TREAT

Transforming Healthcare Through Semantic Interoperability and Self-Efficacy

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Glossary

Abbreviation / acronym	Description
AI	Artificial Intelligence
API	Application Programming Interface
ECG	Electrocardiogram
EHR	Electronic Health Records
FHIR	Fast Healthcare Interoperability Resources standard
GDPR	General Data Protection Regulation
HL7	Health Level Seven set of standards
ML	Machine Learning
NCD	Non-Communicable Disease
NLP	Natural Language Processing
SaaS	Software as a Service
SpO2	Oxygen saturation
TREAT	Transforming Healthcare Through Semantic Interoperability & Patient Self-Efficacy
VLM	Vision-Language Model
XAI	Explainable AI

1 Executive Summary

This deliverable provides the description of the demonstrators in the TREAT project. It is the result of task 1.2 of work package 1. WP1 provides the baseline for the other work packages in the TREAT project, by providing the requirements and related workflows of the project use cases, to be used as reference in the development of the technical solution of the project: these requirements will guide the work of WP2 on data collection, algorithms, and privacy and security issues, WP3 in AI technologies and methodologies, and WP4 on the development of the project platform, software, and semantic interoperability concepts.

Task 1.2 integrates the technologies developed in WP2-WP4 into specific demonstrators, in accordance with the use cases specified in task 1.1. For each demonstrator, end-users are involved in a co-creation, iterative process, providing feedback to the developments in WP2-4 from target groups (e.g. acceptance testing, usability optimization, UX assessment, integration with work routines, ...). This process will result in a more user-centered design, with features and functionality tailored to the specific needs of patients, their families, and care providers.

2 Introduction

The role of this document is to provide information on the final status of the demonstrators defined for the TREAT project:

- **UC1: Patient-centric digital ecosystem**

  This use case concentrates on the development of a patient-centric digital ecosystem to improve self-efficacy for patients to manage cardiac metabolic diseases, specifically type 2 diabetes at home and the hospital. Further, the development of a wearable device that supports interoperability and can provide real-time decision-making data to both clinicians and patients at an institutional level. This use case supports TREATs goal to increase patient self-efficacy in managing non-communicable diseases (such as type 2 diabetes) by developing a patient centred platform that addresses interoperability between health institutions, decreases the reliance on healthcare providers, and increases patient adherence

- **UC2: Integrated System for Osteoarthritis Patients**

  The goal of the use case is to realize an integrated system for osteoarthritis patients which can be used by physical therapists and lifestyle coaches to administer and remotely monitor interventions/training programs, supported by automated personalized coaching. This use case supports TREAT's overall goals of improving individualized clinical care, specifically focusing on long-term adherence of individuals with diabetes mellitus and osteoarthritis to norms of healthy physical activity. This process will be optimized through remote physical monitoring, semantic interoperability and the use of AI for personalized recommendations. Each partner of the consortium will provide their expertise to work on this common goal.

- **UC3: Recommender SaaS Platform**

  This use case considers the integration of data from various sources (diet, pharmacological treatment, out-of-hospital monitoring, care pathways) into a platform which is able to provide personalized recommendations and improve the effectiveness of treatment for patients with chronic non-communicable diseases. (NCDs). This will include collaboration between health professionals, pharmacists and advanced artificial intelligence (AI) technologies. The platform will be provided through an API, which will allow us to offer it as a Software as a Service (SaaS) solution, allowing its use by other entities and facilitating its integration into various health platforms.

- **UC4: Diabetes monitoring**

  This use case will focus on a diabetes-specific solution aimed at enhancing self-efficacy and improving clinical workflows. The solution will provide a multi-layered framework, including collecting data from patients using two types of wearable devices, measuring the glucose level in the blood and record the electrical signals in the heart, which will be processed using AI on the platform for semantic operability.

- **UC5: Distributed Diagnoses and Home Healthcare**

  This use case pertains to distributed diagnoses and home healthcare, aiming to develop economically efficient methods for user-centred and home-based systems. These systems focus on monitoring health-related quality of life, particularly for patients with chronic diseases. In this context, the integration of personal devices (such as smartphones and wearables) with hospital information systems allows for remote patient monitoring. The system collects data from sensors, patients, families, and primary care

professionals, integrating it with information from the hospital's individual personal care system. This integration enables the development of various services, including information dissemination, coaching, analysis, and alarming

- **UC6: Enhancing Patient Self-Efficacy and NCD Management through AI-Powered Remote Monitoring**

  The Well@Home platform will integrate AI assistance to streamline patient management for healthcare professionals. This will be achieved in three phases: 1) Enhancing data visualization and obtaining the required dataset, 2) Implementing a predictive AI assistant for patient diagnosis, and 3) Adding a prescriptive AI assistant to optimize content labelling and delivery timing. The goal is to improve the patient's self-efficacy, treatment adherence and decrease healthcare costs by reducing the reliance on healthcare professionals.

- **UC7: TREAT Complete**

  The TREAT Complete demonstrator is the project's integrated, cross-country demonstrator and serves as the final, ecosystem-level showcase of the TREAT project. Where the preceding demonstrators (UC1 to UC6) each present the solution of an individual consortium within its own clinical domain and platform, TREAT Complete deliberately does the opposite: it brings those individual building blocks together into a single, coherent care journey that spans multiple countries, consortium partners, and platforms.

The following chapters provides a description of each demonstrator, as well as its availability of the demonstrator components.

3 Patient-centric Digital Ecosystem demonstrator

The Canadian use case (UC1) focuses on improving self-efficacy for people living with type 2 diabetes by combining patient-reported lifestyle information with relevant clinical context and producing patient-tailored guidance through engaging digital interactions. In Canada, this demonstrator is implemented through My Viva's patient-facing tools (My Viva Plan for lifestyle tracking/journaling and Yaro for conversational reflections) together with a controlled integration to the AI recommender engine developed by TU/e (Hankins, Tim). The overall goal is to support daily self-management and longitudinal learning by capturing real-world behaviors, reflections, and (where available) clinical context, then using that de-identified integrated dataset to generate personalized lifestyle guidance that can be delivered back to patients in an understandable, supportive way.

The final UC1 demonstrator is a privacy- and security-preserving data workflow that supports: (1) capture of lifestyle and journaling data through My Viva Plan and Yaro, (2) ingestion of wearable/device telemetry where available, and (3) inclusion of EHR/EMR-derived clinical context when approved and available for use. Data is normalized for interoperability (including FHIR where applicable), then minimized and de-identified (anonymization/pseudonymization) before being made available to the TU/e recommender engine through a controlled interface. The TU/e recommender then produces personalized lifestyle guidance topics, which is surfaced back to patients through engaging interfaces (particularly Yaro) to support adherence and self-efficacy.

From an operational perspective, UC1 is executed in the context of a structured study workflow. Participants are onboarded first into My Viva Plan (with Yaro added when available), baseline and week 12 surveys are administered, and clinicians provide bi weekly support sessions during the 12 week program. Participant journaling data, wearable data when applicable, and EMR data (when consented and transferred through the defined secure process) are reviewed in regular cycles and used both for clinician recommendations and as learning material to improve AI-generated guidance.

The UC1 demonstrator is provided to users through My Viva's patient-facing digital platforms, with My Viva Plan used for onboarding and lifestyle journaling and Yaro used for conversational reflection and patient-facing guidance. The TU/e recommender engine is integrated as an external component via a controlled interface to generate personalized lifestyle recommendations from de-identified integrated data, with recommendations delivered back through the patient-facing experience.

Operationally, the UC1 study workflow includes recruitment through a partnered clinic, a defined consent process (including a separate EMR consent), secure storage of EMR files in a designated SharePoint area, and a 12 week cadence with bi weekly clinician sessions, baseline/week 12 surveys, and optional interviews at completion.

The study is supported by ethics approvals that enable recruitment and execution under the approved protocol "Enhancing Self Efficacy in Type 2 Diabetes Management through Data Collection for AI Training," including HREBA certification (effective 26 Nov 2025 through 25 Nov 2026).

4 Integrated System for Osteoarthritis Patients demonstrator

The Dutch use case aims to develop an integrated digital health system to improve the management of osteoarthritis in individuals. The system combines wearable sensors, real-time data analysis, and personalized coaching to support physical therapists and lifestyle coaches in remotely monitoring and guiding patients through individualized intervention and training programs. The goal is to enhance long-term adherence to healthy movement behaviours, improve overall physical fitness, and reduce the complications related to diabetes and osteoarthritis.

This use case focuses on enabling patients to manage their health, supported by a system that collects data on physical activity, fitness levels, and adherence to exercise programs. Personalized feedback and coaching will be provided based on the collected data, aiming to improve patient self-efficacy and long-term health outcomes.

By integrating home-based care with advanced digital technologies, the system will empower patients to take control of their disease management, reduce the need for frequent in-person visits, and contribute to broader health objectives such as reducing the burden of chronic diseases and promoting healthier lifestyles.

Data Collection:

- Elitac wearables: will provide a garment to wear the wearable devices
- DEMCON: Will collect activity data from patient wearable devices.
- Maastricht University: Will collect additional activity data and user, and usability data.
- Beweeghuis: Will provide per-patient electronic health records (EHRs), if available, patient condition reports, and prescribed activity plan details at the start of the trial, to the central system of Medrecord.
- TU/e: Will collect activity data from wearables, chat logs, daily reflections, and lifestyle data through the medical AI chatbot.

Data Interoperability:

- DEMCON: Will make the patient wearable data stream available via a secure RESTful API according to a common TREAT standard to the Medrecord system.
- TU/e: Will integrate with the central Medrecord platform. By integrating data analytics from wearables, lifestyle, EHRs, and authoritative medical information, the AI/ML system will act as the primary interface for accessing AI-mediated lifestyle and treatment recommendations (to patients and clinicians, respectively).
- MEDrecord: Stores the information according to medical data storage requirements, in a format such that it is exchangeable with medical parties and the consortium

AI/ML Integration:

- TU/e: will perform applied research and experimentation with a general and extensible system architecture that can accommodate seamless integration with existing or emerging services. The AI/ML system will provide lifestyle and treatment recommendations (to patients and clinicians, respectively) based on available data inputs as well as a state-of-

the-art medical question answering system. It will be accessible via API to Dutch consortium partners.
- Almende: Will create a motivational engine that produces utterances to motivate the patients given their recent achievements and set targets. It will be a separate module that can be "plugged" into a chatbot architecture.

Patient Interaction:
- TU/e: will perform applied research and experimentation with a medical chat assistant, that communicates with the coach and patient via the chatbot. The assistant may be accessed via simple text chat or augmented reality (AR) avatar using a mobile or desktop device. The medical assistant will engage in chat, answer patient questions, and offer patient-appropriate wellness recommendations that promote patient self-adherence.
- MEDrecord: will build the AI-supported chatbot avatar designed to help patients and coaches better understand and manage the patient's health. The application will be available on both desktop and mobile, offering a seamless and approachable experience for patients. It will be able to use input from external AI/ML modules.
  - The chatbot avatar can engage in real-time conversations with patients and coaches, answering questions and offering personalized health support.
  - Patients can view and track biomedical markers, like blood pressure or glucose levels, within the same interface, helping them stay on top of their health.
  - The assistant guides patients and coaches through smart, conversational questionnaires that feel more like a dialogue than a form, making it easier to share key health information.
  - Patients receive tailored coaching based on their data and needs, from medication adherence to lifestyle improvements, all delivered in everyday language.
  - A built-in knowledge section offers access to trusted health information, curated and contextualized for the patient's condition and journey.

The entire experience is supported by MEDrecord's secure health data infrastructure, ensuring sensitive information is handled responsibly.

The demonstrator is provided:

- The MOXBASE1 and Pacer tracker are adapted and first versions have been used for a trial already.
- The first version of the wearable has been used for a trial already, this wearable will only be improved for the final demonstrator.
- The API of Johan sports is available.
- A containerized version of the Device Analytics and medical chatbot services is available for internal testing.
- The development and integration of additional components is underway, specifically the medical knowledge graph, distributed systems infrastructure, databases, APIs, and monitoring systems, and will be deployed onto TU/e High Performance Computing hardware once the required data sharing agreements are finalized.

5 Recommender SaaS Platform demonstrator

AI-enabled SaaS recommender and semantic interoperability platform for chronic NCD management, integrating clinical, pharmaceutical, dietary, monitoring and care-pathway data to support personalized treatment, patient adherence and coordinated care.

- GLINTT: diet–drug–patient interaction analysis, FarmaTools/DietTools integration, AI modules, XAI, knowledge graphs.
- DEXTRO: AI-assisted care pathways, workflow optimization, conversational AI assistant, semantic interoperability server.

In the Spanish use case of the TREAT project, the generation of intelligent agents trained as a service (Agent-as-a-Service, AaaS) is proposed, where each partner contributes through the development of agents specialized in their technological and functional domain.

Both agents will be deployed as accessible services through APIs, allowing:

- Integration into external platforms (HIS, EHR, pharmacy systems, mobile apps)
- Standards-based interoperability (HL7, FHIR)
- The reuse of capacities in different organizational contexts (multi-tenancy)
- Continuous evolution through learning and feedback mechanisms

The system is presented as a panel of intelligent assistants ("Chatbot Assistants"), where the agents developed by the consortium partners are displayed in a decoupled way:

- DEXTRO Agent (Dextro Chatbot): Oriented to real-time hospital operations and clinical risk support, aligned with its role in the optimization of care routes and clinical processes.
- GLINTT Agent (Glintt Chatbot): It is also focused on real-time clinical operations, but specialized in the contextual analysis of the patient, including treatment-diet-pharmacy interaction.

Each agent is presented as a standalone service accessible on demand ("Open"), reflecting:

- Decoupled deployment via APIs
- Domain-encapsulated cognitive abilities
- Possibility of integration into different external platforms

The TREAT demonstrator is provided to users as a web-based service, accessible through a secure online interface.

Access to the platform is managed via user authentication (username and password), ensuring controlled usage and compliance with data protection requirements. This access mechanism allows different user profiles (e.g., healthcare professionals, researchers, evaluators) to interact with the system in a secure and personalized manner.

The demonstrator is deployed in a cloud-based environment, enabling:

- Remote access without the need for local installation

- Centralized updates and maintenance
- Scalability according to the number of users and use cases

Through this web interface, users can:

- Interact with the different AI agents (GLINTT and DEXTRO) via conversational interfaces
- Submit queries in natural languages.
- Receive contextualized responses based on clinical knowledge and operational data

In addition, the underlying system exposes its functionalities through API endpoints, allowing potential integration with external healthcare platforms (e.g., EHR, pharmacy systems), although this integration is not required for accessing the demonstrator itself.

The current version of the demonstrator is intended for controlled access by project partners and selected stakeholders, particularly in the context of the upcoming evaluation and validation phase.

6 Diabetes Monitoring demonstrator

The target outcome of the use case is to develop a prototype of an AI-supported healthcare system that continuously monitors blood glucose levels in diabetes patients, collects ECG, body temperature, blood pressure, and SpO2 data, and integrates with wearable ECG t-shirts developed by Livewell and additional devices. The system will enable long-term, continuous collection of individual health data, which will be evaluated by AI algorithms and shared with other stakeholders.

From ARD studies, through AI-based processing, the system will generate health-related indicators and display them to healthcare professionals via structured dashboards. It will also ensure semantic interoperability with E-Kalite's health intelligence systems, making it possible for clinicians to provide personalized recommendations based on patient-specific information. The demonstrator will be developed in accordance with both GDPR and Türkiye's KVKK legislation.

E-Kalite, on the other hand, plans to build a health intelligence visualization platform that combines information from Livewell's smart t-shirt, Anadolu Sigorta's electronic health records, and WHO datasets. By applying AI models, the platform will produce personalized diabetes risk evaluations and deliver different layers of visualization tailored to various user groups. These will include tools for monitoring data quality for AI developers, patient-oriented views that compare personal risk with similar profiles, interfaces for healthcare professionals showing risk levels against clinical thresholds, executive dashboards for population-based insights, and a public portal presenting diabetes statistics at national and international levels.

In addition to the visualization platform, another key element of the demonstrator is an AI-supported medical recommendation module specifically designed for diabetes care. This component will make use of scanned and unstructured medical documents, including health information forms, epicrisis notes, laboratory reports, imaging reports, and examination documents. Anadolu Sigorta contributes to this module through an AI-supported medical document processing pipeline that applies vision-language models, OCR-supported processing, and natural language processing methods to extract patient-related clinical information and convert it into structured clinical data.

The structured information obtained from these records will serve as the foundation for semantic representation and downstream predictive analysis. Extracted clinical findings such as diagnoses, complaints, laboratory values, imaging-related findings, procedures, and other patient-specific indicators will be semantically enriched and represented in a knowledge graph. This graph will link clinical findings to patients, visits, documents, and source evidence, enabling traceability between AI-generated outputs and the original medical records.

By detecting patterns and risk factors in historical medical documentation, the module will support the generation of patient risk profiles and provide clinicians with AI-supported recommendations and early warning signals concerning diabetes progression and related complications. In this way, Anadolu Sigorta's contribution complements real-time sensor data with structured and explainable clinical knowledge extracted from historical health documents.

Overall, this system will be incorporated into the wider TREAT platform in order to strengthen personalized care pathways and clinical decision-making. Fully aligned with GDPR and Türkiye's KVKK requirements, the demonstrator will support the broader aim of improving patient-specific interventions through interoperable, explainable, and data-driven health intelligence.

In the first phase, the initial version of a smart t-shirt prototype capable of collecting ECG signals and transmitting them to a mobile device via Bluetooth has been successfully developed. This t-shirt is ready for the integration of basic heart rhythm detection parameters.

To complement this hardware layer, a mobile application will be developed to receive and visualize biosignal data from the wearable device. This app forwards the data to a backend server, where initial analysis modules extract key clinical indicators. ARD has also initiated test integrations with the e-Kalite platform through secure API interfaces. Together, these elements form the foundation for a closed-loop demonstrator system that connects patient monitoring with clinical decision-making tools.

Building on the software and interface layer, E-Kalite has developed visualization mockups for patients, healthcare professionals, and administrators that demonstrate the intended user experience. While not yet connected to real data pipelines, these mockups effectively show how different personas would interact with the system. Additionally, E-Kalite has successfully crawled and visualized WHO diabetes data for the project's public website, providing comparative analyses across different countries and regions. The preliminary work includes:

- Mockups of patient data visualization against reference populations
- Healthcare professional dashboard designs showing risk scores
- Administrative view concepts for population health metrics
- Functioning WHO data visualizations for public awareness

Parallel to these interface efforts, the data management and AI processing infrastructure for the AI-assisted medical recommendation module has been successfully developed. This module is designed to process scanned and unstructured medical records, extract clinically relevant information, and transform these outputs into structured representations that can be used by downstream AI and visualization components.

For unstructured documents, the system employs vision-language models, OCR-supported processing, and NLP techniques to extract structured clinical information. These outputs are then converted into a unified clinical format and prepared for semantic enrichment through the knowledge graph layer.

The Anadolu Sigorta component focuses on generating structured clinical data from heterogeneous medical documents rather than directly retrieving clinical variables from operational database tables. The extracted information is linked to its source document and patient context, enabling evidence-aware patient profiles to be created. These structured outputs are then represented in a semantic graph to support explainable querying, risk profiling, and recommendation generation.

In the subsequent phases of the project, the enhanced prototype (integrating the ECG t-shirt, blood pressure monitor, SpO2 meter, temperature sensor, and glucose meter) will be tested on

a limited number of volunteer patients and made accessible to project stakeholders and potential users. The final demonstrator will be presented as part of a pilot field study, fully integrated with the entire system.

The production platform operates within Anadolu Sigorta's secure environment and, in line with KVKK requirements, is not externally accessible. For consortium demonstrations, reviewer presentations, and project documentation, a local digital twin of the platform populated with synthetic patient data is available, replicating the dashboards, medical document processing outputs, semantic graph structure, and conversational AI functionality without exposing real patient documents or identifiable health data. WHO data visualizations remain publicly accessible on the project website.

The LiveWell ECG t-shirt prototype will be made available for controlled pilot testing with selected volunteers and project stakeholders. During the pilot phase, the t-shirt will be used to collect ECG data in real-life or semi-controlled environments, supporting the validation of signal acquisition, user comfort, Bluetooth data transfer, and integration with the ARD backend and E-Kalite visualization components.

7 Distributed Diagnoses and Home Healthcare demonstrator

The demonstrator developed within the TREAT project aims to enable remote and continuous monitoring of patients integrated into (i) Cardiac Rehabilitation Programs (CRP), (ii) Paediatric Diabetes, and (iii) Paediatric Obesity, ensuring the collection, monitoring, and analysis of relevant clinical data both inside and outside the hospital environment.

Through integrated devices (such as blood pressure monitors, smart scales, continuous glucose monitoring devices, etc.), it is possible to collect vital parameters and automatically transmit them to the clinical team through the patient mobile app, ensuring real-time distributed diagnostic assistance and personalized home care.

This demonstrator also includes a mobile app for patients, with features such as alert notifications, medication reminders, appointment/exam scheduling, and recommendations based on clinical progress, fostering greater adherence to the program and empowering patients in managing their health.

Referrals to the Cardiac Rehabilitation Program (CRP) can be made through different pathways, depending on the phase of the program in which the patient is enrolled. The CRP is structured in two main phases: Phase I and Phase II.

Patients are typically referred to Phase I following an acute cardiac event that results in hospital admission. Each day, nurses review the list of inpatients with cardiac pathology using the HER system, identifying candidates for rehabilitation. After assessing clinical stability and the patient's capacity to participate in exercise, eligible patients are referred to Phase I and begin rehabilitation sessions.

Referral to Phase II may occur at the end of Phase I, or by the family physician if the cardiac event took place outside ULSTMAD. In this phase, a cardiologist reviews the clinical information available in the EHR system and determines whether the patient meets the criteria to join the program.

Once the referral is accepted, the patient progresses through a series of consultations, including cardiology, nursing, and physiatry, and undergoes complementary exams before joining a rehabilitation group. These steps, currently performed at different stages, will be centrally recorded in the Individual Integrated Care Program (ICP).

This digital platform will ensure that, according to assigned permissions, all healthcare professionals involved have timely and efficient access to the patient's clinical information. During rehabilitation sessions, clinical and functional parameters are recorded according to the program phase:

- Phase I: Heart rate, oxygen saturation, blood pressure, exercise sets, and repetitions.

- Phase II: Heart rate, oxygen saturation, blood pressure, weight, BMI, abdominal circumference, blood glucose, and peak values of heart rate, blood pressure, and oxygen saturation during training.

All records will be entered digitally in the ICP platform, centralizing information, facilitating real-time access and updates by the care team, and supporting continuous clinical monitoring through graphical tools and automatic reports. Patient progress is further monitored by comparing responses to questionnaires administered at different time points (initial assessment, Mediterranean diet adherence, quality of life, final assessment, and satisfaction with nursing care).

Referrals for a child to attend the First Multidisciplinary Pediatric Obesity Consultation can be made by any in-house physician using the EHR system, or by primary care physicians through the platform.

During the consultation in which the patient is referred, the attending physician may record indicators such as Z-score, BMI, weight, height, and age. However, referrals may also be submitted without these indicators, relying solely on the clinical summary of the patient. Nonetheless, it is crucial that any referral includes relevant clinical information to ensure the multidisciplinary team has the necessary data for an appropriate and effective assessment.

Once the referral is submitted, a pediatric triage physician reviews the clinical information to determine whether the patient meets the criteria for scheduling the First Multidisciplinary Pediatric Obesity Consultation.

This initial consultation involves coordinated assessments by Nursing, Nutrition, Psychology, and Pediatrics, and leads to a referral to an Individual Care Plan (ICP). The ICP serves both as a dynamic, patient-centered roadmap for follow-up and intervention, ensuring that care is structured, goal-oriented, and adapted to the child's evolving needs, and as a clinical record platform that centralizes personal data, medical history, educational content, and standardized scales and questionnaires.

The process is supported by interoperability between several EHR systems, allowing multidisciplinary team centralized access to health records and progress updates. This integration significantly enhances continuity of care and facilitates coordinated decision-making. As consultations progress, professionals will have access to updated clinical data, enabling comparisons across visits and supporting more accurate monitoring of health indicators.

At present, there is no formal referral process in place at ULSTMAD for the first multidisciplinary consultation for childhood diabetes. Typically, referrals occur when a child is seen by the attending physician during an emergency department visit due to a symptomatic presentation.

Upon arrival at the emergency department, the patient registers at the administrative desk, where staff record the visit and create a clinical episode. The triage nurse then evaluates the child and classifies the severity of the case using the Manchester Triage System, assigning a priority wristband accordingly. The patient is then assessed by the Emergency Physician, who performs clinical evaluation and diagnosis. In cases of Type 1 Diabetes Mellitus (T1DM), hospitalization in

the Pediatrics Department is required. At discharge, the physician informs the caregivers that the child will be followed in Pediatric outpatient consultations within the scope of the multidisciplinary diabetes care program.

This initial consultation involves coordinated assessments by Nursing, Nutrition, Psychology, and Pediatrics, and is formally referred and integrated into the Individual Care Plan (ICP). As with the process for Pediatric Obesity, the ICP serves as a dynamic and patient-centered roadmap for follow-up and intervention, ensuring that care is structured, goal-oriented, and tailored to the child's evolving clinical and psychosocial needs.

The process is supported by interoperability between several systems, allowing the multidisciplinary team centralized access to health records and real-time updates. This integration significantly enhances continuity of care and facilitates collaborative, informed decision-making. As consultations progress, healthcare professionals will have access to updated clinical records, enabling longitudinal comparisons across visits and more accurate monitoring of clinical indicators.

By the end of the project, the goal is to have a fully functional demonstrator capable of:

- Collecting real-time physiological data during workouts or daily activities of the patients.
- Automatically processing this data to generate clinical alarms (normal, alert, critical).
- Providing detailed dashboards for clinicians, with visualization of history, progress, and treatment adherence.
- Sending personalized notifications to the patient and the clinical team.

The solution will also be validated in a real-world environment with patients undergoing home rehabilitation, ensuring usability, clinical efficacy, and feasibility of integration into existing healthcare services.

The final demonstrator will be available by the end of the TREAT project, with the possibility of:

- Being used by other partner healthcare institutions for pilot tests.
- Serving as the basis for the large-scale implementation of hybrid rehabilitation programs (in-person and home-based).
- Allowing extensions to other healthcare areas, such as secondary prevention programs.
- The technological infrastructure will first be made available in a quality-controlled environment for final validation and will only then be used in a real clinical context.

The preliminary version is available at ULSTMAD to be used in real clinical context. The Preliminary Demonstrator integrates the main components under development across the three projects, allowing users to interact with early versions of referral, scheduling, and data visualization workflows.

The data model supports cross-disciplinary review and longitudinal tracking of patient outcomes. This will provide a strong foundation for future analytical and decision-support capabilities.

Wearable devices integration, in partnership with Plux, will start in 2026, along with the integration with the patient app provided by Seamlink.

8 Enhancing Patient Self-Efficacy and NCD Management through AI-Powered Remote Monitoring demonstrator

The Well@Home demonstrator focuses on enhancing patient self-efficacy and improving the management of non-communicable diseases (NCDs) through AI-powered remote monitoring and clinical decision support within the Well@Home platform.

The demonstrator combines descriptive, predictive, and prescriptive AI functionalities to support healthcare professionals in patient monitoring, risk identification, and recommendation management. The first stage focuses on enhanced visualizations and trend-based monitoring within the Clinical Command Center (CCC) and Alerts Dashboard. The second stage introduces predictive AI models capable of identifying potential disease trajectories using anonymized patient data from partner hospitals. The third stage introduces AI-assisted recommendations and educational support functionalities.

The system is designed to support longitudinal patient monitoring while taking the patient's broader clinical context into account rather than focusing on a single medical specialty. The project currently remains mostly in the research phase, with potential market introduction foreseen approximately two years after project completion and subject to healthcare regulatory requirements and validation procedures.

The final demonstrator is planned as an integrated AI-supported remote monitoring and recommendation environment within the Well@Home platform.

The demonstrator includes enhanced visualization capabilities within the Clinical Command Center (CCC) and Alerts Dashboard, supporting healthcare professionals in identifying evolving patient conditions and trends approaching clinically relevant thresholds. Both step-based and slope-based trend visualizations are being explored to improve interpretation of longitudinal patient data.

The platform also integrates the Early Warning Score (EWS) as a measurement type within the existing measurement framework, including dashboard visualization and manual measurement workflows for healthcare professionals and patients.

The predictive AI layer focuses on identifying elevated patient risk for non-communicable diseases using anonymized patient data from partner hospitals. Predictions are based on International Disease Codes (IDC) and are planned to be displayed within patient profiles and dashboard environments.

The demonstrator also includes a patient tagging system based on questionnaire data and patient information. These tags are intended to support recommendation logic, educational article matching, and future AI-supported workflows.

The prescriptive component is based on a recommendation engine integrated into the Well@Home education module. The recommendation engine combines predictive outputs with

educational articles and rule-based clinical guidance to support personalized lifestyle recommendations. Educational articles can be grouped into assignable article sets. These sets can be matched to disease codes and assigned to patients as a single unit within the platform workflows. The recommendation engine uses these relationships to support AI-assisted recommendation and educational content selection.

All AI-generated recommendations and educational suggestions require validation by healthcare professionals before being shared with patients.

The demonstrator further emphasizes transparent AI integration, ensuring that AI-generated predictions and recommendations remain clearly distinguishable from clinically confirmed diagnoses.

The demonstrator is being developed as an integrated component of the Well@Home platform. Healthcare professionals access the demonstrator functionalities through existing platform environments, including the Clinical Command Center (CCC), Alerts Dashboard, patient profiles, measurement workflows, and education module.

Patients access assigned educational articles, measurements, and notifications through the existing Well@Home patient application.

The AI and recommendation functionalities are currently intended for controlled project usage, testing, and validation activities within the TREAT project environment.

The consortium aims to have all required framework components, integrations, and demonstrator functionalities in place by the end of the TREAT project in order to showcase the complete demonstrator workflow during the final TREAT review. This includes the end-to-end integration of visualization components, predictive AI workflows, recommendation support mechanisms, and educational content matching within the Well@Home platform environment.

Due to the delayed funding approval and later project start of the Belgian consortium compared to the overall international TREAT project timeline, part of the local development and refinement activities will continue beyond the formal end of the international TREAT project. While the required demonstrator components and technical framework are expected to be operational for the final project review, additional post-project work is expected to further fine-tune and validate the underlying AI models powering the predictive insights and recommendation functionalities.

9 TREAT Complete demonstrator

The TREAT Complete demonstrator is the project's integrated, cross-country demonstrator and serves as the final, ecosystem-level showcase of the TREAT project. Where the preceding demonstrators (UC1 to UC6) each present the solution of an individual consortium within its own clinical domain and platform, TREAT Complete deliberately does the opposite: it brings those individual building blocks together into a single, coherent care journey that spans multiple countries, consortium partners, and platforms.

Its purpose is to demonstrate the TREAT ecosystem as a whole, showing how independent applications, each historically operating within its own silo, can semantically interoperate to support one continuous patient journey. In doing so, the demonstrator brings together the four key innovations that the TREAT project set out to deliver, and shows them working in concert rather than in isolation:

- Integration of wearable technology: continuous capture of vital parameters and activity data through connected devices.
- Interoperability: secure, standards-based, cross-border data exchange between otherwise separate platforms.
- AI recommenders: early detection, trend analysis, and personalisation of the care journey based on real patient data.
- Engaging interfaces: professional clinical dashboards and patient-centred, conversational experiences.

To make this tangible, the demonstrator follows the fictional but realistic journey of a single patient, Arthur, from early risk detection through acute telemonitoring, into long-term lifestyle management and AI-supported coaching, and finally back into clinical decision-making. Arthur's story acts as the connective tissue that ties the individual consortium solutions into one narrative and makes the value of an interoperable ecosystem visible from end to end.

The demonstrator is built around two complementary goals. The first goal is to prove genuine interoperability: validating live, cross-border data exchange over the shared TREAT Interoperability Framework rather than through simulated or point-to-point connections. The second goal is to tell a coherent story: demonstrating a federated healthcare ecosystem in which diverse platforms, AI services, and wearables can dynamically plug into a seamless patient journey without re-engineering the underlying foundation. The essential characteristic being demonstrated is synergy, the idea that these innovations become substantially more powerful when orchestrated together than when used in isolation.

The final TREAT Complete demonstrator is an end-to-end, cross-country patient journey running on a shared demonstration environment, in which independent platforms exchange data live through the TREAT Interoperability Framework. It is designed to be shown as a single, closed-

loop scenario, while remaining modular enough that further consortium partners can take part in the journey by pushing data in, pulling data out, or contributing a parallel branch.

The scenario centres on Arthur, 54, living in Belgium, a father of two who runs a small logistics company and enjoys cycling, gardening, and cooking. Arthur has an undiagnosed underlying Type 2 Diabetes condition and, importantly, has sufficient historical medical data available in the ecosystem to enable AI-based pattern detection. His journey transitions from acute clinical follow-up into long-term lifestyle management, which is what allows the demonstrator to exercise the full breadth of the TREAT ecosystem.

The demonstrator is structured as a six-phase journey. Each phase is anchored to a specific consortium platform and highlights one or more of the four key innovations, while the transitions between phases are where interoperability is demonstrated most explicitly.

- Phase 1: Early Signal Detection (Belgium, Well@Home). The journey begins in the Well@Home platform. The Well@Home Smart Recommender Engine analyses Arthur's prior clinical history, vital-parameter trends, and risk indicators, and flags a potential underlying condition (Type 2 Diabetes). This represents clinical decision support, helping healthcare professionals identify patients who require structured follow-up. (Innovation: AI recommenders.)

- Phase 2: Acute Follow-Up via Telemonitoring (Belgium, Well@Home). A healthcare professional enrols Arthur in a Diabetes Care Path. Using connected devices, Arthur measures blood glucose, heart rate, blood pressure, and weight, and the data flows automatically into the platform. The care team monitors his status through the Clinical Command Center (CCC) and the Alerts Dashboard, enabling structured overview, risk stratification, and prioritised intervention. (Innovations: wearables, engaging interfaces.)

- Phase 3: Cross-Platform Data Flow (TREAT Interoperability Framework). As Arthur stabilises, he is enrolled into a MyViva Diabetes Plan. The relevant vital parameters and patient context collected in Well@Home are securely transferred to MyViva across borders via the TREAT Interoperability Framework, with no duplication or manual re-entry. This transition is the first explicit demonstration of standards-based, cross-border data exchange. (Innovation: interoperability.)

- Phase 4: Lifestyle Management (Canada, MyViva). The focus shifts to long-term lifestyle management. Arthur follows a structured diabetes plan in MyViva and completes journaling activities. The prior vital parameters received from Well@Home enrich his patient profile, combining clinical and behavioural insight in a single view. His profile is enriched further with wearable and activity data provided by Johan Sports (Netherlands), which is pushed into the journey over the same interoperability framework, adding an objective view of Arthur's daily activity to the clinical and self-reported picture. (Innovations: engaging interfaces, wearables.)

- Phase 5: AI-Powered Coaching (Netherlands, TU/e AI engine, and Canada, Yaro). MyViva sends Arthur's vital parameters and journaling data to the AI Recommender Engine developed by TU/e. The engine analyses trends and generates personalised

conversational themes and coaching prompts. These recommendations are delivered through Yaro, the virtual AR coach, which conducts a structured, engaging conversation with Arthur about his health journey. (Innovations: AI recommenders, engaging interfaces.)

- Phase 6: Closing the Loop (Belgium, Well@Home). Following the coaching conversation, a structured summary report is generated and transferred back to Well@Home through the TREAT Interoperability Framework. Healthcare professionals can review the behavioural insights and integrate them into clinical decision-making, thereby closing the care loop between lifestyle management and clinical care. (Innovation: interoperability.)

Arthur's data does not only serve the platforms that generate it. Because everything is exchanged over the shared framework in a standardised format, the same information can be made available to other consortium systems in parallel, each of which uses it in its own context. In Turkey, data from the journey is ingested into a dashboard and interpreted within an insurance setting, showing how the same interoperable data takes on additional meaning when it is given the right context. In Spain, data from the journey is consumed and analysed within a dedicated dashboarding system, offering a further analytical perspective on Arthur's evolving profile. These touchpoints illustrate the central message of the demonstrator: in a connected ecosystem, the same interoperable patient data can be surfaced to the right stakeholder, in the right context, to generate the specific insight each of them needs, whether a clinician, a lifestyle coach, an insurer, or an analytical service, without any party having to own or duplicate the full dataset.

Technically, the demonstrator runs on a shared TREAT demonstration environment. The interoperability backbone that connects the participating platforms is set up and hosted by BeWell Innovations, and is based on the TREAT Interoperability Framework using a message-based exchange (RabbitMQ) with a standardised clinical data format (FHIR). Each participating consortium member exposes its contribution through its own shared demo environment, which connects to this common backbone. As long as a partner adheres to the TREAT data format, it can, in principle, take part in the journey by pushing data in or pulling data out, without changes to the foundation.

The demonstrator brings together contributions from across the consortium, each partner connecting its own platform or service into Arthur's journey through the shared interoperability framework.

Partner (country)	***Contribution***
BeWell, Well@Home (Belgium)	Hosts the shared interoperability backbone; provides early detection through the Smart Recommender, acute telemonitoring via connected devices, and closes the care loop with clinical review.

MyViva (Canada)	Delivers long-term lifestyle management and journaling, and hosts the Yaro AR coach that delivers AI-driven coaching; contributes the structured summary back into the loop.
TU/e (Netherlands)	Provides the AI recommender engine and conversational logic that generate personalised coaching themes from Arthur's actual patient data.
Johan Sports (Netherlands)	Provides wearable and activity data into the journey over the interoperability framework, enriching Arthur's profile with objective daily-activity data.
Turkey	Ingests data from the journey into its dashboard, demonstrating how the same data is re-used interoperably and interpreted within an insurance context.
Spain	Consumes data from the journey to analyse and visualise it within its own dashboarding system.
Portugal	Ingests data from the journey to be analysed within the Integrated Care Plan, namely device metrics.

The TREAT Complete demonstrator is provided as a shared, cross-consortium demonstration environment rather than as a single product owned by one partner. The shared interoperability backbone that connects the participating platforms is set up and hosted by BeWell Innovations, and each participating consortium member makes its contribution available through its own shared demo environment connected to that backbone.

Access is intended for controlled project, demonstration, and validation purposes within the TREAT consortium. Because the demonstrator is built on standards-based interoperability, it is also designed to remain extensible: further consortium partners can connect to the journey by following the TREAT data format and pushing data in or pulling data out, allowing the demonstrator to continue to serve as a living proof of concept for the federated TREAT ecosystem.