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The influence of education and occupational complexity in the cognitive performance of older adults with mild cognitive impairment

La influencia de la educación y la complejidad laboral en el desempeño cognitivo de adultos mayores con deterioro cognitivo leve

A influência da educação e da complexidade laboral no desempenho cognitivo de idosos com comprometimento cognitivo leve

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Abstract: The objective of this paper is to assess the relative importance of education and occupational complexity to determine the cognitive performance on patients with mild cognitive impairment (MCI). 80 patients with MCI were assessed using the following instruments: questionnaire of sociodemogrhapical data, questionnaire on attainment of occupation, and an extended neuropsychological battery. Abilities tested were: logical memory (Signoret Memory Battery, TAVEC), attention (Digit span, TMTA), language (Vocabulary WAIS III, Boston Naming Test, Verbal Fluency), executive functions (TMTB, Analogies WAIS III, Matrix reasoning WAIS III) and visuoconstruction (Block design WAIS III). Results show that occupational complexity is more relevant than education for cognition of vocabulary, to achieve cognitive flexibility and to obtain visuoconstructive abilities. Education is more important for abstract reasoning and sustained attention. Occupational complexity and education have a unique and important role in the maintenance of cognitive abilities, working as buffers for cognitive impairment during aging.
Keywords: older adults, occupational complexity, mild cognitive impairment, education, cognitive performance

Resumen: El presente estudio tiene como objetivo evaluar el peso relativo de la educación y la complejidad laboral en la determinación del rendimiento cognitivo de sujetos con deterioro cognitivo leve (DCL). Fueron evaluados 80 sujetos con DCL, con los siguientes instrumentos: cuestionario de datos demográficos y sociales, cuestionario de agenciamiento de la actividad laboral y una batería neuropsicológica ampliada: memoria (Memoria lógica Signoret Batería, TAVEC), atención (Digit span, TMTA), lenguaje (Vocabulario WAISIII, Test de denominación de Boston, fluidez verbal), funciones ejecutivas (TMTB, analogías WAIS III, razonamiento matricial WAISIII) y construcción visual (cubos WAISIII). Los resultados muestran que la complejidad laboral tiene un peso mayor que la educación en la cognición como son el vocabulario, la flexibilidad cognitiva y las habilidades visuoconstructivas. La educación, tiene mayor peso en el razonamiento abstracto y la atención sostenida. La complejidad ocupacional y la educación desempeñan un papel diferencial e importante en el mantenimiento de las capacidades cognitivas, siendo factores amortiguadores del deterioro cognitivo en el envejecimiento.

Palabras clave: adultos mayores, complejidad laboral, deterioro cognitivo leve, educación, rendimiento cognitivo

Resumo: O presente estudo tem como objetivo avaliar o peso relativo da educação e da complexidade laboral na determinação do desempenho cognitivo de sujeitos com comprometimento cognitivo leve (CCL). Foram avaliados 80 sujeitos com CCL, com os seguintes instrumentos: questionário de dados demográficos e sociais, questionário de direcionamento da atividade laboral e uma bateria neuropsicológica ampliada: memória (Memória lógica Signoret Bateria, TAVEC), atenção (Digit span, TMTA), linguagem (Vocabulário WAIS III, Teste de denominação de Boston, fluência verbal), funções executivas (TMTB, analogias WAIS III, raciocínio matricial WAIS III) e construção visual (cubos WAIS III). Os resultados mostram que a complexidade laboral tem um peso maior que a educação na cognição, como no vocabulário, na flexibilidade cognitiva e nas habilidades visual-construtivas. A educação tem mais peso no raciocínio abstrato e na atenção sustentada. A complexidade ocupacional e a educação desempenham um papel diferencial e importante na manutenção das habilidades cognitivas, sendo fatores que amenizam o declínio cognitivo no envelhecimento.

Palavras-Chave: idosos, complexidade laboral, declínio cognitivo leve, educação, desempenho cognitivo

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Introduction

Cognition and aging

A process known as population aging has been observed for the last decades. This phenomenon occurs due to a decrease in both birth and mortality rates (Phillips, 2017). Worldwide population has reduced the average annual growth rate. Argentina is aligned with the rest of the world and it is foreseen that negative rates will be registered in the current millennium (Peláez, Monteverde & Acosta, 2017). In the current decade, aging rate shows a proportional increase for older adults with respect to total population with figures reaching a growth of 32% for males and 48% for females in comparison to former periods (Tisnés & Salazar, 2016). It is considered that the increase in general population will be directly connected with the incidence of pathologies specific to senescence when disorders of cognitive functions might start to manifest. Among all the changes that older adults might experience, the ones that worry the most elderly people and health professionals are those present in cognitive functions, because they might be indicators of the presence of dementia.

Dementia is a collective name given to brain disorders that cause progressive degeneration and affect memory, thinking, behavior and emotion (Alzheimer's Association, 2016). Alzheimer's disease and vascular dementia are the most common examples. Both diseases together are responsible for almost 90% of cases. Every three seconds, someone in the world develops dementia. Over 50 million people around the globe live with dementia and it is expected that this number might double every 20 years, reaching the figure of 152 million people affected by 2050 (Alzheimer Disease International, 2019).

Cognitive disorders can be characterized from subjective memory complaints up to dementia. Most of the research made during the last years has positioned mild cognitive impairment (MCI) as a possible transition between normal aging and initial stages of dementia. MCI is a stage in between normal cognition and dementia and includes patients with symptoms in their cognitive abilities that exceed a significant value but has minimal functional impact (Petersen et al., 1999; Sánchez Contreras, Moreno Gómez, & García Ortíz, 2010). Although not all patients with MCI develop dementia, recent prospective research has reported medium annual conversion rates of 10.24% (IC 95% 6,9–11,) (Bruscoli & Lovestone, 2004). During the last years, great progress has been made not only in the research field, but also in the clinical environment to establish a general criterion to diagnose MCI. The workgroup made up by the National Institute on Aging and the Alzheimer's Association has made a review and update of the main criterion to diagnose MCI, with the aim of providing evidence on neuropsychological, ethnic and biological markers and build recommendations on the criterion to follow to identify this disease (Albert et al., 2011).

As per the proposed clinical diagnose criterion developed by the *National Institute on Aging and Alzheimer's Association Workgroups* (Albert et al., 2011), a patient with MCI has the following symptoms: 1. A concern originated because of a change in cognition in comparison to the previous condition of the patient. This concern can be manifested by the patient himself, a trusted informant, or trough clinical observation made by an expert doctor. 2. Impairment in one or more cognitive abilities (including episodic memory, executive functioning, attention, language and visuospatial abilities). Cognitive performance in one or more cognitive abilities should be lower than expected considering age and educational background of the patient. In case cognitive tests are made to monitor the patient's performance, a cognitive decline will probably be observed as time advances. 3. Independence while performing functional abilities. 4. No signs of dementia evidenced.

The concept mild cognitive impairment has been divided into 4 subtypes: 1. Amnestic MCI-Single Domain; 2. Amnestic MCI-Multiple Domain; 3. Non-Amnestic MCI-Single Domain; 4. Non-Amnestic MCI-Multiple Domain (Petersen, 2004). The subtypes of MCI that have been associated more frequently with the development of AD are Amnestic MCI-Single Domain; (a-MCI-sd) and Amnestic MCI-Multiple Domain (a-MCI-md) (Petersen et al., 2001). The Manual of Mental Disorders (DSM-5) indicates that the term MCI is framed within the group of a minor neurocognitive disorders. What differentiates a minor neurocognitive disorder from a major disorder is the fact that cognitive difficulties should not influence the ability of the patient to perform daily tasks. In case the person's ability to develop day-to-day tasks is affected, then there is presence of major neurocognitive disorders, such as Alzheimer's Disease (American Psychiatric Association, 2013).

However, there is scientific evidence that proves that several psychosocial elements might buffer the decline observed in some cognitive functions. In this sense, the concept of "buffering" acquires a great importance to maintain good performance of cognitive abilities through the years, making it possible to maintain functional independence (Roldán-Tapia, García, Cánovas, & León, 2012). Several investigations show that individuals who should have structurally developed dementia, on many occasions do not manifest to have cognitive behavioral symptoms (Stern, 2002; Valenzuela & Sachdev, 2006). Stern (2009) suggests that this difference occurs due to what is known as cognitive reserve (CR). CR theory maintains that the brain can build alternative circuits in the presence of a brain injury or a neurological disease to protect the person from cognitive impairment. Since there are no drugs to prevent cognitive impairment, it is important to examine indicators that could help to expand the cognitive reserve of an adult person and delay the beginning of cognitive decrease. This area of study represents an important contribution for older adults and for the medical attention system. Older adults wish and need to maintain their cognitive abilities to prevent one of the most feared consequences of aging: cognitive disorders, to be able to maintain and enjoy their roles and social functions (Meng & D'Arcy, 2012).

Occupational complexity and education to buffer cognitive impairment

CR theory establishes that different areas of lifestyle such as education, work and engagement in leisure activities, give a person an enormous amount of abilities that allow him to face more effectively the anatomy and physiology changes that take place in the brain as a consequence of a brain injury or neurodegenerative disease, which lowers the appearance of a disorder (Harrison et al., 2015). Engagement in stimulating physical and mental activities might generate transference effects and improve cognitive performance (Stern & Munn, 2010). People who are highly educated and possess occupations that imply important mental challenges obtain better performance results in laboratory tests and in several measures of cognitive performance of transversal design, as well as the cognitive change rate and the beginning of cognitive impairment (Pool et al., 2016).

Among all the factors that make up the CR theory, one of the most studied is the importance of education as a buffer for cognitive impairment in older adults. A higher educational level is generally associated with a better cognitive performance, pointing out that during life this factor might have a leading role to delay the appearance of problems with memory, attention, language and executive functions (Thow et al., 2018). Intellectual wellbeing obtained through formal education might protect cognitive health while aging. 12 or more years of formal education in comparison with less than 12 years generate better cognitive health in older adults.

In connection to the relation between occupation and cognition, it is worth mentioning the role that the complexity of the occupation has. This characteristic of the occupation has been of great interest in relation to cognitive performance during the last decades (Andel et al., 2014; Smart, Gow & Deary, 2014). A widely used method to measure occupational complexity is to assess it following information included on the Dictionary of Occupational Titles (U.S. Department of Labor, 1965). This is a source of information used in United States in which labor analysts have defined occupation with respect to three complexity levels: 1. complexity working with people, 2. complexity working with data, 3. complexity working with things, which gives as a result an index of general complexity of the occupation (Smart, Gow & Deary, 2014). Scientific findings regarding this topic (Andel et al., 2005; Boots et al., 2015; Correa Ribeiro, Lópes & Lorenco, 2013), point out that effects of occupational complexity on cognitive performance are a possible indicator of cognitive reserve (Stern, 2002). This theory states that environmental enrichment might provide an individual with resources to better face any brain disease caused by dementia. The hypothesis of cognitive reserve is considered an active model, suggesting that it is influenced by mental enrichment (Stern, 2009). Individuals spend most of their life at their working environments, so occupational activity, seen as an environment, is one of the most important sources of health and stimulation of cognitive abilities. Kohn and Schooler (1983), were pioneers in the study of the impact that occupational complexity has on cognitive performance. The authors suggest that more complex occupations demand people to make cognitive activities that are more demanding. Occupations that are intellectually challenging are connected to better cognitive abilities on older adults, suggesting that occupational characteristics might influence the aging process of the brain (Gow, Avlund & Mortensen, 2014).

In this context, in which the expectations of intervention and prevention pay particular attention to experiences and lifestyles maintained through the years, these are considered key factors to determine and outline cognitive aging. Several researchers (Giogkaraki, Michaelides & Constantinidou, 2013; Stern, 2012; Stern, & Munn, 2010) have tried to identify how the role of the different components that build the CR, such as education, occupational complexity, intellectual quotient and engagement in leisure activities serve as stimulants for cognition and are indicators for cognitive impairment in older adults. The associations that constitute this relation are not completely clear for scientific literature and it is relevant to assess if there are discrepancies on the modulator role that these factors might have in connection to cognition in the old age (Tucker & Stern, 2011).

This paper aims to assess the relative importance that education and occupational complexity must determine cognitive performance in a group of older adults with MCI.

Materials and methods

Research design

The steps followed were those of a correlational design. Independent variables (IV) of the present research are the variables that conform the cognitive reserve of the individual such as education and occupational complexity. Dependent variable (DV) is the cognitive performance measured through different neuropsychological tests.

Participants

80 patients with MCI were assessed (age: 76.6 ± 6.9 years, 67% female, education: 11.5±3.7 years old). Interviews were made to patients with MCI over 65 years of age, all of them were residents of the community and attended a service of cognitive neurosciences of a neurology institution located in the City of Buenos Aires, Argentina. When the interview was held the patients were retired from their occupations. All patients needed to qualify with the inclusion/exclusion criterion established by the National Institute on Aging and Alzheimer's Association Workgroups (Albert et al., 2011) for the diagnose of MCI.

Inclusion criterion:

- Present memory complaints confirmed by an informant.
- Present memory deficit or other cognitive function in the psychological test (achieving a performance of or equal to 1.5 standard deviations under the average expected for his age and education.
- Have normal functioning in social, family and professional activities (daily tasks).
- No dementia diagnosed.

Exclusion criterion:

- Patients who at the time of the interview presented other chronicle neurology diagnose (such as epilepsy, cerebrovascular disease, AIDS, tumors, etcetera).
- That cognitive impairments started because of an acute episode (cerebrovascular accident, head trauma, encephalitis, etcetera).

- With a major psychiatric disorder as per the DSM-IV (APA, 1994) diagnosed before 50 years of age (examples: schizophrenia, major depression, etcetera).
- With signs of abuse of psychotropics or substances.

Instruments

- *Preliminary screening test.* To perform a general screening and confirm that all patients accomplished with the inclusion/exclusion criterion requested for the assessment, a semistructured interview was made. A questionnaire was used to collect sociodemographic information by asking for basic data and making questions related to the clinical history and functional level of the patient. Likewise, a neurological and psychiatric interview was made (RFA), which included a mapping of the cognitive performance through the Mini Mental State Exam (MMSE) (Folstein, Folstein & McHugh, 1975) and the Clock Drawing Test (CDT) (Sunderland et al., 1989). In order to exclude from the sample assessed patients that presented disturbances in their emotional state that might affect the cognitive performance, the Beck Depression Inventory (BDI) was used (Beck, Ward, Mendelson, Mock & Erbaugh, 1961) together with the Hospital and Anxiety Depression Scale HADS (Zigmond & Snaith, 1983).

- *Functional level of the patient.* It was assessed with the Index of Independence in Activities of Daily Living (Katz, 1983) and the Lawton And Brody Instrumental Activities of daily living scale (19669).

- *Neuropsychology test.* In order to assess the following cognitive functions: memory, attention, language, executive functions and visuocontruction, a wide neuropsychology test battery was selected. The intention was to assess cognitive functions following the guidelines described by the Grupo de Trabajo de Neurología de la Conducta y Neurociencias Cognitivas, Sociedad Neurológica Argentina [Neurology Workgroup of Behavior and Cognitive Neuroscience, Argentine Socirty of Neurology] (Allegri et. al, 2011). This battery is daily used on cognitive neuroscience services in Argentina and the administration of it takes about 60 minutes. The selected tests have scales of assessment for Spanish speaking population. Most of the tests used are validated for Argentine population. A description of the used tests is included below:

- *Signoret Memory Battery* (Leis et al., 2018; Signoret & Whiteley, 1979). In this assessment the patient needs to withhold and repeat immediately and with delay most of the data included on a narrative verbally presented. Maximum score is of 12 items in total. The patient is given two different scores: one for the immediate recall of the story and the other for what the patient recalls after 30 minutes of having read it.

- *Test Auditivo Verbal España Complutense TAVEC* [Complutense Verbal Learning Test] (Benedet & Alejandre, 1998). This is a test of verbal learning that has an initial list (A) of 16 nouns, made up by four different semantic categories. The application consists of five tests of immediate recall (IR), followed by a test of interference list (B), which has the same amount of words. Later, the patient is assessed with a free short-term recall test of list A and a clued recall test (RC). After 20 minutes have passed, the patient is assessed with a free delayed recall test, a clued recall test and a recognition test, made up by 44 nouns. The test allows the investigator to assess recall capacity, perseverance, and different types of intrusions and false positives.

- *Boston Naming Test (BNT)* (Allegri et al., 1997; Kaplan, Googlas & Weintraub, 1986). It is a visual nomination test. The patient needs to name 60 drawings of objects, after 20 seconds the individual receives semantic clues and later phonological. As per the score, a resume of the spontaneous, latent and correct responses is obtained following semantic or phonological clues. For the total score, only the responses produced spontaneously or using semantic clues are considered correct. Maximum score is of 60 points.

- *Verbal Fluency Test* (Burin, Ramenzoni & Arizaga, 2003; Spreen & Benton, 1977). *Phonological Fluency:* In this test, patients are requested to name in 60 seconds as many words as possible for them that begin with a particular letter. In Spanish, it is common to use letters P, L and M. The use of proper names, numbers and words within the same family is excluded. *Semantic Fluency:* This test assesses the ability to evoke and name words within a particular category in a set amount of time, which is normally 60 seconds. The mostly used category is animals.

- *Trail Making Test* (Margulis, Louhau & Ferreres, 2018; Reitan, 1958). This is a test that requires pencil and paper to perform it and is comprised of two different parts. Part A consists of a paper of A4 size in which numbers from 1 to 25 are randomly distributed. The patient needs to join the numbers as quickly as possible without lifting the pencil. Final punctuation is the time elapsed. This test assessed motor skills, visual search and scanning and sustained attention. Part B of the assessment is used to test flexibility, speed and sequencing, as well as split attention and motor skills. The objective of this assessment is that the patient has to join as quickly as possible a series of number and letters distributed in a paper. He needs to join a number with a letter (numbers in ascending order and letters following the alphabet. Final punctuation of this part is obtained considering the time elapsed.

- *Wechsler Memory Scale (WMS)* (Wechsler, 1997). The digit span subtest is made up of two different tests that are assessed independently from one another. Digits are presented on ascending and descending order, forward and backwards. In both tests, the investigator reads directly the series of numbers. When numbers are read forward, the patient is requested to repeat the series in the order in which it was presented; when numbers are read backwards, the series must be repeated in reverse order. The parts of the test are administered separately. Each ascending item is composed by two elements. The test is interrupted when the patient obtains a score that equals zero in both attempts. Maximum possible score in each test is of 16 points. Direct repetition of numbers is an assessment for attention and immediate auditory memory. Repetition of numbers backwards is useful to measure working memory.

- *Wechsler Adult Intelligence Scale (WAIS III)* (Wechsler, 2002). These tests are of frequent use to measure cognitive abilities in the context of a neuropsychology battery assessment (Burin, Drake & Harris, 2007). The following subtests were included in the present research.

Vocabulary: In this test, the patient is requested to define some words from frequent to barely frequent daily use. A total amount of 32 items are presented and each gets a score of 0, 1 or 2 according to the response given. Maximum possible score is of 66 points. This test measures classification and conceptualization abilities. It starts with item number 4 and the administration of it is interrupted if the patient gives six consecutive answers of 0 score.

Analogies: In this subtest, the patient receives orally two different elements and he needs to describe what those elements have in common. A total amount of 19 numbers are presented and each gets a score of 0, 1 or 2. Maximum possible score is of 33 points. This test measures the ability to order and classify similar concepts. It starts with item 6. The test is interrupted when the patient gives 3 consecutive wrong answers.

Matrix reasoning: This test assesses logic and reasoning using abstract visual material. The patient receives different visual design patterns and has to identify within a series of 5 options which of them is more accurate to complete the given design. The test is composed by 26 patterns. Maximum possible score is of 29 points. The test is interrupted when the patient gives five consecutive wrong answers.

Block design: This is a visual construction test useful to measure execution speed. The patient receives 26 designs that he needs to reproduce with six-faced blocks that have different pattern. It starts with pattern 5 and the test is interrupted when the patient scores zero for four times in a row. Maximum score is of 68 points, and an extra point is received according to the response speed.

Since the test gives as result scores expressed in different scales (normative score, T score, gross score) for better comparison and analysis purposes they will be transformed into Z score. On psychology investigations, scores under z= - 1,5 are considered alterations (Brurin, Drake & Harris, 2007).

- *Occupational experience: Questionnaire on Attainment of Occupational Experience* (CAAL, as per its Spanish acronym), (Feldberg, Stefani, Somale & Allegri, 2016; Kohn & Schooler, 1983). This questionnaire is a Spanish adaptation of the test developed by Kohn and Schooler (1983) and measures the psychological effects of the occupation an individual develops. It is made up of 9 open and closed questions with set alternative answers that assess different aspects connected to the main occupation, such as complexity. Complexity is tested through a series of open questions that are later classified by the investigator following the classification grid, where different levels of complexity are shown depending on the materials used to perform a job (data, people, things) and the general complexity of the occupation as per Kohn and Schooler (1983) classification. This is tested using Likert scales. General complexity of the main occupation is valued with a scale that goes from 1 (maximum complexity job) to 7 (minimum complexity job). The questionnaire is administered in 7 minutes approximately.

Procedures

Patients with MCI under neurological treatment in the service of cognitive neurosciences in an institute specialized in neurology were invited to participate in this investigation. The patients go through two different instances: on the first one, the neurologist registers all the socio demographic data and tests the patient's state of mind, functional level and cognitive screen were applied. On the second stage, a wide neuropsychological assess is administered. This test is part of the annual cognitive control that patients with MCI perform in this institution. On the same interview, and after a brake, the patient completes the CAAL questionnaire (Feldberg, Stefani, Somale & Allegri, 2016). The whole assessment process lasts from 90 to 120 minutes.

After the patient receive a detailed and clear explanation of the study, and data confidentiality was granted, a written consent was signed. The assessment was carried out as per the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH), last review of the Declaration of Helsinki, adopted in 1964 (World Medical Association (WMA), 2001).

Statistical analysis

Information correspondent to psychosocial variables and specific aspects of the occupational experience are presented with percentages, measures and standard deviations in agreement with the levels of variable scores.

A multiple linear regression analysis was also made to assess the performance that older adults with MCI obtained on neuropsychological tests of memory, attention, language, executive functions and the interaction of them with the variables "education" and "occupational complexity", jointly considered (R), and the independent contribution of the latter (predictable variable) for the prediction of "cognitive performance" in each function tested (criterion variable). For this purpose, the significance level 95% was used together with the software *Statistical Package for the Social Sciences*-SPSS version 22.0.

Results

Tables 1 and 2 describe sociodemographic characteristics, main occupation performed prior to retirement, kind of MCI according to neurological diagnose, and the performance observed in the neuropsychological tests administered for: verbal episodic memory, attention, language, executive functioning and visual construction.

As per the sociodemographic profile and the main occupation of the patients interviewed, the average age was of 76.59 years (*DE*= 6.6) and education average was 11.30 years (*DE*= 3.71), bigger percentage is connected to female gender (68%), Argentine nationality (89%), married marital status (56%). Main Occupation activities included were employee (26%), crafts (27%) and merchant (15%). Average amount of years in the occupation was of 28.74 yeas (*DE*= 17.44) and average amount of hours worked per week was of 41.43 (*DE*=13.61). In connection to the neurological diagnose, most patients were under the category of Amnestic MCI-Multiple Domain (58%) followed by Amnestic MCI-Single Domain (23%).

Table 1
Sociodemographic profile of the sample (N= 80)

Gender	
Male	25 (32%)
Female	55 (68%)
Age (years)	*M*= 76 ± *DE*= 6.6
Education (years)	*M*= 11 ± *DE*= 3.71
Nationality	
Argentinian	72 (89%)
Foreigner	8 (11%)
Marital status	
Single	2 (4%)
Married	46 (56%)
Widow	23 (28%)
Divorcee	5 (6%)
Living with a partner	4 (6%)
Occupation	
Crafts	22 (29%)
Employee	29 (34%)
Merchant	11 (15%)
Teacher	7 (8%)
Independent professional	6 (8%)
Senior executive	5 (6%)
Years worked	*M*= 28 ± *DE*= 17.44
Average working hours per week	*M*= 41 ± *DE*= 13.61
Diagnose	
Amnestic MCI-Single Domain	19 (23%)
Amnestic MCI-Mutiple Domain	48 (58%)
Non-Amnestic MCI-Single Domain	5 (7%)
Non-Amnestic MCI-Mutiple Domain	8 (12%)

There is a description of the performance achieved by interviewed patients on the tracking and cognitive tests administered, as well as functional level and the scores obtained in the scales that assess general state of mind (depression and anxiety).

Table 2
Performance achieved by patients on screening tests functional level, state of mind and neuropsychological tests (Z score)

Tests (Z score)	MCI	
	M	*DE*
Screening tests		
MMSE	27.44	1.95
Clock drawing test	6.29	.10
AVD	24	0
AIVD	0	0
I. Beck	7	3.47
HAD-A	2.23	2.55
Memory		
Logic Memory (IR)	-1.36	1.1
Logic Memory (DR)	-1.28	1.2
TAVEC IR	-1.19	.98
TAVEC DR	-1.38	1.18
TAVEC REC	- 63	1.08
Attention		
Forward digits	.16	1.3
Backwards digits	- 42	.71
TMT-A	-1.15	1.16
Language		
Boston	-1.02	1.28
Fl. Semantic	.15	.71
Fl. Phonology	.07	1.08
Vocabulary (WAIS-III)	.16	.71
Executive functions		
Analogies (WAIS-III)	- 65	1.16
Matrix (WAIS-III)	- 23	.89
Block design (WAIS-III)	- 42	.71
TMT-B	-1.15	1.16

On the battery of tests administered, it is worth mentioning that on the screening tests (MMSE and Drawing Watch Test) the scores obtained locate the patients in a performance rank that goes from normal to mild impairment (Allegri et al., 1999). All patients have functional independence and there is no meaningful presence of symptoms of either depression or anxiety, which might affect their cognitive performance negatively. They accomplish the inclusion/exclusion criterion set to participate in this research.

In connection to the performance on neuropsychology tests, expressed in Z score, where z=-1.5, there are indicators of deficient score. It was observed that the areas affected the most are: episodic verbal memory, particularly when the patient needs to recall a story; logic memory of immediate and delayed recall of a story; delayed recall in the list of words TAVEC. The results obtained match the prevalent diagnose of the group made up of patients with Amnestic MCI-Single Domain and Multiple Domain.

Tables 4 to 6 show for cognitive functions: memory, attention, language and executive functions, the Pearson correlation coefficient "r" between education (tested with amount of years of study) and general occupational complexity (obtained through the administration of the CAAL questionnaire), with results obtained in the neuropsychology tests used to assess cognitive performance of each ability analyzed. Pearson correlation coefficient "r" are statistically meaningful .05 , indicate the importance of these variables as "predictors" to determine the cognitive performance of functions or variables considered "criterion". Besides, there is information included of the coefficient of multiple correlation (R) and standard regression (b), obtained in the four tests of multiple regression. The latter can be statistically meaningful when 05 can be considered an indicator of relative importance of each predictor in the equation of regression to predict the cognitive performance (criterion).

Table 3

Prediction of memory cognitive performance: education and occupational complexity

Predictors	Episodic verbal memory performance									
	Logic Memory IR		Logic Memory DR		List IR TAVEC		List DR TAVEC		List REC TAVEC	
	R=.18		R=.16		R=.26		R=.26		R=.26	
	r	β	r	β	r	β	r	β	r	β
Education	.02	.01	.12	.09	.02	.10	.01	.07	.04	.01
Occupational Complexity	.04	.05	.11	.04	.11	.19	.04	.10	.07	.09

Table 4

Prediction of attention cognitive performance: education and occupational complexity

Predictors	Attention performance			
	TMT-A		Span	
	R=.32		R=.24	
	r	β	r	β
Education	.30**	.19*	.18	.33
Occupational Complexity	.29**	.16	.09	.21

*** $p \leq .01$*

Table 5
Prediction of language cognitive performance: education and occupational complexity

Predictors	Language performance							
	Vocabulary		Fl. Phonology		Fl. Semantic		Boston	
	R=.47**		R=.16		R=.24		R=.30	
	r	β	r	β	r	β	r	β
Education	.41**	.19	.03	.11	.10	.11	.17	.03
Occupational Complexity	.45**	.32**	.14	.22	.05	.01	.23	.21

*** p ≤ .01*

Table 6
Prediction of executive functions cognitive performance: education and occupational complexity

Predictors	Executive functions performance									
	TMT-B		Backwards Span		Matrix (WAIS-III)		Analogies (WAIS-III)		Block design (WAIS-III)	
	R=.32**		R=.25		R=.27*		R=.35		R=.27*	
	r	β	r	β	r	β	r	β	r	β
Education	.24**	.04	.20*	.06	.20*	.26*	.05	.12	.22*	.08
Occupational Complexity	.32**	.29*	.24**	.20	.08	.09	.02	.10	.26**	.20*

** p ≤ .05, ** p ≤ .01*

On the one side, the results obtained show the independent contribution that education has to determine the performance of some cognitive abilities: a) “attention”, mainly in the ability to monitor and sustained and selective attention (TMTA - Table 4); and b) “executive functions” for the abstract reasoning (Reasoning Matrix WAIS III - Table 6).

On the other side, the independent contribution that occupational complexity can be pointed out: a) “language” development, especially in the Vocabulary test (Vocabulary WAIS III-Table 5); and b) some aspects connected to “executive functions” such as cognitive flexibility (TMT B) and planning of visuocontructive abilities (Block design WAIS-III) (Table 6).

Discussion

Over the last years, several scientific research (Daffner, 2010; Valenzuela & Sachdev, 2006), have pointed out that environmental, behavioral and genetic factors might influence the appearance of mild impairment and affect the capacity that the brain has to tolerate the damage. Variables such as education, occupation, and use of free time are related to the beginning and the progression rate of cognitive deficits during aging. The hypothesis of cognitive reserve tries to explain the neuropathology findings in patients with neurodegenerative diseases who have remained mentally healthy through their entire lives, what suggests that some adults are capable of coping with pathology changes related to Alzheimer’s better than others (Stern, 2009).

This investigation objective has been to analyze the relative importance that education and occupational complexity have on cognitive performance in a group of older adults diagnosed with MCI. Considering the results obtained, it can be said that the level of education and occupation in the frame of CR would have a moderating role for cognitive functions. Referring to education particularly, it would moderate sustained and selective attention, and some aspects related to executive functions such as abstract reasoning. As regards occupational complexity, it seems to have a positive implication for verbal, abilities, cognitive flexibility and visuoconstructive abilities.

On the statistical analysis performed, it is manifested primarily the independent contribution that the level of education has in connection to some cognitive abilities such as sustained and selective attention; and some aspects related to executive functions as is abstract reasoning. The results obtained herein are aligned with the findings of other investigations (Meng & D Arcy, 2012; Tucker-Drob, Johnson & Jones, 2009) that defend that education has a positive impact on cognitive abilities during early stages of aging and that the benefits received last for a lifetime. It is accurate to deduct that those individuals who remain in the educative system for longer periods of time would benefit on some areas of cognition that are trained and stimulated, such as sustained attention and abstract reasoning. Individuals who have attended different levels of education might probably obtain better performance results in tests of attention, surveillance, abstract reasoning, necessary cognitive functions necessary to achieve advanced levels of education.

It is important to point out the importance of the independent contribution that occupational complexity has in the areas of verbal abilities, cognitive flexibility and visuoconstructive abilities. This is a preliminary research made with 80 patients, and occupational complexity has been assessed as a global skill. A future objective will be to widen the amount of patients interviewed to assess the impact that working with specific materials such as data, people and things have on cognitive performance. Although in this research general complexity of the occupation was analyzed, based on the information received by the patients regarding the particular characteristics of their occupation, it was noticed that verbal abilities, cognitive flexibility and visuocontructive abilities get benefits. Cognitive functions that can be associated to working with people, analyze data or make manual qualified work will be object of future study using a bigger and varied sample to better assess the impact of occupation on some areas of cognition.

Several researchers (Andel, Silverstein & Kareholt, 2014; Phillips, 2017) who have analyzed occupational complexity with specific materials, have discovered that occupations that involve participation of people generally imply a development of social skills where language and communication have a major role. Likewise, Gow, Avlund and Mortensen (2014) have observed that people whose occupation is connected to data handling have a positive association with tasks that demand high levels of attention and imply speed for processing and working memory. They point out that complex manual work might have positive effects on specific areas of cognition, such as visuoespatial abilities.

As regards memory, neither education nor occupational complexity have contributed to determine the performance of older adults with MCI. A probable cause for this could be little variable obtained in this area by the interviewed patients. 81% of the individuals interviewed have been diagnosed with amnestic MCI, 23% obtained scores of amnestic MCI-Single Domain and 58% of amnestic MCI-Mutiple Domain. In both groups, the memory was an affected function. It is suggested that this research is deepened in future investigations with bigger and varied samples.

The results obtained are in agreement with other reserarch that try to identify the factors that promote healthy cognitive aging in older adults. Within the frame of the cognitive reserve, occupational complexity and education have a unique and important role in the maintenance of cognitive abilities, working as buffers for cognitive impairment during aging.

Following the guidelines proposed by the WHO (2012) it is of great importance to have sanitary policies designed to buffer the cognitive impairment suffered by older adults, as this is one of the main reasons that causes disabilities and the need of receiving constant professional assistance. Since there are no new drug treatments to help prevent cognitive impairment in the old age, this topic should receive sanitary priority, particularly in countries with aged population.

The theory of the cognitive reserve provides theoretical elements to plan policies to prevent problems with cognitive health. To identify those elements that promote a healthy cognitive aging is key to develop programs of intervention and prevention. Since nowadays there is dissimilar and contradictory evidence regarding the importance that each of the elements have to build brain protection in vulnerable individuals. This research adds local scientific evidence regarding the great importance that education and occupational complexity have to module cognitive disorders in the process of brain aging, as well as an indicator of the cognitive reserve. MCI is a diagnosed disease that embraces individuals in cognitive risk (Petersen, Smith, Waring, Ivnik,, Tanglos & Kokmen, 1999). In the theory of cognitive reserve (Stern, 2009), it is useful not only for prevention but also for later clinical monitoring to identify markers and tools that allow identify the most vulnerable patients of the group. So, to analyze protectors and risk factors regarding sociodemographic and psychosocial variables such as education and occupational complexity, provide useful information to plan strategies of intervention and prevention on vulnerable populations.

Global epidemiology researches show a clear increase in the population of older adults with respect to general population. This manifests a progressive and significant increase in the amount of adults that would probably suffer dementia in the upcoming decades (Alzheimer Disease International, 2019). That is the reason why to remain in the educative system and the occupational complexity are sociodemographic characteristics that not only guarantee a better future but also might indicate the path of cognitive aging, giving the patient more or less resources, depending on the case, to buffer the impairment, keeping functional independence and without the need of receiving care during old age.

To conclude, it should be mentioned that this research has limitations, like the application of a neuropsychology battery with possible implications in the level of tiredness of the patient that might have affected the performance obtained on the administered tests. Besides, it is not possible to generalize the results due to the kind of sample used and the number of patients interviewed, since all of them belong to a middle class status. It is proposed to continue developing local research with bigger samples to include different socio economic an educational levels that allow to assess the importance of the studied variables education and occupational complexity in samples with wider characteristics and without evidences of cognitive impairment.

References

Albert, M. S., De Kosky, S. T., Dickson, D., Dubois, B., Feldman, H. H., Fox, N. C., ... & Snyder, P. J. (2011). The diagnosis of mild cognitive impairment due to Alzheimer’s disease: Recommendations from the National Institute on Aging-Alzheimer’s Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & dementia*, *7*(3), 270-279. doi: https://doi.org/10.1016/j.jalz.2011.03.008

Allegri, R. F., Arizaga, R. L., Bavec, C. V., Colli, L. P., Demey, I., Fernández, M. C., ... & Kremer, J. (2011). Enfermedad de Alzheimer. Guía de práctica clínica. *Neurología Argentina*, *3*(2), 120-137. doi: https://doi.org/10.1016/S1853-0028(11)70026-X

Allegri, R.F., Mangone, C.A. & Rymberg S. (1997). Spanish version of the Boston naming test in Buenos Aires. *The Clinical Neuropsychologist, 11*(4), 416-420. doi: https://doi.org/10.1080/13854049708400471

Allegri, R. F., Ollari, J. A., Mangone, C. A., Arizaga, R. L., De Pascale, A., Pellegrini, M., ... & Delembert, W. (1999). El "Mini Mental State Examination" en la Argentina: instrucciones para su administración. *Revista Neurológica Argentina*, *24*(1), 31-35.

Alzheimer's Association (2016). 2016 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, *12*(4), 459-509. doi: https://doi.org/10.1016/j.jalz.2016.03.001

Alzheimer Disease International (2019). Kit de herramientas Mes Mundial del Alzheimer de 2019. Available at: https://www.alz.co.uk/news/adi-launches-lets-talk-about-dementia-global-campaign-for-world-alzheimers-month

American Psychiatric Association (2013). *Manual Diagnóstico y Estadístico de los Trastornos Mentales (DSM–5®),* 5º. *Ed.* Arlington, VA: Asociación Americana de Psiquiatría.

Andel, R., Silverstein, M., & Kåreholt, I. (2014). The role of midlife occupational complexity and leisure activity in late-life cognition. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 70*(2), 314-321. doi: https://doi.org/10.1093/geronb/gbu110

Andel, R., Crowe, M., Pedersen, N. L., Mortimer, J., Crimmins, E., Johansson, B., & Gatz, M. (2005). Complexity of work and risk of Alzheimer's disease: a population-based study of Swedish twins. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *60*(5), 251-258. doi: https://doi.org/10.1093/geronb/60.5.p251

Asociación Médica Mundial. Declaración de Helsinski (2001). Principios éticos para las investigaciones médicas en seres humanos. *Revista Neurología Argentina*, *26*, 75-77. doi: https://doi.org/10.17126/joralres.2013.009

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of general psychiatry*, *4*(6), 561-571. doi: https://doi.org/10.1001/archpsyc.1961.01710120031004

Benedet, M. J., & Alejandre, M. A. (1998). *Test de Aprendizaje Verbal España-Complutense (TAVEC)*. Madrid: TEA Ediciones. doi: https://doi.org/10.33588/rn.5910.2014328

Boots, E. A., Schultz, S. A., Almeida, R. P., Oh, J. M., Koscik, R. L., Dowling, M. N., ... & Asthana, S. (2015). Occupational complexity and cognitive reserve in a middle-aged cohort at risk for Alzheimer's disease. *Archives of Clinical Neuropsychology*, *30*(7), 634-642. doi: https://doi.org/10.1093/arclin/acv041

Bruscoli, M., & Lovestone, S. (2004). Is MCI really just early dementia? A systematic review of conversion studies. *International Psychogeriatrics, 16*(2), 129-140. doi: https://doi.org/10.1017/s1041610204000092

Burin, D. I., Ramenzoni, V. & Arizaga, R. L. (2003). Evaluación neuropsicológica del envejecimiento. Normas según edad y nivel educacional. *Revista Neurológica Argentina, 28,* 149-152.

Burin, D. I., Drake, M. A. & Harris, P. (2007). *Evaluación neuropsicológica en adultos*. Buenos Aires: Paidós.

Correa Ribeiro, P. C., Lopes, C. S., & Lourenço, R. A. (2013). Complexity of lifetime occupation and cognitive performance in old age. *Occupational medicine*, *63*(8), 556-562. doi: https://doi.org/10.1093/occmed/kqt115

Daffner, K. R. (2010). Promoting successful cognitive aging: A comprehensive review. *Journal of Alzheimers Disease, 19*(4), 1101–1122. doi: https://doi.org/10.1111/j.1744-1609.2010.00150.x

Feldberg, C., Stefani, D. Somale, M. V. & Allegri, R. F. (2016). Traducción y validación del Cuestionario sobre Agenciamiento de la Actividad Laboral, en sujetos argentinos. *Revista Neurología Argentina*, *8*(1), 17-29. doi: https://doi.org/10.1016/j.neuarg.2015.09.004

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. *Journal of psychiatric research*, *12*(3), 189-198. doi: https://doi.org/10.1016/0022-3956(75)90026-6

Giogkaraki, E., Michaelides, M. P., & Constantinidou, F. (2013). The role of cognitive reserve in cognitive aging: Results from the neurocognitive study on aging. *Journal of Clinical and Experimental Neuropsychology, 35*(10), 1024–1035. doi: https://doi.org/10.1080/13803395.2013.847906

Gow, A. J, Avlund, K. & Mortensen E. L. (2014). Occupational characteristics and cognitive aging in the Glostrup 1914 cohort. *Journal of Gerontology B, 69*(2), 228–236. doi: https://doi.org/10.1093/geronb/gbs115

Harrison, S. L., Sajjad, A., Bramer, W. M., Ikram, M. A., Tiemeier, H., & Stephan, B. C. M. (2015). Exploring strategies to operationalize cognitive reserve: A systematic review of reviews. *Journal of Clinical and Experimental Neuropsychology*, *37*(3), 253-64. doi: https://doi.org/10.1080/13803395.2014.1002759

Kaplan, E.; Goodglass, H. & Weintraub, S. (1986). *Test de Vocabulario de Boston*. Madrid: Panamericana.

Katz, S. (1983). Assessing self-maintenance: Activities of daily living, mobility, and instrumental activities of daily living. *Journal of American Geriatric Society*, *31*(12), 721–727. doi: https://doi.org/10.1111/j.1532-5415.1983.tb03391.x

Kohn, M. L. & Schooler, C. (1983). *Work and personality: An inquiry into the impact of social stratification*. Norwood, NJ: Ablex.

Lawton, M. P. & Brody, E. M. (1969). Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist* 9(3), 179-186. doi: https://doi.org/10.1093/geront/9.3_part_1.179

Leis, A., Allegri, R., Roman, F., Iturry, M., Crotti, B., Gatto, E., & Rojas, G. J. (2018). Datos normativos de la versión argentina de la batería de eficacia mnésica Signoret (BEM 144) para ser aplicados en la evaluación neurocognitiva. *Neurología Argentina*, *10*(3), 127-136. doi: https://doi.org/10.1016/j.neuarg.2018.04.002

Margulis, L. E., Louhau, M. R. S., & Ferreres, A. R. (2018). Baremo del Trail Making Test para Capital Federal y Gran Buenos Aires. *Revista Argentina de Ciencias del Comportamiento*, *10*(3), 54-63. doi: https://doi.org/10.32348/1852.4206.v10.n3.19741

Meng, X., & D'Arcy, C. (2012). Education and dementia in the context of the cognitive reserve hypothesis: A systematic review with meta-analyses and qualitative analyses. *Plos One*, *7*(6), 382-445. doi: https://doi.org/10.1371/journal.pone.0038268

Organización Mundial de la Salud (2012). *Demencias*. Ginebra: OMS Ediciones.

Peláez, E., Monteverde, M., & Acosta, L. (2017). Celebrar el envejecimiento poblacional en argentina. Desafíos para la formulación de políticas. *SaberEs*, *9*(1).

Petersen, R. C. (2004). Mild cognitive impairment as a diagnostic entity. *Journal of internal medicine*, *256*(3), 183-194. doi: https://doi.org/10.1111/j.1365-2796.2004.01388.x

Petersen, R. C., Doody, R., Kurz., A., Mohs, R. C., Morris, J. C. & Rabins, P. V. (2001). Current concepts in mild cognitive impairment. *Archives of Neurology, 58*, 1985-1992. doi: https://doi.org/10.1001/archneur.58.12.1985

Petersen, R. C., Smith, G. E., Waring, S. C., Ivnik, R. J., Tangalos, E. G., & Kokmen, E. (1999). Mild cognitive impairment: clinical characterization and outcome. *Archives of neurology, 56*(3), 303-308. doi: https://doi.org/10.1001/archneur.56.3.303

Phillips, C. (2017). Lifestyle modulators of neuroplasticity: how physical activity, mental engagement, and diet promote cognitive health during aging. *Neural plasticity*, *2017*. doi: https://doi.org/10.1155/2017/3589271

Pool, L. R., Weuve, J., Wilson, R. S., Bültmann, U., Evans, D. A., & De Leon, C. F. M. (2016). Occupational cognitive requirements and late-life cognitive aging. *Neurology, 86*(15), 1386-1392. doi: https://doi.org/10.1212/wnl.0000000000002569

Reitan, R. M. (1958). Validity of the Trail Making Test as an indication of organic brain damage. *Perception Motor Skills, 8*(3), 271-275. doi: https://doi.org/10.2466/pms.8.7.271-276

Roldán-Tapia, L., García, J., Cánovas, R., & León, I. (2012). Cognitive reserve, age, and their relation to attentional and executive functions. *Applied Neuropsychology: Adult*, *19*(1), 2-8. doi: https://doi.org/10.1080/09084282.2011.595458

Sanchez Contreras, M., Moreno Gómez G. A. & García Ortíz, L. H. (2010) Deterioro cognitivo, nivel educativo y ocupación en una población de una clínica de memoria. *Revista Colombiana de Psiquiatría*, *39*(2), 347-361. doi: https://doi.org/10.1016/s0034-7450(14)60255-9

Signoret, J. L. & Whiteley, A (1979). Memory battery scale. *International Neuropsychology Society Buletin*, *2*, 2-26.

Smart, E. L., Gow, A. J., & Deary, I. J. (2014). Occupational complexity and lifetime cognitive abilities. *Neurology*, *83*(24), 2285-2291. doi: https://doi.org/10.1212/wnl.0000000000001075

Spreen, O. & Benton, A. (1977). *Neurosensory Center Comprehensive Examination for Aphasia*. V*ictoria, British Columbia: University of Victoria Neuropsychology Laboratory*.

Stern, Y. (2002). What is cognitive reserve? Theory and research application of the reserve concept. *Journal of the International Neuropsychological Society*, *8*(3), 448-460. doi: _https://doi.org/10.1017/S1355617702813248

Stern, Y. (2009). Cognitive reserve. *Neuropsychologia*, *47*(10), 2015-2028. doi: https://doi.org/10.1016/j.neuropsychologia.2009.03.004

Stern, Y. (2012). Cognitive reserve in ageing and Alzheimer's disease. *The Lancet Neurology*, *11*(11), 1006-1012. doi: https://doi.org/10.1016/s1474-4422(12)70191-6

Stern, C., & Munn, Z. (2010). Cognitive leisure activities and their role in preventing dementia: a systematic review. *International Journal of Evidence-Based Healthcare*, *8*(1), 2-17. doi: https://doi.org/10.1111/j.1744-1609.2010.00150.x

Sunderland, T., Hill, J. L., Mellow, A. M., Lawlor, B. A., Gundersheimer, J., Newhouse, P. A. & Grafman, J. (1989): Clock drawing in Alzheimer’s disease: a novel measure of dementia severity. *Journal of the American Geriatric Society*, 37(8), 725-729. doi: https://doi.org/10.1111/j.1532-5415.1989.tb02233.x

Thow, M. E., Summers, M. J., Saunders, N. L., Summers, J. J., Ritchie, K., & Vickers, J. C. (2018). Further education improves cognitive reserve and triggers improvement in selective cognitive functions in older adults: The Tasmanian Healthy Brain Project. *Alzheimer's & Dementia: diagnosis, assessment & disease monitoring*, *10*, 22-30. doi: https://doi.org/10.1016/j.dadm.2017.08.004

Tisnés, A., & Salazar-Acosta, L. M. (2016). Envejecimiento poblacional en Argentina: ¿qué es ser un adulto mayor en Argentina? Una aproximación desde el enfoque de la vulnerabilidad social. *Papeles de población*, *22*(88), 209-236.

Tucker, A. M., & Stern, Y. (2011). Cognitive reserve in aging: Review. *Current Alzheimer Research*, *8*(4),354-360. doi: https://doi.org/10.2174/156720511795745320

Tucker-Drob, E. M., Johnson, K. E., & Jones. R. N. (2009). The cognitive reserve hypothesis: a longitudinal examination of age-associated declines in reasoning and processing speed. *Developmental Psychology*, *45*(2), 431-446. doi: https://doi.org/10.1037/a0014012

U.S. Department of Labor (1965). *Dictionary of Occupational Titles*. Washington, D.C.: Government Printing Office.

Valenzuela, M. J., & Sachdev, P. (2006). Brain reserve and dementia: A systematic review. Psychological *Medicine*, *36*(4), 441–454. doi: https://doi.org/10.1017/s0033291705006264

Wechsler, D. (1997). *The Wechsler Memory Scale*. San Antonio, Tex: Psychological Corp.

Wechsler, D. (2002). *WAIS III: Test de Inteligencia para adultos*. Buenos Aires: Paidós.

Xu, W., Tan, L., Wang, H. F., Tan, M. S., Tan, L., Li, J. Q., ... & Yu, J. T. (2016). Education and risk of dementia: dose-response meta-analysis of prospective cohort studies. *Molecular neurobiology*, *53*(5), 3113-3123. doi: https://doi.org/10.1007/s12035-015-9211-5

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta psychiatrica scandinavica*, *67*(6), 361-370. doi: https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

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