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Research Article

The Impact of Social Vulnerability in the Elderly Cognition

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Abstract

Introduction: Demographic factors like age, sex and educational level are the main variables known to have an impact on cognition. In order to accurately detect cognitive deficits these factors are usually controlled in neuropsychological testing through the use of pertinent normative data. Besides educational level, social vulnerability implies other variables that have also been shown to have an impact on cognitive decline during ageing such as socioeconomic status. However, the impact of these variables is not often considered while conducting neuropsychological assessments, neither in clinical nor experimental settings.

Objective: to compare cognitive performance of a group of healthy older adults considered part of a socially vulnerable context with a group of similar sex, age and educational level but considered part of a non-vulnerable context.

Materials and Methods: 60 participants were included in the study: 30 were part of a socially vulnerable context (Group-1) and the other 30 were outside of that context (Group-2). They underwent a neuropsychological assessment which included cognitive (ACE III) and executive (IFS) and social cognition (Mini-SEA) screening tests, together with several other neuropsychological instruments classically used to assess different cognitive dominions.

Results: Significant differences were observed in cognitive performance between both groups (G1 y G2). Even when the cut-off point for low educational level was used, in G1 values below the cut-off point were found in more than 80% of the cases.

Conclusion: This study shows the impact that being part of a socially vulnerable context has on cognitive performance with the majority of healthy subjects of the socially vulnerable group being misclassified as demented even with the low educational cutoff taken into account. This finding is of great importance for clinical and experimental neuropsychological assessment worldwide, but mainly in regions such as LA where social vulnerability must be taken into consideration when selecting normative data to infer the presence of cognitive deficits.

Keywords: Social Vulnerability; Elderly; Cognition; Neuropsychology

Abbreviations

LA: Latin America; SDH: Social Determinants of Health; SES: Socioeconomic Status

Introduction

In both experimental and clinical settings, the cognitive performance of older adults can be assessed through neuropsychological tests in which results are compared with those of a reference group. Typical aspects considered in this comparison are gender, age, and educational level, all of which have shown an impact on cognitive performance. However, the possible impact of other variables or factors associated with the brain has not been considered when interpreting the results of the neuropsychological evaluation. Compared to other regions where classic factors such as age and gender drive healthy ageing, other factors related to greater disparity and variability between countries, such as those in Latin America (LA), could also play a role [1].

In Argentina, it is estimated that there are more than 5 million people over 65 years of age, of which only approximately 16% completed secondary education [2]. The average number of years of schooling completed in the world is 7.6, evidencing a regional dichotomy between developing countries (7.09) and countries in Europe and Central Asia (9.64). In LA and the Caribbean, people obtained an average of 8.26 years of formal education [3].

Associated with educational level, the region is exposed to a wide variety of factors of a mainly economic and social nature that influence brain health (material, social, political, and cultural conditions) and that shape our lives and behaviours [4]. Recent studies describe the social determinants that could increase risks to brain health, including socioeconomic resources, social adversities, social participation, and social context factors associated with pathological ageing [5]. According to the World Health Organization, the Social Determinants of Health (SDH) refer to the conditions in which people are born, work, live and age, as well as the broader set of forces and systems that shape the needs of society everyday life [4].

This comprises the social (eg, formal education, job prestige) and economic (eg, material assets, monetary income) resources of an individual [6]. There is evidence of the cross-sectional impact of these factors on the deterioration of a wide range of functional abilities and cognitive abilities (low socioeconomic status, higher cognitive poverty), regardless of health status [7-9]. Older adults of low socioeconomic status (SES) have less access to cognitively stimulating environments and cultural resources, which hinders their cognitive functioning in general and executive functioning in particular [6]. Thus, different studies have described worse cognitive performance in adults of lower SES, for example, in memory tasks (immediate and delayed recall), executive functions, and semantic verbal fluency [9]. As mentioned, even if there is evidence of a positive relationship between education and advanced age [9,10], the level of education is only one of the many components of SES.

In an impressive and current investigation, they reported that the cognition of older adults and the low socioeconomic level have been related to some SDH, such as social exclusion, isolation and reduced social interactions. The results highlight a heterogeneity combination of risk factors affecting cognition associated with inequality [1].

These unequal contexts that characterise the region expose its population to a situation of social vulnerability that inevitably leads them to a greater risk of presenting cognitive deterioration and, in some cases, dementia. Greater socioeconomic inequalities reduce the satisfaction of basic human needs and access to health services, which, together with greater exposure to multiple risk factors, seems to increase the prevalence of cognitive impairment and dementia [11].

Partial data are available on the prevalence of cognitive impairment in Argentina [12-14] and the available data are even less known in vulnerable contexts. Bartolini., *et al.* (2014) reported a prevalence of 15% for non-dementia cognitive impairment and 8.3% for dementia, that is, a total of 23.3% of the population over 60 years of age with cognitive impairment [12]. Their study showed similar results to those reported in other Latin American studies [15].

The social, cultural and political factors mentioned above expose different communities, homes and people to a condition of social vulnerability due to the risks, weaknesses or disadvantages they have to face, negatively impacting their personal and family development [16,17]. Extreme cases are those with no home or

family, without occupation or networks of social support [18]. This puts them in a situation of complete defenselessness and insecurity, which brings as a result greater risks, crises or stress [19,20], without the possibility to improve their realities and reach a level of wellbeing [18].

According to specialists in the region, there is a lack of research on cognitive dysfunction associated with ageing and on the modulatory role of heterogeneous and disparity-related factors in this domain [1,6].

The general objective of this study is to compare cognitive performance of a group of healthy older adults considered part of a socially vulnerable context with a group with similar sex, age and educational level but without social vulnerability. This will produce evidence of the impact that context has on cognition beyond age, gender, and even educational level. This finding is of general importance for clinical and experimental neuropsychological evaluation throughout the world and particularly in countries with high rates of social vulnerability, such as LA.

Materials and Methods

Study design and setting

This is a descriptive, correlational, exploratory and cross-sectional study.

All participants are over 60 years and are residents of San Juan, Argentina.

Permission was initially obtained from the local research ethics committee, and all participants signed the informed consent prior to their inclusion.

Participants

60 participants, 35 females and 25 males.

All participants were administered a neuropsychological assessment and were divided in two groups matched by age and educational level, but differing in the context in which they live, were compared. One considered part of a socially vulnerable context (Group-1) and the other considered part of a non-vulnerable context (Group-2).

No sensory difficulties that hinder the development of the evaluation. No history of neurological or psychiatric diseases and no clinical diseases that affect cognition, no use of psychoactive substances and no sensory difficulties that hinder the development of the evaluation.

Group-1: Considered part of a socially vulnerable context group

30 older adults (15 females and 15 males). Subjects in this group did not have the economic resources to cover their expenses, nor housing nor social coverage and, in most cases, they do not have a social support network. Age of this group ranged from 60 to 90 and educational level ranged from 1 to 18. Were recruited from the healthy adult's unit of a state residence for the elderly, without psychiatric and neurological pathologies, who reported being independent in their activities of daily living.

Group-2: Considered part of a non-vulnerable context

30 older adults (19 females and 13 males). Subjects of this group reside in their own homes, accompanied by at least one relative. These participants were selected to match Group_1 in age, gender and educational level. Were recruited by word of mouth and resided in different departments of the province of San Juan. They do not report the presence of psychiatric and neurological pathologies or dependence in their activities of daily living.

Neuropsychological assessment

The battery was composed of cognitive, executive and social cognition screening tests and of several neuropsychological tests to evaluate different cognitive functions.

The Addenbrooke's Cognitive Examination version III (ACE-III) [21,22] is an extended cognitive screening technique. It is composed of five cognitive domains, attention, memory, language, verbal fluency, and visuospatial abilities, for a total of 100 points. The INECO Frontal Screening (IFS) [23, 24] is an easy to administer instrument to assess several domains of executive function in a short period of time, for a total of 30 points. The Mini-SEA [25] is a quick and brief cognitive assessment test developed to study social cognition. It consists of a modified version of the faux pas Test and an emotional recognition test based on Ekman's faces, for a total of 30 points.

The neuropsychological test that included attention and executive functions (Trail Making Test A and B, Forward and Back Digit Span (WAIS III), memory (Rey Auditory Verbal Learning Test

-RAVLT-, Rey-Osterrieth complex figure -R-OCF-, semi-complex figure -S-CF- in subject with less than 4 years of education-), language (phonological and semantic verbal fluency, The Cordoba Naming Test), social cognition and emotional assessment (mini-SEA: facial emotion recognition and the Faux Pas Test).

Procedure for statistical analysis of data

The results will be stored in a database created for this study, using the Microsoft Excel spreadsheet. The SPSS program was used for specific statistical processing. The data was analysed using descriptive statistics (Chi square test was used to detect differences in gender and t test to evaluate the other parametric variables). Continuous variables were analysed with Student's Independent samples t-test.

Results and Discussion

Results

Participants

Group-1: Considered part of a socially vulnerable context group

30 participants, 15 females and 15 males, aged between 60 and 90 years, with a mean age of 74.73 (8.78), 15 (50%) females and 15 (50%) males. 29 (96.7) right-handed and 1 (3.3%) left-handed. The mean years of education was 6.43 (4.43), with a minimum of one year and a maximum of 18 years. Occupation throughout life, 12 (40%) trades, 6 (20%) housewives and the rest merchants, administrative staff, teachers and non-teachers. Current occupation, retired or with a pension 30 (100%).

Group-2: Considered part of a non-vulnerable context

30 participants, 19 females and 11 males, aged between 67 and 84 years, with a mean age of 72.77 (4.71), 19 (63.3) females and 11 (36.7%) males. 28 (93.3%) right-handed, 1 (3.3%) left-handed and 1 (3.3%) ambidextrous. The mean years of education was 6.43 (2.04), with a minimum of 2 years and a maximum of 12 years. Occupation throughout life, 13 (43.3%) trades, 6 (20%) housewives, 5 (16.7%) merchants and the rest administrative, teaching and non-teaching. Current occupation, retired or with a pension 24 (80%), housewife 3 (10%), and merchant 3 (10%),

No statistically significant differences were observed in sex, age or years of formal education (Table 1).

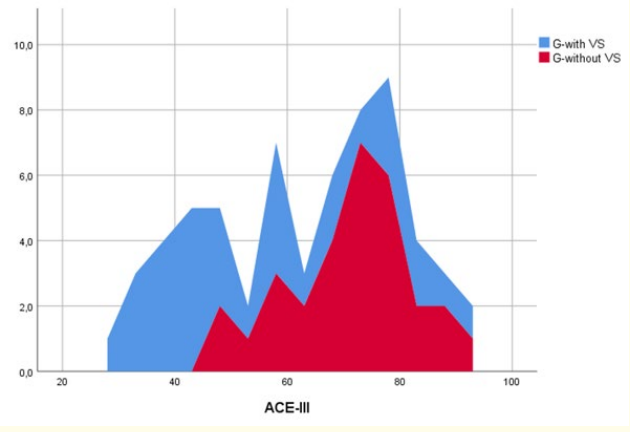
	G-with SV		G-without SV		t test				
	n 30		n 30						
	Means	standard deviations	Means	standard deviations	t	df	p	95% difference confidence interval	
Age	74.73	8.78	72.77	4.17	1.08	1.96	0.28	-1.70	5.63
Years of education	6.43	4.47	6.43	2.04	0.00	0.00	1.00	-1.81	1.81
Sex F/M	15/15		19/11		$\chi 2$ (1, N = 30) = 1.08, p 0.297				

Table 1: Means, standard deviations and group differences between G-with SV and G-without SV for sociodemographic variables: age, years of education and sex.

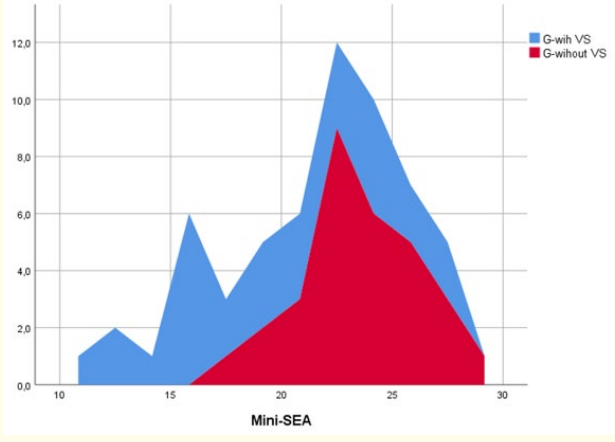
Neuropsychological assessment

- **Group-1**: the mean for the ACE-III was 53,43 (17,72). The mean in the IFS was 9,08 (6,34). The mean in the MiniSEA was Media 19,64 (4,67) (see graphic 1, 2 and 3).
- **Group-2**: the mean for the ACE-III was 71,73 (11,47). The mean in the IFS was 17,13 (4,9). The mean in the MiniSEA was 23,49 (2,53) (see graphic 1, 2 and 3).

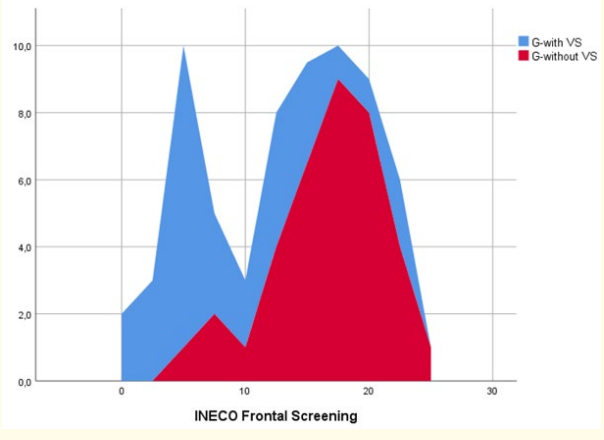
Significant differences between Group-1 and Group-2 was observed in ACE-III ($t(49) = -4.74$; $p < 0.01$), IFS ($t(54) = -5.50$; $p < 0.01$) and MiniSEA ($t(42) = -3.91$; $p < 0.01$). In all cases, Group-1 obtained lower scores than Group-2 (table 2).



Graph 1: Overlapping area plot: ACE-III total score for G-with VS and for G-without VS.



Graph 3: Overlapping area plot: Mini-SEA total score for G-with VS and for G-without VS.



Graph 2: Overlapping area plot: INECO frontal screening total score for G-with VS and for G-without VS.

	G-with SV		G-without SV		t test				
	n 30		n 30						
	Means	standard deviations	Means	standard deviations	t	df	p	95% difference confidence interval	
ACE III	53.43	17.72	71.73	11.47	-4.74	-18.3	0.00	-26.04	-10.55
IFS	9.08	6.34	17.13	4.90	-5.50	-8.05	0.00	-10.98	-5.11
Mini-SEA	19.64	4.67	23.49	2.53	-3.91	-3.84	0.00	-5.82	-1.86

Table 2: Means, standard deviations and group differences between G-with SV and G-without SV for ACE-III, IFS and MiniSEA.

Significant differences between Group_1 and Group_2 were observed in back digit spam (t (58) = -2.01; $p < 0.05$), Trail Making Test A (t (21) = 2.46; $p < 0.05$), Semantic verbal fluency (t (50) = -2.14; $p < 0.05$), RAVLT total learning (t (56) =-3.25; $p < 0.01$), R-OCF delay (t (49) = -2.03; $p < 0.05$), The Cordoba Naming Test (t (56) =-2.47; $p < 0.05$) and MiniSEA faux pass total (t (48) = -3.21;

$p < 0.01$) and emotional recognition ($t(39) = -3.38$; $p < 0.01$). In all cases, Group-1 obtained lower scores than Group-2 (Table 3).

							T test				
	G-with VS			G-without VS			t	df	P	95% difference confidence interval	
	N	Means	standard deviations	N	Means	standard deviations					
Foward Digit Span (WAIS)	30	4.17	1.32	30	4.73	1.36	-1.64	-0.57	0.11	-1.26	0.13
Back Digit Span (WAIS)	30	2.40	1.52	30	3.03	0.81	-2.01	-0.63	0.05	-1.27	0.00
Trail Making Test A	18	116.94	64.04	29	77.31	30.17	2.87	39.63	0.01	11.84	67.43
Trail Making Test B	5	169.60	220.17	23	199.48	64.96	-0.30	-29.88	0.57	-136.4	76.64
Phonological Verbal Fluency	30	7.30	4.74	30	8.53	3.51	-1.15	-1.23	0.26	-3.39	0.92
Semantic Verbal Fluency	30	10.00	4.98	30	12.33	3.29	-2.14	-2.33	0.04	-4.51	-0.15
RAVLT-Trail 1 (initial)	30	2.86	1.38	30	3.30	1.18	-1.31	-0.44	0.19	-1.12	0.23
RAVLT-Total trails 1-5 (total learning)	30	20.43	8.83	30	27.53	7.79	-3.25	-7.11	0.00	-11.48	-2.73
RAVLT-Distracter List	30	2.83	1.90	30	3.63	2.08	-1.56	-0.80	0.12	-1.83	0.23
RAVLT-Delayed	30	5.80	3.84	30	6.80	3.24	-1.09	-1.00	0.28	-2.84	0.84
RAVLT-Recognition	30	11.53	3.20	30	12.47	2.56	-1.25	-0.93	0.22	-2.43	0.56
R-OCF-Copy	23	27.35	10.18	29	29.38	5.59	-0.86	-2.03	0.40	-6.84	2.78
R-OCF-Delayed	23	9.52	6.49	29	12.98	5.64	-2.03	-3.46	0.05	-6.88	-0.04
R-OCF-Recognition	23	17.85	4.92	29	18.79	3.40	-0.79	-0.94	0.43	-3.33	1.44
S-CF-Copy	5	6.30	2.11	1	4.50						
S-CF-Delayed	5	2.88	0.85	1	0.00						
S-CF-Recognition	5	5.25	3.40	1	11.00						
The Cordoba Naming Tets-Total	28	15.79	6.11	30	19.17	4.19	-2.47	-3.38	0.02	-6.12	-0.64
Mini-SEA-FauxPas-Hit	29	20.10	7.12	30	25.33	4.60	-3.34	-5.23	0.00	-8.38	-2.08
MiniSEA-FauxPas-Reject	29	7.31	2.67	30	7.30	2.81	0.01	0.01	0.99	-1.42	1.44
MiniSEA-Fauxpas-Affective component	29	3.48	1.21	30	4.07	0.87	-2.12	-0.58	0.04	-1.14	-0.03
MiniSEA-Fauxpas-Cognitive component	29	3.07	1.65	30	4.13	0.82	-3.13	-1.06	0.00	-1.75	-0.38
MiniSEA-Fauxpas-Total	29	10.28	2.75	30	12.24	1.83	-3.21	-1.96	0.00	-3.18	-0.73
MiniSEA-Emotional Recognition	29	9.37	2.74	30	11.26	1.26	-3.38	-1.89	0.00	-3.02	-0.76

Table 3: Means, standard deviations and group differences between G-with SV and G-without SV for neuropsychological assessment.

Screening test, cut-off and prevalence of cognitive impairment.

Group with social vulnerability (Group-1): 80% of the subjects obtained scores below the suggested cut-off point for age and educational level in ACE-III and 90% obtained scores below the suggested cut-off point for age and educational level in IFS. And 56.7% obtained a score below the cut-off point in MiniSEA (see graphic 1, 2 and 3).

Group without social vulnerability (Group-2): 36.7% of the subjects obtained scores below the suggested cut-off point for age and educational level in ACE-III. The 33.3% obtained scores below the suggested cut-off point for age and educational level in IFS. And 13.3% obtained a score below the cut-off point in MiniSEA (see graphic 1, 2 and 3).

Discussion

The general objective of this study was to compare cognitive performance of a group of healthy older adults considered part of a socially vulnerable context group with a group with similar sex, age and educational level but without social vulnerability.

Comparing both groups with screening tests, general ones (ACE-III), executive ones (IFS) and social cognition-related (Mini-SEA), it is observed that the group with social vulnerability shows significantly lower values, compared to the group without social vulnerability in all the screening and neuropsychological tests, even when the groups were matched by age and educational level.

This finding is associated with what was reported by Santamaría-García and his team (2023) with respect to the fact that the classic risk factors associated with cognition, such as age and sex, were less accentuated than those related to social and educational disparities. health in the elderly.

If we consider the suggested cut-off point for the screening tests used (ACE-III, IFS and MiniSEA), in the group with social vulnerability, a prevalence of greater cognitive deterioration is observed in comparison with the group without social vulnerability, and even greater than the informed prevalence for the general population. This is particularly interesting since people included in the group were recruited from a unit for healthy adults without psychiatric and neurological pathologies and who reported being independent in activities of daily living. These finding is even more striking if we consider that the used cut-off points consider, in case of ACE-III, the educational level [22] and in case of IFS [23,24] and MiniSEA [25] the age and the educational level, as reported by different research [6,8,9].

This trend has already been exposed in the literature that shows the highest prevalence rate of cognitive impairment in individuals in a context of social vulnerability [11,12,15]. Even, as already mentioned, very recent studies have shown the role of inequality in the prediction of brain health [5]. However, most of these studies did not study the impact of social vulnerability once controlled by level of formal education [6,10,12,15]. In our results, social vulnerability seems to explain the higher incidence of cognitive impairment in the study sample, even when controlling for the level of formal education.

In this context, it is worth emphasising that it is even more meaningful that those results also reflect that the established cut-off points for these screening tests, frequently used in clinical practices to detect cognitive deterioration, determine cognitive deterioration in a high percentage of individuals considered healthy. In other words, those tests and their cut offs seem not appropriate for detecting cognitive deterioration in people with social vulnerability, even when considering sex, age and educational level.

Furthermore, when assessing in depth and with specific tests for each cognitive domain, significant differences were found in executive functions (verbal work memory, selective attention and processing speed), memory (verbal learning, visual recording), language (semantic verbal fluency and denomination) and social cognition (theory of mind and emotions recognition).

Our results are in line with previous studies showing that SES is a variable that has a large impact on cognitive functioning, like theory of the mind (ToM) and executive functions [10]. Within this same reasoning, Migeot and collaborators (2022) reported a worse performance in the group of low SES with respect to higher SES, not only in the general cognitive state but also in the executive functions and social cognition.

Because cognitive deterioration is the principal cause of disability starting at 60 years old, understanding the variables associated with it is one of the great challenges, particularly in

less developed countries in which cultural, political and economic factors explain more than half of the cases of dementia [11]. The SES impacts directly on social security and social determinants; therefore, greater social inequality reduces the satisfaction of basic human needs and access to health services [6,11].

Even if the level of formal education cannot be underestimated, this study shows that this variable by itself cannot explain the role of other variables with an impact on cognition and associated with social vulnerability, understood as the risks, weaknesses or disadvantages to which that a group of people is exposed. These disadvantages are not only associated with demographic reasons but also economic, cultural and political ones that negatively affect their personal and family development [16-18] and places them in a situation of total defencelessness' and insecurity [19,20] with no possibility of to face their situation and therefore, to reach a level of well-being [18].

All these discoveries provide evidence of the omnipresent role of social circumstances over the central processes of ageing and, as Steptoe and Zaninotto (2020) conclude, they suggest that the more vulnerable segments of society age more rapidly than the more privileged ones. These results enable us to better understand the effect of inequity in cerebral health, and in consequence, progress in the development of public policies which promote a healthy ageing in countries of low resources and in all Latin America [5,6].

The context by which an individual has been exposed throughout his/her life or even in the period of old age is directly associated with the cognitive deterioration that a person presents during ageing. The quality of life that a person has had has an effect on the cognitive level.

Conclusion

This study is a humble contribution to the recent global initiatives that demand research on factors associated with brain health in the population of the countries of the region.

This, together with other local initiatives, constitutes the starting point for thinking about a group of plans for the prevention and promotion of brain health and treatment programs that seek the well-being of people with cognitive impairment and especially those population groups more vulnerable.

This study allowed us to differentiate aspects associated with social vulnerability contexts and their impact on cognition. Thus, although it is known that education affects cognition, in our sample matched with educational level we can see how the situation of vulnerability to which people are exposed has a direct relationship with the incidence of cognitive deterioration.

It is imperative that private capital, as well as governments, civil society with its capacity and science, work collaboratively towards a more humane, equitable and sustainable world [1,5], which will indirectly impact in a reduction in the prevalence of cognitive impairment, particularly in low- and medium-income countries where vulnerability is one of the factors with the greatest influence on it.

It is necessary to reduce the inequities in the field of social health, the systematic and periodic differences in the state of health that are observed between regions and between individuals belonging to the same region with particular social and economic realities.

Future studies should include a better description of sociodemographic variables (including parental educational level, marital status, coexistence group, area of residence) as well as housing conditions, access to public services and social and cultural participation throughout life.

It is important to highlight some limitations of this work, mainly those associated with the group considered vulnerable. On the one hand, no index was used to objectively measure vulnerability and, on the other hand, the group was institutionalised and no clinical measure was used to ensure that they did not develop dementia.

It is considered highly relevant that future research studies older adults exposed to social vulnerability with objective measures that assess the course of their lives, such as their current situation (inside and outside institutions) and the impact of these variables on cognitive performance.

Our results highlight the fact that, in addition to age and educational level, social vulnerability should be considered when designing or adapting normative data and neuropsychological tools. The hard regional work should generate adequate tools for our population and, therefore, strengthen both clinical and experimental neuropsychological clinical practice.

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Conflict of Interest

It is declared that there is no economic interest or conflict of interest.

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