

PREVENTIVE, SCREENING SYSTEM FOR EARLY DETECTION OF DEMENCIA



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Introduction

The increased life expectancy, coupled with declining birth rates, has led to a global **demographic shift towards an aging population**. By 2100, the number of people aged 60 and above is projected to more than triple. This will pose numerous challenges on a societal level, particularly regarding the diagnosis, treatment, and ensuring proper quality of life for individuals with dementia. In order to address this, we have been **seeking a system that could provide a solution for the early-stage assessment of dementia**.

Problem

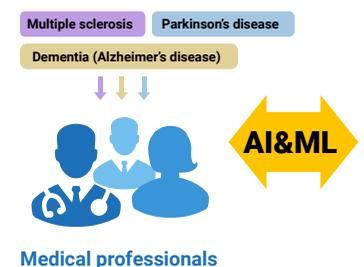
According to the data from the World Health Organization (WHO), **Alzheimer's disease and other forms of dementia have entered the top ten causes of death**. In the year 2019, these diseases ranked seventh globally.

The process of diagnosing dementia is slow and time-consuming. **Currently, there are no adequately developed systems and strategies at the local level for screening and treatment**.

In Hungary, there is no artificial intelligence algorithm that can determine the early signs of dementia based on the patient's digital behavior patterns.

Concept of PreDEM

Based on the professional criteria we established, we have chosen the **PreDEM Platform** for our investigation.



Early screening, identification and data-driven risk analysis
Non-invasive, patient-engaging procedures (**cognitive games and tests**) for diagnostic and therapeutic purposes.
Patient education, knowledge of available social support.
Supportive tools for those who have developed a chronic condition but wish to live in their own home.

There is a significant difference between the results of treated patients and the healthy population.

In general, the following can be said about the lower performers

This group includes people who have a previously confirmed mild cognitive impairment with a high likelihood of an **organic background**, a known internal medical condition (hypertension and/or diabetes and/or other endocrine disorders, heart disease, sleep apnea), or "only" **initial dementia**, and therefore require further investigation to determine the type of dementia.

In general, the better performers are

They are presumably **pseudo demented**, who experience their memory problems as real, and for whom **cognitive testing has also helped to overcome depression**. It should be noted that many of these patients also have known internal medical conditions (hypertension and/or diabetes and/or other endocrine disorders, heart disease, sleep apnea) or have had a COVID infection. **Follow-up** of this group of patients is therefore necessary, because memory impairment of organic origin cannot be excluded, but regular, repeated testing is sufficient, as means of monitoring for the time being.

Methods

Carry out a pilot in the following areas:

Clinical standards MMSE MoCA ADAS-Cog BICAMS	Stroop tests Color recognition by letter color Color recognition by background color	Memory games Classic Semantic Mathematical	Other cognitive games Word guess Shape recall
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For cognitive games, we have developed a unified and normalized evaluation system that enables the comparison of results across individual games.

PILOT data 17.09.2021 to 19.12.2021

Participants with dementia 25 participants 7252 tests completed

Control group 31 participants 612 tests completed

Data at 24.05.2023

Participants with dementia 32 participants 12750 tests completed (+5 498) growth

Control group 61 participants 9057 tests completed (+8 445) growth

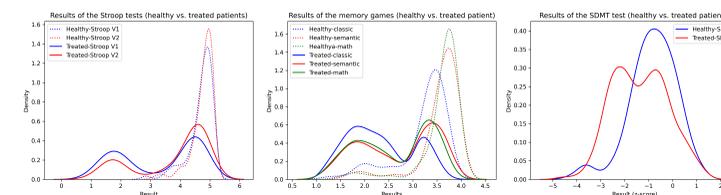
Participants with Parkinson's disease 39 participants 2246 tests completed

The pilot study was so successful among the participating patients that several of them continued with the tests even after the study period.

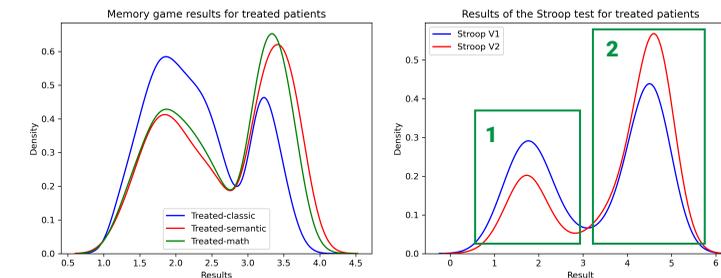
Results

The analysis of the results revealed remarkable difference between the results of the two population groups.

This difference is illustrated by the density functions of the distribution of the results.



If we focus on the data of treated patients only, the density functions allow us to identify the two groups even better:



Conclusion

The Platform we chose (PreDEM) screens the first, otherwise imperceptible signs of dementia - with risk analysis that based on early screening and artificial intelligence processing and by using games that assess cognitive abilities. One significant finding from our study is that **regular performance of cognitive games leads to significant improvement, which supports the effectiveness of the PreDEM Platform in therapy**.

Future

The widespread use of the Platform in prevention, diagnosis, and therapy would allow everyone to access **high-quality care regardless of location, time, or space**. We proposed incorporating new variations of existing games and implementing new cognitive games as well.

A new development has also been initiated, focusing on the application of **Machine Learning to classify treated patients based on their results**. This classification enables the identification of patients with organic backgrounds or pseudodementia.

To achieve digital well-being, we are implementing screening, diagnostic, and therapeutic cognitive games and tests within the Platform for Parkinson's disease, dementia (primarily Alzheimer's disease), and Multiple Sclerosis. During the performance of these activities in patients' homes, their cognitive behaviors are digitally recorded.