DOI: 10.5455/msm.2016.28.424-428

Received: 20 October 2016; Accepted: 11 December 2016

© 2016 Amela Ibrahimagic, Lejla Junuzovic Zunic, Mirsada Rasidovic, Bojan Radic, Ahmet Kantic

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ORIGINAL PAPER

Mater Sociomed. 2016 Dec; 28(6): 424-428

Predictability of Social-anamnestic Variables on Receptive Vocabulary and Cognitive Functioning of the Elderly Population

Amela Ibrahimagic¹, Lejla Junuzovic Zunic¹, Mirsada Rasidovic², Bojan Radic³, Ahmet Kantic⁴

¹Faculty of Education and Rehabilitation, Tuzla University, Tuzla, Bosnia and Herzegovina

²Nursing Home "Vesna Micanović" Brcko, Bosnia and Herzegovina

³Association „Svijet u slikama“ Zenica, Bosnia and Herzegovina

⁴Institution of Public Utility Health Center Tesanj, Tesanj, Bosnia and Herzegovina

Corresponding author: Amela Ibrahimagic. Present Address: Setalište Slana banja Street 4/1, 75000 Tuzla, Bosnia and Herzegovina

ABSTRACT

Introduction: Aging, as an irrepressible biological process involves a series of physiological and pathological changes. The main aim of this study was to examine the correlation and predictability of receptive vocabulary and cognitive functioning of elderly people with anamnestic variables: chronological age, sex, level of formal education, marital status, years of work and retirement and years spent in an institution for the elderly. **Material and Methods:** The sample of participants consisted of 120 elderly people, average age was 78 years, placed in institutional care for elderly people in four cities in Bosnia and Herzegovina. It was three groups of variables: anamnestic, receptive vocabulary assessment, and cognitive assessments. A Montreal Cognitive Assessment Scale (MoCA) was used for the assessment of cognitive abilities. In order to estimate the receptive vocabulary Peabody Picture Vocabulary Test (PPVT-III-HR) was used. **Results:** Results of multiple regression analysis show that part of the variance of receptive language which is explained by the model (anamnestic variables) was 44.0% and of cognitive functioning was 33.7%. The biggest single contribution to explaining the development of receptive vocabulary was given by predictor variable of college education ($\beta = 0.417$) then variable university education ($\beta = 0.293$), while the smallest single contribution was given by variable secondary education ($\beta = 0.167$). The biggest single contribution to explaining the results of tests of cognitive function was given by predictor variable College education ($\beta = 0.328$) and variable unskilled ($\beta = -0.229$), which has a negative effect on the increase in recent cognitive functioning. **Conclusion:** Anamnestic variables were valid predictors of receptive vocabulary and cognitive functioning of elderly people. The highest individual contribution was given by variables describing the level of formal education of elderly.

Keywords: PPVT-III-HR, MoCA, regression analysis.

1. INTRODUCTION

Language is a system of codified knowledge and it is unique for all people living in a certain linguistic community (1). Language and communication skills are associated with skills in other areas of development for all individuals (2). Language, speech, voice and communication change during the life of adults (18-65 years) and elderly (over 65 years). The scientific literature published in the last three decades documents the 'normal' selective improvements related to the years, as well as a subtle decline in language, speech, voice, and communication (3). Basic cognitive functions are: attention, working memory, long term memory and perception. Higher levels of cognitive function are:

speech and language, decision-making and executive functions which include planning, organization, implementation and evaluation of many activities that do not qualify as routine. Basic cognitive functions most affected by aging are attention and memory. Higher levels of cognitive functions such as language process and decision making, are also affected by aging, but rely more on the basic cognitive functions and generally show a deficit if the basic functions are impaired. Although these features are looked at individually, it is clear that they overlap in interesting and complex ways (4). The weakening of language processing, such as increasing difficulty in understanding spoken language or in the production of words while speaking, causes

a reduced desire of older people to communicate, and can damage assessment of their language competence both to themselves and to others (5). When the speech is faster, the elderly, unlike young people, have lower perception of understanding. In understanding meaningful sentences in rapid speech, the age difference plays an important role (6). Elderly people know more words than young people. Elderly people have greater difficulties in the production of certain words (7).

2. AIM

The main aim of this study was to examine the correlation and predictability of receptive vocabulary and cognitive functioning of elderly people with anamnestic variables: chronological age, sex, level of formal education, marital status, years of work and retirement and years spent in an institution for the elderly.

3. MATERIAL AND METHODS

The sample of participants consisted of 120 elderly people, placed in institutional care for elderly people in four cities in Bosnia and Herzegovina (BiH): Tuzla (Public Institute Retirement Home), Mostar (Home for the Elderly), Sarajevo (Gerontology Center) and Brčko (Nursing homes, "Vesna Mićanović", "Sun", "Kusturica" and "Onion"). The youngest participant was 65 and the oldest 90 years old. The sample consisted of elderly with: verified stroke; dementia; verified stroke and dementia; and without a manifested brain diseases. After examining the medical records we established the exclusion criteria (presence of epilepsy, multiple sclerosis, psychosis, cancer and inflammatory diseases of the brain and trauma with fractures of the skull).

The sample of variables consisted of three groups: an anamnestic (chronological age, gender, level of formal education, marital status, working years, the retired years; the residence in institutional care for the elderly); estimated receptive test, equivalent vocabulary (raw test scores of receptive vocabulary, standardized value receptive test, percentile receptive to the normal distribution receptive test, stanine value receptive test, age equivalent receptive test); and cognitive assessment (connectivity test, visual-constructional abilities (cube), visual-constructional abilities (hour), naming, attention, vigilance, serial subtraction, repeating sentences, fluency, abstraction, delayed recall, orientation, total).

The procedure and instruments: The survey was conducted in seven establishments of institutional care for elderly people in four cities in BiH. After obtaining approval from these institutions, testing was done by three qualified examiners from September 2014 to May 2015. The information about the participants was received from the respondents with social workers, nurses and caregivers working in institutional care where the participants live, as well as insight into medical records. Subsequently, after obtaining consent from the individuals, individual testing was done. First we applied Montreal Cognitive Assessment, (MoCA), and then the Peabody Picture Vocabulary Test (PPVT-III-HR) (8, 9).

As a measuring instrument for assessment of receptive vocabulary, the PPVT-III-HR was used. Each task consisted of four black-white illustrations. The task of the participants

was to choose a drawing that best shows the meaning of the words pronounced by the examiner. Individual form of testing was used to test, write and score the answers, to determine the derivative points and record other data about the participant. The pamphlet included a table with the standards (where the raw scores were converted into standardized points), and the data necessary to determine the reliability and confidence intervals. For the assessment of cognitive abilities we used MoCA test. The scale was designed as a quick tool to select patients with mild cognitive impairment. MoCA includes various cognitive domains: attention and concentration, executive functions, memory, language, visual-constructional skills, conceptual thinking, calculation and orientation. The duration of the test was about ten minutes. The total score was 30 points, and 26 or more showed good cognition. Less than 26 points showed spectrum of mild cognitive impairment, and less than 21 points indicates dementia.

Statistical analysis was performed by SPSS 21.0. It included the computation of basic statistical parameters, Chi-square test, Kolmogorov Smirnov test for normal distribution and regression analysis. Statistical significance, that was accepted, was for the value of $p < 0.05$.

4. RESULTS

The sample consisted of 120 elderly people, 39.2% male and 60.8% female. Chi-square test showed a statistically significant difference in the proportion of men and women, $\chi^2 = 5.633$; $df = 1$; $p = 0.018$. The sample consisted of 12.5% people who were categorized as unskilled, 53.3% of which were categorized as skilled laborers, 15.8% with secondary education, 13.3% categorized as those with college education, and 5.0% with an university degree. Chi-square test showed a statistically significant difference in the proportion of participants that were in a category based on their formal education, $\chi^2 = 87.250$; $df = 4$; $p = 0.0001$. The sample consisted of 9.2% of participants who were married, 75% of participants who were widowers, 8.3% of participants who were divorced, and 7.5% of participants who were single. In the sample there were no participants who were living together but not married (out of wedlock). Chi-square test showed a statistically significant difference in the proportion of participants with respect to their marital status, $\chi^2 = 160.067$; $df = 3$; $p = 0.0001$.

Table 1 show the descriptive indicators of chronological age, years of work, years of work and retirement, years in institutional care for the elderly, from the sample. The average chronological age of the participants was 78 years, 7 months and 2 days (78.59) with a standard deviation of 5 years, 11 months and 20 days. Measures of skewness and kurtosis, which are reflected in the value z for easier comparison, indicate a negative asymmetry and the platycurtic distribution. Using Kolmogorov Smirnov test of normal distribution we determined that there was a significant deviation from the normal distribution, and that the distribution was asymmetric; $K-S = 0.86$; $df = 120$; $p = 0.038$.

To test the hypothesis of a possibility of predicting receptive vocabulary in elderly people using the mentioned anamnestic variables, linear regression was used. The variables that were of categorical character (education level and

	Mean	Std. deviation	Minimum	Maximum.	Skewness	Kurtosis	Kolmogorov-Smirnov test
Chronological age	78.59	5.97	65.00	90.00	-1.402	-1.102	*
Years of work	21.68	15.30	.00	46.00	-1.354	-3.225	*
Years of retirement	16.48	13.40	.00	44.00	0.624	-2.799	*
Years in institutional care	3.46	3.61	.08	17.00	8.641	8.837	*

Table 1. Descriptive indicators of anamnestic variables for all participants * Asymmetric distribution

marital status) were translated into “dummy” variables. The first thing to check was if the assumptions of multicollinearity were verified so we checked the correlation coefficients between predictors and criteria. It was found that the correlations range from 0.003 to 0.571 for receptive vocabulary and from 0.019 to 0.571 for cognitive functioning, suggesting a link between these variables where none of the variables exceed the correlation coefficient of 0.700, which would be too high. It is also evident that correlation between the predictors does not exceed the value of $r = 0.900$ (10) indicating the absence of multicollinearity. Collinearity which was estimated by measuring the tolerance and variance inflation factor (VIF) indicate that there was no violation of the criteria where we were guided by criteria for the values of tolerance over 0.10 and VIF values of less than 10 (10), from the analysis were excluded variables of skilled labor and marital status because of not corresponding these assumptions. By examining the diagram Normal Q-Q plot and diagrams of dispersion (Scatter plot) we found satisfying assumptions of atypical points, distribution normality, and linearity, homogeneity of variance and independence of residuals. It is found that points lie approximately in the right diagonal line indicating no large deviations from normal. A review of standardized residuals, showed the existence of cases that exceed the value of ± 3.0 standard deviations which were then excluded from further analysis. As it is shown in Table 2 it can be seen that part of the variance of receptive language which is explained by the model (anamnestic variables) was 44.0%. ANOVA results, which estimated the significance of the model, showed that the model was statistically significant, $F(12, 105) = 6.869$; $p = 0.0001$. It is also evident that the part of variance of cognitive development that is explained by the model (anamnestic variables) amounted to 33.7%. ANOVA results, estimating the significance of the model showed that the model was statistically significant, $F(12, 105) = 4.447$; $p = 0.0001$.

Model	R	R ²	R _c ²	F	p
Receptive language	0,663	0,440	0,376	6,869	0,0001
Cognitive functioning	0,580	0,337	0,261	4,447	0,0001

Table 2. Results of multiple regression analysis with anamnestic variables as predictor variables and receptive language and cognitive functioning as criteria variable Legend: R- coefficient of correlation, R² – coefficient of determination, R_c² – corrected coefficient of determination, F-ratio analysis of variance, p – probability (N=118)

Table 3 shows the individual contributions of predictor variables explaining the criteria. In order to compare the individual contributions of individual predictor values, column Beta was estimated or standardized beta coefficients was estimated. On the basis of these indicators it can be seen

as the biggest single contribution to explaining the results of the test of receptive language was given by predictor variable of college education ($\beta = 0.417$) then variable university education ($\beta = 0.293$), while the smallest single contribution was given by variable secondary education ($\beta = 0.167$).

Model	Standardized Beta	P	Correlation		
			Predictor-criteria	Partial	Semipartial
(Constant)		.000			
Chronological age	-.155	.079	-.184	-.171	-.130
Gender	-.054	.551	-.195	-.058	-.044
Years of work	-.141	.234	.326	-.116	-.087
Years of retirement	.140	.180	.214	.131	.099
Years in institutional care	-.117	.125	-.166	-.149	-.113
Unskilled	-.270	.004*	-.396	-.275	-.214
Secondary education	.167	.045*	.142	.195	.148
College education	.417	.000*	.409	.434	.361
University degree	.293	.001*	.274	.326	.258
Married	-.010	.895	.041	-.013	-.010
Divorced	.049	.585	.274	.053	.040
Single	-.102	.207	-.026	-.123	-.093

Table 3. Evaluation of predictors for receptive language * Significant ($p < 0,05$)

Table 4 shows the individual contributions of predictor variables explaining the criteria. In order to compare the individual contributions of individual predictors were estimated value of the column Beta or estimated standardized beta coefficients. On the basis of these indicators can be seen as the biggest single contribution to explaining the results of tests of cognitive function given predictor variable college education ($\beta = 0.328$) and variable unskilled ($\beta = -0.229$), which has a negative effect on the increase in recent cognitive functioning while the smallest unique contribution gives variable secondary education ($\beta = 0.200$).

5. DISCUSSION

Older adults achieve better results on vocabulary receptive tests than younger adults (11). The size of the advanced vocabulary increases with age, and a decline is manifested only at very old age (12). Vocabulary increases significantly with age (13). The results show that age plays a certain role in the development of receptive vocabulary. The level of education influences the word, fluency, vocabulary (14). It was proved to be a true statement for this study due to the variables of college education and university degree that made the largest contribution to explaining the test results

Model		Stand-ardized	p	Correlation		
		Beta		Predictor-criteria	Partial	Semi-partial
1	(Constant)		.000			
	Chronological age	-.163	.089	-.232	-.165	-.136
	Gender	-.064	.518	-.175	-.063	-.052
	Years of work	.016	.900	.291	.012	.010
	Years of re-tirement	-.046	.685	.094	-.040	-.032
	Years in insti-tutional care	-.134	.107	-.183	-.157	-.129
	Unskilled	-.229	.024*	-.333	-.217	-.181
	Secondary education	.200	.028*	.185	.212	.177
	College edu-cation	.328	.001*	.343	.329	.284
	University degree	.154	.092	.170	.164	.135
	Married	-.091	.284	-.056	-.104	-.086
	Divorced	.030	.756	.241	.030	.025
	Single	-.026	.769	.043	-.029	-.023

Table 4. Evaluation of predictors for cognitive functioning. * Significant ($p < 0,05$)

of receptive vocabulary. Vocabulary variable showed the strongest correlation with the level of education of the participants (13). The largest contribution to explaining the test of cognitive functioning is given by the predictor variable of college education and variable of (unskilled, which has a negative effect on the increase of recent cognitive functioning, while the lowest contribution is by the variable secondary education. Thus obtained results are consistent with research from 2007 (15) where is stated state that the higher level of education is a protective factor in the development of dementia, and that with age risk increases. Fabijanić (2014) states that the level of education and age are the biggest risk factors for developing dementia (16). These data indicate the importance of education in preventing cognitive impairment, but that does not only mean formal education but active, engaged lifestyle, emphasizing mental activity and educational aspirations in early life, that can have a positive impact on cognitive functions in later life. It is not only the level of formal education that reduces the risk of dementia; it is also a high level of free-time activities that are also a protective factor (17). The ongoing education plays a role in the prevention of cognitive impairment (18). A low level of education is associated with a higher risk of dementia (19). The positive impact of education on cognitive functioning is associated with the creation of "cognitive reserves" in the course of life which explains why people with higher intelligence quotients, professional achievement and participation in free-time activities showed less clinical or cognitive changes during the aging process (20). Innate intelligence or aspects of life experience such as educational or professional qualifications can provide a cognitive reserve, in the form of a set of skills or repertoires that allow some people to cope with the pathology better than others (21). The intelligence, education level and occupation are the main active components of cognitive reserve (22).

6. CONCLUSION

Anamnestic variables (chronological age, gender, level of formal education, marital status, working years, the retired years; the residence in institutional care for the elderly) are valid predictors of receptive vocabulary and cognitive functioning of elderly people. The highest individual contribution was given by the variables that describe the level of formal education of older people.

- Authors Statement: All authors were included in preparing of this article, including final proof reading.
- Conflict of interest: none declared.

REFERENCES

1. Blaži D, Banek Lj. Posebne jezične teškoće-uzrok školskom neuspjehu? Hrvatska revija za rehabilitacijska istraživanja. 1998; 34(2): 183-90.
2. Martin GE, Klusek J, Estigarribia B, Roberts JE. Language Characteristics of Individuals with Down Syndrome. Topics in Language Disorders. 2009; 29(2): 112-32.
3. Orange JB. Language and communication disorders in older adults: selected considerations for clinical audiology. In: Hickson L (Ed.) Proceedings of the second international adult conference Hearing Care for Adults. 2009. The Challenge of Aging. Chicago, SAD, 2009: 87-102.
4. Glisky EL. Brain Aging: Models, Methods, and Mechanisms. Changes in Cognitive Function in Human Aging. Boca Raton: CRC Press. 2007.
5. Hummert ML, Garstka TA, Ryan EB, Bonnesen JL. The role of age stereotypes in interpersonal communication. In: Nussbaum JF, Couplan J (Ed.). Handbook of Hummert communication and aging research. Hillsdale, NJ: Lawrence Erlbaum. 2004: 91-115.
6. Wingfield A, Peelle JE, Grossman M. Speech rate and syntactic complexity as multiplicative factors in speech comprehension by young and older adults. Aging Neuropsychology and Cognition. 2003; 10: 310-22. doi:10.1076/anec.10.4.310.28974.
7. Burke DM. Theoretical approaches to language and aging. In: T. Perfect, E. Mayor (Ed.). Models of cognitive aging. Oxford UK: Oxford University Press. 2000: 204-37.
8. Nasreddine ZS, Phillips NA, Bedirian V, Charbonneau S, Whitehead V, Collin I. et al. The Montreal Cognitive Assessment (MoCA): A Brief Screening Tool For Mild Cognitive Impairment. Journal of the American Geriatrics Society. 2005; 53: 695-9.
9. Kovačević M, Padovan N, Hržica G, Kuvač-Kraljević J, Mustapić M, Dobravac G, et al. Peabody slikovni test rječnika (PPVT – III – HR). Jastrebarsko: Naklada Slap, 2009.
10. Tabachnick BG, Fidell LS. Using Multivariate Statistics (6th ed.). Boston: Pearson, 2013.
11. Bialystok E, Luke G. Receptive vocabulary differences in monolingual and bilingual adults. Bilingualism: Language and Cognition. 2012; 15(2): 397- 401.
12. Bowles RP, Grimm KJ, McArdle JJ. A Structural Factor Analysis of Vocabulary Knowledge and Relations to Age. Journal of Gerontology. Psychological Sciences. 2005; 60(5): 234- 41.

13. Schroeder DH, Salthouse TA. Age-related effects on cognition between 20 and 50 years of age. *Personality and Individual Differences*. 2004; 36: 393-404. doi: 10.1016/S0191-8869(03)00104-1.
14. Zupančič M. Spoznavni razvoj in vsakdanja kompetentnost v pozni odraslosti. In: Marjanović LjU, Zupančič M (Ed.). *Razvojna psihologija*. Ljubljana: Znanstvenoraziskovalni inštitut Filozofske fakultete, 2004: 774-91.
15. Vincze G, Almos P, Boda K, Dome P, Bodi N, Szlavik G, et al. Risk factors of cognitive decline in residential care in Hungary. *International Journal of Geriatric Psychiatry*. 2007; 22(12): 1208-16.
16. Fritsch T, McClendon MJ, Smyth KA, Lerner AJ, Friedland RP, Larsen JD. Cognitive functioning in healthy aging: the role of reserve and lifestyle factors early in life. *Gerontologist*. 2007; 47(3): 307-22.
17. Scarmeas N, Levy G, Tang MX, Manly J, Stern Y. Influence of leisure activity on the incidence of Alzheimer's Disease. *Neurology*. 2001; 57(12): 2236-42.
18. Uzun S, Kozumplik O, Folnegović-Šmalc V. Alzheimer's dementia: current data review. *Coll Antropol*. 2011; 35(4): 1333-7.
19. Letenneur L, Gilleron V, Commenges D, Helmer C, Orgogozo JM, Dartigues JF. Are sex and educational level independent predictors of dementia and Alzheimer's disease? Incidence data from the PAQUID project. *J Neurol Neurosurg Psychiatry*. 1999; 66(2): 177-83.
20. Tucker AM, Stern Y. Cognitive reserve in aging. *Curr Alzheimer Res*. 2011; 8(4): 354-60.
21. Scarmeas N, Stern Y. Cognitive Reserve and Lifestyle. *J Clin Exp Neuropsychol*. 2003; 25(5): 625-33.
22. Whalley LJ, Deary IJ, Appleton CL, Starr JM. Cognitive reserve and the neurobiology of cognitive aging. *Ageing Res Rev*. 2004; 3(4): 369-82.