

## LETHE project looks at digital cognitive biomarkers

LETHE is a personalised prediction and intervention model for early detection and reduction of risk factors causing dementia, based on AI and distributed Machine Learning. Alzheimer Europe asked project coordinator Sten Hanke to discuss the details of this new EU-funded project.

### What is the problem you are aiming to address with the LETHE project?

Cognitive impairment is common among elderly adults. Dementia, the most severe expression of cognitive impairment, represents the main cause of disability in elderly people. Globally, about 47 million people were living with dementia in 2015, and this number is projected to triple by 2050.

Dementia is the greatest global challenge for health and social care in the 21<sup>st</sup> century, and increases in numbers and costs are driven, worldwide, by improved longevity resulting from the welcome reduction in people dying prematurely.

As the world's population increases in age, the number of people living with dementia grows, and this number is projected to continue to rise. Dementia has long been considered to be neither preventable nor treatable, but while the underlying illnesses are not curable, today we know that the disease course might be modifiable with good preventive interventions at an early stage.

With LETHE we want to identify risk factors at an early stage, project their development based on Artificial Intelligence (AI) methods, and apply early interventions to modify these risk factors. The aim is to shift the onset of dementia and cognitive decline to later stages. Modifying risk factors could make a big difference to the global impact of dementia, which would, in turn, have huge positive implications for social and health-care costs.

Literature suggests that dementia prevalence would be halved if its onset were delayed by

five years. Furthermore, estimates suggest that a 10% reduction in the prevalence of the principal health and lifestyle factors would reduce worldwide dementia prevalence by more than a million cases. Estimates also suggest that an intervention which delays dementia by 1 year could decrease the number of people living with dementia by 9 million, across the globe by 2050.

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While we might not expect risk factor modification to have this magnitude of effect in reality, any reduction in dementia risk would be a great achievement.

### What are the concrete objectives and actions that will be undertaken in LETHE?

Based on a data pool of 130,000 datasets from clinical centres in Europe, we will try to develop an initial prediction model of dementia-related risk factors and factors influencing the progress of cognitive decline. These datasets include prevention trial data, observational and longitudinal data, as well as insurance data.



Sten Hanke

In parallel, we will implement an information and communications technology (ICT)-based intervention framework, inspired by the [Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability \(FINGER\)](#) protocol which allows a semi-automated lifestyle intervention for people at risk of dementia. The ICT framework will, on the one hand, collect several types of passive and active behaviour data, through app-based questionnaires, wearables and other sensors; and on the other hand, provide some personal lifestyle guidance, to help keep the person adherent to the individual intervention protocol. LETHE will also make use of some interfaces which go beyond a normal app, such as robots or smart glasses.

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Based on the data collected during a trial spanning more than two years, we will train an AI prediction model, first to gather knowledge about the influence of lifestyle parameters on the dementia risk factor progression, and then to adapt the individual lifestyle guidance in real-time to prevent the progression of the

risk factors and, by so doing, shift the onset of dementia to later stages in life.

**What are the benefits of a personalised prediction and intervention model?**

The clear benefit of automating the FINGER protocol is that, if LETHE is successful, theoretically anyone at any age could start to follow this tailored lifestyle intervention to shift the potential onset of dementia in later life. In the future, we might even be able to identify possibilities more easily, to understand our personal predisposition to certain chronic diseases before the first symptoms are even visible. This is the moment where ICT based interventions which can close to whole loop of measuring the progress and providing the guidance can bring a benefit to help people to stay healthy. The effects and the progression of the disease or the risk factors can be very individual, depending on several factors such as genetic predisposition and social background, among others. It is becoming clearer that a one-size-fits-all intervention may not be the best approach, particularly as we are all individuals and have our own preferences and habits. For example, one person might find it easier to walk 10,000 steps every day, while another finds it more convenient to follow a vegetarian diet. The important thing is that we manage to keep each person adherent to their individual protocol.

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Another important thing we can do, also, when we collect data, is to see which intervention protocols and therapies are successful for which individuals, and to learn from that and apply it to other individuals with the same pre-disposition.

**What are your expectations from and hopes for the LETHE project?**

We have many hopes for the project. As mentioned, one goal would be to achieve an ICT-based intervention setup which can also be applied to prevent other chronic diseases. Then, we hope to find more insights into the relationship between different dementia risk factors and, by so doing, gain knowledge about the factors which are influencing dementia progression or the development of the disease in general – especially in the early stages.

Furthermore, it would be great to see that the personal ICT intervention, together with the ICT-based lifestyle guidance really prove the positive impact that lifestyle interventions

can have, even in such a short period of time as the 2–3 years in the project.

Another aim is to collect a behaviour data set during the project, which will help us to further develop so-called ‘digital biomarkers’, which in the future might replace traditional biomarkers to diagnose and monitor dementia and risk factors. We expect a future shift to more information being taken from quantitative data measured in real-life settings, rather than from clinical data examinations.

Over all, the project has many hopes and expectations, both on the research and technical side, regarding data, algorithms and ICT intervention, but also on the clinical side regarding knowledge about dementia and its influencing factors.

In the long term, it should be possible to build a healthcare system that aims to prevent diseases and to keep people healthy for as long as possible, thus providing better quality of life for everyone.

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