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Alzheimer Europe partners in three new projects linked to Artificial Intelligence

Alzheimer Europe is pleased to partner in three new projects. In this article, we present a brief overview of ADIS (JPND funded), eBRAIN-Health (Horizon Europe funded) and Pattern-Cog (ERA PerMed funded). The perspective of each project's coordinator is presented, regarding the rationale behind the projects and the concrete actions being undertaken.

Holger Fröhlich

ADIS

ADIS stands for "Early Diagnosis of Alzheimer's Disease by Immune Profiling of Cytotoxic Lymphocytes and Recording of Sleep Disturbances". The project is funded through the EU Joint Programme - Neurodegenerative Disease Research (JPND). JPND is the largest global research initiative aimed at tackling the challenge of neurodegenerative diseases.

The ADIS project will run for a period of three years with a budget of 1.3 million, distributed among seven collaborators.

Interview with Project Coordinator Prof. Dr Holger Fröhlich, Fraunhofer SCAI, Germany

What is the problem you are aiming to address with ADIS?

ADIS focuses on the question of how we could achieve earlier diagnosis of Alzheimer's disease (AD) in the future. This is important, because the disease likely starts decades before the manifestation of first symptoms. The success of any future medical treatment critically depends on starting as early as possible, because the damages to the brain that are initiated by the disease are irreversible. Another reason why earlier diagnosis is so important is the strongly increasing number of patients with AD. The diagnosis, treatment and care of each of these patients is very expensive. So, it would help, if in the future a higher percentage of patients could be diagnosed in primary care institutions rather than in specialised memory clinics.

For both these reasons, we need measurements (biomarkers), and these biomarkers should be sufficiently easy to assess so that this can also be done by general practitioners. In the ADIS project, we thus focus on blood-based biomarkers as well as sleep disturbances.

What are the concrete objectives and actions which will be undertaken by ADIS?

Our two concrete objectives are to evaluate whether blood-based biomarkers derived from special types of immune cells and sleep disturbances allow us to reliably distinguish AD patients at different stages of the disease from healthy subjects; and to understand, in how far sleep disturbances might influence blood-based biomarkers. This is important, because we need to know which type of measurements are most effective and most efficient.

Our concrete actions include running a clinical study with 75 participants (25 with AD, 25 with mild cognitive impairment and 25 cognitively normal participants), that we carefully assess via standard questionnaires, a smartwatch (worn at home), an augmented reality game (to monitor cognition) and via blood sampling.

From each of the blood samples we measure many different molecular markers, even on the level of individual cells. We use statistical as well as advanced computational approaches (including Artificial Intelligence) to find patterns in the data generated by our study. This will help us to evaluate whether blood-based biomarkers and sleep disturbances might allow us to detect AD at an early disease stage.

> "ADIS will leverage cutting-edge science and technology with clinical expertise to explore biomarkers for earlier diagnosis of Alzheimer's disease, which is essential to enhance success chances of any treatment."

adis
Early Diagnosis of Alzheimer's Disease
by Immune Profiling of Cytotoxic Lymphocytes
and Recording of Sleep Disturbances

https://www.adis-project.eu/
@ADIS_JPND

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eBRAIN-Health

eBRAIN-Health is a Horizon Europe-funded research project that was launched in July 2022, with a total budget of almost 13 million EUR. Involving 20 partners including Alzheimer Europe, the project will run for four years, until July 2026. Alzheimer Europe is leading the public involvement activities and contributes to communications and outreach work for the project.

Interview with Project Coordinator Prof. Petra Ritter, Berlin Institute of Health at Charité University Hospital, Germany

Petra Ritter

What is the problem you are aiming to address with eBRAIN-Health?

Brain health costs in Europe are estimated to exceed EUR 800 billion per year. However, we still lack effective, disease-modifying treatments for Alzheimer's disease (AD) and dementia, which affect over 10 million people in Europe alone. There are many factors that contribute to this. Firstly, there are still gaps in knowledge about the specific biological processes in the brain that cause these diseases, which often affect people with multiple health problems. In addition, we lack precise, highly-accurate tools and systems for modelling, diagnosing and monitoring the progress of AD, which may take decades to develop. Together, these and other factors mean that people with AD can wait years to be diagnosed, and lack effective treatments that could change the course of the disease.

Many research studies have been collecting data and information to better understand the biological basis of AD, assess diagnostic and monitoring biomarkers and test potential treatments. These individual studies can be limited by the range of tests and assessments used, and by the number and diversity of participants that are included. In addition, while large investments in dementia research have been made over the last decade, there are technical barriers that hinder progress: such as a lack of integration, and insufficient computational exploitation and re-use of research data. In eBRAIN-Health, we are aiming to address these barriers, by developing a secure research platform for accurate "digital twins" of the brain, created by assembling a large range of data sources. Using these digital versions of individuals to model disease progression could accelerate brain research, and improve clinical decision-making for patients with Alzheimer's and other neurodegenerative diseases.

What are the concrete objectives and actions which will be undertaken by eBRAIN-Health?

As mentioned above, our project is built around the concept of "digital twins". Digital twins are virtual representations of individuals, created based on vast quantities of clinical data and scientific knowledge. Using artificial intelligence, this information can be integrated into a "digital twin", personalised to resemble the clinical characteristics of individual people. As our real-time, virtual representations, digital twins have the potential to support more accurate and personalised decision-making, for example by allowing doctors to simulate the future outcomes of different treatment options.

In eBRAIN-Health, a large variety of data sources will be brought together in a GDPR-compliant research platform, to support the development of digital representations of the brain. These data sources will include brain scans, behavioural studies and lifestyle surveys, as well as clinical data from thousands of patients and healthy peers. The data will be combined with biological information from scientific research on the brain, helping to build complete and highly-detailed simulations of the brain.

These simulations can then be personalised to resemble individual people, creating a brain "digital twin". These "digital twins" will allow a large number of researchers to conduct innovative brain research within a powerful digital platform that keeps patient data secure and confidential. In addition, the digital twins have the potential to improve our understanding of brain function and disease at an individual level; improve diagnosis and risk prediction and optimise potential therapies.

> "Digital twins that simulate individual brains have the potential to accelerate research, and improve clinical decision-making for patients with AD. In eBRAIN-Health, we are working together to realise this potential, by developing a powerful digital platform that will keep patient data secure whilst driving innovation."

eBRAIN-Health

https://www.ebrain-health.eu/
https://twitter.com/EbrainHealth

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Pattern-Cog

Pattern-Cog stands for "Personalised ageing pattern for early risk detection and prevention of cognitive impairment and dementia in cognitively healthy individuals". The European project officially started on 1 June 2022 and has a duration of three years. The project has a budget of 1.7 million from ERA PerMed, distributed across a total of six partners: University of Eastern Finland, Jena University Hospital, Karolinska Institutet, Fundaction Centro de Investigacion de Enfermedades Neurologicas, Charité Universitatmedizin Berlin and Alzheimer Europe. In this project, Alzheimer Europe co-leads the work packages dedicated to public involvement and communication/dissemination.

Interview with Project Coordinator Jussi Tohka, University of Eastern Finland

Jussi Tohka

What is the problem you are aiming to address with Pattern-Cog?

The overarching goal of the Pattern-Cog project is to improve dementia prevention strategies by developing and validating a personalised medicine methodology for the detection of earliest signs of impending cognitive decline and markers, to enable early and personalised multidomain interventions. Effective disease modifying drugs are not yet widely available, but a multidomain lifestyle intervention (FINGER randomised controlled trial, RCT) has been shown to improve cognition and other related outcomes in older adults from the general population with elevated risk for developing dementia.

Findings from FINGER and other multidomain lifestyle trials have made it clear that intervention effectiveness may be dependent on a personalised approach to prevention, in which the first task is to accurately identify people at-risk who are most likely to benefit from an intervention. In addition, it is likely that future intervention strategies will be most effective when applied at the earliest stages of the disease.

There are a large number of personalised medicine studies looking at predicting the transition from mild cognitive impairment (MCI) to dementia at the level of an individual. However, there are virtually no methods to: 1) identify individuals in the pre-symptomatic phase of the disease who will transition to MCI in the future and 2) assess the prevention potential and impact of interventions in a personalised manner. These are the critical blind spots targeted by the Pattern-Cog project.

What are the objectives and actions taken when implementing the Pattern-Cog project?

The primary objectives of Pattern-Cog are: 1) to develop an innovative methodology for predicting future cognitive decline indicative of high risk for clinical transition, 2) to test the methodology in ongoing RCTs for dementia prevention and 3) to develop solutions to the ethical, legal, and social issues associated with computer-assisted dementia risk prediction.

Pattern-Cog will combine data from several relatively routine measures (e.g., magnetic resonance imaging, neuropsychological testing, and risk factors) to develop the prediction methodology that we describe as a personalised aging pattern. The innovative aspect of the method development is that the personalised aging pattern is trained based on data from cognitively healthy individuals.

> "The innovative aspect of the Pattern-Cog method development is that the personalised aging pattern is trained based on data from cognitively healthy individuals. We will use several existing databases (i.e. large observational study of healthy aging) and dementia intervention/prevention trials to develop and validate our method."

To develop and validate the method, we will use several existing databases, including a large observational study of healthy aging ("Vallecas Study") and dementia intervention/prevention trials (e.g., FINGER, MIND-AD mini). Ethical, legal, and social aspects of dementia prediction and prevention are essential components of the project.

Pattern-Cog will help answer relevant questions about the management of research data in multinational studies of personalised medicine in dementia. Equally important is understanding the views and concerns of people with cognitive impairment and dementia regarding algorithm-based prediction of future cognitive decline. Even as clinical tools are being developed, Pattern-cog will organise public engagement activities to understand how best to communicate the results of risk assessments based on algorithmic approaches.

Pattern-Cog

Personalised ageing pattern
for early risk detection and prevention
of cognitive impairment and dementia
in cognitively healthy individuals

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#ERAPerMed

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