AUTH COMFORTage pilots

Introduction to Aristotle University of Thessaloniki (AUTH)

The Aristotle University of Thessaloniki (AUTH) is one of the largest Universities in South East Europe and the largest one in Greece covering all disciplines. It has been actively participating in the Erasmus Program since 1987, accounting approximately one fourth of the total Erasmus mobility in Greece in the frame of Student for Studies Mobilities as well as Staff for Teaching Mobilities.

Aristotle University is hosting the most prominent School of Medicine. We are home to world-leading educators, physicians, surgeons, and medical scientists. The School of Medicine was founded in 1942 and bears ever since as its official emblem a bust of Hippocrates (commonly referred to as the “Father of Medicine”). It is one of the four Schools of AUTH’s Faculty of Health Sciences and the largest School of AUTH. It accounts for more than 30.000 graduates, some of them with a great impact on science and humanity. It has recently been ranked top in an international evaluation among the country’s seven University Medical Schools.

Dementia and frailty in Greece

In Greece, one-quarter of the population is over 60 years old, and more than 450,000 already suffer from dementia-related diseases. According to Alzheimer

Europe, the incidence rate of dementia in Greece (in % of the population) was 1.99% in 2018 and will reach 3.95% in 2050. This is the second highest rate in the EU, just after Italy.

Frailty incidence rate varies depending on the scale used, but one can estimate this rate to be between 14 and 16% for the population aged 50+[1]. According to the SHARE study, the prevalence of frailty among individuals aged 65 years and older was found to be 14.7%, with an additional 44.9% identified as pre-frail[2].

A first Greek National Action Plan for Dementia was approved in March 2016 but it was only in 2023 that a bill was introduced to support an updated and more comprehensive plan. It aims to enable an effective treatment of dementia syndromes and improve the quality of life for people with dementia and their caregivers, support the prevention of dementia and the promotion of the population's health and focus on the implementation of cost-effective management measures for the dramatically increased number of people with dementia. The registration and classification of people with dementia in Greece and research on dementia are two important axes of this action plan.

From vision to reality: 15 years of continuous innovation in ageing care and holistic health through research, education and lifelong learning anchored in technology and community.

The Laboratory of Medical Physics and Digital Innovation (iMedPhys) is a dynamic and interactive scientific community. It is the largest laboratory of the Aristotle University of Thessaloniki in terms of number of researchers, research projects, funding, and overall academic output.

[1] https://www.sciensano.be/sites/default/files/ocaoimh2023comparing.pdf
[2] https://www.mdpi.com/2072-6643/16/23/3982#:~:text=In%20Greece%2C%20the%20prevalence%20of,study%20%5B7%2C8%5D.

The mission of the Laboratory is to excel in education and interdisciplinary research, within an environment that fosters creativity and collaboration. iMedPhys leads research in cutting-edge areas such as assistive technologies for health and well-being, digital health, living labs, applied neuroscience, smart hospitals, medical education technology and innovation, medical imaging and emerging fields like brain-computer interfaces and medical and social robotics.

iMedPhys consists of several research teams, each being a leader in its respective field, pursuing innovative and interdisciplinary research. Its members are internationally recognized for research excellence and have received funding from a broad range of sources.

The Laboratory offers state-of-the-art working spaces and specialized research infrastructures, including:

- A **Digital Living Lab Simulation Space**
- A **Hospital-Based Transitions Living Lab**
- A **Rehabilitation Laboratory** equipped with a human centrifuge short-arm
- A **Fully Equipped Neuroscience Lab** featuring high-density EEG, neurofeedback, and an OPM-MEG unit (BioMEGa) for human brain dynamics, biomedical technology and digital health applications.
- An advanced **Virtual Reality Lab**

The Laboratory is also preparing to launch the first **"Immersive Cube"** in the region—an innovative large-scale infrastructure that will transform a classroom into a 360° interactive environment with 3D projections surrounding students and instructors. This **CAVE-type (Cave Automatic Virtual Environment) Immersive Cube** offers a fully immersive virtual reality experience, enhancing medical education through realistic simulations of environments and procedures that are otherwise difficult or unsafe to explore in real life.

iMedPhys has significantly contributed, during the last 15 years, in a number of flagship, EU-wide projects and initiatives.

At the heart of the digital transformation of health and quality life of older adults is the belief that older individuals are not merely recipients of care, but equal contributors and research partners to a patient-centered, digitally connected healthcare ecosystem . Through knowledge exchange and lifelong learning, we are witnessing a redefinition of ageing, one that celebrates autonomy, embraces digital skills, and strengthens cognitive and physical well-being.

A short history of iMedPhys

This vision took concrete shape for the first time in 2008 with the **Long Lasting Memories (LLM) project**, coordinated by iMedPhys. The LLM project marked a turning point: not only did it highlight the unmet needs of older adults, but it also introduced innovative, technology-driven tools to support cognitive and physical well-being (Bamidis et.al. (2015), Konstantinidis, E. I. et. al. (2014), Styliadis et.al., (2015)). For many older participants, this was their first encounter with technology, and it became the beginning of a shared journey towards empowerment and digital inclusion.

Building on LLM's success, the LLM Care ecosystem emerged as a comprehensive, technology-based service platform that combines physical and cognitive training based on neuroplasticity principles. LLM Care became more than a product; it evolved into a social care innovation model. Through strong partnerships with municipalities, regional authorities, healthcare experts, and non-governmental organizations that support vulnerable groups, it has impacted the quality of life of thousands of older individuals across Greece, Cyprus and Europe. Today, it stands as a member of the European Innovation Partnership on Active and Healthy Ageing (with a three star reference site on EIP on AHA) and the European Network of Living Labs (ENoLL) showcasing what's possible when academic research rigor is driven by real-world challenges and meets community-based action.

iMedPhys was the coordinator of the CAPTAIN H2020 project, which envisioned a future where virtual assistants could support older adults navigate complex daily routines, offering gentle guidance based on real-time needs. Within CAPTAIN, AUTH iMedPhys established a strong community of older adults committed to drive research for independent living, through digital technologies. In that respect, older adults were involved from the outset of the project, ensuring that the final product reflected their real-life experiences and needs. Following the successful completion of the project, a spin-off start-up was established (CAPTAIN Coach) , with the aim to exploit research outcomes and bring real-world impact to the lives of older adults. CAPTAIN Coach was one of the the first 12 spin-offs at AUTH.

More recently, AUTH iMedphys participated in large-scale pilots of innovative technologies and its LLM Care system through the SHAPES (Smart and Healthy Ageing through People Engaging in Supportive Systems) project. With 36 partners across 14 countries, AUTH iMedPhys implemented a real-world pilot study, involving number of older adults across many social care structures etc. to understand how data-driven personalization and ethical digital design can improve care delivery and quality of life and support older individuals live independently.

Some other significant research initiatives that contributed to the collection of a wealth of data relevant to active and healthy aging included the USEFIL and UNCAP projects. Within the USEFIL and UNCAP projects a **longitudinal BigData collection** took place, through ecologically valid experimentation settings and protocols, as well as in-the-wild use of remote patient technologies. In total, 250 older adults have contributed with 500 records of self-reported data and involved 13 different stakeholders.

In parallel, iMedPhys has a long experience in **empowering older adults through digital educational programs** promoting the uptake of assistive technologies. Key past projects include the DISCOVER project, the AD-Autonomy, ERMAT and mHealth-AD Erasmus+ projects. A major objective of the aforementioned projects is the development of a wealth of digital educational resources equipping informal carers and healthcare professionals with digital skills and competences, which can be transferred to the real world and transform the lives of humans. Such skills and

competencies are crucial to allow the adoption of digital health tools (assistive technologies, mobile health apps and portable devices such as wearables) in the support of older adults and the promotion of their independence in the community. In this context, a number of innovative training programs have been developed and piloted with older adults suffering from cognitive and physical impairments and their supports. AUTH iMedPhys has transformed this knowledge base into courses available to future healthcare professionals, that participate in Undergraduate and Post Graduate programs such as the ManagiDiTH Master's Program, as open MOOCs delivered through the Biomedical Research and Education Special Unit (BRESU) and seminars delivered through the Center for Education and Lifelong Learning of Aristotle University of Thessaloniki.

The Rise of Thess-AHALL: From Ageing to Holistic Wellbeing

The Thessaloniki Action for Health & Wellbeing Living Lab (Thess-AHALL) was founded in 2014 by the Lab of Medical Physics and Digital Innovation at the School of Medicine of Aristotle University of Thessaloniki (AUTH). Initially known as the Thessaloniki Active & Healthy Ageing Living Lab, Thess-AHALL was Greece's first Living Lab and a pioneering force in Europe, setting the stage for citizen-led innovation in health and wellbeing.

In its early days, Thess-AHALL focused on Active and Healthy Ageing, using participatory methodologies to improve the lives of older adults, chronic patients, and vulnerable populations. Its approach was simple yet powerful: involve people not just as end-users but as co-designers of the solutions meant to serve them. Through collaborative research and citizen science, the Living Lab began shaping technologies that addressed physical, mental, and social health challenges, while also empowering healthcare professionals and caregivers.

Living Environment Simulation (eHome)

From the beginning, Thess-AHALL focused on Active & Healthy Ageing (AHA), applying co-creation and participatory design to develop tools that truly reflect what older adults want and need. But the lab didn't stop there.

Since 2022, Thess-AHALL has been relaunched with even greater ambition, expanding its activities beyond ageing to include oncology, environmental resilience, agri-food systems, urban health, culture, and communication. This evolution transformed Thess-AHALL from a thematic initiative focused on ageing into a dynamic coalition that connects researchers, local authorities, civil society, and industry.

Projects like LifeChamps brought artificial intelligence and data analytics into cancer care, improving quality of life for older cancer patients. It directly inspired the Cancer Living Labs initiative, which later evolved into PECan, ONCODIR and COMFORT, each exploring new frontiers in cancer prevention, diagnosis, and personalized treatment through AI, digital health, and real-world Living Lab testing.

This model is now **influencing a broader European policy.** As the co-lead of the Harmonization Working Group and **the head of the Health & Wellbeing Working Group of ENoLL** (the European Network of Living Labs) , Thess-AHALL helps Living Labs across Europe define **common standards** while preserving their local uniqueness.

Today, Thess-AHALL is more than a lab. It's a mindset. It brings together citizens, researchers, and decision-makers to co-design real solutions in real environments. The City of Thessaloniki itself has become a living laboratory, where new ideas are tested not behind closed doors but in the neighborhoods, hospitals, schools, and public spaces of the city.

Thess-AHALL continues to redefine what it means to do research with and for society. And the journey is just beginning!

The Lab produces high-impact scientific publications, contributes to international research collaborations, and generates valuable evidence from its extensive clinical datasets, which include cognitive, motor, and brain function assessments. This evidence informs both the academic community and clinical practice, advancing the understanding of cognitive decline and supporting strategies that promote overall health and quality of life. Since 2020, Thess-AHALL has also actively participated in the European Commission's **City Science Initiative** alongside the Municipality of Thessaloniki (Lead City on "Mental Health & Well-Being"), coordinating social innovation actions that explore how science, technology, and research can support cities in addressing contemporary mental health and well-being challenges. This citizen-driven and evidence-based

approach strengthens the role of research in public policy and ensures inclusive, future-ready innovation in health and care.

AUTh plays a central role in COMFORTage:

Pilot 6 Study starts a journey to Support Frail Older Adults with Brain Training, Exercise, and Nutrition via Digital Tools

Pilot 6 is **part of a larger journey** that started years ago at the Lab of Medical Physics and Digital Innovation (iMedPhys), where researchers have been using technology to help older people stay healthy and independent. This new study explores how a **mix of cognitive games, physical exercises, and nutritional recommendations,** delivered through **a friendly app, a cognitive training platform, and supported by wearable devices** like smartwatches, can improve cognition and physical strength in older adults who are becoming frail. These tools and interventions were designed based on years of experience from earlier projects and have been tested and improved together with older adults. The study will run for 18 months, assessing the efficacy of a remote multimodal intervention and identifying key risk factors for cognitive decline and frailty with ultimate scope to make a real difference in people's daily lives.

What Are the Goals of the Study?

The main objectives are to:

- Evaluate the efficacy of the remote multimodal intervention in reducing cognitive decline among pre-frail and frail older adults
- Identify Risk Factors: Investigate early risk factors contributing to both frailty and cognitive decline.

What's the Study About?

The study is exploring whether a six-month remote intervention that includes cognitive training, physical exercise, and nutrition guidance—delivered through a

cognitive training platform, an app, and wearable devices—can improve the health of pre-frail older adults. Researchers will assess participants at four time points: the beginning (baseline), after six months, and then again at 12 and 18 months to track both short- and long-term outcomes.

Who's Involved?

Pilot 6 will include 150 participants aged ≥ 55 years, divided into groups of 50 individuals each. Eligible participants will be those who are pre-frail older adults and do not have dementia or severe cognitive decline and severe physical impairment.

Participants' recruitment will be actualised within the network of the Thessaloniki Action for Health & Wellbeing Living Lab - Thessahall, under the auspices of the Lab of Medical Physics and Digital Innovation, Aristotle University of Thessaloniki (AUTH), as well as the Ippokrateio General Hospital of Thessaloniki in the 3rd Cardiology Department.

The measurements occur at the Medical Physics & Digital Innovation Laboratory, Aristotle University of Thessaloniki (AUTH), and the Ippokrateio General Hospital of Thessaloniki.

Participants will follow a standardized protocol, collecting demographical, medical, neuropsychological, motor, nutritional, and quality of life data. Obtaining these data will allow us to have a concrete profile of the participants' cognitive and physical profile and the changes that will happen over time.

The study design consists of the following groups:

- **Intervention Group:** Receives a remote multimodal intervention with interactive cognitive training (using the fully validated tool BrainHQ), physical training , and nutrition guidance and educational training and all supported by wearable technology (Fitbit and smart scales).

- **Active Control Group:** Uses a simpler version of the app with general health tips, basic exercises, and leisure games like Sudoku, but without targeted the main elements of the intervention.
- **Passive Control Group:** Continues with their usual lifestyle and medical care, without any added intervention.

Healthy older adults (with no signs of frailty) are also participating as a comparison group and will be assessed throughout the study.

How Does It Work?
Participants in the intervention group receive tablets and smartphones (if needed), along with full training to use the tools. They're encouraged to complete cognitive training three times a week, use a mobile app for daily physical activity and nutrition guidance, and track their progress with a smartwatch and smart scale.

The app includes features like physical training activities, nutritional training and guidance, and educational content on general health topics on frailty and prevention, physical activity and on nutrition, mindful eating strategies, and a **badge system** to motivate users and enhance engagement.

Pilot 6 will leverage different opt-in tools to support data collection. The mHealth mobile application provides physical and nutritional training and the educational content and monitoring their progress. The BrainHQ, which provides interactive games for cognitive training, allows personalization to the needs of each person. Finally, the Training and Education Toolkit (TET) provides the opportunity to participants to have a more in-depth educational training in frailty, self-management, and digital tools.

Plans to leverage COMFORTage platform:

Pilot 6 will leverage the COMFORTage platform to support a more precise, personalized approach to the early detection and management of cognitive decline. By contributing rich, multidimensional datasets, including cognitive,

physical, nutritional, and lifestyle indicators. The pilot will enhance the COMFORTage platform's algorithms and contribute valuable inputs to the development of AI-driven models. These data will be integrated into the platform's predictive analytics to support early identification of individuals at high risk for dementia, enabling timely and targeted interventions. A central innovation is the use of Digital Twins, which will facilitate predictive simulations and allow clinicians to forecast disease trajectories and tailor care pathways accordingly.

Pilot 13: Empowerment Through Digital and Health Literacy

At Thess-AHALL, the Living Lab for Health and Wellbeing at the Aristotle University of Thessaloniki (AUTH), innovation is deeply rooted in collaboration. Pilot 13 builds on this tradition, asking a powerful question: **How can older adults be empowered to confidently manage their health and use digital tools?**

The pilot draws from past successful projects like DISCOVER, ERMAT, and mHealth-AD, which used hands-on learning and co-creation to close the digital divide. Now, Pilot 13 takes it a step further, combining workshops, real-life practice, and personalized mentoring to support older adults, not just in learning technology, but in feeling more capable, connected, and in control of their health.

What's the Goal?

Pilot 13 is designed to **improve both digital and health literacy** among older adults. By using a person-centered, participatory approach, the program ensures that the tools and educational content developed are not only useful but truly meaningful and sustainable. Continuous feedback from participants helps shape every step of the process.

AUTh also plays a central role in the development of two important "products" of COMFORTage: The Training and Education Toolkit (TET) and the Training and Education Marketplave (TEM) digital platforms. They are open-access, digital learning solution designed to support older adults, caregivers, and healthcare

professionals in addressing the challenges of ageing, frailty, and dementia, reducing digital exclusion and supporting more informed, connected, and resilient ageing communities.

Who Can Participate?

Participants are selected through an open call within the "Collaboration and Research Community for Independent Living", a network of more than 100 active members, including older adults (60+), informal caregivers, and healthcare professionals.

Pilot 13 will include 40 participants aged 60 years ((Healthy, MCI, mild Dementia, Frail), or older who score above 24 on the Mini-Mental State Examination (MMSE), indicating adequate cognitive function for participation. In addition, other stakeholders will be involved in an advisory and co-creation capacity. These include healthcare professionals with prior experience in caring for older adults, as well as informal caregivers or relatives aged 18 or older who have similar caregiving experience.

A Four-Phase, Person-Centered Approach

The study unfolds across four key phases:

- Needs Assessment & Co-Creation: Understanding participants' challenges and collaboratively designing educational tools.
- Initial Implementation: Launching group sessions and digital activities tailored to participants' needs.
- Optimization & Digital Guidance: Refining interventions and providing personalized support through digital mentoring.
- Evaluation: Measuring impact to inform future programs and applications.

Pilot 13 will gather a comprehensive set of data to evaluate participants' needs, progress, and outcomes. The data will include demographic information, cognitive and functional assessments, quality of life and status of health, and digital literacy.

Additionally, data on the acceptance and usability of digital tools, including the educational platform and the Healthentia mentoring system, will be collected. Qualitative insights will also be gathered through participant interviews and group discussions to better understand personal experiences and feedback.

Three Types of Interventions

To deliver meaningful outcomes, the pilot combines three interconnected types of interventions:

Co-Creation and Co-Validation: Participants engage in workshops and focus groups to co-design, revise, and test both the educational content and the COMFORTage training learning platform (TET). Their input directly informs technical specifications and platform features.

Traditional Education & Experiential Learning: Group sessions blend theory with hands-on activities, followed by independent practice at home using digital tools. Participants later gather for feedback sessions to discuss challenges and exchange experiences.

Personalized Digital Mentoring: Tailored digital guidance is provided through tools like Healthentia, offering personalized recommendations and tracking progress.

Pilot 13 isn't just about teaching digital skills. It's about empowering older adults to manage their health, engage with technology, live more independently and promote inclusion, and lifelong learning in an increasingly digital world.

What will the COMFORTage platform bring to pilots & AUTH

The COMFORTage platform will play a central role in Pilot 13 with the use of a core component, TET and TEM, which will provide a digital environment tailored to the needs of older adults, helping them build both digital and health literacy. It will offer

educational content, practical tools supporting older adults as they navigate technology and health-related decisions in their daily lives.

For AUTH, the COMFORTage platform represents an opportunity to expand its mission of participatory innovations in healthcare. It strengthens Thess-AHALL's role as a Living Lab for Health and Wellbeing by combining research, education, and real-world impact and adds to the vision of iMedPhys by creating useful services and innovations for vulnerable societal groups.

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