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affecTive basEd iNtegrated carE for better Quality of Life: TeNDER Project

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Acronyms and Abbreviations

Acronym	Description
TeNDER	affecTive basEd iNtegrateD carE for better Quality of Life
WPx	Work Package
Tx.x	Task
Mx	Month (where x defines a project month e.g. M8)
EU	European Union
IoT	Internet of Things
IoHT	Internet of Healthcare Things
GP	General practitioner, primary care physician
QoL	Quality of Life
Pwd	Person with dementia
AD	Alzheimer's Disease
PD	Parkinson's Disease
CVD	Cardiovascular Disease
WHO	World Health Organization
NGOs	Non-governmental organizations
EHR	Electronic Health Records
OECD	Organisation for Economic Co-operation and Development
REST APIs	REST Application Programming Interface

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Executive Summary

TeNDER is a multi-sectoral project funded by Horizon 2020, the EU Framework Programme for Research and Innovation, developing an integrated care model to manage multi-morbidity in patients with neurodegenerative diseases and/or cardiovascular diseases. The TeNDER consortium is developing an integrated care ecosystem for assisting people with chronic diseases of Alzheimer's, Parkinson's and Cardiovascular Diseases through the use of affect based micro tools. These micro tools will be able to recognize the mood and habits of a person and thus adapt the system's probes to the person's needs via a multi-sensorial system and match with clinical (from Electronic Health Records EHRs) and clerical patient information, while preserving privacy, ethical principles, providing data protection and security, with the result of an increased quality of life for patients, their caregivers and health care professionals.

In order to achieve these general goals, TeNDER will perform 5 large-scale pilots (in 4 countries) in order to test services targeting patients, their caregivers and healthcare professionals. At each pilot setting (in Slovenia, Italy, Germany and Spain), patients will be monitored according to the use cases and scenarios defined. TeNDER's technical, legal and ethical experts ensure that all personal and health data is protected according to the General Data Protection Regulation (GDPR). This deliverable follows on D2.1, being its general goal to advance on user requirements collection and analysis, and base the services definition by technical partners. It is thus a deliverable that connects end users' results, quality approach and technical development.

D2.2 advances a preliminary analysis of the needs and gaps of Integrated Health Care Service Provision from the point of view of TeNDER use cases, linking them with the actual status of the countries participating in the pilots. TeNDER organizations have worked together on defining and validating the suite of TeNDER Service Provision and finally by designing and by administering questionnaire surveys or interviews involving end-users, health and social professionals from the 4 country clusters.

Finally, TeNDER end user organizations have also advanced on their common research methodology, aligning at the same time with WP6 and WP7. Biweekly Telcos have been held among end users' organizations in order to collaboratively define the present document. Services Provision flows have been described, together with survey items and interviews' templates for performing the analysis of service provision flows with patients, health professionals and caregivers.

1. Introduction

1.1 Purpose and Scope

The TeNDER project is creating an integrated and personalized ecosystem to assist people with chronic diseases such as Alzheimer's disease, Parkinson's disease and cardiovascular diseases, also involving comorbidities. Micro services will also be provided in the system to improve the users' quality of life.

These services will be usable through a web platform and a dedicated app with the aim to offer digital support to retrieve and manage their personal and health data, detected through a set-up of connected devices and sensors. Under these perspectives privacy will be preserved, monitoring the ethical principles, providing data protection and security, with the result of an increased quality of life for citizens using the TeNDER system (patients, caregivers or professionals).

This deliverable 2.2 provides in the first place country profiles of integrated health care status and features. A general description of the TeNDER ecosystem follows, focusing mainly on research questionnaires, research methodology and a template for performing the analysis of Service Provision flows, to be administered to patients, health professionals and caregivers. To sum up the structure of the document: section 2 details Integrated Health Care Service profiles; section 3 provides a general overview of the TeNDER Service Provision; chapter 4 provides a proper assessment methodology in order to administer the questionnaires that are included in the annexes.

2. Integrated Health Care Service profiles

According to the World Health Organization (WHO) framework, five strategies are comprised regarding the integration of care: creating an enabling environment; strengthening governance and accountability; reorienting the model of care; coordinating services within and across sectors; engaging and empowering people and communities. This expectation follows the WHO framework on integrated people-centered health services, that is depicted in the picture below (link: https://www.scirocco-project.eu/wp-content/uploads/2018/11/2018-10-24_FConf-S1-3-Nuri-Polanco-Integrated-Care-WHO-Perspective.pdf)

Framework on integrated people-centred health services: five strategies



© World Health Organization 2016

Figure 1: WHO framework for integrated care

The European Commission has defended a coherent with the previous position regarding the desirability of the integration of care and also the means to achieve it. One first step has been to advance on the tools to assess the integration of care, both through devoted papers and projects such as Scirocco¹, stating that "the transition to integrated care is a highly complex process in all aspects: design, implementation and assessment of integrated care", using as definition of integrated care the following: "Integrated care includes initiatives seeking to improve outcomes of care by overcoming issues of fragmentation through linkage or co-ordination of services of providers along the continuum of care" [1]. Typically the integration of care seeks improving the quality of life of patients and reducing costs, especially those related to the management of chronic conditions. With an increasingly growing population in Europe, cognitive impairments as well as heart diseases are a major social and health issue. According to the WHO in a 2018 report [2] dementia, including Alzheimer's disease, remains one of the biggest global public health challenges our generation is facing. In the same time, other reports from the same organization suggest that Cardiovascular disease (CVD) represented 31% of all global deaths in 2016, and it is deemed as the leading cause of

¹ See <https://www.scirocco-project.eu/>, 17th June 2020.

premature death (37% of all deaths under the age of 70) and disability in Europe and worldwide (WHO) [3].

Moreover, the number of people living with dementia worldwide in 2015 is estimated at 47 million, set to almost double by 2030 and is likely to rise to about 152 million by 2050. Cognitive impairment, however, is a disabling comorbidity that represents a major challenge for Healthcare Systems and it is frequent in people affected by other diseases such as Parkinson's with 1.2 million people affected in Europe [4]. People suffering from Parkinson's disease experience issues such as: 1) loss of judgment, 2) alterations in behaviour, 3) sudden mood changes and 4) difficulties in planning and organizing, which are symptoms far less known in comparison with the symptoms related to motion alteration. Alzheimer's, Parkinson's and Cardiovascular diseases, mainly found in senior people as multi-morbidities, are estimated to cost more than EUR 196 billion a year in the EU [5] and a trillion US dollars worldwide with forecast estimation double by 2030. Therefore, this considerable concern is moving public authorities (National Health Systems NHSs), policy makers, researchers and private businesses to join forces to develop holistic solutions to extend autonomy of people affected by these diseases while maintaining, or even improving, their Quality of Life (QoL).

Digital tools - such as those developed in the TeNDER project - are expected to be used in order to improve the integration of care all over the European Union and from the perspective of the European Union itself. Digital tools are expected to promote citizens' empowerment and person-centred care (as opposed to the prevalent disease-centred care). As Dr. Stain has posed, "integrated care is a concept centred around the needs of service users", being TeNDER's cocreation approach an optimal means to achieve these expected results [6]. HOPE position paper² on integrated care states that integrated care in Europe is moving, that further evidence is required and that in practice, after a comparative assessment of integrated care models in Europe, integrated care involves four dimensions:

- Provision of care closer to patients' home
- Use of ICT to support patients and professionals
- Involvement of social care and community care
- New roles and new skills for HC professionals

All these dimensions will be supported by the TeNDER system.

2.1 Italy

The Italian healthcare system is a de-centralized system, organized in 3 levels (national, regional and local): these 3 levels share planning and financing responsibilities. Moreover, the ministry of health has defined the Healthcare Network Monitoring System, an integrated system of healthcare information aimed at acquiring a timely knowledge of services offered by national facilities, monitoring out-patient specialists and pharmaceutical treatments, distributing medications and medicinal products, home care, rest and care homes for the elderly, emergency care, hospital pharmaceutical care, drug addiction care, psychiatric care to adults patients and healthcare provided at hospice facilities [7]. Public financing accounted for almost 76 % of total health spending in 2014 [8].

² Hope's position paper on Integrated Care, see http://hope.be/wp-content/uploads/2017/02/PP34_2017_POSITION-PAPER_HOPE-vision-on-Integrated-care.pdf, 17th June 2020.

2.1.1 Integrated Health Care Services Provision in Italy

The funding source of the Italian healthcare system is national and regional taxes. Citizens must purchase a ticket in order to have access to services within the National Health Service. The National Italian Healthcare System covers all citizens and legal foreign residents.

In Italy, primary healthcare (diagnosis, treatment and first level rehabilitation together with prevention, health promotion and education activities, family doctors and pediatricians, on-call services, pharmacies and home carers) are provided by the general practitioners, having contracts with the Italian national healthcare system [9].

As mentioned in Deliverable 2.1, a care system was set up in the framework of the National Plan for elderly people which includes social work centers (important for the social and health sector), Integrated home care services (a combination of integrated and coordinated health and social activities which seek to keep an elderly person at home as long as possible), day centers (semi-residential structure, within the public district, which hosts disabled elderly people for a short-term period) and nursing homes (residential structure, organized as small groups, “nuclei”, which provides healthcare, social care, and functional rehabilitation for people with disabilities). Services are provided by the regions having legislative powers over health and welfare. Nevertheless, home care services are financed entirely by local councils.

2.1.2 Identified gaps and prospective

In the last years there has been an increase in integrated home care for people over sixty-five years [10], due to the increase of the elderly population with disabilities. Furthermore, an important challenge of the Italian national system is to achieve budgetary goals (because it has high cost) without reducing provision of health services for patients [10]. The potential use of technologies in the context of personalized care may provide an important solution to these requests, improving the working conditions of Italian health professionals and the quality of life of patients as well.

2.2 Spain

The Health Care Service Provision in Spain reaches almost the entire population (over 99%), being based on public provision of health care services at a National level, that are implemented through the Regional authorities (Autonomous Communities) [12]. There has been approved a “Strategy for Addressing Chronicity in the National Health System (2012), that has derived in different models of “integrated” or “continuous” care for the different regions of Spain, being the integration of care particularly relevant for patients facing chronic conditions [13]. Additionally, there is a regional level document committing Madrid region with the integration of care [14].

The provision of integrated health care services in Spain is organized into two environments or levels of care: Primary Care and Specialized Care [15].

Primary Care provides the population with a series of basic services within an isochronous distance of 15 minutes from any place of residence. The first level of care is the Health Centres with a multidisciplinary team of administrative staff, family doctors, pediatricians, nurses, social workers, midwives and, in some cases, dentists, psychologists and physiotherapists. Due to its accessibility in the community, health promotion and disease prevention tasks are

paramount at this level. As a maximum expression of accessibility and equity of access, Primary Care is moved to the citizen's home when necessary.

Specialized Care is provided in specialty centers and hospitals, on an outpatient or inpatient basis. After the care process, the patient and his or her clinical history are returned to the Primary Care level which, having all the data from his or her health biography, guarantees the overall clinical and therapeutic vision.

2.2.1 Integrated Health Care Service Provision in Spain

Within this organization, the location of care resources basically responds to planning on delimited demographic demarcations, called Health Areas. These are established by each autonomous community taking into account factors of various kinds, but, above all, responding to the idea of proximity of services to users. The Health Areas are, in turn, subdivided into basic Health Areas that constitute the territorial framework of Primary Care, where health activities are carried out by health centers. Each area has a general hospital as a reference for Specialized Care. Some health services include intermediate organizational structures between the Health Area and the basic area.

Healthcare is one of the main instruments of income redistribution policies among Spanish citizens: each person contributes taxes according to his or her economic capacity and receives health services according to his or her health needs.

Healthcare for common illnesses and non-work-related accidents in Spain is a non-contributory benefit financed through taxes and included in the general financing of each autonomous community.

2.2.1 Identified Gaps and prospective

As a result of increased life expectancy and the prevalence of chronic diseases, the number of older people with disabilities has increased. This situation translates into the loss of walking, climbing and descending stairs, and more specifically, the difficulty of carrying out basic, instrumental and advanced activities of daily life. It is estimated that 19% of the population aged 65 and more have difficulties in carrying out daily activities; personal hygiene (17%) is the most frequent limitation, followed by getting dressed (14%) [16].

The high number of chronic diseases, the syndromes that configure them and the situations of incapacity generate an increase in the needs for use of the health system by the elderly population. This population is the one that generates the greatest socio-health demand: 50% of the professional time of the primary care physician, 70% of the geriatric-oriented physician and 62% of pharmaceutical expenditure [17].

In view of this need, there has been a growing demand for other more specialized services for the control and treatment of specific chronic pathologies, such as specialized associations, day centres, rehabilitation centres and assisted living facilities, among others.

2.3 Germany

Integrated care first started to develop in the German Healthcare system with the GKV-reform-law in 2000, especially with § 140 SGB V. In the German sector, the term “Integrated Care” is similar to the US-concept of “Managed Care” and thus includes forms of provision,

such as disease or case management. Furthermore, the concept aims to coordinate the utilization of healthcare services and thus, to improve quality of healthcare provision.

In the concept of Managed Care, the provision of healthcare services takes place with the patient being led through a network of service providers, considering aspects of quality and cost-efficiency of the service integration.

2.3.1 Integrated Health Care Service Provision in Germany

In Germany, integrated care is part of standard care provision, with the services generally orienting on the contracted scope of service. Thus, providers are allowed to offer services beyond the point of standard care, if it has been accepted by the Joint National Committee (gemeinsamer Bundesausschuss, G-BA).

However, as the Association of Statutory Health Insurance Physicians (Kassenärztliche Vereinigung) is not a contracting party of integrated care, the obligation to ensure mandatory service (Sicherstellungsauftrag) might be limited (§ 140 b SGB V) and thus, needs to be taken care of by partners of an IV-contract (integrated care contract) of the statutory health insurances.

As integrated care is an interdisciplinary subject, several professional disciplines, ranging from medicine to pharmaceuticals or rehabilitation and care, can participate in the service provision.

The insured person is free to participate in the integrated care of his/her statutory insurance company and has to be informed about contracts regarding integrated care, participating service providers and agreed standards of quality. Furthermore, a service provider is only allowed to use data, documented by the integrated care provision, if the insured person authorizes it, and the information is used for treatment. With the utilisation of this type of care provision, the insured person is being led through the healthcare system (§ 140 a SGB V).

Communication between service providers is standardized through networking and an agreement on a binding action framework. Therefore, communication is more transparent, allowing all involved sectors and disciplines to be informed about the healthcare provision of the insured. Furthermore, all contracting parties are obligated to ensure a qualitative, effective, sufficient, appropriate and economic care of the insured (§ 140 b SGB V).

Integrated care can be divided in indication specific and not indication specific integrated care. Indication specific integrated care relates to patients with special chronic diseases in need of intensive care. On the other hand, not indication specific integrated care represents a comprehensive and population-based care, even if it is not fully developed yet.

Moreover, integrated care can be differentiated in horizontal and vertical integrated care. Vertical integrated care deals with the integration of various service providers of various sectors, e.g. resident doctors, clinics or rehabilitation centres. This type includes all stages of provision and thus, constitutes the most frequent one.

The horizontal integrated care enables comprehensive and process-oriented care in one sector, e.g. integration of several doctors in private practice, outpatient rehabilitation centres or self-employed pharmacists.

Financing of the service provision is based on a common budget for respective insured persons. This means that contracted service obligations beyond the obligation to ensure mandatory service (Sicherstellungsauftrag) of the Association of Statutory Health Insurance Physicians (Kassenärztliche Vereinigung) is fulfilled by individual contracts. The regulation of the remuneration of integrated care is negotiated by the contracting parties (insurance companies and service providers). This leads to different IV contracts, depending on the individual health insurance party of the statutory health insurance.

All in all, the most important characteristic of integrated care is the fact that involved service providers are being reorganized and assembled with the aim to care for the insured with preferably few interfaces, and to reach throughout all stages and sectors. Therefore, system boundaries need to be overcome in order to prevent e.g. duplicated examinations or unnecessary hospitalisations, and integrate prevention, rehabilitation and care to the supply chain.

2.3.1 Identified Gaps and prospective

In Germany, no or only few evaluation(s) of the effectiveness of models for integrated care are present, as scientific monitoring is not mandatory for this, as it is part of standard care. Furthermore, there are no obligations for contracting parties to publish present results. Overall, there is a general lack of aims and outcomes and findings regarding efficiency of integrated care.

The few studies [17] conducted, e.g. by Medical Network 24 [18] or by IGES-Institute [19], mostly focus on the economic success of integrated care models only and not on e.g. general effects on healthcare provision or from what and how the economic success results.

Another problem is that insured persons are not familiar with new innovative types of care and therefore cannot classify them accordingly, due to lack of experience or knowledge.

Furthermore, participating in integrated care is, from a financial point of view, still not very profitable for the insured, as there is still no systematically acquired data regarding quality improvement of healthcare provision with integrated care.

The implementation of integrated care is also problematic and difficult, as conventional structures and professions are being established. This includes the heterogeneity of qualifications, various courses of education and graduations of non-medical health professionals in the German healthcare system. Thus, it is very difficult to scientifically evaluate the quality of healthcare provisions.

Moreover, extensive administrative expenses and delimitation rules regarding conventional contracts of healthcare provision are problematic.

2.4 Slovenia

In Slovenia the Integrated care is not yet organized as a single coordinated service, and services are provided as healthcare and social care. The services - components of Integrated care are regulated by Ministry of Labour, Family, Social Affairs and Equal Opportunities and Ministry of Health. There is an ongoing process to enable coordinated cooperation of social care, nursing and health care services in Slovenia.

Slovenia is in process of the reform of the long-term care and personal assistance system. The proposal of new legislation was in 2016, but is still in progress. Long-term support is available to 4 % of the Slovenian population, that is about 80.000 people. Among those, 1% gets the care from the institutions (20.000 people), 3% from carers (60.000 people), according to SHARE research³. Slovenia finances long-term care on average with 201 EUR per person (EU 471 per person) [21]. This is why there are several social care and healthcare programmes co-financed by the ministries and executed by NGOs in communities.

2.4.1 Integrated Health Care Service Provision in Slovenia

As described in Deliverable 2.1, in Slovenia there are home care services (home care and mobile services), social services, institutionalized care (day care centres, nursing homes, nursing hospitals) and NGOs that provide companionships, telephone helplines, consultations and trainings for carers. Services are provided by:

- social work centres (public social welfare institutions established in the Social Welfare Act) and centres for social work (62 centres with territorial jurisdiction by the territories of administrative units, differing in size or number of employees);
- home-care services organized by local community (Ministry of Labour, Family, Social Affairs and Equal Opportunities controls these services by granting concessions or permissions for work. Every local community must organize home care services and must provide for at least 50% subsidy. Because municipalities pay a different share, the price paid by users can vary. Nevertheless, a lot of persons in need for homecare services remain without them as local communities are unable to provide funding for the required level of services;
- patronage services provided by nurses (prescribed by general practitioners (GP));
- GP visits at home and physiotherapy at home (prescribed by GPs);
- homes for elderly and day care-centres (Ministry of Labour, Family, Social Affairs and Equal Opportunities regulates this institutional care services by granting a concession to public or private organizations. The care services are subsidized by the state and Health insurance institute of Slovenia, depending on the health state of the individual);
- night-care services (for persons with dementia);
- palliative care centres;
- institutional care in public hospitals (temporary or in late disease stage);
- NGOs providing social care and healthcare services.

2.4.1 Identified Gaps and prospective

Rights to services and benefits are defined in different legal acts. Potential recipients must seek help in different institutions that are not connected to a common platform. Thus, most people are left out and don't get the benefit of the services. There are health inequalities

³ <http://www.share-slovenija.si/strani/SHARE>, 17th June, 2020.

between individual population groups and between regions in Slovenia. The most problems have patients living at home.

Older adults with chronic diseases live at home, either alone or with their family. There is a lot of older couples where one is in need of care and the other is the carer. Many obstacles are faced regarding safety and wellbeing as one that needs care is left home alone at least once per day. Older adults need assistance for physical independence, stimulation to get outside with enhanced safety. They also need help to maintain functional knowledge of their personal details and to retrieve information about daily activities.

There is a process of the introduction of new technologies. In Resolution of the National Health Care Plan 2015-2025, it was recognized that a complex system such as healthcare requires the effective use of information and communication technologies. In this regard, the modernization of processes and their IT support will need to be accelerated, as the eHealth project has not yet produced the appropriate results.

Financial access to health services is most influenced by direct out-of-pocket expenditures. They can represent a financial burden for households because they are unpredictable, unlimitedly high, and most burdensome for chronic patients and the elderly.

There is still limited health care for those who have multiple health, social and other problems. Regional differences in the treatment of persons with dementia were recognized in the Dementia management strategy in Slovenia until 2020. There are too long queues for some health services and treatments due to lack of specialist support and insufficient personnel coverage in homes for elderly. According to the OECD (Health at Glance 2014), in 2012, Slovenia had 2.5 doctors per thousand populations (EU-28 average was 3.4⁴). That is why more information about the patient is needed to speed up the process of the diagnosis and treatment follow-ups also by interconnection between healthcare and social care sectors. The need to provide personalized information, social support and company with enhanced physical activity, or health monitoring and perceived safety is unfulfilled.

⁴ https://ec.europa.eu/health/sites/health/files/state/docs/health_glance_2014_exs_en.pdf

3. Suite of TeNDER Service Provision

3.1 Initial Architecture Description

The TeNDER System architecture is featured by a modular structure with multiple levels of functionality aiming to provide several different types of services, which we will describe more in detail afterwards. As shown below in figure 2, three main layers have been designed in order to provide the TeNDER services which will be presented to end users through different dedicated interfaces.

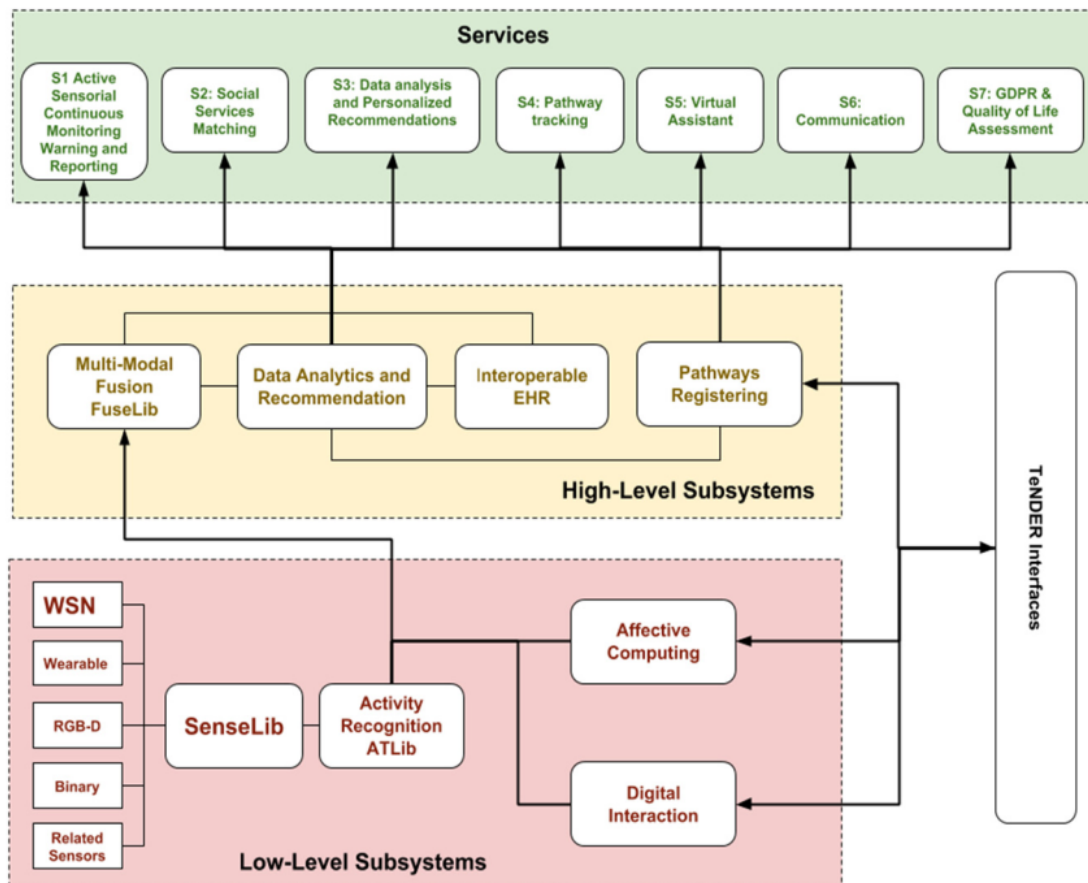


Figure 2: TeNDER Initial Architecture

There are at least two or more databases of different nature (relational or non-relational) for the storage of sensor, clinical and clerical patient data.

Each element works independently and interoperates with other modules through interfaces. By breaking down the structure, we have six different entity types as described in the image below, namely: clients, service REST APIs, services server, sensor server, persistence REST APIs, and data repositories.

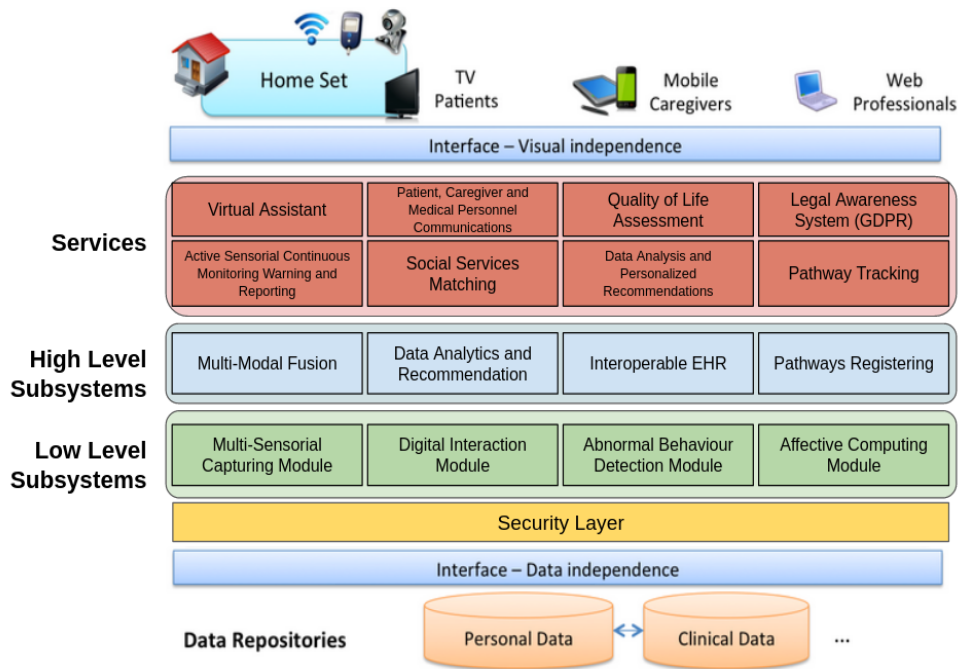


Figure 3: Technical Architecture Overview

3.1.2 Architecture layers description

As previously mentioned, TeNDER is divided into 3 core layers that are retrieved and presented through several interfaces. These modules are respectively named as Low-Level Subsystems, High-Level Subsystems and Services layers. Both, the services and the high-level subsystems are going to run on TeNDER’s central infrastructure and the low-level subsystems are going to run on local machines at patients’ sites (e.g. homes, daycare centres, hospitals). This approach serves to ensure the scalability of the system and to allow the integration of future nodes.

Low-level Subsystems: First layer regarding the “Data preparation” modules that will be used to ensure reliable and local raw data acquisition, storage and process, and finally to anonymize all signals captured by the patients’ devices. The Low Level Subsystem is composed of the following modules:

- *Multi-Sensorial Capturing module.*
Core subsystem that enables to track patient variables and ability dependencies services, related functionality that track and register specific health characteristics, from direct health situation information to periodical test results and feedback from professionals. Subsystem core functionalities are: 1. Enable users to choose which health characteristics to track and 2. Provide an efficient feedback mechanism that, along with user activity recognition and, through multimodal fusion, allow for the extraction of valuable conclusions regarding health status;
- *Affective Computing module.*
This module applies advanced deep learning and Computer Vision techniques to extract relevant features (i.e. general, facial, speech or behavioral) that can allow to estimate the expression and mood of patients. This information is extracted by using

the smartphone devices and will be used as input to up-level services that will support the patient;

- *Digital Interaction Module*

With the objective of having a personalized platform that can adapt its behavior to the patients' condition and interaction with the TeNDER platform and its services, TeNDER will design and develop an interaction tracking system. This module analyses the patients' access to the different interfaces and their behavior when using the platform in any of the interfaces. This digital behavior analysis will feed the platform to identify personalized recommendations and help the user (patient, caregiver, social carer, professional), by analyzing her/his knowledgeability on her/his condition and the treatment or processes that need to be followed;

- *Abnormal Behavior Detection module*

This subsystem analyzing sensing information to identify behavior and inform any interested party (professionals, formal/informal caregivers) about the patient situation. Exploiting intelligent capabilities of an indoors activity recognition methodology, employing ambient and depth sensors, environmental sensors and mobile based sensors, this core subsystem provides the TeNDER ecosystem with the capability of assessing on the real deviations from the expected daily behavior of the person being monitored, thus identifying their abnormal behaviors;

High-level Subsystem: The data has to undergo the following processes: acquisition, data anonymization, activity recognition, data aggregation, data enrichments. Once the data is gathered, preprocessed and some initial events are detected, data will be sent and aggregated in the cloud and enhanced with the EHR in order to provide verified medical information to the output service. The High Level Subsystem is composed of the following modules:

- *Multi-Modal Fusion.*

This subsystem utilizes over state-of-the-art Deep Learning techniques and provides input to the Data Analytics, Pathway registering and the Electronic Health Record. The module receives information from the low-level subsystems and provides information regarding abnormal behavior patterns of patients, emotional status, and sends notifications and recommendations to the users regarding training material relevant to the status of their respective primary conditions.

- *Data Analytics and Recommendation.*

This subsystem uses input from: the Multimodal Fusion subsystem; information residing in external repositories related to historical data; patient profile and interaction via interfaces and pathway registry. Its main focus is the customization of services and its functionalities.

- *Interoperable EHR.*

On the basis of existing Electronic Health Record systems, this module provides the necessary conditions for data exchange, according to the European regulation, consisting of the database to store the medical profile that extends the available information from physical, medical and behavioural activity.

With this subsystem aiming at managing and organising patient information that is provided by a series of different low-level subsystems, HL7 FHIR (hl7.org/fhir) has

been chosen as the standard specification for data exchange. FHIR is a next generation standards framework created by HL7, and stands for “Fast Healthcare Interoperability Resources”, leveraging the latest web standards and applying a tight focus on implementation. FHIR solutions are built from a set of modular components called “Resources” and can be easily assembled into working systems that solve real-world clinical and administrative problems, being suitable for the use in a wide variety of contexts, such as mobile phone apps, cloud communications, EHR-based data sharing, server communication in large institutional healthcare providers, and much more.

In order to achieve these goals, an instance of HAPI FHIR Server (<https://hapifhir.io/>), an open-source and complete implementation of the HL7 FHIR standard for healthcare interoperability in Java, will be integrated. HAPI has been designed to provide a flexible way of adding FHIR capability to applications, allowing different types of clients to connect to this server (cf. figure below; link: from <https://hapifhir.io/>).

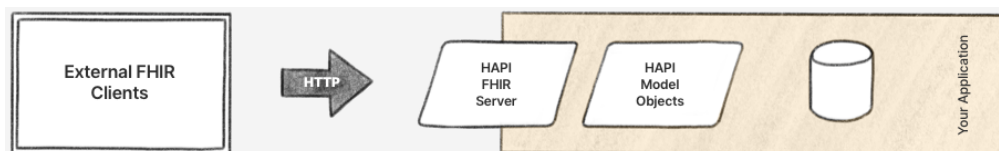


Figure 4: EHR architecture regarding HAPI FHIR implementation

The HAPI Server’s implementation of the FHIR standard provides an HTTP API to perform CRUD (create, read, update and delete) operations on the database, supporting different deployment schemes and relational databases. Initial tests are being done with HAPI’s R4 version (since the latest is branded as unstable) and PostgreSQL v12.0 relational database (but others can be used, maintaining the structural integrity equal to the guidelines and examples provided in their documentation). The server has modules developed by the HAPI community that implement an assortment of functionalities and allow users to interact with the server with relative ease, which will support the other HLS.

- *Pathway Registering.*

This module aims to support healthcare professionals accessing information regarding the patient’s health record. This subsystem tracks historical data related to the patient’s visits to doctors and hospitals and also collaborates with the Low-level Subsystems in order to collect information about the patient’s status and indoor movement patterns and trajectories. Also, this module collects specific information coming from a Virtual Assistant and other LLS submodules in order to provide secure, quick and easy data access regarding the patient’s record. The TeNDER platform will provide authorization and authentication mechanisms to the users, assuring that each healthcare professional should have access only to her/his patient’s data. To provide a high level of security, TeNDER evaluates open-source implementations like Keycloak server which is a state-of-the-art open-source Identity and Access Management solution aimed to accommodate modern applications and services. TeNDER’s user management service will provide a single-sign-on point for all services based on OpenID Connect, OAuth 2.0 and SAML. Once logged-in to the platform, users do not have to login again in order to access a different application. This means

that the healthcare professional is going to be authorized once on the logged-in process in the platform and the Pathway registering module will provide access to information that is related only to his/her patients. Furthermore, all the exchanged data between the health-care professionals and the platform are going to use encrypted connections (ex. HTTPS). In order to achieve this, Pathway Registering will provide Restful APIs for all entities within TeNDER and a subset of them are going to be exposed through the secured TeNDER's interfaces.

- *Virtual Assistant.*

This module employs TeNDER interfaces, inputs and signals detected by sensors and processed in the Low-Level subsystem, with the view to extract relevant information about the status of the patient's emotional and health condition. It is linked to the recommendation module in order to provide vocal recommendations as well as to the Pathway Registering module tracking events on the patient.

Under this assumption, the Virtual Assistant module is composed of two sub-modules, namely voice recognition module and Assistant module, as described briefly below:

- Voice Detection sub-Module receives input from the audio stream in real-time from the microphone located in a decreed scenario and performs a sound recognition;
- Assistant sub-Module provides vocal recommendations to the patient, through querying database at regular intervals to determine the presence of new reminders, then schedule an event at set times and, through the text to speech functionality, formulates and synthesizes the phrase that will be played through the speaker connected to the computer which is located in the environment of the patient.

Services: The third layer of TeNDER links the final clusters of TeNDER services designed and conceived to tackle all the main variables from clinical, social and quotidian perspective, that daily affect patients with the considered diseases, in order to improve their QoL and better involve and support HealthCare actors, professional caregivers, carers and informal caregivers, and other professionals. The TeNDER services are described in detail in the section below.

All of the services will be exposed and accessible for all end-users by dedicated platform and mobile application means (a first version of the TeNDER Platform is expected for M22 in the framework of D5.4), by means developing proper and tailored user interfaces based on the gathered and assessed user requirements and scenarios described in D2.1, D2.2 and D2.3 (forecasted).

3.2 Suite of TeNDER Service

3.2.1 Users and Key Features of TeNDER

TeNDER services development and provision will focus on several technical aspects for better coping with the patient needs, as well as to support professionals in their daily work.

Therefore, the identified macro-category end-user groups are to fall into the category of dementia patients which falling in the category of person with dementia (AD), patient with cardiovascular disease (CVD), patient with Parkinson disease (PD) and end-users such as

carers and informal caregivers, formal caregivers, health professionals and other related professionals.

In the table below, for each identified category we will list its specific type of end-users as decreed in the D2.1.

Table 1: End-Users category

PRIMARY END-USERS	SECONDARY END-USERS			
Patient	Carers and Informal Caregivers	Formal Caregivers	Health and social Professionals	Other Professionals
<ul style="list-style-type: none"> - AD - CVD - PD 	<ul style="list-style-type: none"> - Family - friends - volunteers 	<ul style="list-style-type: none"> - day-care center workers - home-care providers - residential-care - non-residential care 	<ul style="list-style-type: none"> - general practitioner - nurses - psychotherapist - clinical neurologist - geriatrics - pharmacologist - psychiatrist - physician - radiologist - speech therapist - cardiologist - music therapist - occupational therapist - physiotherapist - social workers - nurse assistant - psychologist - rehabilitator 	<ul style="list-style-type: none"> - movement scientist - work instructor - animator - administrative

The TeNDER services work by using all information generated through the TeNDER ecosystem and headed by the central decision system, in order to ensure services provision, as depicted in Figure 4 below.

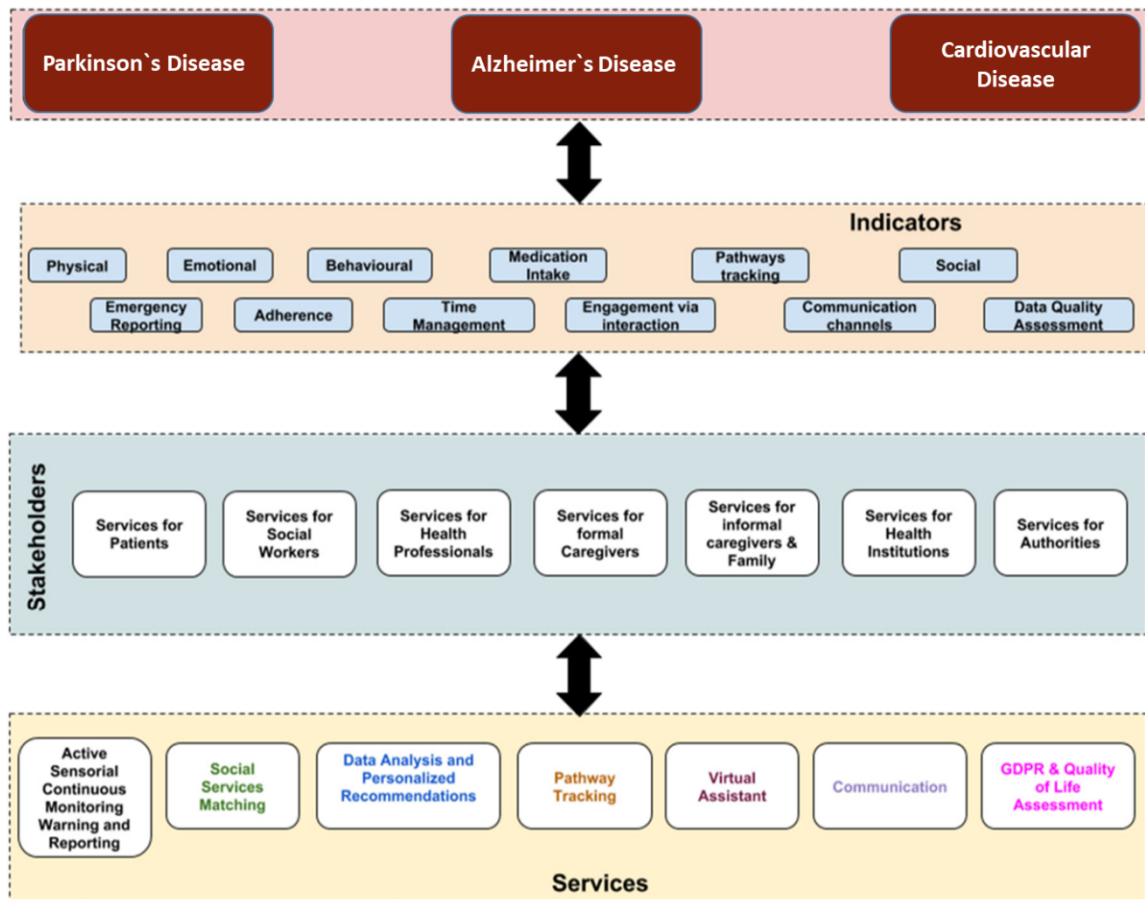


Figure 5: TeNDER Services and Stakeholders

Under this perspective, all the TeNDER services are flexible and enable cost-effective personalization. The modular structure is for instance the precondition for customizable services that can target both, general variables for all the diseases, as well as specific disease needs. In terms of user experiences, all services ensure a high standard of accessibility and usability, provisioning appropriate visual interfaces, by involving directly end-users in the co-design and iterative validation of the services provision ecosystem.

3.2.2 Service 1: Active Sensorial Continuous Monitoring, Warning and Reporting

This service will take advantage of the use of multi-sensorial infrastructure to provide dedicated services to patients, within the following category of micro-services:

- **HEALTH TRACKING SERVICE:** This service will offer the opportunity to the patients to monitor their biological and behavioral variables, such as blood pressure, weight, reaction to stimulus, social behavior (among others). The service will be in charge of capturing relevant data from the patient and his/her environment to detect normal and abnormal situations;
- **EMOTIONAL/AFFECTIVE DETECTION SERVICE:** This service will be oriented to primary end-users. It intends to detect the patients' moods, in order to support their

status and enabling services that might help the patients in case of negative feelings (i.e. sadness, depression-like status);

- **WARNING AND REPORTING SERVICE:** This service will be in charge of controlling the patient variables and report any special/abnormal event to the adequate stakeholder (caregiver, informal caregiver and family). According to the type of event, the relevance and the action required will be defined (i.e. to call emergency services).

Table 2: Service 1

Service 1	Description
Main Functionalities	Main functionalities provided: <ul style="list-style-type: none"> - Health Tracking; - Emotional/Affective detection; - Warning/Reporting Services.
Interfaces Exposed (output)	TeNDER services Rest Endpoint, Front End applications.
Interfaces Requested (input)	TeNDER sensors signal, LSS module inputs, HLS module inputs.

3.2.3 Service 2: Social Services Matching

This service is mainly devoted to bringing the social supply to the patients, by integrating nutrition and non-medical assistance functionalities in the daily routines of the patients in addition to medication intake. Its system works locally through devices that are monitoring the patient's status and enabling local carers to access and make decisions/provide support services by means of the dedicated visual interface on the TeNDER Platform.

Moreover, patients can select/obtain services and type of assistance from a list available locally or have information about the type of assistance provided or available. They can follow their own status and wellbeing, getting suggestions/instructions about nutrition or exercise. Caregivers can use monitoring data and user requirement information to analyze the situation and start/adjust the level of support and select adequately trained staff to provide assistance. Feedback from monitoring or change in available services may lead to a modification of the level of support.

Medical information (from other subsystems) may also assist to set the adequate level and combination of support services.

The services will be provided to users, carers (formal or informal), family and social workers (and institutions).

Table 3: Service 2

Service 2	Description
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Main Functionalities	Main functionalities provided: - remote social supply of services and advice; - monitoring of patient status.
Interfaces Exposed (output)	Front End applications.
Interfaces Requested (input)	Available TeNDER sensors, Recommendation System, Monitoring, Medical Information from other subsystems.

3.2.4 Service 3: Data Analysis and Personalized Recommendations

Professional oriented service to offer value to the patient based on the data gathered through different services and through the analysis of the interaction amongst all of the involved parties. The objective will be to generate knowledge by a continuous data analysis focused on all the patient's information, identifying patterns and models of best practices incoordination, treatment, offered recommendations, gamification integration, interaction design, among others. Knowledge will be offered to medical and social professionals while using platform services with information on alternatives used by other professionals on the platform regarding the actions they are making.

FOLLOW-UP PROTOCOLS: Chronic conditions require follow up protocols in order to understand their evolution and the patient's specific needs at all stages. This service will automatically recommend forms and questionnaires to identify patients' status, while recommendations will also be targeted to caregivers that take care of patients on a daily basis. The service will include different protocols depending on the disease of the patient and will be opened to new protocols when future targets are incorporated into the platform.

Table 4: Service 3

Service 3	Description
Main Functionalities	Main functionalities provided: - continuous data analysis of patients; - remote recommendations and advices; - follow-up protocols.
Interfaces Exposed (output)	TeNDER services Rest Endpoint, Front End applications
Interfaces Requested (input)	Available TeNDER sensors, Recommendation System.

3.2.5 Service 4: Pathway Tracking

This service employs all data flow across the system and will analyze the patients' non-clinical activity, providing all stakeholders with relevant information to optimize time management in the patients' healthcare pathway.

- **CLERICAL PATHWAY:** Using all the available information, this service will register the entire repository of events associated with healthcare attention to the patient. The ambition of this service is that the data of the patients' clerical activities (i.e. visit to primary health care, visits to the neurologist, GPs, among others) could be available ubiquitously to all health-related institutions if authorized by patients themselves.
- **QUALITY OF DATA PROVIDED:** This service will enable TeNDER to improve continuously in the manner that information is retrieved and presented to health professionals. Therefore, this service will define the mechanisms to have a continuous feedback on the quality (usefulness) of recommendations, graphs, evolutions and inferences to attain the optimal efficiency of the system.

Table 5: Service 4

Service 4	Description
Functionalities	Main functionalities provided: <ul style="list-style-type: none"> - Clerical pathway; - Remote reporting of data of the patient clerical activities; - continuous feedback by professionals.
Interfaces Exposed (output)	TeNDER services Rest Endpoint, Front End applications.
Interfaces Requested (input)	TeNDER sensors signal, LSS module inputs, HLS module inputs.

3.2.6 Service 5: Virtual Assistant

The Virtual assistant cluster will provide the following two services:

- **MONITORING SERVICE:** Based on the sound picked up by the software and with the matching of other TeNDER suite service's signal, the Virtual Assistant will be able to monitor the status of the patient, activate certain services such as "calling" (send a push notification to the mobile app) the professional or a carer or activating other services offered by the platform based on the settings set by the users. The Monitoring service will also be equipped with time slot programming so that users can pre-set the monitoring period according to their needs and preferences.
- **REMINDER SERVICE:** Thanks to the speaker that the Virtual Assistant will be equipped with, it will be possible to provide general information about appointments or medication intake. There will be two macro categories of reminders, i.e. medication administration and medical appointment. Its interface will allow the user to pre-set standard voice reminders. This part of the service will be more addressed to the category of the secondary end-users, making it possible to set reminder times and generate a voice reminder through the interface of smartphones and tablets.

Table 6: Service 5

Service 5	Description
Main Functionalities	Main functionalities provided: <ul style="list-style-type: none"> - Monitoring services; - Reminder services.
Interfaces Exposed (output)	TeNDER services Rest Endpoint, Front End applications.
Interfaces Requested (input)	Microphone signal, LSS module inputs, HLS module inputs.

3.2.7 Service 6: Patient, Caregiver and Medical Personnel Communications

Service to offer social communication among users of the Platform at different privacy levels and with different objectives:

- **CARE SUPPORT:** Communication among family members, carers, caregivers and patients to reduce patient loneliness and to offer personal services to the patient.
- **SOCIAL INTERACTION:** Among patients (e. g. with similar situations) to motivate patients to socialise;
- **PROFESSIONAL CARE SUPPORT:** Communication between professionals and patients, also with caregivers and carers, if authorized by the patients;
- **COORDINATION:** Foster coordination among health and social professionals.
- **SHARE KNOWLEDGE:** Communication among professionals to share treatment knowledge and best practices;

Table 7: Service 6

Cluster 6	Description
Main Functionalities	Main functionalities provided: <ul style="list-style-type: none"> - online communications space; - shared Information space.
Interfaces Exposed (output)	Rest Endpoint, Pub/Sub, Notification via Pub/sub, Front End applications.
Interfaces Requested (input)	TeNDER front-end layers.

3.2.8 Service 7: GDPR & Quality of Life Assessment

This service will be in charge of certifying and guaranteeing that data shared among TeNDER actors will be GDPR compliant. This service will allow users to know and measure the impact of their communications via TeNDER channels. Additionally, this service will allow to match

questionnaires related to QoL in an interactive manner by using interface dynamic tools and serious games.

Table 8: Service 7

Service 7	Description
Main Functionalities	Main functionalities provided: <ul style="list-style-type: none">- online administration of questionnaires;- data sharing compliance
Interfaces Exposed (output)	Rest Endpoint, Pub/Sub, Notification via Pub/sub, Front End applications.
Interfaces Requested (input)	TeNDER front-end layers.

4. Assessment methodology

Requirements identified in D2.1 are to be further assessed using TeNDER common co-design and research methodology. Previous requirements identified were based on the academic literature, expert knowledge and previous projects' results. Next steps will involve the TeNDER consortium to iteratively validate requirements with real end users through dedicated surveys and interviews. Due to the Covid-19 situation, TeNDER end users' organizations had to delay the starting date of the field work with end users as it was previously planned in Deliverable 2.1. Confinement made it challenging to implement the field work, for all of the involved organizations in the TeNDER project. Health care provider organizations such as SKBA or SERMAS were not legally allowed to contact patients directly according to their signed informed consents, being thus required to wait until health care professionals were back to their routine duties after being devoted to fighting Covid-19 through their health care services. At the time of writing this deliverable, June 2020, gradual de-escalation is in place, allowing to forecast, if this positive evolution continues, that the TeNDER consortium will put into place contingency measures such as contacting potential participants by post, or reaching them through other means such as through the profile of end users' social media and inviting them to fill in the questionnaires, that will be fully anonymized. User requirements will thus be further validated and defined and will support the definition of the overall TeNDER architecture. Furthermore, throughout this phase, core developments of independent components of TeNDER setups will take place.

4.1 Assessment objectives

TeNDER consortium has worked to define in detail the planning of the assessment in real-world living environments of patients, their caregivers and care professionals, and define scenarios for project pilots. TeNDER co-creation process will bring together the teams from different sectors of research health and social care, that will be involved in TeNDER iterative testing. For primary end-users (persons/patients) some technologies are readily available on the market, but often they are lacking end-users' requirements and usability feedback when being developed. The objective of this task is to provide tools to collect the insights from participants' views for the system specification taking into account the defined pilot description, being further developed in the next upcoming D2.3, D6.1 in D7.1.

To carry out the study of the end-users, it is required to design a cross-sectional descriptive observational study that explores their needs and acceptability through questionnaires and interviews. In this exploratory phase we will provide basic description that will be used for the design of the study that includes pilots in the second phase of the Project. Participants and methodological approach for co-creation process are described in Deliverable 2.1, Chapter 4. The criteria for recruitment of the participants in piloting will be followed as described in Deliverable 1.1, Chapter 2 (see also Deliverable 6.1). The report on user needs and gaps will be presented in the Deliverable 2.3 in M12.

The participants will be recruited by the researchers in each of the 5 participating countries that will carry out piloting. The researchers will explain that the participation is voluntarily to all persons that meet the selection criteria until the necessary sample size is reached. The sample size for each country in this phase is at least 20 patients, 20 carers/caregivers, and 10 participants from professional group in surveys and at least 9 interviews including users from patients, carers/caregivers and professionals, as described in Deliverable 2.1, chapter 4.

Two ways of data collection are envisaged based on the situation that is possible in each country, taking into account the constantly changing Covid-19 situation.

4.2. Questionnaires

Questionnaires will be offered in two ways:

1. In case of collecting feedbacks with questionnaires by post: person will be contacted by phone/personally and a brief explanation of the project will be given; if agreed, the questionnaire (Annex 1) will be sent by post with stamped envelope inside and request to send back the filled questionnaire or asked to be filled, with offering assistance by the researcher that recruits the person. When collected, the questionnaire will be treated anonymously (in case collecting by post, divided from the envelope). Only the participants that will meet criteria described below will be included in the descriptive analysis.
2. In case of web-based feedback: the candidates will be offered to access the link for filling in the anonymous questionnaire if they meet following criteria bellow.

General criteria for collecting the data in the exploratory phase:

a) patients:

- Understanding local language.
- Acceptance to participate themselves
- Having classified one of the following:
 - Mild cognitive impairment
 - Dementia or Alzheimer's Disease
 - Parkinson's Disease
 - Cardiovascular Disease

b) caregivers:

- To live with and/or take care of a relative (or other close relationship) affected by Parkinson's disease or Alzheimer's disease or/and other dementia or cardiovascular diseases.
- To be employed by a private or public entity or directly by the patients to provide direct care and thus support daily activities of the person.

c) professionals:

- To be qualified and working in an area specialized in the care of Parkinson's, Alzheimer's or/and dementia and cardiovascular diseases (including general practitioners, nurses, social workers and others, as described in Deliverable 2.1)

4.2. Interviews

The interview methodology allows to establish a closer relationship with the participants. Thus, we can collect the opinion of several persons, identify behaviours, concerns and disagreements. Interviews will be conducted with patients, caregivers (professional/family) and health professionals. Regarding the COVID-19 situation, we will provide interviews by telematics (web videoconferencing tools) and if restrictions will allow, in some countries, also

F2F (face-to-face). The language usage, nonverbal communication and ethical considerations as described in Deliverable 1.1 and Deliverable 2.1, will be taken into account.

The participation will be voluntary based and the participant will be informed that he or she can choose to withdraw from the interview anytime, can choose not to answer any question, and decide that his or her information will not be included in the analysis anytime. Further, the participant will be informed about his/her participation. He/She will have the appointment with the researcher and first of all will be welcomed and thanked for participating. Afterwards, he/she will sign the informed consents (face to face) or be recorded to agree (telematics) after being given all the appropriate explanations about the development of the interview. Similarly, the participant will be informed that audio recording can be made of the interview to facilitate the transcription of the data obtained and its subsequent analysis; after the transcription the recordings will be destroyed. Once everything is clear, the interview will begin. If the person agrees (written for face-to face, and recorded for telematics), he or she will be summoned for the interview (face to face or telematics, depending on how the situation with Covid-19 is presented and the deadlines we set).

The interview will be divided into general topics (Annex 2):

- opening: giving a brief introduction of TeNDER and explanation;
- warming-up: participants introduce themselves, answering some questions about themselves that are relevant for the subject in discussion;
- focused questions: a transition between the previous very general exchanges and increasingly specific questions and discussion of the issues to be covered will occur;
- closing: researcher's role is to summarize and recapping and eventually clarify remaining issues.

4.3 Data collection

Data will be collected through a specific questionnaire and interview for each population profile: patients, caregivers and socio / health professionals (Annex 1 and 2).

- ✓ Patients:
 - Socio-demographic variables: sex, age group, and educational level.
 - Housing characteristics: type of housing, presence of elevator and rural or urban area.
 - Care: type of caregiver, time of care and cohabitation.
 - Chronic illness: type (AD, PD or CVD) and degree (mild, moderate or advanced).
 - Smart monitoring tools: previous experiences, needs and acceptability.
- ✓ Caregivers/Career:
 - Socio-demographic variables: sex, age group and educational level.
 - Chronic illness of the person cared for: type (AD, PD or CVD) and degree (mild, moderate or advanced).
 - Intelligent monitoring tools: previous experiences, needs and acceptability.
- ✓ Professional:
 - Socio-demographic variables: sex, age group and profession.
 - Intelligent monitoring tools: previous experiences, needs and acceptability.

4.3 Roadmap and time plan

- M1-M6: First version requirements based on previous project knowledge, First User stories development
- M7-M12: Validation with end users of requirements through surveys

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ANNEX 1 QUESTIONNAIRES

Questionnaire - Patients

The European project „TeNDER“(affective basEd iNtegrated carE for better Quality of Life) is developing an integrated support ICT based system promoting integrated care for patients with Dementia, Parkinson’s disease and/or cardiovascular diseases. By combining user-friendly technologies and substantial research experience, TeNDER will help address the need to further integrate health and social care, empowering patients and involving their care ecosystem in their TeNDER care support system. An intelligent monitoring-system is a technologically enhanced environment, which aims at improving the patient’s care, empowerment and quality of life. With the use of different technologies (sensors, cameras, also using artificial intelligence), the measurement of health data and general data on activity, movement or emotional status of the patient will be enabled. Further, an analysis of the data allows the system to make decisions regarding necessary actions to help improving the self-management of the chronic diseases involved, or to promote the involvement of their care ecosystem by sending data to their selected caregivers, family members and/or care professionals.

The objective of this questionnaire is to better understand your preferences regarding the technology being developed for this project. All your data will be stored and analyzed anonymously and will be used only for the purpose of developing the TeNDER tool to make it as useful as possible. There are no right or wrong answers, every opinion is valid and very valuable to us. Please feel free to respond.

Demographic data	
Gender:	<input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Diverse
Age	<input type="checkbox"/> ≤ 59 years <input type="checkbox"/> 60-65 years <input type="checkbox"/> 66-70 years <input type="checkbox"/> 71-75 years <input type="checkbox"/> 76-80 years <input type="checkbox"/> 81 years ≤

Education (completed educational level achieved):	<input type="checkbox"/> no formal education <input type="checkbox"/> primary school <input type="checkbox"/> secondary school <input type="checkbox"/> vocational training <input type="checkbox"/> University (master degree or higher level) Other (please specify)...
Living Environment	
Most of the time, I live in ...	<input type="checkbox"/> a house <input type="checkbox"/> an apartment or a flat <input type="checkbox"/> A residence in internal regime <input type="checkbox"/> other (please specify)...
I spend part of the day in	<input type="checkbox"/> day care center <input type="checkbox"/> rehabilitation center
Please describe your living environment: My place of residence is in	Number of rooms _____ Floor _____ <input type="checkbox"/> elevator is available <input type="checkbox"/> backyard /garden is available <input type="checkbox"/> urban area <input type="checkbox"/> rural area <input type="checkbox"/> remote rural area Other (please specify) _____

I live at home	<input type="checkbox"/> alone <input type="checkbox"/> with a partner <input type="checkbox"/> other: _____
Characteristics of the care received	
I receive care from...	<input type="checkbox"/> A hired person coming home How many hours per week? _____ <input type="checkbox"/> A family member or friend who takes care of me on an unpaid basis How many hours per week? _____ <input type="checkbox"/> Other type of caregiver How many hours per week? _____

Information about your health:				
I am autonomous in carrying out my daily activities				
definitely	probably	possibly	probably not	don't know
Would you classify yourself in any of these health conditions?		<input type="checkbox"/> Mild cognitive impairment <input type="checkbox"/> Dementia or Alzheimers' Disease <input type="checkbox"/> Parkinsons' Disease <input type="checkbox"/> Cardiovascular Disease		
At what stage of the disease would you consider yourself?		<input type="checkbox"/> Lightweight stage <input type="checkbox"/> Moderate stage <input type="checkbox"/> Advanced or severe stage		

Do you have other (chronic) diseases? If so, indicate them:	<input type="checkbox"/> Yes <input type="checkbox"/> No <hr style="border: 0; border-top: 1px solid black; margin-top: 20px;"/>				
Information about your technology acceptance What do you think about the use of new technologies such as smart phones, tablets, internet...					
I am already using the following technologies:					
Mobile phone	every day	a few days in a week	once per week	a few times per month	don't use
Smart bracelet	every day	a few days in a week	once per week	a few times per month	don't use
Tablet	every day	a few days in a week	once per week	a few times per month	don't use
Computer	every day	a few days in a week	once per week	a few times per month	don't use
I am using technologies for the following activities:					
Reading and writing emails	every day	a few days in a week	once per week	a few times per month	don't use
Internet access	every day	a few days in a week	once per week	a few times per month	don't use
Calendar and notifications	every day	a few days in a week	once per week	a few times per month	don't use
Playing games	every day	a few days in a week	once per week	a few times per month	don't use

Intelligent monitoring-system: we would like to know your opinion on using monitoring system, having option to use services, having a system installed at your residence, both if you consider it useful and if you and your beloved would accept it. Please rate how useful you consider each of the devices and services for you personally.				
Have you ever used a technological system that records your activity or constants? For example, a smart watch that records your heart rate, steps or anything else about you			<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know	
If yes, how would you rate this experience?				
very satisfied	satisfied	moderately satisfied	a little satisfied	unsatisfied
Regardless of your previous experience in using a monitoring system, would you like to try it?			<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know	
I would like my carer to have access to this information and support me				
definitely	probably	possibly	probably not	don't know
Below, we will present some examples. Please tell how useful you find them and if you want to try them.				
Location and activity monitoring The objective of this monitoring is to detect the presence of the person in the home, the location in the room and recognition of activities. The location monitoring is intended for detection of presence at home, room-level location, and activity recognition. The system will collect and analyze information and inform you or the careers who will help to solve the unwanted situation.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful

I would accept bracelet like device (for example like a small wrist-watch)				
definitely	probably	possibly	probably not	don't know
Monitoring requires installation of an additional, small (coin size) device for collecting the information from the bracelet like device.				
I would accept installing a monitoring equipment at home				
definitely	probably	possibly	probably not	don't know
I would like my carer to have access to this information and support me				
definitely	probably	possibly	probably not	don't know
Sleep quality monitoring The system will detect the quality of your sleep and provide you with the full report next morning (light sleep, deep sleep, total time of sleep, if you wake up and go out of your bed during the night...). Gathered data can be used for detection of nocturnal activity patterns and usage of sanatoria.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I would accept a bracelet as a device or a coin size device embedded into slippers as an accessory for monitoring if I leave the bed and where I go during the night				
definitely	probably	possibly	probably not	don't know
I would accept placing a small device close to my bed or a small device placed under the mattress				

definitely	probably	possibly	probably not	don't know
I would accept installing a small device on sanitaria pipeline				
definitely	probably	possibly	probably not	don't know
I would prefer switching the monitor device on in the evening and switching it off in the morning				
definitely	probably	possibly	probably not	don't know
Monitoring requires use of an additional, small (coin size) device for collecting the information from the bracelet.				
I would accept installing a monitoring equipment at home				
definitely	probably	possibly	probably not	don't know
I would like my carer to have access to this information and support me				
definitely	probably	possibly	probably not	don't know
Personal calendar The purpose of this system is to remind you of planned activities and important dates. For example: It will send a mobile alert to you or your caregiver to remind you of things like medical appointments.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I would agree to use this application on my mobile device to receive alerts:				

definitely	probably	possibly	probably not	don't know
I think that use of SMS notification for this purpose is useful				
definitely	probably	possibly	probably not	don't know
I think that use of voice notification for this purpose is useful				
definitely	probably	possibly	probably not	don't know
I would like my carer to have access to this information and support me				
definitely	probably	possibly	probably not	don't know
Medication regime reminders <p>The goal of the smart pillbox is to help people have control over taking their medications as prescribed by their doctor.</p> <p>For example: Pills are placed in a small round box that is turned after each pill is taken. The pillbox can remind you of the time and day of taking and will allow you to access the pills only at the time set, except in some cases where you need exceptional access.</p>				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I would agree to use this application on my mobile device to receive alerts:				
definitely	probably	possibly	probably not	don't know
I think that use of SMS notification for this purpose is useful				

definitely	probably	possibly	probably not	don't know
I think that use of voice notification for this purpose is useful				
definitely	probably	possibly	probably not	don't know
I would like my carer to have access to this information and support me				
definitely	probably	possibly	probably not	don't know
External Location Monitoring The objective of the location through a bracelet is to know where the person is. For example: If you go for a walk you can activate the device and in case you get lost, your family or caregiver will be able to know where you are.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I would accept bracelet like device (for example like a wrist-watch)				
definitely	probably	possibly	probably not	don't know
I would accept mobile phone like device				
definitely	probably	possibly	probably not	don't know
I would like my carer to have access to this information and support me				

definitely	probably	possibly	probably not	don't know
Safety and wellbeing – ambient monitoring at home <p>The goal is to control your safety and well-being in your home. Through small, discreet sensors that collect information on:</p> <ul style="list-style-type: none"> - Lights and electricity; - Ambient temperature and air quality; - Whether windows or doors are open or closed. <p>For example: In the event that the front door is left unlocked , gas is turned on, or other incidents occur in the home, you or your caregiver or family will be alerted...</p>				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
This functionality requires installation of small (coin size) device for collecting the data.				
I would accept installing monitoring equipment at home				
definitely	probably	possibly	probably not	don't know
I would like my carer to have access to this information and support me				
definitely	probably	possibly	probably not	don't know
Emotional state detection <p>The aim of this system is to detect negative emotions. For example, if you are depressed, aggressive or otherwise emotionally disturbed, it will be detected by the device and recorded to help you, whether by your caregiver, family members or healthcare professionals.</p>				
How do you perceive it?				

very useful	useful	quite useful	not very useful	not useful
To collect this information, we need to install discreet devices in your home (the size of a chocolate bar) that would capture the expression of your face and voice through a camera and microphone that capture data.				
I would accept a camera like device at home				
definitely	probably	possibly	probably not	don't know
I would accept installing a microphone at home				
definitely	probably	possibly	probably not	don't know
I would like my carer to have access to this information and support me				
definitely	probably	possibly	probably not	don't know
This is the last question: Do you have any other comment or suggestion for us to consider where the technology could be useful for you, your caregivers and involved care professionals?				
How would you like that we communicate or you check your information?		<input type="checkbox"/> Voice via speaker <input type="checkbox"/> Computer or tablet screen <input type="checkbox"/> Text-message on personal device <input type="checkbox"/> Combination of the above		

Thank you very much for your support!

Questionnaire - Caregiver

The European project „TeNDER“(affectiVe basEd iNtegrateD carE for better Quality of Life) is developing an integrated support ICT based system promoting integrated care for patients with Dementia, Parkinson’s disease and/or cardiovascular diseases. By combining user-friendly technologies and substantial research experience, TeNDER will help address the need to further integrate health and social care, empowering patients and involving their care ecosystem in their TeNDER care support system. An intelligent monitoring-system is a technologically enhanced environment, which aims at improving the patient’s care, empowerment and quality of life. With the use of different technologies (sensors, cameras, also using artificial intelligence), the measurement of health data and general data on activity, movement or emotional status of the patient will be enabled. Further, an analysis of the data allows the system to make decisions regarding necessary actions to help improving the self-management of the chronic diseases involved, or to promote the involvement of their care ecosystem by sending data to their selected caregivers, family members and/or care professionals.

The objective of this questionnaire is to better understand your preferences regarding the technology being developed for this project. All the data will be stored and analyzed anonymously and will be used only for the purpose of developing the TeNDER tool to make it as useful as possible. There are no right or wrong answers, every opinion is valid and very valuable to us. Please feel free to respond

Demographic data	
Gender:	<input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Diverse
Age of a person you take care of	<input type="checkbox"/> ≤ 59 years <input type="checkbox"/> 60-65 years <input type="checkbox"/> 66-70 years <input type="checkbox"/> 71-75 years <input type="checkbox"/> 76-80 years <input type="checkbox"/> 81 years ≤
Your Education (completed educational level achieved):	<input type="checkbox"/> no formal education <input type="checkbox"/> primary school <input type="checkbox"/> secondary school <input type="checkbox"/> Vocational training <input type="checkbox"/> University (master degree, higher level) Other (please specify) ... <hr/>

Disease related information of the person you care for:					
I would say that the person I care for is autonomous in performing his/her daily activities					
definitely	probably	possibly	probably not	don't know	
Do you care for a person with any of these diseases?		<input type="checkbox"/> Mild cognitive impairment <input type="checkbox"/> Dementia or Alzheimers' Disease <input type="checkbox"/> Parkinsons' Disease <input type="checkbox"/> Cardiovascular Disease			
In which stage of the disease would you consider the person you care for?		<input type="checkbox"/> Slightly affected <input type="checkbox"/> Moderately affected <input type="checkbox"/> Advanced or serious			
Does the person have other chronic diseases?		<input type="checkbox"/> Yes <input type="checkbox"/> No			
If so, indicate them:		_____			
Information about your technology acceptance					
What do you think about the use of new technologies such as smart phones, tablets, internet...?					
I am already using the following technologies:					
Mobile phone	every day	a few days in a week	once per week	a few times per month	don't use
Smart bracelet	every day	a few days in a week	once per week	a few times per month	don't use
Tablet	every day	a few days in a week	once per week	a few times per month	don't use
Computer	every day	a few days in a week	once per week	a few times per month	don't use

I am using technologies for the following activities:

Reading and writing emails	every day	a few days in a week	once per week	a few times per month	don't use
Internet access	every day	a few days in a week	once per week	a few times per month	don't use
Calendar and notifications	every day	a few days in a week	once per week	a few times per month	don't use
Playing games	every day	a few days in a week	once per week	a few times per month	don't use

Intelligent monitoring-system: We would like to know your opinion on using monitoring system, having option to use services, having a system installed at your residence, both if you consider it useful and if you and your beloved would accept it. Please rate how useful you consider each of the devices and services for you personally.

Have you ever used an intelligent monitoring-system?

- ☐ Yes
- ☐ No
- ☐ Don't know

If yes, how would you rate this experience?

very satisfied	satisfied	moderately satisfied	a little satisfied	unsatisfied
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Regardless of your previous experience in using a monitoring system, would you like to try it?

- ☐ Yes
- ☐ No
- ☐ Don't know

Below, we will present some examples. Please tell how useful you find them and if you want to try them.

Location and activity monitoring The location monitoring is intended for detection of presence at home, room level location and activity recognition. The system will collect and analyze information and inform you in case the person you are taking care of is in an abnormal situation.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I think he/she would accept bracelet like device (for example like a wrist-watch)				
definitely	probably	possibly	probably not	don't know
Monitoring requires use of an additional, small (coin size) device for collecting the information from the bracelet. I think he/she would accept installing a monitoring equipment at home				
definitely	probably	possibly	probably not	don't know
Sleep quality monitoring The system will detect the quality of the sleep and provide the full report next morning (light sleep, deep sleep, total time of sleep, if waking up and going out of bed during the night...). Gathered data can be used for detection of nocturnal activity patterns and usage of sanatoria.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I think he/she would accept bracelet like device or a coin size device embedded into slippers as an accessory for monitoring if he/she leaves the bed and where he/she goes during the night				
definitely	probably	possibly	probably not	don't know

I think he/she would accept placing a small device close to bed or a small device attached to the bed				
definitely	probably	possibly	probably not	don't know
I think he/she would accept installing a small device on sanitaria pipeline				
definitely	probably	possibly	probably not	don't know
I think he/she would prefer switching the monitor device on in the evening and switching it off in the morning				
definitely	probably	possibly	probably not	don't know
Monitoring requires use of an additional, small (coin size) device for collecting the information from the bracelet.				
I think he/she would accept installing a monitoring equipment at home				
definitely	probably	possibly	probably not	don't know
Personal calendar The system calendar will remind the person you take care of - and when agreed in some cases also you - about planned activities and important dates (like: appointment with the doctor, attending friend's birthday, etc.). It can send alerts to his/her phone and reminders of the activity.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I think he/she would agree to use this application on my mobile device to receive alerts:				
definitely	probably	possibly	probably not	don't know

I think that use of SMS notification for this purpose is useful				
definitely	probably	possibly	probably not	don't know
I think that use of voice notification for this purpose is useful				
definitely	probably	possibly	probably not	don't know
I think that use of web site interface for this purpose is useful				
definitely	probably	possibly	probably not	don't know
I think he/she would accept installing a monitoring equipment at home				
definitely	probably	possibly	probably not	don't know
Medication regime reminders <p>The goal of the smart pillbox is to help people have control over taking their medications as prescribed by their doctor.</p> <p>For example: Pills are placed in a small round box that is turned after each pill is taken. Pill dispenser is connected with TeNDER system and it can monitor medication regime and remind him/her to take the pills. If agreed you can be reminded if pills are not taken, too.</p>				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I think that use of SMS notification for this purpose is useful				
definitely	probably	possibly	probably not	don't know
I think that use of voice notification for this purpose is useful				

definitely	probably	possibly	probably not	don't know
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External Location Monitoring

The objective of the location through a bracelet is to know where the person is. For example: If a person goes for a walk, he/she can activate the device and in case he/she gets lost, you will be able to know where he/she is.

How do you perceive it?

very useful	useful	quite useful	not very useful	not useful
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I think he/she would accept bracelet like device

definitely	probably	possibly	probably not	don't know
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I think he/she would accept mobile phone like device

definitely	probably	possibly	probably not	don't know
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Safety and wellbeing – ambient monitoring at home

The goal is to control your safety and well-being in your home. Through small, discreet sensors that collect information on:

- Lights and electricity;
- Ambient temperature and air quality;
- Whether windows or doors are open or closed.

For example: In the event that the front door is left unlocked, gas is turned on, or other incidents occur in the home, the person and you will be alerted...

How do you perceive it?

very useful	useful	quite useful	not very useful	not useful
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I think he/she would accept installing monitoring equipment at home

definitely	probably	possibly	probably not	don't know
Emotional state detection The aim of this system is to detect negative emotions. For example, if a person is depressed, aggressive or otherwise emotionally disturbed, it will be detected by the device and recorded to help, whether by caregiver, family members or healthcare professionals.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
To collect this information, we need to install discreet devices in your home (the size of a coin) that would capture the expression of your face and voice through a camera and microphone that capture data. I think he/she would accept installing a camera like device at home				
definitely	probably	possibly	probably not	don't know
I think he/she would accept installing a microphone at home				
definitely	probably	possibly	probably not	don't know
This is the last question: Do you have any other comment or suggestion for us to consider on how the technology could be useful for you?				
How would you like that we communicate or you check information?		<input type="checkbox"/> Voice via speaker <input type="checkbox"/> Computer or tablet screen <input type="checkbox"/> Text-message on personal device <input type="checkbox"/> Combination of the above		

Thank you very much for your support!

Questionnaire – Employees (Professionals)

The European project „TeNDER“ (affective basEd iNtegrated carE for better Quality of Life) is developing an integrated support ICT based system promoting integrated care for patients with Dementia, Parkinson’s disease and/or cardiovascular diseases. By combining user-friendly technologies and substantial research experience, TeNDER will help address the need to further integrate health and social care, empowering patients and involving their care ecosystem in their TeNDER care support system. An intelligent monitoring-system is a technologically enhanced environment, which aims at improving the patient’s care, empowerment and quality of life. With the use of different technologies (sensors, cameras, also using artificial intelligence), the measurement of health data and general data on activity, movement or emotional status of the patient will be enabled. Further, an analysis of the data allows the system to make decisions regarding necessary actions to help improving the self-management of the chronic diseases involved, or to promote the involvement of their care ecosystem by sending data to their selected caregivers, family members and/or care professionals.

The objective of this questionnaire is to better understand your preferences regarding the technology being developed for this project. All the data will be stored and analyzed anonymously and will be used only for the purpose of developing the TeNDER tool to make it as useful as possible. There are no right or wrong answers, every opinion is valid and very valuable to us. Please feel free to respond

Demographic data	
Gender:	<input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Diverse
Occupation:	<input type="checkbox"/> nurse <input type="checkbox"/> general practitioner <input type="checkbox"/> neurologist <input type="checkbox"/> cardiologist <input type="checkbox"/> clinical neurologist <input type="checkbox"/> psychiatrist <input type="checkbox"/> pharmacologist <input type="checkbox"/> radiologist <input type="checkbox"/> geriatric <input type="checkbox"/> social worker <input type="checkbox"/> work instructor

	<input type="checkbox"/> animator <input type="checkbox"/> psychologist <input type="checkbox"/> speech therapist <input type="checkbox"/> occupational therapist <input type="checkbox"/> rehabilitator <input type="checkbox"/> movement scientist <input type="checkbox"/> administrative worker Other:
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Information about your technology acceptance

What do you think about the use of new technologies such as smart phones, tablets, internet...

I am already using the following technologies:

Mobile phone	every day	a few days in a week	once per week	a few times per month	don't use
Smart bracelet	every day	a few days in a week	once per week	a few times per month	don't use
Tablet	every day	a few days in a week	once per week	a few times per month	don't use
Computer	every day	a few days in a week	once per week	a few times per month	don't use

I am using technologies for the following activities:

Reading and writing emails	every day	a few days in a week	once per week	a few times per month	don't use
Internet access	every day	a few days in a week	once per week	a few times per month	don't use

Calendar and notifications	every day	a few days in a week	once per week	a few times per month	don't use
Playing games	every day	a few days in a week	once per week	a few times per month	don't use

Intelligent monitoring-system: We would like to know your opinion on using monitoring system, having option to use services, if you consider it useful. Please rate how useful you consider each of the devices and services for you personally.

Have you ever used an intelligent monitoring-system?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
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If yes, how would you rate this experience?

very satisfied	satisfied	moderately satisfied	a little satisfied	unsatisfied
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Regardless of your previous experience in using a monitoring system, would you like to try it?"	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know
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Below, we will present some examples. Please tell how useful you find them and if you want to try them:

Location and activity monitoring

The location monitoring is intended for detection of presence at home, room level location, and activity recognition.

How do you perceive it?

very useful	useful	quite useful	not very useful	not useful
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I perceive this useful for

Parkinson Disease	Mild cognitive Impairment	Dementia or Alzheimer Disease	Cardiovascular Disease	
Sleep quality monitoring <p>The system will detect the quality of your sleep and provide with the full report next morning (light sleep, deep sleep, total time of sleep, if you wake up and go out of your bed during the night...). Gathered data can be used for detection of nocturnal activity patterns and usage of sanatoria.</p>				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I perceive this useful in				
Parkinson disease	Mild cognitive impairment	Dementia or Alzheimer disease	Cardiovascular disease	
Medication regime reminders <p>A pill dispenser is a tool for helping people to remember to take their medication as needed, on an hourly or daily basis. It allows to access the pills only at the time(s) set. Pills are set on a small round dial that turns after each pill is taken. Pill dispenser is connected with TeNDER system and it can monitor medication regime and remind a patient to take the pills.</p>				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I perceive this useful in				
Parkinson Disease	Mild cognitive impairment	Dementia or Alzheimer disease	Cardiovascular disease	
External Location Monitoring <p>The objective of the location through a bracelet is to know where the person is. For example: If a person goes for a walk, he/she can activate the device and in case he /she gets lost, you will be able to know where he/she is.</p>				

How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I perceive this useful in				
Parkinson disease	Mild cognitive impairment	Dementia or Alzheimer disease	Cardiovascular disease	
Safety and wellbeing – ambient monitoring Sensors for ambient monitoring are small unobtrusive devices, which are intended to monitor: <ul style="list-style-type: none"> - Lights and electricity; - Ambient temperature and air quality; - Whether windows or doors are open or closed. - . 				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I perceive this useful in				
Parkinson disease	Mild cognitive impairment	Dementia or Alzheimer disease	Cardiovascular disease	
Emotional state detection With the help of intelligent technologies, causes of negative emotions (outbursts, sadness, apathy) should be detected and prevented.				
How do you perceive it?				
very useful	useful	quite useful	not very useful	not useful
I perceive this useful in				

Parkinson disease	Mild cognitive impairment	Dementia or Alzheimer disease	Cardiovascular disease
This is the last question: Do you have any other comment or suggestion for us to consider on what the technology could be doing for you if patient agrees to communicate?			
How would you like to communicate?		<input type="checkbox"/> Voice via speaker <input type="checkbox"/> Computer or tablet screen <input type="checkbox"/> Text-message on personal device <input type="checkbox"/> Combination of the above	

Thank you very much for your support!

ANNEX 2 INTERVIEWS

PATIENTS INTERVIEW

CONCEPT TO MEASURE	QUESTIONS
Demographic and living arrangements	<ol style="list-style-type: none"> 1. Age 2. Gender 3. Level education 4. Living arrangements
Daily activities, Quality of Life and Challenges faced	<p>During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities: Being unconfident to do things, being scared to leave the home, postponing things because they make you feel uncomfortable and scared, ...?</p> <ol style="list-style-type: none"> 1. How do you feel when you are alone at home? Can you tell me if there is any fear or insecurity at that time? Have you stopped doing any of your daily tasks because you are alone? 2. Do you feel that your quality of sleep has worsened in the last 4 months? Can you tell me if any fear or insecurity appears during the night? 3. Have you ever forgotten an important appointment? Does forgetting cause you any insecurity or distress? Does needing someone else to remind you cause you any insecurity or distress? 4. Have you ever forgotten to take prescribed medication? Does forgetting cause you any insecurity or distress? Does needing someone else to supervise you cause you any insecurity or distress? 5. How do you feel when you go out alone on the street? Can you tell me if any fear or insecurity appears at that time? Have you stopped going out alone on the street out of fear and insecurity because you are alone? 6. Are you worried about forgetting to close windows, taps, gas, stoves or any other household appliances? Could you tell me if you have any fears or insecurities about this? 7. Do you feel that your emotional state has worsened in the last 4 months? Can you tell me if any fears or insecurities appear because of this?
Technologies usage and experience	<p>What do you think about the use of new technologies such as smart phones, tablets, internet...? If so, what activities do you carry out with them? If not, why don't you use them?</p> <p>Do you think they can make our day-to-day life easier and offer us advantages?</p> <p>Do you feel able to use them or do you feel unsafe?</p>

	<p>Would you be willing to use them to be able to use a platform like the one we propose?</p> <p>Now we are going to suggest a series of devices that would support the system to collect information about your activity level, vital signs... I would like to know if you would be willing to use them or not and for what reasons. Here we can talk about cameras, bracelets, sensors... I will now explain examples of the devices. Please tell me how useful each of them would be to you: (example) Have you ever used a technological system that records your activity or your constants? For example, a smart watch that records your heart rate or your steps. If so, what would you say this experience was like?</p> <p>Even if you have no previous experience of using a monitoring system, would you like to try it?</p> <p>Would you have for example a bracelet that detects the presence in the home, the personal location in the room and recognition of activities. For example: The system can detect with the help of the bracelet when you leave home, you are not moving for a long time, or do not leave any room, or make abnormal movements. This could detect an urgent situation and alert someone to resolve it. Would you like to try? In case of refusal, why?</p> <p>If you would have this device, would you like your caregiver to have access to the information and support you in your experience? To which information would you grant him/her access (personal location in the room, when leaving the house, ...). Would you like that your caregiver is alerted if you don't feel comfortable or something went wrong? Would you like to watch the reports on your activity like steps performed, level of daily activity – how? By the end of the day or during the day?</p> <p>Would you allow your caregiver to have the access to the reports?</p> <p>(the same open questions for other functionalities, for collecting feedbacks of personal experience)</p>
Technologies facilitation	<ol style="list-style-type: none"> 1. After a brief explanation about the system, do you think a system of this type is useful? Do you like the idea? Why? 2. Which characteristics would you like to choose to track and have feedback on a daily level? 3. The system would also have a recommendation module; would you like to try? Which parts of the system catch your interest especially and why? 4. Would you like to participate in service design? What is most important to you to be monitored, reported to you and how would you like to receive the alerts? 5. If you could benefit from a system like the proposed one, which support mode would you prefer because it seems the most



	convenient? Smartphone, tablet or computer? (Here, the user can give more than one answer, picking up the reasons for his/her preferences.)
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CAREGIVERS (AND CARERS) INTERVIEW

CONCEPT TO MEASURE	QUESTIONS
Demographic and living arrangements	<ol style="list-style-type: none"> 1. Age 2. Gender 3. Level of education 4. Living arrangements
Daily activities, QoL and Challenges faced	<p>Are you worrying about the person you take care of often and why? Do you feel that you don't have enough time for yourself as being a caregiver?</p>
Technologies usage, and experience	<p>What do you think about the use of new technologies such as smart phones, tablets, internet...? If so, what activities do you carry out with them? If not, why don't you use them?</p> <p>Do you think they can make our day-to-day life easier and offer us advantages?</p> <p>Do you feel able to use them or do you feel unsafe?</p> <p>Would you be willing to use them and help the person you take care for to be able to use a platform like the one we propose?</p> <p>Now we are going to suggest a series of devices that would support the system to collect information about activity level, vital signs of the person you are taking care of.</p> <p>I would like to know if you would be willing to support him/her or not and for what reasons.</p> <p>Here we can talk about cameras, bracelets, sensors...</p> <p>I will now explain examples of the devices. Please tell me how useful each of them would be to you:</p> <p>(example)</p> <p>Have you ever used a technological system that records your activity or your constants? For example, a smart watch that records your heart rate or your steps.</p> <p>If so, what would you say this experience was like?</p> <p>Even if you have no previous experience of using a monitoring system, would you like to try it?</p> <p>Do you think this kind of monitoring would help the person you are taking care of and you to release some of the worries?</p> <p>If he/she could have for example a bracelet that detects the presence in the home, the personal location in the room and recognition of activities... For example: He / She may want to monitor if he /she leaves the home, has not moved for a long time, or does not leave any room, or makes abnormal movements. This could detect an urgent situation and alert you to resolve it.</p> <p>Would you like to try and support the person to use it? In case of refusal, why?</p> <p>If he /she would have this device, would you as a caregiver want to have access to the information? What information would you find useful to have access to (location in the room, when leaving the house, ...)? Would you like that you are alerted if a person doesn't feel comfortable or</p>

	<p>something went wrong? Would you like to watch the reports on his/her activity – how? By the end of the day or during the day?</p> <p>(the same open questions for other functionalities, for collecting feedbacks of personal experience)</p>
Technologies facilitation	<ol style="list-style-type: none"> 1. After a brief explanation about the system, do you think a system of this type is useful? Do you like the idea? Why? 2. Which characteristics would you like to choose to support the person you are taking care of and have feedback on a daily level? 3. The system would also have a recommendation module; would you like to try? Which parts of the system would especially catch your interest and why? 4. Would you like to participate in service design? What do you think is most important to the person you are taking care of to be monitored, reported to you and how would you like to receive the alerts? 5. If the person you take care of could benefit from a system like the one described above, what functionalities would you like it to have? Which one(s) do you perceive as most useful? (Here we can leave room for them to add ideas to the proposals we already have made) 6. If you could benefit from a system like the proposed one, which support mode would you prefer because it seems the most convenient to you? Smartphone, tablet or computer. (Here, the user can give more than one answer, picking up the reasons for his/her preferences.) 7. Do you think that the person you take care of would make use of this type of support? Why yes? Why not? 8. As a caregiver/family member, do you think that your close environment (other family members, friends...) would accept the use of this type of technology? Why?

PROFESSIONALS INTERVIEWS

CONCEPT TO MEASURE	QUESTIONS
Demographic and living arrangements	<ol style="list-style-type: none"> 1. Age 2. Gender 3. Profession 4. Place of work: hospital/rhb room/others(specify)
Daily activities and Challenges faced	<p>What are your daily professional activities?</p> <p>What are your most important difficulties when dealing with your patients?</p>

Technologies usage and experience	<p>What do you think about the use of new technologies such as smart phones, tablets, internet...? What is your experience with those technologies in daily management? Do you perceive them helpful with your work? Do you use telecare? What is your experience?</p> <p>What do you think of using those technologies for people with disease...? If so, what activities do you think would be best to carry out with them? If not, why don't you see their use as a benefit?</p> <p>Do you think they can make our day-to-day life easier and offer advantages in your professional work?</p> <p>Do you perceive that they can help you optimize management times?</p> <p>Do you feel able to use them?</p> <p>Now we are going to suggest a series of devices that would support the system to collect information about activity level, vital signs of the person.</p> <p>Here we can talk about cameras, bracelets, sensors... I will now explain examples of the devices. Please tell me how useful each of them would be to you:</p> <p>(example)</p> <p>Have you ever used a technological system that records your activity or your constants? For example, a smart watch that records your heart rate or your steps.</p> <p>If so, what would you say this experience was like?</p> <p>Even if you have no previous experience of using a monitoring system, would you like to try the system that reports on people with ...?</p> <p>Do you think this kind of monitoring would help the person with (disease...) and you?</p> <p>If he/she could have for example a bracelet that detects the presence in the home, his/her location in the room and recognition of activities... For example: He / She may want to inform a caregiver if he /she leaves the home, has not moved for a long time, or does not leave any room, or makes abnormal movements. This could detect an urgent situation and alert also you to resolve it.</p> <p>If he /she would have this device, would you like to have access to the information? What information will you find useful to have access to (his/her location in the room, when leaving the house, ...). Would you like to be alerted if a person doesn't feel comfortable or something went wrong? Would you benefit from the reports on his/her activity – how? Would you prefer to have access to the reports during the day? Would you like to support the person to use it? In case of refusal, why?</p> <p>(the same open questions for other functionalities, for collecting feedbacks of personal experience)</p>
Technologies facilitation	<ol style="list-style-type: none"> 1. After a brief explanation, do you think a system of this type is useful? Do you like the idea? Why? 2. As a professional, what aspects could be useful to you in the regular development of your work? 3. What kind of functionalities should an integrated care system such as the one proposed have so that you would be interested in it in your

	<p>usual work? What would be the objectives of the functionalities you propose as a professional?</p> <p>4. What advantages would the implementation of a system of this type have for your work?</p> <p>5. What would be the main disadvantages and limitations for the implementation of a system of this type?</p> <p>6. What type of support would facilitate the use of this technology in your workplace, smartphone, tablet, computer?</p> <p>7. Do you think that a system of this type could increase the quality of care that the patient receives? Why? What functionalities could achieve this objective?</p> <p>8. Do you think this type of system could save time in managing communications with your patients or with other professionals?</p> <p>9. If you had to design a system of this type, what functions would be essential? Why? For what purpose?</p> <p>10. Do you think that the implementation of a system of this type would be perceived positively by professionals?</p>
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Interviewers, please note:

- 1) Farewell: Once again we would like to thank you for your selfless participation in this research. If you have any questions regarding this matter, please contact us at the telephone or via w-mail – provided by the researcher.
- 2) Transcription of the audio record of the interview.
- 3) Qualitative data analysis and interpretation with descriptive analysis.
- 4) Scenario development according to the Deliverable 2.1.