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Suggested instruments for General Practitioners in countries with low schooling to screen for cognitive impairment in the elderly

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ABSTRACT

Background: General Practitioners (GPs) from underdeveloped countries apply cognitive impairment (CI) assessment tools translated and adapted to cultural setting from other idioms, mainly English. As schooling in elderly from underdeveloped countries tends to be relatively heterogeneous, it is necessary to establish normative and cut-off scores for these CI instruments that are based on studies conducted locally. Some CI screening instruments frequently used by Brazilian specialists in dementia were analyzed to determine which could be most useful to GPs in their working sets.

Method: Two hundred forty-eight patients aged 65 years or older that had been assisted by GPs in a tertiary hospital in Brazil were evaluated. Based on the MMSE and/or Short-IQCODE scores, 52 probable cases were identified on the basis of clinical data, performances on the neuropsychological tests and questionnaires (Functional Assessment Questionnaire/FAQ, Category Verbal Fluency/CVF, Clock Drawing Test /CDT) and blood tests and brain CT.

Results: The combination of a functional questionnaire with a cognitive instrument had higher sensitivity and specificity than using the instruments alone. A FAQ cut-off of 3 in conjunction with a CDT cut-off of 6 proved optimal (93% sensitivity and 92.5% specificity). A higher specificity (93.5%) was attained using a combination of the FAQ (cut-off of 3) with the CVF (cut-off of 10).

Conclusions: For low schooling elderly, the combination of the FAQ and CVF represented a very simple method of increasing the chances of correct screening. For those with higher schooling, the combination of the FAQ and CDT was more suitable.

Key words: cognitive impairment, screening, cognitive testing, developing country, aging

Introduction

General practitioners (GPs) from underdeveloped countries face rapidly aging populations accompanied by the consequent clinical peculiarities such as cognitive impairment (CI; Prince, 2000; Mathew and Mathuranath, 2008). Despite its high prevalence, the value of screening for CI in the elderly remains controversial (Boustani *et al.*, 2003) although much can be done for CI patients and their caregivers during the course of these diseases. (Fox *et al.*, 2013) Previous studies have shown that CI in the elderly is frequently overlooked by GPs (Barret *et al.*, 1997; Renshaw *et al.*, 2000; Valcour *et al.*, 2000; Jacinto *et al.*, 2011). In Brazil, about 75% of the population receive medical care exclusively from the public Unified Health System (UHS) whose healthcare assistance is centered on GPs. (Portal Brasil, 2013) In the UHS, high patient demand has led to briefer GP appointments that are too short for a complete cognitive assessment. With regard to CI screening, it is necessary for GPs to have access to instruments that are easy and quick to apply (Jacinto *et al.*, 2012).

Most of the CI assessment tools available in Brazil have been translated from other languages – mainly English – and adapted to our cultural setting. As schooling in elderly from underdeveloped

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countries such as Brazil tends to be relatively heterogeneous, it is necessary to establish normative and cut-off scores for these CI instruments that are based on studies conducted locally (Prince, 2000; Mathew and Mathuranath, 2008). In the present study, CI screening instruments frequently used by Brazilian specialists in dementia were analyzed to determine which could be most useful to GPs in their working sets.

Methods

Data for this study were drawn from three previous studies whose methods have been reported elsewhere (Jacinto *et al.*, 2011; 2012; 2013). Briefly, 248 patients aged 65 years or older that had been assisted by GPs in a tertiary hospital of the city of São Paulo (Brazil) were evaluated. Considering previously clinical experience of the outpatients' services, 20% of these patients were expected to be cognitively impaired. Indeed, 52 patients from these 248 were cognitively impaired.

In the assessment, a geriatrician recorded clinical antecedents and use of medications. The Mini-Mental State Examination – MMSE (Folstein *et al.*, 1975; Brucki *et al.*, 2003), the short version of the Informant Questionnaire on Cognitive Decline in the Elderly – Short-IQCODE (Jorm, 1994; Bustamante *et al.*, 2003), the Brief Cognitive Battery – Edu (BBRC-Edu) which comprises: naming ten simple drawings, incidental and immediate memory, learning, category verbal fluency (CVF), the clock drawing test – CDT, delayed recall and recognition tasks (Nitrini *et al.*, 1994; 2004; 2007), the Functional Activities Questionnaire – FAQ (Pfeffer *et al.*, 1982), Forward and Backward Digit Span, were applied to the patient and an informant. Short-IQCODE and/or MMSE scores were used to classify patients into probable cognitively impaired cases or by using cut-off scores previously suggested for the Brazilian population. Probable cases underwent neuropsychological evaluation using the Dementia Rating Scale (Porto *et al.*, 2003), laboratory tests (blood count, thyroid hormones, syphilis serology, liver function, kidney function, vitamin B12, and folic acid levels), and a brain computed tomography (CT) scan (Caramelli *et al.*, 2011).

Final diagnoses were established in a consensus meeting with the presence of two neurologists specialized in dementia (SMDB, RN) and the geriatrician who had initially evaluated the patients (AFJ), using all available data. The probable cases and a sample of 53 patients considered not cognitively impaired based on the MMSE and/or Short-IQCODE scores were evaluated on the basis of clinical data, performances on the neuropsychological tests and questionnaires for all subjects, and additionally on laboratory and CT results for probable cases. Patients were classified into cases with dementia, cognitive impairment no dementia (CIND), and without cognitive impairment (WCI). Of the 248 elderly patients, three did complete the study and were considered "missings" and 52 were initially classified as cognitively impaired (21 had a final diagnosis of dementia, 22 CIND and six cases were ultimately considered not cognitively impaired). Of the dementia group, six cases were classified as mild, seven were moderate, and eight were severe considering Clinical Dementia Rating (Morris, 1993). All 53 individuals classified as not cognitively impaired by the screening instruments had the final diagnosis of WCI in the consensus meeting. The specificity of the screening method (MMSE and/or Short-IQCODE) was 100%, whereas its sensitivity was 82.7%.

The Research Ethics Committee of the *Hospital das Clínicas* of the *Universidade de São Paulo*, Medical School, Brazil approved this study.

Statistical analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences) version 11.5 for Windows and "R: A Language and Environment for Statistical Computing" software. Demographic data for the three groups ("dementia", "CIND," and "WCI") were compared using the Kruskall–Wallis test followed by a multiple comparison test ("*post hoc*"). The Kruskall–Wallis test was used to compare the performances on instruments among the groups, followed by a "*post hoc*" test. ROC curves were used to determine the sensitivity and specificity of these instruments. Logistic regression was used in order to obtain a score for the combination of the FAQ with three other easy, fast-to-apply instruments: the Clock Drawing Test, Verbal Fluency, and delayed recall item of the Brief Cognitive Battery, while the sensitivity and specificity of these scores were obtained by ROC curve.

Results

Demographic data for the dementia, CIND, and WCI groups are shown in Table 1. Patients with dementia had a lower educational level than WCI patients.

Comparison of performances among the three groups is shown in Table 2. Statistically significant differences were found for all the instruments used. The respective sensitivity and specificity of the instruments are given in Table 3. The combination

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Table 1. Median, interquartile interval, and comparisons by age and schooling in the groups

	MEDIAN (IQI)				
	WCI ($N = 202$)	CIND ($N = 22$)	DEMENTIA ($N = 21$)	p*	MULTIPLE COMPARISONS**
Age	70 (67–74)	69.5 (67–73.3)	72 (67–75.5)	0.28	D = CIND = WCI
Schooling	4 (2–8)	4 (2–8.3)	2 (2–4)	0.02	D = CIND CIND = WCI D<WCI

* Kruskall-Wallis Test; **Dunn's *post hoc*; IQI, inter quartile interval; D, dementia; CIND, cognitive impairment no dementia; WCI, without cognitive impairment.

Table 2. Performances on the instruments and comparisons among the three groups

	MEDIAN (IQI)				
	DEMENTIA ($N = 21$)	CIND ($N = 22$)	WCI ($N = 202$)	p^*	MULTIPLE COMPARISONS**
FAQ	8 (5.5–26.5)	3 (1.8–5)	0 (0–0)	<0.001	D = CIND>WCI
Digit span (forward)	4 (3–5)	5 (4–5.3)	5 (4–6)	<0.001	D<CIND = WCI
Digit span(backward)	1 (0–2)	2 (1–3)	2 (2–3)	<0.001	D<CIND = WCI
Visual perception and naming	10 (5.5–10)	10 (10–10)	10 (10–10)	<0.001	D<CIND = WCI
Incidental memory	4 (0.5–5)	5 (5–6.25)	6 (5–7)	<0.001	D<CIND = WCI
Immediate memory	5 (1–6.5)	7 (6–7)	7 (7–8)	<0.001	D<CIND<WCI
Learning	6 (1–6.5)	7 (6–8)	8 (7–9)	<0.001	D<CIND<WCI
Verbal Fluency	7 (3–8.5)	10.5 (9–11.3)	12 (10–15)	<0.001	D<CIND<WCI
Clock Drawing Test	2 (1–4.5)	5.5 (4–8)	9 (8–10)	<0.001	D = CIND<WCI
Delayed Recall	4 (0–5)	5.5 (4–8)	8 (7–8)	<0.001	D<CIND<WCI
Recognition	8 (3.5–9.5)	8 (7.8–9.3)	10 (10–10)	<0.001	D = CIND<WCI

*Kruskall–Wallis Test; ** "*post hoc*"; D, Dementia; CIND, Cognitive Impairment No Dementia; WCI, Without Cognitive Impairment; IQI, Interquartile Interval; FAQ, Functional Activities Questionnaire.

Table 3. Area under ROC curve, sensitivity, and specificity of the instruments for "dementia" and "cognitive impairment no dementia" vs. "without cognitive impairment" groups

	AREA	*p*	CI (AREA: 95%)	CUT-OFF SCORE	SENSITIVITY (%)	SPECIFICITY (%)
FAQ	0.945	<0.001	0.902–0.988	3	84.0	94.0
Digit span (forward)	0.691	<0.001	0.600–0.783	4	70.8	58.1
Digit span (backward)	0.720	<0.001	0.634–0.805	1	77.2	48.8
Visual perception and naming	0.610	0.024	0.507–0.713	9	95.5	25.6
Incidental memory	0.730	<0.001	0.644–0.815	5	68.3	67.4
Immediate memory	0.759	<0.001	0.681–0.836	6	81.7	51.2
Learning	0.826	<0.001	0.754–0.898	7	70.3	81.4
Verbal fluency	0.777	<0.001	0.701–0.853	10	71.3	69.8
Clock drawing test (CDT)	0.821	<0.001	0.754–0.888	6	79.2	67.4
Delayed recall	0.799	<0.001	0.726–0.872	6	77.2	69.8
Recognition	0.804	<0.001	0.721–0.886	9	75.7	76.7
FAQ + CDT	0.965	<0.001	0.941–0.989	− 1.55	93	92.5
FAQ + Delayed Recall	0.944	<0.001	0.930–0.983	− 2.20	86.4	89.6
FAQ + CVF	0.957	<0.001	0.905–0.983	− 1.43	88.4	93.5

CI, Confidence Interval; FAQ, Functional Activities Questionnaire; CDT, Clock Drawing Test; CVF, Category Verbal Fluency.

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of a functional questionnaire with a cognitive instrument had higher sensitivity and specificity than using the instruments alone. A FAQ cut-off of 3 in conjunction with a CDT cut-off of 6 proved optimal (93% sensitivity and 92.5% specificity). A higher specificity (93.5%) was attained using a combination of the FAQ (cut-off of 3) with the CVF (cut-off of 10).

Discussion

In this study, the FAQ showed the highest sensitivity and specificity considering all the instruments used in the cognitive assessment. Three tests were chosen for analysis with the FAQ given they are easy to apply (CDT and CVF) and also, in the case of delayed recall, because this type of memory is usually impaired in early phases of dementia. The most specific score was observed for the FAQ and CVF combination, whereas the most sensitive score was attained with combined use of the FAQ and CDT.

CVF may be the most useful test for GPs since patient writing or drawing is not required plus the test takes only one minute to apply. In this study, CVF failed to show high sensitivity or specificity in the detection of CI when analyzed alone but in combination with FAQ, both sensitivity and specificity were enhanced. Our CVF score of 10 is similar to values obtained in other Brazilian studies although our sample was not stratified into schooling levels as observed in these previous studies (Brucki and Rocha, 2004; Caramelli *et al.*, 2007; Radanovic *et al.*, 2009). Regarding the delayed recall task of the BBRC-Edu, the present study found lower sensitivity and specificity compared to the study by Takada *et al.* (2006), although their sample of cognitively impaired individuals contained only dementia cases, while our sample included CIND patients. It is likely that the efficacy of the delayed recall in discriminating CIND from WCI is not as high as for dementia thus explaining the lower sensitivity and specificity seen in the present study. The accuracy of the Clock Drawing Test for CI screening has been previously evaluated (Aprahamian *et al.*, 2009) and shown to be effective for discriminating dementia, but less effective for mild cases of dementia or CIND from normal individuals and that might be the reason for the low specificity of the CDT found in our study when used alone, what was expected since CDT is a test mostly influenced by schooling. The combination of the CDT and FAQ showed the highest accuracy for distinguishing both dementia and CIND from WCI in our study, although the utility of the CDT in populations with lower schooling is well-known.

In their working sets, GPs would require a sheet of paper, a pencil, and about five minutes to perform the CI and functional screening using the FAQ, CVF, and CDT. Despite its high accuracy and the fact that functional scales are not biased by schooling (Perroco *et al.*, 2009), the FAQ has a limitation on its use insofar as an informant is required to be present with the patient where this may not always be possible. These instruments appear to be useful as screening tools for GPs in countries with populations that have heterogeneous schooling.

The clinical implications of our results should be considered. In Brazil, GPs held only 50% of the basic knowledge required for early detection of dementia (Jacinto *et al.*, 2013) and thus, establishing instruments and their scores to facilitate this screening process is paramount. The combination of the FAQ and CFV represents a very simple method of increasing the chances of correct screening. Besides, these two instruments can be useful in most of the Brazilian regions' cultural aspects since FAQ comprises simple daily tasks even in rural areas and CFV allows patients to cite animals that are common in their living areas without restrictions. In the case of patients with higher schooling, the combination of the FAQ and CDT is more suitable.

Conflict of interest

None.

Description of authors' roles

Alessandro Ferrari Jacinto obtained and analyzed data and wrote the paper. Vanessa de Albuquerque Citero, Sonia Maria Dozzi Brucki, Milton de Arruda Martins, and Ricardo Nitrini revised the paper writing. Claudia Sellitto Porto applied neuropsychological tests.

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