THCS

TRANSFORMING HEALTH AND CARE SYSTEMS

PEER-HOME care

Pedagogy and Enriched Environment for Home based Stroke Rehabilitation

A Research Project in Home-based Stroke Rehabilitation

European Context…

- Only 30–50% of stroke survivors in many countries receive adequate rehabilitation.
- Support after discharge is often inconsistent or missing.
- Families carry much of the burden without training or resources.

The Stroke Action Plan for Europe calls for stronger follow-up care and innovative solutions.

PEER-HOMEcare vision…

- From hospital dependency to empowered home recovery.
- From fragmented services to integrated support for families and therapists.
- From passive rest to active, enriched environments.

THCS
TRANSFORMING HEALTH AND CARE SYSTEMS

Who do we need to succeed?

Inside consortium:

- Universities & research centres
- Rehabilitation hospitals
- Stroke associations

Outside partners:

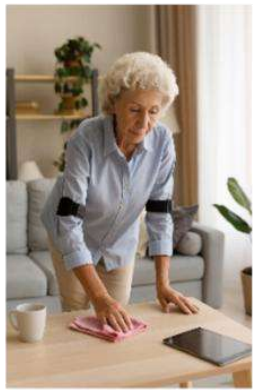
- Policymakers
- Funders
- Local health providers & municipalities

How are we going to succeed…

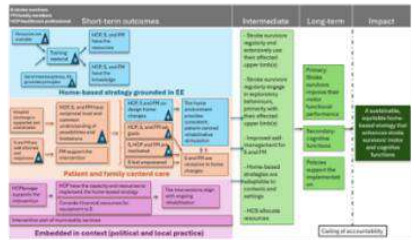
Enriched Environment Animal Studies

Theory and Framework for Human Application

Lived Experiences



Pilot Testing



Intervention Structure

Multi Country Feasibility Trial

PEER-HOMEcare

THCS
TRANSFORMING HEALTH AND CARE SYSTEMS

Enriched Environment Animal Studies

Preclinical (animal) studies show **25–50%** improvements in motor and cognitive outcomes in models exposed to enriched environments. **However, only marginal and inconsistent effects are observed when these approaches are translated to human clinical settings.**

PEER-HOMEcare

THCS
TRANSFORMING HEALTH AND CARE SYSTEMS

Theory and Framework for Human Application

Enriched Environment Animal Studies

Lived Experiences

We conducted two scoping reviews to build the scientific foundation for PEER-HOMEcare:

Environmental Enrichment in Animal Models of Stroke *(Published 2025)*

1. Reviewed 116 animal studies.
2. Defined enrichment as a strategy that modifies the everyday environment to add opportunities for movement, exploration, and social interaction.
3. Identified strategies and principles for enriching the environment.

Home-Based Stroke Rehabilitation Practices *(Published 2025)*

1. Mapped existing methods and approaches to home-based stroke rehabilitation in humans.
2. Found that many current practices lack structure, integration of family, and pedagogical principles.
3. Highlighted major gaps in follow-up care after discharge.

What does environmental enrichment mean?

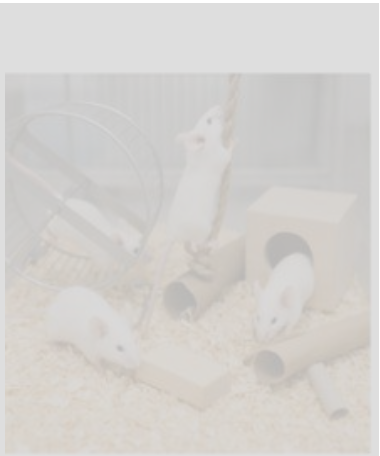
Enrichment means making small and regular modifications to the home environment (e.g., changing the type, shape, and location) for example of utensils in the kitchen.

The principles from animal science (novelty, variety, challenge, scaffolding, tailoring) can guide these modifications in the people's homes.

PEER-HOMEcare

THCS
TRANSFORMING HEALTH AND CARE SYSTEMS

Theory and Framework for Human Application



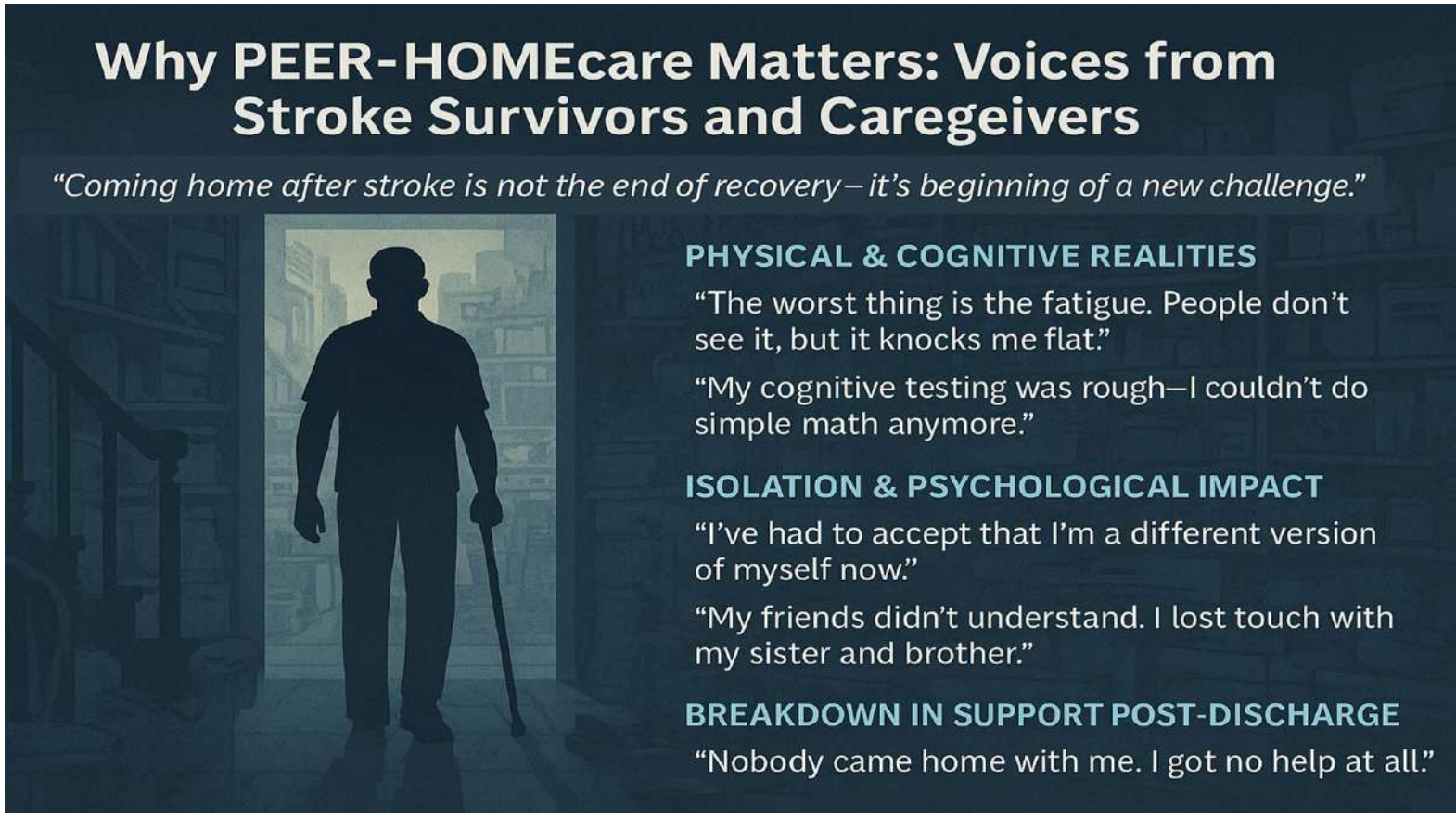
Enriched Environment Animal Studies

Lived Experiences

Understanding the Context – Stakeholder Voices

Listening to Patients, Families, and Therapists

We conducted 45 semi-structured interviews in Norway, Sweden, and Latvia with stroke survivors, family members, and healthcare professionals to understand their lived experiences of home rehabilitation after stroke.



PEER-HOMEcare

THCS
Transforming Health and Care Systems

Enriched Environment Animal Studies

Theory and Framework for Human Application

Lived Experiences

Pilot Testing

Pilot Study – Testing the Intervention in a Real Home-like Environment

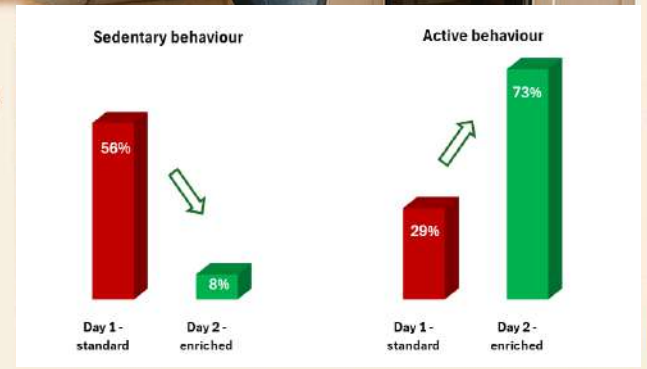
At Sunnaas Rehabilitation Hospital, we created a realistic apartment to test the PEER-HOMEcare intervention with five stroke survivors.

Day 1: No modifications

Day 2-3: Gradual enrichment — rearranged furniture, tools placed within reach, tasks added

Results

- Active behaviours rose from 29% to 73%.
- Passive behaviours dropped from 56% to 8%.



Survivors used their affected arm more in cooking and self-care tasks.

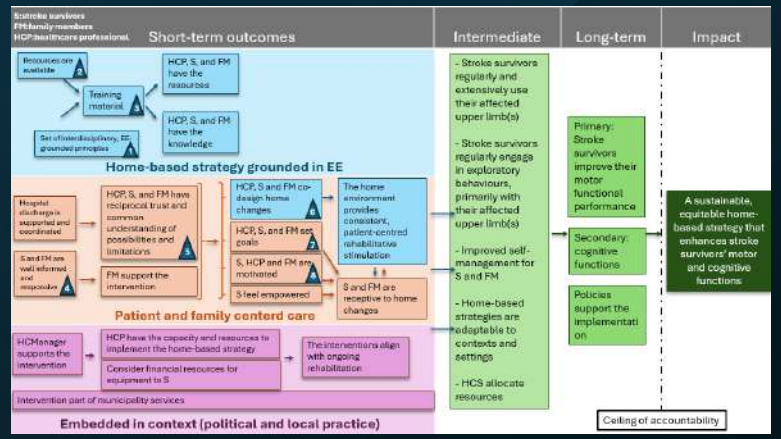
Motivation increased when activities reflected personal routines.

PEER-HOMEcare

THCS
TRANSFORMING HEALTH AND CARE SYSTEMS

PEER-HOMEcare

Currently we are working on a series of manuscripts…



From Principles to Framework

- Focus: Integrating complex systems science, movement sciences, and educational pedagogy to operationalize environmental enrichment (EE) principles in home-based stroke rehabilitation.
- Contribution: Moves beyond animal research to create a conceptual and practical framework for enriched environments tailored to stroke survivors' homes.

Designing the Intervention

- Focus: Developing a multi-component intervention that is contextualized across distinct national healthcare systems (Norway, Sweden, Latvia).
- Framework used: Guided by the Medical Research Council (MRC) framework for complex interventions.
- Contribution: Demonstrates how evidence, co-design, and programme theory refinement can produce a robust, adaptable intervention.

Feasibility Study Protocol

- Focus: Preparing for a multi-country feasibility study, which will begin in January 2026 in Norway, Sweden, and Latvia.
- Details: Includes study design, methodology, outcomes, and procedures to ensure transparency and replicability.
- Contribution: Tests whether PEER-HOMEcare is feasible and acceptable in real health systems, paving the way for larger trials.

THCS
TRANSFORMING HEALTH AND CARE SYSTEMS

Feasibility Trial (2026–2027)

- The full intervention will be tested in Norway, Sweden, and Latvia starting in 2026.
- Around 45 stroke survivors will take part.
- Families and healthcare professionals will be trained and supported.
- Outcomes will measure both feasibility (can it work in health systems?) and acceptability (do survivors, families, and staff find it meaningful?).
- This trial will inform future large-scale European implementation.

PEER-HOMEcare

THCS
TRANSFORMING HEALTH AND CARE SYSTEMS

Thank you for listening

Project Lead/ Coordinator – Norway

James Robert Rudd

- jamesr@nih.no

www.peerhomecare.com

Project PIs

Norway – Sunnaas Rehabilitation Hosp

Arve Opheim – Clinical Lead

- Arve.Opheim@sunnaas.no

Sweden – University of Gothenburg

- **Prof. Katharina Stibrant Sunnerhagen**
- ks.sunnerhagen@neuro.gu.se

Latvia – Rīga Stradiņš University

- **Prof. Guna Bērzina**
- guna.berzina@rsu.lv

NIH NORWEGIAN SCHOOL OF SPORT SCIENCES

SUNNAAS SYKEHUS

UNIVERSITY OF GOTHENBURG

RĪGAS STRADIŅA UNIVERSITĀTE

PEER-HOMEcare

THCS TRANSFORMING HEALTH AND CARE SYSTEMS

MI-RICORDO PROJECT

Emanuela Foglia

30 September 2025

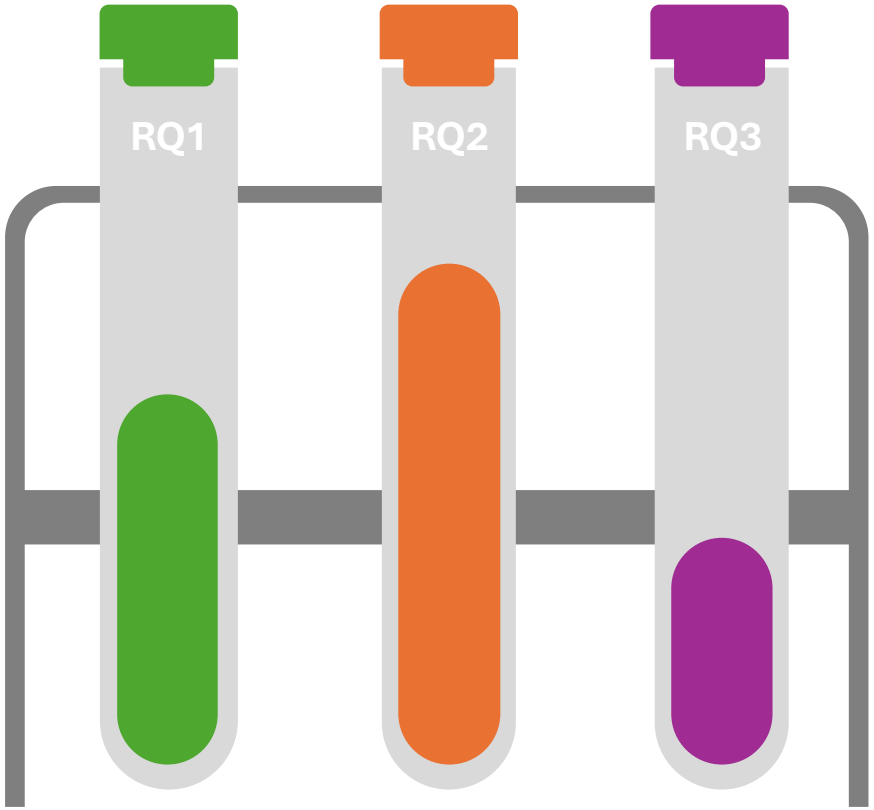
MI RICORDO OBJECTIVES

To **study and reconfigure an innovative digital healthcare solution**, able to offer continuity of care for **people with cognitive impairment**, already developed and tested in the Italian context, for its **transferability, transcultural adaptation and acceptance in different contexts (Italy, Portugal and France**) and in different settings of reference: hospital, home, nursing home and day center

To **evaluate** the efficacy of the **RICORDO digital solution in the enhancement of the global cognitive level and in promoting the patient's activation** in his/her own healthcare routine and the related level of acceptance

To **propose a multidimensional model** that, starting from the MAST (Model for Assessment of Telemedicine) approach, could support **the effective validation and adaptation of telemedicine digital solutions**, considering also safety, clinical effectiveness, patient perspectives, economic aspects, organizational domains, socio-cultural, legal, ethical aspects, finally acceptability, and reimbursement concerns

Research questions



01

Research Question 1

How to adapt an innovative tele-rehabilitation solution transculturally, in different European countries?

02

Research Question 2

Which are the main drivers in terms of efficacy, safety, use and acceptance of RICORDO telehealth platform, in the clinical practice?

04

Research Question 3

Which are the determinants of transcultural validation in the different settings of care and national contexts, using a multidimensional approach such as the MAST?

Partners

Founded in 1991 by entrepreneurs from the Varese Province and Alto Milanese, LIUC – Carlo Cattaneo University was established to bridge the gap between education and the evolving needs of the business world. With a strong focus on economics, law, technology, science, and management, LIUC has developed expertise in the healthcare sector, specializing in technology assessment, validation, and the analysis of social and healthcare processes.

ASTIR, a consulting and technology company founded in 2006, is engaged in various projects and services aimed at innovating the healthcare sector. Beyond the RICORDO-DTx digital solution for the cognitive rehabilitation of patients with dementia, designed in collaboration with Fondazione Don Gnocchi, ASTIR has developed the Italian Rare Neuromuscular Diseases Patient Registries and the Lombardy Regional 118-Emergency Departments collaborative system for managing medical emergencies.

The Don Gnocchi Foundation is composed of 28 centers across 9 regions of Italy. These clinics provide care for frail older people through inpatient services, continuous daytime care, and outpatient programs, offering cognitive rehabilitation with both conventional and experimental approaches. At the IRCCS in Milan, the CADiTeR has developed and tested innovative telerehabilitation protocols to support patients at home, aligning with the Don Gnocchi Foundation's mission to promote innovation and research in the biomedical field and advance technologies for improving healthcare.

MUNDIS – Associação Cívica de Formação e Cultura activities focus on the Human and Social Sciences area, emphasizing transcultural activities, and adaptation and development of digital solutions. MUNDIS has been involved in the development of digital solutions that integrate art and culture into the neuropsychological rehabilitation process for children and elderly individuals. MUNDIS would extend this acquired knowledge to the intersection of neuropsychology and neurorehabilitation in an integrated manner, with the transcultural adaptation of the proposed digital solution in Portugal.

Université Côte d'Azur (UCA) and **Centre Hospitalier Universitaire de Nice (CHU)**, within the CoBTeK Lab and the Centre for Memory, worked on several projects related to remote assessment, diagnostic, follow-up, and stimulation in the context of cognitive disorders in elderly. In the project DeepSpA, a web-based platform was developed to allow remote assessment of cognitive disorders in elderly using known and validated clinical tests adapted to telemedicine settings.

Study design- Cross-cultural adaptation

Each rehabilitation activity included in RICORDO **will be translated and adapted for the cultural transferability** by a panel of experts

The first release of RICORDO for the Portuguese and French culture **will be validated with a user-centered design involving end-users** (rehabilitation staff and patients), with three cycles of Design-Evaluation-Redesign

Based on feasibility results, at the end of each cycle **the solution will be refined and redesigned**. At the end of the third cycle, a final prototype of RICORDO will be released.

Study design- Multidimensional assessment

A multidimensional assessment starting from the **MAST (Model for Assessment of Telemedicine) approach** will be implemented, thus also requiring an interdisciplinary approach

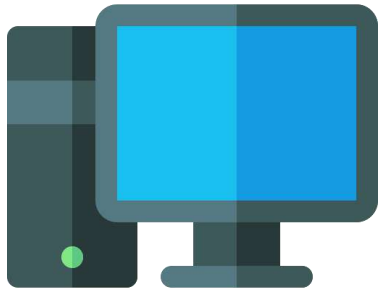
Three different data sources were used: **1) scientific evidence, 2) health economics tools for the economic evaluation of the patients' pathway and 3) qualitative approaches**, by means of the development of specific qualitative questionnaires

Dimensions will be safety, clinical **effectiveness**, patient perspectives, **economic** aspects, **organizational** domains, **socio-cultural**, **legal**, **ethical** aspects, finally **acceptability**, and **reimbursement** concerns

RICORDO DTx

Hospital

Home



- **Rehabilitation Prescription**
- **Therapy Monitoring**

- **Rehabilitation**

Medical Device

Cognitive activities

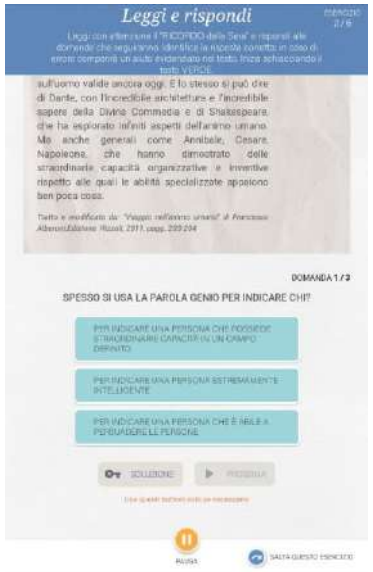
Sequence

Word salad

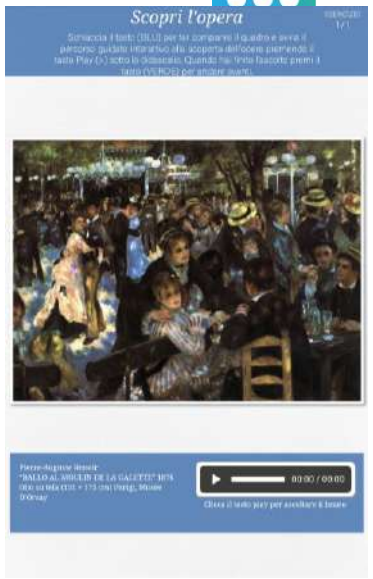
Matrix

Calculations

Post card

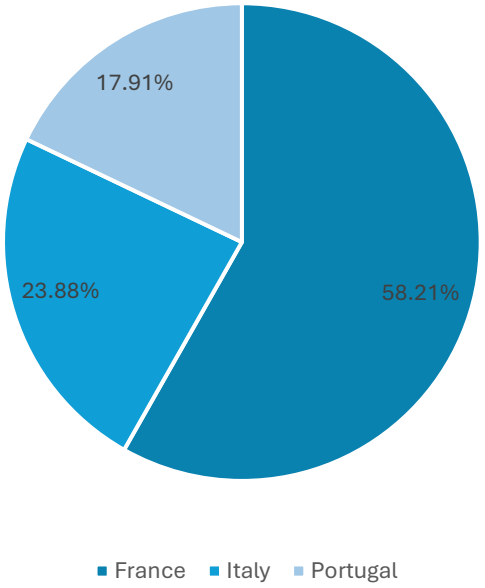


Song and Poem

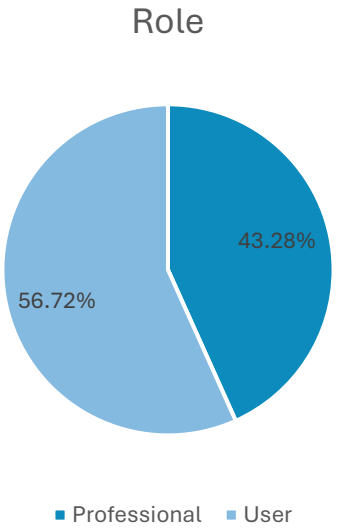


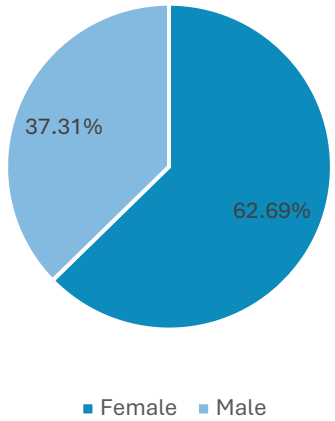
Paintings

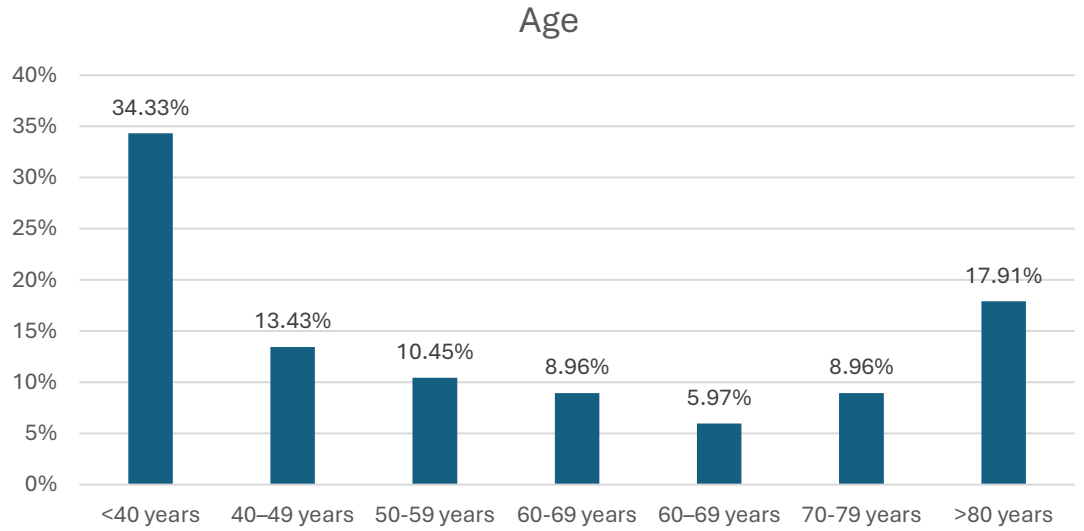
Preliminary results from User Experience Perception Survey



Total respondents: 67

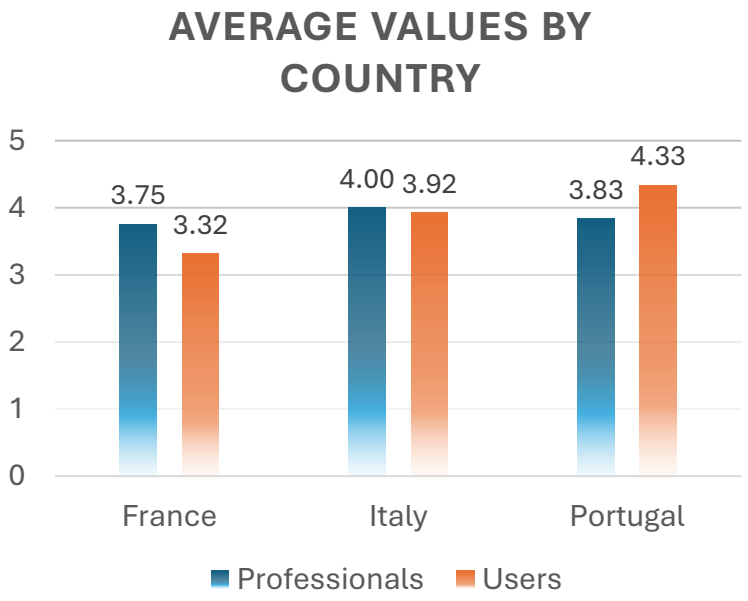




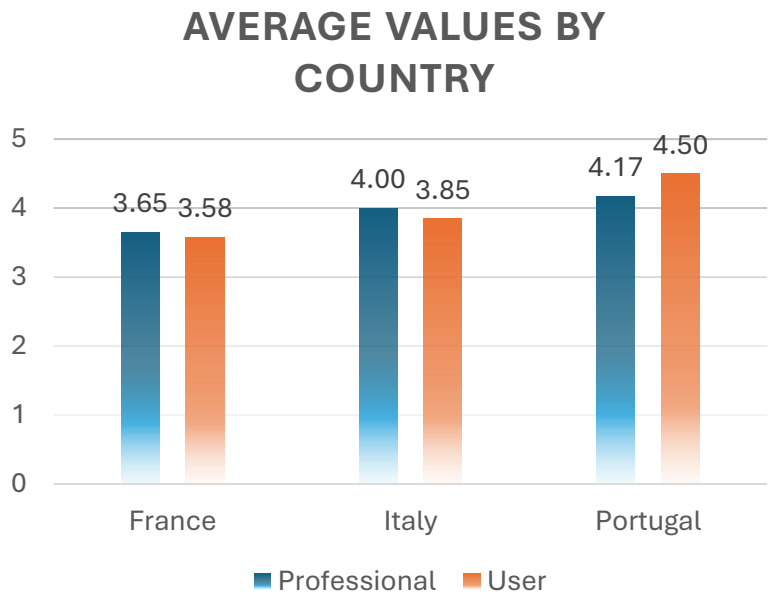


Preliminary results from User Experience Perception Survey

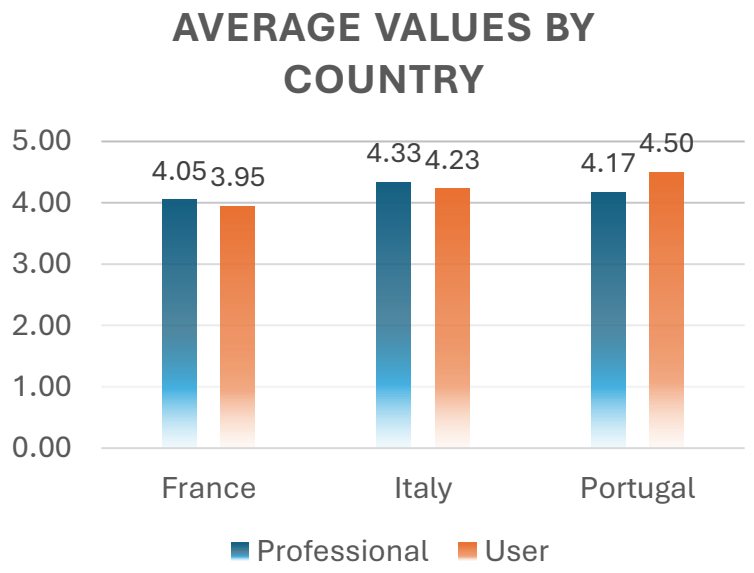
1. How easy was it to use the device? (Likert scale 1-5)



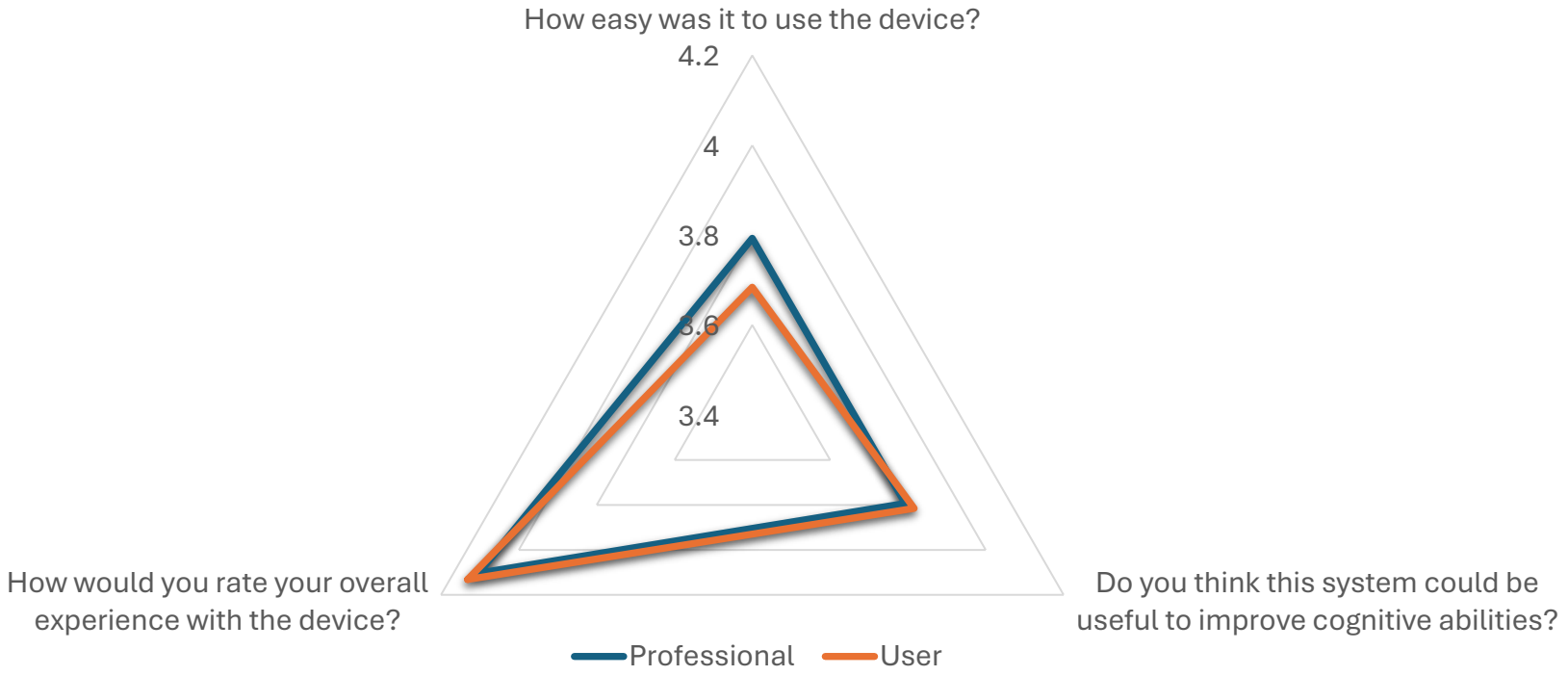
2. Do you think this system could be useful to improve cognitive abilities? (Likert scale 1-5)



3. How would you rate your overall experience with the device? (Likert scale 1-5)



Preliminary results from User Experience Perception Survey



Average answers stratified by role

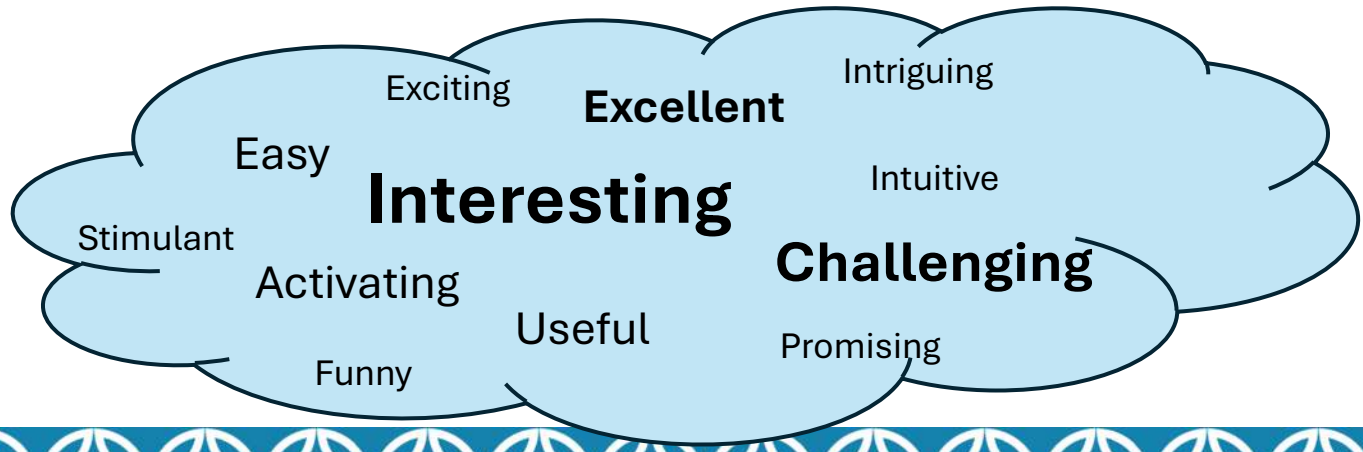
- Overall, both professionals and users **rated** the device **positively** across all three dimensions.
- **Perceived usefulness** and overall experience reach higher scores than ease of use, confirming the **system's strong potential**.
- **Results are very promising**, while still highlighting room for **improvement** in usability and cultural adaptation.

Preliminary results from User Experience Perception Survey (2/2)

	France	Italy	Portugal	Entire sample
How easy was it to use the device?*	3,54	3,94	4,08	3,73
Do you think this system could be useful to improve cognitive abilities?*	3,62	3,88	4,33	3,81
How would you rate your overall experience with the device?*	4,00	4,25	4,33	4,12

**Mean values from 1 to 5, where 1 = not at all, and 5 = very much)*

Choose one adjective to describe your experience



Project Impacts

Improved efficacy and safety of the neuro-rehabilitation pathway, with an increased self-management

Personalized care, resulting in more effective interventions, targeted therapy, and individualized goal setting

Increased efficiency and cost savings

Improved accessibility, with the possibility to manage individuals who face geographic, mobility, or transportation barriers

Appropriate approach to the reimbursement of the pathway in each Country involved

Co-funded by the European Union

THCS
TRANSFORMING HEALTH AND CARE SYSTEMS

THANK YOU FOR YOUR ATTENTION!

LIUC The Business University

UNIVERSITÉ CÔTE D'AZUR

mundis
ASSOCIAÇÃO CÍVICA DE FORMAÇÃO E CULTURA

chu de Nice

ASTIR
CREATIVE TECHNOLOGY

Fondazione Don Carlo Gnocchi Onlus

THCS
transforming health and care systems

Joint Transnational Call 2023

"HEALTHCARE OF THE FUTURE"

Co-funded by the European Union

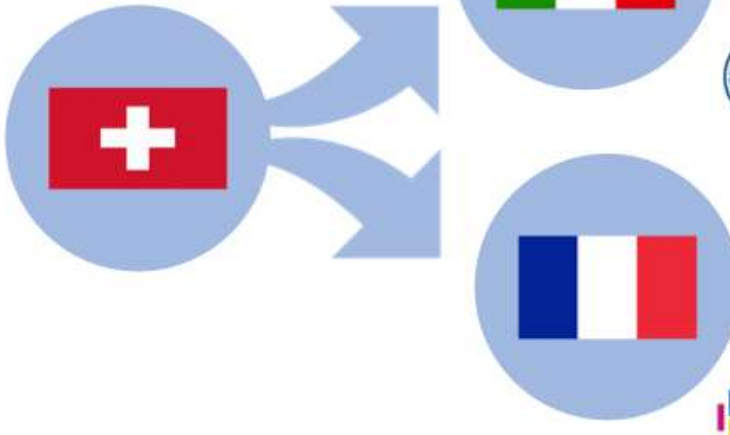
NeuroRehab4EU

"Democratising access to an innovative, evidence-based model of care for neurological disorders in Europe"

2024-2026

SWISS NEUROREHAB

CHUV mindmaze Hes·so VALAIS WALLIS



CONGREGAZIONE DELLE SUORE INFERMIERE DELL'ADDOLORATA
OSPEDALE VALDUCE

UNIVERSITÀ DI PAVIA

Fondazione Don Carlo Gnocchi Onlus

HCL HOSPICES CIVILS DE LYON

Inserm

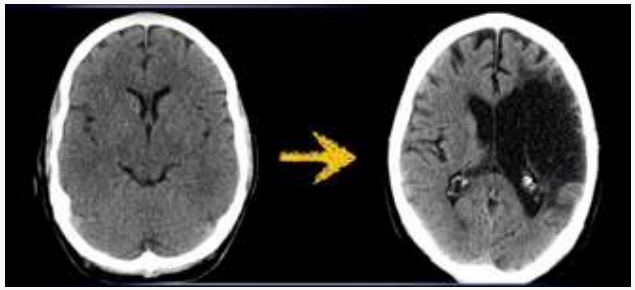
Co-financed by:

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Innosuisse – Swiss Innovation Agency

DIRECTION GÉNÉRALE DE L'OFFRE DE SOINS

MIUR

The problem

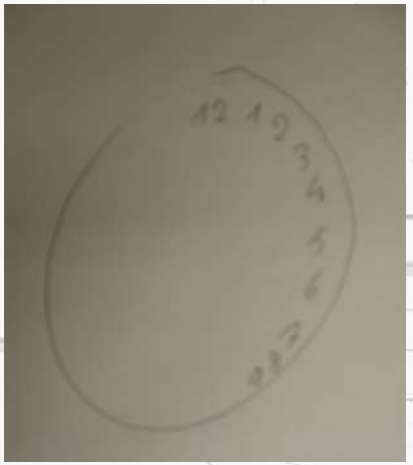


Brain lesion

Upper limb sensorimotor deficits

Locomotion deficits

Cognitive deficits



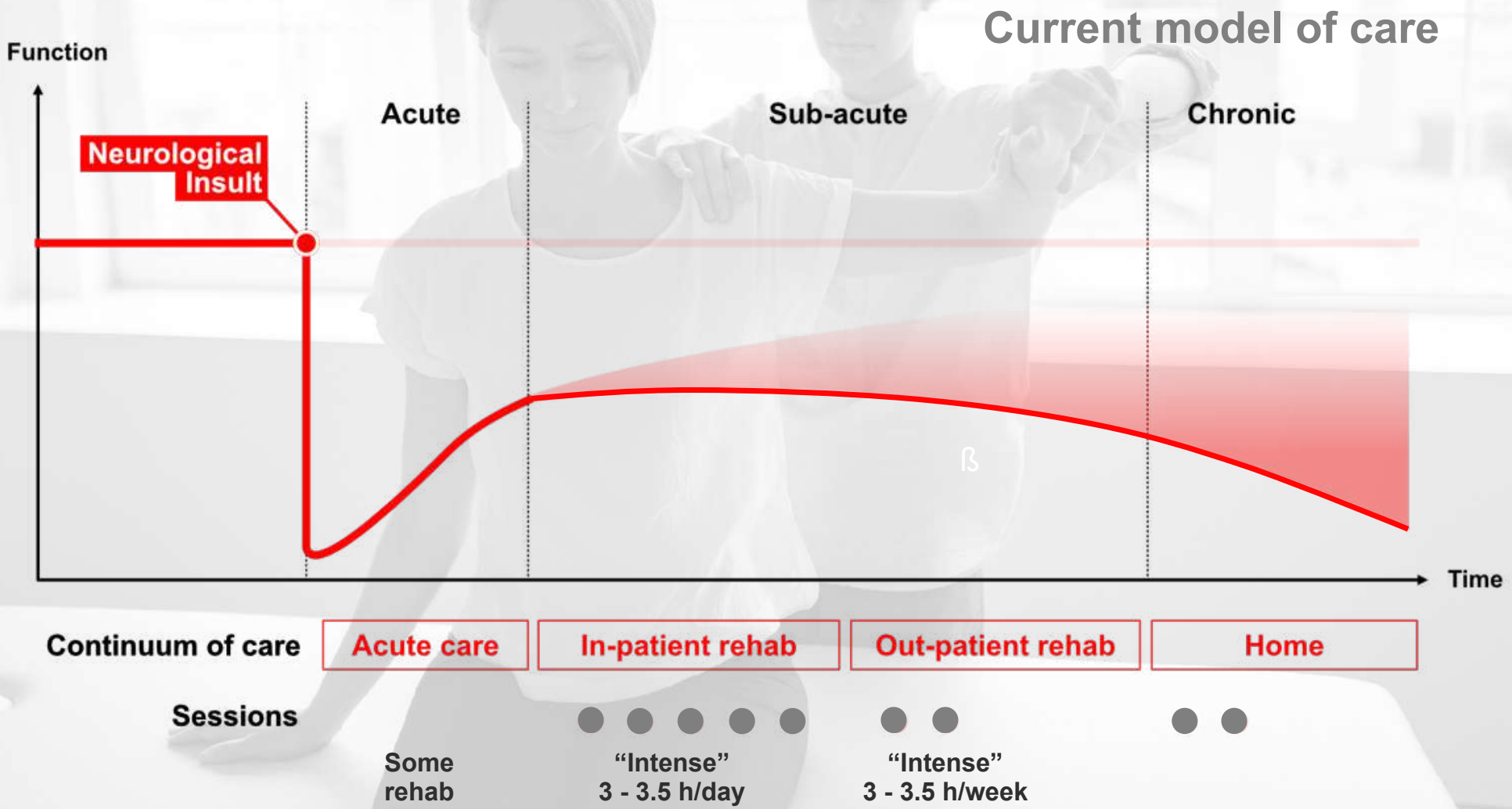
The problem

An **ageing society**, with increasing **acquired neurological disease.**

Neurorehabilitation is suboptimal: patients return home with cognitive/ motor impairments **affecting independence and quality of life.**

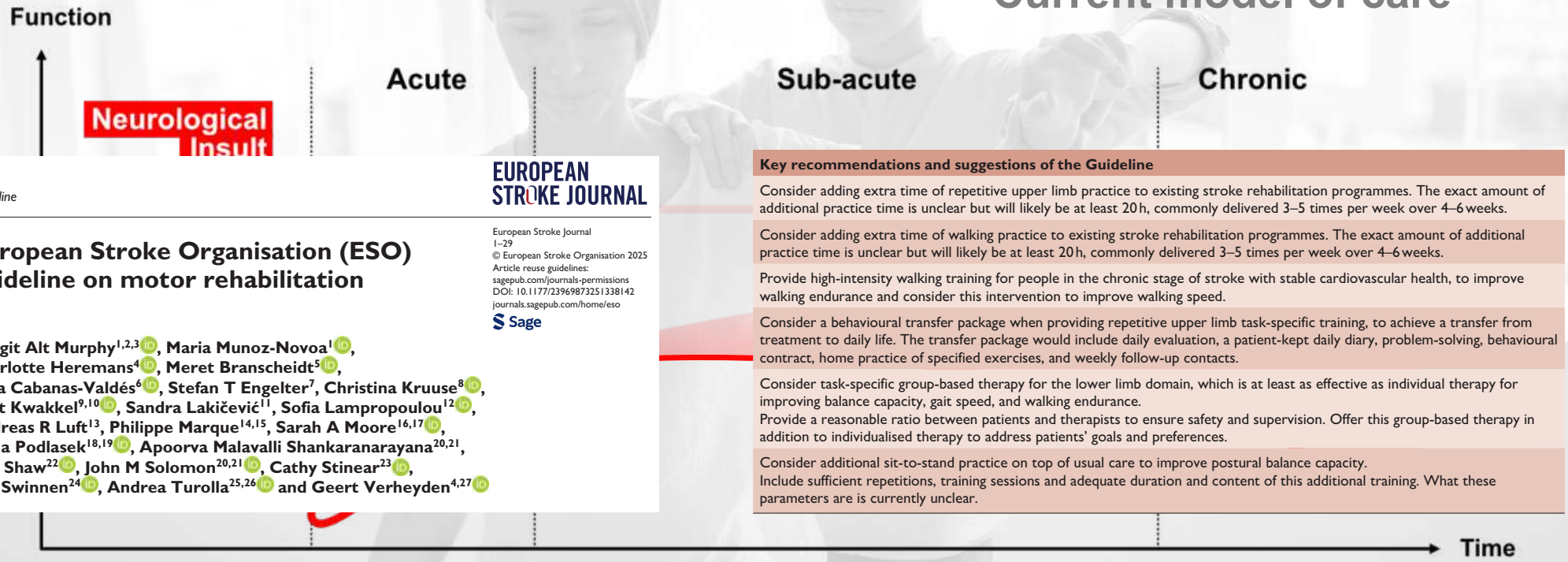
The current care model is **underdosed**, based on **segregated phases of treatment**, in 1 therapist-1 patient mode, with limited home-treatment to maintain the rehabilitation benefit.

The problem


Current model of care
Function
Acute
Sub-acute
Chronic
Neurological Insult
Time
Continuum of care
Acute care
In-patient rehab
Out-patient rehab
Home
Sessions
Some rehab
"Intense" 3 - 3.5 h/day
"Intense" 3 - 3.5 h/week

The problem

Current model of care



Guideline

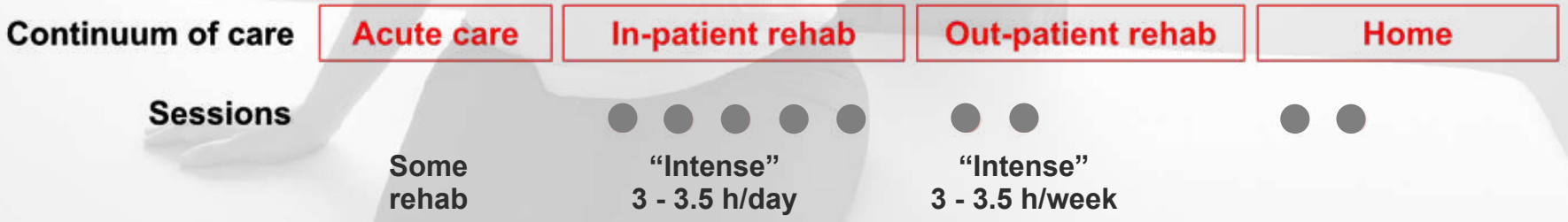
EUROPEAN STROKE JOURNAL

European Stroke Journal
1–29
© European Stroke Organisation 2025
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/23969873251338142
journals.sagepub.com/home/eso
Sage

European Stroke Organisation (ESO) guideline on motor rehabilitation

Margit Alt Murphy[1,2,3], Maria Munoz-Novoa[1], Charlotte Heremans[4], Meret Branscheidt[5], Rosa Cabanas-Valdés[6], Stefan T Engelter[7], Christina Kruuse[8], Gert Kwakkel[9,10], Sandra Lakičević[11], Sofia Lampropoulou[12], Andreas R Luft[13], Philippe Marque[14,15], Sarah A Moore[16,17], Anna Podlasek[18,19], Apoorva Malavalli Shankaranarayana[20,21], Lisa Shaw[22], John M Solomon[20,21], Cathy Stinear[23], Eva Swinnen[24], Andrea Turolla[25,26] and Geert Verheyden[4,27]

Key recommendations and suggestions of the Guideline
Consider adding extra time of repetitive upper limb practice to existing stroke rehabilitation programmes. The exact amount of additional practice time is unclear but will likely be at least 20 h, commonly delivered 3–5 times per week over 4–6 weeks.
Consider adding extra time of walking practice to existing stroke rehabilitation programmes. The exact amount of additional practice time is unclear but will likely be at least 20 h, commonly delivered 3–5 times per week over 4–6 weeks.
Provide high-intensity walking training for people in the chronic stage of stroke with stable cardiovascular health, to improve walking endurance and consider this intervention to improve walking speed.
Consider a behavioural transfer package when providing repetitive upper limb task-specific training, to achieve a transfer from treatment to daily life. The transfer package would include daily evaluation, a patient-kept daily diary, problem-solving, behavioural contract, home practice of specified exercises, and weekly follow-up contacts.
Consider task-specific group-based therapy for the lower limb domain, which is at least as effective as individual therapy for improving balance capacity, gait speed, and walking endurance. Provide a reasonable ratio between patients and therapists to ensure safety and supervision. Offer this group-based therapy in addition to individualised therapy to address patients' goals and preferences.
Consider additional sit-to-stand practice on top of usual care to improve postural balance capacity. Include sufficient repetitions, training sessions and adequate duration and content of this additional training. What these parameters are is currently unclear.



The opportunity

- Evidence-based medicine in neurorehab: **high dose** treatment is effective (Ward et al., 2019) and can be achieved with new technology (Krakauer et al., 2019; Arbuckle et al., 2025)
- **Digital therapies: evidence-based therapeutic interventions** that are driven by high quality software programs to prevent, manage, or treat a medical disorder or disease.
- **Telerehabilitation** (Cramer et al., 2019)

The solution






NeuroRehab4EU



inpatient	outpatient	Home

Build a model of Continuum of Care (CoC) from hospital to home

Actions
1. the studies

SWISS NEUROREHAB

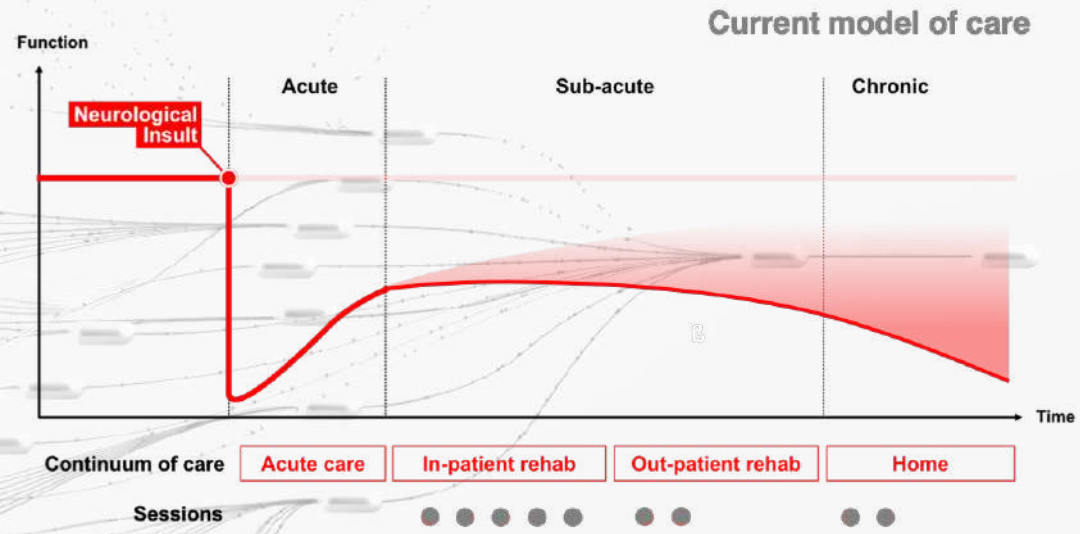
FIT4MEDROB
Fit for Medical Robotics

UNIVERSITÀ DI PAVIA
Department of Brain and Behavioral Sciences

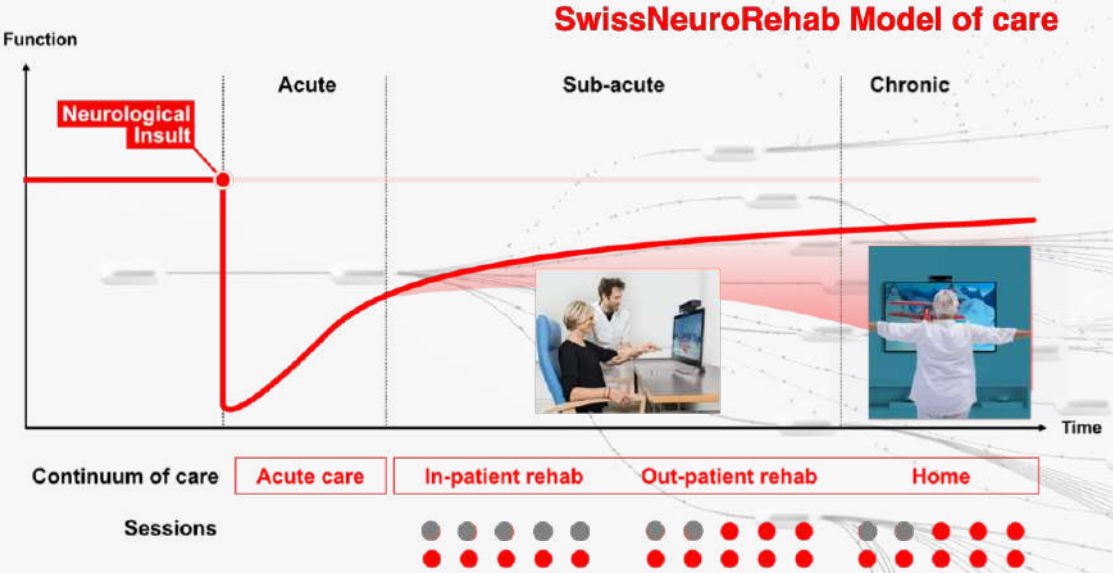
HCL
HOSPICES CIVILS DE LYON

CRNL
Centre de Recherche Neurosciences Lyon

Current care



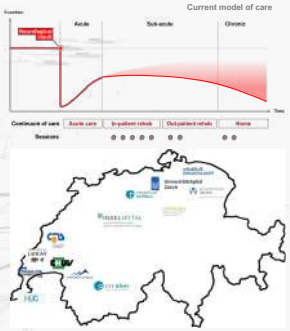
New Model



The studies

SWISS NEUROREHAB

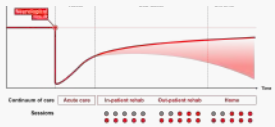
Observational study



Tot.N=450; at 09/2025=100

Interventional Pilots

HIHD
for upper limb/trunk



RPRT
for leg strenght

i-VR
for cognition

Rehandybot
for hand dexterity

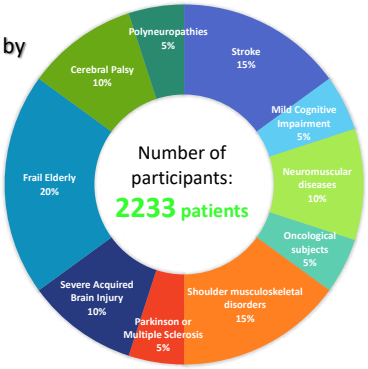
4 Interventional pilots, N=400

FIT4MEDROB
Fit for Medical Robotics

UNIVERSITÀ DI PAVIA
Department of Brain and Behavioral Sciences

Ministero dell'Università e della Ricerca | PNC

Pragmatic Trials (%) by Disease



mBI come outcome comune

Platform Trial

PATIENT COUNTER

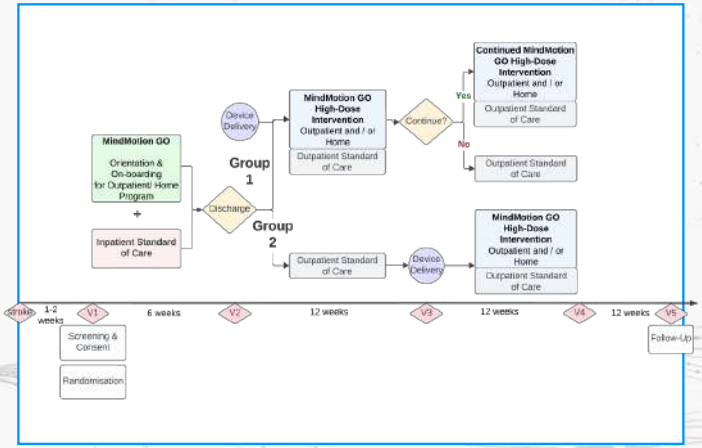
554

SINCE AUGUST 24th

20 pragmatic clinical trials

HCL
HOSPICES CIVILS DE LYON

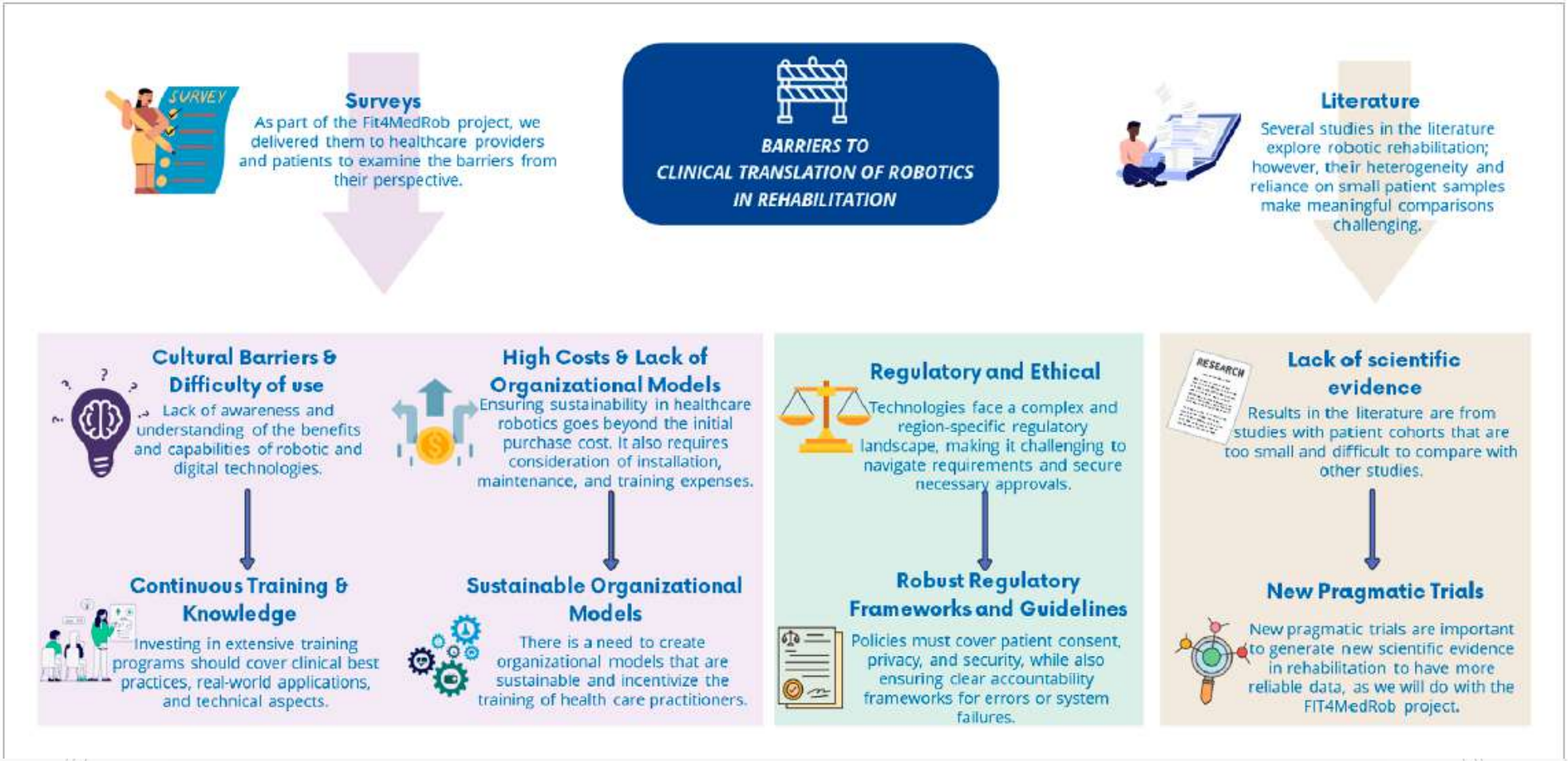
CRNL
Centre de Recherche Neurosciences Lyon



RCT =46 per group; ethics approved

NeuroRehab4EU

Consensus Mapping the needs of neurorehabilitation

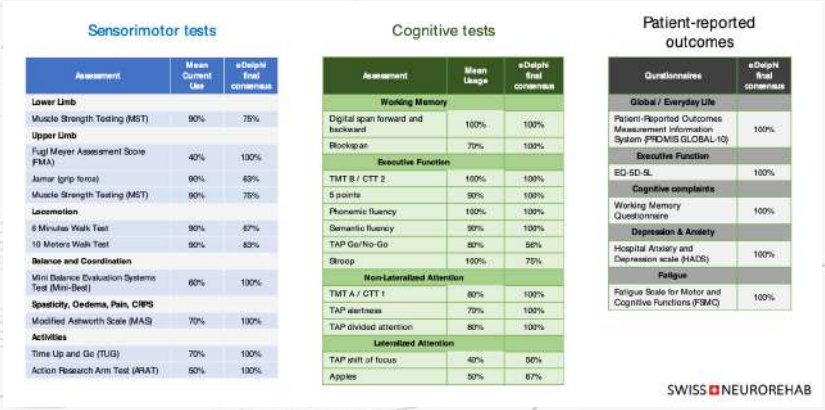


Consensus

Measuring the outcomes of neurorehabilitation

SWISS NEUROREHAB

Core Battery



Sensorimotor tests

Assessment	Mean Current Use	eDelphi final consensus
Lower Limb		
Muscle Strength Testing (MST)	90%	75%
Upper Limb		
Fugl Meyer Assessment Score (FMA)	40%	100%
Jamar (grip force)	90%	63%
Muscle Strength Testing (MST)	90%	75%
Locomotion		
6 Minutes Walk Test	90%	67%
10 Meters Walk Test	90%	83%
Balance and Coordination		
Mini Balance Evaluation Systems Test (Mini-Best)	60%	100%
Spasticity, Oedema, Pain, CRPS		
Modified Ashworth Scale (MAS)	70%	100%
Activities		
Time Up and Go (TUG)	70%	100%
Action Research Arm Test (ARAT)	50%	100%

Cognitive tests

Assessment	Mean Usage	eDelphi final consensus
Working Memory		
Digital span forward and backward	100%	100%
Blockspan	70%	100%
Executive Function		
TMT B / CTT 2	100%	100%
5 points	90%	100%
Phonemic fluency	100%	100%
Semantic fluency	90%	100%
TAP Go/No-Go	80%	56%
Stroop	100%	75%
Non-Lateralized Attention		
TMT A / CTT 1	80%	100%
TAP alertness	70%	100%
TAP divided attention	80%	100%
Lateralized Attention		
TAP shift of focus	40%	56%
Apples	50%	67%

Patient-reported outcomes

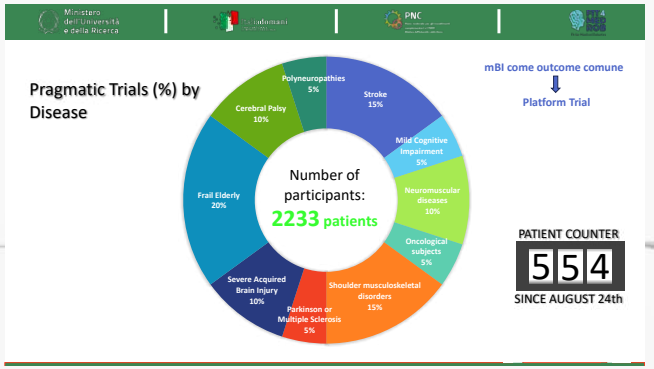
Questionnaires	eDelphi final consensus
Global / Everyday Life	
Patient-Reported Outcomes Measurement Information System (PROMIS GLOBAL-10)	100%
Executive Function	
EQ-5D-5L	100%
Cognitive complaints	
Working Memory Questionnaire	100%
Depression & Anxiety	
Hospital Anxiety and Depression scale (HADS)	100%
Fatigue	
Fatigue Scale for Motor and Cognitive Functions (FSMC)	100%

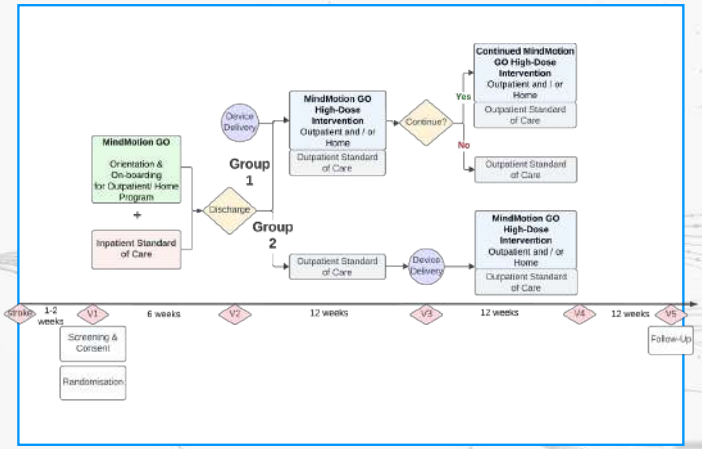
SWISS NEUROREHAB

FIT4MEDROB
Fit for Medical Robotics

HCL HOSPICES CIVILS DE LYON

CRNL Centre de Recherche Neurosciences Lyon

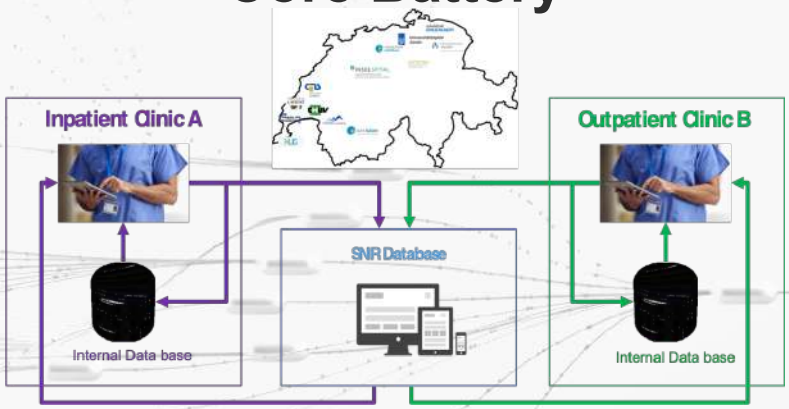




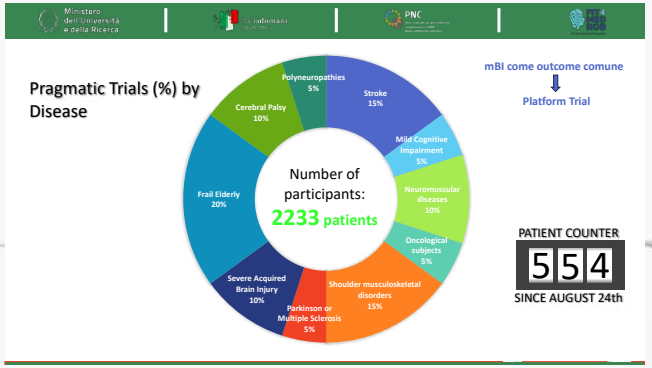
Consensus Capturing data of neurorehabilitation

SWISS NEUROREHAB

Core Battery

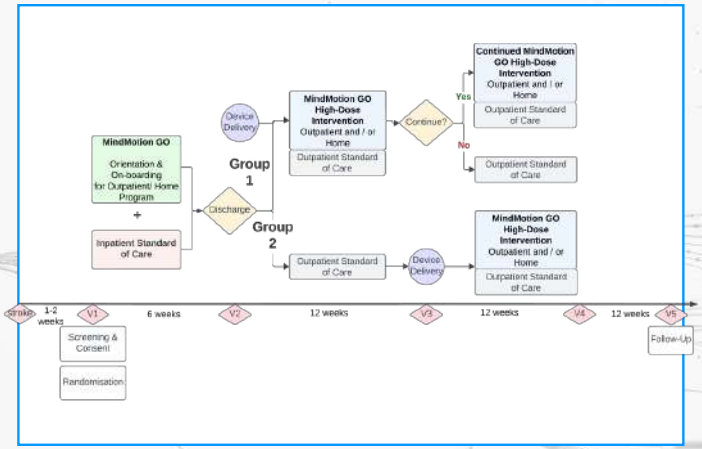


FIT4MEDROB
Fit for Medical Robotics



HCL HOSPICES CIVILS DE LYON

CRNL Centre de Recherche Neurosciences Lyon



REDCap
Research Electronic Data Capture

Roadmap

Implementing the new model of neurorehabilitation in clinical practice

SWISS NEUROREHAB

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Département fédéral de l'intérieur DFI
Office fédéral de la santé publique OFSP

FIT4MEDROB
Fit for Medical Robotics

Ministero della Salute

HCL HOSPICES CIVILS DE LYON

CRNL Centre de Recherche Neurosciences Lyon

Roadmap

FIT4MEDROB
Fit for Medical Robotics

SWISS NEUROREHAB

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

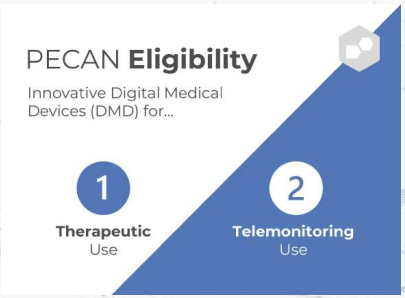
Département fédéral de l'intérieur DFI
Office fédéral de la santé publique OFSP

European stakeholder workshop

Ministero della Salute

HCL
HOSPICES CIVILS DE LYON

CRNL
Centre de Recherche Neurosciences Lyon



NeuroRehab4EU

Education

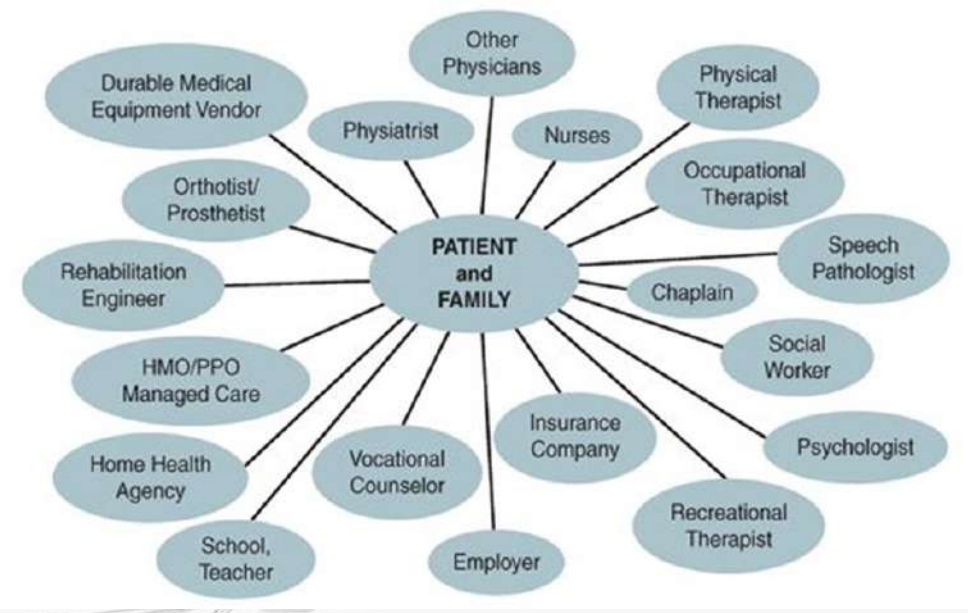
Mapping the educational needs, building new programs

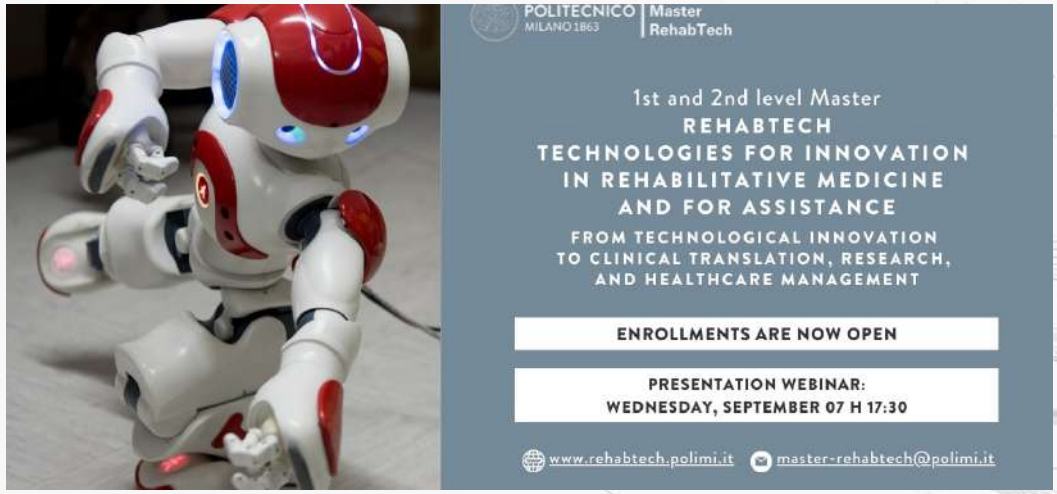
SWISS NEUROREHAB

FIT4 MED ROB
Fit for Medical Robotics

HCL HOSPICES CIVILS DE LYON

CRNL Centre de Recherche Neurosciences Lyon





THCS
transforming health and care systems

Joint Transnational Call 2023

"HEALTHCARE OF THE FUTURE"

Co-funded by the European Union

NeuroRehab4EU

https://www.fit4medrob.it/

"Democratising access to an innovative, evidence-based model of care for neurological disorders in Europe"

2024-2026

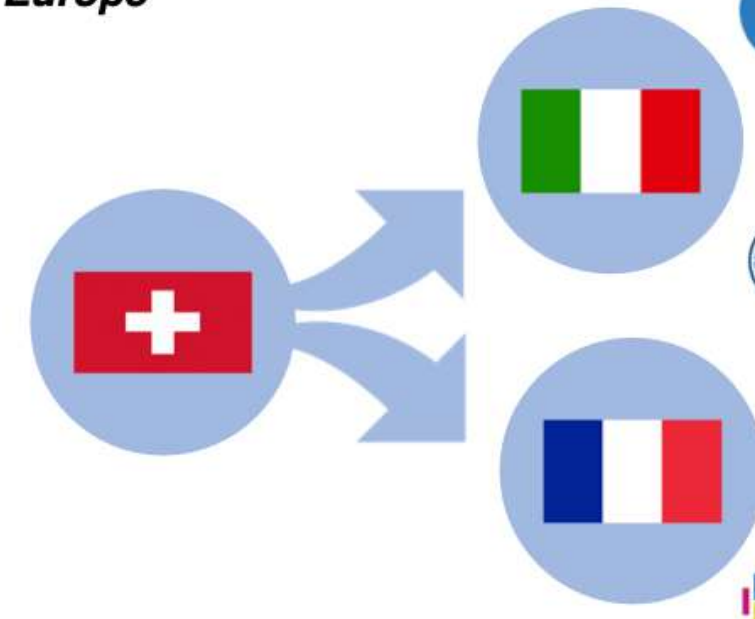
CONGREGAZIONE DELLE SUORE INFERMIERE DELL'ADDOLORATA
OSPEDALE VALDUCE

UNIVERSITÀ DI PAVIA

Fondazione Don Carlo Gnocchi Onlus

SWISS NEUROREHAB

CHUV mindmaze Hes·so VALAIS WALLIS



HCL HOSPICES CIVILS DE LYON

Inserm

https://www.swissneurorehab.ch/

Co-financed by:

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Innosuisse – Swiss Innovation Agency

DIRECTION GÉNÉRALE DE L'OFFRE DE SOINS

MIUR

andrea.serino@chuv.ch
traian.popa@chuv.ch