

ESCOLA DE CIÊNCIAS DA SAÚDE
PROGRAMA DE PÓS-GRADUAÇÃO EM PSICOLOGIA
DOUTORADO EM PSICOLOGIA CLÍNICA

MARIANNE FARINA

**COGNIÇÃO E RESERVA COGNITIVA EM IDOSOS: UM ESTUDO
LONGITUDINAL**

Porto Alegre
2019

PÓS-GRADUAÇÃO - *STRICTO SENSU*



Pontifícia Universidade Católica
do Rio Grande do Sul

PONTIFÍCIA UNIVERSIDADE CATÓLICA DO RIO GRANDE DO SUL
ESCOLA DE CIÊNCIAS DA SAÚDE
PROGRAMA DE PÓS-GRADUAÇÃO EM PSICOLOGIA
DOUTORADO

MARIANNE FARINA

**COGNIÇÃO E RESERVA COGNITIVA EM IDOSOS: UM ESTUDO
LONGITUDINAL**

Prof^a. Dra. Tatiana Quarti Irigaray
Orientadora

Prof. Dra. Carmen Moret-Tatay
Coorientadora

Porto Alegre
2019

MARIANNE FARINA

**COGNIÇÃO E RESERVA COGNITIVA EM IDOSOS: UM ESTUDO
LONGITUDINAL**

Tese apresentada como requisito parcial para a obtenção do título de Doutor em Psicologia Clínica pelo Programa de Pós-Graduação em Psicologia da Pontifícia Universidade Católica do Rio Grande do Sul.

Porto Alegre

2019

Ficha Catalográfica

F225c Farina, Marianne

Cognição e reserva cognitiva em idosos : um estudo longitudinal
/ Marianne Farina . – 2019.

163.

Tese (Doutorado) – Programa de Pós-Graduação em Psicologia,
PUCRS.

Orientadora: Profa. Dra. Tatiana Quarti Irigaray.

Co-orientadora: Profa. Dra. Carmen Moret-Tatay.

1. idosos. 2. envelhecimento. 3. cognição. 4. reserva cognitiva. 5.
estudo longitudinal. I. Quarti Irigaray, Tatiana. II. Moret-Tatay,
Carmen. III. Título.

Elaborada pelo Sistema de Geração Automática de Ficha Catalográfica da PUCRS
com os dados fornecidos pelo(a) autor(a).

Bibliotecária responsável: Salete Maria Sartori CRB-10/1363

MARIANNE FARINA

**COGNIÇÃO E RESERVA COGNITIVA EM IDOSOS: UM ESTUDO
LONGITUDINAL**

Aprovada em: ____ de _____ de ____.

BANCA EXAMINADORA

Profa. Dra. Carla Helena Augustin Schwanke
Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS)

Profa Dra. Clarissa Marcelli Trentini
Universidade Federal do Rio Grande do Sul (UFRGS)

Prof^a. Dra. Sílvia Virginia Coutinho Areosa
Universidade de Santa Cruz do Sul (UNISC)

Porto Alegre

2019

Dedicatória

Dedico esta tese aos primeiros idosos de minha vida: meus queridos avós.

Em especial a vó Helena (*in memorian*) e a vó Dilma. Impossível não lembrar de vocês na construção deste trabalho.

Agradecimentos

Muitas pessoas fizeram parte da minha trajetória acadêmica, que iniciou há mais de 10 anos na Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS). Primeiramente agradeço à minha família, em especial à minha mãe Valéria Farina e ao meu irmão Erik Farina pelo amor e apoio incondicional.

À Irani Iracema de Lima Argimon, minha parceira de caminhada desde 2008 no mundo acadêmico da Psicologia, quem me apresentou para minha super orientadora de doutorado, Tatiana Quarti Irigaray, agradeço pela confiança e parceria. Desejo que todos os acadêmicos encontrem pessoas como vocês em suas trajetórias.

À minha coorientadora, Carmen Moret-Tatay, pela parceria e acolhimento desde que a conheci, em 2014 e pela receptividade maravilhosa na Universidad Católica de Valencia San Vicente Mártir, na Espanha.

Às colegas da clínica Núcleo Médico Psicológico, em especial à Regina Maria Fernandes Lopes, pela parceria na pesquisa.

Ao Grupo de Pesquisa Avaliação, Reabilitação e Interação Humano-Animal (ARIHA) e ao Grupo Avaliação e Intervenção no Ciclo Vital (AICV), meus lares na PUCRS, nos quais conheci pesquisadores incríveis, que se tornaram bons amigos também. Em especial ao Alan Bastos, Bruna Fernandes, Camila Oliveira, Dalton Breno Costa, Gabriela Pires, Fernanda Cerutti, Luis Henrique Paloski, Nicolas Cardoso, Susy Ane Viana e Valéria Gonzatti.

Aos meus queridos auxiliares de pesquisa que participaram da minha coleta de dados, Beatriz Tadwald Nunes, Daiane Santos de Oliveira, Jéssica Santos Machado, João André Weber e Priscylla Danielle de Oliveira Ferreira.

Ao professor Wagner de Lara Machado por sua colaboração, especialmente nas análises estatísticas.

Aos companheiros de longa data, Fer Castro e Gabriela Bichinho.

Ao Programa de Pós-Graduação em Psicologia da PUCRS, pelas oportunidades de aprimorar o meu conhecimento ao longo destes anos.

À Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior (CAPES) por financiar o meu doutorado e o período de estágio sanduíche no exterior.

Finalmente, com muito carinho, agradeço aos idosos que participaram desta pesquisa longitudinal, colaborando para a construção da tese.

Obrigada!

“Hoje, neste tempo que é seu, o futuro está sendo plantado. As escolhas que você procura, os amigos que você cultiva, as leituras que você faz, os valores que você abraça, os amores que você ama, tudo será determinante para a colheita futura.”

(Padre Fábio de Melo)

Resumo Expandido

Introdução: No processo de envelhecimento há modificações nas condições biológicas, psicológicas e sociais do indivíduo, que podem trazer prejuízos na saúde mental e física, bem como a diminuição das funções cognitivas dos idosos. O conceito de reserva cognitiva vem sendo cada vez mais estudado, visando compreender como o cérebro se adapta aos processos de degeneração e compensa os déficits ocorridos decorrentes tanto de processos patológicos, quanto do envelhecimento normativo. A reserva cognitiva é um constructo hipotético, que é caracterizado pela discrepância entre a gravidade de uma patologia subjacente e as manifestações clínicas de idosos cognitivamente preservados. O modelo ativo de reserva cognitiva considera que a existência de diferenças individuais nas funções cognitivas ou neurais possibilitam às pessoas lidarem de forma mais efetiva com os danos cerebrais decorrentes do processo neurodegenerativo do envelhecimento normal. **Objetivos:** O objetivo geral desta tese foi investigar o funcionamento cognitivo, a reserva cognitiva e sintomas de ansiedade e de depressão em idosos não clínicos, em um intervalo de quatro anos. Para isso, foram realizados três estudos, um deles teórico, que objetivou identificar as variáveis que contribuem para a reserva cognitiva em idosos. Já os outros dois, trataram-se de estudos empíricos. O primeiro teve como objetivos comparar o funcionamento cognitivo de idosos no intervalo de quatro anos e identificar se as variáveis sociodemográficas explicavam a variação no funcionamento cognitivo de idosos em um intervalo de quatro anos. O segundo investigou as características sociodemográficas, funcionamento cognitivo, reserva cognitiva e sintomas de depressão e ansiedade dos idosos e verificou se essas variáveis contribuem para uma medida indireta de reserva cognitiva de idosos em um intervalo de quatro anos. **Método:** Trata-se de uma investigação longitudinal, em que foram avaliados 64 idosos não clínicos, residentes da grande Porto Alegre, Rio Grande do Sul, Brasil, nos anos de 2013 e 2017. Os instrumentos utilizados na coleta dos dados foram: ficha de dados sociodemográficos e clínicos; Mini-Exame do Estado Mental (MEEM); Subtestes Códigos e Dígitos da Escala de Inteligência Wechsler para Adultos - WAIS-III; *Trail Making Test (TMT)*; Fluência Verbal (categoria animal); *Rey Auditory-Verbal Learning Test (RAVLT)*; Inventário de Ansiedade de Beck (BAI); Escala de Depressão Geriátrica (GDS-15). A descrição dos dados foi realizada por meio de frequências absolutas (n) e relativas (%) para variáveis qualitativas, e por média e desvio padrão para variáveis quantitativas. Para verificar a associação entre as variáveis avaliadas foram utilizadas as Correlações de *Pearson* ou de *Spearman*, conforme distribuição dos dados, de acordo com o resultado do Teste *Kolmogorov-Smirnov*. Para verificar o poder preditivo das variáveis, foram realizadas Análises de Regressão Linear Múltipla. Foram analisados os pesos de regressão padronizados e não padronizados, intervalos de confiança, significância estatística e a variância explicada pelos modelos estabelecidos. **Resultados:** A maioria da amostra avaliada, 81,3%, foi de mulheres. A média de idade foi de 69,17 anos ($DP = 6,12$, amplitude de 60 a 83) na primeira etapa e de 73,19 anos ($DP = 6,12$, amplitude de 64 a 87) na segunda etapa. A média de anos de estudo foi de 12,67 anos ($DP = 5,2$) e 30,78 anos de atividade profissional ($DP = 12,59$). Em relação a diferença do desempenho cognitivo no intervalo de quatro anos, foi identificado que os participantes apresentaram

declínio no funcionamento cognitivo global, memória episódica verbal tardia e velocidade de processamento. Já em relação aos componentes que contribuíram para uma medida indireta de reserva cognitiva, encontrou-se que a ansiedade foi a principal variável preditora, bem como a realização de atividades cognitivamente estimulantes, como o uso de aparelhos eletrônicos, aprendizagem de outro idioma, palavras cruzadas e anos de estudo, idade e morar com outra pessoa. **Conclusão:** Apesar das diferenças encontradas no desempenho cognitivo de idosos no intervalo de quatro anos serem estatisticamente significativas, ressalta-se que a diminuição nos escores não apontaram um declínio cognitivo. No entanto, demonstraram uma tendência de declínio cognitivo com o passar dos anos, mesmo em idosos não clínicos. Em relação às variáveis contribuintes para a reserva cognitiva, os resultados indicaram que a ansiedade se relacionou de forma negativa com reserva cognitiva, bem como a variável idade. Já a realização de atividades cognitivamente estimulantes, anos de escolaridade e morar com alguém foram consideradas como contribuintes para reserva cognitiva de idosos.

Palavras-chave: idosos, envelhecimento, cognição, reserva cognitiva, estudo longitudinal.

Resumen Ampliado

Introducción: En el proceso de envejecimiento hay modificaciones en las condiciones biológicas, psicológicas y sociales del individuo, que pueden traer perjuicios en la salud mental y física, así como la disminución de las funciones cognitivas de los ancianos. El concepto de reserva cognitiva viene siendo cada vez más estudiado, buscando comprender cómo el cerebro se adapta a los procesos de degeneración y la compensación de los déficits ocurridos resultantes tanto de procesos patológicos, como del envejecimiento normativo. La reserva cognitiva es un constructo hipotético, que se caracteriza por la discrepancia entre la gravedad de una patología subyacente y las manifestaciones clínicas de ancianos cognitivamente preservados. El modelo activo de reserva cognitiva considera que la existencia de diferencias individuales en las funciones cognitivas o neurales posibilitan a las personas lidiar de forma más efectiva con los daños cerebrales resultantes del proceso neurodegenerativo del envejecimiento normal. **Objetivos:** El objetivo general de esta tesis fue investigar el funcionamiento cognitivo, la reserva cognitiva y los síntomas de ansiedad y depresión en ancianos no clínicos, en un intervalo de cuatro años. Para ello, se realizaron tres estudios, uno de ellos teórico, que trató de identificar las variables que contribuyen a la reserva cognitiva en ancianos. Los otros dos, fueron estudios empíricos. El primero tuvo como objetivos comparar el funcionamiento cognitivo de ancianos en el intervalo de cuatro años y verificar si las variables sociodemográficas explicaban la variación del funcionamiento cognitivo de los participantes longitudinalmente. El segundo estudio investigó las características sociodemográficas, funcionamiento cognitivo, reserva cognitiva y síntomas de depresión y ansiedad de ancianos y verificó qué variables contribuyen a una medida indirecta de reserva cognitiva de ancianos en un intervalo de cuatro años. **Método:** Se trata de una investigación longitudinal, en la que se evaluaron 64 ancianos no clínicos, residentes de la gran Porto Alegre, Rio Grande do Sul, Brasil, en los años de 2013 y de 2017. Los instrumentos utilizados en la recolección de los datos fueron: ficha de datos sociodemográficos y clínicos; Mini-Examen del Estado Mental (MEEM); Subtestes de Códigos y Dígitos de la Escala de Inteligencia Wechsler para Adultos - WAIS-III; Trail Making Test (TMT); Fluidez verbal (categoría animal); Rey Auditorio-Verbal Learning Test (RAVLT); Inventario de Ansiedad de Beck (BAI); Escala de Depresión Geriátrica (GDS-15). La descripción de los datos fue realizada por medio de frecuencias absolutas (n) y relativas (%) para variables cualitativas, y por media y desviación estándar para variables cuantitativas. Para verificar la asociación entre las variables evaluadas se utilizaron las correlaciones de Pearson o de Spearman, según la distribución de los datos, de acuerdo con el resultado del test Kolmogorov-Smirnov. Para verificar el poder predictivo de las variables, se realizaron Análisis de Regresión Lineal Múltiple. Se analizaron los pesos de regresión estandarizados y no estandarizados, intervalos de confianza, significancia estadística y la varianza explicada por los modelos establecidos. **Resultados:** La mayoría de la muestra evaluada, es decir, el 81,3%, fue de mujeres. El promedio de edad fue de 69,17 años ($DT = 6,12$, amplitud de 60 a 83) en la primera etapa y de 73,19 años ($DT = 6,12$, amplitud de 64 a 87) en la segunda etapa. El promedio de años de estudio fue de 12,67 años ($DT = 5,2$) y 30,78

años de actividad profesional ($DT = 12,59$). En relación a la diferencia del desempeño cognitivo en el intervalo de cuatro años, se identificó que los participantes presentaron declinación en el funcionamiento cognitivo global, memoria episódica verbal tardía y velocidad de procesamiento. En cuanto a los componentes que contribuyeron a una medida indirecta de reserva cognitiva, se encontró que la ansiedad fue la principal variable predictora, así como la realización de actividades cognitivamente estimulantes, como el uso de aparatos electrónicos, aprendizaje de otro idioma, crucigramas y años de estudio, edad y vivir con otra persona. **Conclusión:** A pesar de que las diferencias encontradas en el desempeño cognitivo de ancianos en el intervalo de cuatro años alcanzaron el nivel de significación estadística, se resalta que la disminución encontrada no apunta a un declive cognitivo. Sin embargo, estos resultados demostraron una tendencia al declive cognitivo con el paso de los años, incluso en ancianos no clínicos. En relación a las variables contribuyentes a la reserva cognitiva, los resultados indicaron que la ansiedad se relacionó de forma negativa con reserva cognitiva, así como la variable edad. La realización de actividades cognitivamente estimulantes, años de escolaridad y vivir con alguien fueron consideradas como contribuyentes para la reserva cognitiva de ancianos.

Palabras clave: ancianos, envejecimiento, cognición, reserva cognitiva, estudio longitudinal.

Expanded Abstract

Introduction: During the aging process there are changes in the individual's biological, psychological and social conditions, which can lead to impairments in mental and physical health, as well as a reduction in the cognitive functions of the elderly. The concept of cognitive reserve has been increasingly studied, aiming to understand how the brain adapts to the processes of degeneration and compensates for the deficits that occur due to both pathological processes and normative aging. Cognitive reserve is a hypothetical construct, which is characterized by the discrepancy between the severity of underlying pathology and the clinical manifestations of cognitively preserved elderly. The active cognitive reserve model considers that the existence of individual differences in cognitive or neural functions enable people to deal more effectively with the brain damage resulting from the neurodegenerative process of normal aging. **Objectives:** The general objective of this thesis was to investigate cognitive functioning, cognitive reserve and symptoms of anxiety and depression in non-clinical seniors within a period of four years. For this, three studies were carried out, one theoretical, that aimed to identify the variables that contribute to the cognitive reserve in the elderly. The other two, however, were empirical studies. The first one had as objectives to compare the cognitive functioning of the elderly in the period of four years and to verify if the socio-demographic variables explained the variation of the cognitive functioning of the participants longitudinally. The second study investigated the sociodemographic characteristics, cognitive functioning, cognitive reserve and symptoms of depression and anxiety in the elderly, and verified which variables contribute to an indirect measure of the cognitive reserve of the elderly in an interval of four years. **Methods:** This was a longitudinal study, in which 64 non-clinical elderly individuals from Porto Alegre, Rio Grande do Sul, Brazil, were evaluated in 2013 and 2017. The instruments used in the data collection were: sociodemographic and clinical data; Mini-Mental State Examination (MMSE); Wechsler Intelligence Scale Codes and Digits Subtests for Adults - WAIS-III; Trail Making Test (TMT); Verbal fluency (animal category); Rey Auditory-Verbal Learning Test (RAVLT); Beck Anxiety Inventory (BAI); Geriatric Depression Scale (GDS-15). The data were described by means of absolute (n) and relative (%) frequencies for qualitative variables and by the mean and standard deviation for quantitative variables. In order to verify the association between the evaluated variables, the Pearson or Spearman Correlations were used, according to data distribution, according to the Kolmogorov-Smirnov Test result. To verify the predictive power of the variables, Multiple Linear Regression Analysis was performed. We analyzed the standardized and non-standardized regression weights, confidence intervals, statistical significance **Results:** The majority of the sample evaluated, 81.3%, were women. The mean age was 69.17 years ($SD = 6.12$, range 60-83) in the first stage and 73.19 years ($SD = 6.12$, amplitude 64-87) in the second stage. The mean number of years studied was 12.67 years ($SD = 5.2$) and 30.78 years of professional activity ($SD = 12.59$). Regarding the difference of the cognitive performance in the interval of four years, it was identified that the participants showed a decline in the global cognitive functioning, late verbal episodic memory and processing speed. Concerning the components that contributed

to an indirect measure of cognitive reserve, it was found that anxiety was the main predictor variable, as well as the performance of cognitively stimulating activities, such as age, years of study, living with another person, the use of electronic devices, doing crosswords and learning another language. **Conclusion:** Although the differences found in the cognitive performance of the elderly in the interval of four years are statistically significant, it is emphasized that the decrease in the scores did not indicate a cognitive decline. However, they have shown a tendency to cognitive decline over the years, even in non-clinical elderly. Regarding the variables contributing to the cognitive reserve, the results indicated that anxiety was negatively related to cognitive reserve, as well as the variable of age. On the other hand, the realization of cognitively stimulating activities, years of study and living with someone were considered as contributors to the cognitive reserve of the elderly.

Keywords: elderly, aging, cognition, cognitive reserve, longitudinal study.

Sumário

1 Apresentação	18
1.1 Envelhecimento e funcionamento cognitivo	18
1.2 Reserva cognitiva.....	20
1.3 Sintomas de humor (ansiedade e depressão)	22
2 Justificativa.....	23
3 Objetivos	24
3.1 Objetivo principal	24
3.2 Objetivos específicos	24
3.2.1 Artigo teórico.....	24
3.2.2 Artigos empíricos	24
4 Método	26
4.1 Delineamento	26
4.2 Participantes	26
4.3 Instrumentos	26
4.4 Procedimentos éticos	29
4.5 Procedimentos de coleta de dados	29
4.6 Procedimentos de análise de dados.....	30
Referências.....	32
5 Seção Teórica.....	36
5.1 Cognitive reserve in elderly and its connection with cognitive performance: a systematic review	36
6 Seções Empíricas.....	53
6.1 Assessing cognitive changes in non-clinical older adults: A 4-year longitudinal study in Brazil.....	53
6.2 Components of cognitive reserve: a longitudinal assessment of elderly people from the community	76
Apêndice A - Questionário de Dados Sociodemográficos e Clínicos	100
Apêndice B – Protocolo de avaliação da cognição e sintomatologia depressiva	106
Apêndice C – Termo de Consentimento Livre e Esclarecido	114
Apêndice D – Orçamento	117
Apêndice E – Artigo “Neuroticism and quality of life: testing for mediated effects of anxiety in older adults without cognitive impairment” (submetido para publicação)..	118

Apêndice F – Capítulo “Reserva Cognitiva: fatores associados ao longo do ciclo vital” (no prelo).....	136
Anexo A - Declaração do Exame de Qualificação.....	151
Anexo B – Carta de aprovação do Comitê de Ética em Pesquisa.....	152
Anexo C - Comprovante do Doutorado Sanduíche	155
Anexo D – Comprovante da coorientação	157
Anexo E – Comprovante do artigo publicado “Cognitive reserve in elderly and its connection with cognitive performance: a systematic review”	158
Anexo F – Comprovante do artigo submetido para publicação “Assessing cognitive changes in non-clinical older adults: A 4-year longitudinal study in Brazil”	159
Anexo G – Comprovante do artigo submetido para publicação “Components of cognitive reserve: a longitudinal assessment of elderly people from the community” ..	160
Anexo H – Comprovante do artigo submetido para publicação “Neuroticism and quality of life: testing for mediated effects of anxiety in older adults without cognitive impairment”	161
Anexo I – Comprovante de aceite do capítulo “Reserva cognitiva: fatores associados ao longo do ciclo vital”	162

1 Apresentação

A presente Tese de Doutorado está vinculada ao grupo de pesquisa “Avaliação, Reabilitação e Interação Humano-Animal”, inserido no Programa de Pós-Graduação em Psicologia da Pontifícia Universidade Católica do Rio Grande do Sul e coordenado pela Professora Doutora Tatiana Quarti Irigaray. O grupo de pesquisa tem como proposta investigar questões relacionadas ao processo de envelhecimento humano, tratando de avaliação e reabilitação psicológica. Dessa forma, o tema central abordado nesta Tese é o funcionamento cognitivo e a reserva cognitiva em idosos, avaliados em um intervalo de quatro anos.

1.1 Envelhecimento e funcionamento cognitivo

O aumento da expectativa de vida e o envelhecimento demográfico são considerados um fenômeno mundial (Zhang et al., 2017). No processo de envelhecimento, há mudanças nas condições biológicas, psicológicas e sociais do indivíduo, que podem levar a uma redução na saúde mental e física, bem como a diminuição das funções cognitivas dos idosos (Kuns, Paulino, & Aprile, 2015; Yamada, Landes, Mimori, Nagano, & Sasaki, 2015).

Com o processo de envelhecimento, a capacidade de aprendizagem e a facilidade em lidar com novas informações diminuem e tornam-se mais lentas. Não necessariamente os indivíduos idosos irão desenvolver demência, mas há alterações no desempenho cognitivo observadas na literatura, como no funcionamento da memória, atenção, processamento da informação, raciocínio, linguagem e funções executivas (Monica, Johnsen, Atzori, Groeger, & Dijk, 2018; Tsai et al., 2016).

Um estudo longitudinal que acompanhou 1054 idosos na Alemanha, pelo período de oito anos, encontrou uma menor taxa de declínio cognitivo nos participantes que tiveram maior nível de complexidade nas tarefas de trabalho que os estimulavam mentalmente. Já os idosos com menos estímulos no trabalho obtiveram maior taxa de declínio cognitivo, apontando que as características laborais podem proporcionar efeitos positivos para a saúde (Then et al., 2015). Outro estudo longitudinal, realizado nos Estados Unidos da América, acompanhou 698 idosos durante 10 anos, com o objetivo de caracterizar as habilidades cognitivas cotidianas dos participantes, e identificou que a cognição sofre alterações, ocorrendo declínio cognitivo ao longo do envelhecimento (Yam, Gross, Prindle, & Marsiske, 2014).

1.2 Reserva cognitiva

Recentemente, o grupo de trabalho de Stern et al. (2018) publicou um artigo em que atualiza conceitos de reserva cognitiva e reserva cerebral, com intuito de ser referência aos pesquisadores da área. A reserva pode ser conceituada como um construto hipotético e pode ser descrita através de dois modelos, o passivo, caracterizado pela integridade das estruturas cerebrais; e o modelo ativo em que há uma intenção da pessoa de realizar atividades que diminuam os efeitos dos prejuízos cognitivos decorrentes do envelhecimento.

O modelo ativo de reserva cognitiva é definido como a capacidade do cérebro de tolerar uma determinada quantidade de lesões sem o aparecimento de sintomatologias, minimizando manifestações clínicas de um possível processo de neurodegeneração. É um recurso que auxilia o indivíduo a retardar as mudanças cognitivas naturais que ocorrem no envelhecimento (Stern, 2017). Ainda não há um consenso sobre quais componentes estão envolvidos na reserva cognitiva, mediante o modelo ativo em idosos (Stern et al., 2018). Entretanto, é considerada um processo normal, em que o cérebro saudável funciona durante a realização de atividades que demandam habilidades cognitivas (Lojo-Seoane, Facal, & Juncos-Rabadán, 2012; Rami et al., 2011).

Uma pesquisa da Espanha identificou que idosos com menor reserva cognitiva, possuem menos recursos cognitivos e, por isso, têm uma maior ativação cerebral das redes neurais, mas menos eficientes, na realização de tarefas cognitivas (Solé-Padullés et al., 2009). Também, foram identificados que indivíduos com níveis mais elevados de reserva cognitiva podem ser mais capazes de se basear em redes neurais alternativas em face de alterações cerebrais, a fim de manter a função cognitiva (Barulli & Stern, 2013). Outros estudos indicam que a variabilidade interindividual é proveniente das diferenças nas redes cerebrais ou nos processos cognitivos subjacentes ao desempenho de qualquer tarefa, e aumenta na medida em

que as pessoas envelhecem (Duarte, Ranganath, Trujillo, & Knight, 2006; Sánchez, Cabaco, Litago, Maciá, & López, 2017).

Em relação às variáveis que compõem a reserva cognitiva de idosos, diversos estudos apontam que a escolaridade, atividade profissional e estilo de vida ativo (interação social, prática de atividades estimulantes cognitivamente e atividades físicas) estão presentes (Darwish, Farran, Assaad, & Chaaya, 2018; Evans et al., 2018). Um estudo considerou a escolaridade como um moderador do desempenho neuropsicológico e, consequentemente, um aspecto importante para a qualidade do envelhecimento funcional do sistema nervoso central de idosos (Paula et al., 2016).

1.3 Sintomas de humor (ansiedade e depressão)

De acordo com Oliveira, Antunes e Oliveira (2017), sintomas depressivos e de ansiedade são comumente encontrados em idosos. Essas sintomatologias têm sido associadas a uma pior percepção de qualidade de vida, sendo consideradas um indicador de maior mortalidade nessa população (Weber et al., 2015). Um estudo realizado na Holanda, observou que indivíduos idosos deprimidos, ao experienciarem eventos estressantes, apresentaram maiores níveis de ansiedade e de depressão (Van der Veen et al., 2016).

Indivíduos com baixos níveis de ansiedade são mais resistentes ao comprometimento cognitivo durante o envelhecimento (Farina, Moret-Tatay, Paloski, & Irigaray, no prelo). Já maiores níveis de ansiedade estão associados a uma pior percepção de qualidade de vida no envelhecimento (Green, Magee, Steiner, & Teachman, 2017). Deste modo, acredita-se que a percepção da qualidade de vida, sendo um constructo que depende da percepção do indivíduo, seja mediada pelo processamento cognitivo (Bowling, Banister, Sutton, Evans, & Windsor, 2002).

2 Justificativa

No processo de envelhecimento podem ocorrer prejuízos no funcionamento cognitivo de idosos, bem como uma alta prevalência de sintomas de ansiedade e depressão. Desta forma, constata-se a importância de investigar a respeito do envelhecimento cognitivo, bem como variáveis que podem atuar como fatores de risco e protetivos nesse processo do ciclo vital.

De acordo com o Instituto Brasileiro de Geografia e Estatística (IBGE, 2018), o Estado do Rio Grande do Sul é o quinto estado com maior expectativa de vida do país, chegando aos 78 anos, acima da média nacional, que é de 76 anos. Ou seja, a população está vivendo mais, especialmente os idosos do Sul do país, evidenciando a relevância de estudos com idosos gaúchos, bem como, brasileiros.

Neste sentido, acredita-se ser importante conhecer as alterações que podem ocorrer no processo de envelhecimento, mesmo em populações não clínicas, identificando quais variáveis podem estar associadas a ele, bem como as mudanças cognitivas inerentes a esse período do desenvolvimento, a influência do estilo de vida e o conhecimento de fatores protetivos e de risco (Stern., 2018; Winblad et al., 2016). Espera-se, também, que os resultados desta Tese promovam maior conhecimento sobre os fatores que estão associados ao funcionamento cognitivo de idosos, em um intervalo de quatro anos, contribuindo para a implementação de atividades que promovam um envelhecimento com mais saúde, autonomia e melhor qualidade de vida dessa população.

3 Objetivos

3.1 Objetivo principal

- Comparar o funcionamento cognitivo, a reserva cognitiva e sintomas de ansiedade e de depressão de idosos em um intervalo de quatro anos.

3.2 Objetivos específicos

3.2.1 Artigo teórico

- Realizar uma revisão sistemática de literatura a respeito das variáveis que compõem a reserva cognitiva de idosos.

3.2.2 Artigos empíricos

Artigo 1

- Comparar o funcionamento cognitivo de idosos em um intervalo de quatro anos;

- Investigar se as variáveis sociodemográficas (idade, escolaridade, realização de atividades intelectuais e realização de atividade física) sintomas de depressão e de ansiedade podem explicar a variação no funcionamento cognitivo de idosos em um intervalo de quatro anos.

Artigo 2

- Verificar quais variáveis sociodemográficas (idade, atividade profissional, tempo de aposentadoria, escolaridade dos pais e do participante, leitura, palavras cruzadas, utilização de aparelhos eletrônicos, aprendizagem de outro idioma, atividade física, histórico familiar de demência e morar com alguém) e sintomatologia de ansiedade e de depressão contribuem para uma medida indireta de reserva cognitiva de idosos em um intervalo de quatro anos.

4 Método

4.1 Delineamento

Trata-se de um estudo prospectivo, com delineamento longitudinal. Foram avaliados indivíduos com 60 anos ou mais. As avaliações foram realizadas em dois momentos, no intervalo de quatro anos, nos anos de 2013 e 2017.

4.2 Participantes

Na etapa I, em 2013, foram avaliados 108 idosos. Na etapa II, em 2017, foram reavaliados 64 idosos. Inicialmente, entrou-se em contato por telefone com todos os participantes. Os motivos de não participação na etapa II foram os seguintes: o telefone de contato estava desatualizado ou impossibilitado de receber ligações ($n = 20$), o indivíduo não quis participar da segunda etapa ($n = 13$), estava apresentando sintomas de demência segundo informação de familiar ($n = 4$), mudou de cidade ($n = 4$) e estava viajando durante o período da coleta ($n = 3$), totalizando 44 participantes excluídos na etapa II.

4.3 Instrumentos

a) Ficha de dados sociodemográficos e clínicos: entrevista estruturada que investigou sexo, idade, estado civil, escolaridade, atividade profissional, tempo de aposentadoria, atividades intelectuais (leitura, palavras cruzadas, aprendizagem de outro

idioma e uso de aparelhos eletrônicos, como computador, tablet, celular smartphone), atividade física, sintomas de ansiedade e de depressão.

b) Mini-Exame do Estado Mental (MEEM): é uma medida de rastreio que possibilita uma visão global do funcionamento cognitivo do paciente. Os escores podem variar de zero a um, de um total de 30 pontos (Bertolucci, Brucki, Campacci, & Juliano, 1994; Folstein, Folstein, & McHugh 1975). Os pontos de corte utilizados, neste estudo, foram: 21 pontos para o grupo de analfabetos, 22 para baixa escolaridade, 23 para média escolaridade e 24 para indivíduos com alta escolaridade. Esses valores foram baseados no estudo de Kochhann Varela, Lisboa Chaves (2010) realizados com idosos do Sul do Brasil. O alpha de Cronbach foi de 0,80 (Santos, Cerchiari, Alvarenga, Faccenda, & Oliveira, 2010).

c) Subtestes Códigos e Dígitos da Escala de Inteligência Wechsler para Adultos - WAIS-III: o subteste Códigos avalia, principalmente, a velocidade de processamento. Já o subteste Dígitos avalia atenção, memória imediata e memória de trabalho. Foi encontrado alpha de Cronbach de 0,84 para o subteste Dígitos, referente a pessoas de 60 a 89 anos (Nascimento, 2004; Wechsler, 2004).

d) *Trail Making Test (TMT)*: é uma tarefa que avalia atenção sustentada, atenção dividida, sequenciação e habilidades grafomotoras. Contêm duas partes: TMT-A, composta por 25 círculos com números, e TMT-B, formada por números e letras, que devem ser conectados na sequência. A correção é calculada por meio do tempo gasto pelo indivíduo para completar cada parte (Chan, Lam, Wong, & Chiu, 2003; Lezak, 2004; Strauss, Sherman, & Spreen 2006).

e) Fluência Verbal (categoria animal): é uma tarefa que avalia componentes das funções executivas, como fluência verbal, inibição e geração de palavras. Consiste em

solicitar ao participante que diga, o mais rápido possível, o nome de diferentes animais durante um minuto (Strauss et al., 2006). O alpha de Cronbach foi de 0,74 (Santos, 2009).

f) *Rey Auditory-Verbal Learning Test (RAVLT)*: é composto por duas listas de palavras, formadas por 15 palavras cada. A primeira lista é repetida cinco vezes (A1, A2, A3, A4, A5) para o participante recordar o maior número de palavras escutadas. Posteriormente, é lida uma lista distratora (B), seguida da recordação da primeira lista (A6). Após 20 a 30 minutos, solicita-se que o participante recorde a primeira lista (A7) (Boake, 2000; Rey, 1958). O A1 avalia a memória imediata, o somatório de A1-A5 a síntese do processo de aprendizagem, o A6 corresponde à evocação imediata e o A7 à evocação tardia (Malloy-Diniz, Fuentes, Mattos, & Abreu, 2018). No Brasil, os padrões normativos para o teste têm sido desenvolvidos para a faixa etária de 16 a 89 anos de idade (Malloy-Diniz, Lasmar, Gazinelli, Fuentes, & Salgado, 2007). O alpha de Cronbach variou de 0,80 a 0,95 (Mitrushina, 1999).

g) Inventário de Ansiedade de Beck (BAI): avalia a intensidade da sintomatologia de ansiedade por meio de uma escala de sintomas, composta por 21 itens, na qual o sujeito deve assinalar como se sentiu nas últimas duas semanas, por meio de uma escala de quatro pontos. Neste estudo, utilizaram-se os pontos de corte sugeridos pelo manual, que estão subdivididos em: 0 a 10 sintomas mínimos, 11 a 19 leves, 20 a 30 moderados, e 31 a 63: graves. O alpha de Cronbach foi de 0,90 (Cunha, 2001; Leite, Rangé, Ribas Junior, Fernandez, & Silva, 2012).

h) Escala de Depressão Geriátrica (GDS-15): consiste em um questionário de 15 questões utilizado para verificar a intensidade de sintomas depressivos. É composto por duas opções de resposta: sim e não (Yesavage et al., 1983). Para os escores inferiores a cinco considera-se ausência de sintomas e para aqueles acima de cinco, presença de sintomas

depressivos. A escala apresentou um alpha de Cronbach de 0,81 (Almeida & Almeida, 1999; Paradela, Lourenço, & Veras, 2005).

4.4 Procedimentos éticos

Primeiramente, o projeto de pesquisa foi encaminhado à Comissão Científica da Escola de Ciências da Saúde e submetido à aprovação no Comitê de Ética da Faculdade de Psicologia da PUCRS, sob o número 63196816.8.0000.5336. Após aceitarem participar da pesquisa, os participantes assinaram o Termo de Consentimento Livre e Esclarecido (TCLE). Os procedimentos éticos baseiam-se nas Diretrizes e Normas Regulamentadoras de Pesquisa envolvendo Seres Humanos (Resolução 510/16 e Resolução 466/12 do Conselho Nacional de Saúde).

4.5 Procedimentos de coleta de dados

Em ambas as etapas (I e II), a avaliação foi realizada por uma psicóloga e por estudantes de Psicologia, treinados previamente. O local de aplicação dos instrumentos foi em uma sala localizada dentro de uma clínica de atendimento psicológico, e em salas disponibilizadas para coleta de dados no Programa de Pós-Graduação em Psicologia. Os idosos foram avaliados individualmente, em uma sessão com duração aproximada de duas horas.

A ordem de aplicação dos instrumentos foi a seguinte: ficha de dados sociodemográficos, testes cognitivos (MEEM, RAVLT, Códigos, Dígitos, recordação do RAVLT, TMT, Fluência Verbal Animais) e escalas de sintomas de ansiedade e depressivos.

Os participantes que apresentaram algum prejuízo ou necessidade de atendimento foram encaminhados para o Serviço de Atendimento e Pesquisa em Psicologia (SAPP) da PUCRS.

A devolução dos resultados foi oferecida no mês de abril de 2018, quando os idosos foram convidados a comparecer nas instituições onde os dados foram coletados. A devolução foi realizada de forma grupal, com uma média de 10 idosos por encontro. Na ocasião, foram apresentados os resultados globais da pesquisa e fornecido um parecer com os principais resultados de cada indivíduo. A maioria dos participantes recebeu a devolução pessoalmente ($n = 42$) e os demais ($n = 22$) por telefone.

4.6 Procedimentos de análise de dados

Para o artigo teórico, foi realizada uma revisão sistemática de literatura a respeito da reserva cognitiva de idosos. Para os estudos empíricos, foram conduzidas análises estatísticas por meio do *software* SPSS versão 17, considerando um nível de significância de 5%.

A descrição dos dados coletados foi realizada por meio de frequências absolutas (n) e relativas (%) para variáveis qualitativas, e por média e desvio padrão para variáveis quantitativas. Para verificar a prevalência das variáveis avaliadas (características sociodemográficas, cognição e sintomas de ansiedade e depressão), foi utilizada estatística descritiva (frequência, média e desvio padrão).

A fim de verificar a relação entre as variáveis envolvidas nesta pesquisa, foram utilizadas as Correlações de *Pearson* ou de *Spearman*, conforme distribuição dos dados, de acordo com o resultado do Teste *Kolmogorov-Smirnov*. Para analisar o poder preditivo das variáveis investigadas, foram realizadas análises de Regressão Linear Múltipla. Foram

analisados os pesos de regressão padronizados e não padronizados, intervalos de confiança, significância estatística e a variância explicada pelos modelos estabelecidos.

Referências

- Almeida, O. P., & Almeida, S. A. (1999). Confiabilidade da versão brasileira da Escala de Depressão em Geriatria (GDS) versão reduzida. *Arquivos de Neuropsiquiatria*, 57(2B), 421-6.
- Argimon, I. I. L., Gonzatti, V., Tatay, C. M., & Irigaray, T. Q. (2016). Personalidade e longevidade: pessoas abertas para novas experiências e extrovertidas vivem mais? In: E. M. Berlezi, L. S. Filho, S. B. B. Garces (Eds.). *Envelhecimento Humano – Compromisso das Universidades Gaúchas*. (pp.137). Ijuí, RS: Editora Unijuí.
- Barulli, D., & Stern, Y. (2013). Efficiency, capacity, compensation, maintenance, plasticity: emerging concepts in cognitive reserve. *Trends in cognitive sciences*, 17(10), 502-509. doi: 10.1016/j.tics.2013.08.012.
- Bertolucci, P. H., Brucki, S., Campacci, S. R., & Juliano, Y. (1994). O mini-exame do estado mental em uma população geral: impacto da escolaridade. *Arquivos de Neuropsiquiatria*, 52(1), 1-7. doi: 10.1590/S0004-282X1994000100001
- Boake, C. (2000). Edouard Claparede and the auditory verbal learning test. *Journal of Clinical and Experimental Neuropsychology*, 22(2), 286-292. doi: 10.1076/1380-3395(200004)22:2;1-1;FT286
- Bowling, A., Banister, D., Sutton, S., Evans, O., & Windsor, J. (2002). A multidimensional model of the quality of life in older age. *Aging & mental health*, 6(4), 355-371.
- Chan, C. W. Y., Lam, L. C. W., Wong, T. C. M. & Chiu, H. F. K. (2003). Modified Card Sorting Test Performance among Community Dwelling Elderly Chinese People. *Hong Kong Journal of Psychiatry*, 13(2), 2-7.
- Conselho Nacional de Saúde. (2012). *Resolução nº 466/12*. Recuperado de http://bvsms.saude.gov.br/bvs/saudelegis/cns/2013/res0466_12_12_2012.html
- Conselho Nacional de Saúde. (2016). *Resolução nº 510/2016*. Recuperado de <http://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf>
- Cunha, J. A. (2001). Manual da versão em português das Escalas Beck. São Paulo, SP: Casa do Psicólogo.
- Daffner, K. R. (2010). Promoting successful cognitive aging: a comprehensive review. *Journal of Alzheimer's disease*, 19(4), 1101-1122.
- Darwish, H., Farran, N., Assaad, S., & Chaaya, M. (2018). Cognitive Reserve Factors in a Developing Country: Education and Occupational Attainment Lower the Risk of Dementia in a Sample of Lebanese Older Adults. *Frontiers in aging neuroscience*, 10, 277. doi: 10.3389/fnagi.2018.00277
- Duarte, A., Ranganath, C., Trujillo, C., & Knight, R. T. (2006). Intact recollection memory in high-performing older adults: ERP and behavioral evidence. *Journal of Cognitive Neuroscience*, 18(1), 33-47. doi: 10.1162/089892906775249988
- Evans, I. E., Llewellyn, D. J., Matthews, F. E., Woods, R. T., Brayne, C. E., & Clare, L. (2018). Social isolation, cognitive reserve, and cognitive function in later life. *Plos One*, 17, 1-14. doi: 10.1371/journal.pone.0201008
- Evans, I. E., Llewellyn, D. J., Matthews, F. E., Woods, R. T., Brayne, C., & Clare, L. (2018). Social isolation, cognitive reserve, and cognition in older people with depression and anxiety. *Aging & Mental Health*, 1-10. doi: 10.1080/13607863.2018.1506742
- Farina, M., Moret-Tatay, C., Paloski, L.H., & Irigaray, T. Q. (no prelo). Neuroticism and Quality of life: Testing for mediated effects of Anxiety in older adults without cognitive impairment. *Aging and Mental Health*.

- 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.
- Green, J. S., Magee, J. C., Steiner, A. R., & Teachman, B. A. (2017). When the "Golden Years" turn blue: Using the healthy aging literature to elucidate anxious and depressive disorders in older adulthood. *International Journal of Behavioral Development*, 41(2), 295-307. doi: 10.1177/0165025415613855
- Instituto Brasileiro de Geografia e Estatística (IBGE) (2018). *Tábua completa de mortalidade para o Brasil – 2017 – Breve análise da evolução da mortalidade no Brasil*. Recuperado de ftp://ftp.ibge.gov.br/Tabuas_Completas_de_Mortalidade/Tabuas_Completas_de_Mortalidade_2017/tabua_de_mortalidade_2017_analise.pdf
- Jesus, M. F. (2010). *Estudo avaliativo dos motivos relacionados ao processo de aposentadoria dos servidores da Cnen*. (Dissertação de Mestrado). Recuperado de <http://mestrado.cesgranrio.org.br/pdf/dissertacoes2009/15%20Dezembro%202010%20Dissertacao%20Maria%20de%20Fatima%20Jesus%20Turma%202009.pdf>
- Kochhann, R., Varela, J. S., Lisboa, C. S. M., & Chaves, M. L. F. (2010). The Mini Mental State Examination. *Dementia e Neuropsychologia*, 4(1), 35-41.
- Kuns, E., Paulino, C. A., & Aprile, M. R. (2015). Memória e envelhecimento: caracterização em um grupo de idosos com doença vestibular. *Revista Equilíbrio Corporal e Saúde*, 5(2). doi: 10.17921/2176-9524.2013v5n2p%25p
- Leite, P. L., Rangé, B. P., Ribas Junior, R. C., Fernandez, J. L., & Silva, A. A. O. (2012). Validação e aferição de fidedignidade da versão brasileira da Compulsive Buying Scale. *Revista de Psiquiatria Clínica*, 39(3), 100-105.
- Lezak, M. D. (2004). *Neuropsychological assessment* 4th edition. New York, USA: Oxford University Press.
- Lojo-Seoane, C., Facal, D., & Juncos-Rabadán, O. (2012). ¿ Previene la actividad intelectual el deterioro cognitivo? Relaciones entre reserva cognitiva y deterioro cognitivo ligero. *Revista Española de Geriatria y Gerontología*, 47(6), 270-278. doi: 10.1016/j.regg.2012.02.006
- Malloy-Diniz, L. F., Fuentes, D., Mattos, P., & Abreu, N. (2018). *Avaliação neuropsicológica – 2ª edição*. Artmed Editora.
- Malloy-Diniz, L. F., Lasmar, V. A. P., Gazinelli, L. S. R., Fuentes, D., & Salgado, J. V. (2007). Teste de aprendizagem auditivo-verbal de Rey: aplicabilidade na população idosa brasileira. *Revista Brasileira de Psiquiatria*, 29(4), 324-329.
- Meira, S. S., Vilela, A. B. A., Casotti, C. A., & da Silva, D. M. (2017). Autoestima e fatores associados às condições sociais em idosos. *Revista de Pesquisa Cuidado é Fundamental Online*, 9(3), 738-744.
- Mitrushina, M. (1999). Rey Auditory-Verbal Learning Test. *Handbook of Normative Data for Neuropsychological Assessment*, 323-370. New York, NY: Oxford University Press.
- Monica, C. D., Johnsen, S., Atzori, G., Groeger, J. A., & Dijk, D. J. (2018). Rapid eye movement sleep, sleep continuity and slow wave sleep as predictors of cognition, mood, and subjective sleep quality in healthy men and women, aged 20–84 years. *Frontiers in Psychiatry*, 9. doi: 10.3389/fpsy.2018.00255
- Nascimento, E. (2004). Adaptação, validação e normatização do WAIS-III para uma amostra brasileira. Wechsler D. *WAIS-III: Manual para administração e avaliação*. São Paulo, SP: Casa do Psicólogo.

- Oliveira, D. V., Antunes, M. D., & Oliveira, J. (2017). Ansiedade e sua relação com a qualidade de vida em idosos: revisão narrativa. *Cinergis*, 18(4), 316-322. doi: 10.17058/cinergis.v18i4.9951
- Opdebeeck, C., Matthews, F. E., Wu, Y. T., Woods, R. T., Brayne, C., & Clare, L. (2018). Cognitive reserve as a moderator of the negative association between mood and cognition: evidence from a population-representative cohort. *Psychological medicine*, 48(1), 61-71. doi: 10.1017/S003329171700126X
- Paradela, E. M. P., Lourenço, R. A., & Veras, R. P. (2005). Validação da escala de depressão geriátrica em um ambulatório geral. *Revista de saúde pública*, 39, 918-923.
- Rami, L., Valls Pedret, C., Bartrés Faz, D., Caprile, C., Solé Padullés, C., Castellví, M., ... & Molinuevo, J. L. (2011). Cuestionario de reserva cognitiva. Valores obtenidos en población anciana sana y con enfermedad de Alzheimer. *Revista de Neurología*, 52(4), 195-201.
- Rey, A. (1958). *L'examen clinique en psychologie*. Paris, France: Press Universitaire de France.
- Sánchez, M. W., Cabaco, A. S., Litago, J. D. U., Maciá, E. S., & López, B. B. (2017). Reserva Cognitiva: Un análisis bibliométrico desde su implantación hasta la actualidad. *Revista de Psicología de la Salud*, 5(1), 86-113.
- Santos, C. S., Cerchiar, E. A. N., Alvarenga, M. R. M., Faccenda, O., & Oliveira, M. A. C. (2010). Avaliação da confiabilidade do Mini-Exame do Estado Mental em idosos e associação com variáveis sociodemográficas. *Cogitare Enfermagem*, 15(3).
- Santos, S. A. E. N. (2009). *Fluência verbal semântica e fonêmica: estudos psicométricos e normativos numa amostra de adultos idosos saudáveis*. [Dissertação de Mestrado], Universidade de Coimbra, Portugal. Recuperado de <http://hdl.handle.net/10316/15774>
- Silva, G. V., & Lippi, M. C. (2015). Envelhecimento, saúde pública e projeto de serviço. *Gestão e Saúde*, 6(1), 266-290.
- Simon, J., Gilsoul, J., & Collette, F. (2015). *The executive functioning in normal aging: Impact of the cognitive reserve*. [Pôster]. Recuperado de <http://hdl.handle.net/2268/185655>
- Solé-Padullés, C., Bartrés-Faz, D., Junqué, C., Vendrell, P., Rami, L., Clemente, I. C., ... & Barrios, M. (2009). Brain structure and function related to cognitive reserve variables in normal aging, mild cognitive impairment and Alzheimer's disease. *Neurobiology of Aging*, 30(7), 1114-1124. doi: 10.1016/j.neurobiolaging.2007.10.008
- Stern, Y., Arenaza-Urquijo, E. M., Bartrés-Faz, D., Belleville, S., Cantilon, M., Chetelat, G., ... & Okonkwo, O. (2018). Whitepaper: Defining and investigating cognitive reserve, brain reserve, and brain maintenance. *Alzheimer's & Dementia*. doi: 10.1016/j.jalz.2018.07.219
- Strauss, E., Sherman, E. M. S., & Spreen, O. (2006). *A compendium of neuropsychological tests 3rd edition*. New York, USA: Oxford U. Press.
- Then, F. S., Luck, T., Lupp, M., König, H. H., Angermeyer, M. C., & Riedel-Heller, S. G. (2015). Differential effects of enriched environment at work on cognitive decline in old age. *Neurology*, 84(21), 2169-2176. doi: 10.1212/WNL.0000000000001605
- Tsai, J. C., Chen, C. W., Chu, H., Yang, H. L., Chung, M. H., Liao, Y. M., & Chou, K. R. (2016). Comparing the Sensitivity, Specificity, and Predictive Values of the Montreal Cognitive Assessment and Mini-Mental State Examination When Screening People for Mild Cognitive Impairment and Dementia in Chinese population. *Archives of Psychiatric Nursing*, 30(4), 486-491. doi: 10.1016/j.apnu.2016.01.015
- Van der Veen, D. C., Van Dijk, S. D., Comijs, H. C., Van Zelst, W. H., Schoevers, R. A., & Oude Voshaar, R. C. (2016). The importance of personality and life-events in anxious

- depression: from trait to state anxiety. *Aging & Mental Health*, 1-7. doi: 10.1080/13607863.2016.1202894
- Weber, K., Canuto, A., Giannakopoulos, P., Mouchian, A., Meiler-Mititelu, C., Meiler, A., ... & De Ribaupierre, A. (2015). Personality, psychosocial and health-related predictors of quality of life in old age. *Aging & Mental Health*, 19(2), 151-158. doi: 10.1080/13607863.2014.920295
- Wechsler, D. (2004). WAIS-III: Escala de Inteligência Wechsler para Adultos: Manual; Adaptação e Padronização de uma amostra Brasileira. São Paulo, SP: Casa do Psicólogo.
- Winblad, B., Amouyel, P., Andrieu, S., Ballard, C., Brayne, C., Brodaty, H., ... & Fratiglioni, L. (2016). Defeating Alzheimer's disease and other dementias: a priority for European science and society. *The Lancet Neurology*, 15(5), 455-532.
- Yam, A., Gross, A. L., Prindle, J. J., & Marsiske, M. (2014). Ten-year longitudinal trajectories of older adults' basic and everyday cognitive abilities. *Neuropsychology*, 28(6), 819-828. doi: 10.1037/neu0000096
- Yamada, M., Landes, R. D., Mimori, Y., Nagano, Y., & Sasaki, H. (2015). Trajectories of cognitive function in dementia-free subjects: radiation effects research foundation adult health study. *Journal of the Neurological Sciences*, 351(1), 115-119. doi: 10.1016/j.jns.2015.02.050
- Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., & Leirer, V. O. (1983). Development and validation of a geriatric depression screening scale: a preliminary report. *Journal of Psychiatric Research*, 17(1), 37-49. doi: 10.1016/0022-3956(82)90033-4
- Zahodne, L. B., Stern, Y., & Manly, J. J. (2015). Differing effects of education on cognitive decline in diverse elders with low versus high educational attainment. *Neuropsychology*, 29(4), 649.
- Zhang, Y., Cai, J., An, L., Hui, F., Ren, T., Ma, H., & Zhao, Q. (2017). Does music therapy enhance behavioral and cognitive function in elderly dementia patients? A systematic review and meta-analysis. *Ageing Research Reviews*, 35, 1-11. doi: 10.1016/j.arr.2016.12.003

5 Seção Teórica

5.1 Cognitive reserve in elderly and its connection with cognitive performance: a systematic review

Farina, M., Paloski, L. H., de Oliveira, C. R., de Lima Argimon, I. I., & Irigaray, T. Q. (2018). Cognitive reserve in elderly and its connection with cognitive performance: a systematic review. *Ageing International*, 43(4), 496-507.

Abstract:

The cognitive reserve may delay impairments in the normal aging process, improving the resilience in cognitive functioning. The main objective of this study was to investigate, through a systematic review, which variables form the cognitive reserve. Furthermore, the association between the cognitive reserve and the cognitive functioning was also verified. Three judges searched for articles in PsycINFO, Pubmed and Scopus databases. The Cochrane recommendations, which offer directions for systematic reviews and meta-analysis, were utilized. Six surveys were gathered following the criteria of inclusion and exclusion. Studies indicate that gender, age, individual's education, parents' education, profession, reading activity, social engagement and humor are the main variables of the cognitive reserve. Education was the most assessed variable in the studies, followed by profession. It was concluded that the main cognitive reserve variable is education and that there is a significant correlation with a healthy cognitive maturation in the elderly.

Keywords: cognitive reserve, cognitive functioning, elderly.

Introduction

There are expected cognitive changes in normal aging (Carvalho, Neri, & Yassuda, 2010), some of them also pathological, which can start with mild cognitive impairment and progress to dementia (Curado, 2013). Cognitive reserve (CR) consists of delaying cognitive impairments from the neurodegenerative process of normal aging, increasing the resilience of cognitive functioning (Sobral, Pestana, & Paúl, 2014; Ward, Summers, Saunders, & Vickers, 2015). Among the most significant changes in the cognitive functioning of the elderly, studies indicate slowing in the speed of information processing as the years pass (Cosenza &

Malloy-Diniz, 2013; Lezak et al., 2013). Two models describe CR. The passive, also named as cerebral or neural reserve, is characterized by the integrity of the brain structures. The brain has a greater tolerance to develop pathology, before clinical symptoms appears (Stern, 2012) and refers to structural aspects of the brain such as the size and counting of synapses (Nucci, Mapelli, & Mondini, 2012). The active model consists of an active intention of the brain to minimize brain damage, using cognitive or compensatory processes (Stern, 2002). Thus, CR in the active model may be a variable that explains the discrepancy between the individual's cerebral pathology and its clinical manifestation (Barulli, Raktin, Lemaire, & Stern, 2013).

A set of factors present throughout life may explain the differences in CR in individuals (Stern, 2016). Although there is no consensus on which components are involved in CR, some studies indicate that within the active model, education, professional activity, intelligence and participation in leisure activities that stimulate cognition are contributing factors (Stern, 2002). Other featured components are reading, writing, playing a musical instrument, studying languages, traveling, physical activity, feeding and social interaction (Leon, García-García, & Roldan-Tapia, 2014; Nucci, Mapelli, & Mondini, 2012; Scarmeas et al., 2009). On the other hand, components which seem to have a negative association with cognitive reserve are humor, i.e., depression, propensity to boredom and loneliness (Conroy, Golden, Jeffares, O'Neill, & McGee, 2010; Opdebeeck, Nelis, Quinn, & Clare, 2015).

It is observed some efforts to develop capable scales in order to evaluate some of the active components of CR, as in the case of the Cognitive Reserve Scale developed by León, García and Roldán-Tapia (2011). This scale was elaborated for the Spanish population and it has evidence of validity, with a Cronbach alpha of 0.77. The Cognitive Reserve Index Questionnaire test was developed by Nucci et al. (2012) and it seeks to evaluate active components of CR.

The CR works as a protective factor against cognitive decline and dementia (Marioni, Van Den Hout, Valenzuela, Brayne, & Matthews, 2012), demonstrating greater resistance to pathologies related to brain aging (Zahodne et al., 2015). In the study by Prince et al. (2012), for example, it was found that higher levels of education and involvement in professional activities are associated with a lower incidence of dementia in the elderly. Elderly individuals with complete higher education are less probable to have cognitive impairment when compared to individuals with lower education. High educational level in consonance with the frequent practice of reading are predictors of better cognitive functioning in the elderly (Contador, Bermejo-Pareja, Del Ser, & Benito-León, 2015). It is also observed that elderly individuals with high education have a better performance in tests of cognitive flexibility and capacity of updating (Simon, Gilsoul, & Collette, 2015).

The CR is a hypothetical construct and, as a result, still does not present a specific measurement, with no consensus about all the variables that are part of this construct. Thus, the main objective of this study was to investigate, through a systematic review, which variables compose CR in the elderly. In addition, the relationship of the components of CR with the cognitive functioning of the elderly was verified.

Method

The present study followed recommendations of Cochrane, aiming to guide the development of systematic reviews of the literature (Higgins & Green, 2008). Cochrane Data base of Systematic Review (CDSR) was utilized in the research. Data Base of Abstracts of Reviews of Effects (DARE) was utilized in order to verify the existence of previous systematic review about the subject. In these searches, no specific studies about the subject were found.

In the process of constructing the string, several tests were performed with different descriptors in order to contemplate the largest number of studies about the subject. For the construction of the string, tools as TermFinder for the PsychINFO database and the Medical Subject Headings (MeSH) index of the Pubmed/Medline database were utilized. The final version of the search string for English articles was "Cognitive Reserve" AND "Cognition" AND "Elderly".

Peer review was utilized as search restrictor, and the descriptors should be presented in the abstract or in the title of the articles. In the search process of the articles, quotation marks were utilized in each descriptor. The search in the databases was made by researcher and two judges, included in the review only those articles that presented the entire criteria of inclusion. This procedure was performed on July 7, 2015. Regarding the year of publication of the articles, articles published in the last five years, from 2011 to 2015, were utilized as restrictors for being considered more recent studies.

The criteria of inclusion utilized were: (1) empirical articles; (2) Articles written in Portuguese, Spanish or English; (3) articles that included the three descriptors in the abstract; (4) studies with only elderly individuals. These criteria were applied through the reading of the title and the abstract of articles. The criteria of exclusion were: (1) duplicate articles; (2) articles that contained the word "cognitive reserve", without evaluation.

The researchers independently analyzed the relevant articles and issued an opinion about their inclusion or exclusion in the review. In cases where there were divergences of opinion a third judge was contacted. After the process of selecting the studies and defining which articles would be included in the review, the researchers tabulated the data.

When searching the string terms in the PsycINFO, Pubmed and Scopus databases, 118 articles available were found. Then the abstracts were read and 97 articles were removed for not meet the inclusion criteria, leaving 21 potentially relevant articles, which were read

integrally. Finally, 15 articles were removed for met the exclusion criteria, resulting in a final bank of six articles for the present study. In addition, a fluxogram (Figure 1) of the process of obtaining articles is presented.

Insert Figure 1 here.

Results

The data of the studies included in systematic review is presented in Table 1. It summarily presents the authorship of articles, the country where the research was done, objectives, instruments, interventions made and, finally, the main findings.

Insert Table 1 here.

The six articles analyzed included 14.210 participants over 60 years old: 8.440 (59%) female and 5.686 (41%) male. The greatest age found was 102 years old ($M = 72.7$ years) (Conroy et al., 2010). The articles were published between 2010 and 2014. It was observed a prevalence of women involved in research in all articles, except one that did not specified the number of men and women (Bruno, Brown, Kapucu, Marmar, & Pomara, 2014).

The participants were mostly recruited in the community. Only two studies recruited clinical elderly individuals, from Family Health Service and Service of Neurology from Valencian Health Agency, respectively (Marioni et al., 2012; Moral et al., 2013) In relation to design, five articles presented transversal and longitudinal cross sections (Marioni et al., 2012).

In relation to the country of origin of articles, one of them is from Brazil (Ribeiro, Lopes, & Lourenço, 2013), two are from Spain (López-Higes, Rubio-Valdehita, Prados, & Galindo, 2013; Moral et al., 2013), two from United Kingdom (Conroy et al., 2010; Marioni et al., 2012) and one from the United States of America (Bruno et al., 2014).

The variables identified in the articles with greater frequency in relation to CR were, respectively, education (Bruno et al., 2014; Conroy et al., 2010; López-Higes et al., 2013; Marioni et al., 2012; Moral et al., 2013), professional activity (López-Higes et al., 2013; Marioni et al., 2012; Moral et al., 2013; Ribeiro et al., 2013), sociodemographic data: age (Bruno et al., 2014; Moral et al., 2013), gender (female or male) (Moral et al. 2013) and parents' education (López-Higes et al., 2013). The variables reading activity (López-Higes et al., 2013), social engagement (Marioni et al., 2012) and humor (propensity to boredom, loneliness and depression) (Conroy et al., 2010) were also investigated.

The level of education of elderly individuals presented average and standard deviation in one article, which obtained an average number of 16.4 years of study ($SD = 2,6$) (Bruno et al., 2014). Three studies distributed the education of participants in two categories. 688 participants up 9 years of study and 768 had over 9 years of study (Conroy et al., 2010; López-Higes et al., 2013; Ribeiro et al., 2013) and one study did not present the education of participants (Marioni et al., 2012).

Discussion

This study aimed to identify the variables that compose the CR and its influence in cognitive function of elderly individuals. Through evaluation of articles found, it was identified that age, gender, individuals' education, parents' education, professional activity,

reading activity, humor (propensity to boredom, loneliness and depression) and social engagement are considered variables that compose CR.

The main finding of the study highlights education as the most favorable and influential component of CR in cognition of elderly individuals. The variable education was measured in five of six articles included (Bruno et al., 2014; Conroy et al., 2010; López-Higes et al., 2013; Marioni et al., 2012; Moral et al., 2013). Invariably, it was found that education presents a positive relation with cognitive functioning (Bennett et al., 2003; Mellor et al., 2016).

Education has an important function in neuropsychological processing, once that the greater the number of years of education, the better the performance of individuals in neuropsychological tasks (Parente, Scherer, Zimmermann, & Fonseca, 2009). One research identified the variable years of education as an aggravator to cognitive decline in elderly individuals (Amieva et al., 2014), which means that the greater the number of years of education, the lower the risk of developing dementia. The protective effect of education may be explained by the constitution of CR, which delays the cognitive and functional appearance of neurodegenerative dysfunctions (Le Carret et al., 2003).

It was verified in this research that studying protects individuals from cognitive decline. In this sense, education appears as the component of most impact in CR (Silva et al., 2015). It is associated to greater cognitive aging and, in this manner, to a greater CR (Vance et al., 2012).

The variables gender (women and men), age, parents' education and reading activity were also related to CR (Bruno et al., 2014; López-Higes et al., 2013; Moral et al., 2013). Other studies also highlighted that CR is influenced by sociodemographic characteristics (Aartsen, Smits, Van Tilburg, Knipscheer, & Deeg, 2002; Oliveira et al., 2015). When dividing elderly individuals with low CR and cognitive decline, it was found a higher

prevalence of women in both groups; 63.6% and 82.6% respectively (Moral et al., 2013). When approaching differences of gender in cognitive rehabilitation, men and women differ in form and size of some brain structures and in hormone dosage, as estrogen (Sohlberg & Mateer, 2009) and it may also influence in cognitive functioning.

In relation to age, studies highlight that elderly individuals are more vulnerable to cerebral injuries (Sohlberg & Mateer, 2009), which means that cognitive dysfunctions may be more recurrent over the years. A study performed in 1.068 elderly individuals identified that lower age and longer periods of study have a positive impact in cognition (Mellor et al., 2016). Another study also identified that factors as advanced age, female gender, lower education and presence of cognitive impairment are more related to Alzheimer's disease in noninstitutionalized elderly (Geerlings, Jonker, Bouter, Adèr, & Schmand, 1999).

Reading activity was also associated to a better cognitive functioning and to a better quality of life for elderly individuals (Melo, 2013; Silva, 2014). In other studies, reading activity was seen as a stimulating cognitive activity, for example, solving crosswords (Rami et al., 2011) and therefore considered a "cognitive leisure activity" (Lee & Chi, 2015.) Several studies highlight that leisure activities have a positive influence in "cognitive functioning of the elderly. It was identified that a greater number of leisure activity and years of study are protective factors in elderly cognition (Argimon & Stein, 2005).

Another variable that may be positively related to cognition is professional activity (López-Higes et al., 2013; Marioni et al., 2012; Moral et al., 2013; Ribeiro et al., 2013). The practice of professional activities influences cognitive functioning in the sense of being an important variable of CR. The study of Sobral, Pestana and Paul (2014) which aimed to identify the predictor variables of CR from two evaluated groups (one composed of participants with Alzheimer's disease and the other composed of healthy individuals over 65 years old) found that both education and professional activity contributes to CR. A greater

level of cognitive function in elderly individuals with larger periods of study and professional activity was also identified (Vemuri et al., 2014).

Professional activity may influence CR (both years of activity and years of retirement), considering that during retirement professional arrangements, productivity and responsibilities are decreased and stress is reduced. On the other hand, other activities related to family and community may increase (Wang & Schultz, 2010). In this manner, a larger period of exercise of professional activities that demand reasoning and specific abilities contribute to CR, considering the necessity to utilize cognitive capacities.

Social engagement was associated to CR as the direct relation to cognitive functioning (Marioni et al., 2012) Silva and Yassuda (2013) state that individuals who are more involved in social activities may be healthier and present a better quality of life and cognitive functioning. Other studies also highlighted a positive relation between social engagement and a better cognitive performance in elderly (Figueiredo et al., 2013; Vemuri et al., 2014; Wang et al., 2002).

While evaluating lifestyle, cognitive decline and risk of dementia in 2.854 elderly individuals for 20 years, Marioni et al. (2015) observed an association among increase of social, physical and intellectual activities, a slower cognitive decline and a decrease of dementia incidence. Reading activities, education, professional activity and leisure, even when initiated in advanced age, improve cognitive functioning. Studies demonstrate that the adequate stimulation in healthy elderly people improves cognitive functioning (Irigaray, Gomes Filho, & Schneider, 2012; Irigaray & Schneider, 2008).

Humor characteristics as propensity to boredom, loneliness and depression were also identified as inversely associated to cognitive functioning (Conroy et al., 2010.) A study found an association between depression, increase of risks of cognitive decline and Alzheimer's disease in the elderly (Geerlings et al., 2000). The study of Tzang, Yang, Yeh,

Lu and Tsai (2015) states the loneliness and depression are common characteristics in the process of aging. They have a direct impact in cognitive functioning of elderly individuals. It is found in scientific literature that social isolation is significantly associated to decrease in all measures of cognitive functioning.

Loneliness is associated to a poor evocation and late memory. It is observed that, even in individuals with higher education levels, social isolation causes impairment to cognitive functioning. Both loneliness and isolation are associated to poorer cognitive functioning in individuals of advanced age (Shankar, Hamer, McMunn, & Steptoe, 2013). In this manner, through investigation and analysis of the six articles found, it was identified that the active model of CR is composed of the variables gender, age, education, parents' education, professional activity, reading activity, social engagement, humor (propensity to boredom, loneliness and depression) and cognitive functioning

It is believed that CR is composed of many other variables that were not contemplated in this review, due to the existence of other activities that may be beneficial to the cognition of the elderly. Other activities, such as travelling, playing electronic games and practicing physical activity are components to be verified in new studies. Investigate other aspects as routine exams, psychological treatments, use of alcoholic beverage, the type of home and socioeconomic conditions. These suggested variables may influence the humor of the elderly individual and also influence CR.

A limitation of this study was to verify only the variables present in the active model of CR. However, according to the objectives of this review it was opted to verify only the first model, due to the contemplation of the second model, which consider biological, physical and neurological questions that are not in the scope of this review.

References

- Aartsen, M. J., Smits, C. H. M., van Tilburg, T., Knipscheer, K. C. P. M., & Deeg, D. J. H. (2002). Activity in older adults: Cause or consequence of cognitive functioning? A longitudinal study on everyday activities and cognitive performance in older adults. *Journal of Gerontology: Psychological Sciences*, 57(2), 153-162. <https://doi.org/10.1093/geronb/57.2.P153>
- Amieva, H., Mokri, H., Le Goff, M., Meillon, C., Jacqmin-Gadda, H., Foubert-Samier, A., .. & Dartigues, J. F. (2014). Compensatory mechanisms in higher-educated subjects with Alzheimer's disease: a study of 20 years of cognitive decline. *Brain*, 137(4), 1167-1175. 10.1093/brain/awu035. <https://doi.org/10.1093/brain/awu035>
- Argimon, I. I., & Stein, L. M. (2005). Habilidades cognitivas em indivíduos muito idosos: um estudo longitudinal. *Cadernos de Saúde Pública*, 21(1), 64-72. [10.1590/S0102311X2005000100008](https://doi.org/10.1590/S0102311X2005000100008)
- Barulli, D. J., Rakitin, B. C., Lemaire, P., & Stern, Y. (2013). The influence of cognitive reserve on strategy selection in normal aging. *Journal of the International Neuropsychological Society*, 19(07), 841-844. <https://doi.org/10.1017/S1355617713000593>
- Bennett, D. A., Wilson, R. S., Schneider, J. A., Evans, D. A., Mendes de Leon, C. F. , Arnold, S. E., Barnes, L. L., & Bienias, J. L. (2003). Education modifies the relation of AD pathology to level of cognitive function in older persons. *Neurology*, 60(2), 1909-1915. <https://doi.org/10.1212/01.WNL.0000069923.64550.9F>
- Bruno, D., Brown, A. D., Kapucu, A., Marmar, C. R., & Pomara, N. (2014). Cognitive Reserve and Emotional Stimuli in Older Individuals: Level of Education Moderates the Age-Related Positivity Effect. *Experimental Aging Research*, 40(2), 208-223, <https://doi.org/10.1080/0361073X.2014.882212>
- Carvalho, F. C. R., Neri, A. L., & Yassuda, M. S. (2010). Treino de memória episódica com ênfase em categorização para idosos sem demência e depressão. *Psicologia Reflexão e Crítica*, 23(2), 317-323. <https://doi.org/10.1590/S0102-79722010000200014>
- Conroy, R. M., Golden, J., Jeffares, I., O'Neill, D., & McGee, H. (2010). Boredom-proneness, loneliness, social engagement and depression and their association with cognitive function in older people: a population study. *Psychology, Health & Medicine*, 15(4), 463-473. <https://doi.org/10.1080/13548506.2010.487103>
- Contador, I., Bermejo-Pareja, F., Del Ser, T., & Benito-León, J. (2015). Effects of education and word reading on cognitive scores in a community-based sample of Spanish elders with diverse socioeconomic status. *Journal of Clinical and Experimental Neuropsychology*, 37(1), 92-101. <https://doi.org/10.1080/13803395.2014.989819>
- Curado, G. F. D. S. (2013). *Reabilitação Neuropsicológica Grupal de idosos institucionalizados com Declínio Cognitivo sem Demência*. [Masters Dissertation]. Retrieved from <http://repositorio.ismt.pt/handle/123456789/320>.
- Figueiredo, C. S., Assis, M. G., Silva, S. L. A., Dias, R. C., & Mancini, M. C. (2013). Functional and cognitive changes in community-dwelling elderly: Longitudinal study. *Brazilian Journal of Physical Therapy*, 17(3), 297-306. <https://doi.org/10.1590/S1413-35552012005000094>
- Geerlings, M. I., Bouter, L. M., Schoever, R., Beekman, A. T., Jonker, C., Deeg, D. J., ... & Schmand, B. (2000). Depression and risk of cognitive decline and Alzheimer's disease Results of two prospective community-based studies in The Netherlands. *The British Journal of Psychiatry*, 176, 568-575. <https://doi.org/10.1192/bjp.176.6.568>
- Geerlings, M. I., Jonker, C., Bouter, L. M., Adèr, H. J., & Schmand, B. (1999). Association between memory complaints and incident Alzheimer's disease in elderly people with

- normal baseline cognition. *American Journal of Psychiatry*, 156(4), 531-537. <https://doi.org/10.1176/ajp.156.4.531>
- Higgins, T. P. & Green, S. (2008). *Cochrane handbook for systematic reviews of interventions*, 5. Chichester, England: Wiley-Blackwell. (p. 649). <https://doi.org/10.1002/9780470712184.fmatter>
- Irigaray, T. Q., Gomes Filho, I., & Schneider, R. H. (2012). Efeitos de um treino de atenção, memória e funções executivas na cognição de idosos saudáveis. *Psicologia Reflexão Crítica*, 25(1), 182-187. <https://doi.org/10.1590/S0102-79722012000100023>
- Irigaray, T. Q., & Schneider, R. H. (2008). Participação de idosos em uma universidade da terceira idade: motivos e mudanças ocorridas. *Psicologia: Teoria e Pesquisa*, 24(2), 211-216. Retrieved from http://www.scielo.br/scielo.php?script=sci_arttext&pid=S010237722008000200011&lng=pt&tlng=pt. <https://doi.org/10.1590/S0102-37722008000200011>
- Jones, R. N., Manly, J., Glymour, M. M., Rentz, D. M., Jefferson, A. L., & Stern, Y. (2011). Conceptual and measurement challenges in research on cognitive reserve. *Journal of the International Neuropsychological Society*, 17(04), 593-601. <https://doi.org/10.1017/S1355617710001748>
- Le Carret, N., Lafont, S., Letenneur, L., Dartigues, J. F., Mayo, W., & Fabrigoule, C. (2003). The effect of education on cognitive performances and its implication for the constitution of the cognitive reserve. *Developmental Neuropsychology*, 23(3), 317-337. https://doi.org/10.1207/S15326942DN2303_1
- Lee, Y., & Chi, I. (2015). Do cognitive leisure activities really matter in the relationship between education and cognition? Evidence from the aging, demographics, and memory study (ADAMS). *Aging & Mental Health*, 1-10. <https://doi.org/10.1080/13607863.2015.1011081>
- León, I., García, J., & Roldán-Tapia, L. (2011). Construcción de la escala de reserva cognitiva en población española: Estudio piloto. *Revista de Neurología*, 52(11), 653-660.
- Leon, I., García-García, J., & Roldan-Tapia, L. (2014). Estimating cognitive reserve in healthy adults using the Cognitive Reserve Scale. *PloS one*, 9(7), e102632. <https://doi.org/10.1371/journal.pone.0102632>
- Lezak, Howieson, Bigler e Tranel. (2013). *Neuropsychological Assessment*. 5ªed. Oxford University. ING.
- López-Higes, R., & Rubio-Valdehita, S. (2014). Variabilidad em la comprensión gramatical de mayores sanos: diferencias em función de la reserva cognitiva. *Revista de Logopedia, Foniatría y Audiología*, 34(2), 51-59. <https://doi.org/10.1016/j.rlfa.2013.11.004>
- López-Higes, R., Rubio-Valdehita, S., Prados, J. M., & Galindo, M. (2013). Reserva cognitiva y habilidades lingüísticas em mayores sanos. *Revista Neurologia*, 57, 97-102.
- Malloy-Diniz, L. F., Fuentes, D., & Cosenza, R. M. (2013). *Neuropsicologia do envelhecimento: uma abordagem multidimensional*. Artmed Editora.
- Marioni, R. E., Proust-Lima, C., Amieva, H., Brayne, C., Matthews, F. E., Dartigues, J. F., & Jacqmin-Gadda, H. (2015). Social activity, cognitive decline and dementia risk: a 20-year prospective cohort study. *BMC Public Health*, 15(1), 1. <https://doi.org/10.1186/s12889-015-2426-6>
- Marioni, R. E., Van den Hout, A., Valenzuela, M. J., Brayne, C., & Matthews, F. E. (2012). Active cognitive lifestyle associates with cognitive recovery and a reduced risk of cognitive decline. *Journal of Alzheimer's Disease*, 28(1), 223-230. <https://doi.org/10.3233/JAD-2011-110377>

- Mellor, D., Lewis, M., McCabe, M., Byrne, L., Wang, T., Wang, J., ... & Xiao, S. (2016). Determining Appropriate Screening Tools and Cut-Points for Cognitive Impairment in an Elderly Chinese Sample. *Psychological assessment*. <https://doi.org/10.1037/pas0000271>
- Moral, J. C. M., Rodríguez, T. M., Galán, A. S. (2013). Comparación entre ancianos anos con alta y baja reserva cognitiva y ancianos con deterioro cognitivo. *Universitas Psychologica*, 12(1), 73-80.
- Nucci, M., Mapelli, D., & Mondini, S. (2012). Cognitive Reserve Index questionnaire (CRIq): a new instrument for measuring cognitive reserve. *Aging Clinical Experimental Research*, 24(3). <https://doi.org/10.3275/7800>
- Oliveira, E. M. D., Silva, H. S. D., Lopes, A., Cachioni, M., Falcão, D. V. D. S., Batistoni, S. S. T., ... & Yassuda, M. S. (2015). Advanced Activities of Daily Living (AADL) and cognitive performance among older adults. *Psico-USF*, 20(1), 109-120. <https://doi.org/10.1590/1413-82712015200110>
- Opdebeeck, C., Nelis, S. M., Quinn, C., & Clare, L. (2015). How does cognitive reserve impact on the relationships between mood, rumination, and cognitive function in later life? *Aging & Mental Health*, (ahead-of-print), 1-8. <https://doi.org/10.1080/13607863.2014.962005>
- Parente, M. A. D. M. P., Scherer, L. C., Zimmermann, N., & Fonseca, R. P. (2009). Evidências do papel da escolaridade na organização cerebral. *Neuropsicologia Latinoamericana*, 1(1), 72-80.
- Prince, M., Acosta, D., Ferri, C. P., Guerra, M., Huang, Y., Rodriguez, J. J. L., ... & Acosta, I. (2012). Dementia incidence and mortality in middle-income countries, and associations with indicators of cognitive reserve: a 10/66 Dementia Research Group population-based cohort study. *The Lancet*, 380(9836), 50-58. [https://doi.org/10.1016/S0140-6736\(12\)60399-7](https://doi.org/10.1016/S0140-6736(12)60399-7)
- Rami, L., Valls-Pedret, C., Bartrés-Faz, D., Caprile, C., Solé-Padullés, C., Castellví, M., ... & Molinuevo, J. L. (2011). Cuestionario de reserva cognitiva. Valores obtenidos em población anciana sana y com enfermedad de Alzheimer. *Revista de Neurología*, 52(4), 195-201.
- 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. <https://doi.org/10.1093/occmed/kqt115>
- Scarmeas, N., Luchsinger, J. A., Schupf, N., Brickman, A. M., Cosentino, S., Tang, M. X., ... Stern, Y. (2009). Physical activity, diet, and risk of Alzheimer disease. *Jama*, 302(6), 627-637. <https://doi.org/10.1001/jama.2009.1144>
- Shankar, A., Hamer, M., Mc Munn, A., & Steptoe, A. (2013). Social isolation and loneliness: relationships with cognitive function during 4 years of follow-up in the English Longitudinal Study of Ageing. *Psychosomatic Medicine*, 75(2), 161-170. <https://doi.org/10.1097/PSY.0b013e31827f09cd>
- Silva, A. M., Cavaco, S., Moreira, I., Bettencourt, A., Santos, E., Pinto, C., ... & Teixeira-Pinto, A. (2015). Cognitive reserve in multiple sclerosis: Protective effects of education. *Multiple Sclerosis Journal*, 21(10), 1312-1321. <https://doi.org/10.1177/1352458515581874>
- Silva, H. S. D., & Yassuda, M. S. (2013). Engajamento social, lazer e envelhecimento cognitivo. *Neuropsicologia do envelhecimento: Uma abordagem multidimensional*, 428-437.
- Silva, P. C. D. (2014). A influência do efeito priming e estimulação cognitiva para a leitura oral de textos em idosos com Doença de Alzheimer. *Revista do Sell*, 4(1), 1-21. <https://doi.org/10.1001/jama.2009.1144>

- Simon, J., Gilsoul, J., & Collette, F. (2015). The executive functioning in normal aging: Impact of the cognitive reserve. Retrieved from <http://hdl.handle.net/2268/185655>.
- Sobral, M., Pestana, M. H., & Paúl, C. (2014). A importância da quantificação da reserva cognitiva. *Revista Portuguesa de Enfermagem de Saúde Mental*, (12), 51-58.
- Sohlberg, M. M., & Mateer, C. A. (2009). *Reabilitação Cognitiva*. São Paulo, SP: Livraria Santos Editora.
- Stern, Y. (2002). What is cognitive reserve? Theory and research application of the reserve concept. *Journal of the International Neuropsychological Society*, 8, 448–460.
- Stern, Y. (2012). Cognitive reserve in ageing and Alzheimer's disease. *The Lancet Neurology*, 11(11), 1006-1012. [https://doi.org/10.1016/S1474-4422\(12\)70191-6](https://doi.org/10.1016/S1474-4422(12)70191-6)
- Stern, Y. (2016). An approach to studying the neural correlates of reserve. *Brain Imaging and Behavior*, 1-7. <https://doi.org/10.1007/s11682-016-9566-x>
- Tzang, R. F., Yang, A. C., Yeh, H. L., Liu, M. E., & Tsai, S. J. (2015). Association of Depression and Loneliness with Specific Cognitive Performance in Non-Demented Elderly Males. *Medical science monitor: international medical journal of experimental and clinical research*, 21, 100. <https://doi.org/10.12659/MSM.891086>
- Vance, D. E., Kaur, J., Fazeli, P. L., Talley, M. H., Yuen, H. K., Kitchin, B., & Lin, F. (2012). Neuroplasticity and successful cognitive aging: a brief overview for nursing. *The Journal of neuroscience nursing: journal of the American Association of Neuroscience Nurses*, 44(4). <https://doi.org/10.1097/JNN.0b013e3182527571>
- Vemuri, P., Lesnick, T. G., Przybelsi, S. A., Machulda, M., Knopman, D. S., Mielke, M. M., Roberts R. O., Geda Y. E., Rocca W. A., Petersen R. C., & Jack Jr. C. R. (2014) Association of lifetime intellectual enrichment with cognitive decline in older population. *JAMA Neurology*, 71(8), 10-24. <https://doi.org/10.1001/jamaneurol.2014.963>
- Wang, H. W., Karp, A., Winblad, B., & Fratiglioni, L. (2002). Late-life engagement in social and leisure activities is associated with a decreased risk of dementia: A longitudinal study from the Kungsholmen Project. *American Journal of Epidemiology*, 155(12), 1081-1087. <https://doi.org/10.1093/aje/155.12.1081>
- Wang, M, Shultz, K. (2010). Employee retirement: a review and recommendations for future investigation. *Journal of Management*, 36, 172–206. <https://doi.org/10.1177/0149206309347957>
- Ward, D. D., Summers, M. J., Saunders, N. L., & Vickers, J. C. (2015). Modeling cognitive reserve in healthy middle-aged and older adults: the Tasmanian Healthy Brain Project. *International Psychogeriatrics*, 27(04), 579-589. <https://doi.org/10.1017/S1041610214002075>
- Zahodne, L. B., Stern, Y., & Manly, J. J. (2015). Differing effects of education on cognitive decline in diverse elders with low versus high educational attainment. *Neuropsychology*, 29(4), 649. <https://doi.org/10.1037/neu0000141>

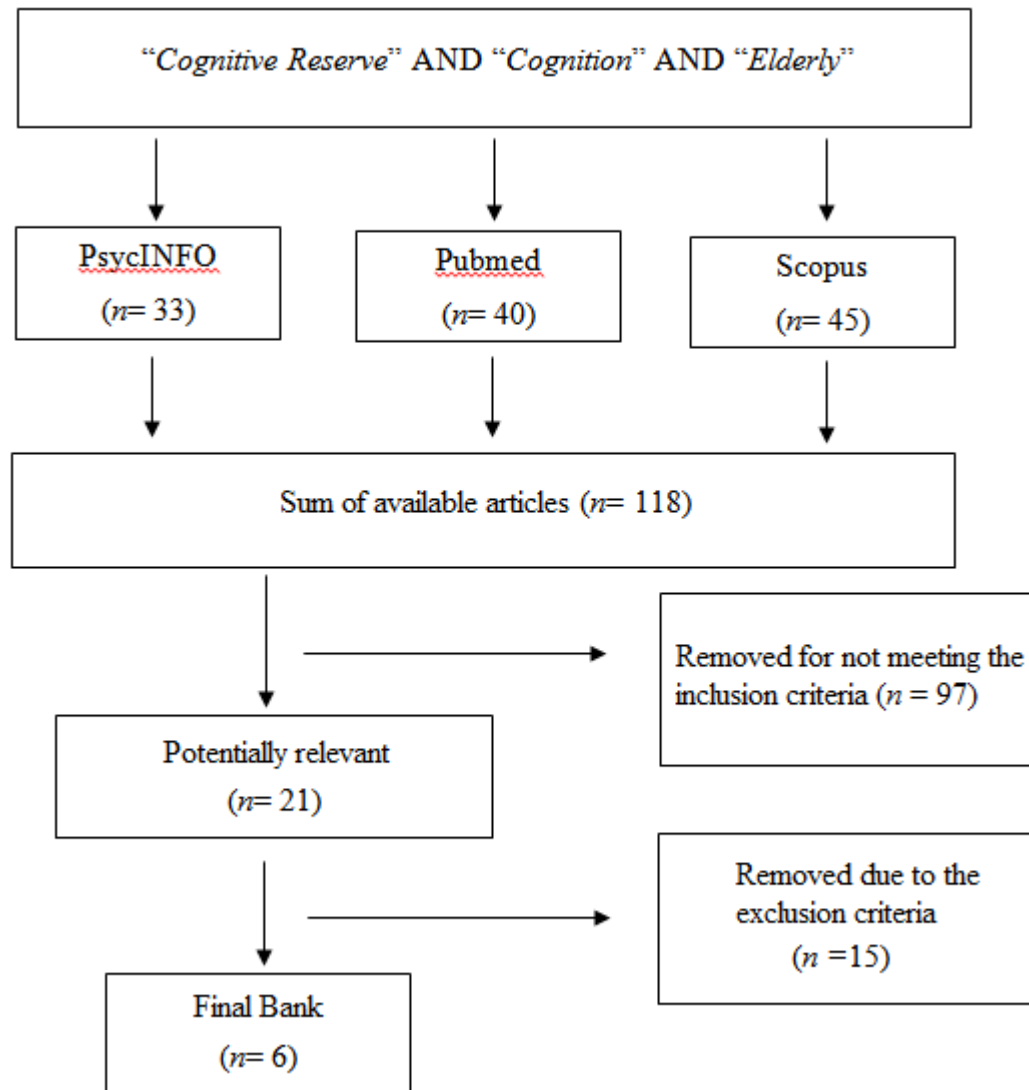


Figure 1. Fluxogram about the process of obtaining articles.

Table 1 Information about articles found

Author, year and country	N, gender and age	Education	Objective	Instruments	Main Findings
Conroy et al. (2010), United Kingdom.	N = 749	N = 404 up 9 years of study.	To examine the relation of the variables: education, humor (propensity to boredom, loneliness and depression) in cognitive functioning.	FDS	The variables propensity to boredom, loneliness and depression were related to worse cognitive functioning.
	W = 399 M = 350	N = 345 over 9 years of study.		AMT HADS Depression Subscale	Fewer years of education were associated with a decrease in cognitive functioning.
	Age			Structured Interview	
	65–102 Average = 74,2				
Marioni et al. (2012), United Kingdom.	N = 12.492	Nonexistent datum	To verify the association between the variables education, professional activity and social engagement in cognitive functioning.	MMSE	High indexes in the variables education, professional activity and social engagement are associated with a better cognitive functioning.
	W = 7460			CLS	
	M = 5032				
	Age ≥ 65 Average = 75,2 (DP = 6,9)				
López-Higes et al. (2013), Spain.	N = 83	N = 50 up 9 years of study.	To determine the variables that influence the cognitive reserve and their relation to cognitive functioning.	ESB	The variables education, parental education, professional activity and reading activity are related to cognitive functioning.
	W = 44	N = 33 over 9 years of study.		MMSE	
	M = 39			CRC	
	Age = de 60 a 75 Average age = 64,8 (DP = 4,3)			BNT FDS	

Table 1 (continued)

Author, year and country	N, gender and age	Education	Objective	Instruments	Main Findings
Moral et al. (2013), Espain.	N = 178 W = 101 M = 77 Age ≥ 65 years old Average = 74,3 (DP = 6,9)	N = 111 N = 37 no studies N = 36 with primary education N = 14 with secondary education N = 24 with higher education	To compare elderly with high and low cognitive reserve. In particular, the variables vocabulary, education and professional activity.	WAIS III – subtest vocabulary MMSE FDS	When comparing the two groups (high and low cognitive reserve), were found significant differences among all variables: age, gender, education and professional activity.
Ribeiro et al. (2013), Brazil	N = 624 W = 436 M = 188 Age ≥ 65	N = 234 up 9 years of study. N = 390 over 9 years of study.	To investigate the association between the variable professional activity and cognitive functioning.	MEEM Semi structured interview	The complexity of professional activity is associated with improved cognitive functioning.
Bruno et al. (2014), United States of America.	N = 84 Age: 60–88 Average = 75,1 (DP = 6,6)	10 to 21 years of study. Average = 16,4 (DP = 2,6)	To investigate whether cognitive reserve is related to age and cognitive functioning.	MERI TMT MMSE HDS	Education has a moderating effect between age and cognitive functioning. Elderly individuals with more years of education remember more words compared to elderly individuals with fewer years of education.

W = Women; M = Men; Sociodemographic Data Sheet (SDS); Memory Evaluation Research Initiative (MERI); Trail Making Test (TMT); Mini-Mental State Examination (MMSE); Abbreviated Mental Test (AMT); Hospital Anxiety and Depression (HADS); Cognitive Lifestyle Score (CLS); ECCO Senior de Boston (ESB); Cuestionario de Reserva Cognitiva (CRC); Boston Nomination Test (BNT); Wechsler Adult Intelligence Scale (WAIS-III); Hamilton Depression Scale (HDS)

6 Seções Empíricas

Esta seção é composta por dois artigos empíricos resultantes da investigação longitudinal realizada (etapas I e II). Juntamente, visam responder aos objetivos geral e específicos propostos inicialmente.

6.1 Assessing cognitive changes in non-clinical older adults: A 4-year longitudinal study in Brazil

Artigo submetido a Revista *Aging and Mental Health* no dia 08 de janeiro de 2019.

Abstract:

Several biopsychosocial changes in individuals in life-span might be found, resulting in a decline of cognitive abilities. In this way, the aim of this study was to compare cognition in non-clinical elderly in Brazil for a four-year period, as well as to examine what variables may explain cognitive function variations detected during this time. For this purpose, a longitudinal study with the participation of 64 elderly Brazilians, from 2013 to 2017. Socio-demographic information, as well as the following tests were employed: the Mini-Mental State Examination (MMSE), the Wechsler Adult Intelligence Scale (WAIS) - 3rd Edition - Digital Symbol-Coding subtests, the Verbal Fluency Test (animal category), the Rey Auditory-Verbal Learning Test, the Beck Anxiety Inventory (BAI), and the Geriatric Depression Scale 15-item version (GDS-15). In order to compare cognitive variables, the Wilcoxon signed-rank test for repeated measures was used. Temporal comparisons of nominal variables were carried out using McNemar's chi-square tests for matched pairs. Finally, a multiple linear regression and correlation analyses were carried out, using the scores of participants' cognitive performance variation scores (Δ) as dependent variables, while the others were used as independent variables. Global cognitive function, delayed verbal episodic memory and processing speed experienced significant decline in four years. The main predictor for cognitive performance variations in elderly persons was the symptomatology of anxiety.

Keywords: elderly persons, cognition, normal aging, longitudinal.

Introduction

The aging process is linked to several normative changes in people's biological, psychic and social conditions, being age-related cognitive decline one of the most frequent causes of disability in the elderly (Courtney-Long et al., 2015; Fan et al., 2018). These changes may lead, not only to a decline in cognitive performance (Almeida, 2012; Fortes-Burgos, Neri, & Cupertino, 2008; Yamada, Landes, Mimori, Nagano, & Sasaki, 2015), it also in a decrease in people's learning abilities, as well as a decrease in their ability to process new information. Furthermore, changes may occur in the performance of memory, attention, information processing, reasoning, language, and executive functions, in addition to others (Almeida, 2012; Tsai et al., 2016), even in normal aging processes (Moret-Tatay, et al., 2017).

With regards to cognitive functions, the memory commitment level of an elderly person may be related to his/her education level, attention level, emotions experienced during life as well as individual attributes (Kuns, Paulino, & Aprile, 2015). Moreover, literature indicates that having a more active lifestyle also leads to improved cognitive function in elderly persons (Murphy, Spillane, Cully, Navarro-Pardo, & Moret-Tatay, 2016; Stern, 2017). Physical exercise and intellectual activities have been associated with improved performance in activities that measure the processing speed, working memory and executive function of elderly persons (Carral, Curras, Pérez, & Suárez, 2017; Murphy, & Cunningham, 2012; Murphy, O'sullivan, & Kelleher, 2014). These activities may also contribute to an increase in processing speed levels and reasoning skills in this population (Engeroff, Ingmann, & Banzer, 2018; Sanchez-Lopez et al., 2018; Pedroso et al., 2018). That is, an active routine may contribute to mental and cognitive health, as well as to longevity (Araújo, 2017). In view of the changes occurring in normal aging processes - which take place not only due to biological

and genetic aspects, but also because of individual lifestyle choices (Fechine & Trompieri, 2015), it is important to identify the changes in elderly persons' cognitive function throughout the years.

According to Baudouin, Isingrini, & Vanneste, (2018), one of the variables of interest is the speed of information processing, which is a crucial ability in life-span, as it enables the efficient operation of higher order cognitive functions (such as reasoning and is implicated in various models of cognitive decline). Two of the most widespread theories in this field are the executive dysfunction and cognitive slowing down (Luszcz & Lane, 2008; Salthouse, 1996). The first one stipulates that the decline in cognition is mainly due to decreased executive functioning, which has been supported with studies involving results in the frontal lobe (a brain area especially sensitive to aging). On the other hand, it is considered that speed processing decreases in the elderly, and as a result, time to perform operations is reduced, leading to less efficiency in this cognitive processing. Lastly, one underlying variable to cognition, that might add variability and a poorer performance, is the level of anxiety that an older person might suffer. More precisely, the bidirectional nature of this association has been reported in the literature, as the presence of anxiety has been linked to a poorer cognitive performance in the elderly (Beaudreau & O'Hara, 2008). Research in the field has been focused in the comparison between cognitively impaired older adults and intact older individuals (Hwang, Masterman, Ortiz, Fairbanks, & Cummings, 2004; Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010). However, and according to Beaudreau & O'hara (2009), a limitation of these studies is that they typically employ trait or personality measures rather than anxiety measures. Furthermore, this variable might be of interest for visible cognitive process such as memory. Several authors (Evans, Charness, Dijkstra, Fitzgibbons, & Yoon, 2018; Moon, Jang, & Jeong; 2015) pointed out that anxiety

disorders might be linked to a decrease in verbal episodic memory. Thus, a better understanding of this relationship of anxiety and speed processing in the elderly, may elucidate it's in the aging process.

This research aims to examine which variables may be associated with the cognitive performance in the elderly. Studies involving this population are important and even suggested by literature. However, there are few longitudinal studies developed with Brazilian elderly persons, especially non-clinical studies. The need for studies with this outline, which intend to assess the cognitive performance of elderly persons during a given period to time, must be highlighted (Farina, 2015; Lopes, 2014). Hence, the main objective was to evaluate the cognitive performance exhibited by elderly persons during a four-year period. Furthermore, we sought to study if age, education level, intellectual activities, physical exercise, symptoms of depression and anxiety may explain variations the cognitive performance of elderly persons in a four-year period. Finally, the role of speed processing and anxiety is examined in terms of current models in cognition. In a theoretical level, results might help to implement current models of cognition in the field. In an applied level, results are of interest for a particular population such as the Brazilian one.

Method

Outline

This is a study with a longitudinal outlining, which estimated the temporal effects of various variables, refining the level of inference about the influence of such variables. The assessments were carried out on two occasions, four years apart from each other, in 2013 and in 2017.

Participants

In stage I, in 2013, 108 elderly persons were assessed. In stage II, in 2017, 64 elderly persons were assessed. Initially, all participants were contacted by telephone. The reasons for non-participation in stage II were the following: the phone number information given was out-of-date or disconnected ($n = 20$), the individual did not want to participate in stage II ($n = 13$), the individual started to show symptoms of dementia, according to family members ($n = 4$), the individual moved to another city ($n = 4$) or was traveling during the collection period ($n = 3$); in total, 44 participants did not take part in stage II.

With regard to socio-demographic information, most participants - 81.3% - were female ($n = 52$). The average number of years in school was 12.67 years ($DP = 5.2$), with an average of 30.78 years of formal professional activities ($DP = 12.59$) and 15.86 years in retirement ($DP = 9.64$). Regarding the age of the participants, the average age in stage I was 69.17 years old ($DP = 6.12$, range: from 60 to 83), while in stage two it was 73.19 years old ($DP = 6.12$, range: from 64 to 87).

Instruments

Clinical and socio-demographic form: structured interview aiming at assessing the sex, age, marital status, education level, profession, years in retirement, intellectual activities (reading, crossword puzzles, learning other languages and use of electronic devices, such as computers, tablets and smartphones), physical activities, as well as symptoms of anxiety and depression.

Mini-Mental State Examination (MMSE): a screening aid that allows for a global view of a patient's cognitive function. Scores may range from zero to one, out of 30 points in total (Bertolucci, Brucki, Campacci, & Juliano, 1994; Folstein, Folstein, & McHugh 1975).

The cut-off numbers used in this study were the following: 21 points for the group of illiterate people; 22 points for people with low education level, 23 for people with average education level, and 24 for people with high education level. These values were based on a study by Kochhann et al. (2010) carried out with elderly persons in Southern Brazil. Cronbach's alpha was 0.80 (Santos, Cerchiari, Alvarenga, Faccenda, & Oliveira, 2010).

Wechsler Adult Intelligence Scale (WAIS) - 3rd Edition; Digital Symbol-Coding subtests: The Coding subtest mainly assesses processing speed. As for the Digital Symbol subtest, it assesses attention, immediate memory and working memory. With regard to internal consistency, Cronbach's alpha was 0.84 for the Digital Symbols subtest concerning people aged 60 to 89 (Nascimento, 2004; Wechsler, 2004).

Verbal Fluency Test (animal category): it is a task that assesses components of executive functions, such as verbal fluency, inhibition and word generation. It consists of asking participants to say, as quickly as possible, the name of several animals in the course of one minute (Strauss, Sherman, & Spreen, 2006). Cronbach's alpha was 0.74 (Santos, 2009).

Rey Auditory-Verbal Learning Test (RAVLT): it is composed of two word lists, with 15 word each. The first list is repeated five times (A1, A2, A3, A4, and A5) so that participants memorize the largest number of words heard. Afterwards, a distracter list is read (B), followed by a recollection of the first list (A6). After 20-30 minutes, participants are asked to remember the first list (A7) (Boake, 2000; Rey, 1958). A1 assesses immediate memory, and the A1-A5 sum assesses the summary of the learning process; as for A6, it assesses immediate recollection, while A7 assesses delayed recollection (Malloy-Diniz, Fuentes, Mattos, & Abreu, 2018). In Brazil, the normative standards for the test have been developed for an age range going from 16 to 89 years old (Malloy-Diniz, Lasmar, Gazinelli,

Fuentes, & Salgado, 2007). The internal consistency of the instrument varied from 0.80 to 0.95 (Mitrushina, 1999).

Beck Anxiety Inventory (BAI): it assesses symptomatology intensity in terms of anxiety by means of a scale of symptoms, comprised of 21 items, on which subjects must indicate how they felt in the last two weeks by using a four-point scale. In this study, we used the cut-off points suggested by the manual, which are subdivided as follows: 0 to 10: minimal symptoms, 11 to 19: mild, 20 a 30: moderate, and 31 to 63: serious. With regard to internal consistency, Cronbach's alpha was 0.90 (Cunha, 2001; Leite et al., 2012).

Geriatric Depression Scale 15-item version (GDS-15): it consists of a 15-question questionnaire used to assess the intensity of depression symptoms. It is comprised of two answer options: yes and no (Yesavage et al., 1983). For scores lower than five, the absence of symptoms is declared and, for scores above five, the presence of depression symptoms is attested. The scale presented a Cronbach's alpha of 0.81 (Almeida & Almeida, 1999; Paradela, Lourenço, & Veras, 2005).

Ethical Procedures

Firstly, the study project was forwarded to the School of Health Science's Scientific Commission and submitted to Ethics Committee of PUCRS's School of Psychology for approval under No. 63196816.8.0000.5336. After agreeing to participate in the study, the participants signed an Informed Consent Form. The ethical procedures are based on the Guidelines and Standards Regulating Research Involving Human Beings (Resolution No. 510/16 and Resolution No. 466/12 by the National Health Council).

Data Collection Procedures

In both stages (I and II), the assessment was carried out by a psychologist and Psychology students, who have been previously trained. The instruments were applied in a room inside a psychological treatment clinic, as well as in rooms belonging to the Graduate Program in Psychology, which were made available for collecting information. The elderly persons were assessed individually at a session that lasted approximately two hours.

The order in which the tests were applied was the following: socio-demographic form, cognitive tests (MMSE, RAVLT, Coding, Digital Symbol, RALVT recollection, Verbal Fluency (Animals) and scales of symptoms of anxiety and depression. Participants with any indication of loss or need for treatment were sent over to PUCRS's Psychology Research and Treatment Service Center.

The results were given back in April 2018, when the elderly persons participating in the study were invited to go to the institutions where their information was collected for the results. The return of these results was executed with a group setting, with an average number of 10 elderly persons per group/meeting. At that time, the global results of the study were presented and a report with the main results of each individual was provided. Most participants received their results in person ($n = 42$) while the remaining participants ($n = 22$) received their results on the phone.

Data Analysis Procedures

The univariate distribution of the variables under investigation was estimated by means the Shapiro–Wilk test, adopting a significance level of 0.5. Once it has been assessed that some variables had an asymmetric distribution, the subsequent hypothesis tests were carried out using non-parametric analyses. In order to compare cognitive variables in the two

assessment instances, we used the Wilcoxon signed-rank test for repeated measures. Temporal comparisons of nominal variables were carried out using McNemar's chi-square tests for matched pairs. The significance level adopted in this study was $\alpha = 0.05$.

Subsequently, correlation analyses were carried out in order to verify the association level between variables. Afterwards, multiple linear regression analyses were carried out, using the scores of participants' cognitive performance variations (Δ) in stages I and II as dependent variables (DV), while socio-demographic information and symptoms of anxiety and depression were used as independent variables (IV), in order to investigate what variables may explain cognitive function variations detected in elderly persons in this four-year interval. For collinearity purposes, we only used the measure of one of the collection stages for the following variables: age (stage II) and education level (stage I). For all other socio-demographic variables, we took into account the amounts shown in stage I and II: learning a second language, reading, doing crossword puzzles, use of electronic devices, exercising, symptoms of anxiety and depression.

The estimation method used was the stepwise least squares method, which selects the main predictors in a progressive way, taking into account the criterion of statistical difference with regard to the previous model. The standardized and non-standardized progression weights were analyzed, as well as confidence intervals, statistical significance and variance explained by the model.

Results

Firstly, socio-demographic variables were examined in both stages I and II. In this way, McNemar's chi-square test provided the results of the comparison made between stages.

However, only the physical activity variable showed significant increase in four years. The results of this analysis are presented in Table 1.

Insert Table 1 here.

By comparing the performance shown by the elderly persons in the cognitive tests in stages I and II, it was possible to see a decline in global cognitive function (MEEM), in delayed verbal episodic memory (RAVLT A7), and in processing speed (Coding). Significant differences in the performance shown by elderly persons in the other cognitive tests were not found. The average of the scores and the comparison between stages I and II is depicted on Table 2.

Insert Table 2 here.

Lastly, Table 3 depicts the explanatory models for variations in participants' cognitive performance when comparing stages I and II. The predictors for each variable referring to variations in participants' cognitive performance were the following: the predictors for global cognitive function were symptoms of anxiety and learning a second language, which together accounted for 29% of MEEM's performance variations. The predictor for processing speed was only education level, with a 29% explanatory power in the Coding subtest. The predictors for immediate verbal episodic memory were crossword puzzles and physical exercise, which together accounted for 16.9% of RAVLT A1's performance, and the predictor for delayed verbal episodic memory was the symptomatology of anxiety, with a 6.9% explanatory power in RAVLT A7. There were no predictors for the remaining cognitive components - attention

and memory (immediate and working memory) (Digital Symbol) and verbal fluency, word generation and inhibition (Verbal Fluency).

Insert Table 3 here.

Discussion

The main objective of this article was to examine cognitive variations in the elderly through a non-clinical sample during four-year term. Furthermore, we sought to investigate if age, education level, intellectual activities, physical exercise, symptoms of depression and anxiety may explain variations the cognitive performance of elderly persons in period.

Results indicated as the main changes in the cognitive function of elderly persons a decrease in global cognitive function, in processing speed, as well as in delayed verbal episodic memory. Despite these differences being significant on a statistical level, it is worth stressing that a decrease in the scores does not indicate cognitive decline, given the fact that, even with such decrease, the sample average remains within expected levels for the age range in question, therefore not characterizing a clinical condition (Irigaray & Schneider, 2012). However, these results show a trend in cognitive decline as years go by, even in elderly persons in a non-clinical situation (Deary et al., 2009).

The decline in global cognitive function, indicated by the comparison between stages I and II, may have occurred due to the natural physiological process of aging (Faber, Scheicher, & Soares, 2017; Rebok, 2014). Other studies have also indicated a decrease of performance in cognitive tracking tests, with a longitudinal assessment (Li, Zhu, Qiu, & Zeng, 2017; Rawtaer et al., 2017). The cause of decrease in cognitive abilities may be various, complex, isolated or

working in combination. This condition may occur due to mood conditions, which represents even an early sign of dementia (Soares & Rossignoli, 2014).

In this present study, it was possible to verify that lower levels of anxiety and learning another language are predictors of an improved global cognitive performance of elderly persons within a four-year period. High levels of anxiety, as well as the presence of psychic suffering, have been identified as having a connection with cognitive undermining in elderly persons (Leung, Cheng, Yu, Yiend, & Lee, 2018; Sinoff, & Werner, 2003). Another study has pointed out that learning another language is connected with an improvement in an individual's cognitive functions, since it has strengthened their cognitive abilities and increasing their attention skills, as well as memory, control, inhibition and other executive functions (Bialystok, 2009).

The processing speed has also experienced a significant decrease in the sample group, supporting literature findings that indicate a decrease in this element as the process of aging occurs (Lu, Chan, Fung, & Lan, 2016; Nouchi, Saito, Nouchi, & Kawashima, 2016). In this study, the only variable that revealed itself as a predictor for processing speed was the education level, indicating that the more years an elderly person studied, the better is their processing speed. Oliveira et al. (2017) verified that more years of study are positively associated with improved cognitive performance in elderly persons (Oliveira et al., 2017). Another study concluded that more years of study are associated with improved processing speed in elder persons with chronic illnesses (Ihle et al., 2018).

The results of this study indicate a decrease in the delayed verbal episodic memory scores, whose only predictors is the symptomatology of anxiety. The findings of a study carried out by Moon, Jang e Jeong (2015) support these results, pointing towards a relationship between anxiety disorders and a decrease in verbal episodic memory. Moreover,

elderly persons with global cognitive decline as well as episodic memory decline may present a greater risk of developing Alzheimer's disease (Charchat-Fichman, Caramelli, Sameshima, & Nitrini, 2005).

Despite the decline in some cognitive components (global cognitive function, delayed verbal episodic memory and processing speed), other remained stable (attention, immediate verbal episodic memory, immediate memory, working memory, executive functions: verbal fluency, inhibition and word generation). Thus, these results suggest that for four years, elderly persons have, in general, preserved these functions. This is of interest in terms of slowing down theoretical models, as executive functions seem to be preserved in this population, supporting the classical theory of cognitive slowing down for this non-clinical population.

Nevertheless, a large body of research in literature describes a decrease in executive functions in elderly persons (Lopes, Bastos, & Argimon, 2017; Monica, Johnsen, Atzori, Groeger, & Dijk, 2018), which is expected as they age, and more precisely, in clinical population. In spite of this, this study has found no significant differences in executive functions (verbal fluency, inhibition, word generation and flexibility), that is, elderly persons kept these components in stable levels throughout the four-year period. A hypothesis to explain the stability of such cognitive functions (attention, immediate verbal episodic memory, immediate memory, working memory, executive functions: verbal fluency, inhibition and word generation) is the substantial increase in habits such as exercising in the last four years. It is believed that this factor may have helped in maintaining cognitive functions on stable levels, as exercising may increase brain plasticity and neurogenesis capacity, contributing positively to a given individual's cognitive function (Cotman & Berchtold, 2002).

With regard to attention capacity, there were no significant statistical differences when comparing the two instances analyzed, results that are different from the ones found by Arsic et al. (2015), who has pointed to a decrease in cognition and in attention quality during the aging process. In this sample group, the elderly persons have preserved their attention capacity and the hypothesis that may explain this is that, throughout the years, they have strengthened protective elements, such as physical and intellectual activities (Argimon, 2006; Vaportzis & Gow, 2018).

The elderly persons assessed showed a stable working memory, supporting another study that assessed elderly persons with an active lifestyle (Carral et al., 2017). Participants have also maintained stable scores in cognitive tasks that assessed their immediate memory as well as their immediate verbal episodic memory. Doing crossword puzzles and exercising have been identified as predictors for immediate verbal episodic memory, indicating that by doing these activities, there is an improvement in immediate verbal episodic memory in elderly persons, which was a result also found by Lachman et al. (2010). Another study also found an association between exercising & intellectual activities and an improvement in elderly persons' memory performance (Oliveira, Pena, & Silva, 2015).

Lastly, the relationship between elderly persons exercising and improved cognitive function has been extensively reinforced in examples found in literature (Engeroff, Ingmann, & Banzer, 2018; Kirk-Sanchez & McGough, 2014; Nouchi et al., 2014; Pedroso et al., 2018; Shih, Paul, Haan, Yu, & Ritz, 2018).

Exercising, especially activities such as yoga/meditation, contributes positively to improved attention performance in elderly persons (Gothe, Kramer, & McAuley, 2017), and it may be deemed a protective aspect in terms of executive functions (Assed, Carvalho, Rocca, & Serafim, 2016; Souza, Porto, Souza, & Silva, 2016). Despite the fact that only the physical

activity attribute reached a statistically significant increase in the second stage of this study, the practice of intellectual activities (reading, crossword puzzles, and electronic devices, learning another language) remained stable. Another study observed that the use of technological devices benefited episodic memory and executive functions in elderly persons (Basak & Qin, 2018). Such cognitive stability found in these two moments of this study may be explained by the increase in the frequency of physical activities carried out by elderly persons and by the continuance of intellectual activities (Vaportzis & Gow, 2018).

These results are of interest for both theoretical and applied levels. More precisely, regarding policies and interventions across largely driven by contextual factors in Brazil. We conclude that participants had a decrease in cognitive performance during this four-year period, but there were no changes in clinical conditions, which characterizes a non-pathological decrease. However, we believe that these elderly persons may experience cognitive decline in the future if alterations remain at this speed.

As a limitation to this study, we may mention a sample loss that was bigger than the expected percentage, which was 15% (Argimon & Stein, 2005). Furthermore, we can suppose that the elderly persons who decided to participate in university studies have a more active profile, characterized by the performance of activities which are inherently protective of cognitive functions. Despite we expected cognitive declines in some elements of the sample, the participants in this study remained functional and active subjects. Other studies also investigated the benefits of an active lifestyle in elderly persons, the influence of education levels, the importance of leisurely and physical activities as variables that operate in order to protect an individual's cognition and well-being, with regard to longevity (Santos, Andrade, & Bueno, 2009; Souza, Porto, Souza, & Silva, 2016).

References

- Almeida, O. P., & Almeida, S. A. (1999). Confiabilidade da versão brasileira da Escala de Depressão em Geriatria (GDS) versão reduzida. *Arquivos de Neuropsiquiatria*, 57(2B), 421-6.
- Araujo, C. M. N. F. D. (2017). *Associação entre atividade física, aptidão física e mortalidade em idosos da comunidade: estudo Fíbra*. Universidade Estadual de Campinas, UNICAMP. [Master Dissertation]. Retrieved from <http://repositorio.unicamp.br/jspui/handle/REPOSIP/330617>
- Argimon, I. I. L. (2006). Aspectos cognitivos em idosos. *Avaliação Psicológica*, 5(2), 243-245.
- Argimon, I. I., & Stein, L. M. (2005). Habilidades cognitivas em indivíduos muito idosos: um estudo longitudinal. *Cadernos de Saúde Pública*, 21(1), 64-72. doi: 10.1590/S0102-311X2005000100008
- Arsic, S., Konstantinovic, L., Eminovic, F., Pavlovic, D., Popovic, M. B., & Arsic, V. (2015). Correlation between the quality of attention and cognitive competence with motor action in stroke patients. *BioMed Research International*, 2015. doi: 10.1155/2015/823136
- Assed, M. M., Carvalho, M. K. H. V. D., Rocca, C. C. D. A., & Serafim, A. D. P. (2016). Memory training and benefits for quality of life in the elderly: A case report. *Dementia & Neuropsychologia*, 10(2), 152-155. doi: 10.1590/S1980-5764-2016DN1002012.
- Basak, C., & Qin, S. (2018). Virtual cognitive training in healthy aging and mild cognitive impairment. *Aging, Technology and Health*, 215-235. doi: 10.1016/B978-0-12-811272-4.00009-9
- Beaudreau, S. A., & O'Hara, R. (2008). Late-life anxiety and cognitive impairment: a review. *The American Journal of Geriatric Psychiatry*, 16(10), 790-803. doi: 10.1097/JGP.0b013e31817945c3
- Beaudreau, S. A., & O'hara, R. (2009). The association of anxiety and depressive symptoms with cognitive performance in community-dwelling older adults. *Psychology and Aging*, 24(2), 507. doi: 10.1037/a0016035
- Bertolucci, P. H., Brucki, S., Campacci, S. R., & Juliano, Y. (1994). O mini-exame do estado mental em uma população geral: impacto da escolaridade. *Arquivos de Neuropsiquiatria*, 52(1), 1-7. doi: 10.1590/S0004-282X1994000100001
- Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition*, 12(1), 3-11. doi: doi.org/10.1017/S1366728908003477
- Boake, C. (2000). Edouard Claparede and the auditory verbal learning test. *Journal of Clinical and Experimental Neuropsychology*, 22(2), 286-292. doi: 10.1076/1380-3395(200004)22:2;1-1;FT286
- Carral, J. M. C., Curras, D. M., Pérez, C. A., & Suárez, M. H. V. (2017). Effects of two programmes of combined Land-Based and Water-Based exercise on the cognitive function and fitness levels of healthy older adults. *Motriz: Revista de Educação Física*, 23(2). doi: 10.1590/s1980-6574201700020011
- Charchat-Fichman, F. H., Caramelli, P., Sameshima, K., & Nitrini, R. (2005). Declínio da capacidade cognitiva durante o envelhecimento. *Revista Brasileira de Psiquiatria*, 27(21), 79-82. doi: 10.1590/S1516-44462005000100017

- Conselho Nacional de Saúde. (2012). *Resolução nº 466/12*. Retrieved from http://bvsms.saude.gov.br/bvs/saudelegis/cns/2013/res0466_12_12_2012.html
- Conselho Nacional de Saúde. (2016). *Resolução nº 510/2016*. Retrieved from <http://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf>
- Cotman C. W., Berchtold NC (2002) Exercise: A behavioral intervention to enhance brain health and plasticity. *Trends Neuroscience*, 25, 295–301. doi: 10.1016/S0166-2236(02)02143-4
- Cunha, J. A. (2001). *Manual da versão em português das Escalas Beck*. São Paulo, SP: Casa do Psicólogo.
- Deary, I. J., Corley, J., Gow, A. J., Harris, S. E., Houlihan, L. M., Marioni, R. E., ... & Starr, J. M. (2009). Age-associated cognitive decline. *British medical bulletin*, 92(1), 135-152. doi: 10.1093/bmb/ldp033
- Engeroff, T., Ingmann, T., & Banzer, W. (2018). Physical Activity Throughout the Adult Life Span and Domain-Specific Cognitive Function in Old Age: A Systematic Review of Cross-Sectional and Longitudinal Data. *Sports Medicine*, 1-32. doi: 10.1007/s40279-018-0920-6
- Evans, J., Charness, N., Dijkstra, K., Fitzgibbons, J. M., & Yoon, J. S. (2018). Is episodic memory performance more vulnerable to depressive affect in older adulthood? *Aging, Neuropsychology, and Cognition*, 1-20. doi:10.1080/13825585.2018.1424314
- Faber, L. M., Scheicher, M. E., & Soares, E. (2017). Depressão, Declínio Cognitivo e Polimedicção em idosos institucionalizados. *Revista Kairós: Gerontologia*, 20(2), 195-210. doi: 10.23925/2176-901X.2017v20i2p195-210
- Farina, M. (2015). *Personalidade em idosos: relações com o funcionamento adaptativo e psicopatológico*. (Master Dissertation). Faculdade de Psicologia, PUCRS, Porto Alegre, RS. Retrieved from <http://hdl.handle.net/10923/7193>
- Fechine, B. R. A., & Trompieri, N. (2015). O processo de envelhecimento: as principais alterações que acontecem com o idoso com o passar dos anos. *InterSciencePlace*, 1(20).
- 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.
- Gothe, N. P., Kramer, A. F., & McAuley, E. (2017). Hatha Yoga Practice Improves Attention and Processing Speed in Older Adults: Results from an 8-Week Randomized Control Trial. *The Journal of Alternative and Complementary Medicine*, 23(1), 35-40. doi: 10.1089/acm.2016.0185
- Hwang, T. J., Masterman, D. L., Ortiz, F., Fairbanks, L. A., & Cummings, J. L. (2004). Mild cognitive impairment is associated with characteristic neuropsychiatric symptoms. *Alzheimer Disease & Associated Disorders*, 18(1), 17-21. doi: 10.1097/00002093-200401000-00004
- Ihle, A., Oris, M., Fagot, D., Chicherio, C., van der Linden, B. W., Sauter, J., & Kliegel, M. (2018). Associations of educational attainment and cognitive level of job with old age verbal ability and processing speed: The mediating role of chronic diseases. *Applied Neuropsychology: Adult*, 25(4), 356-362. doi: 10.1080/23279095.2017.1306525
- Irigaray, T. Q., & Schneider, R. H. (2012). Efeitos de um Treino de Atenção, Memória e Funções Executivas na Cognição de Idosos Saudáveis. *Psicologia: Reflexão e Crítica*, 25(1).
- Kirk-Sanchez, N. J., & McGough, E. L. (2014). Physical exercise and cognitive performance in the elderly: current perspectives. *Clinical Interventions in Aging*, 9, 51. doi: 10.2147/CIA.S39506

- Kochhann, R., Varela, J. S., Lisboa, C. S. M., & Chaves, M. L. F. (2010). The Mini Mental State Examination. *Dementia e Neuropsychologia*, 4(1), 35-41.
- Lachman, M. E., Agrigoroaei, S., Murphy, C., & Tun, P. A. (2010). Frequent cognitive activity compensates for education differences in episodic memory. *The American Journal of Geriatric Psychiatry*, 18(1), 4-10. doi: 10.1097/JGP.0b013e3181ab8b62
- Leite, P. L., Rangé, B. P., Ribas Junior, R. C., Fernandez, J. L., & Silva, A. A. O. (2012). Validação e aferição de fidedignidade da versão brasileira da Compulsive Buying Scale. *Revista de Psiquiatria Clínica*, 39(3), 100-105.
- Leung, C. J., Cheng, L., Yu, J., Yiend, J., & Lee, T. M. (2018). Six-month longitudinal associations between cognitive functioning and distress among the community-based elderly in Hong Kong: A cross-lagged panel analysis. *Psychiatry Research*, 265, 77-81. doi: 10.1016/j.psychres.2018.04.045
- Li, J., Zhu, X., Qiu, C., & Zeng, Y. (2017). Leisure activities, education, and cognitive impairment: a population-based longitudinal study. *Innovation in Aging*, 1(suppl_1), 330-330. doi: 10.1093/geroni/igx004.1214
- Lopes, R. M. F. (2014). *Funções executivas e memória em idosos: um estudo sobre os efeitos de um treino cognitivo e repercussões na qualidade de vida*. (Doctor's Thesis) Faculdade de Psicologia, PUCRS, Porto Alegre, RS. Retrieved from <http://hdl.handle.net/10923/7033>
- Lopes, R. M. F., Bastos, A. S., & Argimon, I. I. L. (2017). Treino das funções executivas em idosos: uma revisão sistemática da literatura. *Cuadernos de Neuropsicología/Panamerican Journal of Neuropsychology*, 11(1).
- Lu, H., Chan, S. S., Fung, A. W., & Lam, L. C. (2016). Efficiency of attentional components in elderly with mild neurocognitive disorders shown by the attention network test. *Dementia and geriatric cognitive disorders*, 41(1-2), 93-98. doi: 10.1159/000441350
- Malloy-Diniz, L. F., Fuentes, D., Mattos, P., & Abreu, N. (2018). *Avaliação Neuropsicológica – 2ª edição*. Artmed Editora.
- Malloy-Diniz, L. F., Lasmar, V. A. P., Gazinelli, L. S. R., Fuentes, D., & Salgado, J. V. (2007). Teste de aprendizagem auditivo-verbal de Rey: aplicabilidade na população idosa brasileira. *Revista Brasileira de Psiquiatria*, 29(4), 324-329.
- Mitrushina, M. (1999). Rey Auditory-Verbal Learning Test. *Handbook of Normative Data for Neuropsychological Assessment*, 323-370. New York, NY: Oxford University Press.
- Monica, C. D., Johnsen, S., Atzori, G., Groeger, J. A., & Dijk, D. J. (2018). Rapid eye movement sleep, sleep continuity and slow wave sleep as predictors of cognition, mood, and subjective sleep quality in healthy men and women, aged 20–84 years. *Frontiers in Psychiatry*, 9. doi: 10.3389/fpsy.2018.00255
- Moon, C. M., Yang, J. C., & Jeong, G. W. (2015). Explicit verbal memory impairments associated with brain functional deficits and morphological alterations in patients with generalized anxiety disorder. *Journal of affective disorders*, 186, 328-336. doi: 10.1016/j.jad.2015.07.038
- Moret-Tatay, C., Lemus-Zúñiga, L. G., Tortosa, D. A., Gamermann, D., Vázquez-martínez, A., Navarro-Pardo, E., & Conejero, J. A. (2017). Age slowing down in detection and visual discrimination under varying presentation times. *Scandinavian journal of psychology*, 58(4), 304-311.
- Murphy, M., & Cunningham, R. K. (2012). A crossword a day improves verbal fluency: a report of an intervention study. *The Irish Journal of Psychology*, 33(4), 193-198.

- Murphy, M., O'sullivan, K., & Kelleher, K. G. (2014). Daily crosswords improve verbal fluency: a brief intervention study. *International Journal of Geriatric Psychiatry*, 29(9), 915-919.
- Murphy, M., Spillane, K., Cully, J., Navarro-Pardo, E., & Moret-Tatay, C. (2016). Can Word Puzzles be Tailored to Improve Different Dimensions of Verbal Fluency? A Report of an Intervention Study. *The Journal of Psychology*, 150(6), 743-754.
- Nascimento, E. (2004). Adaptação, validação e normatização do WAIS-III para uma amostra brasileira. *Wechsler D. WAIS-III: Manual para administração e avaliação*. São Paulo, SP: Casa do Psicólogo.
- Nouchi, R., Saito, T., Nouchi, H., & Kawashima, R. (2016). Small Acute Benefits of 4 Weeks Processing Speed Training Games on Processing Speed and Inhibition Performance and Depressive Mood in the Healthy Elderly People: Evidence from a Randomized Control Trial. *Frontiers in Aging Neuroscience*, 8, 302. doi: 10.3389/fnagi.2016.00302
- Nouchi, R., Taki, Y., Takeuchi, H., Sekiguchi, A., Hashizume, H., Nozawa, T., ... & Kawashima, R. (2014). Four weeks of combination exercise training improved executive functions, episodic memory, and processing speed in healthy elderly people: evidence from a randomized controlled trial. *Age*, 36(2), 787-799. doi: 10.1007/s11357-013-9588-x
- Oliveira, C. R., Lima, M. M. B. M. P., Esteves, C. S., Gonzatti, V., Viana, S. A. R., Irigaray, T. Q., & Argimon, I. I. L. (2017). Normative data of the Brazilian elderly in Logical Memory subtest of WMS-R. *Avaliação Psicológica*, 16(1). doi: 10.15689/ap.2017.1601.02
- Oliveira, C., Pena, L., & Silva, M. (2015). Envelhecimento, memória e estímulo cognitivo. *Journal of Aging and Innovation*, 4(2), 21-31.
- Paradela, E. M. P., Lourenço, R. A., & Veras, R. P. (2005). Validação da escala de depressão geriátrica em um ambulatório geral. *Revista de Saúde Pública*, 39(6), 918-923. doi: 10.1590/S0034-89102005000600008
- Pedroso, R. V., Corazza, D. I., Andreatto, C. A. D. A., Silva, T. M. V. D., Costa, J. L. R., & Santos-Galduróz, R. F. (2018). Cognitive, functional and physical activity impairment in elderly with Alzheimer's disease. *Dementia & Neuropsychologia*, 12(1), 28-34. doi: 10.1590/1980-57642018dn12-010004
- Rawtaer, I., Gao, Q., Nyunt, M. S. Z., Feng, L., Chong, M. S., Lim, W. S., ... & Ng, T. P. (2017). Psychosocial Risk and Protective Factors and Incident Mild Cognitive Impairment and Dementia in Community Dwelling Elderly: Findings from the Singapore Longitudinal Ageing Study. *Journal of Alzheimer's Disease*, 57(2), 603-611. doi: 10.3233/JAD-160862
- Rebok, G. W., Ball, K., Guey, L. T., Jones, R. N., Kim, H. Y., King, J. W., ... & Willis, S. L. (2014). Ten-year effects of the advanced cognitive training for independent and vital elderly cognitive training trial on cognition and everyday functioning in older adults. *Journal of the American Geriatrics Society*, 62(1), 16-24. doi: 10.1111/jgs.12607
- Rey, A. (1958). *L'examen clinique en psychologie*. Paris, France: Press Universitaire de France.
- Sanchez-Lopez, J., Silva-Pereyra, J., Fernández, T., Alatorre-Cruz, G. C., Castro-Chavira, S. A., González-López, M., & Sánchez-Moguel, S. M. (2018). High levels of incidental physical activity are positively associated with cognition and EEG activity in aging. *PloS one*, 13(1), e0191561. doi: 10.1371/journal.pone.0191561

- Santos, C. S., Cerchiari, E. A. N., Alvarenga, M. R. M., Faccenda, O., & Oliveira, M. A. C. (2010). Avaliação da confiabilidade do Mini-Exame do Estado Mental em idosos e associação com variáveis sociodemográficas. *Cogitare Enfermagem*, 15(3).
- Santos, F. H., Andrade, V. M., & Bueno, O. F. A. (2009). Envelhecimento: um processo multifatorial. *Psicologia em estudo*, 14(1). doi: 10.1590/S1413-73722009000100002
- Santos, S. A. E. N. (2009). *Fluência verbal semântica e fonêmica: estudos psicométricos e normativos numa amostra de adultos idosos saudáveis*. [Master Dissertation], Universidade de Coimbra. Retrieved from <http://hdl.handle.net/10316/15774>
- Shih, I. F., Paul, K., Haan, M., Yu, Y., & Ritz, B. (2018). Physical activity modifies the influence of apolipoprotein E ϵ 4 allele and type 2 diabetes on dementia and cognitive impairment among older Mexican Americans. *Alzheimer's & Dementia: the journal of the Alzheimer's Association*, 14(1), 1-9. doi: 10.1016/j.jalz.2017.05.005
- Sinoff, G., & Werner, P. (2003). Anxiety disorder and accompanying subjective memory loss in the elderly as a predictor of future cognitive decline. *International Journal of Geriatric Psychiatry*, 18(10), 951-959. doi: 10.1002/gps.1004
- Soares, E., & Rossignoli, P. D. S. (2014). Depression and cognitive decline: factors related to demographics and psycho pharmacotherapy on elderly in nursing homes. *African Journal of Psychiatry*, 01-09. doi: 10.4172/1994-8220.1000160
- Souza, M. A. H. D., Porto, E. F., Souza, E. L. D., & Silva, K. I. D. (2016). Profile of lifestyle of older elderly persons. *Revista Brasileira de Geriatria e Gerontologia*, 19(5), 819-826. doi: 10.1590/1809-98232016019.150224
- Stern, Y. (2017). An approach to studying the neural correlates of reserve. *Brain imaging and behavior*, 11(2), 410-416. doi: 10.1007/s11682-016-9566-x
- Strauss, E., Sherman, E. M. S., & Spreen, O. (2006). *A compendium of neuropsychological tests 3rd edition*. New York, USA: Oxford U. Press.
- Tsai, J. C., Chen, C. W., Chu, H., Yang, H. L., Chung, M. H., Liao, Y. M., & Chou, K. R. (2016). Comparing the sensitivity, specificity, and predictive values of the montreal cognitive assessment and mini-mental state examination when screening people for mild cognitive impairment and dementia in chinese population. *Archives of Psychiatric Nursing*, 30(4), 486-491. doi: 10.1016/j.apnu.2016.01.015
- Vaportzis, E., & Gow, A. J. (2018). People's Beliefs and Expectations About How Cognitive Skills Change with Age: Evidence From a UK-Wide Aging Survey. *The American Journal of Geriatric Psychiatry*. doi: 10.1016/j.jagp.2018.03.016
- Wechsler, D. (2004). *WAIS-III: Escala de Inteligência Wechsler para Adultos: Manual; Adaptação e Padronização de uma amostra Brasileira*. São Paulo, SP: Casa do Psicólogo.
- Wolitzky-Taylor, K. B., Castriotta, N., Lenze, E. J., Stanley, M. A., & Craske, M. G. (2010). Anxiety disorders in older adults: a comprehensive review. *Depression and Anxiety*, 27(2), 190-211. doi: 10.1002/da.20653
- Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., & Leirer, V. O. (1983). Development and validation of a geriatric depression screening scale: a preliminary report. *Journal of Psychiatric Research*, 17(1), 37-49. doi: 10.1016/0022-3956(82)90033-4

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001

Table 1
Comparison of socio-demographic variables in a four-year period (n = 64).

Variable	Stage I		Stage II		McNemar's Chi-square (2)	p
	n	%	n	%		
Marital Status						
Married	39	61	34	53.1	3.57	0.17
Widow/Widower	15	23.4	20	31.3		
Single	10	15.6	10	15.6		
Reading						
No	10	15.6	9	14.1	1.57	0.99
Yes	54	84.4	55	85.9		
Crossword Puzzles						
No	26	40.6	25	39.1	4.06	0.99
Yes	38	59.4	39	60.9		
Use of computer						
No	24	37.5	26	40.6	4.3	0.79
Yes	40	62.5	38	59.4		
Learning another language						
No	47	73.40%	44	68.8	4.05	0.58
Yes	17	26.60%	20	31.2		
Physical activity						
No	51	79.7	33	51.60%	2.9	<0.001
Yes	13	20.3	31	48.40%		

Table 2
Comparison of cognitive performance in a four-year period (n = 64).

Variable	Mean and Standard Deviation	Median (range)	Wilcoxon (z)	p
Global cognitive function (MEEM)				
Stage 1	28.09 (1.58)	28.00 (8)	-2.51	0.012
Stage 2	27.28 (2.65)	28.00 (13)		
Immediate verbal episodic memory (RAVLT A1)				
Stage 1	5.14 (1.53)	5.00 (6)	-1.28	0.2
Stage 2	4.86 (1.73)	5.00 (7)		
Delayed verbal episodic memory (RAVLT A7)				
Stage 1	8.13 (3.5)	8.00 (15)	-2.46	0.014
Stage 2	7.28 (3.5)	7.00 (14)		
Processing Speed (Coding)				
Stage 1	45.14 (14.41)	47.50 (69)	-2.82	0.005
Stage 2	42.39 (16.07)	45.00 (78)		
Attention and immediate/working memory (Digital Symbols)				
Stage 1	13.38 (3.91)	12.50 (19)	-1.51	0.131
Stage 2	12.88 (3.19)	13.00 (16)		
Verbal fluency, inhibition and word generation (Fluency - Animals).				
Stage 1	15.68 (4.39)	16.00 (24)	-0.87	0.384
Stage 2	16.25 (4.21)	16.00 (18)		

Table 3

Multiple linear regression in order to forecast differences in cognitive performance between stages I and II ($n = 64$).

Difference in cognitive performance between stage 1 and 2 (DV)	R^2 (variance)	Predictors (IV)	F (df)	p	Non-standardized Beta coefficient (β)	Standard error	Standardized Beta coefficient (β)	t	p	CI 95%	
										Lower Limit	Upper Limit
Global cognitive function (Δ MEEM)	29.00%	BAI 2	13.858 (2) 61	<0.001	-0.141	0.033	-0.459	-4.264	<0.001	-0.207	-0.075
		Learning another language 2			1.284	0.556	0.249	2.311	0.024	0.173	2.396
Immediate verbal episodic memory (Δ RAVLT A1)	16.90%	Crossword puzzles 2	7.399 (2) 61	0.001	1.108	0.389	0.327	2.846	0.006	0.329	1.886
		Gym 1			1.213	0.472	0.295	2.571	0.013	0.270	2.157
Delayed verbal episodic memory (Δ RAVLT A7)	6.90%	BAI 2	5.573 (1) 61	0.021	-0.106	0.045	-0.289	-2.361	0.021	-0.196	-0.016
Processing Speed (Δ Coding)	29.00%	Education level	13.858 (1) 62	<0.001	0.774	0.195	0.450	3.968	<0.001	0.384	1.164

Note. CI = Confidence interval; R^2 = R adjusted; Δ variation.

6.2 Components of cognitive reserve: a longitudinal assessment of elderly people from the community

Artigo submetido a Revista *Archives of Clinical Neuropsychology* no dia 18 de dezembro de 2018.

Abstract:

Introduction: Cognitive reserve, which is acquired throughout life, enables individuals to preserve their cognition, despite a possible underlying brain pathology. **Objective:** verify which components contribute to an indirect measurement of cognitive reserve in elderly people, assessed longitudinally within a four-year interval. **Method:** The sample was initially comprised of 108 elderly people from the community; four years later, 64 of them were reassessed. The following instruments were used: sociodemographic form; Mini-Mental State Examination; subtests from the Wechsler Adult Intelligence Scale - Third Edition; Trail Making Test; Verbal Fluency Test (animal category); Rey Auditory-Verbal Learning Test; Beck Anxiety Inventory; and the Geriatric Depression Scale 15-item version. Multiple linear regression analyses were performed for the data analysis. **Results:** The sample was predominantly composed of women (81.3%); the mean years of study was 12.67 (SD=5.2); and the mean age of the sample was 73.19 years (SD=6.12). With respect to the variables related to cognitive reserve, it was found that anxiety is the predictor variable of more cognitive components: overall cognitive function, immediate and delayed verbal episodic memory, auditory attention, immediate and working memory, sustained and divided attention, sequencing and graphomotor skills. **Conclusions:** It was found that cognitive decline is associated with anxiety, and this variable is negatively related to cognitive reserve, as well as to the age variable. Engaging in cognitively stimulating activities, years of study and living with someone were deemed to be factors that help build cognitive reserve in elderly people.

Keywords: cognitive reserve, elderly people, longitudinal.

Introduction

The concept of reserve was introduced by Katzman et al. (1989), while describing the discrepancy between the severity of an underlying pathology (e.g. Alzheimer's) and clinical manifestations in cognitively preserved elderly people. The reserve has two models: the passive model, also called brain or neural reserve – which deals with structural characteristics of the brain (Stern, 2017) – and the active model, defined as a construct that helps the brain adapt to processes of degeneration, through cognitive processing resources used to compensate deficits that have occurred. This model considers that individual differences in cognitive or neural functions enable people to more effectively cope with brain damage resulting from the neurodegenerative process of normal aging (Stern, 2009; 2018). The term used to explain this process is called cognitive reserve.

Both models are complementary and dependent, since cognitive reserve, which is acquired throughout life, contributes to brain reserve, causing increased volume or improvement of the neural connections of brain structures (e.g. prefrontal cortex, white matter and grey matter), after performing cognitively stimulating activities (Gleich, Lorenz, Gallinat, & Kühn, 2017; Gong et al., 2017).

In the aging process, engaging in stimulating experiences throughout life can help people cope with age-related neuronal changes, minimizing cognitive decline through cognitive reserve (Steffener & Stern, 2012; Tucker & Stern, 2011). Neural activity is shaped by cognitive activities performed throughout life, and cognitive reserve can often be stimulated through life cycle activities.

The working group of Stern et al. (2018) pointed out that there is still no consensus in the literature on the concept of cognitive reserve, despite the fact that there are major

differences in cognitive performance among healthy elderly people. This has sparked a growing interest in the factors that may contribute to individual differences in cognitive and brain aging. Some of the factors include: years of study, profession, intelligence, lifestyle or engaging in social, cognitive and leisure activities (O'Shea et al., 2015; Stern, 2017).

Successful cognitive aging encompasses cognitive reserve and brain capacity (Daffner, 2010; Zahodne et al., 2015). Existing cognitive or functional brain processes can be influenced by innate conditions (genetic) and experiences lived over the course of life, which are therefore mutable (Stern et al., 2018). Getting older (normal aging) can be mitigated by variables related to people's lifestyle, reinforcing the importance of longitudinal monitoring for an assessment of cognitive reserve in action, which may even establish causal relationships (Stern, 2017).

Bennett et al. (2006) argued that the building of processing resources (perception speed and working memory) may be considered a component of cognitive reserve. A study by Siedlecki et al. (2009) suggested that some components of executive functions, such as cognitive flexibility, may also be part of cognitive reserve, since it is influenced by life experiences. A study by Lojo-Seoane, Facal, Guàrdia-Olmos and Juncos-Rabadán (2014) included indicators associated with participation in social and cultural activities, which already have a positive effect on delaying symptoms of cognitive decline (Verghese et al., 2006; Wilson et al., 2007).

A prospective longitudinal study, conducted in Brazil's South Region, investigated the cognitive abilities of elderly people at two specific times, within an interval of three years. Despite considerable sample loss due to the participants' ages (over 80 years old), it was possible to identify that physical and leisure activities, as well as social interaction, served as protective factors against cognitive decline in the participants (Argimon & Stein, 2005). In

other words, having an active lifestyle, with intellectual, physical and leisure activities, contributed to better cognition and quality of life, and had an influence on decreasing the risk of neurological disorders, deceleration and neurodegeneration throughout the aging process (Shah & Martins, 2017; Silveira & Portuguese, 2017).

The objective of the present study was to determine which factors contribute to an indirect measurement of cognitive reserve in elderly people, within a four-year interval. In this study, cognitive reserve was measured indirectly through the performance of the elderly people in tests that assessed cognitive functions. The variables examined in this study that could boost cognitive reserve were based on previous studies (Farina, Paloski, Oliveira, Argimon, & Irigaray, 2017; Stern, 2018): age, profession, length of time retired, level of education of the parents and the participant, reading, crossword puzzles, use of electronic devices, learning another language, physical activity, history of dementia in the family, living with someone and symptoms of anxiety and depression.

Method

Design

This is a study with a longitudinal and prospective design, which estimated the temporal effects of various variables and fine-tuned the level of inference in relation to the association and influence of these variables. The assessments were carried out on two occasions, four years apart from each other, in 2013 and in 2017.

Participants

In 2013, Stage I, 108 elderly people residing in the state of Rio Grande do Sul, Brazil, were assessed. In Stage II, in 2017, the participants from the first stage were contacted by phone and invited for a reassessment. The final sample of Stage 2 was comprised of 64 elderly people, with 44 former participants excluded. The reasons for not participating were: the phone number was out-of-date or disconnected ($n = 20$), the individual did not want to participate in Stage II ($n = 13$), the individual was manifesting symptoms of dementia, according to family members ($n = 4$), the individual had moved to another city ($n = 4$) or was traveling during the collection period ($n = 3$).

Instruments

Sociodemographic and clinical data form: structured interview that inquired about sex, age, marital status, level of education, with whom the person lives, profession, number of years retired, intellectual activities (reading, crossword puzzles, learning another language and use of electronic devices, such as computers, tablets or smartphones), physical activity and health conditions.

Cognitive Functions

Mini-Mental State Examination (MMSE): a screening tool that provides an overall view of a patient's cognitive functions. Scores can range from zero to a total of 30 points (Bertolucci, Brucki, Campacci, & Juliano, 1994; Folstein, Folstein, & McHugh, 1975). The cut-off numbers used in this study were: 21 points for illiterate people; 22 points for people with a low level of education, 23 for people with an average level of education, and 24 for people with a high level of education. These values were based on a study by Kochhann et al.

(2010) conducted with elderly people in southern Brazil. Cronbach's alpha for the MMSE was 0.80 (Santos, Cerchiari, Alvarenga, Faccenda, & Oliveira, 2010).

Digit symbol and coding subtests from the Wechsler Adult Intelligence Scale (WAIS-III): the coding subtest primarily assesses processing speed, whereas the digit symbol subtest assesses auditory attention, immediate memory and working memory. With regard to internal consistency, Cronbach's alpha was 0.84 for the digit symbol subtest for people aged 60 to 89 years (Nascimento, 2004; Wechsler, 2004).

Trail Making Test: is a task that assesses sustained attention, divided attention, sequencing and graphomotor skills. It contains two parts: TMT-A, composed of 25 circles with numbers, and TMT-B, formed by numbers and letters that need to be connected in sequence. The correlation is calculated through the time spent by the individual to complete each part (Chan, Lam, Wong, & Chiu, 2003; Lezak, 2004; Strauss, Sherman, & Spreen 2006).

Verbal Fluency (animal category): assesses executive function components, such as verbal fluency, inhibition and word generation. It consists of asking participants to say, as quickly as possible, the names of different animals in the course of one minute (Strauss et al., 2006). Cronbach's alpha was 0.74 (Santos, 2009).

Rey Auditory-Verbal Learning Test (RAVLT): is composed of two lists, containing 15 words each. The first list is repeated five times (A1, A2, A3, A4 and A5) to help participants remember the largest number of words heard. Afterwards, a distracter list is read (B), followed by recalling the first list (A6). After 20 to 30 minutes, participants are asked to recall the first list (A7) (Boake, 2000; Rey, 1958). A1 assesses immediate memory; the sum of A1 to A5 assesses the synthesis of the learning process; A6 corresponds to immediate recall; and A7 refers to delayed recall (Malloy-Diniz, Fuentes, Mattos, & Abreu, 2018). In Brazil, rules for the test have been established for an age range of 16 to 89 years (Malloy-

Diniz, Lasmar, Gazinelli, Fuentes, & Salgado, 2007). Cronbach's alpha varied from 0.80 to 0.95 (Mitrushina, Bone, & D'Elia, 1999).

Symptoms of anxiety and depression

Beck Anxiety Inventory (BAI): measures the intensity of anxiety symptoms through a symptom scale comprised of 21 items, where individuals need to mark how they felt in the last two weeks, using a four-point scale. In this study, the cut-off points suggested by the manual were used, subdivided as follows: 0 to 10: minimal symptoms; 11 to 19: mild; 20 to 30: moderate; and 31 to 63: serious. Cronbach's alpha was 0.90 (Cunha, 2001; Leite et al., 2012).

Geriatric Depression Scale (GDS-15): with rules established by Yesavage et al. (1983) and used to determine the level of symptoms of depression in elderly people. It consists of a questionnaire with 15 questions, with two response options: yes and no. Scores lower than five are considered as absence of symptoms and above five indicates the presence of symptoms of depression. The Cronbach's alpha of the scale was 0.81 (Almeida & Almeida, 1999; Paradelo, Lourenço, & Veras, 2005).

Ethical Procedures

The study design was sent to the Scientific Commission of the School of Health Sciences and submitted for approval by the Research Ethics Committee of the Pontifical Catholic University of Rio Grande do Sul (PUCRS) under No. 63196816.8.0000.5336. After agreeing to participate in the study, the participants signed a Free and Informed Consent Form. The ethical procedures were based on the Guidelines and Regulatory Standards for

Research Involving Human Beings (Resolution No. 510/16 and Resolution No. 466/12 of the National Health Council).

Data Collection Procedures

In both stages (I and II), the assessment was performed by a psychologist and Psychology students, who had been trained in advance. The data collection instruments were applied in a psychological treatment clinic and in rooms provided by the Graduate Studies Program in Psychology of PUCRS. The elderly people were assessed individually in a session that lasted approximately two hours.

The tests were applied in the following order: socio-demographic form, cognitive tests (MMSE, RAVLT, Coding, Digit Symbol, RALVT recall, Verbal Fluency - Animals) and symptoms of anxiety and depression. Participants indicating any loss or the need for treatment were referred to the Psychology Treatment and Research Center at PUCRS.

The results were delivered in April 2018, in a group setting, with an average number of 10 elderly people per meeting. A slide show presentation was used in regard to the research and, afterwards, a report was provided with the main results from the reassessment of each individual. Most of the participants received their results in person ($n = 42$) and the others ($n = 22$) by phone.

Data Analysis Procedures

The cognitive function predictor variables were selected theoretically, based on previous cognitive reserve studies (Farina, Paloski, Oliveira, Argimon, & Irigaray, 2017; Stern, 2017). For indirect measurement estimate of cognitive reserve, the cognitive performance of the individuals in Stage II was considered. In relation to the

sociodemographic characteristics, due to collinearity, only one of the stages for collecting the variables was used: age (Stage II), number of years worked (Stage I), number of years retired (Stage I), years of study of the parents and participant (Stage I). For the other variables, the results from both Stages I and II were considered: cognitively stimulating activities such as reading, crossword puzzles, use of electronic devices or learning another language, physical activity, history of dementia in the family, living with someone and symptoms of anxiety and depression. It should be pointed out that temporal effects are considered when independent variables from Stage I influence or explain the outcome (Stage II). When independent variables that explain the outcome (Stage II) are variables from Stage II, they are considered contemporary effects.

Afterwards, multiple linear regression analyses were carried out, with cognitive functions serving as dependent variables (DV), and sociodemographic and anxiety/depression information as independent variables (IV). The estimation method used was stepwise least squares, which progressively selects the main predictors, taking into account the criterion of statistical difference in relation to the previous model. The standardized and non-standardized regression weights were analyzed, as well as confidence intervals, statistical significance and variance explained by the model.

Results

In relation to the socio-demographic information, most of the participants (81.3%) were women ($n = 52$). As for age, the mean age in Stage I was 69.17 years old ($SD = 6.12$, ranging from 60 to 83), whereas in Stage two it was 73.19 years ($SD = 6.12$, ranging from 64 to 87). Among the characteristics that did not vary over the four-year period were: years of

study of the participants, with a mean of 12.67 years ($SD = 5.2$); number of years working, with a mean of 30.78 years ($SD = 12.59$); number of years retired, with a mean of 15.86 years ($SD = 9.64$); and years of study of the parents, with a mean of 4.95 years ($SD = 3.78$). With respect to health conditions, in the first data collection stage, 67.2% ($n = 42$) of the participants had health problems. In the second stage, 87.5% ($n = 55$) reported health problems, representing an increase of 20.3% ($n = 13$) of individuals with new clinical conditions. In the multiple linear regression analysis, the explanatory models for cognitive reserve were verified as shown in Table 1.

Insert Table 1.

It can be seen that symptoms of anxiety (Stage II), use of electronic devices (Stage I), learning another language (Stage I) and living with someone (Stage I) jointly accounted for 51.3% of the variance in overall cognitive function (MMSE) of the participants. The use of electronic devices (Stage I) and symptoms of anxiety (measured by the BAI) (Stage II) explained 18.8% of the variance in verbal episodic memory (immediate) (RAVLT A1). Symptoms of anxiety (Stage II) and living with someone (Stage I) explained 21.5% of the performance of verbal episodic memory (delayed) (RAVLT A7).

Years of study, doing crossword puzzles (Stage I) and age (Stage II) accounted for 40.6% of processing speed performance (Coding). Age (Stage II) and symptoms of anxiety (Stage I) explained 19.6% of the scores for attention, immediate memory and working memory (Digit symbol). Symptoms of anxiety (Stage II), doing crossword puzzles (Stage I) and age (Stage II) accounted for 24.6% of the variance in performance in sustained attention tasks, sequencing and graphomotor skills (TMT-A). These same variables accounted for

31.5% of the performance in divided attention tasks, sequencing, flexibility and graphomotor skills (TMT-B). Finally, the age variable (Stage II), alone, accounted for 12.7% of the variance in verbal fluency (animals), which assessed executive functions such as verbal fluency, inhibition and word generation.

It was noted that anxiety was the most frequent significant predictor variable, accounting for behavior in six out of the eight cognitive tasks performed. The age variable was next, corresponding to five out of the eight cognitive tasks. In relation to cognitively stimulating activities, doing crossword puzzles was the most frequent predictor variable, explaining the performance of three out of the eight cognitive tasks, followed by use of electronic devices and living with someone, corresponding to two tasks. The other variables – years of study and learning another language – explained one cognitive task.

Discussion

The primary objective of this study was to identify the variables that contribute to cognitive reserve in elderly people, over a four-year interval. It was found that symptoms of anxiety, use of electronic devices, learning another language, crossword puzzles, years of study, living with someone and age were part of the cognitive reserve of elderly people. Symptoms of anxiety and age had a negative impact on cognitive reserve and all the rest had a positive effect.

According to these results, it can be concluded that anxiety was the variable that accounted the most for the cognitive performance of the elderly people within the four-year period, and was present in six out of the eight explanatory models. In this study, symptoms of anxiety were predictors of poor performance in overall cognitive function, working memory,

immediate memory and verbal episodic memory (immediate and delayed), attention, (auditory, sustained and divided), sequencing, flexibility and graphomotor skills. Similar findings were obtained in other studies, indicating that executive functions may decrease in elderly people suffering from anxiety (Beaudreau & O'Hara, 2008; Mantella et al., 2007). Bierman, Comijs, Jonker and Beekman (2005) found that symptoms of anxiety may be predictors of poorer performance in verbal memory tasks, as well as loss of learning skills in elderly people. Beaudreau and O'Hara (2009) observed that symptoms of anxiety were associated with impaired attention performance in this population.

Yochim, Mueller and Segal (2013) also found a relationship between anxiety and executive functions, especially in the TMT test (sequencing, flexibility and graphomotor skills), which was also used in the present study. The findings suggest that elderly people may have difficulties switching between two lines of thought or in performing multiple tasks simultaneously, which can affect work productivity as well the ability to engage in complex or multi-faceted tasks, such as driving or participating in social activities. In the view of these authors, decreased executive function due to anxiety can have a high cognitive impact, hindering individuals from wielding all the cognitive resources needed for executive tasks. On the other hand, it can also be assumed that individuals with fewer executive function skills are less able to suppress anxiety.

After anxiety, age was the variable with the highest predictive power for cognitive reserve, found in five of the eight explanatory models. Since normal aging process is associated with a decrease in cognition (Monica, Johnsen, Atzori, Groeger, & Dijk, 2018), the age variable would be expected to be a predictive factor. However, apart from age, other variables also influence certain cognitive components.

According to the results, age is a predictive factor of decline in working memory, immediate memory, processing speed, auditory, sustained and divided attention, and executive functions: sequencing and graphomotor skills, verbal fluency, inhibition and word generation. Neurological diseases sometimes accompany biological aging. The study of neurodegenerative diseases, as well as age-associated cognitive decline, has been extensively addressed in the literature, in view of the modifications in plasticity and neural connections that occur during aging (Mertens, Reid, Lau, Kim, & Gage, 2018; Navakkode, Liu, & Soong, 2018; Wolinsky, Weg, Howren, Jones, & Dotson, 2016).

Different studies have indicated that increased age is associated with a decrease in certain cognitive domains, such as information processing speed (Eckert et al., 2010), episodic memory (Grady & Craik, 2000; Prull et al., 2000) and working memory (Park et al., 2002). A Spanish study investigated implicit and explicit memory in an associative verbal recognition task in elderly people with mild cognitive decline, in relation to cognitive reserve. In the assessment of cognitive performance, it was noted that higher cognitive reserve levels were associated with better performance in both groups, where the age variable was a contributing factor to cognitive reserve (Algarabel et al., 2016).

Engaging in activities such as crossword puzzles, learning another language and use of electronic devices were also found to contribute to overall cognitive function, processing speed, verbal episodic memory (immediate), divided and sustained attention, sequencing, flexibility and graphomotor skills in the present study. There were also indications in the literature that individuals who frequently participate in cognitively stimulating leisure activities, such as reading, playing cards and doing crossword puzzles, started cognitive decline later (Hall et al., 2009; Zhu, Qiu, Zeng, & Li, 2017).

Doing crossword puzzles was also identified in the present study as a predictor of processing speed, sequencing and graphomotor skills, and sustained and divided attention. Crossword puzzles are a learned skill, related to education, even though not all people with formal education actively engage in this pastime. Therefore, doing crossword puzzles is a way of assessing proficiency in a specific learned skill and, for this reason, can help maintain cognition (Pillai et al., 2011).

The role of crossword puzzles in maintaining cognitive function is relevant, considering their widespread availability (newspapers, books and the Internet), ease of access and low cost (Pillai et al., 2011). According to some authors, they can reduce the risk of cognitive decline, due to the effect of memory on cognitive reserve, by directly intervening in the modification of a disease or they may be markers for other healthy behaviors (Verghese et al., 2003, 2006).

Use of electronic devices was identified as a predictor of overall cognitive function and immediate verbal episodic memory. A hypothesis for explaining this result would be that the use of electronic devices contributes to activation in brain regions, and may promote greater neural and functional plasticity (Pessini, Reis, César, & Gamez, 2018) and, consequently, lead to better cognitive performance. The literature indicates that performing computerized cognitive activities is beneficial to overall cognitive performance, memory, processing speed, executive functions, attention and visual-spatial capacity in cognitively preserved adults (Kueider, Parisi, Bruto, & Rebok, 2012).

Learning another language was identified as contributing to cognitive reserve, mainly in relation to overall cognitive function. It was observed that bilingualism has an impact on brain structure, in that people need to select a language or communicate, which involves executive function capacity, cognitive control and cognitive flexibility (Dasha et al., 2017;

Reyes et al., 2018). In addition, it can be considered that this activity protects against symptoms of dementia in elderly people (Bialystok, Craik, & Freedman, 2007).

The regression model also revealed that years of study was a predictor of processing speed performance. Springer, McIntosh, Winocur and Grady (2005) found that older people with more years of study had higher frontal involvement during successful memory recall, compared to participants with fewer years of study. These findings indicate that healthy elderly people with high cognitive reserve are more inclined to involve other brain regions – not normally activated – when they perform certain tasks, in order to assist cognitive function. The findings of a longitudinal study by Zahodne et al. (2011) demonstrated that education influences cognitive performance, especially in relation to processing speed, which coincided with the findings of the present study. The authors of that study reported that although better cognitive performance is associated with years of study, the rate of cognitive decline during aging is independent of education.

The living with someone variable was also a predictor of overall cognitive function and delayed verbal episodic memory in elderly people. It can be argued that individuals who live with someone have greater social interaction and that this ultimately boosts their cognitive and memory function (Derksen et al., 2015). In a longitudinal assessment of individuals over 55 years of age, Rawtaer et al. (2017) identified that the association between having a spouse and satisfaction with life protected individuals from the development of dementia or cognitive decline. Another study found that individuals with fewer interpersonal relationships had a greater tendency toward developing dementia (Kuiper et al., 2015). Therefore, it is possible to propose that interaction with other people encourages individuals to engage in intellectual and physical activities, which help keep elderly people more active.

This study makes important contributions with respect to the components that can contribute to an indirect measurement of cognitive reserve in elderly people. It was decided to consider different indicators as components of cognitive reserve, in view of the fact that most of the variables reported in the literature had some level of influence on this construct. Thus, the authors believe that it is possible to obtain a more comprehensive and complete understanding of the building of cognitive reserve, as well as minimize the risk of overlooking any activity that contributes to this construct. Another contribution is related to the fact that this was an innovative study, in the sense of assessing the elderly population of Rio Grande do Sul longitudinally.

Due to the longitudinal design of the study, a sample loss was expected, but it was larger than expected, based on the parameters of a study by Argimon and Stein (2005), and constituted a limitation of the study. Therefore, it is suggested to conduct future longitudinal studies with the elderly population, using a larger sample size, since loss can be greater than expected. The authors believe it is still important to carry out further studies that monitor elderly people, in order to determine the impact of socioeconomic variables on the cognitive function of individuals over the course of years. This will make it possible to develop preventive and treatment measures for the elderly, leading to cognitive aging with better health and quality of life.

References

- Algarabel, S., Sales, A., Pitarque, A., Meléndez, J. C., Escudero, J., & Mayordomo, T. (2016). Associative and implicit memory performance as a function of cognitive reserve in elderly adults with and without mild cognitive impairment. *The Spanish Journal of Psychology*, 19. doi: 10.1017/sjp.2016.10

- Almeida, O. P., & Almeida, S. A. (1999). Confiabilidade da versão brasileira da Escala de Depressão em Geriatria (GDS) versão reduzida. *Arquivos de Neuropsiquiatria*, 57(2B), 421-6.
- Argimon, I. I., & Stein, L. M. (2005). Habilidades cognitivas em indivíduos muito idosos: um estudo longitudinal. *Cadernos de Saúde Pública*, 21(1), 64-72. doi: 10.1590/S0102-311X2005000100008
- Beaudreau, S. A., & O'Hara, R. (2008). Late-life anxiety and cognitive impairment: a review. *The American Journal of Geriatric Psychiatry*, 16, 790-803. doi: 10.1097/JGP.0b013e31817945c3
- Beaudreau, S. A., & O'hara, R. (2009). The association of anxiety and depressive symptoms with cognitive performance in community-dwelling older adults. *Psychology and Aging*, 24(2), 507. doi: 10.1002/jclp.20644
- Bennett, D. A., Schneider, J. A., Arvanitakis, Z., Kelly, J. F., Aggarwal, N. T., Shah, R. C., & Wilson, R. S. (2006). Neuropathology of older persons without cognitive impairment from two community-based studies. *Neurology*, 66(12), 1837-1844. doi: 10.1212/01.wnl.0000219668.47116.e6
- Bertolucci, P. H., Brucki, S., Campacci, S. R., & Juliano, Y. (1994). O mini-exame do estado mental em uma população geral: impacto da escolaridade. *Arquivos de Neuropsiquiatria*, 52(1), 1-7. doi: 10.1590/S0004-282X1994000100001
- Bialystok, E., Craik, F. I., & Freedman, M. (2007). Bilingualism as a protection against the onset of symptoms of dementia. *Neuropsychologia*, 45(2), 459-464. doi: 10.1016/j.neuropsychologia.2006.10.009
- Bierman, E. J. M., Comijs, H. C., Jonker, C., & Beekman, A. T. F. (2005). Effects of anxiety versus depression on cognition in later life. *American Journal of Geriatric Psychiatry*, 13, 686-693. doi: 10.1176/appi.ajgp.13.8.686
- Boake, C. (2000). Edouard Claparede and the auditory verbal learning test. *Journal of Clinical and Experimental Neuropsychology*, 22(2), 286-292. doi: 10.1076/1380-3395(200004)22:2;1-1;FT286
- Chan, C. W. Y., Lam, L. C. W., Wong, T. C. M. & Chiu, H. F. K. (2003). Modified Card Sorting Test Performance among Community Dwelling Elderly Chinese People. *Hong Kong Journal of Psychiatry*, 13(2), 2-7.
- Conselho Nacional de Saúde. (2012). *Resolução nº 466/12*. Retrieved from http://bvsms.saude.gov.br/bvs/saudelegis/cns/2013/res0466_12_12_2012.html
- Conselho Nacional de Saúde. (2016). *Resolução nº 510/2016*. Retrieved from <http://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf>
- Cunha, J. A. (2001). *Manual da versão em português das Escalas Beck*. São Paulo, SP: Casa do Psicólogo.
- Daffner, K. R. (2010). Promoting successful cognitive aging: a comprehensive review. *Journal of Alzheimer's disease*, 19(4), 1101-1122. doi: 10.3233/JAD-2010-1306
- Dasha, T., Ghazi-Saidic, L., Berroira, P., Adrover-Roige, D., Benalif, H., & Ansaldo, A. I. (2017). Is the bilingual brain better equipped for aging? *Cachiers de L'Ilob*, 8, 117-130. doi: 10.18192/olbiwp.v8i0.1887
- Derksen, B. J., Duff, M. C., Weldon, K., Zhang, J., Zamba, K. D., Tranel, D., & Denburg, N. L. (2015). Older adults catch up to younger adults on a learning and memory task that involves collaborative social interaction. *Memory*, 23(4), 612-624. doi: 10.1080/09658211.2014.915974

- Eckert, M. A., Keren, N. I., Roberts, D. R., Calhoun, V. D., & Harris, K. C. (2010). Age-related changes in processing speed: unique contributions of cerebellar and prefrontal cortex. *Frontiers in Human Neuroscience*, 4, 10. doi: 10.3389/neuro.09.010.2010
- Farina, M., Paloski, L. H., Oliveira, C. R., Argimon, I. I. L., & Irigaray, T. Q. (2017). Cognitive reserve in elderly and its connection with cognitive performance: a systematic review. *Ageing International*, 1-12. doi: 10.1007/s12126-017-9295-5
- 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.
- Gleich, T., Lorenz, R. C., Gallinat, J., & Kühn, S. (2017). Functional changes in the reward circuit in response to gaming-related cues after training with a commercial video game. *Neuroimage*, 152, 467-475. doi: 10.1016/j.neuroimage.2017.03.032
- Gong, L., Yin, Y., He, C., Ye, Q., Bai, F., Yuan, Y., ... & Zhang, Z. (2017). Disrupted reward circuits is associated with cognitive deficits and depression severity in major depressive disorder. *Journal of Psychiatric Research*, 84, 9-17. doi: 10.1016/j.jpsychires.2016.09.016
- Grady, C. L., & Craik, F. I. (2000). Changes in memory processing with age. *Current opinion in neurobiology*, 10(2), 224-231. doi: 10.1016/S0959-4388(00)00073-8
- Hall, C. B., Lipton, R. B., Sliwinski, M., Katz, M. J., Derby, C. A., & Verghese, J. (2009). Cognitive activities delay onset of memory decline in persons who develop dementia. *Neurology*, 73(5), 356-361. doi: 10.1212/01.wnl.0000202520.68987.48
- Katzman, R., Aronson, M., Fuld, P., Kawas, C., Brown, T., Morgenstern, H., ... Ooi, W.L. (1989). Development of dementing illnesses in an 80-year-old volunteer cohort. *Annals of Neurology*, 25, 317-324. doi: 10.1002/host.410250402
- Kochhann, R., Varela, J. S., Lisboa, C. S. M., & Chaves, M. L. F. (2010). The Mini Mental State Examination: review of cutoff points adjusted for schooling in a large Southern Brazilian sample. *Dementia and Neuropsychologia*, 4(1), 35-41. doi: 10.1590/S1980-57642010DN40100006
- Kueider, A. M., Parisi, J. M., Bruto, A. L., & Rebok, G. W. (2012). Computerized Cognitive Training with Older Adults: A Systematic Review. *PLoS ONE*, 7, doi: 10.1371/journal.pone.0040588
- Kuiper, J. S., Zuidersma, M., Voshaar, R. C. O., Zuidema, S. U., van den Heuvel, E. R., Stolk, R. P., & Smidt, N. (2015). Social relationships and risk of dementia: a systematic review and meta-analysis of longitudinal cohort studies. *Ageing Research Reviews*, 22, 39-57. doi: 10.1016/j.arr.2015.04.006
- Leite, P. L., Rangé, B. P., Ribas Junior, R. C., Fernandez, J. L., & Silva, A. A. O. (2012). Validação e aferição de fidedignidade da versão brasileira da Compulsive Buying Scale. *Revista de Psiquiatria Clínica*, 39(3), 100-105.
- Lezak, M. D. (2004). *Neuropsychological assessment 4th edition*. New York, USA: Oxford University Press.
- Lojo-Seoane, C., Facal, D., Guàrdia-Olmos, J., & Juncos-Rabadán, O. (2014). Structural model for estimating the influence of cognitive reserve on cognitive performance in adults with subjective memory complaints. *Archives of Clinical Neuropsychology*, 29(3), 245-255. doi: 10.1093/arclin/acu007
- Malloy-Diniz, L. F., Lasmar, V. A. P., Gazinelli, L. D. S. R., Fuentes, D., & Salgado, J. V. (2007). The Rey auditory-verbal learning test: applicability for the Brazilian elderly population. *Revista Brasileira de Psiquiatria*, 29(4), 324-329. doi: 10.1590/S1516-44462006005000053

- Malloy-Diniz, L. F., Lasmar, V. A. P., Gazinelli, L. S. R., Fuentes, D., & Salgado, J. V. (2007). Teste de aprendizagem auditivo-verbal de Rey: aplicabilidade na população idosa brasileira. *Revista Brasileira de Psiquiatria*, 29(4), 324-329.
- Mantella, R. C., Butters, M. A., Dew, M. A., Mulsant, B. H., Begley, A. E., Tracey, ... & Lenze, E. J. (2007). Cognitive impairment in late-life generalized anxiety disorder. *The American Journal of Geriatric Psychiatry*, 15, 673-679.
- Mertens, J., Reid, D., Lau, S., Kim, Y., & Gage, F. H. (2018). Aging in a Dish: iPSC-Derived and Directly Induced Neurons for Studying Brain Aging and Age-Related Neurodegenerative Diseases. *Annual Review of Genetics*, (0). doi: 10.1146/annurev-genet-120417-031534
- Mitrushina, M. N., Bone, K. B., D'Elia, L. F. (1999). *Manual de Dados Normativos para Avaliação Neuropsicológica*. New York, NY: Oxford University Press, USA.
- Monica, C. D., Johnsen, S., Atzori, G., Groeger, J. A., & Dijk, D. J. (2018). Rapid eye movement sleep, sleep continuity and slow wave sleep as predictors of cognition, mood, and subjective sleep quality in healthy men and women, aged 20-84 years. *Frontiers in Psychiatry*, 9. doi: 10.3389/fpsyt.2018.00255
- Nascimento, E. (2004). Adaptação, validação e normatização do WAIS-III para uma amostra brasileira. Wechsler D. *WAIS-III: Manual para administração e avaliação*. São Paulo, SP: Casa do Psicólogo.
- Navakkode, S., Liu, C., & Soong, T. W. (2018). Altered function of neuronal L-type calcium channels in ageing and neuroinflammation: implications in age-related synaptic dysfunction and cognitive decline. *Ageing Research Review*, 86-99. doi: 10.1016/j.arr.2018.01.001
- O'shea, D. M., Fieo, R. A., Hamilton, J. L., Zahodne, L. B., Manly, J. J., & Stern, Y. (2015). Examining the association between late-life depressive symptoms, cognitive function, and brain volumes in the context of cognitive reserve. *International Journal of Geriatric Psychiatry*, 30(6), 614-622. doi: 10.1002/gps.4192
- Paradela, E. M. P., Lourenço, R. A., & Veras, R. P. (2005). Validação da escala de depressão geriátrica em um ambulatório geral. *Revista de Saúde Pública*, 39(6), 918-923. doi: 10.1590/S0034-89102005000600008
- Park, D. C. (2002). Aging, cognition, and culture: a neuroscientific perspective. *Neuroscience & Biobehavioral Reviews*, 26(7), 859-867. doi: 10.1016/S0149-7634(02)00072-6
- Pessini, R. A., de Menezes Reis, R., César, H. V., & Gamez, L. (2018). Análise da plasticidade neuronal com o uso de jogos eletrônicos. *Journal of Health Informatics*, 10(1).
- Pillai, J. A., Hall, C. B., Dickson, D. W., Buschke, H., Lipton, R. B., & Verghese, J. (2011). Association of crossword puzzle participation with memory decline in persons who develop dementia. *Journal of the International Neuropsychological Society*, 17(6), 1006-1013. doi: 10.1017/S1355617711001111
- Prull, M. W., Gabrieli, J. D., & Bunge, S. A. (2000). Age-related changes in memory: A cognitive neuroscience perspective. Retrieved from <http://psycnet.apa.org/record/2000-07017-002>
- Rawtaer, I., Gao, Q., Nyunt, M. S. Z., Feng, L., Chong, M. S., Lim, W. S., ... & Ng, T. P. (2017). Psychosocial risk and protective factors and incident mild cognitive impairment and dementia in community dwelling elderly: findings from the Singapore longitudinal ageing study. *Journal of Alzheimer's Disease*, 57(2), 603-611. doi: 10.3233/JAD-160862

- Rey, A. (1958). *L'examen clinique en psychologie*. Paris, France: Press Universitaire de France.
- Reyes, A., Paul, B. M., Marshall, A., Chang, Y. A., Bahrami, N., Kansal, L., ... McDonald, C. R. (2018). Does bilingualism increase brain or cognitive reserve in patients with temporal lobe epilepsy? *Epilepsia*, 59(5), 1037-1047. doi: 10.1111/epi.14072
- Santos, C. S., Cerchiari, E. A. N., Alvarenga, M. R. M., Faccenda, O., & Oliveira, M. A. C. (2010). Avaliação da confiabilidade do Mini-Exame do Estado Mental em idosos e associação com variáveis sociodemográficas. *Cogitare Enfermagem*, 15(3).
- Santos, S. A. E. N. (2009). *Fluência verbal semântica e fonêmica: estudos psicométricos e normativos numa amostra de adultos idosos saudáveis*. [Masters Dissertation], Universidade de Coimbra, Portugal. Retrieved from <http://hdl.handle.net/10316/15774>
- Shah, T. M., & Martins, R. N. (2017). *Synergistic Effects of Combined Physical Activity and Brain Training on Neurological Functions*. Retrieved from <https://www.sciencedirect.com/science/article/pii/B9780128050941000174>
- Siedlecki, K. L., Stern, Y., Reuben, A., Sacco, R. L., Elkind, M. S. V., & Wright, C. V. (2009). Construct validity of cognitive reserve in a multiethnic cohort: The Northern Manhattan Study. *Journal of the International Neuropsychological Society*, 15(4), 558–569. doi: 10.1017/S1355617709090857
- Silveira, M. M. D., & Portuguese, M. W. (2017). Analysis of life quality and prevalence of cognitive impairment, anxiety, and depressive symptoms in older adults. *Estudos de Psicologia (Campinas)*, 34(2), 261-268. doi: 10.1590/1982-02752017000200007
- Springer, M. V., McIntosh, A. R., Winocur, G., & Grady, C. L. (2005). The relation between brain activity during memory tasks and years of education in young and older adults. *Neuropsychology*, 19(2), 181. doi: 10.1037/0894-4105.19.2.181
- Steffener, J., & Stern, Y. (2012). Exploring the neural basis of cognitive reserve in aging. *Biochimica et Biophysica Acta (BBA) Molecular Basis of Disease*, 1822(3), 467-473. doi: 10.1016/j.bbadis.2011.09.012
- Stern, Y. (2009). Cognitive reserve. *Neuropsychologia*, 47(10), 2015-2028. doi: 10.1016/j.neuropsychologia.2009.03.004
- Stern, Y. (2017). An approach to studying the neural correlates of reserve. *Brain imaging and behavior*, 11(2), 410-416. doi: 10.1007/s11682-016-9566-x
- Stern, Y., Arenaza-Urquijo, E. M., Bartres-Faz, D., Belleville, S., Cantilon, M., Chetelat, G., ... & Okonkwo, O. (2018). Whitepaper: Defining and investigating cognitive reserve, brain reserve, and brain maintenance. *Alzheimer's & Dementia*. doi: 10.1016/j.jalz.2018.07.219
- Strauss, E., Sherman, E. M. S., & Spreen, O. (2006). *A compendium of neuropsychological tests 3rd edition*. New York, USA: Oxford U. Press.
- Tucker, A. M., & Stern, Y. (2011). Cognitive reserve in aging. *Current Alzheimer Research*, 8(4), 354-360. doi: 10.2174/156720511795745320
- Verghese, J., LeValley, A., Derby, C., Kuslansky, G., Katz, M., Hall, C., et al. (2006). Leisure activities and the risk of amnesic mild cognitive impairment in the elderly. *Neurology*, 66(6), 821–827. doi: 10.1212/01.wnl.0000202520.68987.48
- Verghese, J., LeValley, A., Derby, C., Kuslansky, G., Katz, M., Hall, C., ... Lipton, R. B. (2006). Leisure activities and the risk of amnesic mild cognitive impairment in the elderly. *Neurology*, 66(6), 821–827. doi: 10.1212/01.wnl.0000202520.68987.48
- Verghese, J., Lipton, R.B., Katz, M.J., Hall, C.B., Derby, C.A., Kuslansky, G., ... Buschke, H. (2003). Leisure activities and the risk of dementia in the elderly. *The New England Journal of Medicine*, 348(25), 2508–2516. doi: 10.1056/NEJMoa022252.

- Wechsler, D. (2004). *WAIS-III: Escala de Inteligência Wechsler para Adultos: Manual; Adaptação e Padronização de uma amostra Brasileira*. São Paulo, SP: Casa do Psicólogo.
- Wilson, R. S., Scherr, P. A., Schneider, J. A., Tang, Y., & Bennett, D. A. (2007). Relation of cognitive activity to risk of developing Alzheimer disease. *Neurology*, 69(20), 1911–1920. doi:10.1212/01.wnl.0000271087.67782
- Wolinsky, F. D., Weg, M. W. V., Howren, M. B., Jones, M. P., & Dotson, M. M. (2016). Effects of cognitive speed of processing training on a composite neuropsychological outcome: results at one-year from the IHAMS randomized controlled trial. *International Psychogeriatrics*, 28(2), 317-330. doi: 10.1017/S1041610215001428
- Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., & Leirer, V. O. (1983). Development and validation of a geriatric depression screening scale: a preliminary report. *Journal of Psychiatric Research*, 17(1), 37-49. doi: 10.1016/0022-3956(82)90033-4
- Yochim, B.P., Mueller, A.E., Segal, D.L. (2013). Late life anxiety is associated with decreased memory and executive functioning in community dwelling older adults. *Journal of Anxiety Disorders*, 27(6), 567-575. doi: 10.1016/j.janxdis.2012.10.010
- Zahodne, L. B., Glymour, M. M., Sparks, C., Bontempo, D., Dixon, R. A., MacDonald, S. W., & Manly, J. J. (2011). Education does not slow cognitive decline with aging: 12-year evidence from the Victoria Longitudinal Study. *Journal of the International Neuropsychological Society*, 17(6), 1039-1046. doi: 10.1017/S1355617711001044
- Zahodne, L. B., Manly, J. J., Brickman, A. M., Narkhede, A., Griffith, E. Y., Guzman, V. A., ... & Stern, Y. (2015). Is residual memory variance a valid method for quantifying cognitive reserve? A longitudinal application. *Neuropsychologia*, 77, 260-266. doi: 10.1016/j.neuropsychologia.2015.09.009
- Zhu, X., Qiu, C., Zeng, Y., & Li, J. (2017). Leisure activities, education, and cognitive impairment in Chinese older adults: a population-based longitudinal study. *International Psychogeriatrics*, 29(5), 727-739. doi: 10.1017/S1041610216001769

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001

Table 1
Multiple linear regression for predicting cognitive reserve ($n = 64$)

Cognitive functions (DV)	R^2 (variance)	Predictors (IV)	F (df)	p	Non-standardized Beta coefficient (β)	Standard Error (SE)	Standardized Beta coefficient (β)	t	p	CI (95%)	
										Lower Limit	Upper Limit
Overall cognitive function (MEEM)	51.30%	BAI2	17.295 (4, 58)	<0.001	-0.181	0.034	-0.535	-5.373	<0.001	-0.248	-0.113
		Use of electronic devices1			1.855	0.512	0.337	3.623	0.001	0.830	2.880
		Learning another language1			1.766	0.544	0.296	3.249	0.002	0.678	2.854
		Living with someone1			0.27	0.115	0.23	2.346	0.022	0.04	0.501
Immediate verbal episodic memory (RAVLT A1)	18.80%	Use of electronic devices1	8.173 (2, 60)	<0.001	1.169	0.429	0.324	2.725	0.008	0.311	2.027
Delayed verbal episodic memory (RAVLT A7)	21.50%	BAI2	6.902 (2, 41)	0.003	-0.056	0.026	-0.253	-2.127	0.038	-0.109	-0.003
		Living with someone1			-0.208	0.063	-0.455	-3.312	0.002	-0.335	-0.081
Processing speed (Coding)	40.60%	Years of study	15.132 (3, 59)	<0.001	0.419	0.184	0.312	2.272	0.028	-0.335	-0.081
		Crossword puzzles1			1.556	0.316	0.500	4.919	<0.001	0.923	2.188
		Age2			7.377	3.217	0.226	2.293	0.025	0.940	13.815
Auditory attention and immediate and working memory (Digit symbol)	19.60%	Age2	8.548 (2, 60)	0.002	-0.594	0.267	-0.227	-2.222	0.03	-1.128	-0.059
		BAI1			-0.21	0.059	-0.405	-3.548	0.001	-0.328	0.920
Sustained attention, sequencing and graphomotor skills (TMT-A)	24.60%	BAI2	7.742 (3, 59)	<0.001	-0.09	0.039	-0.268	-2.349	0.022	-0.167	-0.013
		Crossword puzzles1			1.247	0.466	0.299	2.679	0.01	0.316	2.179
		Age2			-19.713	7.422	-0.295	-2.656	0.01	-34.564	-4.863
Divided attention, sequencing, flexibility and graphomotor skills (TMT-B)	31.50%	BAI2	10.491 (3, 59)	<0.001	1.305	0.599	0.244	2.177	0.033	0.106	2.505
		Age2			4.755	1.326	0.382	3.586	0.001	2.102	7.407
		Crossword puzzles1			4.714	1.707	0.295	2.762	0.008	1.299	8.129
Verbal fluency, inhibition and word generation (Fluency - Animals)	12.70%	Age2	10.000 (1, 61)	0.002	-47.599	21.132	-0.238	-2.252	0.028	-89.884	-5.314
					-0.258	0.082	-0.375	-3.162	0.002	-0.422	-0.095

7 Considerações Finais

A presente Tese de Doutorado avaliou o funcionamento cognitivo, a reserva cognitiva e variáveis relacionadas ao envelhecimento, em um intervalo de quatro anos. Também discutiu a respeito de fatores envolvidos na reserva cognitiva indireta, bem como variáveis do estilo de vida que influenciam à cognição e a saúde mental de idosos, avaliados longitudinalmente. Os principais resultados encontrados foram os seguintes:

- No intervalo de quatro anos, os idosos avaliados apresentaram declínio no funcionamento cognitivo global, memória episódica verbal tardia e velocidade de processamento;
- Verificou-se uma tendência de declínio cognitivo com o passar dos anos, mesmo em idosos não clínicos;
- Foram identificadas as variáveis: sintomas de ansiedades, aprendizagem de outro idioma, realização de palavras cruzadas, prática de exercício físico e escolaridade como preditoras na diferença do desempenho cognitivo dos participantes no intervalo de quatro anos;
- As variáveis que contribuíram para uma medida indireta de reserva cognitiva de idosos foram: idade, sintomas de ansiedade, morar com outra pessoa e realização de atividades cognitivamente estimulantes.

Apesar de os resultados encontrados apontarem contribuições à literatura científica sobre esta temática, esta pesquisa apresenta limitações, tendo em vista que a perda amostral foi maior que a esperada. Desta forma, sugere-se que novos estudos longitudinais sejam realizados, recrutando um número maior de participantes idosos, considerando que as perdas nessa faixa etária podem ser maiores que esperadas.

Espera-se que sejam realizados novos estudos de acompanhamento longitudinal com idosos, bem como investigar indivíduos de outras regiões do Brasil, podendo aprimorar os resultados apresentados nesta Tese de Doutorado. Acredita-se que este trabalho irá proporcionar contribuições tanto ao meio acadêmico e científico, quanto para os profissionais que trabalham com idosos, no

sentido de trazer resultados atuais a respeito do envelhecimento cognitivo e questões associadas à saúde mental dos indivíduos.

Apêndice A - Questionário de Dados Sociodemográficos e Clínicos

FICHA DE DADOS SOCIODEMOGRÁFICOS E CLÍNICOS

Aplicador: _____ Data da aplicação: ____/____/____
1. Nome do participante: _____ 2. Telefone Contato: _____ 3. Telefone Contato familiar: _____
4. Data de nascimento: ____/____/____ Idade (em anos completos): ____ anos
5. Sexo: (1) Feminino (2) Masculino
6. Cidade de Procedência: _____
7. Estado civil: (1) Casado (2) União estável (3) Solteiro (4) Viúvo (5) Divorciado
8. Escolaridade: (1) Nenhuma (2) Ensino fundamental incompleto/Primário incompleto (3) Ensino fundamental completo/Primário completo (4) Ensino médio incompleto/Ginásio incompleto/ Curso Técnico/Magistério incompleto (5) Ensino médio completo/Ginásio completo/ Curso Técnico/Magistério (6) Ensino superior incompleto (7) Ensino superior completo
9. Quantos anos de escolaridade (sem repetências): _____
10. Escolaridade dos pais (escolher o de maior escolaridade):

- (1) Nenhuma
- (2) Ensino fundamental incompleto/Primário incompleto
- (3) Ensino fundamental completo/Primário completo
- (4) Ensino médio incompleto/Ginásio incompleto/ Curso Técnico/Magistério incompleto
- (5) Ensino médio completo/Ginásio completo/ Curso Técnico/Magistério
- (6) Ensino superior incompleto
- (7) Ensino superior completo

11. Quantos anos de escolaridade dos pais (sem repetências): _____

12. Fluência em outras línguas:

- (1) Não (2) Sim **Se sim, assinale abaixo:**

Outras línguas:

Língua: _____ (1) Fala (2) Lê (3) Escreve (4) Compreende

Língua: _____ (1) Fala (2) Lê (3) Escreve (4) Compreende

13. Mora com alguém?

- (1) Esposo (a)
- (2) Filho (a)
- (3) Parente
- (4) Amigo (a)
- (5) Instituição
- (6) Sozinho
- (7) Pais

14. Sua residência é:

- (1) Própria

(2) Alugada

(3) Instituição

(4) De algum familiar

15. Qual sua ocupação atual?

(1) Nunca trabalhou

(2) Trabalhando em tempo integral

(3) Trabalhando em tempo parcial

(4) Trabalhando como autônomo

(5) Trabalha informalmente

(6) Realiza trabalho voluntário

(7) Em benefício

(8) Aposentado

(9) Pensionista

(10) Dona de Casa

(11) Desempregado(a)

16. Quantos anos de atividade profissional? _____

17. De qual fonte provém sua renda?

(1) Pensão

(2) Salário

(3) Ajuda de terceiros

(4) Aposentadoria

18. Se está aposentado, quanto tempo de aposentadoria: _____anos.

19. Nos últimos 12 meses, quais das atividades de lazer abaixo você realizou?

(A) Atividades de raciocínio:

a) Leitura. Se sim, quantas vezes por semana: _____

b) Cruzadas/Caça-palavras. Se sim, quantas vezes por semana: _____

c) Cartas. Se sim, quantas vezes por semana: _____

d) Bingo. Se sim, quantas vezes por semana: _____

e) Computador/Tablet. Se sim, quantas vezes por semana: _____

f) Jogos eletrônicos/Celular Smartphone/Videogame. Se sim, quantas vezes por semana:

(B) Atividades lúdicas:

a) Viajar. Se sim, quantas vezes por ano: _____

b) Festas. Se sim, quantas vezes por mês: _____

- c) Cinema. Se sim, quantas vezes por mês: _____
- d) Televisão/Rádio. Se sim, quantas vezes por semana: _____
- e) Música. Se sim, quantas vezes por semana: _____

(C) Atividade física:

- a) Caminhada. Se sim, quantas vezes por semana: _____
- b) Bocha. Se sim, quantas vezes por semana: _____
- c) Futebol. Se sim, quantas vezes por semana: _____
- d) Academia. Se sim, quantas vezes por semana: _____

20. Você participa de atividades em grupo?

(a) Não

(b) Sim. Se sim, quais atividades: _____

21. Você tem/teve algum problema de saúde ou doença importante nos últimos 4 anos?

(1) Não

(2) Sim. Qual(is)? _____

22. Utilizou medicação nos últimos 4 anos?

(1) Não

(2) Sim. Qual(is)? _____

23. Tem feito exames de rotina com seu médico nos últimos 4 anos?

(1) Não

(2) Sim. Qual(is)? _____

24. De um mês pra cá, você tem deixado de realizar alguma atividade por motivos de saúde?

(1) Não

(2) Sim. Qual(is)? _____

25. Houve alguma hospitalização prévia nos últimos 4 anos?

(1) Não

(2) Sim. Se sim, qual motivo: _____

26. Você tem/teve alguma doença mental (ex.: depressão) nos últimos 4 anos?

(1) Não

(2) Sim. Qual(is)? _____

27. Você realizou algum tratamento psicológico ou psiquiátrico nos últimos 4 anos?

(1) Não

(2) Sim, mas não faço atualmente

(3) Sim e faço atualmente

28. Qual a renda mensal da sua família (considere a renda de todos os integrantes inclusive você)?

(1) até 2 salários mínimos (2) De 2 a 4 salários mínimos (3) Superior a 5 salários mínimos

29. Você fuma ou já fumou cigarro de tabaco?

(1) Não (2) Sim. **Se sim, responda:**

() Consumo **atual** Em que quantidade: _____ (cigarros/dia)

() Consumo **anterior** (prévio) Em que quantidade: _____ (cigarros/dia)

30. Você costuma consumir bebidas alcoólicas?

(1) Não (2) Sim. **Se sim, responda:**

() Consumo **atual** Que tipo: () Cerveja () Vinho () Whisky () Outros Qual:

Em que quantidade: (copos/ocasião)

Com que frequência: (doses/vezes ao dia, semana ou mês)

() Consumo **anterior** (prévio) Que tipo: () Cerveja () Vinho () Whisky () Outros Qual:

Em que quantidade: (copos/ocasião)

Com que frequência: (doses/vezes ao dia, semana ou mês)

31. Caso você tenha assinalado na questão anterior a resposta SIM quanto ao consumo de bebidas alcoólicas, responda: Em relação ao seu hábito de beber (Questionário CAGE):

a) Alguma vez você sentiu que deveria diminuir a quantidade de bebida ou parar de beber?

(1) Não (2) Sim

b) As pessoas o(a) aborrecem porque criticam o seu modo de beber?

(1) Não (2) Sim

c) Você se sente culpado pela maneira com que costuma beber?

(1) Não (2) Sim

d) Você costuma beber pela manhã para diminuir o nervosismo ou a ressaca?

(1) Não (2) Sim

32. Histórico de Demência na Família:

(1) Não

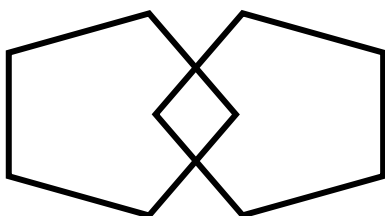
(2) Sim

Se sim: (1) Pai (2) Mãe (3) Irmão. Outros: _____

Apêndice B – Protocolo de avaliação da cognição e sintomatologia depressiva

MINI-EXAME DO ESTADO MENTAL (MEEM)

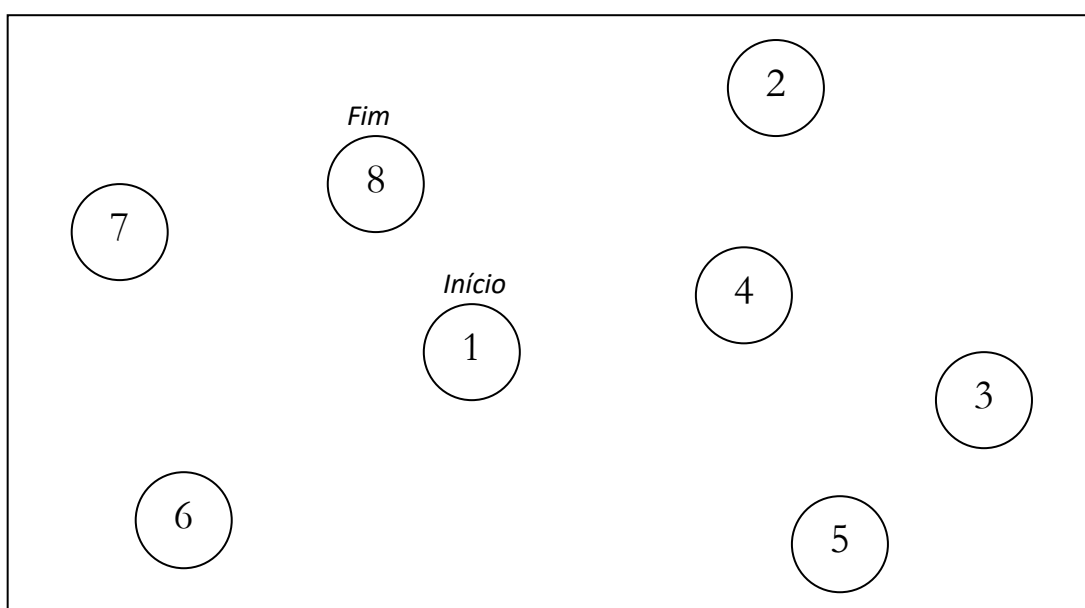
Mini-Mental de Folstein (1975), adaptado por Brucki <i>et al</i> (2003)			
Orientação Temporal (05 pontos) <i>Dê um ponto para cada item</i>	Que ano nós estamos? Ano		
	Que mês nós estamos? Mês		
	Que dia do mês é hoje? Dia do mês		
	Que dia da semana é hoje? Dia da semana		
	Que hora é agora (aproximadamente) Semestre/Hora aproximada		
Orientação Espacial (05 pontos) <i>Dê um ponto para cada item</i>	Que estado é este que residimos? Estado		
	Que cidade que estamos? Cidade		
	Qual bairro ou rua próxima?		
	Local geral: que local é este aqui (apontando ao redor num sentido mais amplo: hospital, casa de repouso, própria casa)		
	Andar ou local específico: em que local nós estamos (consultório,dormitório, sala, apontando para o chão)		
Registro (3 pontos)	Repetir: GELO, LEÃO e PLANTA		
Atenção e Cálculo (5 pontos) Dê 1 ponto para cada acerto. Considere a tarefa com melhor aproveitamento.	Subtrair $100 - 7 = 93 - 7 = 86 - 7 = 79 - 7 = 72 - 7 = 65$		
	Soletrar inversamente a palavra MUNDO=ODNUM		
Memória de Evocação (3 pontos)	Quais os três objetos perguntados anteriormente?		
Nomear dois objetos (2 pontos)	Relógio e caneta		
Repetir (1 ponto)	“NEM AQUI, NEM ALI, NEM LÁ”		
Comando de estágios (3 pontos) Dê 1 ponto para cada ação correta)	“Apanhe esta folha de papel com a mão direita(1), dobre-a ao meio (1) e coloque-a no chão (1)”		
Escrever uma frase completa (1 ponto)	“Escreva alguma frase que tenha começo, meio e fim”		
Ler e executar (1 ponto)	FECHE SEUS OLHOS		
Copiar diagrama (1 ponto)	Copiar dois pentágonos com interseção		
PONTUAÇÃO FINAL (escore = 0 a 30 pontos)			

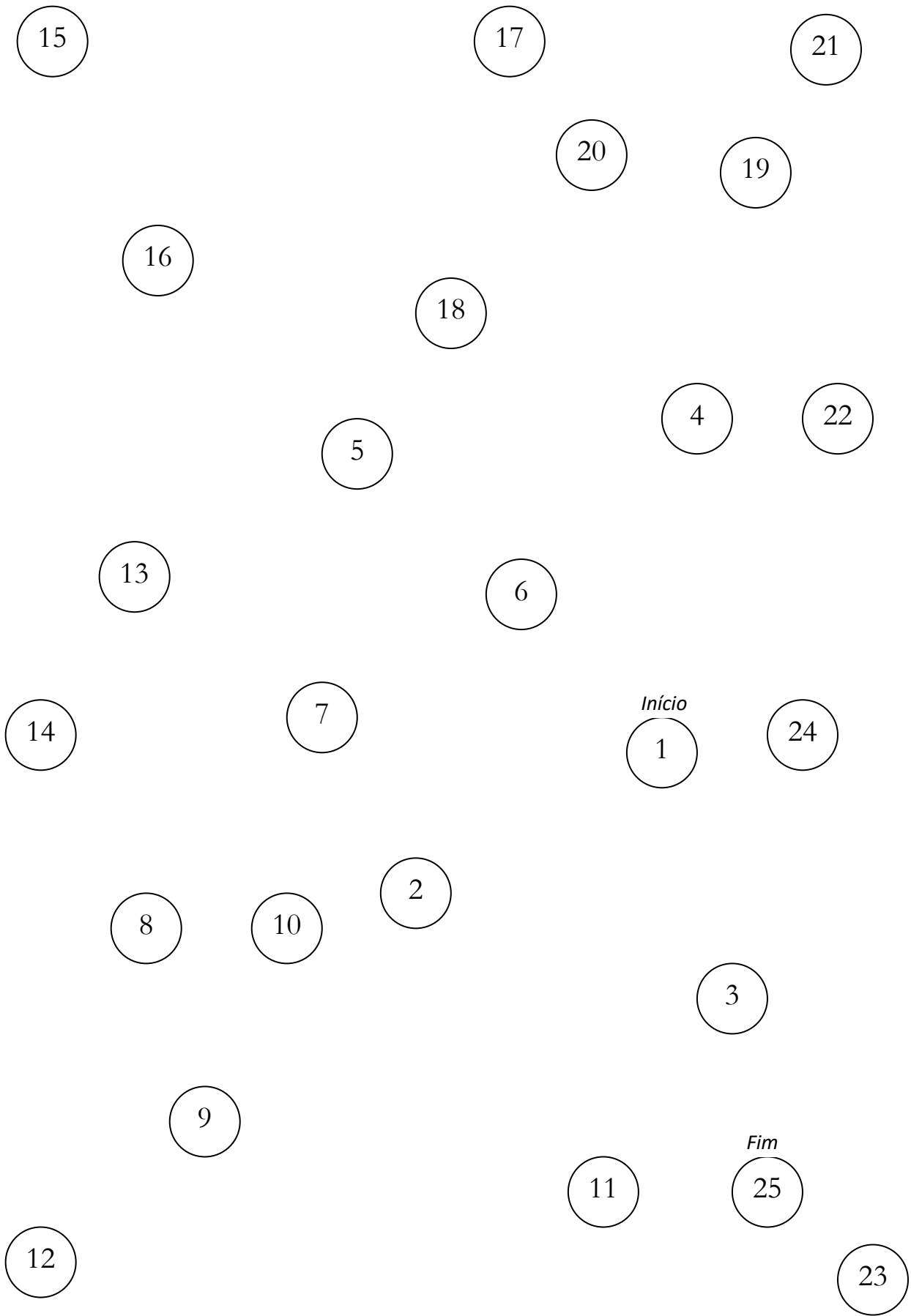


TRAIL MAKING TEST (TMT) - CRONOMETRAR**TRAIL MAKING TEST**

Part A

AMOSTRA



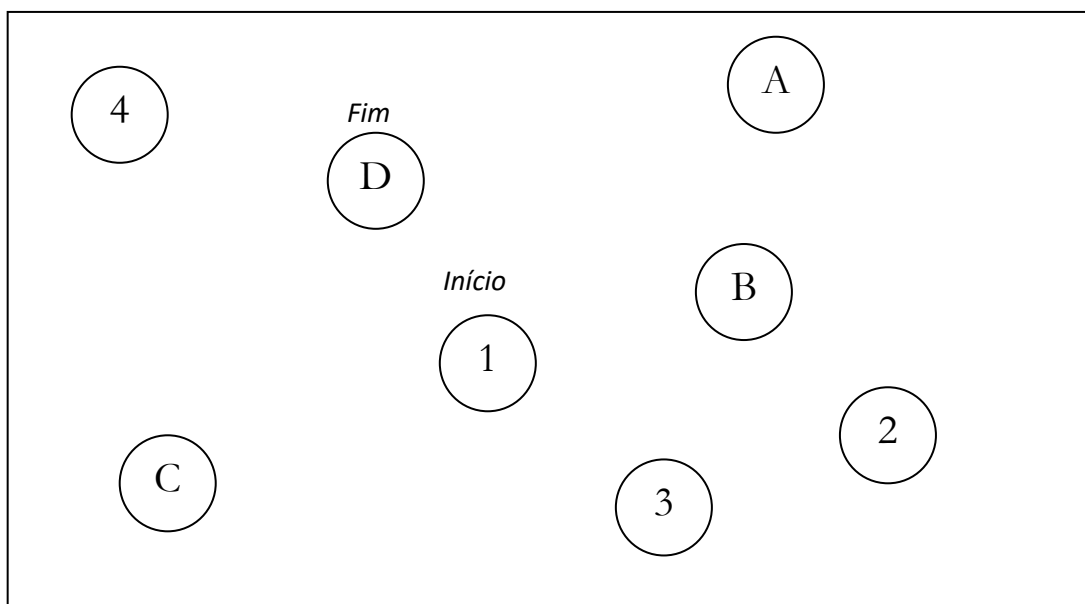


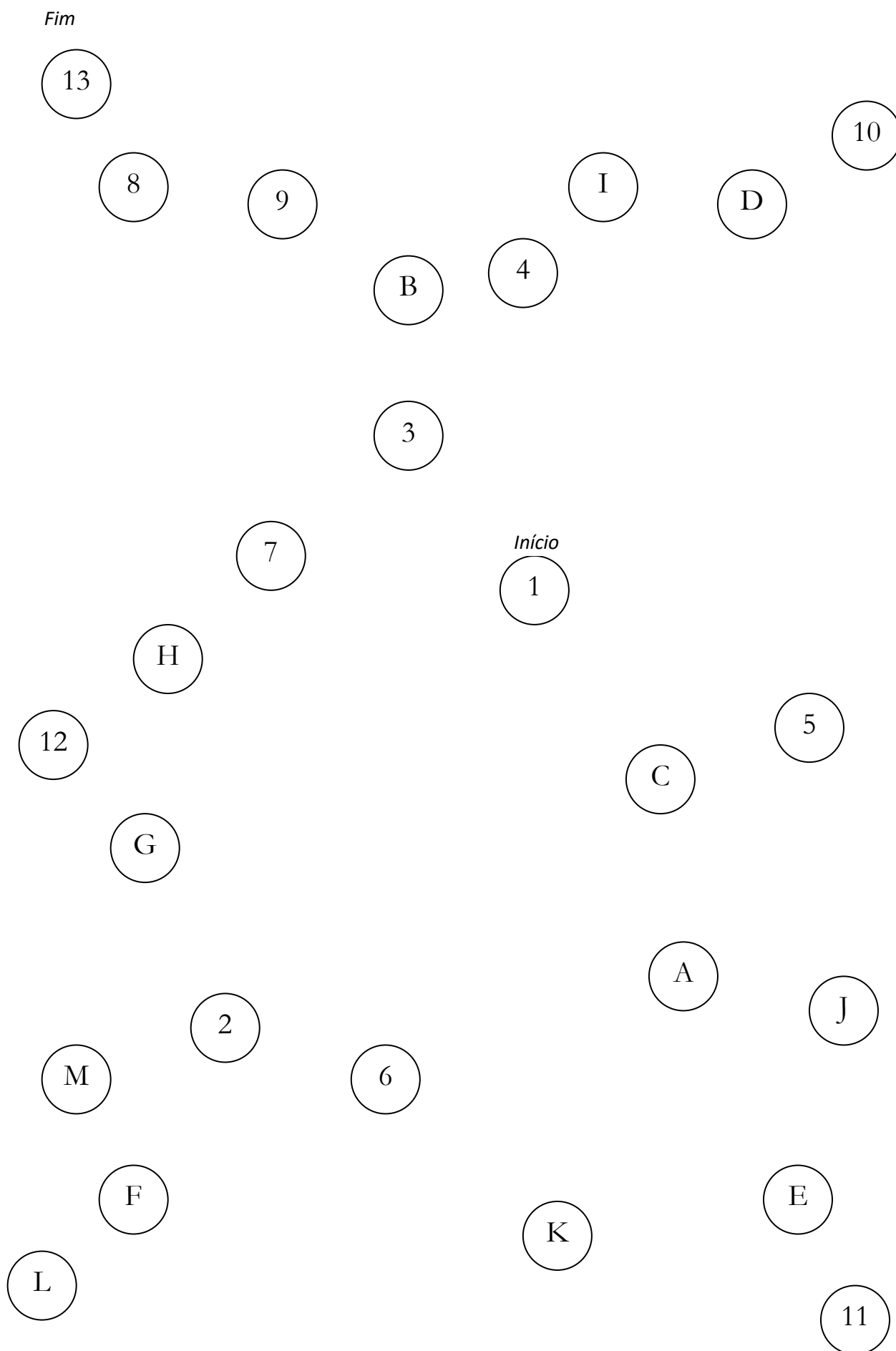
TRAIL MAKING TEST

Part B

- Na Parte B, o sujeito deve traçar uma linha de forma a unir, sequencialmente, 25 círculos com números ou com letras, distribuídos aleatoriamente numa folha, alternando números, do 1 ao 13, e letras, do A ao M (por ex. 1, A, 2, B, 3, C, etc.). Os resultados correspondem ao tempo necessário para a realização da tarefa e ao número de erros.

AMOSTRA





GABARITO TRAIL MAKING TEST

Nome: _____ Data de Nascimento: ____/____/____
 Escolaridade: _____ Data da Avaliação: ____/____/____

PARTE A: máximo de 24 acertos

- () 1-2
- () 2-3
- () 3-4
- () 4-5
- () 5-6
- () 6-7
- () 7-8
- () 8-9
- () 9-10
- () 10-11
- () 11-12
- () 12-13
- () 13-14
- () 14-15
- () 15-16
- () 16-17
- () 17-18
- () 18-19
- () 19-20
- () 20-21
- () 21-22
- () 22-23
- () 23-24
- () 24-25

PARTE A

Total de acertos: ____
 Total de erros: ____
 Tempo do teste: ____

PARTE B: máximo de 24 acertos

- () 1-A
- () A-2
- () 2-B
- () B-3
- () 3-C
- () C-4
- () 4-D
- () D-5
- () 5-E
- () E-6
- () 6-F
- () F-7
- () 7-G
- () G-8
- () 8-H
- () H-9
- () 9-I
- () I-10
- () 10-J
- () J-11
- () 11- L
- () L-12
- () 12-M
- () M-13

PARTE B

Total de acertos: ____
 Total de erros: ____
 Tempo do teste: ____

TESTE DE FLUÊNCIA VERBAL – Categoria Animal

FLUÊNCIA SEMÁNTICA (CATEGORIA ANIMAL):Tempo limite: 1 minuto	
1.	26.
2.	27.
3.	28.
4.	29.
5.	30.
6.	31.
7.	32.
8.	33.
9.	34.
10.	35.
11.	36.
12.	37.
13.	38.
14.	39.
15.	40.
16.	41.
17.	42.
18.	43.
19.	44.
20.	45.
21.	46.
22.	47.
23.	48.
24.	49.
25.	50.
TOTAL ANIMAIS:	
(FAS Word Fluency (o Controlled Oral Word Association-COWA: Guilford, 1967; Guilford & Guilford, 1980; Spreen & Strauss, 1998)	

ESCALA DE DEPRESSÃO GERIÁTRICA (GDS)

1 Você está satisfeito com a sua vida?	Sim	Não*	
2 Você deixou de lado muitas de suas atividades e interesses?	Sim*	Não	
3 Você sente que sua vida está vazia?	Sim*	Não	
4 Você sente-se aborrecido com frequência?	Sim*	Não	
5 Está você de bom humor na maioria das vezes?	Sim	Não*	
6 Você teme que algo de ruim lhe aconteça?	Sim*	Não	
7 Você se sente feliz na maioria das vezes?	Sim	Não*	
8 Você se sente freqüentemente desamparado?	Sim*	Não	
9 Você prefere permanecer em casa do que sair e fazer coisas	Sim*	Não	
10 Você sente que tem mais problemas de memória que antes?	Sim*	Não	
11 Você pensa que é maravilhoso estar vivo?	Sim	Não*	
12 Você se sente inútil?	Sim*	Não	
13 Você se sente cheio de energia?	Sim	Não*	
14 Você sente que sua situação é sem esperança?	Sim*	Não	
15 Você pensa de que a maioria das pessoas estão melhores do	Sim*	Não	
Correção: marcar 1 ponto para cada resposta com *	TOTAL =		

Apêndice C – Termo de Consentimento Livre e Esclarecido

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

O Senhor(a)_____ está sendo convidado(a) como voluntário(a) a participar do estudo **FATORES DE PERSONALIDADE, FUNCIONAMENTO COGNITIVO E QUALIDADE DE VIDA EM IDOSOS: UM ESTUDO LONGITUDINAL**, que tem como objetivo comparar os fatores de personalidade, o desempenho cognitivo e a percepção de qualidade de vida de idosos em um intervalo de quatro anos. Acreditamos que essa avaliação seja importante porque fará um acompanhamento do funcionamento global do participante, identificando pontos fortes e possíveis disfunções. Com isso, serão realizadas orientações e encaminhamentos ao idoso.

PARTICIPAÇÃO NO ESTUDO

A sua participação no estudo referido será da seguinte forma: profissionais e alunos de Psicologia irão realizar a administração dos instrumentos psicológicos em uma sala silenciosa, dentro da Clínica Núcleo Médico Psicológico ou em salas disponibilizadas na Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS). A avaliação será realizada em um dia, em uma sessão com duração de duas horas.

RISCOS

É possível que aconteça o seguinte desconforto durante a avaliação: cansaço durante a administração dos instrumentos psicológicos e mobilização emocional pelo conteúdo questionado, sobre os quais medidas serão tomadas para sua redução, tais como intervalo durante a atividade e oferecimento de água, chá e café durante a aplicação dos instrumentos. Esta atividade não haverá riscos.

BENEFÍCIOS

A pesquisa possivelmente trará como benefício a sua contribuição pessoal para o desenvolvimento de um estudo científico, além do acompanhamento de seu funcionamento cognitivo, personalidade e a qualidade de vida em um intervalo de 4 anos, sobre os quais você poderá esclarecer dúvidas a qualquer momento.

SIGILO E PRIVACIDADE

Como participante de pesquisa, sua privacidade será respeitada, seu nome e qualquer outro dado que possa te identificar serão mantidos em sigilo. Os pesquisadores se responsabilizam pela guarda e confidencialidade das informações, bem como a não exposição dos dados de pesquisa.

AUTONOMIA

Será garantida assistência a você durante toda a pesquisa, assim como o livre acesso a todas as informações e esclarecimentos sobre o estudo e suas consequências, ou seja, tudo o que queira saber antes, durante e depois de sua participação. Você pode se recusar a participar do estudo ou retirar seu consentimento a qualquer momento sem precisar se justificar, e, caso esta seja sua vontade, não sofrerá prejuízo algum na assistência recebida.

CONTATO

Os pesquisadores envolvidos com o referido projeto são Marianne Farina e Tatiana Quarti Irigaray da PUCRS e com eles você pode manter contato pelo telefone (51) 99955 1581 e (51) 99997 9670 e pelo e-mail mariannefarina@yahoo.com.br.

O Comitê de Ética em Pesquisa (CEP) é composto por um grupo de pessoas que trabalham para garantir que seus direitos como participante de pesquisa sejam respeitados. O grupo tem a obrigação de avaliar se a pesquisa foi planejada e se está sendo executada de maneira ética.

Se você achar que a pesquisa não está sendo realizada de tal forma ou que está sendo prejudicado de alguma maneira, entre em contato com o Comitê de Ética em Pesquisa da Pontifícia Universidade Católica do Rio Grande do Sul (CEP-PUCRS) localizado na Av. Ipiranga, 6681, Prédio 50, Sala 703 CEP: 90619-900 - Bairro Partenon - Porto Alegre – RS, também estará disponível pelo telefone (51) 3320-3345 ou e-mail: cep@pucrs.br, de segunda a sexta-feira, das 8:00 às 12:00 e das 13:30 à 17:00.

DECLARAÇÃO

Declaro que li e entendi todas as informações presentes neste Termo de Consentimento Livre e Esclarecido e tive a oportunidade de discutir as informações relacionadas à pesquisa. Todas as minhas perguntas foram respondidas e eu estou satisfeito com as respostas. Entendo que receberei uma via assinada e datada deste documento e que outra via assinada e datada será arquivada nos pelo pesquisador responsável do estudo.

Por fim, fui orientado a respeito do que foi mencionado neste termo e compreendo a natureza e o objetivo do estudo e manifesto meu livre consentimento em participar, estando totalmente ciente de que não há nenhum valor econômico a receber ou a pagar por minha participação.

Porto Alegre, _____ de _____.

Assinatura do participante de pesquisa



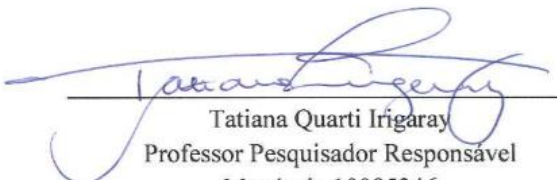
Marianne Farina (Doutoranda)



Tatiana Quarti Irigaray (Orientadora)

Apêndice D – Orçamento

Itens a serem financiados		Valor Unitário R\$	Valor Total R\$	Fonte Viabilizadora (Ver ao pé da folha)
Especificações	Quantidade			
Caneta	10	1,00	10,00	4
Pacote folha de ofício A4	5	15,00	75,00	4
WAIS	108	28,00	3024,00	4
BAI	108	9,00	972,00	4
Fotocópias	108	0,15	16,20	4
Assessoria estatística	3	120 (hora)	360,00	4
Encadernações + Capa oficial	8	18,50	148,00	4
			Total: 4605,20	


 Tatiana Quarti Irigaray
 Professor Pesquisador Responsável
 Matrícula 10085346

- 1- Patrocinador
- 2- Agência de Fomento (Anexar comprovante)
- 3- Serviço
- 4- Pesquisador
- 5- Outros

Apêndice E – Artigo “Neuroticism and quality of life: testing for mediated effects of anxiety in older adults without cognitive impairment” (submetido para publicação)

Marianne Farina^{1*}
 Carmen Moret-Tatay²
 Luis Henrique Paloski¹
 Tatiana Quarti Irigaray¹

¹ Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS) – Avenida Ipiranga, 6681 – Partenon, 90619-900, Porto Alegre/RS – Brazil.

² Universidad Católica de Valencia San Vicente Mártir (UCV) - Carrer de Quevedo, 2, 46001, Valencia, Espanha.

*Researcher of Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) – Brazil.

Abstract:

Introduction: Plasticity has been related to some compensatory behavioral changes in aging that might occur, in many fields, personality included. Literature also supports its linked with quality of life in late life. However, the question of whether personality might affect symptomatology in the elderly, and its inherent relation to quality of life, has been the topic of debate. The aim of this study is to examine the mediating role of variables such as anxiety on personality and the quality of life in the elderly without cognitive impairment. Method: a sample of 106 elderly participants (cognitive healthy and aged from 60 to 91 years old) was selected. Variables such as personality, anxiety and quality of life were measured through the Personality Factorial Battery (PFB), the Beck Anxiety Inventory (BAI), the WHOQOL-BREF and the WHOQOL-OLD questionnaire. Results: The anxiety symptomatology was identified as mediating role of the relation between personality and quality of life in elderly persons, intensifying this relationship. The others personality's factors did not present statistical significance. Conclusion: Anxiety mediates the effect of neuroticism personality on quality of life in the elderly without cognitive impairment. This might suggest that, even if studies claim invariance of neuroticism in late life, its effect on quality of life might be susceptible to variables such anxiety.

Keywords: personality; big five, quality of life, anxiety; elderly.

Resumen:

La plasticidad se ha relacionado con algunos cambios comportamentales compensatorios en el envejecimiento que pueden ocurrir, en muchos campos, incluida la personalidad. La literatura también apoya su relación con la calidad de vida en los últimos años de la vida. Sin embargo, la cuestión de si la personalidad podría afectar la sintomatología en los ancianos y su relación inherente con la calidad de vida, ha sido el tema de debate. El objetivo de este estudio es examinar el papel mediador de variables como la ansiedad sobre la personalidad y la calidad de vida en personas mayores sin deterioro cognitivo. Método: se seleccionó una muestra de 106 participantes ancianos

(cognitivos sanos y con edades comprendidas entre 60 y 91 años). Variables como la personalidad, la ansiedad y la calidad de vida se midieron a través de la Personality Factorial Battery (PFB), el Beck Anxiety Inventory (BAI), el WHOQOL-BREF y el cuestionario WHOQOL-OLD. Resultados: la sintomatología de la ansiedad se identificó como el papel mediador de la relación entre la personalidad y la calidad de vida en personas mayores, intensificando esta relación. Los factores de la personalidad de los otros no presentaron significación estadística. Conclusión: la ansiedad media el efecto de la personalidad del neuroticismo en la calidad de vida en los ancianos sin deterioro cognitivo. Esto podría sugerir que, incluso si los estudios afirman, la invariancia del neuroticismo en los últimos años de la vida, su efecto sobre la calidad de vida podría ser susceptible a variables tales como la ansiedad.

Palabras clave: personalidad, big five, ansiedad, calidad de la vida, personas mayores.

Introduction

In the aging process, there are changes in the biological, psychological and social conditions of the individual. These changes may lead to a reduction in mental and physical health, such as a decrease in cognitive functions, and more precisely a decrease in the quality of life. This variable has been described as a protective measure of psychopathologies that require the adaptation of the elderly to deal with this process (Almeida, 2012; Fortes-Burgos, Neri, & Cupertino, 2008; Yamada, Landes, Mimori, Nagano, & Sasaki, 2015). In this way, quality of life can be considered a multidimensional construct and concerns the individual's perception of their position in life, culture and the value system in which they live in relation to their goals, expectations and standards (WHOQOL, 1994). In a study conducted in Britain it was found that the main predictors of quality of life were expectations and social relationships, personality, health and functional ability in people over 65 years (Bowling, Banister, Sutton, Evans, & Windsor, 2002). However, the particular relationship among them is rather complex.

The literature indicates that differences in quality of life can be explained by the personality factors of the individual (Weiss, Bates, & Luciano, 2008). More precisely, the extroversion and neuroticism factors might have a direct and inverse association with quality of life, respectively (Stolarski, 2016). The literature has identified high level of neuroticism and low extroversion factor associated with psychopathological symptoms in the elderly, in particular for anxiety (Bruce & Lynch, 2011; Farina, Irigaray, & Argimon, 2016; Gonzatti et al., 2017; Paulus, Vanwoerden, Norton, & Sharp, 2016; Quanes et al., 2017). Another study identified a moderating effect of personality associated with virtual social interaction and quality of life in adults (Gerson, Plagnol, & Corr, 2016). Considering that people with high levels of extraversion may present a higher level of social interaction, this association of characteristics related to extraversion and perception of quality of life is reinforced.

The others factors of personality were also identified as associated with a better quality of life in the elderly. Associated with health-related behaviors, conscientiousness is associated with a better perception of quality of life in the elderly (Friedman & Kern, 2014). High levels of openness and agreeableness were associated with better quality of life in aging compared to the younger group. However, the neuroticism and extroversion factors were not significant in this study (Weber et al., 2015). Already Ryff (2008) identified that the factors extroversion and conscientiousness are directly and, neuroticism, inversely associated with the perception of quality of life in aging.

It has been seen that, in addition to personality factors, sociodemographic and psychopathological characteristics are associated with quality of life in the elderly. The presence of mood symptoms, such as depression and anxiety, as well as the presence of physical diseases are associated with a worse perception of quality of life in the elderly,

and this perception is an indicator of higher mortality in this population (Friedman & Kern, 2014; Weber et al., 2015).

One study with older depressed participants facing life events, showed evidence of an anxiety and depressive symptoms increase (Van der Veen et al., 2016). This emphasized the role of personality, in particular, for the factor of neuroticism. High levels of neuroticism are generally associated with anxiety and emotional instability (Chen, Pu, Shi, & Zhou, 2017).

Additionally, other study examined the role of social interaction - which may be related to high levels of extroversion and low levels of neuroticism – and this is associated with quality of life in the elderly (Arslantas, Adana, Ergin, Kayar, & Acar, 2015). The authors identified that loneliness, health problems and lack of leisure activities are related to a poorer quality of life. Those older participants who live alone might be considered at risk if they do not participate in social activities. On the other hand, several studies suggest that cognitive functioning is affected by anxiety symptoms in the elderly. When assessing cognition and anxiety in older Brazilians, an association between memory impairment and anxiety symptoms was identified (Paulo & Yassuda, 2010). Moreover, a lower level of anxiety can be considered a protective factor for the cognition in the elderly.

Considering that cognitive reserve is a resource that helps the individual to delay the natural cognitive changes that occur in aging (Stern, 2017), one hypothesis pointed out in the literature is that the elderly without cognitive impairment present a better cognitive reserve. Furthermore, this may be also related to the lower levels of anxiety present in that sample. Here, one should bear in mind that the anxiety was identified as one of the components involved in the cognitive reserve in the elderly (Farina, Paloski, Oliveira, Argimon, & Irigaray, 2017), and thus, these factors contribute to a better

perception of quality of life. However, the role of personality among the relationship of anxiety and quality of life in this particular group is of interest and rather scarce in the literature.

Another point to consider is what comes before: the symptoms of anxiety or cognitive impairment. One hypothesis is that individuals with low levels of anxiety are more resistant to cognitive impairment during the aging. Nevertheless, the relation between variables might be affected by other personal variables, such as personality. Therefore, studies that examine the role of this construct are of interest in the optimal aging. In this way, the perception of the quality of life, being a construct that depends on the individual's perception, is believed to be mediated through cognitive processing (Bowling, Banister, Sutton, Evans, & Windsor, 2002).

In this sense, because the elderly are cognitively preserved, the perception of the quality of life of the sample can be considered reliable, reinforcing the robustness of the responses and, consequently, the results. Moreover, this issue is also related to the stability of personality in aging. Even if a large body of research emphasize the invariance of personality in the elderly, or better to say, more stability than change (Aschwanden, Martin, & Allemand, 2017; Costa & McCrae, 1994). However, some studies claimed that variability on the major trait of neuroticism can be observed in the elderly (Chopik & Kitayama, 2017; Roberts, Walton, & Viechtbauer, 2006; Steunenberg, Twisk, Beekman, Deeg, & Kerkhof, 2005).

We hypothesize that variables related to some personality traits in daily functioning, in older adults without cognitive impairment, may affect the described association between quality of life and neuroticism. For this reason, this study aims to fill a gap in the literature, considering that the sample is composed of elderly individuals who do not present cognitive deterioration, being an important factor that contributes to

a better quality of life in aging (Desai, Grossberg, & Chibnall, 2010). Thus, the objective of this study is to examine the role of anxiety in relation to anxiety and the quality of life of the elderly without cognitive impairment.

Method

Participants

An initial sample of 108 individuals were invited to participate in the study, selected by convenience, coming from the city of Porto Alegre, Rio Grande do Sul - Brazil. After the application of the inclusion and exclusion criteria, two participants were excluded of the study. These criteria are described as follows: the participants were included from the criterion of age > 60 years - age criterion based on Brazilian's data (Statute of the Elderly, 2003). The Mini-Mental State Examination (MMSE) was used for exclusion criteria of the sample, with scores ranging from > 18 points for low and medium schooling (first or second grade) and > 26 points for high schooling (Bertolucci, Brucki, Campacci, & Juliano 1994).

Instruments

First of all, a sociodemographic questionnaire was required. This included questions related to age, gender and years of education. Secondly, the MMSE was carried out. This provides an overview of cognitive functioning of the patient. It has been developed by Folstein, Folstein e McHugh (1975), and adapted to Brazil by Bertolucci, Brucki, Campacci, e Juliano (1994). The Brazilian version presents good internal consistence for elderly people $\alpha = 0.80$ (Santos, Cerchiari, Alvarenga, Faccenda, & Oliveira, 2010).

Finally, the questionnaires employed afterwards were related to the main objectives of the study. These are explained as follows: Personality Factorial Battery (PFB): is a Brazilian's psychological instrument, built to evaluate personality through the Big Five Model. The scale has 126 items, answered on a likert scale of 1 to 7 points, in which the person indicates which of the scores best quantifies the affirmations. The PFB includes the factors: neuroticism, extraversion, conscientiousness, openness to experience and agreeableness (Nunes, Hutz, & Nunes, 2010). The internal consistence for each factor was $\alpha = 0.89$ neuroticism, $\alpha = 0.84$ extroversion, $\alpha = 0.85$ agreeableness, $\alpha = 0.83$ conscientiousness and $\alpha = 0.74$ openness to experience (Nunes, Hutz, & Nunes, 2010).

Beck Anxiety Inventory (BAI): measures the severity of anxiety symptoms through 21 items, on a likert scale of 0 to 4 points. The results are obtained by summing the scores of each item. For the psychiatric population, the cutoff points, according to the norms of the Portuguese version, elaborated in 1999, are subdivided into 0 to 10 = minimum, 11 to 19 = low, 20 to 30 = moderate and 31 to 63 = high. The internal consistence was $\alpha = 0.90$ (Beck & Steer, 1993; Cunha, 2001).

WHOQOL-OLD: evaluates the perception of quality of life specifically for the elderly population. It is composed of 24 questions distributed in six facets: sensory abilities (SA); autonomy (AUT); past, present and future activities (PPF); social participation (SP); death and dying (DD); intimacy (INT). Each facet has four items. The values of the 24 items of the WHOQOL-OLD module can be combined to produce a general (overall) score for quality of life in older adults, denoted as the total score of the module of this instrument (Chachamovich, Fleck, & Trentini, 2008). The internal consistence was between $\alpha = 0.71$ and $\alpha = 0.885$ (Fleck, Chachamovich, & Trentini, 2006).

According to the authors, simultaneously the WHOQOL-BREF was applied. It has 26 itens, distributed in domains: physical health, psychological, social relationships and environment (Cruz, Polanczyk, Camey, Hoffmann, & Fleck, 2011). The internal consistence was estimated between $\alpha = 0.69$ and $\alpha = 0.79$ (Moreno, Faerstein, Werneck, Lopes, & Chor, 2006).

Data analysis

The statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) 22. We conducted a mediational analysis using Process Macro for SPSS (Hayes, 2015) to test the hypothesis that anxiety mediates the effect of personality on quality of life in the elderly without cognitive impairment. In this way, Regression-based mediation procedures were executed employing bootstrapping procedures using 10000 samples (Hayes, 2009; MacKinnon & Fairchild, 2009). More precisely, a regression coefficient (and associated t-test) was first calculated on the mediational M variable (and its inherent paths a and b), the X independent variable on the dependent variable without the inclusion of moderator (c' path), and the X independent variable on the dependent variable after the mediator was included (c path). Figure 1 illustrates this analysis in terms of variables and paths. The mediation analyses were performed with instruments WHOQOL-OLD and BREF, BAI and PFB.

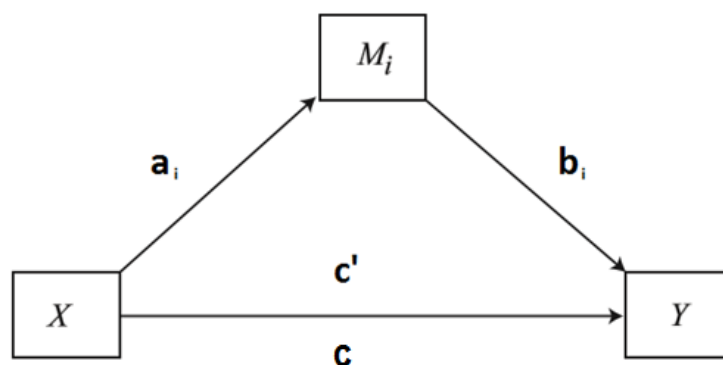


Figure 1. Mediation model to test and its paths.

Results

A total of 106 participants aged 61 years and above. The majority of participants were women (80.2%; $n = 85$) and (19.8 %; $n = 21$) men. Aspects related to health, 81,9% ($n = 86$) did not perform any activity due to health conditions, 76,4% ($n = 81$) never had any mental illness, and 76% ($n = 76$) did physical activity. The Table 1 describes the scores obtained by the participants about age, schooling, as well as the scores of cognition, personality, anxiety symptoms and quality of life.

Table 1.

Self-reported sociodemographic characteristics, cognitive function, factors of personality, anxiety and quality of life.

Variables	Minimum	Maximum	Mean	Std. deviation
Age	60	91	69.05	6.68
Years of education	2	25	12.00	4.86
MMSE	21	30	27.74	1.87
Neuroticism	1.38	5.38	3.32	0.85
Extraversion	2.65	6.23	4.27	0.67
Conscientiousness	2.35	6.32	4.81	0.66
Openness to experience	2.64	5.54	4.23	0.61
Agreeableness	2.69	5.00	3.96	0.46
BAI	0	62	11.47	11.2
WHOQOL-OLD	25	100	65.70	13.54
WHOQOL-BREF	2.63	4.75	3.85	0.40

Note. MMSE = Mini-Mental State Examination; BAI = Beck Anxiety Inventory.

After a mediation analysis was carried out, neuroticism was the factor that had an effect on quality of life mediated by anxiety. The rest of the personality factors did not reach the statistical significance. Moreover, this model was found for both questionnaires on quality of life, Whoqol Old ($F_{(1,102)}=17.1$; $MSE=112.75$; $R^2=0.12$; $p<0.0001$) and Bref ($F_{(1,103)}=19.25$; $MSE=111.35$; $R^2=0.12$; $p<0.0001$). Table 2 describes the underlying variables for the different models in terms of factor of neuroticism. One should bear in mind that the limits did not contain the 0 value, as expected in the literature. Furthermore, the direct effect was smaller than the total effect.

Table 2:

Mediational model coefficients with regards to factor of neuroticism, quality of life, and anxiety.

Factor		Coefficient	SE	<i>t</i>	<i>p</i>	LLCI	ULCI
Whoqol-Old	Path a_1	-4.69	1.12	4.18	0.0001	2.47	6.92
	Path b_2	-0.48	0.16	2.91	0.004	-0.81	-0.15
	Direct effect c'	-5.75	1.40	4.02	0.0001	-8.43	-2.86
	C	-7.92	1.37	5.72	<0.0001	-10.64	-5.20
	Total effect						
Whoqol-Bref	Path a_1	-4.69	1.07	4.38	<0.0001	2.57	6.81
	Path b_2	-0.01	0.003	4.17	0.0001	-0.022	-0.007
	Direct effect c'	-0.16	0.04	3.35	0.001	-0.25	-0.06
	C	-0.22	0.04	4.97	<0.0001	-0.32	-0.13
	Total effect						

Note. SE = standard error; LLCI = lower limit, ULCI = upper limit.

Finally, figure 2 describes the mediational model in terms of different measures of Whoqol (Old and Bref). The model seems to be robust for both measures. As expected, the relationship between neuroticism and anxiety was positive, while the rest were negative, suggesting an increase of $X \rightarrow Y$ for the whole model.

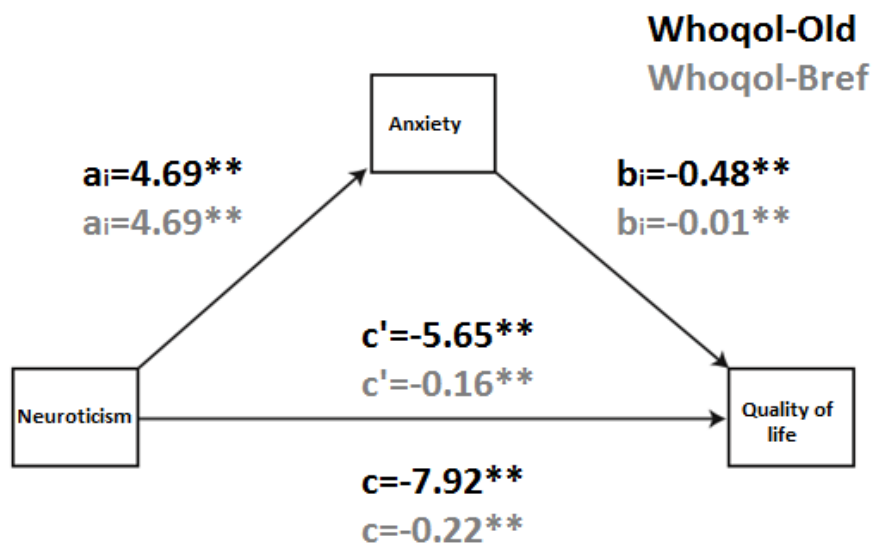


Figure 2. Mediation model across neuroticism and quality of life in terms of Whoqol old and Bref. $p < 0.01^{**}$. Path are described as follows: a_1 (effect of $X \rightarrow M$), b_1 (effect of $M \rightarrow Y$), c' (direct effect) and c (total effect).

Discussion

The main aim of this study was examined the role of anxiety in the association of personality traits and the quality of life in the elderly without cognitive impairment. As expected from the literature, it was found that neuroticism was the factor that had an effect on quality of life mediated by anxiety. First of all, one plausible hypothesis to explain this result is the factors of personality could influence the perception of quality of life (Vollmann, Pukrop, & Salewski), as well as anxiety (Chen, Peng, Ma, & Dong, 2017). Furthermore, it seems that neuroticism and quality of life relationship might be intensified by variables such as anxiety symptomatology. This result supports the idea that, even in late life, neuroticism might be susceptible to changes (Chopik & Kitayama, 2017).

Futhermore, one should bear in mind here that, according to the results, only the neuroticism factor was identified as mediator of this relation. However, the others factors – extraversion, conscientiousness, openness, and agreeableness – did not present statistical significance in the model. With regards to ageing, it was found that neuroticism varies the intensity and extroversion decreases over time, and may generate higher levels of mood symptoms, mainly depression, in the elderly (Lourenço, 2012). In investigating the elderly from 60 to 89 years, Yassine (2011) identified that the extroversion factor is associated with the view of aging as a positive period, with gains and greater control over life, that is, associated to a better perception of quality of life.

The results that associate cognitive functioning and personality find resonance in the literature, mainly highlighting the neuroticism factor. High levels of neuroticism were associated with mortality, and this association was presented as mediated by cognitive, physical and social aspects (Wilson et al., 2005). A lower level of openness, greater neuroticism and extroversion were associated with worse mean of cognitive functioning in aging (Chapman et al., 2012). The factor neuroticism was also seen as associated with higher rates of hypochondriac complaints in adults (Gonçalves, 2011), may be indicating a poor perception of quality of life by the elderly.

The association of anxiety symptomatology and poorer perception of quality of life in the elderly is extensively identified in the literature (Green, Magee, Steiner, & Teachman, 2017; Herrera, Montorio, & Cabrera, 2017; Lopes & Argimon, 2016). However, when considering elderly without cognitive impairment, the number of studies reduces a lot, so the purpose of this study was to evaluate the personality role in relation to anxiety and the quality of life in elderly without cognitive impairment. Generally, studies with older adults describing about the decline of cognitive processing in aging (Terracciano, Stephan, Luchetti, Albanese, & Sutin, 2017). It is believed that

the elderly participants of this study present optimal cognitive function, considering that they did not have cognitive deterioration.

The present study has several shortcomings related to the characteristic of a self-report measurement and an incidental recruitment. Thus, even if this is a common procedure in the literature, some biases might be expected. Moreover, it seems important to highlight that even if some parameters seem to indicate that our sample might present an optimal ageing, more information is needed to conclude that. The optimal aging has three main components: low probability of disease acquisition, high physical and cognitive ability, and active engagement with life (Rowe & Kahn, 1997). Therefore, it should be noted that in this study, the other parameters were not evaluated to confirm this hypothesis. This sample had a high educational level, frequency of physical activity practice, and lower rate of psychopathological diseases. These variables described in maintain optimal cognitive function (Barnes et al., 2007; Yaffe et al., 2009).

For future lines of research, systematic series of studies, where these issues are addressed, are suggested, as well as longitudinal designs, are of interest. Nevertheless, these give strong support to the mediational role of anxiety and its underlying role on quality of life for late life.

References

- Arslantas, H., Adana, F., Ergin, F. A., Kayar, D., & Acar, G. (2015). Loneliness in elderly people, associated factors and its correlation with quality of life: A field study from Western Turkey. *Iranian Journal of Public Health*, 44(1), 43.
- Chen, X., Pu, J., Shi, W., & Zhou, Y. (2017). The Impact of Neuroticism on Symptoms of Anxiety and Depression in Elderly Adults: the Mediating Role of Rumination. *Current Psychology*, 1-9. doi: 10.1007/s12144-017-9740-3
- Aschwanden, D., Martin, M., & Allemand, M. (2017). Cognitive abilities and personality traits in old age across four years: More stability than change. *Journal of Research in Personality*, 70, 202-213. doi: 10.1016/j.jrp.2017.08.002

- Barnes, D. E., Cauley, J. A., Lui, L. Y., Fink, H. A., McCulloch, C., Stone, K. L., & Yaffe, K. (2007). Women who maintain optimal cognitive function into old age. *Journal of the American Geriatrics Society*, 55(2), 259-264. doi: 10.1111/j.1532-5415.2007.01040.x
- Beck, A. T., & Steer, R. A. (1993). *Beck Depression Inventory: Manual*. San Antonio, USA: Psychological Corporation.
- Bertolucci, P. H., Brucki, S., Campacci, S. R., & Juliano, Y. (1994). O mini-exame do estado mental em uma população geral: impacto da escolaridade. *Arquivos de Neuropsiquiatria*, 52(1), 1-7. doi: 10.1590/S0004-282X1994000100001
- Bowling, A., Banister, D., Sutton, S., Evans, O., & Windsor, J. (2002). A multidimensional model of the quality of life in older age. *Aging & mental health*, 6(4), 355-371. doi: 10.1080/1360786021000006983
- Chachamovich, E., Fleck, M. P., Trentini, C., & Power, M. (2008). Brazilian WHOQOL-OLD Module version: a Rasch analysis of a new instrument. *Revista de Saúde Pública*, 42(2), 308-316.
- Chapman, B., Duberstein, P., Tindle, H. A., Sink, K. M., Robbins, J. Tancredi, D. J. & Franks, P. (2012). Personality Predicts Cognitive Function Over Seven Years in Older Persons. *The American Journal of Geriatric Psychiatry*, 20(7), 612–621. doi:10.1097/JGP.0b013e31822cc9cb
- Chen, Y., Peng, Y., Ma, X., & Dong, X. (2017). Conscientiousness moderates the relationship between perceived stress and depressive symptoms among US Chinese older adults. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, 72(suppl_1), S108-S112.
- Chopik, W. J., & Kitayama, S. (2017). Personality change across the lifespan: Insights from a cross-cultural longitudinal study. *Journal of Personality*, 1-7. doi: 10.1111/jopy.12332
- Costa, P. T., Jr., & McCrae, R. R. (1994). Set like plaster? Evidence for the stability of adult personality. In T. F. Heatherton & J. L. Weinberger (Eds.). *Can personality change?* (pp. 21-40). doi: 10.1037/10143-002
- Cruz, L. N., Polanczyk, C. A., Camey, S. A., Hoffmann, J. F., & Fleck, M. P. (2011). Quality of life in Brazil: normative values for the Whoqol-bref in a southern general population sample. *Quality of life research*, 20(7), 1123-1129. doi: 10.1007/s11136-011-9845-3
- Cunha, J. A. (2001). *Manual da versão em português das Escalas Beck*. São Paulo, SP: Casa do Psicólogo.
- Desai, A. K., Grossberg, G. T., & Chibnall, J. T. (2010). Healthy brain aging: a road map. *Clinics in geriatric medicine*, 26(1), 1-16. doi: 10.1016/j.cger.2009.12.002
- Farina, M., Irigaray, T. Q., & Argimon, I. I. (2016). Personalidade e funcionamento adaptativo e psicopatológico em idosos. *Perspectivas em Psicologia*, 13(2), 10-20.
- Farina, M., Paloski, L. H., Oliveira, C. R., Argimon, I. I. L., & Irigaray, T. Q. (2017). Cognitive Reserve in Elderly and Its Connection with Cognitive Performance: A Systematic Review. *Ageing International*, 1-12. doi: 10.1007/s12126-017-9295-5
- Federal, S. (2003). *Estatuto do idoso*. Brasília, DF: Senado Federal.
- Fleck, M. P., Chachamovich, E., & Trentini, C. (2006). Development and validation of the Portuguese version of the WHOQOL-OLD module. *Revista de Saúde Pública*, 40(5), 785-791. doi: 10.1590/S0034-89102006000600007.
- 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.

- Friedman, H.S. & Kern, M.L. (2014). Personality, well-being, and health. *Annual Review of Psychology*, 65, 719-742. doi: 10.1146/annurev-psych-010213-115123
- Gerson, J., Plagnol, A. C., & Corr, P. J. (2016). Subjective well-being and social media use: Do personality traits moderate the impact of social comparison on Facebook? *Computers in Human Behavior*, 63, 813-822. doi: 10.1016/j.chb.2016.06.023
- Gonçalves, D. F. (2011). *As preocupações com a saúde e com a doença no contexto da personalidade: estudo exploratório*. [Master Dissertation], Núcleo de Psicologia da saúde e da doença, Universidade de Lisboa, Lisboa, Portugal.
- Gonzatti, V., Argimon, I. I. L., Oliveira, C. R., Esteves, C. S., Tatay, C. M., Irigaray, T. Q. (2017). Personality factors in the elderly: The relationship between cognitive functioning and depressive symptoms. *Avaliação Psicológica*, 16(1), 38-46. doi: 10.15689/ap.2017.1601.05
- Green, J. S., Magee, J. C., Steiner, A. R., & Teachman, B. A. (2017). When the “Golden Years” turn blue: Using the healthy aging literature to elucidate anxious and depressive disorders in older adulthood. *International Journal of Behavioral Development*, 41(2), 295-307. doi: 10.1177/0165025415613855
- Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication monographs*, 76(4), 408-420. doi: 10.1080/03637750903310360
- Hayes, A. F. (2015). *The PROCESS macro for SPSS and SAS*. [Computer software]. Retrieved from <http://www.processmacro.org>.
- Herrera, S., Montorio, I., & Cabrera, I. (2017). Effect of anxiety on memory for emotional information in older adults. *Aging & Mental Health*, 21(4), 362-368. doi: 10.1080/13607863.2015.1093601
- Lopes, R. M. F., & de Lima Argimon, I. I. (2016). Training contributions of executive functions in perception of quality of life in elderly. *International Neuropsychiatric Disease Journal*, 7(4), 1-13. doi: 10.9734/INDJ/2016/20347
- Lourenço, S. T. F. (2012). *Influência da auto percepção do envelhecimento e dos traços de personalidade na sintomatologia depressiva em idosos*. [Master Dissertation], Faculdade de Psicologia, Universidade de Lisboa, Portugal. Retrieved from <http://hdl.handle.net/10451/8291>.
- MacKinnon, D. P., & Fairchild, A. J. (2009). Current directions in mediation analysis. *Current directions in psychological science*, 18(1), 16-20.
- Moreno, A. B., Faerstein, E., Werneck, G. L., Lopes, C. S., & Chor, D. (2006). Propriedades psicométricas do Instrumento Abreviado de Avaliação de Qualidade de Vida da Organização Mundial da Saúde no estudo pró-saúde. *Caderno de Saúde Pública*, 22(12), 2585-2597.
- Nunes, C. H. S. S., Hutz, C. S., & Nunes, M. F. O. (2010). *Bateria Fatorial de Personalidade (BFP): Manual técnico*. São Paulo, SP: Casa do Psicólogo.
- Ouanes, S., Castelao, E., von Gunten, A., Vidal, P. M., Preisig, M., & Popp, J. (2017). Personality, Cortisol, and Cognition in Non-demented Elderly Subjects: Results from a Population-Based Study. *Frontiers in aging neuroscience*, 9. doi: 10.3389/fnagi.2017.00063
- Papália, D. E.; Olds, S. W., & Feldman, R. D. (2009). *Desenvolvimento Humano*. Porto Alegre, RS: Artmed.
- Paulo, D. L.V., & Yassuda, M. S. (2010). Queixas de memória de idosos e sua relação com escolaridade, desempenho cognitivo e sintomas de depressão e ansiedade. *Revista de Psiquiatria Clínica*, 37(1), 47-61.
- Paulus, D. J., Vanwoerden, S., Norton, P. J., & Sharp, C. (2016). From neuroticism to anxiety: Examining unique contributions of three transdiagnostic vulnerability

- factors. *Personality and Individual Differences*, 94, 38-43. doi: 10.1016/j.paid.2016.01.012
- Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: a meta-analysis of longitudinal studies. *Psychological bulletin*, 132(1), 1. doi:10.1037/0033-2909.132.1.1
- Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist*, 37(4), 433-440. doi: 10.1093/geront/37.4.433
- Ryff, C. D. (2008). Challenges and opportunities at the interface of aging, personality and well-being. In O.P. Oliver, R.W. Robins, & L.A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 399-418). New York, NY: Guilford Press.
- Santos, C. S., Cerchiari, E. A. N., Alvarenga, M. R. M., Faccenda, O., & Oliveira, M. A. A. (2010). Avaliação da confiabilidade do Mini-Exame do Estado Mental em idosos e associação com variáveis sociodemográficas. *Cogitare Enfermagem*, 15(3).
- Stern, Y. (2017). An approach to studying the neural correlates of reserve. *Brain imaging and behavior*, 11(2), 410-416. doi: 10.1007/s11682-016-9566-x
- Steunenberg, B., Twisk, J. W., Beekman, A. T., Deeg, D. J., & Kerkhof, A. J. (2005). Stability and change of neuroticism in aging. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 60(1), 27-33. doi: 10.1093/geronb/60.1.P27
- Stolarski, M. (2016). Not restricted by their personality: balanced time perspective moderates well-established relationships between personality traits and well-being. *Personality and Individual Differences*, 100, 140-144. doi: 10.1016/j.paid.2015.11.037
- Terracciano, A., Stephan, Y., Luchetti, M., Albanese, E., & Sutin, A. R. (2017). Personality traits and risk of cognitive impairment and dementia. *Journal of Psychiatric Research*, 89, 22-27. doi: 10.1016/j.jpsychires.2017.01.011
- Van der Veen, D. C., Van Dijk, S. D., Comijs, H. C., Van Zelst, W. H., Schoevers, R. A., & Oude Voshaar, R. C. (2016). The importance of personality and life-events in anxious depression: from trait to state anxiety. *Aging & Mental Health*, 1-7. doi: 10.1080/13607863.2016.1202894
- Vollmann, M., Pukrop, J., & Salewski, C. (2016). Coping mediates the influence of personality on life satisfaction in patients with rheumatic diseases. *Clinical rheumatology*, 35(4), 1093-1097.
- Wan, H. X. et al. (2009). Personality and lifestyles in relation to dementia incidence. *Neurology*, 72, 253-59. doi: 10.1212/01.wnl.0000339485.39246.87g
- Weber, K., Canuto, A., Giannakopoulos, P., Mouchian, A., Meiler-Mititelu, C., Meiler, A., ... & De Ribaupierre, A. (2015). Personality, psychosocial and health-related predictors of quality of life in old age. *Aging & Mental Health*, 19(2), 151-158. doi: 10.1080/13607863.2014.920295
- WHOQOL Group (1994). Development of the WHOQOL: Rationale and current status. *International Journal of Mental Health*, 23(3), 24-56. doi: 10.1080/00207411.1994.11449286
- Wilson, R. S., Krueger, K. R., Gu, L., Bienias, J. L., de Leon, C. F. M., & Evans, D. A. (2005). Neuroticism, extraversion, and mortality in a defined population of older persons. *Psychosomatic Medicine*, 67(6), 841-845.
- Yaffe, K., Fiocco, A. J., Lindquist, K., Vittinghoff, E., Simonsick, E. M., Newman, A. B., ... & Harris, T. B. (2009). Predictors of maintaining cognitive function in older

- adults The Health ABC Study. *Neurology*, 72(23), 2029-2035. doi: 10.1212/WNL.0b013e3181a92c36
- Yamada, M., Landes, R. D., Mimori, Y., Nagano, Y., & Sasaki, H. (2015). Trajectories of cognitive function in dementia-free subjects: radiation effects research foundation adult health study. *Journal of the neurological sciences*, 351(1), 115-119. doi: 10.1016/j.jns.2015.02.050
- Yassine, I. M. C. (2011). *A auto-percepção do envelhecimento e os traços de personalidade em idosos*. [Master Dissertation], Faculdade de Psicologia, Universidade de Lisboa, Portugal. Retrieved from <http://hdl.handle.net/10451/4335>.

Apêndice F – Capítulo “Reserva Cognitiva: fatores associados ao longo do ciclo vital” (no prelo)

Nicolas de Oliveira Cardoso

Pontifícia Universidade Católica do Rio Grande do Sul

Marianne Farina

Pontifícia Universidade Católica do Rio Grande do Sul

Thaís Landenberger

Pontifícia Universidade Católica do Rio Grande do Sul

Introdução

Esse capítulo visa explorar o conceito de reserva cognitiva, que pode ser considerada a capacidade do cérebro de armazenar experiências adquiridas ao longo da vida, resistindo aos prejuízos cognitivos presente em um quadro demencial. Ainda, é considerado um construto recente na literatura, com implicações no envelhecimento humano. No presente capítulo, serão descritos os fatores relacionados à reserva cognitiva, instrumentos de avaliação e direções futuras para pesquisas nessa temática.

O que sabemos sobre a Reserva Cognitiva?

O conceito de reserva surgiu a partir de observações como a de Katzman et al. (1989), que, após a autópsia de 10 pacientes idosas, identificaram que, apesar de serem consideradas cognitivamente saudáveis em seu desempenho funcional em vida, apresentavam danos severos em sua estrutura encefálica, característicos da Doença de Alzheimer (DA). Uma das hipóteses explicativas, na época, estava relacionada ao

tamanho do cérebro das idosas, os quais eram maiores do que a média da população. No entanto, essa explicação não foi suficiente, dando início às investigações sobre essa discrepância entre a gravidade de uma patologia e os sintomas clínicos exibidos.

Mais adiante, essas especulações levaram, à formulação de dois modelos que explicassem essa preservação do funcionamento cerebral apesar do dano neurológico, constituiu-se então o modelo passivo e o modelo ativo. O modelo passivo, também conhecido como reserva cerebral ou reserva neuronal, é caracterizado pelas características estruturais do cérebro (ex.: tamanho do encéfalo, número de neurônios e sinapses disponíveis). Já o modelo ativo, também chamado de reserva cognitiva (RC) está diretamente relacionado à quantidade (ex.: número de áreas cerebrais afetadas) de lesões que o encéfalo pode suportar antes do surgimento de sintomas clínicos, dada a sua capacidade de compensar o dano (Stern, 2017; Sumowski et al., 2014).

A RC está relacionada à capacidade do cérebro em manter o seu desempenho cognitivo preservado, por um maior período de tempo, durante o curso de uma doença degenerativa (Stern & Habeck, 2017). A qualidade dos danos (ex.: relevância das áreas afetadas e capacidade de neuroplasticidade) ou ainda as diferenças individuais em nível de processamento cognitivo e realização de tarefas é explorada pelo modelo ativo. Neste modelo, o cérebro busca compensar as lesões sofridas através da utilização de recursos cognitivos pré-mórbidos, os quais possui para lidar com danos neurológicos. Está associado a experiências intelectuais e fatores ambientais ao longo da vida (Stern, 2017).

Os modelos de reserva passiva (reserva cerebral) e reserva ativa (RC) são complementares e dependentes um do outro. A RC adquirida ao longo da vida (ex.: nível de instrução, ocupação profissional) contribuirá para a reserva cerebral, sendo

comum a observação de aumento de volume ou aprimoramento das conexões neurais de estruturas encefálicas (ex.: córtex pré-frontal, matéria branca e cinzenta) após exposição a atividades cognitivamente estimulantes (Cardoso, Landenberger, & Argimon, 2017; Gleich, Lorenz, Gallinat, & Kühn, 2017; Gong et al., 2017).

Contudo, para fins de estudo, estes conceitos são comumente abordados individualmente. Isto ocorre devido às diferentes formas de mensuração destes construtos, sendo a reserva cerebral avaliada através de exames de neuroimagem e a RC através de questionários específicos (Groot et al., 2018). Portanto, o conceito de manutenção cerebral está relacionado à capacidade que os indivíduos possuem de preservar a RC e a reserva cerebral, em maior quantidade e por mais tempo (Stern, 2017). Cabe ressaltar que a manutenção cerebral é um conceito novo, o qual tem sido abordado e discutido largamente ao longo dos últimos cinco anos, não estando ainda totalmente formulado (Nilsson & Lövdén, 2018; Stern, 2017).

Fatores associados à formulação da RC

Por ser um conceito recente e ainda especulativo, o universo científico busca identificar quais são os fatores associados ao desenvolvimento da RC. Considerando o fato de não ser observável, a RC é geralmente estudada por meio da modelagem de variáveis latentes, o que permite a análise da relação entre os diferentes indicadores associados a ela, e vinculados à presença ou ausência de deterioração cognitiva. Têm-se visto que algumas atividades realizadas ao longo da vida contribuem para a formação da RC. Dentre elas, destacam-se: escolaridade, ocupação profissional, estilo de vida ativo, atividades intelectuais, atividades físicas e aspectos clínicos (Cardoso, Argimon,

&Pereira, 2017; Farina, Paloski, Oliveira, Argimon, & Irigaray, 2017), que serão explicados a seguir:

Escolaridade: um estudo longitudinal, realizado na Suécia, acompanhou 7.574 indivíduos durante o período de 21 anos, avaliando questões sociodemográficas e de saúde dos participantes. A escolaridade foi um dos fatores relacionados à RC dos indivíduos, sendo considerada protetiva ao desenvolvimento de sintomas demenciais nos adultos, principalmente para aqueles com ensino superior. Também foi observado que um melhor desempenho escolar na infância retardou o aparecimento de declínio cognitivo, tendo em vista que um melhor desempenho cognitivo na infância contribuiu para uma melhor eficiência da rede cerebral e flexibilidade dos participantes (Dekhtyar et al., 2015). Desta forma, a escolaridade pode ser considerada como uma variável moderadora do desempenho cognitivo de indivíduos e, conseqüentemente, contribui para a qualidade do envelhecimento funcional do sistema nervoso central de idosos (Paula, Diniz, Sallum, & Malloy-Diniz, 2016).

Ocupação profissional e estilo de vida ativo: o grau de complexidade das atividades profissionais exercidas pelos indivíduos, também estiveram associadas à RC, sendo que os trabalhos considerados mais complexos estavam relacionados a menos sintomas demenciais em adultos (Dekhtyar et al., 2015). Um estudo longitudinal que acompanhou 1.054 idosos da Alemanha, por oito anos, observou uma menor taxa de declínio cognitivo nos participantes que possuíam um maior nível de complexidade nas tarefas de trabalho que os estimulava mentalmente (Then et al., 2015).

Ao avaliar indivíduos que possuíam menores estímulos no trabalho, com condições consideradas menos desafiadoras, observou-se uma maior taxa de comprometimento cognitivo (Then et al., 2015). Já o estilo de vida ativo, em que o

indivíduo realiza atividades de lazer, físicas e de interação social são apontadas na literatura como benéficas a qualidade vida e, por consequência, contribuindo para uma melhor cognição e RC dos indivíduos (Lara et al., 2017; Sousa & Borges, 2016).

Atividades intelectuais: o envolvimento de adultos e idosos em atividades cognitivamente estimulantes (ex.: leitura e jogos de quebra-cabeça) pode reduzir a ocorrência de problemas cognitivos. Estas atividades são consideradas protetivas tanto à memória, quanto ao funcionamento cognitivo geral, podendo inclusive prevenir sintomas demenciais nos indivíduos (Cardoso, Landenberger et al., 2017; Izquierdo, Myskiw, Benetti, & Furini, 2013; Stern, 2012).

A realização de palavras-cruzadas, utilização de aparelhos eletrônicos e aprendizagem de um novo idioma também contribuíram para uma melhor RC em idosos (Farina et al., no prelo), bem como a utilização de jogos eletrônicos (Cardoso, Argimon et al., 2017). A prática de jogos eletrônicos, inclusive, pode auxiliar na reabilitação cognitiva dos indivíduos que apresentam declínio cognitivo, beneficiando mais especificamente a memória, atenção, processamento de informações e as funções executivas (Cardoso, Landenberger et al., 2017).

Atividade física: há evidências de que o exercício físico é uma das variáveis que leva à melhoria da saúde física e mental. Diversos estudos abordam a contribuição da prática de atividades físicas para um melhor desempenho cognitivo dos indivíduos ao longo do ciclo vital. Desta forma, tem-se visto que a prática de atividades físicas contribuí tanto para a saúde mental, quanto cognitiva dos indivíduos, pois ao realizar estas atividades, são liberados neurotransmissores que geram sensações de prazer, promovendo melhora no sono, além de diminuïrem níveis de colesterol e cortisol

(Arrieta et al., 2018; Fekedulegn et al., 2018; Greeff, Bosker, Oosterlaan, Visscher, & Hartman, 2017).

Variáveis clínicas: ao abordar questões clínicas de saúde, pode-se pensar em problemas físicos e também psicopatológicos que influenciam a cognição dos indivíduos. Ao investigar longitudinalmente idosos brasileiros do Sul do país, observou-se que sintomas de ansiedade foram preditores de uma pior RC nos indivíduos (Farina et al., no prelo). Outros autores também apontaram associação entre a presença de sintomatologia depressiva e solidão e um maior comprometimento cognitivo em indivíduos idosos, variando conforme seus níveis de RC (O'Shea et al., 2015). Em relação às condições cerebrais, tem se visto que condições neurológicas influenciam a RC dos indivíduos. Ao avaliar 72 indivíduos pelo período de cinco anos, a pesquisa de Leary et al. (2018) observou que níveis da RC estavam relacionados à gravidade da lesão cerebral traumática.

Desta forma, pode-se considerar que as características laborais, educacionais e um estilo de vida mais ativo proporcionam efeitos positivos para a saúde mental, física e cognitiva, contribuindo para a RC dos indivíduos. A identificação dos fatores contribuintes a RC, bem como formas de mensurá-los, auxilia na prevenção do adoecimento físico e mental dos indivíduos, favorecendo uma melhor qualidade de vida ao longo do envelhecimento.

Instrumentos de medida de RC

Os primeiros sinais de declínio cognitivo não são simples de serem detectados entre indivíduos com RC mais desenvolvida, de forma que a doença pode ser subdiagnosticada através dos falso-negativos (Elkana et al., 2016). O acesso a uma

medida de RC durante o processo de avaliação cognitiva poderia contribuir para o diagnóstico mais preciso e para a identificação precoce de patologias neurodegenerativas.

A partir do final do século XX, há um aumento, em nível internacional, dos esforços em identificar as variáveis determinantes da RC e uma forma de operacionalizar este construto através de instrumentos de medida confiáveis (Harrison et al., 2015). Muitos estudos consideram o nível de escolaridade ou mesmo o quociente de inteligência (QI) como medidas de RC. No entanto, pesquisas envolvendo instrumentos de medida de múltiplos fatores ainda são escassos. Em uma revisão dos instrumentos que avaliam RC a partir de múltiplas variáveis, foram identificados apenas cinco escalas/questionários no mundo (Tabela 1) (Landenberger, Cardoso, Oliveira, & Argimon, no prelo). Destes instrumentos, no entanto, nenhum é de origem brasileira, e a *Cognitive Reserve Scale* (CRS) está em processo de adaptação transcultural para nosso contexto.

Tabela 1. Instrumentos de medida de RC a partir de múltiplas variáveis

Escala	Autores	Ano	País de origem
<i>Cognitive Reserve Scale (CRS)</i>	León-estrada, Roldan-Tapia, e García-Garcia	2011	Espanha
<i>Cognitive Reserve Index Questionnaire (CRIq)</i>	Nucci, Mapelli, e Mondini	2011	Itália
<i>Cognitive Reserve Questionnaire (CRQ)</i>	Rami, et al.	2011	Espanha
<i>Lifetime of Experiences Questionnaire (LEQ)</i>	Valenzuela e Sachdev	2006	Austrália
<i>Lifetime Cognitive Activity Scale (LCAS)</i>	Wilson, Barnes, e Bennett,	2003	EUA

Um instrumento que auxilie no diagnóstico precoce favorece maior eficiência e otimização dos programas de reabilitação neuropsicológica, acelerando o início do tratamento, bem como adiantando a orientação e os cuidados oferecidos pela família ao paciente. Percebe-se, assim, uma demanda emergente por estudos científicos que sigam investigando as variáveis associadas à RC e formas simples e efetivas de mensurá-la.

Definindo direções futuras para pesquisa

Nesta seção iremos apresentar os avanços científicos mais recentes no campo da RC e propor algumas sugestões para estudos futuros. A maioria das pesquisas atuais buscam compreender o funcionamento e a extensão dos efeitos protetivos da RC (Donders & Stout, 2018; Reyes et al., 2018).

Um desses efeitos está relacionado ao papel da RC frente ao traumatismo cranioencefálico (TCE). Alguns estudos apontam que a RC é capaz de reduzir significativamente os prejuízos cognitivos causados por lesões cerebrais. Sendo o QI e o número de anos de estudo, os fatores pré-mórbidos identificados como responsáveis pela formulação de maior RC e consequente redução dos impactos de um TCE (Donders & Stout, 2018; Leary et al., 2018; Steward et al., 2018).

Contudo, embora exista concordância sobre a relevância do QI e anos de escolaridade pré-mórbidos, não há consenso sobre a extensão dos efeitos protetivos provenientes desses fatores. Sendo que para alguns autores esses fatores seriam suficientes para explicar que a RC é neuroprotetora, independentemente do grau do TCE (Steward et al., 2018). Enquanto outros estudos são mais cautelosos ao defenderem que embora a RC apresente fator protetivo frente ao TCE, mais estudos devem ser realizados para compreender até qual grau de lesão a RC poderá ser de fato protetora

(Donders & Stout, 2018; Leary et al., 2018). Contudo, em um destes estudos, embora os participantes apresentassem alta RC, ela não foi capaz de eliminar completamente os efeitos do TCE (Donders & Stout, 2018).

Outro aspecto atualmente estudado diz respeito a relação entre RC e bilinguismo (Perani et al., 2017; Reyes et al., 2018). Evidências recentes apontam que indivíduos bilíngues apresentam maior desempenho nas funções executivas as quais são associadas a maior RC (Reyes et al., 2018). Exames de neuroimagem corroboram esses achados ao demonstrarem que idosos bilíngues com DA, apresentam maior preservação das conexões neurais relacionadas ao controle executivo, quando comparados a idosos com DA monolíngues (Perani et al., 2017).

Destaca-se que a utilização da segunda língua ao longo da vida é crucial para o desenvolvimento da RC, não sendo suficiente aprender um novo idioma e não o utilizar. Em resumo, quanto maior for a utilização de uma segunda língua ao longo do ciclo vital, maior será a RC adquirida e seus efeitos neuroprotetores frente à neurodegeneração (Perani et al., 2017).

Cabe ressaltar que indivíduos bilíngues não apresentam diferenças cognitivas significativas quando comparados a indivíduos multilíngues, ou seja, o aprendizado de um terceiro, quarto ou quinto idioma, não contribuirá para maior desempenho cognitivo. As redes neurais até então não utilizadas, as quais serão ativadas através da aquisição de um segundo idioma, serão as mesmas envolvidas no aprendizado de línguas subsequentes (Alladi et al., 2013). No entanto, uma meta-análise realizada recentemente levanta dúvidas sobre a real existência dos benefícios gerados pelo bilinguismo. Ressaltando que após a análise de 152 estudos com adultos, não foram encontradas evidências suficientes para sustentar as opiniões amplamente difundidas de que o

bilinguismo estaria associado a benefícios relacionados às funções de controle cognitivo (Lehtonen et al., 2018), sendo necessária a realização de novos estudos que explorem essa associação (Alladi et al., 2013; Lehtonen et al., 2018).

Outro aspecto muito estudado passou a ser relacionado à RC. Trata-se do estresse, o qual como se sabe está associado a diversas condições clínicas, especialmente em idosos, uma vez que o estudo da redução dos efeitos bioquímicos negativos do estresse, no declínio cognitivo e na DA, é um tema extensamente explorado (Niraula, Sheridan, & Godbout, 2017; Pertl et al., 2017).

Um estudo recente evidenciou que cuidar de indivíduos com doença degenerativa contribui para a redução das funções executivas e RC dos cuidadores. Foi observado que quanto maior for a gravidade da patologia e o tempo destinado ao cuidado desses idosos, menor será o desempenho das funções executivas e por consequência da RC. No entanto, é importante ressaltar que este estudo fez uso de metodologia transversal e existe a possibilidade de indivíduos com menor RC estarem propensos a apresentar maior estresse psicológico, sendo este um dos campos com maior necessidade de exploração (Pertl et al., 2017).

Outra hipótese emergente, possivelmente menos estudada ainda do que a associação do estresse e RC, é a de que treinamentos cognitivos ou simplesmente o hábito de jogar vídeo games ao longo do ciclo vital seja um fator contribuinte no desenvolvimento da RC (Stern, 2012). Inúmeros são os estudos que apontam para o aprimoramento das funções cognitivas após intervenções com jogos eletrônicos em todas as faixas etárias do ciclo vital, tanto em populações saudáveis (Cardoso, Argimon et al., 2017; Dale & Green, 2017) como naquelas acometidas por patologias (Cardoso, Landenberger et al., 2017; Taut et al., 2017).

No entanto, dois desses estudos merecem especial atenção, um deles por fortalecer significativamente as conexões estruturais de três redes cerebrais: a rede pré-frontal, o sistema límbico e a rede sensório-motora, estando essas redes diretamente ligadas às funções executivas (Gong et al., 2017). O outro por apresentar evidências concretas de que treinamentos cognitivos baseados em vídeo games podem aprimorar as funções cognitivas e contribuir com a neuroplasticidade (Anguera et al., 2013). Embora existam autores que apontem para a relação entre funções executivas, matéria branca e quantidade de RC (Baker et al., 2017; Pertl et al., 2017), até onde se tem conhecimento ainda não foram realizados estudos investigando diretamente a relação entre videogames e RC, embora Stern (2012), já tenha sugerido a realização de tais pesquisas.

Considerações finais

O capítulo buscou conceitualizar a RC, bem como descrever as principais atividades realizadas ao longo do ciclo vital, que contribuem para a formação da RC, como a prática de atividades intelectuais, atividade física e anos de escolaridade. Finalmente, foram descritos instrumentos de avaliação e perspectivas futuras desse construto.

Desta forma, existe grande esforço, por parte da comunidade científica, na busca por maior compreensão dos conceitos e do funcionamento da RC, reserva cerebral e manutenção cerebral. É de suma importância a realização de estudos que investiguem os mecanismos (ex.: redes neurais, estruturas e regiões cerebrais) capazes de explicar os efeitos da RC observados nos mais diversos campos, bem como a realização de estudos de intervenção, longitudinais, para determinar com maior

fidedignidade os mecanismos responsáveis pelo desenvolvimento da RC, reserva cerebral e manutenção cerebral.

Referências

- Alladi, S., Bak, T. H., Duggirala, V., Surampudi, B., Shailaja, M., Shukla, A. K., . . . Kaul, S. (2013). Bilingualism delays age at onset of dementia, independent of education and immigration status. *Neurology*, 81(22), 1938-1944. doi: 10.1212/01.wnl.0000436620.33155.a4
- Anguera, J. A., Boccanfuso, J., Rintoul, J. L., Al-Hashimi, O., Faraji, F., Janowich, J., . . . Gazzaley, A. (2013). Video game training enhances cognitive control in older adults. *Nature* 501(7465), 97–101. doi: 10.1038/nature12486
- Arrieta, H., Rezola-Pardo, C., Echeverria, I., Iturburu, M., Gil, S. M., Yanguas, J. J., ... & Rodriguez-Larrad, A. (2018). Physical activity and fitness are associated with verbal memory, quality of life and depression among nursing home residents: preliminary data of a randomized controlled trial. *BMC Geriatrics*, 18(1), 80. doi: 10.1186/s12877-018-0770-y
- Baker, L. M., Laidlaw, D. H., Cabeen, R., Akbudak, E., Conturo, T. E., Correia, S., ... Paul, R. H. (2017). Cognitive reserve moderates the relationship between neuropsychological performance and white matter fiber bundle length in healthy older adults. *Brain Imaging and Behavior*, 11(3), 632-639. doi: 10.1007/s11682-016-9540-7
- Cardoso, N. O., Argimon, I. I. L., & Pereira, V. T. (2017). Electronic Games and Elderly Cognition – A Systematic Review. *Psicología desde el Caribe*, 34(2). 139-160. Retrieved from <http://rcientificas.uninorte.edu.co/index.php/psicologia/article/view/8912>
- Cardoso, N. O., Landenberger, T., & Argimon, I. I. L. (2017). Jogos Eletrônicos como Instrumentos de Intervenção no Declínio Cognitivo - Uma Revisão Sistemática. *Revista de Psicologia da IMED*, 9(1), 119-139. doi: 10.18256/2175-5027.2017.v9i1.1941.
- Dale, G., & Green, C. S. (2017). The Changing Face of Video Games and Video Gamers: Future Directions in the Scientific Study of Video Game Play and Cognitive Performance. *Journal of Cognitive Enhancement*, 1(3), 280-294. doi: 10.1007/s41465-017-0015-6
- Dekhtyar, S., Wang, H. X., Scott, K., Goodman, A., Koupil, I., & Herlitz, A. (2015). A life-course study of cognitive reserve in dementia — from childhood to old age. *The American journal of geriatric psychiatry*, 23(9), 885-896. doi: 10.1016/j.jagp.2015.02.002
- Farina, M., Paloski, L. H., Oliveira, C. R., Argimon, I. I. L., & Irigaray, T. Q. (2017). Cognitive reserve in elderly and its connection with cognitive performance: a systematic review. *Ageing International*, 1-12. doi: 10.1007/s12126-017-9295-5
- Farina, M., Costa, D. B., Oliveira, J. A. W., Lima, M. P., Machado, W. L., Moret-Tatay, C., Lopes, R. M. F., Argimon, I. I. L., & Irigaray, T. Q. (no prelo). Cognitive function of Brazilian elderly persons: longitudinal study with non-clinical community sample. *Cognitive Neuropsychiatric*.
- Fekedulegn, D., Innes, K., Andrew, M. E., Tinney-Zara, C., Charles, L. E., Allison, P., ... & Knox, S. S. (2018). Sleep Quality and the Cortisol Awakening Response

- (CAR) among Law Enforcement Officers: The Moderating Role of Leisure Time Physical Activity. *Psychoneuroendocrinology*, 95, 158-169. doi: 10.1016/j.psyneuen.2018.05.034
- Greeff, J. W., Bosker, R. J., Oosterlaan, J., Visscher, C., & Hartman, E. (2017). Effects of physical activity on executive functions, attention and academic performance in preadolescent children: a meta-analysis. *Journal of science and medicine in sport*, 21(5), 501-507. doi: 10.1016/j.jsams.2017.09.595
- Gleich, T., Lorenz, R. C., Gallinat, J., & Kühn, S. (2017). Functional changes in the reward circuit in response to gaming-related cues after training with a commercial video game. *Neuroimage*, 152, 467-475. doi: 10.1016/j.neuroimage.2017.03.032
- Gong, D., Ma, W., Gong, J., He, H., Dong, L., Zhang, D., ... Yao, D. (2017). Action Video Game Experience Related to Altered Large-Scale White Matter Networks. *Neural Plasticity*, 2017, 1-7. doi: 10.1155/2017/7543686
- Groot, C., Loenhoud, A. C., Barkhof, F., Berckel, B. N. M., Koene, T., Teunissen, C. C. . . . Ossenkoppele, R. (2018). Differential effects of cognitive reserve and brain reserve on cognition in Alzheimer disease. *Neurology*, 90(2), e1-e8. doi: 10.1212/WNL.0000000000004802
- Izquierdo, I. A., Myskiw, J. C., Benetti, F., & Furini, C. R. G. (2013). Memória: tipos e mecanismos—achados recentes. *Revista USP*, 98, 9-16. doi: 10.11606/issn.2316-9036.v0i98p9-16
- Katzman, R., Aronson, M., Fuld, P., Kawas, C., Brown, T., Mor-genstern, H., ... Ooi, W.L. (1989). Development of dementing illnesses in an 80-year-old volunteer cohort. *Annals of Neurology*, 25(4), 317–324. doi:10.1002 / host.410250402
- Landenberger, T., Cardoso, N. O., Oliveira, C. R., Argimon, I. I. L. (no prelo). Instrumentos de medida de reserva cognitiva – uma revisão sistemática. *Psicologia Teoria e Prática*.
- Lara, E., Koyanagi, A., Caballero, F., Domènech-Abella, J., Miret, M., Olaya, B., ... & Haro, J. M. (2017). Cognitive reserve is associated with quality of life: A population-based study. *Experimental Gerontology*, 87, 67-73. doi: 10.1016/j.exger.2016.10.012
- Leary, J.B., Kim, G. Y., Bradley, C. L., Hussain, U. Z., Sacco, M., Bernad, M., . . . Chan, L. (2018). The Association of Cognitive Reserve in Chronic-Phase Functional and Neuropsychological Outcomes Following Traumatic Brain Injury. *The Journal of Head Trauma Rehabilitation*, 33(1), E28-E25. doi: 10.1097/HTR.0000000000000329
- Lehtonen M., Soveri, A., Laine, A., Järvenpää, J., De Bruin, A., & Antfolk, J. (2018). Is bilingualism associated with enhanced executive functioning in adults? A meta-analytic review. *Psychological Bulletin*, 134(4), 394-425. doi: 10.1037/bul0000142
- Leon, I., Garcia, J., & Roldan-Tapia, L. (2011). Development of the scale of cognitive reserve in Spanish population: a pilot study. *Revista de neurologia*, 52(11), 653-660. Retirado de <https://www.neurologia.com/articulo/2010704>
- Nilsson, J., & Lövdén, M. (2018). Naming is not explaining: future directions for the "cognitive reserve" and "brain maintenance" theories. *Alzheimer's Research & Therapy*, 18(1), 34. doi: 10.1186/s13195-018-0365-z.
- Niraula, A., Sheridan, J. F., & Godbout, J. P. (2017). Microglia Priming with Aging and Stress. *Neuropsychopharmacology Reviews*, 42(1), 318-333. doi:10.1038/npp.2016.185

- Nucci, M., Mapelli, D., & Mondini, S. (2011). Cognitive Reserve Index questionnaire (CRIq): a new instrument for measuring cognitive reserve. *Aging Clinical and Experimental Research*, 24(3), 218–26. <https://doi.org/10.3275/7800>
- O'Shea, D. M., Fieo, R. A., Hamilton, J. L., Zahodne, L. B., Manly, J. J., & Stern, Y. (2015). Examining the association between late-life depressive symptoms, cognitive function, and brain volumes in the context of cognitive reserve. *International Journal of Geriatric Psychiatry*, 30(6), 614-622. doi: 10.1002/gps.4192
- Paula, J. J., Diniz, B. S., Sallum, I., Malloy-Diniz, L. (2016). Como avaliar idoso de baixa escolaridade? In: Malloy-Diniz, P. Mattos, N. Abreu, D. Fuentes. (Orgs), *Neuropsicologia – Aplicações Clínicas* (pp. 149-160). Porto Alegre, RS: Artmed.
- Perani, D., Farsad, M., Ballarini, T., Lubian, F., Malpetti, M., Fracchetti, A., . . . Abutalebi, J., (2017). The impact of bilingualism on brain reserve and metabolic connectivity in Alzheimer's dementia. *Proceedings of the National Academy of Sciences of the United States*, 114(7), 1690-1695. doi: 10.1073/pnas.1610909114
- Pertl, M. M., Hannigan, C., Brennan, S., Robertson, I. H., & Lawlor, B. A. (2017). Cognitive reserve and self-efficacy as moderators of the relationship between stress exposure and executive functioning among spousal dementia caregivers. *International Psychogeriatrics*, 29(4), 615-625. doi: 10.1017/S1041610216002337
- Rami, L., Valls-Pedret, C., Bartrés-Faz, D., Caprile, C., Solé-Padullés, C., Castellví, M., ... Molinuevo, J. L. (2011). Cuestionario de reserva cognitiva. Valores obtenidos en población anciana sana y con enfermedad de Alzheimer. *Revista de Neurologia*, 52(4), 195–201.
- Reyes, A., Paul, B. M., Marshall, A., Chang, Y. A., Bahrami, N., Kansal, L., . . . McDonald, C. R. (2018). Does bilingualism increase brain or cognitive reserve in patients with temporal lobe epilepsy? *Epilepsia*, 59(5), 1037-1047. doi: 10.1111/epi.14072
- Sousa, K. J. Q., & Borges, G. F. (2016). Estilo de vida, atividade física e coeficiente acadêmico de universitários do interior do Amazonas - Brasil. *Revista Brasileira de Ciências da Saúde*, 20(4), 277-284.
- Stern Y. (2012). Cognitive reserve in ageing and Alzheimer's disease. *The Lancet. Neurology*, 11(11), 1006-1012. doi: 10.1016/S1474-4422(12)70191-6
- Stern, Y. (2017). An approach to studying the neural correlates of reserve. *Brain Imaging and Behavior*, 11(2), 410-416. doi: 10.1007/s11682-016-9566-x
- Stern, Y., & Habeck, C. (2017). Identifying a task-invariant cognitive reserve network. *Alzheimer's & Dementia: The Journal of the Alzheimer's Association*, 13(7), 1445-1446. doi: 10.1016/j.jalz.2017.07.481
- Sumowski, J. F., Rocca, M. A., Leavitt, V. M., Mesaros, D. S., Drulovic, J., DeLuca, J., & Filippi, M. (2014). Brain reserve and cognitive reserve protect against cognitive decline over 4.5 years in MS. *Neurology*, 82(20), 1-8. doi: 10.1212/WNL.0000000000000433
- Steward, K. A., Kennedy, R., Novack, T. A., Crowe, M., Marson, D. C., & Triebel, K. L. (2018). The Role of Cognitive Reserve in Recovery From Traumatic Brain Injury. *The Journal of Head Trauma Rehabilitation*, 33(1), E18-E27. doi: 10.1097/HTR.0000000000000325
- Taut, D., Pinte, S., Roovers, J. W. R., Mananãs, M. A., & Băban, A. (2017). Play seriously: Effectiveness of serious games and their features in motor rehabilitation. A meta-analysis. *Neurorehabilitation*, 101(1), 105-118. doi:10.3233/NRE-171462

- Then, F. S., Luck, T., Lupp, M., König, H. H., Angermeyer, M. C., & Riedel-Heller, S. G. (2015). Differential effects of enriched environment at work on cognitive decline in old age. *Neurology*, 84(21), 2169-2176. doi: 10.1212/WNL.0000000000001605
- Valenzuela, M. J., & Sachdev, P. (2006). Assessment of complex mental activity across the lifespan: development of the Lifetime of Experiences Questionnaire (LEQ). *Psychological Medicine*, 37(7), 1015–1025. doi: 10.1017/S003329170600938X
- Wilson, R., Barnes, L., & Bennett, D. (2003). Assessment of lifetime participation in cognitively stimulating activities. *Journal of Clinical and Experimental Neuropsychology*, 25(5), 634–642. doi: 10.1076/jcen.25.5.634.14572

Anexo A - Declaração do Exame de Qualificação



Pontifícia Universidade Católica do Rio Grande do Sul
ESCOLA DE HUMANIDADES
PROGRAMA DE PÓS-GRADUAÇÃO EM PSICOLOGIA

Ata 07/2016

No vigésimo sétimo dia do mês de setembro de dois mil e dezessets, na sala 923 do Prédio 11, no Campus Universitário da Pontifícia Universidade Católica do Rio Grande do Sul, após sessão de apresentação e defesa das 15h e 30 min às 17h e 45 min, reuniu-se a **sétima** Comissão de Avaliação, do Programa de Pós-Graduação em Psicologia, para arguir e avaliar o trabalho apresentado pela mestranda **MARIANNE FARINA**, com o objetivo de satisfazer os requisitos do **Exame de Qualificação de Doutorado**. A Comissão esteve constituída pela Profa. Dra. Irani Iracema de Lima Argimon (PUCRS) e pelos demais membros da Comissão de Avaliação, Profa. Dra. Camila Rosa de Oliveira (IMED), Profa. Dra. Caroline Tozzi Reppold (UFCSPA) e pela orientadora Profa. Dra. Tatiana Quarti Irigaray (PUCRS). A Comissão deliberou (X) **APROVADO** () **APROVADO COM REFORMULAÇÕES** () **NÃO APROVADO** o Exame de qualificação do Projeto de Tese intitulado **"FATORES DE PERSONALIDADE, FUNCIONAMENTO COGNITIVO E QUALIDADE DE VIDA EM IDOSOS: UM ESTUDO LONGITUDINAL"**. Nada mais a constar, lavrei a presente ata que vai assinada pela Comissão de Avaliação, Relatora, Orientadora, Coordenador e Secretária.

Porto Alegre, 27 de setembro de 2016.

Camila R. Oliveira

Profa. Dra. Camila Rosa de Oliveira
(IMED)

Caroline Tozzi Reppold

Profa. Dra. Caroline Tozzi Reppold
(UFCSPA)

Irani A. Argimon

Profa. Irani Iracema de Lima Argimon
(PUCRS)

Tatiana Quarti Irigaray

Profa. Dra. Tatiana Quarti Irigaray
(PUCRS)

Francielle Abreu

Francielle Abreu
Secretária

Christian Haag Kristensen

Prof. Dr. Christian Haag Kristensen
Coordenador

PUCRS

Av. Ipiranga, 6681 – Prédio 11 – Sala 921
CEP 90619-900
Porto Alegre – RS – Brasil
Fone: (51) 3320-3633
E-mail: psicologia-pg@pucrs.br
www.pucrs.br

Anexo B – Carta de aprovação do Comitê de Ética em Pesquisa

PONTIFÍCIA UNIVERSIDADE
CATÓLICA DO RIO GRANDE
DO SUL - PUC/RS



PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: FATORES DE PERSONALIDADE, FUNCIONAMENTO COGNITIVO E QUALIDADE DE VIDA EM IDOSOS: UM ESTUDO LONGITUDINAL

Pesquisador: Tatiana Quarti Irigaray

Área Temática:

Versão: 1

CAAE: 63198816.8.0000.5336

Instituição Proponente: UNIAO BRASILEIRA DE EDUCACAO E ASSISTENCIA

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.892.265

Apresentação do Projeto:

O objetivo geral deste projeto de pesquisa é comparar os fatores de personalidade, o desempenho cognitivo, a percepção de qualidade de vida e a reserva cognitiva de idosos em um intervalo de quatro anos. Para isso, foi feito um artigo teórico, por meio de uma revisão sistemática da literatura, que buscou investigar quais são as variáveis que compõem a reserva cognitiva em idosos. As pesquisas incluídas na revisão possuem um número significativo de participantes, sendo amostras representadas por diferentes países da Europa, da América do Sul e do Norte. Os resultados apontaram que sexo, idade, escolaridade, escolaridade dos pais, atividade profissional, atividade de leitura, engajamento social e humor são as principais variáveis que compõem a reserva cognitiva. Concluiu-se que a principal variável da reserva cognitiva é a escolaridade e que ela tem uma relação significativa com o envelhecimento cognitivo saudável. Também serão realizados dois artigos empíricos que terão como objetivo comparar a personalidade, a cognição e a percepção de qualidade de vida de idosos em um intervalo de quatro anos. Para isso, será realizada uma pesquisa de método quantitativo e longitudinal, em que os participantes serão examinados em dois momentos, em um intervalo de quatro anos. Irão responder a uma Ficha de Dados Sociodemográficos e Clínicos e instrumentos que avaliam personalidade, funções cognitivas e

Endereço: Av. Ipiranga, 6681, prédio 50, sala 703
Bairro: Partenon **CEP:** 90.619-900
UF: RS **Município:** PORTO ALEGRE
Telefone: (51)3320-3345 **Fax:** (51)3320-3345 **E-mail:** cep@puors.br

PONTIFÍCIA UNIVERSIDADE
CATÓLICA DO RIO GRANDE
DO SUL - PUC/RS



Continuação do Parecer: 1.892.265

qualidade de vida.

Objetivo da Pesquisa:

O objetivo primário da pesquisa é comparar os fatores de personalidade, o desempenho cognitivo e a percepção de qualidade de vida de idosos em um intervalo de quatro anos.

Os objetivos secundários são: 1. Caracterizar os fatores de personalidade, o desempenho cognitivo, a percepção da qualidade de vida e sintomas de depressão e ansiedade dos idosos no intervalo de quatro anos. 2. Verificar a relação dos fatores de personalidade com o desempenho cognitivo, percepção de qualidade de vida e sintomas de depressão e de ansiedade dos idosos em um intervalo de quatro anos. 3. Identificar se os fatores de personalidade são preditores do desempenho cognitivo, da percepção da qualidade de vida e dos sintomas de depressão e de ansiedade dos idosos em um intervalo de quatro anos. 4. Verificar os fatores protetivos para o funcionamento cognitivo dos idosos em um intervalo de quatro anos. 5.

Verificar os fatores de risco para o funcionamento cognitivo dos idosos em um intervalo de quatro anos.

Avaliação dos Riscos e Benefícios:

A participação nesta pesquisa trará riscos mínimos. É possível que aconteça o seguinte desconforto durante a avaliação: cansaço durante a administração dos instrumentos psicológicos e mobilização emocional pelo conteúdo questionado, sobre os quais medidas serão tomadas para sua redução, tais como intervalo durante a aplicação dos instrumentos.

A pesquisa possivelmente trará como benefício a contribuição pessoal para o desenvolvimento de um estudo científico, além do acompanhamento do funcionamento cognitivo, personalidade e a qualidade de vida dos idosos em um intervalo de 4 anos.

Comentários e Considerações sobre a Pesquisa:

Pesquisa relevante e bem delineada. Os objetivos estão claros, bem como a metodologia.

Considerações sobre os Termos de apresentação obrigatória:

Todos os termos obrigatórios foram apresentados.

Recomendações:

Recomenda-se que seja informado o endereço do Currículo Lattes da pesquisadora Irani Iracema de Lima Argimon, já que a mesma faz parte da Equipe de Pesquisa.

Conclusões ou Pendências e Lista de Inadequações:

Projeto aprovado, sem pendências.

Endereço: Av. Ipiranga, 6681, prédio 50, sala 703

Bairro: Partenon

CEP: 90.619-900

UF: RS

Município: PORTO ALEGRE

Telefone: (51)3320-3345

Fax: (51)3320-3345

E-mail: cep@pucrs.br

**PONTIFÍCIA UNIVERSIDADE
CATÓLICA DO RIO GRANDE
DO SUL - PUC/RS**



Continuação do Parecer: 1.892.265

Considerações Finais a critério do CEP:

Diante do exposto, o CEP-PUCRS, de acordo com suas atribuições definidas na Resolução CNS nº 466 de 2012 e da Norma Operacional nº 001 de 2013 do CNS, manifesta-se pela aprovação do projeto de pesquisa proposto.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_P ROJETO_832494.pdf	19/12/2016 12:04:32		Aceito
Outros	lattespesquisadores.pdf	19/12/2016 12:04:14	Tatiana Quarti Irigaray	Aceito
Outros	cartadeautorizacao.pdf	19/12/2016 12:03:54	Tatiana Quarti Irigaray	Aceito
Outros	aprovacaocomissaoacademica.pdf	25/11/2016 14:25:34	Marianne Farina	Aceito
Projeto Detalhado / Brochura Investigador	projeto detalhado.pdf	25/11/2016 14:24:42	Marianne Farina	Aceito
Orçamento	orcamento.pdf	25/11/2016 14:23:53	Marianne Farina	Aceito
Cronograma	cronograma.pdf	25/11/2016 14:23:16	Marianne Farina	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	termoconsentimento.pdf	25/11/2016 14:22:40	Marianne Farina	Aceito
Folha de Rosto	folhaDeRosto.pdf	25/11/2016 14:20:47	Marianne Farina	Aceito

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

PORTO ALEGRE, 16 de Janeiro de 2017

Assinado por:
Denise Cantarelli Machado
(Coordenador)

Endereço: Av. Ipiranga, 6681, prédio 50, sala 703
Bairro: Partenon **CEP:** 90.619-900
UF: RS **Município:** PORTO ALEGRE
Telefone: (51)3320-3345 **Fax:** (51)3320-3345 **E-mail:** cep@pucrs.br

Anexo C - Comprovante do Doutorado Sanduíche



INFORME DEL CO-DIRECTOR

A la Cordinación de Perfeccionamiento de Personal de Nivel Superior

Declaro mi conformidad que la alumna Marianne Farina ha realizado su estancia de doctorado, bajo mi coorientación, en la Universidad Católica de Valencia San Vicente Mártir (UCV). Esto fue durante el período de abril/2017 (inicio) a julio/2017 (término). Además, declaro que la alumna, durante el período que realizó la estancia de doctorado, recibió apoyo financiero de la CAPES en la modalidad de beca PDSE de Brasil. Declaro que la alumna es competente en Español y que estuvo capacitada para desarrollar sus estudios en la UCV bajo la orientación de la Profesora Doctora Tatiana Quarti Irigaray de Pontificia Universidade Católica de Rio Grande do Sul (PUCRS), de Grupo de Pesquisa Avaliação e Interação Humano Animal (ARIHA) y bajo mi coorientación.

Recibí el plan de estudios de la alumna Marianne Farina, que estuvo alineado a los intereses de mis proyectos de investigación, así como de los centros de investigación en la que formo parte en la UCV. En su estadia, realizó todas las actividades propuestas en su plan de estudios, descritas a continuación:

- Trabajo específico en la profundización del conocimiento sobre la realidad brasileña y española en relación al envejecimiento;
- Divulgación del tema de la investigación desarrollado por la doctoranda y el grupo de investigación ARIHA, a través de una comunicación oral titulada: *Un estudio longitudinal sobre la personalidad y los factores asociados con el envejecimiento* en la III Jornada de Investigación de la Facultad de Psicología de UCV;
- Participación como discente en clases de Español para perfeccionar su comunicación y también de clases ministradas por mí y por extranjeros (Erasmus) en la graduación en la Facultad de Psicología da UCV;



- Realización de entrenamiento en disciplinas de Estadística, para el perfeccionamiento del conocimiento de herramientas estadísticas avanzadas de las Redes Bayesianas y técnicas de moderación y mediación.
- Participación en seminarios del grupo de investigación: Mind, Emotion and Behavioral Research Laboratory (MEBlab);
- Participación en sesiones metodológicas, psicométricas y estadísticas en el estudio de la muestra brasileña en los instrumentos de evaluación de la personalidad, cognición y calidad de vida;
- Redacción de un artículo con mi coorientación y coautoría titulado: *Personality as a moderating variable of anxiety and quality of life in cognitively healthy elderly* y también el resumen: *Análise bayesiana do uso de tabaco em idosos: possíveis preditores.*
- Estuvo presente en los Tribunales de Defensa de Tesis de los doctorandos de mi Grupo de Investigación y alumnos de la Facultad de Psicología.
- Participó como vocal en tres Tribunales de Máster en Psicología Jurídica de la UCV.

Y para que así conste, firmo la presente,

Profesora Doctora Carmen Moret Tatay
Facultad de Psicología de la Universidad Católica de Valencia San Vicente Mártir, Españã.

Valencia, 31 de julio de 2017.

 Universidad Católica
de Valencia San Vicente Mártir
 FACULTAD DE PSICOLOGÍA
MAGISTERIO Y CIENCIAS
DE LA EDUCACIÓN

Anexo D – Comprovante da coorientação



Al Programa de Pós-Graduação em Psicologia de la Pontificia Universidade Católica do Rio Grande do Sul (PUCRS)

Doña María Beneyto Arrojo, en calidad de decana adjunta de la Facultad de Psicología, Magisterio y Ciencias de la Educación de la Universidad Católica "San Vicente Mártir" (UCV,

HACE CONSTAR,

Que Carmen Moret Tatay, profesora y investigadora, es co-directora de la tesis de doctorado de la alumna Marianne Farina. Esta tesis se desarrolla en la (PUCRS), Brasil, bajo la dirección de la Profesora Doctora Carmen Moret Tatay. La alumna de doctorado hizo una estancia de doctorado en la UCV bajo la dirección del Profesora Carmen Moret Tatay y manifestamos que este trabajo continuará en el futuro, que comprende el período hasta febrero/2019.

Valencia, España, 03 de enero de 2018.

Atentamente,

Universidad Católica de Valencia San Vicente Mártir
FACULTAD DE PSICOLOGÍA
MAGISTERIO Y CIENCIAS DE LA EDUCACIÓN

María Beneyto Arrojo

Decana adjunta de la Facultad de Psicología, Magisterio y Ciencias de la Educación.

Universidad Católica de Valencia San Vicente Mártir

España

Anexo E – Comprovante do artigo publicado “Cognitive reserve in elderly and its connection with cognitive performance: a systematic review”

Ageing Int
DOI 10.1007/s12126-017-9295-5



Cognitive Reserve in Elderly and Its Connection with Cognitive Performance: A Systematic Review

Marianne Farina¹ · Luis Henrique Paloski¹ ·
Camila Rosa de Oliveira² ·
Irani Iracema de Lima Argimon¹ ·
Tatiana Quarti Irigaray¹

© Springer Science+Business Media New York 2017

Abstract The cognitive reserve may delay impairments in the normal aging process, improving the resilience in cognitive functioning. The main objective of this study was to investigate, through a systematic review, which variables form the cognitive reserve. Furthermore, the association between the cognitive reserve and the cognitive functioning was also verified. Three judges searched for articles in PsycINFO, Pubmed and Scopus databases. The Cochrane recommendations, which offer directions for systematic reviews and meta-analysis, were utilized. Six surveys were gathered following the criteria of inclusion and exclusion. Studies indicate that gender, age, individual's education, parents' education, profession, reading activity, social engagement and humor are the main variables of the cognitive reserve. Education was the most assessed

✉ Marianne Farina
mariannefarina@yahoo.com.br

Luis Henrique Paloski
luishenriquepaloski@gmail.com

Camila Rosa de Oliveira
crd.oliveira@gmail.com

Irani Iracema de Lima Argimon
argimoni@pucrs.br

Tatiana Quarti Irigaray
tatiana.irigaray@pucrs.br

¹ Pontifícia Universidade Católica do Rio Grande do Sul – PUCRS, Avenida Ipiranga, 6681, Partenon, Porto Alegre, RS 90619-900, Brazil

² Faculdade Meridional – IMED, Senador Pinheiro, 304, Vila Rodrigues, Passo Fundo, RS 99070-220, Brazil

Anexo F – Comprovante do artigo submetido para publicação “Assessing cognitive changes in non-clinical older adults: A 4-year longitudinal study in Brazil”

09/01/2019

Yahoo Mail - Fwd: Aging and Mental Health - Manuscript ID CAMH-2019-0015

Fwd: Aging and Mental Health - Manuscript ID CAMH-2019-0015

De: Carmen Moret Tatay (carmenmorettatay@gmail.com)

Para: mariannefarina@yahoo.com

Data: terça-feira, 8 de janeiro de 2019 18:49 BRST

----- Forwarded message -----

From: **Aging and Mental Health** <onbehalf@manuscriptcentral.com>

Date: mar., 8 ene. 2019 a las 20:54

Subject: Aging and Mental Health - Manuscript ID CAMH-2019-0015

To: <carmenmorettatay@gmail.com>

08-Jan-2019

Dear Dr Moret-Tatay:

Your manuscript entitled "Assessing cognitive changes in non-clinical older adults: A 4-year longitudinal study in Brazil" has been successfully submitted online and is presently being given full consideration for publication in Aging and Mental Health.

Your manuscript ID is CAMH-2019-0015.

Please mention the above manuscript ID in all future correspondence or when calling the office for questions. If there are any changes in your street address or e-mail address, please log in to Manuscript Central at <https://mc.manuscriptcentral.com/camh> and edit your user information as appropriate.

You can also view the status of your manuscript at any time by checking your Author Centre after logging in to <https://mc.manuscriptcentral.com/camh>.

Thank you for submitting your manuscript to Aging and Mental Health.

Sincerely,
Aging and Mental Health Editorial Office

--

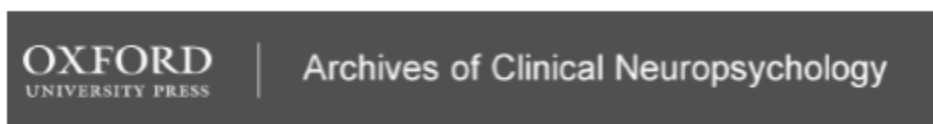
Carmen Moret-Tatay, P.h.D.

International Coordinator, Psychology

MEB lab research coordinator (Mind, Emotion and Behavioural research Lab)

Anexo G – Comprovante do artigo submetido para publicação “Components of cognitive reserve: a longitudinal assessment of elderly people from the community”

Manuscripts submitted to Archives of Clinical Neuropsychology



Components of cognitive reserve: a longitudinal assessment of elderly people from the community

Journal:	<i>Archives of Clinical Neuropsychology</i>
Manuscript ID:	Draft
Manuscript Type:	Original Empirical Article
Keyword:	Cognitive enhancement, Elderly/Geriatrics/Aging

SCHOLARONE™
Manuscripts

<http://mc.manuscriptcentral.com/acnp>

Anexo H – Comprovante do artigo submetido para publicação “Neuroticism and quality of life: testing for mediated effects of anxiety in older adults without cognitive impairment”

30/11/2018

Yahoo Mail - Aging and Mental Health - Account Created in Manuscript Central

Aging and Mental Health - Account Created in Manuscript Central

De: Aging and Mental Health (onbehalf@manuscriptcentral.com)

Para: mariannefarina@yahoo.com.br

Data: sexta-feira, 26 de outubro de 2018 17:50 BRT

26-Oct-2018

Dear Miss Marianne Farina:

A manuscript titled Neuroticism and Quality of life: Testing for mediated effects of Anxiety in older adults without cognitive impairment (CAMH-2018-0664) has been submitted by Miss Marianne Farina to Aging and Mental Health.

You are listed as a co-author for this manuscript. The online peer-review system, Manuscript Central, has automatically created a user account for you.

The site URL and your USER ID for your account is as follows:

SITE URL: <https://mc.manuscriptcentral.com/camh>

USER ID: mariannefarina@yahoo.com.br

https://mc.manuscriptcentral.com/camh?URL_MASK=da908caa00094d61abed1fd700f8e1ad

Please note that your password is case-sensitive.

When logged into the site you will be able to check the status of papers you have authored/co-authored. Please do log in to <https://mc.manuscriptcentral.com/camh> to update your account information, and to change your password to one of your choice.

Thank you for your participation.

Sincerely,
Aging and Mental Health Editorial Office

Anexo I – Comprovante de aceite do capítulo “Reserva cognitiva: fatores associados ao longo do ciclo vital”



Pontifícia Universidade Católica do Rio Grande do Sul
ESCOLA DE CIÊNCIAS DA SAÚDE
PROGRAMA DE PÓS-GRADUAÇÃO EM PSICOLOGIA

Porto Alegre, 22 de Outubro de 2018.

Prezados Senhores(as)

Informamos que o capítulo intitulado “Reserva cognitiva: fatores associados ao longo do ciclo vital” sob autoria de “Nicolas de Oliveira Cardoso, Marianne Farina e Thais Landenberger” encontra-se aceito e no prelo para publicação no livro “Promoção de saúde no Ciclo Vital: possibilidades de avaliação, prevenção e intervenção Clínica” com a organização da Prof. Doutora Irani Iracema de Lima Argimon, Allana Almeida Moraes, Carolina Quiroga e Gabriela Rodrigues.

Prof. Doutora Irani Iracema de Lima Argimon

Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS)

Dr. Irani L. Argimon
Psicóloga
CRP-081021

Escola de Ciências da Saúde
Programa de Pós-Graduação em Psicologia
Pontifícia Universidade Católica do Rio Grande do Sul

PUCRS

Av. Ipiranga, 6681 – Prédio 11 – Sala 921
CEP 91619-900
Porto Alegre – RS – Brasil
Fone: (51) 3328-3633
E-mail: psicologia-ps@pucrs.br
www.pucrs.br



Pontifícia Universidade Católica do Rio Grande do Sul
Pró-Reitoria de Graduação
Av. Ipiranga, 6681 - Prédio 1 - 3º. andar
Porto Alegre - RS - Brasil
Fone: (51) 3320-3500 - Fax: (51) 3339-1564
E-mail: prograd@pucrs.br
Site: www.pucrs.br