



TeleRehaB DSS targets the promotion of AI adoption in everyday clinical practice for balance rehabilitation training.

TeleRehaB aims for developing an AI-based Decision Support System, building upon/ expanding on previously developed platforms, tools, obtained results and know-how (i.e., HOLOBALANCE, SMART BEAR projects), to support effective and affordable treatment for patients at risk of fall for both in clinic and remote home-based care.

Telerehab context and challenges

In an increasingly ageing population, falls are a rising epidemic that account for most (58%) emergency department attendances in over 65s and will cost Europe over 45 billion euros by 2050 (Eurosafe, 2015). Falls are a syndemia that coexists with multiple comorbidities in older adults, such as cardiovascular disease, mood and cognitive disorders that increase the risk of serious falls injuries in older adults and that affect the intervention outcomes.

However, there is either a lack/limited access to falls specialist services within Europe; lack of integrated clinician education; paucity of well-trained clinicians to provide required individualised falls assessment and care. Patient adherence to existing exercise programmes is poor with 70% dropping out early. Falls are a challenging condition for medics, since they can be the result of various pathologies and therefore require input by various specialties with repercussions for required education, integrated care and adaption of optimal and multimodal solutions.

In this context, Telerehab aims to address the following challenges

Scientific challenge: balance physiotherapy is the key intervention for falls prevention. Technology based solutions that support non-expert clinicians to provide multifaceted falls prevention/rehabilitation, using Augmented Reality that increase patient adherence and that are already developed and evaluated in the context of previous projects (HOLOBALANCE, SMART BEAR) will provide wider, easier (home based) and earlier access to high quality falls services and interventions with a proven increased effectiveness compared to standard care.

Technology challenge: Artificial Intelligence tools can provide a better matching between patient and therapist, based both on area of specialty of the healthcare professional as well as to personality trait, aiming towards a win-win situation. Remote diagnostic assessments are another unmet need for faster clinical examinations.

Social and psychological challenge: to support effective and affordable treatment for patients at risk of fall for both in clinic and remote home-based care.

Economical challenge: to demonstrate that the solution is affordable for citizens, convenient for the healthcare and welfare system and that the technical research leads to the widening of market opportunities for business actors.

Telerehab ambition

Our ambition is to build upon the successfully completing **HOLOBALANCE project** a technological platform that supports remote monitoring and home performed balance rehabilitation in order to provide an optimised and semiautomated balance telerehabilitation, to improve balance and reduce the prevalence and impact of falls in older people with additional neurological comorbidity (stroke, cognitive, musculoskeletal, other) to balance impairment, who are in higher need or multifactorial intervention.

This will be achieved through a telerehabilitation diagnostic and management Decision Support System for patients and clinicians, that will be co-created with all stakeholders (patients, clinicians, regulatory and commissioning bodies) harnessing knowledge and tools developed and validated and the experimentally proven machine learning approach of the HOLOBALANCE project.

The proposed TeleRehaB DSS will include:

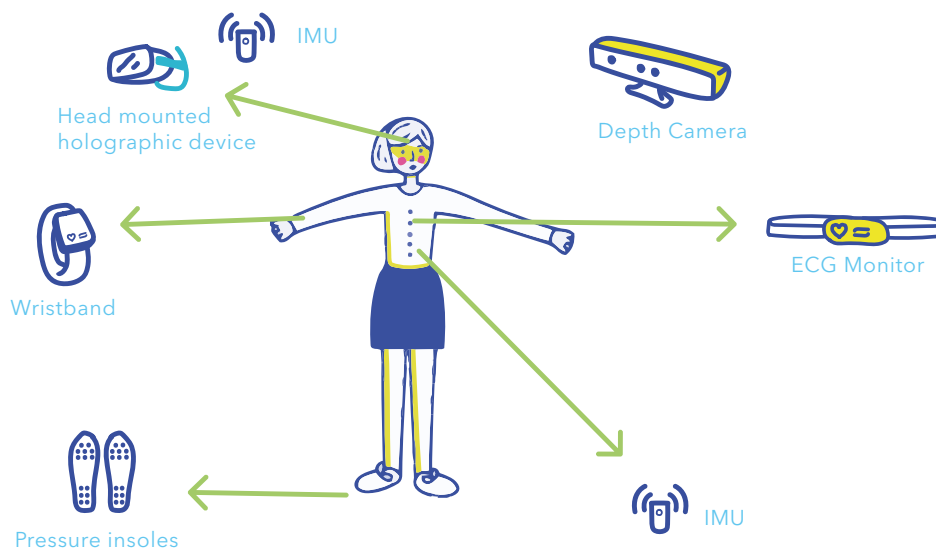
- An adaptable and expandable web-based and cloud facilitated platform and mobile phone apps, coupled with selected sensors, that will link therapist to patient to provide optimised cost-effective balance intervention.
- An AI model that will be constructed on the basis of systematic guidelines and literature reviews, existing clinical partner data, multimorbidity data from biobank/ twin studies repositories and synthetic data. This model will consider multifactorial falls/balance disorders data and related socioeconomic costs and will automatically provide patient-specific, cost-effective interventions.
- A further AI model for exercise progression and patient motivation that will capitalise on the models already developed within HOLOBALANCE and that will be expanded to include additional disease and patient specific factors.
- Disease specific toolboxes according to the balance model that informs patients/ carers and clinicians about the intervention, information/links on disease specific assessment and outcome measures used in the intervention, related disease and intervention guidelines and meta-analyses, instructional videos, which will be reviewed and updated annually.

Telerehab Clinical Study and expected impact

The clinical study is composed by two types of intervention:

Active intervention: HOLOBALANCE balance rehabilitation programme

The HOLOBALANCE intervention includes both standing and walking exercises, and cognitive exercises that were prescribed, according to the physiotherapist's clinical judgement, together with physical activity information and targets decided on an individual's needs and preferences. The exercises are presented to participants by the hologram based virtual physiotherapist with exercises participants required to wear a series of body worn sensors while performing the exercises and progressed over time depending upon the participant's task performance determined by the treating balance physiotherapist.



The technical components of the home based HOLOBALANCE system

In the TeleRehaB Decision Support System the platform will decide which patient will benefit most by performing all components of the HOLOBALANCE intervention consisting of TeleRehaB DSS delivered/progressed balance exercises with/without:

- The AR avatar and feedback
- Augmented Reality gamified intervention
- Sensor monitored exercise performance
- Cognitive training

Control intervention

The comparator will be based on:

- OTAGO Home Exercise Programme for those patients who report falls/are at risk of fall. The OTAGO is a progressive strength and balance training programme provided by a workbook with written instructions and pictures for each exercise.
- Booklet based vestibular rehabilitation for those people with chronic dizziness/imbalance without falls/risk of falls that is a validated and widely used intervention for vestibular disorders.

TeleRehaB DSS

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Ending date: November 2025

Partners:

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2. PANEPISTIMIO IOANNINON, Greece
3. CHULALONGKORN UNIVERSITY, Thailand
4. VILABS OE, Greece
5. ISTRAZIVACKO RAZVOJNI CENTAR ZA BIOINZENJERING
6. BIOIRC DOO, Serbia
7. ACTIVE AGEING ASSOCIATION, Spain
8. ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON, Greece
9. UNIVERSITY COLLEGE LONDON, United Kingdom
10. BIOIRC DOO, Estonia
11. UNINOVA-INSTITUTO DE DESENVOLVIMENTO DE NOVAS TECNOLOGIAS-ASSOCIACAO, Portugal
12. QUANTITAS SRL, Italy
13. UNIVERSITAETSKLINIKUM FREIBURG, Germany
14. GUYS AND ST THOMAS' NHS FOUNDATIONTRUST, United Kingdom
15. DOCTORES RIPOLL Y DE PRADO, S.L.P., Spain

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KEYWORDS

Artificial intelligence, intelligent systems, multi agent systems, computer sciences.

