From heterogeneous patient measurements towards earlier diagnosis in Alzheimer's disease

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European PredictAD project, lead by Principal Scientist Jyrki Lotjonen from VTT Technical Research Centre of Finland, has developed a decision support tool for objective diagnostics of Alzheimer's disease. The tool compares measurements of a patient to measurements of other persons available in large databases and provides a simple index about the severity of the disease. The project has shown that the tool improves the accuracy of diagnosis and clinicians' confidence about their decision, making earlier diagnosis possible.

Dementia has been recently identified as a health priority both in Europe and in the USA. Alzheimer's disease, the most common cause of dementia, alone accounts for costs equivalent to about 1% of the gross domestic product (GDP) of the whole world and the number of persons affected will double in the next 20 years. Early diagnosis plays a key role in solving the problem because treatments of this irreversible disease should be started at an early phase to be efficient.

The current guidelines for the diagnostics of Alzheimer's disease emphasize the role of various biomarkers. These biomarkers include measures from magnetic resonance imaging (MRI), positron emission tomography (PET), biomarkers from cerebrospinal fluid (CSF) and genetic biomarkers in addition to evidenced memory impairment. No single patient measure provides enough information for diagnostics. Currently, clinicians make the final diagnosis by combining

heterogeneous measurements with information from interviews of the patient and relatives. This process involves subjective reasoning and requires strong expertise from the clinicians.

Modern hospitals have huge data reserves containing information that nobody has extracted. For example, the hippocampus is a central structure for memory and affected in Alzheimer's disease and brain MRI image databases contain information about the normal variability of the hippocampus in healthy and disased persons. This information can be utilised in diagnostics by systematic mathematical modelling.

PredictAD has designed a totally novel approach for measuring objectively the state of the patient. This decision support system, developed in close collaboration with clinicians, compares patient measurements with measurements of other persons in large databases and provides at the end an index and graphical representation reflecting the state of the patient. The index is a barometer of the disease making grounds for decisions more solid and objective. The graphical representation provides a clinician in glance information about the status of her/his patient compared with hundreds of other persons, some having the disease and some being healthy.

"The PredictAD tool provides a new option to support decision making by providing objective information about the patient", says Prof. Hilkka Soininen from the University of Eastern Finland, leading the clinical validation of the project.

Prof. Gunhild Waldemar from Copenhagen University Hospital, Rigshospitalet emphasizes the importance of the Alzheimer's disease research: "Successful, early diagnostics combined with the novel drugs under development and early psychosocial care may delay the institutionalization of patients, reducing suffering and the costs to the society. It has been calculated that delaying the onset of the disease by

five years would halve all costs of Alzheimer's disease and delaying onset and progression by only one year would reduce the number of Alzheimer's cases by about 10%."

More information: J. Mattila, J. Koikkalainen, A. Virkki, A. Hviid-Simonsen, M. van Gils, G. Waldemar, H. Soininen, J. Lötjönen, The Alzheimer's Disease Neuroimaging Initiative. Disease State Fingerprint for Evaluating the State of Alzheimer's Disease in Patients. Journal of Alzheimer's Disease 27: 163-176, 2011.

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