



## MentalPlus® as a Tool for Early Detection of Dementias

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### Abstract

**Objective:** To investigate whether MentalPlus® is sensitive in detecting early signs of dementia. **Method:** The Mentalplus®, a neuropsychological evaluation using a group of 35 older people between 65 and 70 years old, was conducted. **Results:** The results obtained by the elderly participants point to a lower-than-average cognitive function, highlighting a dementia state. **Conclusion:** We can diagnose dementias early through the application of MentalPlus®.

**Keywords:** Dementia; Cognitive Impairment; MentalPlus Digital Game; Cognitive Assessment.

## Introduction

It has been estimated that by 2050, people aged 60 and over will represent 21.5%; in 2017, they already account for 12% of the world's population. There is already a correlation between aging and the incidence of dementia, which indicates that it doubles every five years from 65 (Custódio et al., 2017). The research's objective is to identify early signs and symptoms of dementia through the MentalPlus® game. Dementias is a Neurocognitive Major Disorder, and as a diagnostic criterion, it is impaired in the areas of intricate attention, executive function, learning, memory, language, perceptomotor or social cognition (American Psychiatric Association, 2013). The pathology is caused by several brain dysfunctions, considerably decreasing the life span. Most studies point to Alzheimer's as the most prevalent dementia, followed by cardiovascular diseases (Strand et al., 2018). In 2012 we estimated 36 million people with Alzheimer's globally, with an increasing projection of 66 million people in 2030 (Kindell et al., 2016). Cardiovascular diseases, such as hypertension, cause dementia. In less developed countries, the evaluation and treatment of cognitive dysfunctions are less accessible, contributing to the significant increase in dementias. Hypertension affects 32% of adults between 40 and 59 years of age in the United States and 65% of adults over 60. The risk of dementia is 73% higher in women who developed hypertension at age 40 (Gilsanz et al., 2017). The number of people with dementia expects to double every 20 years, especially in low- and middle-developed countries, which may also be due to environmental influences. Economic and ecological variables and emotional aspects of caregivers, such as depressive symptoms, have adverse effects on patients' improvement and life expectancy (Burlá et al., 2013). Recent memory loss is a feature that highlights the processes of dementia, both cognitive

decline due to aging and specific diseases (Eshkoor et al., 2014).

Having the cognitive functions preserved guarantees independence, sociability, capacity for daily routines, and better quality of life. It is necessary to evaluate mental changes in old age to understand which characteristics are due to aging and which may be due to dementia caused by brain diseases (Murman, 2015). Several studies prove the influence that even mild compromises in the cerebral blood flow cause severe brain dysfunctions, including cognitive impairment in the elderly. The natural aging of the organs, and changes in homeostatic functions, generate a higher probability of brain dysfunction (Toth et al., 2016). The neuropsychological instruments used to evaluate cognitive functions generally require considerable time for their application. That ends up hindering the professional and effectiveness of treatment, considering that the sooner the patient is diagnosed with dementia, the better direction, and intervention with therapy (Valentin & Pereira, 2017); (Valentin, 2019). With the development of MentalPlus®, a neuropsychological assessment and rehabilitation tool, such a task has become faster, which also opens space for preventive demand, especially in the elderly (Valentin, 2017), who are the target audience of this study.

## Objective

To investigate if the use of MentalPlus® is sensitive in detecting early signs of dementia.

## Method

The study conducted at FHO - Hermínio Ometto Foundation starting on 07/10/2019 and is part of the MentalPlus® Project, developed in 2013 in partnership with reference centers in national and international research (e.g., HC - USP, University of Copenhagen, Karolinska



Institute, Cleveland Clinic, University of California, Harvard University). MentalPlus® is a digital game developed to evaluate and stimulate neuropsychological functions, patented and registered in the National Library Foundation according to Law No. 9,610/98, under copyright No. 663,707. This digital game identifies the neuropsychological deficits in functions - Attention / Memory / Executive. The task consists of activities for the executive function regarding planning, strategy search, thought flexibility and inhibitory control, attention, resistance to distracting stimulus, impulse control, attention support, and memory. The task involves 25 minutes from start to finish. All the stages of the game must be complete regardless of their difficulties. MentalPlus® has 12 versions with different playful themes, created specifically to solve the learning effect (Valentin & Pereira, 2017). Rogério Ruscitto do Prado did the statistical analysis of the results. After reading the Free and Informed Consent Term (TCLE), the

research candidates were submitted to the MentalPlus® application. The non-probabilistic sampling technique formed the sample for convenience; the authors of this study selected 35 elderly between 65 and 70 years. The control group was chosen based on the selection used of 35 elderly, in which it defined the score pattern compatible with age and education used in this article. The variables analyzed were gender, age, salary range, attention, and memory.

## Results

The tests' results were performed and compared to the control group to evaluate cognitive functions. We observed that the results obtained are below what was expected, verifying the detection of signs of dementia in the group evaluated.

**Table 1.** Description of the characteristics of the elderly according to groups and statistical test results

Variable	Group			p
	Elderly people tested (N = 35)	Control (N = 31)	Total (N = 66)	
<b>Age (years)</b>				0,769*
average ± SD	69,2 ± 4,1	68,9 ± 3,1	69,1 ± 3,6	
median (min.; max.)	70 (60; 75)	70 (60; 73)	70 (60; 75)	
<b>Sex, n (%)</b>				0,389
Male	9 (25,7)	11 (35,5)	20 (30,3)	
Female	26 (74,3)	20 (64,5)	46 (69,7)	
<b>Civil Status, n (%)</b>				0,094#
Single	8 (22,9)	1 (3,2)	9 (13,6)	
Married	21 (60)	22 (71)	43 (65,2)	
Widower	4 (11,4)	6 (19,4)	10 (15,2)	
Divorced	2 (5,7)	2 (6,5)	4 (6,1)	
<b>Education, n (%)</b>				<0,001
Elementary	30 (85,7)	3 (9,7)	33 (50)	
High School	4 (11,4)	8 (25,8)	12 (18,2)	
College	1 (2,9)	20 (64,5)	21 (31,8)	

Chi-square test; # Versatility Ratio test; \* t-Student test

**Table 2.** Description of the results of the MentalPlus® domains according to groups and comparative test results

Variable	Group			p
	Elderly people tested (N = 35)	Control (N = 54)	Total (N = 89)	
<b>MP- Short Term Memory (hits)</b>				<0,001
average ± SD	3,2 ± 2,8	6,4 ± 0,9	4,7 ± 2,7	
median (min.; max.)	3 (0; 10)	7 (4; 7)	6 (0; 10)	
<b>MP- Short Term Memory (errors)</b>				0,206
average ± SD	3,9 ± 2,6	3 ± 1,7	3,5 ± 2,3	
median (min.; max.)	3 (0; 10)	3 (0; 7)	3 (0; 10)	
<b>MP- Short Term Memory (omissions)</b>				<0,001
average ± SD	7 ± 4,6	1,5 ± 1,5	4,4 ± 4,4	
median (min.; max.)	8 (0; 14)	1 (0; 5)	2,5 (0; 14)	
<b>MP- Visuoperception</b>				<0,001
average ± SD	13,7 ± 6,3	33,7 ± 4,9	23,1 ± 11,6	
median (min.; max.)	13 (4; 28)	35 (23; 41)	23 (4; 41)	
<b>MP- Inhibitory Control - Executive Function (hits)</b>				0,231
average ± SD	10 ± 8,2	10,4 ± 2,7	10,2 ± 6,2	
median (min.; max.)	8 (0; 29)	9 (6; 15)	9 (0; 29)	
<b>MP- Inhibitory Control - Executive Function (errors)</b>				<0,001
average ± SD	18,8 ± 18,6	2,1 ± 2	11 ± 15,9	
median (min.; max.)	13 (3; 113)	2 (0; 8)	6,5 (0; 113)	
<b>MP- Inhibitory Control - Executive Functions (omissions)</b>				<0,001
average ± SD	20 ± 8,2	3,2 ± 2,2	12,1 ± 10,4	
median (min.; max.)	22 (1; 30)	3 (0; 8)	6,5 (0; 30)	
<b>MP- Long Term Memory (hits)</b>				0,001
average ± SD	7,5 ± 3,1	9,8 ± 1,9	8,6 ± 2,9	
median (min.; max.)	9 (0; 11)	10 (5; 12)	10 (0; 12)	
<b>MP- Long Term Memory (errors)</b>				0,179
average ± SD	3,2 ± 1,8	2,7 ± 1,4	2,9 ± 1,6	
median (min.; max.)	4 (0; 6)	3 (0; 6)	3 (0; 6)	
<b>MP- Long Term Memory (omissions)</b>				<0,001
average ± SD	7,5 ± 3,1	3,9 ± 1,8	5,8 ± 3,2	
median (min.; max.)	6 (4; 15)	4 (1; 9)	5 (1; 15)	
<b>MP- Alternating Attention (hits)</b>				<0,001
average ± SD	12,3 ± 8,5	32,1 ± 10,4	21,6 ± 13,7	
median (min.; max.)	11 (0; 26)	31 (17; 61)	22 (0; 61)	
<b>MP- Alternating Attention (errors)</b>				<0,001
average ± SD	12,5 ± 10,2	1,3 ± 1,4	7,2 ± 9,4	
median (min.; max.)	9 (1; 47)	1 (0; 5)	4 (0; 47)	
<b>MP- Alternating Attention (omissions)</b>				<0,001
average ± SD	13,3 ± 8,8	2,4 ± 2	8,1 ± 8,5	
median (min.; max.)	14 (0; 30)	1 (0; 8)	4 (0; 30)	
<b>MP- Selective Attention (hits)</b>				0,057
average ± SD	12,6 ± 10,2	14,8 ± 1,2	13,6 ± 7,5	
median (min.; max.)	10 (0; 36)	15 (11; 16)	14,5 (0; 36)	
<b>MP- Selective Attention (errors)</b>				<0,001
average ± SD	12,2 ± 10,4	0,4 ± 0,7	6,7 ± 9,6	
median (min.; max.)	9 (2; 47)	0 (0; 2)	4 (0; 47)	
<b>MP- Selective Attention (omissions)</b>				<0,001
average ± SD	14,1 ± 9,3	0,2 ± 0,4	7,6 ± 9,7	
median (min.; max.)	14 (0; 28)	0 (0; 1)	1 (0; 28)	

Mann-Whitney test

## Discussion

MentalPlus® was created for timely evaluation and cognitive rehabilitation, considering the various diseases that cause cognitive dysfunction, such as dementia, heart problems, organic disorders, among others, in addition to surgical interventions and external factors. This instrument used to evaluate postoperative cognitive dysfunctions, which often affect elderly patients, confirms the validity and accessibility of the MentalPlus® application. Table 1 shows that the elderly in the group tested had statistically lower education than the control group ( $p < 0.001$ ). Table 2 shows that for all domains of MentalPlus®, on the hits part, the tested elderly group showed statistically lower values than the control group ( $p < 0.05$ ), except only in the executive function ( $p = 0.231$ ) and selective attention ( $p = 0.057$ ), errors were also statistically higher in the elderly tested for almost all domains ( $p < 0.05$ ), except in short-term memory ( $p = 0.206$ ) and long-term memory ( $p = 0.179$ ). At the same time, omissions were statistically higher in the elderly tested for all MP domains ( $p < 0.05$ ).

## Conclusion

MentalPlus® identifies early signs of dementia in older people and is useful for the evaluator and the target audience, as it provides reliable data in a considerably short time. This early identification of dementia enables a better quality of life for the elderly, contributing to timely cognitive rehabilitation.

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