.918
7	a	92	0.751	0.001	0.595	0.906
17	–	90	0.730	0.003	0.592	0.869
21	–	87	0.699	0.011	0.537	0.86
16	–	87	0.576	0.331	0.408	0.744
15	–	89	0.461	0.616	0.295	0.626

a = IQCODE-S: 16 items; b = IQCODE-SBr: 15 items.

($p \leq 0.001$). The ROC curves were also used to separate the sample (patients + controls) into two social classes (upper vs. middle + low social classes) and also into three social classes (upper, middle, and low). By dividing the sample into two or three social classes, the areas under the ROC curves for all the instruments (MMSE, IQCODE, IQCODE-S, IQCODE-SBr) ranged from 0.92 to 0.99 and remained statistically significant ($p < 0.001$).

The various IQCODE versions had good internal consistency (Cronbach's α: IQCODE-L = 0.976,

Table 4. Instruments comparison

INSTRUMENTS' CUT-OFF POINTS	SENSITIVITY % (a)	SPECIFICITY % (a)	POSITIVE PREDICTIVE VALUE % (a) (b)	NEGATIVE PREDICTIVE VALUE % (a) (b)
MMSE				
≤ 21	41.18 (31.12–51.24)	100	100	92 (86.46–97.54)
≤ 26	94.12 (89.31–98.93)	77.97 (69.42–86.38)	38.7 (28.75–48.65)	98.9 (96.77–100)
≤ 28	100	47.46 (37.26–57.66)	22 (13.54–30.46)	100
IQCODE-L (26 items)				
≥ 3.16	94.12 (89.31–98.93)	70.7 (61.40–80)	32.2 (22.65–41.75)	98.8 (96.57–100)
≥ 3.38	88.24 (81.66–94.82)	93.1 (87.92–98.28)	65.5 (55.79–75.21)	98.2 (95.48–100)
≥ 3.73	73.53 (64.51–82.55)	100	100	96.2 (92.29–100)
IQCODE-S (16 items)				
≥ 3.2	91.2 (85.41–96.99)	91.4 (85.67–97.13)	61 (51.03–70.97)	98.6 (96.20–100)
≥ 3.53	85.3 (78.03–92.54)	100	100	97.9 (94.97–100)
≥ 3.76	70.59 (61.28–79.90)	100	100	95.8 (91.70–99.90)
IQCODE-SBr (15 items)				
≥ 3.2	97 (93.51–100)	74 (65.04–82.96)	35.7 (25.91–45.49)	99.4 (97.82–100)
≥ 3.6	91.2 (85.41–96.99)	94.8 (90.26–99.34)	72.3 (63.16–81.44)	98.6 (96.29–100)
≥ 3.93	76.5 (67.84–85.16)	100	100	96.6 (92.90–100)

(a) 95% confidence interval.
(b) PPV and NPV corrected for a community dementia prevalence of 12.9%.

Table 5. Review of papers with short versions of the IQCODE

AUTHORS AND YEAR OF PUBLICATION	CUTOFF POINTS	SENSITIVITY %	SPECIFICITY %	ROC CURVES AREAS
Jorm (1994)	≥ 3.38	79	82	0.85
Jorm *et al.* (1996)	≥ 3.38	75	68	0.77
Del-Ser *et al.* (1997)	≥ 3.88	79	73	0.77
Harwood *et al.* (1997)	≥ 3.44	100	86	na
IQCODE-S	≥ 3.53	85.3	100	0.96
IQCODE-SBr	≥ 3.60	91.2	94.8	0.96

na = not available.

IQCODE-S = 0.975, IQCODE-SBr = 0.977). Table 3 shows that the items with poorer performance, according to the ROC curves, were items 15 (area = 0.46) and 16 (area = 0.58) of the IQCODE. Item 15 is "Remembering things that happened to him/her when he/she was young"; and item 16 is "Remembering things he/she learned when he/she was young". On the other hand, the three items with the largest area under the curve were 14, 10 and 5, which deal respectively with learning new things in general, remembering where to find things, and recalling conversations a few days later. In the current sample, item 20 (composing a letter to friends or for business purposes) of the IQCODE-L had the lowest response frequency (n = 74 responses) (Table 3), whereas the other items were responded to by 86–92 carers. Based on the analysis of areas under the ROC curves (Table 3) of individual items, new versions in Portuguese were tested, obtaining a 15-item version (IQCODE-SBr) with area under the curve equal to the original 16-item IQCODE-S (0.96). There were no more than five missing values for IQCODE-L and no more than two missing values for IQCODE S and SBr for each subject. For the IQCODE-L, 66.3% of the sample answered all the questions, 31.5% had fewer than four missing responses and 2.2% had four or five missing values. For the IQCODE-S, 88% of the sample answered all the questions, 8.7% had one missing value and 3.3% had two missing values. For the IQCODE-SBr, 90.2% of the sample answered all the questions, 6.5% had one missing value and 3.3% had two missing values.

Table 4 uses the ROC curve to present sensitivity, specificity and positive and negative predictive values corrected by the prevalence of dementia

in the community for a few cut-off points. The dementia prevalence estimated in the study published by Bottino *et al.* (2008), conducted in the same city as the present study, was used as a reference (12.9%), despite being higher than previously published results on dementia prevalence. The cut-off point that showed the best balance between sensitivity and specificity for the MMSE was ≤ 26 (sensitivity = 94.12% and specificity = 77.97%). The cut-off points obtained for the three versions of the IQCODE that had the best balance between sensitivity and specificity were IQCODE-L 3.38 (sensitivity = 88.2%; specificity = 93.1%); IQCODE-S 3.53 (sensitivity = 85.3%, specificity = 100%); IQCODE-SBr 3.6 (sensitivity = 91.2%; specificity = 94.8%).

Using logistic regression, including age and gender, the MMSE correctly classified 87% of the individuals (sensitivity = 76.5%, specificity = 93.1%). On the other hand, the IQCODE-L version correctly classified 98.3% of the individuals (sensitivity = 82.4%, specificity = 98.3%), the IQCODE-S version 95.7% (sensitivity = 91.2%, specificity = 98.3%) and the IQCODE-SBr version 94.6% (sensitivity = 91.2%, specificity = 96.6%).

Discussion

In this study the comparison between IQCODE-L, IQCODE-S, IQCODE-SBr and MMSE in elderly people with low levels of education showed the superiority of IQCODE versions over the MMSE in terms of sensitivity and accuracy. It was observed that educational level had an influence on the MMSE results (as expected), but there was no significant correlation between educational level and the IQCODE, both in the long and short versions in Portuguese. Evaluation of each item alone showed that the items excluded from the long version did not compromise the instrument's performance. The data suggest that items 15 and 16, because they dealt with the past, may have compromised the IQCODE-L efficacy, with a little smaller area under the curve than the S and SBr versions, which did not include these items. This sample had a lower response frequency in item 20, probably because it evaluates a task that is much influenced by low educational level. This same item was found to have a 97% non-response rate by Tang *et al.* (2003). This finding could also explain why the 15-item version had a similar performance to longer versions that maintained item 20 (see Table 3). Thus, the 15-item version (IQCODE-SBr), which had a similar performance and shorter application time than the other IQCODE versions tested, can be considered the most appropriate for application in a population such as that assessed in the present study.

Educational level in the sample was homogeneously low, with means of 5.44 years of schooling for the patients, and 4.78 years for the controls. Therefore, it differs from studies such as those conducted in Italy (Isella *et al.*, 2002), in a sample that had a higher level of education (7 years), and in China (Fuh *et al.*, 1995), in which mean educational level was low (controls = 1.6 years, patients = 6.6 years). However, in the study performed in China (Fuh *et al.*, 1995), there was a large variation between minimum and maximum educational level, especially in cases (controls = 0–15 years; cases = 0–19 years), and 63% of the sample comprised illiterate individuals. In the study by Fuh *et al.* (1995) on the 26-item version of the IQCODE, only nine items could be excluded with no significant impact on sensitivity and specificity, and both the long (26 items) and short (17 items) versions had quite similar diagnostic accuracies. The authors proposed that, in population samples with a low level of education, items assessing writing and reading skills could be excluded without impairment to test performance. Two items alone had excellent accuracy as a screening test, namely, recalling a conversation a few days later, and handling financial matters, e.g. one's pension, dealing with the bank. The Chinese IQCODE did not show any association with educational level or gender and had a weak association with age; therefore, it can be useful in populations with large variations of educational level (Fuh *et al.*, 1995). The sample assessed by Senanarong *et al.* (2001) had a mean educational level of 4 years, very similar to the sample used in this study, and the diagnosis was performed independently according to DSM-IV criteria. Logistic regression showed that only three items contributed significantly to the diagnosis: remembering what day and month it was; learning to use a new gadget; and handling everyday arithmetic problems. The IQCODE showed an area under the ROC curve of 0.928 vs. 0.814 for the MMSE, similar to the results obtained in this study.

Using the short IQCODE in its Spanish version, Morales *et al.* (1997) compared the instrument in two different samples, one urban and the other rural. The authors did not report educational level for the rural sample, but 78.2% of the individuals were illiterate. Mean educational level was 4.9 years for the urban sample. The IQCODE was better than the MMSE in both samples and there was no influence of age, educational or cultural level, in contrast to what occurred in the MMSE.

The cut-off points for this study were IQCODE-L = 3.38, IQCODE-S = 3.53, and

IQCODE-SBr = 3.6, which are very similar to those suggested in the literature (Jorm, 1994; Jorm *et al.*, 1996; Del-Ser *et al.*, 1997; Harwood *et al.*, 1997), as can be seen in Table 5.

Limitations of the study include the relatively small sample with low mean educational level, but with few illiterate elderly individuals. Data about the educational level of informants were not collected, and this should be addressed in further studies since it may influence the IQCODE results. The control group taken from the Geriatrics Clinic of HCFMUSP did not come from a community-based sample, but they represent the elderly subjects attending our hospital. This sample may comprise informants who are more aware of health changes and who may put too much emphasis on small changes in the elderly, inflating the result of the IQCODE versions used in this study.

In summary, the results suggest that the long and short Brazilian versions of the IQCODE can be used for the screening of mild to moderate cases of dementia. The IQCODE is not influenced by educational level, which makes it an adequate instrument for use in Brazil, a country that has a sizeable proportion of elderly subjects with low educational attainment, and useful for other samples with a similar educational profile. New studies should be conducted to confirm the findings obtained with the new short Brazilian version (IQCODE-SBr) of only 15 items but with a similar performance to that of the longer versions.

Conflict of interest

None.

Description of authors' roles

Dr. Perroco participated in data analysis, and wrote the paper. Dr. Zevallos Bustamante participated in data collection, data analysis and assisted with writing. Ms. Moreno and Drs. Hototian, Lopes and Azevedo participated in data collection. Professor Litvoc participated in data analysis and assisted with writing. Professor Jacob Filho supervised patient recruitment and assisted with writing. Professor Bottino designed the study, obtained funding, supervised the data collection, participated in data analysis and assisted with writing.

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