TeleRehaB
DSS

Transforming balance rehabilitation with AI: supporting healthcare professionals and patients along the entire care pathway

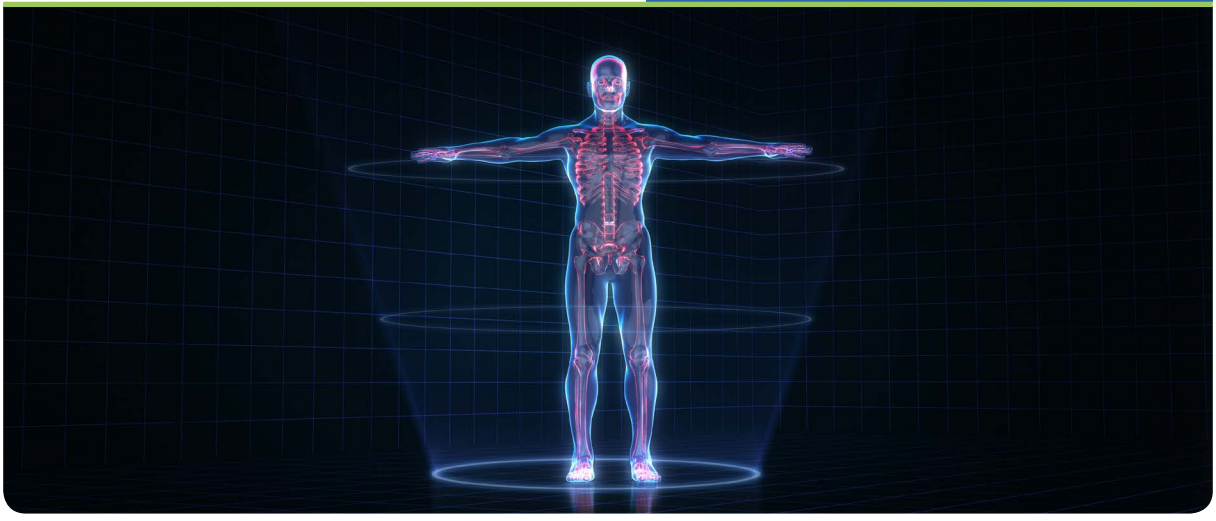
Why TeleRehaB Decision Support System (DSS)

Balance physiotherapy is a key intervention for falls prevention. Due to its complex nature, innovative solutions are needed. The TeleRehaB DSS project addresses the **escalating challenge of falls in an aging population**, a significant contributor to emergency department attendances in individuals **over 65**.

The projected cost of falls, estimated to surpass 45 billion euros by 2050 underscores the urgent need for tailored prevention programs to mitigate the significant medical expenses, rehabilitation costs, and indirect costs associated with falls, as well as lost productivity and diminished quality of life for the patient.

Existing technology-based interventions, developed in prior projects like **HOLOBALANCE and SMART BEAR**, offer increased effectiveness compared to standard care but face barriers in adapting to special populations and addressing cost concerns.

The TeleRehaB DSS project addresses the escalating challenge of falls in an aging population.



Project aims

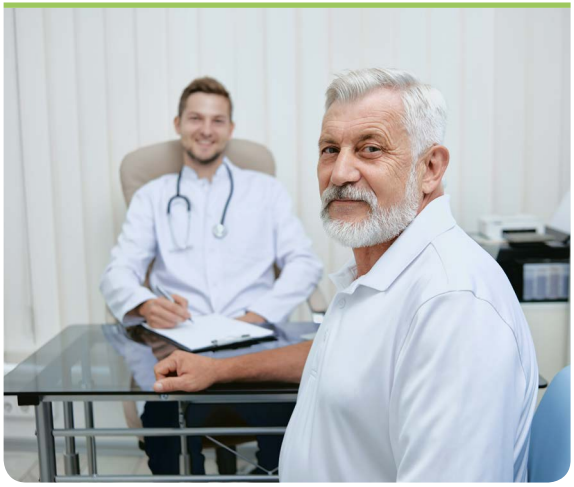
TeleRehaB DSS aims **to streamline the entire clinical pipeline of patient management with balance difficulty/falls.** The project will produce a comprehensive tool for use throughout the clinical pathway, delivering personalised rehabilitation interventions, evaluating prognostic factors, and offering automated balance intervention planning and management.

The project seeks to construct a **DSS powered by Artificial Intelligence (AI), predicting compliance and benefits from different suggested interventions and facilitating remote diagnostic assessments**. This model will consider multifactorial falls/balance disorders data and related socioeconomic costs and will automatically provide patient-specific, cost-effective interventions, limiting need for therapist expertise and maximising effectiveness and value of the chosen intervention.

To visually encapsulate the comprehensive approach of TeleRehaB DSS, a **rich dashboard is provided to clinical experts**. This dashboard guides them through every step of patient management, from initial treatment planning to potential outcomes, automated scheduling, and intuitive monitoring.

On the patient side, TeleRehaB DSS empowers individuals by having them take an active role in their treatment, guided by a virtual coach in real-time within their home environment. The interventions, when compared to standard care, offer efficiency and effectiveness. They incorporate the precise monitoring of movement and gamified activities to enhance engagement and patient participation.

The AI model for exercise progression (limiting the need for patient expertise) and patient motivation will capitalise on the models already developed within HOLOBALANCE and will be expanded to include additional disease and patient specific factors.



The clinical trial (proof of concept)

A **clinical validation study** with nearly **500 patients across five clinical centres** will be conducted to improve patient management **for balance disorders post-stroke, mild cognitive impairment, vestibular dysfunction** (disturbed balance caused by issues with the ear or central nervous system or both), **and long COVID-19.**

The data collected will come from a large set of **retrospective data from previous EC innovation projects**, and prospective **health data from continuous patient monitoring**, and **real-time body motion** (measured in inertial measurement units (IMUs)) for example via wearables.

This data will be analysed using Artificial Intelligence and Machine Learning (AI/ML) in the cloud, which will produce a diagnosis and a personalised treatment plan, accessible both to clinicians on the platform and to patients through their mobile applications.

Primary Objectives

1. Evaluate the cost-effectiveness of the proposed intervention as compared to the standard treatment for middle-aged and older adults with balance disorders and falls.

2. Assess the outcome of the treatment in terms of fall risk and cognition, using clinical measures and real-life data collected by sensors.

Active Intervention

Patients will be selected for the complete TeleRehaB intervention, including multisensory balance exercises delivered with augmented reality (AR), and performance monitoring sensors.

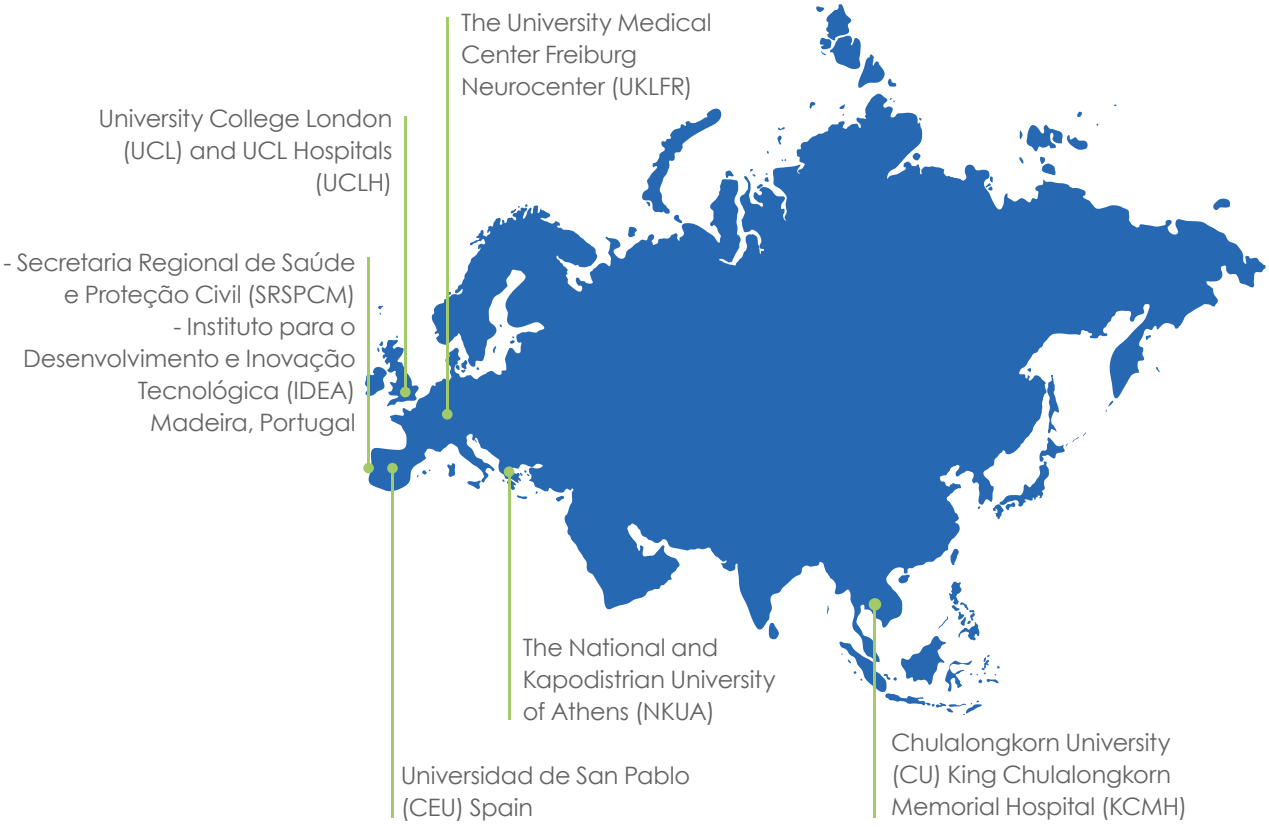
Control Intervention

The previous intervention will be compared with the OTAGO Home Exercise Programme for those at risk of falls and vestibular rehabilitation based for those with chronic imbalance.

Clinical site mapping

The study involves collaboration with five clinical sites, each with a specific focus and expertise in clinical trials and research around the following medical use cases on **balance disorders: Post-stroke, Mild Cognitive Impairment (MCI), Vestibular dysfunction, COVID-19.**

- **Post-stroke**
- **Mild Cognitive Impairment (MCI)**
- **Vestibular dysfunction**
- **COVID-19**



TeleRehaB DSS Impact

Key Benefits

- **Patients:** Receive a holistic approach with personalized treatment plans, cognitive training, and education. The patient-centric model improves independent living, quality of life, and long-term adherence.

- **Healthcare system and professionals:** The advanced AI models developed in TeleRehaB DSS will optimize decision-making and interventions, offering a comprehensive dashboard for clinicians. This results in efficient, precise patient management and a predictive model for individualized care planning. The platform combines evidence-based balance training with resource management, potentially supporting cost savings.

- **Policymakers:** Evidence that demonstrates the benefits to patients and potential healthcare cost reductions.

- **Patient families and carers:** Relatives and caregivers will benefit from enhanced patient quality of life and potential healthcare cost reductions (in systems where patients pay for care).

Business Applications

The outcomes of TeleRehaB DSS have implications beyond healthcare, presenting a viable business model for commercial use. It will set new standards in technology-driven falls prevention and personalized care.

- **Integration with TeleHealth Companies**: Enhances market value through AI-driven personalization.

- **Clinics**: Addresses the need for effective balance rehabilitation programs.

- **Digital Solution Resellers**: Expands portfolios with innovative technology.

- **Research and Guideline Development**: Informs studies and guidelines for balance disorder treatment.

Consortium

Institute of Communication & Computer Systems (ICCS), Greece.	Arinimi on Bridg ou (BRD), Estonia.
Panepistimio Ioanninon (UOI), Greece.	Uninova-Instituto de Desenvolvimento de Novas Tecnologias-Associacao (NOVA), Portugal,
Chulalongkorn University (KCMH), Thailand.	Quantitas SRL (QUAN), Italy.
Vilabs OE (VILABS), Greece.	Universitaetsklinikum Freiburg (UKLFR), Germany.
Istrazivacko Razvojni Centar za Bioinzenjering Bioirc doo (BIOIRC), Serbia.	Universidad de San Pablo (CEU), Spain.
Active Ageing Association (ACT), Spain.	Health Innovation Network (HIN) South London, UK.
Ethniko Kai Kapodistriako Panepistimio Athinon (NKUA), Greece.	University Colleague of London (UCL), UK.
Secretaria Regional de Saúde e Proteção Civil da Madeira (SRSPCM), Portugal.	Instituto para o Desenvolvimento e Inovação Tecnológica (IDEA), Portugal.

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