BRAINTEASER short project's description

Full project name: *"Bringing artificial intelligence home for a better care of amyotrophic lateral sclerosis and multiple sclerosis"*

Funding Programme and Grant Agreement number: H2020 GA n. 101017598

Duration: 01/01/2021 – 01/12/2024 (48 months)

Short description: BRAINTEASER aims to integrate societal, environmental and health data to develop patient stratification and disease progression models for Amyotrophic Lateral Sclerosis (ALS) and Multiple Sclerosis (MS). ALS and MS are two very complex degenerative neurological diseases, but with very different clinical picture, evolution, prognosis and therapies. Common features are that both these chronic diseases affect the nervous system and progressively modify the quality of life of the patients and their families in a significant way.
BRAINTEASER will integrate large clinical datasets with novel patient-generated and environmental data collected using low-cost sensors and apps.
The collected data will allow the development of Artificial Intelligence (AI) tools able to address the current needs of precision medicine, enabling early risk prediction of disease fast progression and adverse events.
Technical solutions developed within the project will follow agile and user-centered approaches, accounting for the technical, medical, psychological and societal needs of the specific users.

Scope and objectives: The system developed in BRAINTEASER will provide quantitative evidence of benefits and effectiveness of using AI in health-care pathways, implementing a proof-of-concept of their use in real clinical setting. Outcomes from the project will also provide a coherent and integrated set of recommendations for public health authorities. BRAINTEASER will support the transition of current healthcare approaches from reactive to predictive, paving the path for patients toward a healthier and more fulfilling life as long as possible.

BRAINTEASER main goals can be summarized as follows:
- To investigate and model ALS and MS progression for patients, who demand to plan their future and being assisted in their daily needs, and for clinicians, who need to deepen disease understanding to personalise patients' treatment and prevent adverse events and fast disease progression,

- To enforce the advantage of using AI models to augment current clinical approaches by introducing innovative descriptors of clinical outcomes, integrating and managing multidimensional datasets, stratifying patients and characterizing the disease evolution to design personalized health and care pathways,

- To enforce the use of AI models in hospital, home-care and in research, adopting an open science paradigm that makes scientific research results accessible to all levels of society, at the same time respecting the privacy and patients' data ownership, and actively involving end users in the technological solution co-design, implementation and commercialization to make sure the project's results will soundly respond to real needs.

Consortium: Universidad Politécnica de Madrid - UPM (ES), Università degli Studi di Padova - UNIPD (IT), FCIÊNCIAS.ID Associação para a Investigação e Desenvolvimento de Ciências – FC.ID (PT), Università degli Studi di Torino - UNITO (IT), Instituto De Medicina Molecular - João Lobo Antunes – iMM (PT), Servicio Madrileño de Salud - SERMAS (ES), Fondazione Istituto Neurologico Nazionale Casimiro Mondino - MNDN-PV (IT), Belit d.o.o. - BELIT (RS), InSilicoTrials Technologies S.p.A - IST (IT), ECHAlliance Company Limited by Guarantee - ECHAlliance (IE), The European Brain Council AISBL - EBC (BE).

Partners' roles in BRAINTEASER

Partner	Role
UPM	Besides coordinating the project, UPM will lead the design and development of the ALS and MS patient app for monitoring, data acquisition and feedback. The app will provide a set of tools to foster the self-management of the disease using educational contents, a report and management of symptoms, as well as services to improve the adherence to treatment. In addition, UPM will be responsible for implementing the clinical tools to monitor, understand the progresses and assess the patients that use the app. Moreover, UPM will contribute to the applicability of the AI models in the clinical context and in the daily patient's routine.
UNIPD	UNIPD will develop a signal processing pipeline for enhancing the signals acquired on ALS and MS patients by wearable sensors monitoring patients' activity/mobility and vital signs. Then, UNIPD will lead the development of AI models to predict the risk of progression in ALS and MS patients. UNIPD will also be responsible of implementing the project's Open Science framework, that will include FAIRification, integration, access, and re-use of the valuable data and research outcomes produced within the project. To maximize the impact of the project, UNIPD will also organize annual open evaluation challenges according to the Open Science approach. Moreover, UNIPD will lead the technical management of the project, coordinating and monitoring the technical activities carried out.
FC.ID	FCIÊNCIAS.ID is leading the work package targeting AI models for patient stratification. It further actively participates in all other tasks concerning the development of AI models to unravel disease mechanisms, predict disease progression, and suggest interventions that can delay disease progression, where patient stratification is key given patient heterogeneity both in ALS and MS.
UNITO	UNITO is one of the most relevant providers for the ALS data, taking care of the PARALS register, one of the largest and complete ALS databases in Europe. UNITO will also have a critical role in developing many of the machine-learning tools, especially for the Deep Learning extensions to the developed models. UNITO will address the concept definition and the general guidelines and work on exploiting the

	sensor-based information to predict ALS and MS disease progression and risk level by coordinating the development of AI methods for disease monitoring.
	UNITO will participate in developing the technological parts and will lead the task of artificial intelligence models for ALS and MS progression. UNITO will collaborate in the development of AI-based models for patient stratification and progression using Deep Learning models and open science and fair data. Moreover, UNITO will lead the task of ethics, management and data management plan.
iMM	iMM will be involved in the concept definition and the project general procedures, including ethical and legal framework for data collection and its use. Will participate in establishing protocols, models and tools to clinicians and patients, in particular regarding personal and environmental sensors. iMM will provide clinical and laboratory data from ALS patients, and evidence-based medical background to establish guidelines for risk predictors, population stratification and variables inclusion. iMM will strongly contribute to clinical-genotype-environmental risks interplay in ALS, and remote clinical data recording from sensors.
SERMAS	SERMAS will be one of the providers of ALS and MS patient's data. They will contribute to the definition of the clinical protocols and requirements for both patients and clinicians. SERMAS will participate in the co-design of the proposed solution and will be responsible for the Spanish pilot being actively involved in the final validation of the project.
MNDN-PV	MNDN-PV will lead the integration of environmental data in the AI models to predict the risk and progression in MS and ALS patients. In details, MNDN-PV will be in charge of the retrospective and prospective collection of environmental findings, the development of subject exposure models with collection of new data from sensors, definition of AI strategies to retrieve dynamic phenotypes, and of providing support to other partners in building predictive modelling with the inclusion of environmental data.
	Mondino Foundation will be supported by the University of Pavia (UNIPV) for the management of retrospective and prospective environmental data, in temporal data processing and outcome prediction methods. UNIPV will support the Consortium in the design and implementation and definition of algorithms for extracting spatio-temporal patterns from multivariate data, including environmental ones.
BELIT	BELIT will lead the establishment, deployment, running and maintenance of the core backbone system infrastructure and processing middleware for data acquisition, consolidation and fusion, storage, management and provision to other modules and components of the BRAINTEASER platform and tools. It will also contribute to the design and development of interactive tools, AI models for disease monitoring and progression and sensory/IoT data ingestion and processing, simulation cloud platform (with specific interest, as industry partner, in the solution certification as a medical

	device), and generally in all software/IoT and bioinformatics-related development. Participation in data sharing, open science and dissemination and exploitation will complement the development and implementation efforts to materialize into sustainable results and marketable products.
IST	IST will integrate a selected number of simulation workflows on the InSilicoTrials.com platform, a commercially viable cloud, compliant with regulations such as GDPR, HIPAA and others like ISO/IEC 2700X standards, GCP technical requirements, Computer System Validation practices as Good Automated Manufacturing Practice (GAMP5). IST will further lead development of an exploitation plan, that will target the effective start-up of the commercialization of the selected number of simulation workflows as Software as a Service (SaaS). Within the BRAINTEASER project's management team, IST will cover the roles of Innovation and Quality & Risk Managers.
ECHAlliance	ECHAlliance will lead the activities related to the Exploitation, Innovation, Communication, Dissemination work strand. As such, ECHAlliance will design the strategy and actions for raising awareness on the BRASINTEASER's achievements with a view to achieve the sustainability of the results after the end of the project. ECHAlliance, will also contribute to the organisation of the Open Evaluation Challenges to validate the project's results and ensure their scalability. Within the BRAINTEASER project's management team, ECHAlliance will cover the role of the Dissemination and Communication Manager.
EBC	The European Brain Council (EBC) is involved in general communication and dissemination of the BRAINTEASER project. To keep the project aligned with other EU and non-EU initiatives with similar or complementary objectives and to foster the exchange of information and ideas with the aim of generating synergies, collaborations and taking advantage of other research activities in the field, EBC will lead the activities related to the "Liaison with related projects/activities (organising coordination activities)".

Website: https://brainteaser.health/ and on CORDIS

Social media: Twitter – LinkedIn

DISCLAIMER

The content of this presentation reflects only the authors' views and the European Commission is not liable for any use that may be made of the information contained herein.