

Investigating the Relationship Between COVID-19 and Naming: A Descriptive Study

Adlandırma ve COVID-19 Arasındaki İlişkinin Belirlenmesi: Tanımlayıcı Çalışma

Elif Nur AKBAYIR^a, Asude Sündüz YAYLA^a, Fenise Selin KARALI^a, Zehra SAVAŞ^b,
Elif İkbal ESKİOĞLU^a

^aDepartment of Speech and Language Therapy, Biruni University Faculty of Health Sciences, İstanbul, Türkiye

^bDepartment of Speech and Language Therapy, Kütahya Health Science University Faculty of Health Sciences, Kütahya, Türkiye

ABSTRACT Objective: Coronavirus disease-2019 (COVID-19) was first discovered in Wuhan, China in 2019, and has spread worldwide since its discovery, leading to the COVID-19 pandemic. It is frequently known that COVID-19 causes side effects such as fever, cough, difficulty in breathing, and neuropsychiatric disorders such as delirium and changes in consciousness by affecting the central nervous system. However, studies on naming and its effect on word-retrieval are very limited. Naming is a language skill that includes the ability of an individual to name an object or an image of an object, that is, the process of recalling words and producing words. The aim of the present study is to determine the relationship between COVID-19 and naming difficulties. **Material and Methods:** In the first stage, a questionnaire was sent to the volunteer participants to obtain demographic information. Among the participants whose demographic information was obtained, naming skills assessment tests were applied to people aged 18-40 who had COVID-19 and those who have not had COVID-19. The Boston Naming Test was used to assess naming, the Pyramid Palm Trees Test to assess access to semantic information, the Word Fluency (K-A-S) Test and categorical fluency tests to assess verbal fluency; and the Montreal Cognitive Assessment Test to assess cognitive skills. **Results:** The test results were analyzed and the relationship between COVID-19 and naming and word-retrieval difficulties was examined. **Conclusion:** The relationship between naming skills and having had COVID-19 was found to be significant.

Keywords: COVID-19; language; naming;
word-retrieval; SARS-CoV-2

ÖZET Amaç: Koronavirüs hastalığı-2019 [coronavirus disease-2019 (COVID-19)] ilk olarak 2019 yılında Çin'in Wuhan kentinde keşfedildikten sonra dünya çapında yayılmış ve COVID-19 pandemisine yol açmıştır. COVID-19'un santral sinir sistemini etkileyerek ateş, öksürük, nefes almada zorluk gibi yan etkilerin yanı sıra bilinç kaybı, sayıklama gibi nöropsikiyatrik bozukluklara da neden olduğu sıklıkla bilinmektedir. Ancak bu durumun adlandırmaya ve sözcük çağırma olana etkisi üzerine yapılan çalışmalar oldukça sınırlıdır. Adlandırma, bireyin bir nesneyi veya nesnenin görüntüsünü adlandırma becerisini, yani sözcükleri hatırlama ve sözcük üretme sürecini içeren bir dil becerisidir. Bu çalışmanın amacı, COVID-19 ile adlandırma arasındaki ilişkiyi belirlemektir. **Gereç ve Yöntemler:** Bu amaçla ilk aşamada gönüllü katılımcılara demografik bilgilerin elde edilmesi amacıyla bir anket gönderilmiştir. Demografik bilgileri elde edilen 18-40 yaş arası katılımcılardan COVID-19 geçiren ve olmayan kişilere adlandırma becerisini değerlendirmek üzere ölçekler uygulandı. Adlandırmayı değerlendirmek için Boston Adlandırma Testi, semantik bilgiye erişimi değerlendirmek için Piramit ve Palmiye Ağaçları Testi, sözel akıcılığı değerlendirmek için Kelime Akıcılığı (K-A-S) Testi ve kategorik akıcılık testleri ile bilişsel becerileri değerlendirmek için Montreal Bilişsel Değerlendirme Testi kullanılmıştır. **Bulgular:** Elde edilen veriler analiz edilerek COVID-19 ile adlandırma ve sözcük çağırma güçlükleri arasındaki ilişki incelenmiştir. **Sonuç:** Bunun sonucunda adlandırma becerisi ile COVID-19 geçirmiş olmak arasındaki ilişkinin anlamlı olduğu belirlenmiştir.

Anahtar Kelimeler: COVID-19; dil; adlandırma;
sözcük çağırma; SARS-CoV-2

Coronavirus disease-2019 (COVID-19) was first discovered in Wuhan, China and the common symptoms of COVID-19 include fever, cough, and short-

ness of breath. Muscle aches, sputum production, and sore throat are less common symptoms.¹ COVID-19 affects the central nervous system (CNS) which has

TO CITE THIS ARTICLE:

Akbayır EN, Yayla AS, Karalı FS, Savaş Z, Eskiöğlü Eİ. Investigating the relationship between COVID-19 and naming: A descriptive study. Türkiye Klinikleri J Health Sci. 2024;9(1):38-43.

Correspondence: Zehra SAVAŞ

Department of Speech and Language Therapy, Kütahya Health Science University Faculty of Health Sciences, Kütahya, Türkiye

E-mail: zehra.savas@ksbu.edu.tr



Peer review under responsibility of Türkiye Klinikleri Journal of Health Sciences.

Received: 04 Aug 2023

Received in revised form: 24 Nov 2023

Accepted: 28 Dec 2023

Available online: 03 Jan 2024

2536-4391 / Copyright © 2024 by Türkiye Klinikleri. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

been proven by many studies.²⁻⁴ In patients with COVID-19, the CNS is affected due to the COVID-19 drugs used for a long time, and neuropsychiatric disorders such as delirium and changes in consciousness can be seen. In addition, headache, dizziness, encephalitis, encephalopathy, cerebrovascular disease, peripheral nervous system damage, and neuromuscular disorders have been reported in patients.^{1,5-8} In the literature, a study conducted on COVID-19's effect on consciousness found that 40 patients with COVID-19 had agitation out of 58 patients and they were hospitalized in the intensive care unit. 26 of these patients were found to have confusion.⁸ Another study on genome sequencing showed that patients with encephalitis have severe acute respiratory syndrome-coronavirus-2 in the cerebrospinal fluid which attacks their CNS.^{7,9} Some people with COVID-19 may have persistent symptoms for weeks or months after they begin to heal. The term post-acute sequelae of COVID-19 (PASC) also known as "Long COVID" is used for COVID-19 infection after acute sequelae. New and persistent cognitive symptoms are common PASC infection and may follow severe or mild illness. In a study to determine the clinical factors associated with PASC, a comprehensive neurocognitive assessment including memory, executive functions, processing speed, attention, working memory, visual-spatial abilities, and language skills was applied to the participants. It was determined that the participants had cognitive impairments based on the reports in the structured interview before and after COVID-19.¹⁰ In another study, a comprehensive neuropsychological evaluation was performed by applying multiple tests such as Montreal Cognitive Assessment (MoCA), Continuous Performance Test II, Rey Auditory Verbal Learning Test, The Rey-Osterrieth Complex Figure, Forward and Backward Number Propagation, Boston Naming, Block Design, Coding, Symbol Search, Trail Making Test, Stroop Test, Verbal Fluency Tasks, and the 15-Object Test. As a result of this study, it was found that all patients in the sample showed cognitive deficits in at least one area. In general, the most affected area was attention (61.9% of the sample), and the second most affected area was executive functions (43% of the sample). Also, attention problems have been found, especially

when it comes to learning, long-term memory, and executive functions.²

Mazza et al. observed that not only executive function and information processing were impaired, but also verbal fluency and working memory.¹¹ In line with this study, a COVID-19 case with a 53-year-old female who went to the emergency room with complaints of general malaise, fever, cough, stuttering, and difficulty in word-finding. Although it was thought that the patient might have aphasia due to stroke and head trauma, it was determined that there was no acute stroke as a result of objective evaluations such as computerized tomography, magnetic resonance imaging, and magnetic resonance angiography. When the patient was contacted again on the second and seventh days after discharge from the emergency room visit, the patient still had speech problems. This patient can not be used to make a generalization because the patient was only followed for seven days after discharge.¹² Therefore, we wanted to investigate the effect of COVID-19 on naming.

Naming is one of the most fundamental functions of language and refers to a person's capacity to identify an object or its picture. The ability to recognize and name visually presented objects requires multiple cognitive processes at a complex level. Retrieving information about concrete objects from different conceptual domains is based on partially dissociated neural systems. Identifying the factors that make naming difficult is important for understanding the causes of naming problems.¹³ Since naming and word retrieval happen in networks spread across different parts of the brain and COVID-19 is known to affect the CNS, it is thought that COVID-19 may be one of the things that affects the naming process. However, it has been observed that there are little studies on naming and word retrieval after COVID-19.

This study aims to explore the relationship between COVID-19 and naming. Therefore, we tested the hypothesis that there is a relationship between COVID-19 and naming. To test our hypothesis, we used a set of language and cognitive tasks. In accordance with the results of the applied tests, we seek to determine the impacts of COVID-19 on language.

MATERIAL AND METHODS

RESEARCH METHOD

The independent variable in this study pertains to the presence or absence of COVID-19. On the other hand, the dependent variables encompass various cognitive activities, including naming and other cognitive functions. The present study obtained ethical approval from the Ethics Committee of Biruni University (Protocol Number: 18.11.2021/61-29) and adhered to the principles outlined in the Declaration of Helsinki 2008.

PARTICIPANTS

72 individuals participated in the study; 36 of the participants had COVID-19, 36 of the participants who were healthy and had no COVID-19 history. The sample size was determined as a result of the power analysis made with the PASS 2019 program with a random sampling method at a reliability level of 85%.

The inclusion criteria for participants with COVID-19 were as follows: (1) age 18 or 40; (2) being a native speaker of Turkish; (3) not having any speech and language impairment; (4) having adequate sensory acuity to complete the tasks; and (5) giving consent to participate in the study. The exclusion criteria for participants with COVID-19 were as follows: (1) age under 18; (2) being bilingual; (3) having an additional disability; (4) having head trauma in the last two years. The demographic information of the participants are shown in Table 1.

As seen in Table 1, we had 72 participants between the ages of 18 and 40 (mean age of 23.41 ± 4.09), and 49 of them were female and 23 of

them were male. When the education level was investigated, 57 had a high school degree, and 15 of them had a bachelor's degree. When the symptoms of the participants were investigated, coughing was the most prominent symptom in the participants with COVID-19. And the other main symptoms are headache, muscle pain, loss of taste and smell, fever, hoarseness, and speech difficulty.

MATERIALS

The research was quantitative research, and the data were collected in two stages. In the first stage, demographic information of the participants was collected. Afterwards, face-to-face or online interviews were conducted with the participants who agreed to participate in the second part. Informed consent was obtained from all participants.

In the socio-demographic information form, participants were asked about their age, gender, place of residency, education level, health status, and whether they had COVID-19. If a participant had COVID-19, there were further questions regarding their symptoms during and after COVID-19. Also, they were asked whether they had difficulty naming things, and if they did, they were expected to give examples to understand whether what they had was naming difficulty.

Afterwards, participants were given a set of cognitive and language skills tests. The Boston Naming Test (BNT) was applied to assess naming and word recall.^{13,14} The Pyramid and Palm Trees Test (PPTT) was used to evaluate semantic access.^{15,16} The Word Fluency Test (K-A-S) was used to evaluate verbal fluency, and the MoCA Test.¹⁷⁻²⁰ was used to evaluate

TABLE 1: Demographic information about participants.

		COVID-19		No COVID-19 history	
		n	%	n	%
Age	18-29	31	86	35	97.2
	30-40	5	14	1	2.8
Sex	Female	21	58.3	28	77.8
	Male	15	41.7	8	22.2
Education level	High school	25	69.4	32	88.9
	Bachelor	11	30.6	4	11.1

cognitive functions. All the assessments were completed in a session.

DATA ANALYSIS

The research data were evaluated in the computer environment in the SPSS 24.0 (IBM SPSS, Inc, Armonk, NY, United States) Package Programme. The descriptive statistics of categorical variables were subjected to frequency analysis, and the results were reported in the form of numerical values and percentages. The descriptive statistics of numerical variables are often reported as the mean (\pm standard deviation) for variables that follow a normal distribution, and the median (min-max) for variables that do not follow a normal distribution.

Upon evaluating the data distribution, a comparison was made between groups with a normal distribution using an independent samples T-test, while a comparison was made between groups with a non-normal distribution using non-parametric methods. The Mann-Whitney U test is a nonparametric statistical test used to compare two independent groups.

RESULTS

As shown in Table 2, there was a statistically significant difference between the BNT scores of COVID-19 patients and healthy subjects. When this difference was analyzed, it was revealed that those who were healthy had higher scores in the task.

There was a statistically significant difference between the MoCA scores of COVID-19 patients and

healthy subjects. When this difference was analyzed, it was revealed that those who were healthy had higher scores in the cognitive assessment.

The PPTT scores of COVID-19 patients and healthy participants were found to be statistically significantly different. When this difference was examined, it was found that the healthier individuals performed better on the task.

There was a statistically significant difference between verbal fluency scores of COVID-19 patients and healthy subjects. When this difference was analyzed, it was revealed that those who were healthy had higher scores in the task.

DISCUSSION

In this study, we examined the relationship between COVID-19 and naming. Naming can be affected by many factors such as age, gender, education, and intelligence. Also, environmental variables such as target word characteristics, priming effect, and exposure time to stimuli can affect naming accuracy and response time.¹³ The performance of participants with COVID-19 in the study was significantly weaker than that of healthy participants regarding naming, cognitive scores, semantic memory, and verbal fluency.

In the literature, the term ‘‘PASC’’, also known as ‘‘Long COVID’’, has been used for COVID-19 infection after acute sequelae. It has been reported that new and persistent cognitive symptoms are a com-

TABLE 2: Comparison between COVID-19 patients with the people with no COVID-19 history.

Tools	Participants	n	Mean	SD	Wilcoxon (Z)	p value
Boston Naming Test	COVID-19	36	26.08	1.296	-5.264	0.000*
	Healthy	36	29.64	0.961		
		n	Mean	SD	T	p value
Montreal Cognitive Assessment	COVID-19	36	26.39	1.626	-2.548	0.015*
	Healthy	36	27.42	2.222		
Pyramid and Palm Trees Test	COVID-19	36	46.11	2.188	-8.336	0.000*
	Healthy	36	49.83	1.732		
Verbal fluency (Categorical)	COVID-19	36	20.00	3.423	-7.780	0.000*
	Healthy	36	29.44	6.185		
Verbal fluency (Letter)	COVID-19	36	39.33	11.076	-12.841	0.000*
	Healthy	36	71.02	11.085		

SD: Standard deviation. *The result is significant when the p value is less than 0.05.

mon post-acute sequela of COVID-19 infection and may follow a severe or a mild disease.¹⁰ In parallel with these findings, our participants who had COVID-19 had significantly lower scores in MoCA ($p=0.015$). MoCA is used to evaluate attention, concentration, executive functions, memory, language, visual construction skills, abstract thinking, calculation, and orientation cognitive functions. Therefore, having lower scores showed that they had impairment in their cognitive abilities. Our participants who had COVID-19 had lower scores in naming when compared to healthy adults. As stated in the literature, naming tasks can be affected by many factors and naming depends on a number of cognitive processes. Therefore, we believe that COVID-19 is one of the factors that affect cognitive processing due to its effect on CNS. Although there are similar studies, it has been observed that the studies on COVID-19 causing naming and word finding difficulties are quite limited.²¹ Other studies must be conducted to understand the effect of COVID-19 on naming.

When it comes to semantic memory, there was a significant difference between the healthy group and participants with COVID-19. Semantic disorders, like any cognitive problems, can lower quality of life if they go untreated. It is crucial to do thorough evaluations of post-COVID-19 individuals in order to correctly diagnose their impairments and implement the most effective rehabilitation, such as speech and language therapy, to prevent a decline in quality of life.²² Mazza et al. reported that COVID-19 patients showed executive function deficits and impaired information processing, as well as verbal fluency and working memory problems.^{11,23} Our data suggested that Turkish speaking patients who had COVID-19 also had lower scores in verbal fluency. Verbal fluency is one of the markers of cognitive impairment and is used to assess lexical knowledge and lexical retrieval ability.²⁴ These difficulties in the COVID-19 patients can be explained by the serious deficits in either verbal ability or executive control as we have seen in the poor verbal fluency performance. The fact that the people in this study who did not need to go to the hospital and whose infections were not

severe still had significant cognitive and linguistic problems is an important finding.

CONCLUSION

The naming, cognitive scores, semantic memory and verbal fluency skills measured by the tests were significantly affected in individuals with COVID-19. According to the findings of our research, having COVID-19 was found to have a detrimental impact on naming.

There are several limitations in this study. The first limitation is not knowing the naming skills of the experimental group before they were exposed to COVID-19. Comparing the same group before and after COVID-19 might give more reliable results. The second limitation of this study is that the sample size is limited to 72 participants, it would be better to conduct a similar study with more participants to generalize the results. It was thought that further and similar studies could provide more detailed information about the naming process.

Source of Finance

This work was supported by The Scientific and Technological Research Council of Türkiye (TUBITAK) within the scope of 2209-A-Research Project Support Programme for Undergraduate Students in 2021 (Project no: 191B012100606).

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Fenise Selin Karalı, Asude Sündüz Yayla, Elif Nur Akbayır; **Design:** Fenise Selin Karalı, Zehra Savaş, Elif İkbal Eskioğlu; **Control/Supervision:** Fenise Selin Karalı, Zehra Savaş, Elif İkbal Eskioğlu; **Data Collection and/or Processing:** Asude Sündüz Yayla, Elif Nur Akbayır; **Analysis and/or Interpretation:** Asude Sündüz Yayla, Elif Nur Akbayır; **Literature Review:** Fenise Selin Karalı, Zehra Savaş, Elif İkbal Eskioğlu; **Writing the Article:** Fenise Selin Karalı, Zehra Savaş, Elif İkbal Eskioğlu; **Critical Review:** Fenise Selin Karalı, Zehra Savaş; **References and Fundings:** Fenise Selin Karalı, Elif İkbal Eskioğlu; **Materials:** sude Sündüz Yayla, Elif Nur Akbayır.

REFERENCES

1. Tatar A. COVID-19 virüsünün neden olduğu salgının bireylerin günlük alışkanlık ve rutinleri üzerindeki etkisi [The impact of the pandemic caused by the COVID-19 virus on individuals' daily habits and routines]. *Journal of International Social Research*. 2021;14(77):682-96. [Crossref]
2. García-Sánchez C, Calabria M, Grunden N, Pons C, Arroyo JA, Gómez-Anson B, et al. Neuropsychological deficits in patients with cognitive complaints after COVID-19. *Brain Behav*. 2022;12(3):e2508. [Crossref] [PubMed] [PMC]
3. Almeria M, Cejudo JC, Sotoca J, Deus J, Krupinski J. Cognitive profile following COVID-19 infection: clinical predictors leading to neuropsychological impairment. *Brain Behav Immun Health*. 2020;9:100163. [Crossref] [PubMed] [PMC]
4. Ortelli P, Ferrazzoli D, Sebastianelli L, Engl M, Romanello R, Nardone R, et al. Neuropsychological and neurophysiological correlates of fatigue in post-acute patients with neurological manifestations of COVID-19: insights into a challenging symptom. *J Neurol Sci*. 2021;420:117271. [Crossref] [PubMed] [PMC]
5. Troyer EA, Kohn JN, Hong S. Are we facing a crashing wave of neuropsychiatric sequelae of COVID-19? Neuropsychiatric symptoms and potential immunologic mechanisms. *Brain Behav Immun*. 2020;87:34-9. [Crossref] [PubMed] [PMC]
6. Acar T, Demirel EA, Afşar N, Akçalı A, Demir GA, Alağöz AN, et al. Nörolojik bakış açısından COVID-19 [The COVID-19 from neurological overview]. *Türk J Neurol*. 2020;26(2):56-106. [Crossref]
7. Şimşekoğlu Ö, Tombul T. Covid-19 pandemisi ve nörolojik tutulumlar [Covid-19 pandemic and neurological manifestations]. *Anadolu Kliniği Tıp Bilimleri Dergisi*. 2020;1(25):246-51. [Crossref]
8. Özen Barut B, Güçlü Altun İ. COVID-19 ile ilişkili nörolojik komplikasyonlar [Neurological complications related with COVID-19]. *Southern Clinics of Istanbul Eurasia*. 2020;31(1):26-30. [Crossref]
9. Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, et al; Washington State 2019-nCoV Case Investigation Team. First case of 2019 novel coronavirus in the United States. *N Engl J Med*. 2020;382(10):929-36. [Crossref] [PubMed] [PMC]
10. Apple AC, Oddi A, Peluso MJ, Asken BM, Henrich TJ, Kelly JD, et al. Risk factors and abnormal cerebrospinal fluid associate with cognitive symptoms after mild COVID-19. *Ann Clin Transl Neurol*. 2022;9(2):221-6. [Crossref] [PubMed] [PMC]
11. Mazza MG, Palladini M, De Lorenzo R, Magnaghi C, Poletti S, Furlan R, et al; COVID-19 BioB Outpatient Clinic Study group; Rovere-Querini P, Benedetti F. Persistent psychopathology and neurocognitive impairment in COVID-19 survivors: Effect of inflammatory biomarkers at three-month follow-up. *Brain Behav Immun*. 2021;94:138-47. [Crossref] [PubMed] [PMC]
12. Morrison N, Levy J, Shoshany T, Dickinson A, Whalen M. Stuttering and word-finding difficulties in a patient with COVID-19 presenting to the emergency department. *Cureus*. 2020;12(11):e11774. [Crossref] [PubMed] [PMC]
13. Soylu AE, Cangöz B. Adaptation and norm determination study of the boston naming test for healthy Turkish elderly. *Noro Psikiyatrs Ars*. 2018;55(4):341-8. [PubMed] [PMC]
14. Goodglass H, Kaplan E, Weintraub S. *Boston Naming Test*. 2nd ed. Philadelphia, PA: Lea & Febiger; 1983.
15. Howard D, Patterson KE. *The Pyramids and Palm Trees Test*. 1st ed. Bury St Edmunds: Thames Valley Test Company; 1992.
16. Bozdemir M, Gurvit IH. Normative data for the Turkish version of the pyramids and palm trees test. *Appl Neuropsychol Adult*. 2022;29(6):1571-7. [Crossref] [PubMed]
17. Bayer M. Yönetici karmaşık dikkat işlevlerini değerlendiren testlerin 8, 9 ve 10 yaş grubu Türk çocuklarında güvenilirlik ve geçerlilik çalışmaları [Yüksek lisans tezi]. İstanbul: Bilim Üniversitesi; 2013. [Link]
18. Borkowski JG, Benton AL, Spreen O. Word fluency and brain damage. *Neuropsychologia*. 1967;5(2):135-40. [Crossref]
19. Selekler K, Uluç S, Cangöz B. Montreal Bilişsel Değerlendirme Ölçeği (MOBİD)'nin hafif bilişsel bozukluk ve Alzheimer hastalarını ayırt edebilme gücünün incelenmesi [Power of discrimination of montreal cognitive assessment (MOCA) scale in Turkish patients with mild cognitive impairment and Alzheimer's disease]. *Türk Geriatri Dergisi*. 2010;13(3):166-71. [Link]
20. Nasreddine ZS, Phillips NA, Bédirian V, Charbonneau S, Whitehead V, Collin I, et al. The montreal cognitive assessment, MoCA: a brief screening tool for mild cognitive impairment. *J Am Geriatr Soc*. 2005;53(4):695-9. Erratum in: *J Am Geriatr Soc*. 2019;67(9):1991. [Crossref] [PubMed]
21. Kumar S, Veldhuis A, Malhotra T. Neuropsychiatric and cognitive sequelae of COVID-19. *Front Psychol*. 2021;12:577529. [Crossref] [PubMed] [PMC]
22. Fiorentino J, Payne M, Cancian E, Plonka A, Dumas LÉ, Chirio D, et al. Correlations between persistent olfactory and semantic memory disorders after SARS-CoV-2 infection. *Brain Sci*. 2022;12(6):714. [Crossref] [PubMed] [PMC]
23. Ferrucci R, Dini M, Groppo E, Rosci C, Reitano MR, Bai F, et al. Long-lasting cognitive abnormalities after COVID-19. *Brain Sci*. 2021;11(2):235. [Crossref] [PubMed] [PMC]
24. Shao Z, Janse E, Visser K, Meyer AS. What do verbal fluency tasks measure? Predictors of verbal fluency performance in older adults. *Front Psychol*. 2014;5:772. [Crossref] [PubMed] [PMC]