

IMPACT OF COGNITIVE PERFORMANCE ON THE FUNCTIONAL CAPACITY OF AN ELDERLY POPULATION IN NATAL, BRAZIL

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Abstract – Functional incapacity and cognitive impairment are conditions related to the process of human aging. Cognitive impairment is considered an important predictive factor for functional impairment in elderly populations. This cross-sectional study analyzes the association between cognitive performance and functional capacity in an elderly population sample in Natal, Brazil. A total of 213 elderly persons were assessed by the BOAS Multidimensional Questionnaire (Brazil Old Age Schedule) and the Mini-Mental State Examination (MMSE). The results of multivariate analysis and linear regression showed that age and schooling level are factors associated with cognitive performance in the elderly of this study. The final explicative model, elaborated by logistic regression, found that cognitive performance was the only predictive variable of functional incapacity for the activities of daily living even when adjusted for sociodemographic variables.

KEY WORDS: MMSE, BOAS, elderly, functional status, cognitive impairment.

Impacto do desempenho cognitivo na capacidade funcional em uma amostra populacional de idosos do nordeste brasileiro

Resumo – A incapacidade funcional e o déficit cognitivo são condições relacionadas com o processo de envelhecimento humano. O déficit cognitivo é considerado um importante fator preditor de prejuízos funcionais em populações idosas. Este estudo transversal analisa a associação do desempenho cognitivo na capacidade funcional de uma amostra populacional idosa residente em Natal-RN. Foram avaliados 213 idosos pelo Questionário Multidimensional-BOAS e pelo Mini-Exame do Estado Mental (MEEM). Através de análise multivariada mediante regressão linear, os resultados apontam a idade e o nível de escolaridade como fatores associados ao desempenho cognitivo nos idosos do estudo. O modelo explicativo final elaborado através de regressão logística apresentou o desempenho cognitivo como a única variável preditora de incapacidade funcional para as atividades da vida diária mesmo quando ajustado por variáveis sócio-demográficas.

PALAVRAS-CHAVE: MEEM, BOAS, idosos, status funcional, comprometimento cognitivo.

Functional dependence is one of the conditions related to the human aging process, and consequent decrease in the quality of life of elderly populations. Aspects such as advanced age, female sex, low schooling levels and comorbidity are strongly associated with functional dependency¹. Functional capacity is influenced by demographic, socioeconomic, cultural and psychosocial factors². Owing to the particular nature of detecting important impairments in elderly populations, functional capacity is increasingly seen by professionals as a new paradigm for assessing health in the elderly. Mental disturbances are common in elderly populations. It is estimated that 8%

are afflicted by these pathologies³. The most important of these are dementias, because of their high frequency and the impact they cause on the health and functional capacity of this population⁴.

Mild cognitive impairment is characterized as the transitional state between normal aging and dementia, and is exemplified by abnormal memory loss for the age and schooling level of the individual, who otherwise exhibits no cognitive impairment⁵. In Brazil and other developing countries, population studies on dementia and cognitive impairment are scarce and there have been no precise estimates to date on their prevalence. A uniform prevalence

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of 3% is estimated, based on the prevalences of specific age groups observed in developed countries and according to the age distribution of the elderly population in developing countries⁶. Since cognitive impairment is an important health problem in elderly populations, owing to its interference in occupational and social functioning⁷, epidemiological studies in developing countries are urgently needed, mainly in urban centers where a large number of elderly live under precarious socioeconomic conditions. These conditions are also observed in mid-size Brazilian cities, as is the case of most capital cities in the northeast, including Natal.

Therefore, the aim of the present study was to analyze the impact of cognitive impairment on functional capacity in a population-based sample of elderly people living in Natal, Brazil.

METHOD

This cross-sectional study used an analytical and observational epidemiological design.

Subject and location

The study was conducted in Natal, capital city of the State of Rio Grande do Norte. The population-based sample consisted of elderly subjects of both sexes, older than 60 years of age, living in the western district of the city and enrolled in their neighborhood Family Health Program (FHP). Institutionalized individuals were not included in the study.

From a population of 14,597 residents in the western district older than 60 years of age (IBGE demographic census of 2000), we obtained a random sample of 213 subjects, taking into account a cognitive impairment frequency of 3%, an error of 5% and a confidence level of 95%.

Measuring instruments

To assess biological aspects and physical health we used the BOAS Multidimensional Questionnaire for Community studies in an Elderly Population, validated for Portuguese^{7,8}. The questionnaire is divided into nine sections. These sections gather information on the main characteristics, needs and problems of an elderly population in a large urban center. Each specific section explores in depth the areas considered important because of their impact on the quality of life of the age group under study.

Functional capacity was assessed based on the activities of daily living (ADL), which were divided in the assessment protocol as follows: 6 items to assess the instrumental activities of daily living (IADL) and 8 items to evaluate the basic activities of daily living (BADL)⁹. Individuals that were unable to perform any one of the activities were considered to be functionally incapacitated.

To assess the cognition of the study group we used the Mini-Mental State Examination (MMSE), which is composed of questions typically grouped into 7 categories, each one designed to

evaluate specific cognitive functions, such as orientation to time (5 points) and to place (5 points), recording 3 words to immediate memory (3 points), attention and calculation (5 points), recalling the 3 words (3 points), language (8 points), and constructive visual capacity (1 point). The MMSE score ranges from a minimum of 0 to a maximum of 30 points¹⁰.

Procedures

A group of trained researchers performed a pilot study before officially collecting the data, to determine if there were biases in subject selection and to verify the measurements of the instruments used. Data collection began after the reliability of the pilot study data was confirmed. The multidimensional questionnaire was applied, using interviews, to elderly residents of different neighborhoods of the western district of Natal. The participants or their legal caregivers signed an informed consent form and the project was approved by the Ethics Committee of the Federal University of Rio Grande do Norte (approval 08/2005).

Data analysis

The SPSS 12.0 statistical package was used to analyze the data. A descriptive analysis was performed for the frequency distribution.

Table 1. Profile of the sample subjects according to sociodemographic characteristics, Natal, Brazil (n=213).

Variables	Absolute frequency	Relative frequency
Sex		
Male	64	30.0
Female	149	70.0
Age ¹ (years)	213	70.2±7.8
Male	64	72.3±8.8
Female	149	69.3±7.1
Color		
White	83	39.0
Mulatto	102	47.9
Black	27	12.7
No response	1	0.4
Schooling (years)		
Illiterate	94	44.1
Some schooling	119	55.9
Family income (month)*		
<1 minimum wage	83	39
≥1 <3 minimum wages	107	50.2
≥3 minimum wages	16	7.5
No response	7	3.3
Cognitive Function – MMSE (Score) ¹		
Illiterate	94	17.4±4.2
Some schooling	119	21.1±4.6
Daily Activities		
BADL dependency**	14	6.6
AIDL dependency**	30	14.1

¹Mean values; *Minimum monthly wage ~ US\$ 240.00; **Basic and instrumental activities of daily living.

Table 2. Linear regression model between the Mini-Mental scores and functional capacity levels for developing BADL and IADL.

			BADL dependency	IADL dependency
Spearman's Rho	MMSE SCORE	Correlation coefficient	-.138(*)	-.214(**)
		Sig. (bilateral)	.044	.002
		N	213	213

*p<0.05; **p<0.01.

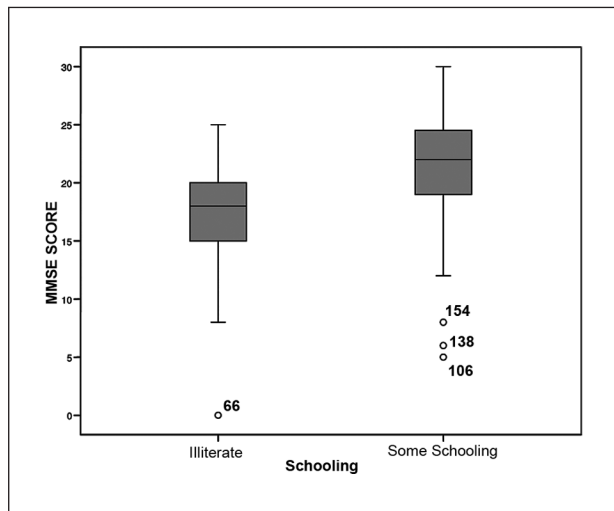


Fig 1. Distribution of Mini-Mental score according to schooling.

tribution of the study variables. Spearman's correlation coefficient was used to analyze the association between MMSE scores and functional capacity levels. Using linear regression, we assessed the degree of predictive variable association with MMSE scores. An explicative model by logistic regression was used to evaluate the association between sociodemographic factors and cognitive function and functional incapacity for BADL and IADL. A significance level of $p < 0.05$ was used for all the tests.

RESULTS

A total of 213 elderly persons were evaluated, 64 men (30.0%) and 149 women (70.0%). Mean overall age was 70.2 ± 7.8 years. The schooling level of the subjects was low; 45.5% were illiterate and only 14% had secondary or university education (Table 1).

Mean total MMSE score of the study subjects was 19.4 ± 4.3 points. After stratifying according to schooling level we observed a score median of 18 points for the illiterate subjects and 22 points for those with some level of schooling (Fig 1).

Functional incapacity for BADL and for IADL was observed in 6.6% and 14.1% of the subjects, respectively. Analyzing the functional incapacity for basic activities of daily living in relation to sex, we found a percentage of 6.3% for the men and 6.7% for the women.

A stratified analysis of the MMSE score according to

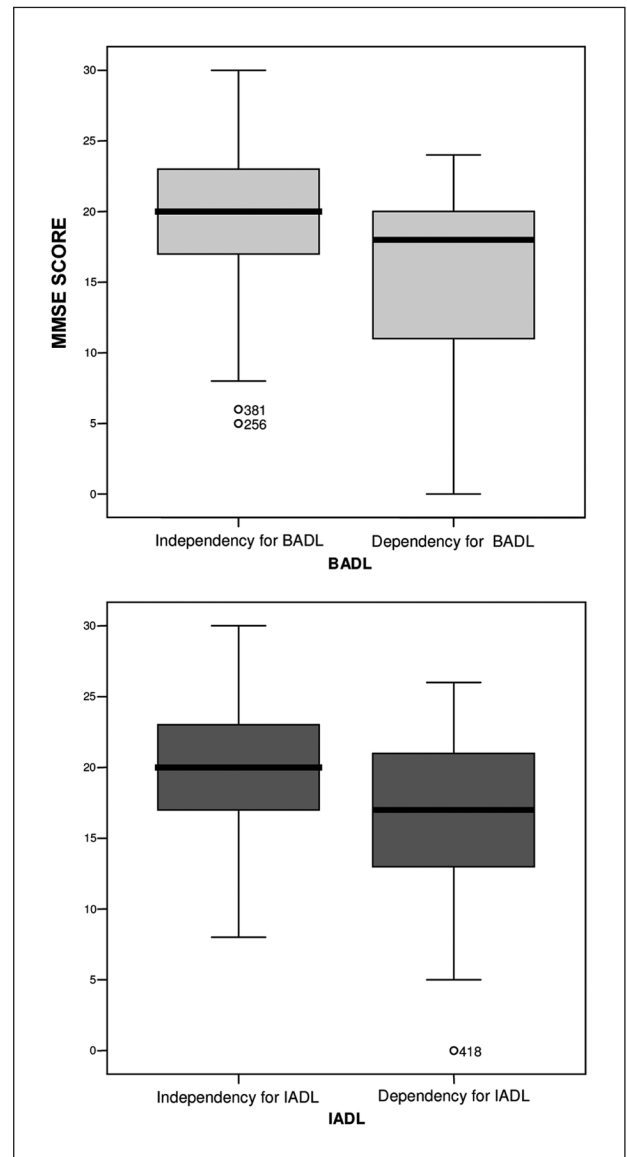


Fig 2. Frequency distribution of the Mini-Mental score stratified by level of functional dependency for basic and instrumental activities of daily living.

functional dependency scores for basic and instrumental ADL showed lower values in the elderly that had difficulty performing these activities (Fig 2).

Spearman's correlation values showed a negative coefficient between the MMSE score and the levels of func-

Table 3. Final multiple linear regression model for the independent variables: age, sex, schooling, compared with the Mini-Mental score (Dependent variable).

	R	Correlation coefficient	p
Age	-0.141	-.220(-.063)	0.0001
Sex	-0.443	-1.811-.924	0.523
Schooling (illiterate)	3.746	2.532-4.960	0.0001
Color	-0.405	-1.286-.476	0.366
Marital state	-0.166	-.810-.477	0.611
Family income	0.026	-.435-.486	0.913

p<0.05.

tional capacity for developing BADL and IADL. This demonstrates that the lower the cognitive performance the higher the functional incapacity for ADL (Table 2).

To examine the possible associations of factors such as age, sex, color, marital status, family income, schooling level and functional capacity with cognitive performance, we developed an explicative model by multiple linear regression. Table 3 shows that age and schooling level were the only factors associated to cognitive performance in the elderly study subjects.

To determine the association of socioeconomic factors and cognitive performance with functional incapacity for the basic and instrumental ADL, we built an explicative model using logistic regression. In the final adjusted model, with functional incapacity as outcome variable, only the MMSE scores (cognitive performance) showed an association with the presence of incapacities for both types of activities (Table 4).

DISCUSSION

Recent studies show mild cognitive impairment (MCI) as an important predictive factor for functional impairment in elderly populations¹¹. It is therefore imperative to assess possible correlations between cognitive performance and the presence of functional impairment in developing the activities of daily living in less privileged populations. With respect to this aspect, the results of the present study strengthen the evidence of cognitive impairment as a strong factor associated with functional incapacity in poorly educated elderly populations.

A large number of elderly subjects reported little or no schooling. This finding, along with advancing age, were identified as the main determinants of cognitive performance levels in the population studied. Similar results were observed in earlier studies^{12,13}. According to Laks¹⁴ and Foss¹⁵, both age and schooling influence cognitive performance, and people with higher schooling levels show, in an ascending hierarchy, better performance than those of less schooled.

Table 4. Odds ratio (OR) for functional capacity in BADL and IADL by the final logistic regression model.

Variables	OR	CI 95%	p
Basic activities of daily living			
MMSE score	1.13	1.12-1.26	0.021
Sex	1.12	0.31-4.07	0.85
Age	1.03	0.93-1.07	0.93
Schooling	1.46	0.44-4.86	0.53
Marital status	1.08	0.59-1.97	0.80
Family income	1.40	0.78-2.49	0.25
Instrumental activities of daily living			
Variables	OR	CI 95%	p
MMSE score	1.18	1.12-1.29	0.0001
Sex	3.03	0.99-9.25	0.85
Age	1.03	0.94-1.04	0.81
Schooling	0.64	0.44-4.86	0.53
Marital status	1.08	0.59-1.97	0.80
Family income	1.40	0.78-2.49	0.25

p<0.05.

The high illiteracy rate found in this study is compatible with the findings of other investigations on elderly Brazilian populations^{16,17}. A large number of the subjects in our study scored less than 23 points on the MMSE. Score differences between the illiterate group and those with some schooling are comparable to those found in previous Brazilian studies^{12,14,16}. In these cases, adjusting the MMSE score according to schooling level is indispensable in recognizing cognitive impairment in elderly population samples, where educational deficiencies are a constant reality. The influence of low schooling on neuropsychological evaluations shows that healthy elderly individuals with low schooling may be erroneously diagnosed as being cognitively impaired, or even demented¹⁵.

Longitudinal studies have proved that cognitive impairment promotes changes in the performance of activities

of daily living^{11,18}. The results of functional incapacity levels of the elderly studied here corroborate those reported in other community-based studies, showing significant differences between the level of dependence for the activities of daily living, when related to the MMSE score^{16,17}. Given that our study is a cross-cut investigation, we are unable to confirm causal relationships. However our results suggest, based on the literature, that there is an inverse relation between cognitive performance and functional incapacity for the activities of daily living^{13,18}, specifically for IADL, where, owing to their complexity and interaction with the surrounding environment, elderly individuals need better cognitive performance to execute these tasks.

Among other implications, the findings of this study point to the need for effective cognitive impairment screening policies in elderly populations treated at public health posts. Preventive actions against the advance of cognitive impairment in elderly populations, through the use of pharmacological interventions such as vitamin B complex supplementation and the practice of physical activity, may be effective in preventing functional incapacities¹⁹.

The results of this study enable the formation of a cognitive performance profile of the elderly population living in Natal, Brazil. Identifying the factors associated to cognitive impairment may reduce the impact of these conditions on functional capacity, through the application of appropriate preventive measures.

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