

BRIEF COMMUNICATION

Performance of illiterate and literate nondemented elderly subjects in two tests of long-term memory

RICARDO NITRINI,¹ PAULO CARAMELLI,¹ EMÍLIO HERRERA, JR.,²
CLÁUDIA SELLITTO PORTO,¹ HELENICE CHARCHAT-FICHMAN,¹
MARIA TERESA CARTHERY,¹ LEONEL TADAO TAKADA,¹ AND EDSON PEREIRA LIMA¹

¹Behavioral and Cognitive Neurology Unit, Department of Neurology, University of São Paulo School of Medicine, Brazil

²Catanduva School of Medicine, Catanduva, Brazil

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Abstract

Cognitive evaluation in developing countries is a difficult undertaking due to low levels of schooling and particularly the illiteracy still frequent in the elderly. This study was part of the epidemiologic evaluation of dementia in Catanduva, Brazil, and had the objective of comparing the performance of illiterate and literate nondemented elderly individuals in 2 tests of long-term memory—the delayed recall of a word list from the CERAD and the delayed recall of common objects presented as simple drawings from the Brief Cognitive Screening Battery (BCSB). Fifty-one elderly subjects (23 illiterates) were evaluated, and the performance of the illiterates and literates differed in the CERAD memory test, but not in the BCSB memory test. This test may be more suitable for the assessment of long-term memory in populations with a high frequency of illiterates, and therefore might prove to be a useful screening tool for the diagnosis of dementia. (*JINS*, 2004, *10*, 634–638.)

Keywords: Neuropsychological evaluation, Illiteracy, Education, CERAD, Dementia

INTRODUCTION

One of the difficulties in the diagnosis of dementia, especially in epidemiological studies, is related to the differences in the performance of subjects in neuropsychological tests due to educational and cultural factors (Manly et al., 1999; Ostrosky-Solis et al., 1998). Tests that evaluate long-term memory are considered to present the highest sensitivity for the neuropsychological diagnosis of dementia (Bondi et al., 1994), but might also be influenced by the factors mentioned previously. One neuropsychological battery that has been recommended for the diagnosis of Alzheimer's disease (AD), is that proposed by the Consortium to Establish a Registry for Alzheimer's Disease (CERAD; Morris et al., 1989), in which the long-term memory test (delayed recall of a word list) is the one which presents the best diagnostic accuracy (Bertolucci et al., 2001; Welsh et al., 1991).

In recent years, we have developed and employed some tests for the diagnosis of dementia in low educated subjects, both for epidemiological and clinical purposes. One of these tests, the delayed recall of 10 common objects presented as simple drawings, part of the Brief Cognitive Screening Battery (BCSB), has shown a high accuracy for the diagnosis of dementia in case–control studies (Nitrini et al., 1994; 1999).

The goal of the present study is to compare the performance of elderly individuals, with no memory complaints and without dementia, in two tests of long-term memory—the one from the CERAD battery and the one from the BCSB—and to verify the impact of illiteracy on each of these tests.

POPULATION AND METHODS

As part of the population-based study that we have been performing in the city of Catanduva, São Paulo State, Brazil (Herrera et al., 2002), we evaluated 1,119 individuals to investigate the incidence of dementia using a general questionnaire covering health and cognitive status, the Mini-

Reprint requests to: Ricardo Nitrini, Rua Bartolomeu Feio, 560, 04580-001 São Paulo–SP, Brazil. E-mail: rnitri@uol.com.br

Mental State Examination (MMSE; Folstein et al., 1975) and the Pfeffer Questionnaire of Functional Activities (PQFA; Pfeffer et al., 1982). Based on the performance in the MMSE and PQFA, participants with suspected dementia along with a control group matched for age and schooling were selected for the next phase of the study. Individuals in the control group were Portuguese-speaking subjects, with no clinical history of memory loss or only with mild complaints, had scores below 6 in the PQFA and scores above specific education-adjusted scores in the MMSE (i.e., 18 for illiterates, 23 for those with 1–7 years of schooling and 26 for those with 8 years or more). These cut-off scores of the MMSE have previously been used in Brazil for illiterates (Caramelli et al., 1998; Herrera et al., 2002) and for other educational levels (Bertolucci et al., 1994). Participants were considered illiterates when they fulfilled all of the following three conditions: they had never attended school or had attended for less than 1 year, they considered themselves as unable to read, and they were unable to read the phrase, “Close your eyes” from the MMSE. When an individual informed that he had not attended school but was able to read, and then read the MMSE phrase, he was considered to be literate and was classified as having 1 year of schooling.

One hundred and five individuals were selected for the control group based on the MMSE and PQFA scores. Twelve refused to participate and 3 could not be located. Another 31 individuals who had referred memory disturbances in the general questionnaire covering health and cognitive status were excluded. The remaining 59 individuals were submitted to the Brazilian version of the CERAD neuropsychological battery (Bertolucci et al., 2001), to the BCSB and to the Cornell scale for depression in dementia (Alexopoulos et al., 1988). Individuals with antecedents of stroke (2), or who had scored higher than 7 in the Cornell scale for depression (6), were also excluded. The final sample comprised 51 individuals.

In the CERAD word list memory task, 10 words are read aloud, one by one, by the subject (or by the examiner in case of reading difficulty). Recalling is done immediately after the presentation, and the procedure is repeated twice more. After a test of constructional praxis, the subject is then requested to recall the words previously presented (Bertolucci et al., 2001).

The BCSB consists of the presentation of a sheet of paper with 10 simple line drawings of common items (a shoe, spoon, hair-comb, tree, turtle, key, airplane, house, book, and a bucket), that had to be named out loud by the individual and then recalled immediately after, in an incidental way (without prior information that the items should be memorized). Then the simple line drawings are presented twice more, being followed on each occasion by the immediate recall and by subsequent interference with a semantic verbal fluency test (usually animals/min, but substituted in this study by fruits/min) and the clock drawing test (Sunderland et al., 1989). After this interference, a delayed recall of the 10 items is requested, followed by a final

recognition test (10 target simple drawings together with 10 distractors). The BCSB is administered in approximately 7 to 10 min (Nitrini et al., 1994).

The performances of the illiterate individuals were first compared to those of the literate individuals. Subsequently, the literate individuals were classified according to mean years of schooling, either as *very low educated* (below the mean) or as *standard educated* (above the mean), and the performances of the three groups were compared.

For statistical analyses, the Mann-Whitney test was used to compare literates and illiterates on age and scores of the neuropsychological tests. When there were more than two groups, the Kruskal-Wallis test was employed. Chi-square analysis was used to compare the proportion of women in each group. The value of significance accepted was .05. Epi-Info 6.0 software (Centers of Disease Control and Prevention, Atlanta, Georgia) was used.

The study was previously approved by the Ethics Committee of the Hospital das Clínicas of the São Paulo University School of Medicine. All subjects had given written consent for their participation in the study, or relatives had given written consent on behalf of subjects unable to sign.

RESULTS

The 51 normal subjects (24 women and 27 men) had a mean age of 73.78 ± 5.44 years, 23 being illiterate and 28 having had one to 13 years of schooling ($M = 3.82 \pm 3.31$). The ages of the illiterate and literate individuals did not differ but there were 16 women and 7 men in the illiterate group, while in the literate group, 8 were women and 20 were men (Table 1).

When the literate individuals were divided into two subgroups, low and standard educated individuals, the ages of the three groups also did not differ (Table 1). The performances of the groups differed significantly in the MMSE, verbal fluency (animals in 1 min), Boston naming (15-item version), clock drawing and in the CERAD memory test (immediate and delayed recall of a word list), but did not differ in the immediate and delayed recall of the items presented as simple drawings, from the BCSB, neither when the illiterate group was compared with the whole literate group nor when the literate group was divided according to mean years of schooling (Table 2). For the immediate recall scores, the mean of three tries both for the CERAD and the BCSB was taken into account.

The low educated individuals obtained scores that fell midway between the illiterate and standard educated individuals for most of the tests, especially for the verbal fluency and Boston naming tests, but not for the BCSB memory tests. There were no differences in performance between men and women for the two memory tests ($p > .2$).

DISCUSSION

The results from the present study confirm that a considerable difference exists between the performance of illiterate

Table 1. Demographic features of illiterate and literate individuals divided into low educated and standard educated individuals

	Illiterate <i>M</i> (\pm <i>SD</i>) <i>MDN</i> (interquartile range)	Literate <i>M</i> (\pm <i>SD</i>) <i>MDN</i> (interquartile range)	<i>p</i> *	Low educated literate <i>M</i> (\pm <i>SD</i>) <i>MDN</i> (interquartile range)	Standard educated literate <i>M</i> (\pm <i>SD</i>) <i>MDN</i> (interquartile range)	<i>p</i> **
Age	74.04 (4.99) 73.0 (69.0–79.0)	73.57 (5.87) 71.0 (70.0–75.0)	.607	74.33 (6.21) 72.0 (70.0–77.0)	72.69 (5.57) 71.0 (69.0–74.0)	.539
Sex						
F	16	8		5	3	
M	7	20	.003	10	10	.003
Years of schooling	—	3.82 (3.31) 3.0 (1.0–4.0)	—	1.67 (0.82) 1.0 (1.0–2.0)	6.31 (3.38) 4.0 (4.0–10.0)	.000

*Comparison between literate and illiterate individuals for age, years of schooling (Mann-Whitney test), and sex (chi-square test).

**Comparison between illiterate, low and standard educated individuals for age, years of schooling (Kruskal-Wallis test), and sex (chi-square test).

and literate individuals, even in simple neuropsychological tests (Ostrosky-Solis et al., 1998). The difference between the groups in the MMSE is somewhat expected, since the inclusion criteria of the study considered different cut-off values as a function of educational level. Moreover, the difference in verbal fluency has been previously reported in the Brazilian population (Brucki et al., 1997). In the clock drawing test the difference was striking.

Notwithstanding, in the delayed recall of items presented as simple drawings from the BCSB, the performances of

the groups did not differ, contrary to what was observed in the CERAD delayed recall of the word list. One explanation for the poorer performance of the illiterates in the delayed recall of the word list from the CERAD battery may be related to the different administration of this test for literate and illiterate individuals. While literate subjects read the 10 words presented in the cards out loud, the illiterates listen to the examiner, who read to them (Bertolucci et al., 2001). It is probable that this distinct form of presentation of the test determines a less favorable encoding condition

Table 2. Cognitive test scores of illiterate and literate elders

Tests	Illiterate <i>N</i> = 23 <i>M</i> (\pm <i>SD</i>) <i>MDN</i> (interquartile range)	Literate <i>N</i> = 28 <i>M</i> (\pm <i>SD</i>) <i>MDN</i> (interquartile range)	<i>p</i> *	Low educated literate <i>N</i> = 15 <i>M</i> (\pm <i>SD</i>) <i>MDN</i> (interquartile range)	Standard educated literate <i>N</i> = 13 <i>M</i> (\pm <i>SD</i>) <i>MDN</i> (interquartile range)	<i>p</i> **
MMSE	21.61 (1.85) 21.0 (20.0–23.0)	26.82 (1.98) 26.5 (26.0–28.0)	.000	26.07 (1.75) 26.0 (25.0–27.0)	27.69 (1.93) 28.0 (26.0–30.0)	.000
Verbal Fluency (animals)	12.13 (3.66) 12.0 (10.0–14.0)	14.86 (3.93) 14.5 (13.0–17.5)	.010	13.67 (3.64) 14.0 (12.0–16.0)	16.23 (3.94) 15.0 (14.0–19.0)	.014
Boston Naming	9.87 (1.82) 10.0 (8.0–11.0)	12.11 (2.22) 12.5 (10.5–14.0)	.001	11.33 (2.41) 12.0 (10.0–13.0)	13.00 (1.63) 13.0 (11.0–14.0)	.000
Clock Drawing	3.00 (1.72) 2.5 (2.0–4.0)	7.52 (1.93) 9.0 (5.0–9.0)	.000	7.20 (2.14) 8.0 (5.0–9.0)	7.92 (1.62) 9.0 (7.0–9.0)	.000
Immediate recall (CERAD)***	4.04 (1.06) 4.0 (3.0–5.0)	5.07 (1.05) 5.0 (4.5–6.0)	.001	5.0 (1.20) 5.0 (4.0–6.0)	5.15 (0.90) 5.0 (5.0–6.0)	.003
Delayed recall (CERAD)	3.70 (2.10) 4.0 (3.0–5.0)	4.96 (2.10) 4.0 (3.0–6.0)	.014	4.87 (1.55) 5.0 (4.0–5.0)	5.01 (1.16) 5.0 (4.0–6.0)	.041
Immediate recall (BCSB)***	6.61 (1.27) 7.0 (6.0–7.0)	6.57 (1.23) 6.0 (6.0–7.5)	.84	6.67 (1.40) 6.0 (6.0–8.0)	6.46 (1.05) 6.0 (6.0–7.0)	.888
Delayed recall (BCSB)	6.87 (1.52) 7.0 (6.0–8.0)	7.26 (1.56) 7.0 (6.0–8.0)	.458	7.43 (1.65) 7.0 (6.0–9.0)	7.01 (1.50) 7.0 (6.0–8.0)	.652

*Comparison between literate and illiterate individuals (Mann-Whitney test).

**Comparison amongst illiterate, low and standard educated individuals (Kruskal-Wallis test).

***mean of three tries.

MMSE: Mini-Mental State examination.

BCSB: Brief Cognitive Screening Battery.

for the illiterates, as reflected by the illiterates' lower scores in the immediate recall of the word list, since only auditory input is used, while the literate individuals read the words as well as saying them out loud (thus employing both auditory and visual inputs). On the other hand, the way of administering the memory test from the BCSB is the same, regardless of the level of schooling, and as the immediate recall of the items by the illiterate and literate individuals did not differ, the encoding process of the items presented as simple drawings from the BCSB is probably not more difficult for the illiterate.

Although there were more women in the illiterate group, our findings are probably unaffected by this feature because there were no differences in performance by men and women in the two long-term memory tests, when illiterate and literate subjects were analyzed together. The predominance of women in the illiterate group in our study is not a matter of chance, but rather, is related to the restricted access of girls to formal education in the first half of the 20th century that has been also reported in other studies (Li et al., 1989; Reis & Castro-Caldas, 1997).

Consistent with our findings, the performance in the delayed recall of line drawings of common objects, was also uninfluenced by literacy status in a community-dwelling elderly population in Spain (Zunzunegui et al., 2000).

In a recent paper, an adapted version of the CERAD word list memory task was used in which the list was read out to the subject, thus making it more appropriate as a diagnostic test for dementia in developing countries (Prince et al., 2003). However, the performance was still affected by education.

In a study evaluating the effect of illiteracy on neuropsychological test performance, Manly et al. (1999) reported that there was no difference between literate and illiterate nondemented elders in the delayed recall of the Selective Reminding Test (Buschke & Fuld, 1974). In this test, participants learn a list of 12 words over six trials. The entire list is read aloud once to the participants, and after each recall attempt, participants are reminded only of those words that were not successfully recalled (Buschke & Fuld, 1974). The absence of difference with the use of this test suggests that when the encoding is reinforced, the performance of illiterates in delayed recall tests is similar to that of literates.

In another study, Ostrosky-Solis et al. (1998) observed that the scores obtained by illiterates and literates in the delayed recall of a word list were not different when the words belonged to the same semantic category, thus reducing the difficulty of the encoding.

Our data suggest that when the items to be recalled are presented as simple drawings, the encoding is made easier for the illiterate. Given the sample in this study was relatively small and did not include highly educated individuals, further studies should be done before concluding that the BCSB memory test is less influenced by educational level. Nevertheless, the current data suggest that for evaluation of populations with a high number of illiterate and low-educated individuals—a common feature in develop-

ing countries—such a test may be more suitable for the assessment of long-term memory, and therefore might prove to be a useful screening tool for the diagnosis of dementia.

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