



# eBRAIN-Health

## Public report D7.2

## Patient and clinical user applications

Project number	<b>101058516</b>
Project title	<b>eBRAIN-Health - Actionable Multilevel Health Data</b>
Submission date	<b>July 2025</b>
Authors	<b>Héctor López Carral (EODYNE), Aarushi Sharma (EODYNE), Gözde Tüter (EODYNE), Claudio Babiloni (UNIROMA1)</b>
Dissemination level	<b>Public (PU)</b>
Public project website	<b><a href="https://ebrain-health.eu">https://ebrain-health.eu</a></b>



Funded by  
the European Union

## Table of content

1. eBRAIN-Health.....	3
2. eBRAIN-Health consortium.....	3
3. Introduction .....	4
4. Partners involved .....	5
5. Description of work performed .....	5
5.1. Rehabilitation Gaming System (RGS).....	5
5.2. The SmartMe&You platform .....	6
5.3. Dementia-oriented conversational chatbot .....	8
5.4. Co-design workshop with Alzheimer Europe .....	8
6. Results.....	9
6.1. Rehabilitation Gaming System (RGS).....	9
6.2. Dementia-oriented conversational chatbot .....	12
6.3. Co-design workshop with Alzheimer Europe .....	15
6.3.1. Pre-questionnaire .....	15
6.3.2. RGSweb demonstration and feedback.....	16
6.3.3. Chatbot presentation.....	19
7. Conclusion, next steps.....	20

## 1. eBRAIN-Health

The Project eBRAIN-Health will deliver a distributed research platform for modeling and simulating complex neurobiological phenomena of human brain function and dysfunction in a data protection compliant environment. It will provide thousands of multilevel virtual brains from patients and healthy human controls for research and innovation. Brain data from multiple sources will be pre-processed. Solving the societal grand challenge of dementia is a big task. Yet it appears feasible in a collective approach. Therefore, we will build an interdisciplinary digital twin for dementia for modeling and simulating complex phenomena at the service of research infrastructure communities. eBRAIN-Health-Cloud will offer end-to-end services for personalized complex brain modeling and simulations in distributed e-infrastructures with data protection by design and by default and simulation-ready human multiscale brain data that range from molecular (genomics, proteomics, metabolomics) and cellular to electrophysiology and imaging to behavioural, clinical, life-style and environmental data as well as data from wearables. Brain data are pre-processed and annotated such that they all relate to a common reference 3D brain space.

eBRAIN-Health-Cloud constitutes a blend of three large-scale research programs: the FET Flagship Human Brain Project with its EBRAINS Research Infrastructure, the EOSC project Virtual Brain Cloud with its Virtual Research Environment for sensitive data and the H2020 project AI-MIND with intelligent tools for dementia risk estimation. The project will have synergies to topics of the Digital Europe Program, such as artificial intelligence, cybersecurity and supercomputing and the Health Data Space.

eBRAIN-Health-Cloud offers a next generation clinical research infrastructure and creates an open yet protected space for groundbreaking digital health innovation by the research infrastructure communities comprising academia and the private sector.

## 2. eBRAIN-Health consortium

- CHARITE – Universitaetsmedizin Berlin, Germany
- EBRAINS, Belgium
- Forschungszentrum Juelich GmbH, Germany
- Stichting Radboud Universiteit, Netherlands
- Universidad Pompeu Fabra, Spain
- OSLO Universitetssykehus, Norway
- tp21 GMBH, Germany
- Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung eV, Germany
- INDOC RESEARCH EUROPE gGmbH, Germany
- Universitaet Wien, Austria
- Universidad Complutense de Madrid, Spain
- EODYNE Systems SL, Spain
- ATHENA – Research and Innovation Center, Greece
- University of Oslo, Norway
- Universita degli Studi di Roma “la Sapienza”, Italy
- Alzheimer Europe, Luxembourg
- Institute National de Recherche en Informatique et Automatique, France
- Centre Hospitalier Universitaire Vaudois, Switzerland
- The University of Edinburgh, United Kingdom

[Find the partners on our website](#)

### 3. Introduction

The **eBRAIN-Health** project is building an integrated digital ecosystem that links large-scale brain data, computational modelling and clinical decision support to advance personalised prevention and treatment of neurological disorders. Within this vision, **Work Package 7 (WP7: Applications and 3D visualization)** translates the project's scientific outputs into practical tools that can be used daily by clinicians, patients and caregivers.

**Deliverable D7.2 “Patient and clinical user applications”** reports the mid-term results of **Task 7.3: Patient & clinical user interfaces for Use Cases (M24–M48)**. Task 7.3 sets out to (i) design and implement user-friendly clinical interfaces capable of presenting model-based predictions, and (ii) provide patients and their informal care network with intuitive applications that foster engagement and self-management.

In the first half of the task (up to Month 36), effort concentrated on three complementary strands:

1. **Rehabilitation Gaming System (RGS) cognitive protocols:** We adapted the existing RGS platform to target mild cognitive impairment (MCI) and early dementia, expanding beyond its original motor-rehabilitation focus. New game-based exercises were designed to stimulate executive functions, working memory and attention, and to run both in the clinic and at home with remote monitoring. Furthermore, they can also be used for a period assessment of cognitive (especially executive and working memory) functions in those patients in telemonitoring mode.
2. **Conversational chatbot for dementia stakeholders:** A multilingual chatbot was prototyped to provide day-to-day guidance to people living with dementia, their relatives and caregivers. Built on evidence-based care pathways and linked to eBRAIN-Health knowledge graphs, the bot answers questions on symptoms, routines and available support, and can escalate to a human professional when confidence thresholds are low.
3. **Co-design workshop with Alzheimer Europe (AE):** In collaboration with AE's Public & Patient Advisory Group, Eodyne facilitated a participatory workshop where fourteen persons with MCI/dementia and eight caregivers tested the RGS cognitive tasks and the chatbot. Quantitative usability scores and qualitative feedback were gathered, informing the next development sprint.

Although the original task scope also envisaged clinical dashboards based on BrainX3 simulations, that integration is scheduled for the second half of the task (M37–M48) and is therefore outside the focus of this deliverable.

The remainder of D7.2 is organised as follows: Section 4 details the partners and their contributions; Section 5 describes the work performed in each strand; Section 6 presents the results, including usability metrics and user feedback; and Section 7 outlines the next steps towards full integration by Month 48.

## 4. Partners involved

The following consortium members contributed directly to the work reported in this deliverable:

- **Eodyne Systems SL (EODYNE)**: Lead partner for Task 7.3.
- **Stichting Radboud Universiteit (SRU)**: Technical partner.
- **Universita degli Studi di Roma “la Sapienza” (UNIROMA1)**: Clinical partner for Task 7.3.
- **Alzheimer Europe (AE)**: Patient and public liaison.

## 5. Description of work performed

During the first half of Task 7.3 (Months 24–36), activities centred on designing, building and validating two patient-facing applications, the cognitive extension of the Rehabilitation Gaming System (RGS) and a dementia-focused conversational chatbot, and on gathering user feedback through a co-design workshop organised with Alzheimer Europe. Development followed an agile, iterative approach: rapid prototyping, internal testing, patient-and-caregiver trials, and refinement cycles. Quantitative usability metrics and qualitative insights from the workshop have already informed the next sprint planning, while regulatory and privacy compliance reviews ran in parallel to ensure alignment with GDPR and medical-device guidelines.

### 5.1. Rehabilitation Gaming System (RGS)

Work of task T7.3 has focused on advancing the Rehabilitation Gaming System (RGS) for cognitive therapy that targets patients with mild cognitive impairment (MCI) or dementia. The **RGS Ecosystem** is Eodyne’s end-to-end neurorehabilitation platform that accompanies a patient from the acute ward to life at home. In the clinic, **RGSclinic** delivers AI-driven virtual-reality exercises that adapt in real time to each person’s motor and cognitive profile, helping therapists maximise recovery while reducing hands-on time and equipment overhead. Once the patient is discharged, the very same therapy can continue on personal devices through **RGS+**, a cross-device front end (smartphone, tablet, laptop or smart-TV) that serves augmented-reality tasks for upper- and lower-limb training as well as the new battery of cognitive games described in this deliverable. Both channels stream pseudonymised session data to **RGS-MIMS**, a web-based medical-information management system where professionals prescribe exercises, receive objective reports and send motivational messages, ensuring seamless continuity of care and fully remote follow-up when needed. Collectively these three layers (clinic, home and cloud) form a single, adaptive workflow that maintains personalisation across settings, boosts patient adherence and gives clinicians a continuous data trail on functional progress throughout the entire rehabilitation journey.

**RGS+** acts as eBrain-Health’s main patient user interfaces to deliver personalized treatment of patients with MCI/dementia on smartphones, tablets, and laptops. Built around Augmented-Reality scenarios and driven by adaptive artificial-intelligence algorithms, the platform personalises every session to the user’s clinical profile and moment-to-moment performance, with the overarching aim of restoring the skills required for Activities of Daily Living: upper-limb reach and fine hand coordination as well as memory, attention, language, spatial neglect and executive control.

Commercial “brain-training” titles such as Lumosity, BrainHQ or Elevate offer convenient cognitive drills, yet none address the motor deficits that are critical after stroke. Evidence shows that coupling

motor and cognitive practice boosts recovery far beyond cognition-only programmes. RGS+ leverages the scalability of consumer devices and the spatial richness of AR to let patients work on both domains at home, cutting costs for hospitals and reducing travel and caregiving burdens.

The current release includes a battery of twelve cognitively focused activities that target memory, attention, speech and executive function while embedding a spatial-motor component through AR. In parallel, the app provides assessment tasks that estimate established clinical scores (Fugl-Meyer, Barthel Index and MoCA) directly from in-app metrics. Usability has been strengthened with short video tutorials that demonstrate correct posture and interaction, real-time motivational prompts during play, detailed progress summaries at session end, and reminder notifications that address the well-known adherence gap in home-based neurorehabilitation. Together these features make RGS+ a comprehensive, data-driven tool for continuous cognitive-motor recovery inside and outside the clinic.

The **Medical Information Management System (MIMS)** is the principal clinical interface within the RGS Ecosystem. Because it is delivered entirely through a web browser, therapists can open it on a desktop, tablet, or smartphone and manage their caseload from any location with an internet connection. All information handled by MIMS (patient identifiers, session records, and outcome measures) is stored securely in the cloud, so no local installation or manual data-transfer step is required.

When a healthcare professional logs in, MIMS presents three core functions. *Patient Profile Management* lets the therapist create a new record or update an existing one, entering baseline clinical scores and relevant notes. In the *Rehabilitation Program Management* section, prescription tools make it possible to assemble a personalised mix of motor-and-cognitive exercises drawn from the RGS+ library and to fine-tune parameters such as session length or difficulty level. Finally, the *Progress Analysis* workspace generates reports and visualisations (including longitudinal progress graphs) that help clinicians review a patient's evolution and decide when programmes should be adjusted.

By pairing RGS+ on the patient side with MIMS on the clinical side, the eBRAIN-Health platform offers a continuous workflow: therapists configure and monitor therapy in MIMS, and patients carry it out on their own devices through RGS+, with performance data feeding back to the clinician's dashboard for evidence-based follow-up.

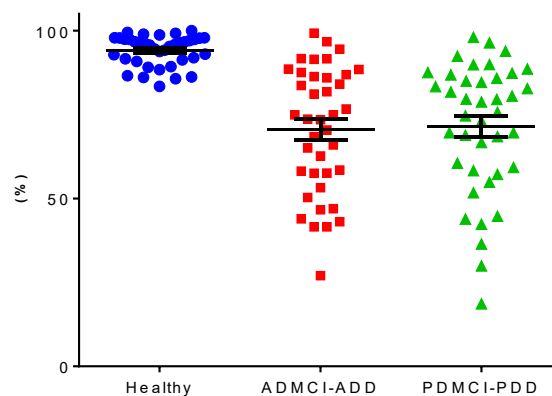
## 5.2. The SmartMe&You platform

Within this project framework, the UNIROMA1 researchers have been assessing the harmonization of the digital environment, known as "SmartMe&You," with the eBRAIN-Health platform. The "SmartMe&You" environment is implemented in the cloud of the GARR Consortium (<https://smartme.cloud.garr.it>), which comprises all Italian public universities. It allows the following services supporting the PDWAVES initiative: (1) collection and processing of clinical (including home telemonitoring of clinically relevant physiological and behavioural parameters), EEG, and MRI data in older cognitively unimpaired healthy controls and patients with Alzheimer's, Parkinson's, and Lewy body disease dementia and mild cognitive impairment from the PDWAVES Consortium ([www.pdwaves.eu](http://www.pdwaves.eu)) and (2) a free app providing a battery of serious videogames for commercial (android-served) tablets that can be used for daily assessment of cognitive functions and brain training in home telemonitoring.

More specifically, the SmartMe&You app provides unsupervised serious video games to measure (1) Fluctuations in cognitive performance, (2) Visuospatial attention processes, (3) Visuospatial executive functions, and (3) Vigilance. A presentation video of that app is available at [https://www.youtube.com/watch?v=wfBm7WxX\\_RY](https://www.youtube.com/watch?v=wfBm7WxX_RY). The user's performance in those video games is automatically transmitted to the mentioned SmartMe&You platform for visualizing patients' cognitive performance and clinical decision-making. Activities are underway to develop a plan for integrating and interoperating the SmartMe&You services for brain training into the eBRAIN-Health platform.

In Task 7.3 activities, we evaluated the usability, acceptability, and validity of the SmartMe&You serious video games for assessing cognitive status in cognitively unimpaired older adults (Healthy) and patients with mild cognitive deficits or mild dementia due to Alzheimer's (ADMCI-ADD) and Parkinson's (PDMCI-PDD) diseases. The validity was assessed using the Mini-Mental State Examination (MMSE) score as the gold standard. The MMSE score and performance (i.e., accuracy and reaction time) of the serious video games were acquired. Statistical analyses were performed using the freeware tool jamovi version 2.3. The results are presented below. All participants accepted the SmartMe&You serious videogames. All healthy individuals (100%), 85% (N = 39) of ADMCI-ADD patients, and 87% (N = 40) of PDMCI-PDD patients were able to complete the SmartMe&You task battery with a mean group accuracy of greater than 70%. The ADMCI-ADD and PDMCI-PDD patients demonstrated significantly lower accuracy (**Figure 1**) and slower reaction times in their video game performances compared to the Healthy group (Rank transformation ANCOVAs,  $p < 0.05$ ). Finally, a statistically significant positive association was found between the MMSE score and task performances in the Healthy, ADMCI-ADD, and PDMCI-PDD participants as a whole group (GLMs;  $p < 0.001$ ). We concluded that the SmartMe&You serious video games demonstrate potential as a useful, practical, free, "green", and unsupervised tool for evaluating cognitive status and decline in older people with and without cognitive deficits in home telemonitoring. This potential opens exciting possibilities for future applications of brain training based on telemedicine in AD and PD patients.

Overall (global) SmartMe&You serious videogames accuracy



**Figure 1:** Individual SmartMe&You mean accuracy scores in Healthy, Alzheimer's disease, and Parkinson's disease participants. *Legend:* ADMCI: mild cognitive impairment due to Alzheimer's disease; ADD: dementia due to Alzheimer's disease; PDMCI: mild cognitive impairment due to Parkinson's disease; PDD: dementia due to Parkinson's disease.

### 5.3. Dementia-oriented conversational chatbot

As part of Task 7.3: Patient & clinical user interfaces for Use Cases, a brand-new conversational chatbot was developed to assist people living with dementia as well as their relatives and caregivers. The chatbot is envisioned as a low-threshold digital companion that users can consult at any time, complementing the structured rehabilitation delivered through RGS+.

From the outset, the design brief stressed three priorities. **First, accessibility:** all interaction had to rely on plain language, short answer blocks and screen layouts that remain readable on phones, tablets and standard desktop browsers. **Second, trustworthiness:** every response is grounded in evidence-based material reviewed by clinical partners and presented with clear disclaimers that the tool is informational, not a substitute for professional medical advice. **Third, relevance:** the chatbot's knowledge base is tuned to the kinds of questions people typically ask when they first encounter dementia (for example, straightforward explanations of what the condition is, how it differs from related terms such as Alzheimer's disease, practical pointers on supporting a newly diagnosed relative, and guidance on where to find trusted services in the user's own country). Each response aims to clear up common misconceptions, suggest concrete next steps for carers, and sign-post reputable local organisations, thereby delivering actionable information rather than broad lifestyle advice.

The initial prototype was demonstrated during the co-design workshop described in the next subsection. Feedback from those sessions (covering, for example, clarity of language, ease of navigation, trustworthiness, and more) has been fed into the next development sprint. Subsequent iterations will refine the dialogue flows, enhance multilingual support, and define a transparent pathway for escalating complex queries to human experts within the eBRAIN-Health network.

By offering on-demand information and emotional reassurance, the chatbot extends the reach of the eBRAIN-Health platform beyond formal therapy sessions, creating a continuous support loop that links clinical care, home-based rehabilitation and everyday self-management.

### 5.4. Co-design workshop with Alzheimer Europe

To obtain early, user-centred feedback on the two patient applications developed under Task 7.3, Eodyne and Alzheimer Europe organised a half-day co-design workshop. The session took place on **27 March 2025, 09:00–13:00, at the Moxy Luxembourg Airport hotel**, and brought together **18 participants** drawn from Alzheimer Europe's Public & Patient Advisory Group alongside three Eodyne facilitators.

AE handled participant outreach through its established networks, ensuring a mix of people living with mild cognitive impairment or early dementia and their informal carers. Eodyne prepared a structured agenda, consent forms, and two sets of questionnaires (pre- and post-interaction) hosted on the Mentimeter platform.

After a brief introduction to Eodyne and a recap of insights from the previous year's workshop, attendees completed a short *pre-questionnaire* that gauged their baseline attitudes toward digital health tools. The group then watched a video walkthrough of the new **RGSweb** interface, followed by a live demonstration in which volunteers tried selected exercises labelled *Gentle Giant* and *Twister Buddy*. Feedback was captured in real time via Mentimeter and open discussion.

In the second half of the programme, facilitators introduced the prototype **AI-powered chatbot**. A sample query was projected for the room, after which participants accessed the bot individually through a QR code on their mobile devices. A structured *post-questionnaire* and a short plenary discussion closed the session, gathering suggestions on usability, language preferences and desired features.

For each activity the team collected (i) completed questionnaires exported from Mentimeter, (ii) anonymised chat logs generated during free exploration of the bot, and (iii) field notes summarising verbal comments. These materials were collated immediately after the workshop and form the raw dataset for the results and usability analysis presented in Section 6.

With this workshop the consortium completed the first full user-experience loop for both RGS+ and the chatbot, securing concrete input for the next development sprint and strengthening ties with the dementia community. The results of this workshop are reported in the next section.

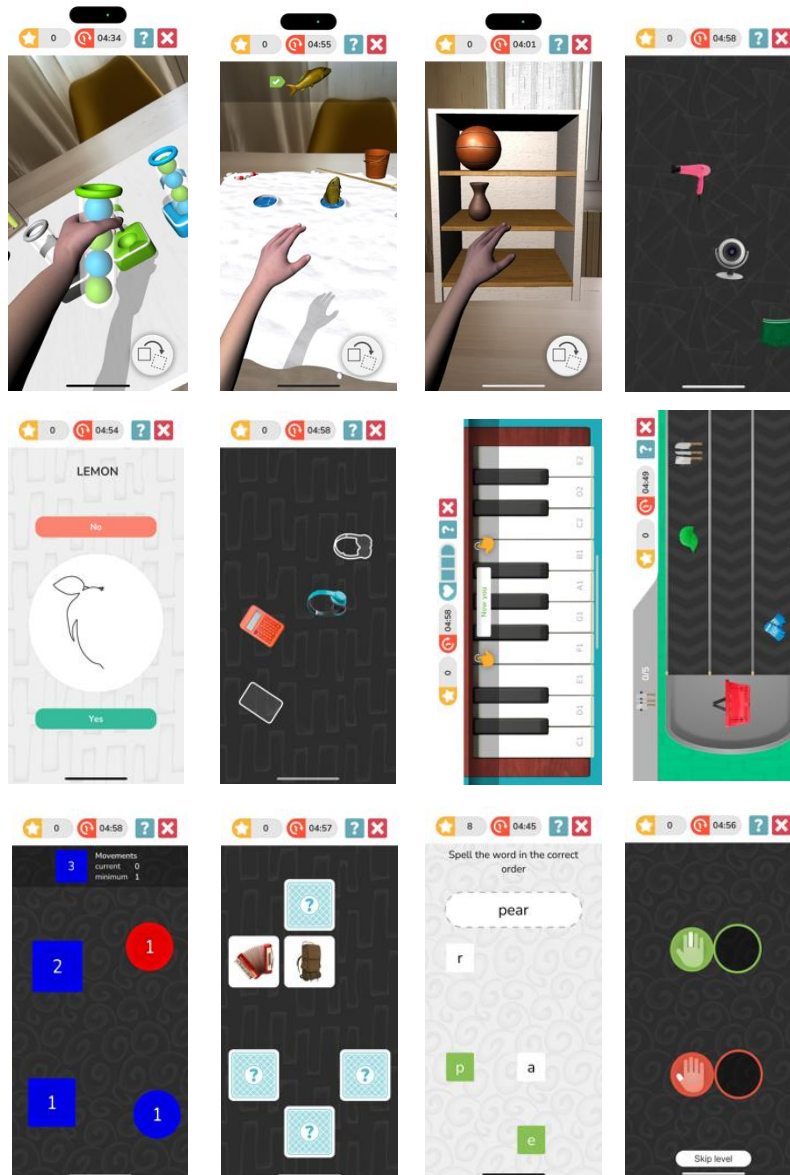
## 6. Results

### 6.1. Rehabilitation Gaming System (RGS)

As a result of the development on RGS, the following cognitive rehabilitation activities are provided for usage within eBrain-Health on the patients' smartphones (see **Figure 2**):

- **Shelves:** Trains working memory and upper limb movements. Users move their arm to retrieve objects from a virtual shelf in a specific sequence.
- **Whack-a-fish:** Trains attention, task switching, movement inhibition, and upper limb coordination. Users must decide whether to catch or ignore fish based on their colour and task rules.
- **Tubes:** Focuses on reasoning and upper limb pronation-supination. Users interact with a virtual scene to sort balls in tubes by colour.
- **Memoseq:** Enhances attention and working memory through tasks like categorization, matching references, ordering by size, or repeating sequences.
- **Guess What:** Designed for aphasic patients, this task trains language by selecting words that describe objects or their associated actions.
- **Fit In:** Trains visual attention and fine motor skills. Users pinch with their thumb and forefinger to drag objects into corresponding silhouettes.
- **Pianoseq:** Focuses on memory by challenging users to repeat melodic sequences, increasing speed and complexity as they progress.
- **Shopping:** Improves attention, executive function, and working memory. Users collect objects from conveyor belts in a specified order.
- **Blobs:** Combines numerical tasks and fine motor skills. Users pinch to split or merge geometric shapes to match references.
- **Memory:** Trains memory through a classic matching pairs game.
- **Popurri:** Merges language, working memory, and task switching. Users spell words under different constraints and calculate the right combinations of bills and coins for payment scenarios.

- **Twister:** Focuses on executive function and fine motor skills. Users drag objects using different fingers to place them on targets.



**Figure 2:** RGS+ activities for cognitive training on smartphones. (Top row, left to right): Shelves, Whack-a-fish, Tubes, Memoseq. (Middle row, left to right): Guess What, Fit In, Pianoseq, Shopping. (Bottom row, left to right): Blobs, Memory, Popurri, Twister.

All the exercises mentioned above feature adaptive difficulty, meaning they automatically adjust based on the patient’s performance. The difficulty is calibrated to maintain approximately a 70% success rate, ensuring that tasks remain sufficiently challenging without becoming discouraging or overly simplistic. This balance is designed to promote engagement and sustained motivation throughout the rehabilitation process.

Additionally, during the workshops, it was observed that some patients preferred using the application on a tablet due to visibility-related challenges. As a result, the application has also been made available on tablet devices to better accommodate users' needs.

To further enhance user-friendliness and support full-body training, a set of exercises has been developed specifically for use on laptops or any device equipped with a camera. This approach facilitates the delivery of full-body motor exercises that patients can perform independently at home. In doing so, we ensure continuity of care through the RGS ecosystem. This product offering is referred to as **RGSweb**.

Some examples of the motor and cognitive exercises available include:

#### **Hand-Tracking Exercises:**

- **Memoseq:** Enhances attention and working memory through tasks like categorization, matching references, ordering by size, or repeating sequences.
- **Mirror:** Use of your non-paretic hand to interact with mirrored images, focusing on motor coordination and visual-motor integration.
- **Recycling:** User trains on grabbing and dropping items into the correct recycling bins, targeting fine motor skills, hand–eye coordination, and executive function.
- **Whack a Mole:** User trains on selecting objects based on category or sequence, promoting reaction time, attention, and cognitive flexibility.
- **Sequences:** The goal is to combine letters and numbers as instructed to train working memory, sequencing, and cognitive processing.
- **Objects Rain:** The goal is to reach and touch falling objects following a rule, engaging upper limb mobility, attention, and rule-based decision-making.

#### **Full-Body Exercises (RGSweb):**

- **Twister Buddy:** User performs balance exercises through weight shifts, steps, and reaching movements to improve dynamic stability, balance and lower body coordination.
- **Costume Party:** User trains on complete sit-to-stand movements to collect costume pieces, focusing on postural control and functional lower limb strength.
- **Gentle Giant:** Focuses on executing squats and tip-toe movements to move objects, enhancing lower limb strength, proprioception, and motor planning.

During the workshop, Eodyne tested Twister Buddy and Gentle Giant with the participants, more details mentioned under section 6.3.2. Here is a detailed description of the two full body exercises:

- **Gentle Giant (Figure 3, left)** is a full-body exercise designed for patients with mild motor impairments who are capable of performing sit-to-stand transitions and maintaining balance. Conducted via camera-based tracking, the exercise begins with a simple calibration step, after which users engage in tasks that challenge both motor and cognitive functions. The activity is divided into two progressive levels. In **Level 1 (Squats)**, users must transport virtual objects from one platform to another by performing squatting movements to lower a bridge and standing upright to lift it again. As difficulty increases, lateral steps are introduced, requiring the user to coordinate sideward movements in addition to vertical squats. This combination enhances lower body strength, dynamic balance, and motor planning. In **Level 2 (Tip-Toe)**, one of the platforms is placed above the user's natural reach, prompting the user to rise onto their toes to raise the bridge and connect the platforms. This level also includes a minimum squat requirement, further engaging lower-limb control and proprioception. Throughout both levels, users must make real-time decisions about the direction and height of movement, reinforcing

cognitive skills such as attention, spatial awareness, and task sequencing, while simultaneously engaging core motor functions.

- **Twister Buddy (Figure 3, right)** is a camera-based, full-body balance training exercise designed to improve postural stability, dynamic control, and fall prevention through progressive weight-shifting tasks. After a brief calibration process, users engage in a sequence of interactive levels that challenge both lower- and upper-body coordination. Across the five levels, users are required to align their body with visual targets, perform hand reaches while balancing, and complete side and forward stepping tasks based on onscreen cues. These movements target leg strength, balance, and functional mobility. Simultaneously, users must process and respond to randomized instructions, promoting cognitive skills such as attention, spatial awareness, motor planning, and dual-tasking. The combined focus on motor control and cognitive engagement makes Twister Buddy particularly effective for enhancing both physical and mental components of rehabilitation.

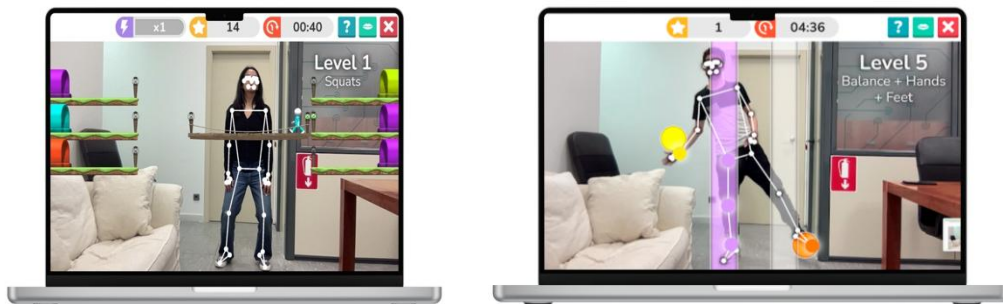


Figure 3: (Left) Gentle Giant and (Right) Twister Buddy

A key component developed to support full-body exercises is the **compensation control slider**, designed based on extensive feedback from therapists. This feature enables the system to detect and limit compensatory movements often adopted by patients during training, thereby encouraging correct motor execution and promoting more effective rehabilitation outcomes.

## 6.2. Dementia-oriented conversational chatbot

We created a brand-new, AI-powered conversational agent (i.e., chatbot) to assist individuals with dementia, their caregivers or relatives, and clinicians. This chatbot was trained on a series of reputable sources to ensure high-quality, accurate information. In its current version, a total of 72 documents, in PDF format, were provided for the training of the chatbot. This collection of documents comes from United Kingdom's Alzheimer's Society<sup>1</sup>. The following are some example documents used for training:

- What is dementia?
- What is Alzheimer's disease?
- Supporting a person with dementia who has depression, anxiety or apathy
- The progression and stages of dementia
- Understanding and supporting a person with dementia
- Caring for a person with dementia: A practical guide
- Going on holiday when a person has dementia
- The dementia guide: Living well after your diagnosis

<sup>1</sup> <https://www.alzheimers.org.uk>

Future version of the chatbot can be re-trained with an even larger and more diverse set of documents to provide other relevant support, as discussed during the workshop detailed in the next subsection. Importantly, the chatbot displays, in a sidebar, the sources it has used to provide each answer, thus increasing the transparency and trustworthiness of the system. Users are able to visualise these and open each document in full to verify the information provided by the system.

From a technical standpoint, the chatbot is powered by OpenAI's gpt-4o-mini large-language-model endpoint. Using this model gives us state-of-the-art comprehension and generation quality while keeping latency and operating costs within the limits of an EU research project. The model natively supports multiple European languages and can handle free-form, often fragmentary queries typical of users who may have mild cognitive impairment, which made it preferable to smaller open-source alternatives that would have required extensive fine-tuning to reach comparable accuracy.

The surrounding stack is hosted entirely on Google Cloud Platform (GCP). A lightweight microservice (containerised and deployed on Cloud Run) receives each user prompt, performs input validation, and enriches the request with context retrieved from a managed vector database that stores project-approved dementia resources (retrieval-augmented generation). Chat sessions themselves, together with anonymised metadata needed for quality monitoring, are written to Cloud Firestore, while performance metrics (latency, error rates, token counts) are streamed to Cloud Monitoring dashboards. This fully managed architecture keeps operational overhead low, satisfies the consortium's security and GDPR requirements, and can scale automatically as the user base grows in the next pilot phase.

When a user opens the chatbot, accessible online through a standard web browser, they are greeted by a screen asking them for their preferred name (for the chatbot to refer to them using it) and to select a "role" from a dropdown list (see **Figure 4**), which at the moment includes four options: patient, caregiver, clinician, or other (see **Figure 5**). The chatbot uses this information to better understand the context of the user's questions and to adjust accordingly the answers it provides. For example, the chatbot will provide answers that use clearer language and shorter sentences when replying to someone living with dementia in comparison to when replying to a healthy caregiver, to account for the cognitive differences. Similarly, it will use more precise and technical language when replying to clinicians, who are familiar with the relevant medical nomenclature.

# Sign up

Enter your name:

Select your role:

patient ▼

Sign up

**Figure 4:** Initial sign up for the chatbot experience, where users can indicate their name and role.

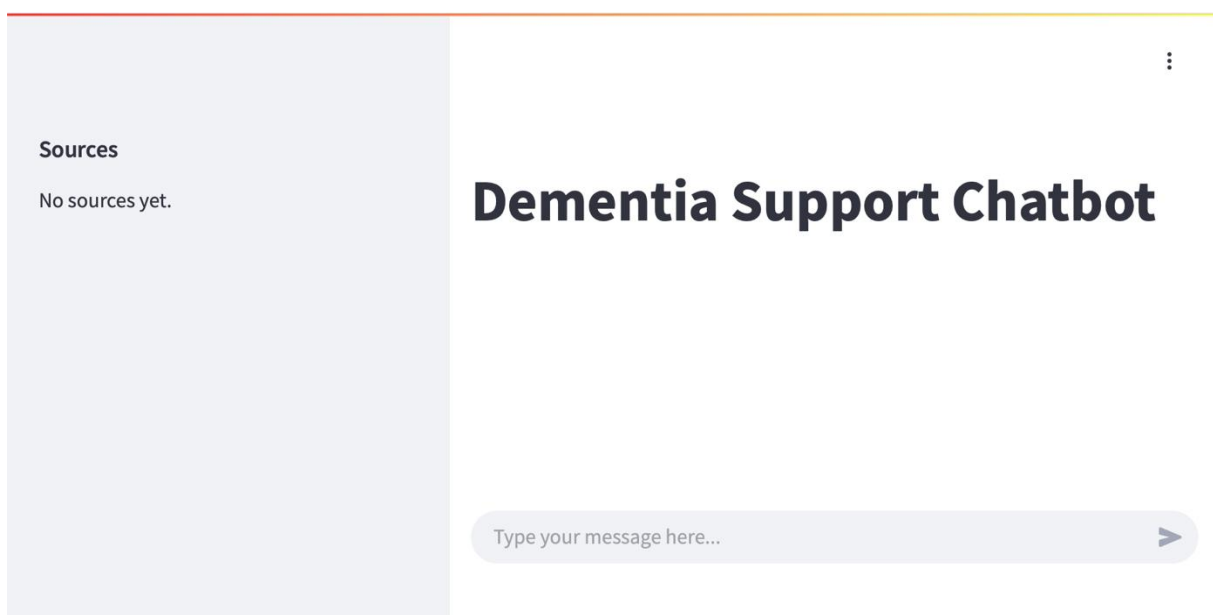
Select your role:

patient ▼

- patient
- caregiver
- clinician
- other

**Figure 5:** Roles available for users, which the chatbot will employ to tailor the answers.

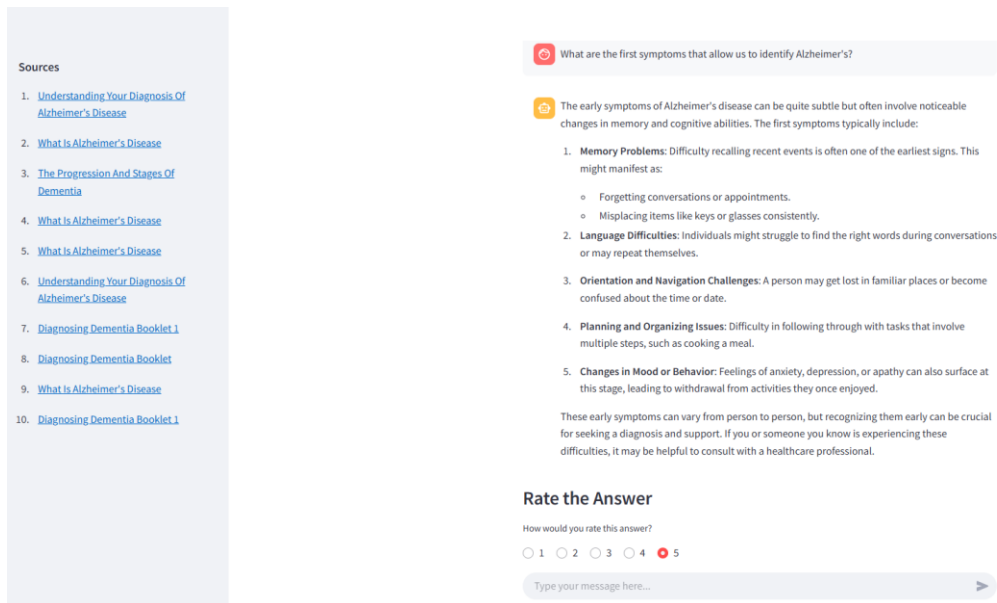
After adding these two pieces of information, the users are taken to the main chatbot screen, where they have a text field on the bottom to type their questions, which they can then submit to receive an answer (see **Figure 6**).



The main chatbot screen features a sidebar on the left with the heading "Sources" and the text "No sources yet." The main area on the right has a vertical ellipsis menu icon in the top right corner and the title "Dementia Support Chatbot" in a large, bold font. At the bottom of the main area is a text input field with the placeholder text "Type your message here..." and a right-pointing arrow button.

**Figure 6:** Main chatbot screen, where users can type their messages.

After a short processing time of a few seconds, the chatbot outputs the answer (see **Figure 7**). As indicated earlier, this answer is adapted to each user, based on their role and other information potentially provided by the user in their explicit interactions with the chatbot. Furthermore, although the user interface is currently only available in English, the chatbot supports a wide variety of languages, so users can interact in their preferred language. For piloting and refining purposes, the system also allows for rating of the answers.



The screenshot shows a chatbot interface. On the left, there is a 'Sources' section with a list of 10 links. The main chat area shows a question: 'What are the first symptoms that allow us to identify Alzheimer's?'. The answer is: 'The early symptoms of Alzheimer's disease can be quite subtle but often involve noticeable changes in memory and cognitive abilities. The first symptoms typically include: 1. Memory Problems: Difficulty recalling recent events is often one of the earliest signs. This might manifest as: Forgetting conversations or appointments. Misplacing items like keys or glasses consistently. 2. Language Difficulties: Individuals might struggle to find the right words during conversations or may repeat themselves. 3. Orientation and Navigation Challenges: A person may get lost in familiar places or become confused about the time or date. 4. Planning and Organizing Issues: Difficulty in following through with tasks that involve multiple steps, such as cooking a meal. 5. Changes in Mood or Behavior: Feelings of anxiety, depression, or apathy can also surface at this stage, leading to withdrawal from activities they once enjoyed. These early symptoms can vary from person to person, but recognizing them early can be crucial for seeking a diagnosis and support. If you or someone you know is experiencing these difficulties, it may be helpful to consult with a healthcare professional.' Below the answer is a 'Rate the Answer' section with a question 'How would you rate this answer?' and a rating scale from 1 to 5, with 5 selected. There is also a text input field for a message.

**Figure 7:** Example question and answer, together with employed sources and option to rate the answer.

### 6.3. Co-design workshop with Alzheimer Europe

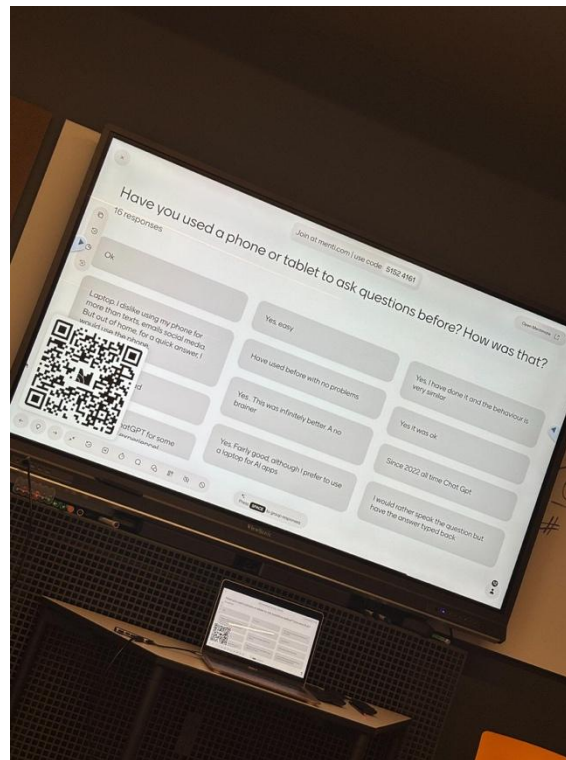
The workshop began with an introduction to Eodyne Systems. Participants were presented with an overview of the company's history, core products, and its collaborations with other organizations. To provide context and continuity, last year's workshop was briefly recapped using the following video: <https://youtu.be/5AZ3yaJXEis>.

This segment included a presentation of results and visual data from last year's sessions, summarizing both the impact of RGSapp and challenges observed in the integration of AR in clinical settings. Developments made since then were also highlighted, especially in usability and patient engagement.

#### 6.3.1. Pre-questionnaire

To assess participants' perceptions of technology before interacting with the system, a set of adapted post-questionnaire items were presented as a pre-assessment using Mentimeter<sup>2</sup>, a software for interactive presentations where the audience can reply to questions on their own devices, which are then graphically displayed on the presentation screen and recorded (see **Figure 8**):

<sup>2</sup> <https://www.mentimeter.com>



**Figure 8:** Example question and received answers using Mentimeter, the platform used to collect participants' feedback.

- Participants were able to access the questionnaire seamlessly via QR code.
- However, several attendees expressed confusion about the purpose of the questions before trying the product.
- As a result, responses tended to be neutral, and the questionnaire was not completed in full.

### 6.3.2. RGSweb demonstration and feedback

Following this, a video for the new RGSweb platform was presented, followed by a live demonstration (see **Figure 9**).



Figure 9: Live demonstration of the Twister Buddy activity by a workshop participant.

Gentle Giant (see Figure 10) drew particular attention and received positive feedback.

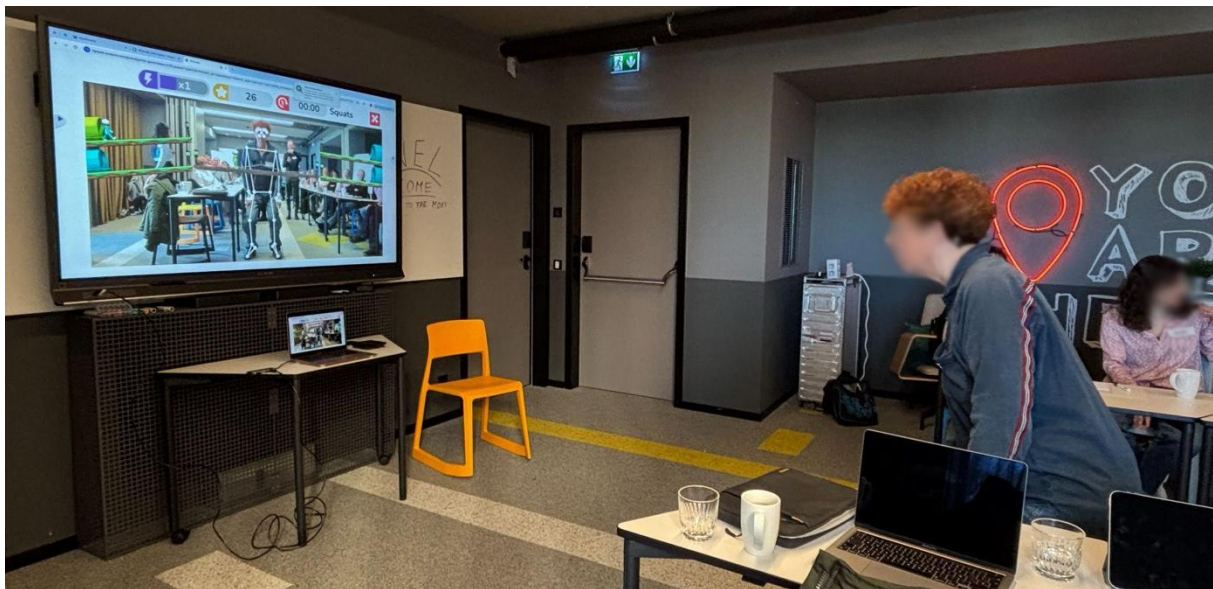


Figure 10: Live demonstration of the Gentle Giant activity by a workshop participant.

#### Key feedback from participants:

- Concerns about **fall risks** were raised, with the suggestion that the system should be used under supervision, especially for individuals with mobility limitations.
- The **screen size** was noted as an important factor; participants emphasized that a large screen enhances usability.
- Compared to other rehabilitation applications, participants appreciated that RGSweb involves **full-body interaction**, enabling comprehensive motor engagement.

The post-questionnaire was then distributed and completed by participants. Descriptive statistics can be seen in **Figure 11**, **Figure 12**, **Figure 13**, **Figure 14**, and **Figure 15**.

#### Descriptive Statistics

	Rate the user interface	Satisfied with the speed	Recommend to others
Valid	15	15	15
Missing	10	10	10
Mean	3.867	4.400	4.400
Std. Deviation	1.060	0.986	0.986
Shapiro-Wilk	0.862	0.674	0.674
P-value of Shapiro-Wilk	0.026	< .001	< .001
Minimum	2.000	2.000	2.000
Maximum	5.000	5.000	5.000

**Figure 11:** Descriptive statistics about the user interface, the speed, and likelihood of recommending.

#### Descriptive Statistics

	Confident using the system	Needed to learn first
Valid	15	15
Missing	10	10
Mean	3.800	2.400
Std. Deviation	1.146	1.298
Shapiro-Wilk	0.828	0.888
P-value of Shapiro-Wilk	0.008	0.063
Minimum	2.000	1.000
Maximum	5.000	5.000

**Figure 12:** Descriptive statistics about confidence when using the system and the need to learn to use it first.

#### Descriptive Statistics

	People would learn quickly	System is cumbersome
Valid	15	15
Missing	10	10
Mean	3.933	2.000
Std. Deviation	0.961	1.000
Shapiro-Wilk	0.868	0.806
P-value of Shapiro-Wilk	0.032	0.004
Minimum	2.000	1.000
Maximum	5.000	4.000

**Figure 13:** Descriptive statistics about speed of learning and whether the system is cumbersome to use.

## Descriptive Statistics

	System is easy to use	Need to support to use
Valid	15	15
Missing	10	10
Mean	4.000	2.667
Std. Deviation	1.134	1.589
Shapiro–Wilk	0.808	0.850
P-value of Shapiro–Wilk	0.005	0.018
Minimum	2.000	1.000
Maximum	5.000	5.000

Figure 14: Descriptive statistics about the easiness of use and support requirement.

## Descriptive Statistics ▼

	Would use RGSweb frequently	System is too complex
Valid	15	15
Missing	10	10
Mean	3.933	1.933
Std. Deviation	1.534	1.100
Shapiro–Wilk	0.719	0.799
P-value of Shapiro–Wilk	< .001	0.004
Minimum	1.000	1.000
Maximum	5.000	4.000

Figure 15: Descriptive statistics about likelihood of using RGSweb frequently and perceived complexity.

### 6.3.3. Chatbot presentation

The second part of the workshop focused on the introduction of AI-powered chatbot, designed to support patients, caregivers, and clinicians.

- Participants reported prior familiarity with AI technologies and expressed interest in its integration into healthcare.
- A live question was entered into the chatbot via a projector so that the group could examine its response.
- Following this, participants connected to the chatbot using a QR code and began asking their own questions individually.

A second round of questions was conducted through Mentimeter, which allowed participants to express feedback and suggestions.

#### General key takeaways from participant feedback:

- A voice-based response option would be appreciated.

- Most chatbot sources were in English; participants suggested providing local language sources.
- The message "You are not alone" was particularly appreciated for its human-like tone.
- To ensure protection, participants recommended using NDAs and collecting emails when sharing sensitive content.
- At the start of the chatbot, users must select between "patient", "caregiver", or "doctor" – this was criticized due to terminology concerns.
  - Some participants felt that the term "patient" was not ideal.

## 7. Conclusion, next steps

The first half of Task 7.3 has delivered the two patient-facing applications that anchor WP7's contribution to the eBRAIN-Health ecosystem. **RGS+** now offers a single, cross-device front end that blends motor and cognitive rehabilitation in augmented-reality scenarios, while the **Medical Information Management System (MIMS)** gives clinicians a unified workspace for prescription and follow-up. In parallel, a multilingual **conversational chatbot** provides round-the-clock, plain-language answers to the questions that typically arise when dementia is first diagnosed. A co-design workshop with Alzheimer Europe confirmed the overall usefulness of both tools and produced concrete, user-led recommendations for improving accessibility, safety prompts and the brevity of chatbot replies.

These outcomes move WP7 beyond proof-of-concept toward products that patients and caregivers can realistically use at home, and they lay the groundwork for tighter integration with the data-analysis and visualisation services developed elsewhere in the project.

In the next reporting period, up to the finalisation of T7.3, we will:

- **Address workshop feedback:** Add an enlarged-text mode and higher-contrast colour palette in RGS+, introduce an audio read-out option and concise-answer toggle in the chatbot, and insert explicit safety reminders for full-body AR tasks.
- **Expand clinical reach:** Deploy RGS+ and the chatbot in additional pilot sites, collect longitudinal telemetry and usability metrics, and benchmark adherence rates against baseline motor-only rehabilitation.
- **Complete platform integration:** Connect RGS+ outcome metrics to the predictive analytics developed in WP8 and expose selected results in the 3D visualisation environment planned for the second half of WP7.

Together, these steps will turn the current prototypes into fully integrated, clinically deployable components of the eBRAIN-Health platform, ready to support personalised care and empower people living with dementia across Europe.

### Disclaimer

*This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101058516. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or other granting authorities. Neither the European Union nor other granting authorities can be held responsible for them.*