Introduction
Dementia, including Alzheimer's disease and related disorders, currently represents one of the greatest public health challenges. With the expected sharp increase in cases over the coming decades, there is an urgent need to better understand and address this complex societal issue. Our research project focuses on analyzing cognitive functioning, aiming to identify both risk and protective factors that influence the development of cognitive impairment and dementia.

Objective
The main goal of our project is to clarify the mechanisms underlying cognitive decline, with a particular focus on middle-aged adults in Poland. Through a comprehensive, longitudinal study, we aim to identify key risk and protective factors that influence cognitive function and brain structure. Using advanced data analysis methods, we seek to uncover processes involved in cognitive impairment and cerebral small vessel disease (CSVD), ultimately paving the way for more effective prevention strategies and intervention programs.

Study description
This project builds on the infrastructure of our previous PURE-MIND study and draws from a unique cohort of 810 participants who previously underwent brain MRI and neuropsychological assessments. In the current phase, we will repeat MRI scans, cognitive testing, and blood analyses—including inflammatory and immune markers. A novel element of our study is the ex vivo assessment of immune cell activity and analysis of immunological factors as potential biomarkers of neurodegeneration. By applying a harmonized MRI protocol and advanced statistical and network analysis techniques, we ensure reliable longitudinal comparisons. At the national level, this is a pioneering study—the first large-scale population-based project in Poland with such a broad scope, specifically focused on CSVD and cognitive impairments in a non-geriatric population.

Justification
This research addresses the growing need to counter the increasing prevalence of dementia—an issue with significant personal, social, and economic consequences. By focusing on middle-aged adults, we aim to gather data essential for designing early interventions that could delay or prevent the onset of cognitive decline. Furthermore, by exploring modifiable risk and protective factors, we hope to encourage public engagement in preserving cognitive health through lifestyle and health-related behaviors.

Expected results
We anticipate several significant outcomes from our study. First, we aim to identify modifiable risk factors associated with cognitive decline, offering valuable insight into the potential for targeted preventive interventions. In addition, by clarifying the role of CSVD in cognitive impairment, we hope to contribute to the development of focused diagnostic and therapeutic strategies. This project has the potential to enhance our understanding of cognitive health and serve as a foundation for public health programs aimed at reducing the prevalence of dementia.
In summary, our research marks an important step toward unraveling the mechanisms of cognitive decline and strengthening cognitive reserve. By combining cutting-edge scientific methods with a focus on the midlife population, we strive to deliver practical results that may improve the lives of those living by cognitive impairment. Through these efforts, we aim to help build a future where cognitive health is protected and prioritized, ensuring a better quality of life for all.